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Finance and Risk Perspectives

PERFORMANCE OF INDIAN COMMODITY FUTURES MARKET: AN ANALYSIS

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Abstract. *This paper studies the diversification benefits of adding commodity futures to a traditional portfolio of stocks and bonds. When compared with traditional portfolios, unconstrained and constrained mean variance optimal portfolios that incorporate commodity futures exhibit high ex-ante Sharpe ratios. High ex-ante Sharpe ratios demonstrate the diversification potential of commodity futures. To recognize the diversification benefits, which can be realized by investors on adding commodity futures, asset allocation strategies, namely, strategic asset allocation (buy and hold strategy) and tactical asset allocation (momentum and term structure strategy) are analysed from 2004-2012 on yearly basis using monthly data of most liquid commodity futures contracts traded in Indian commodity futures exchange. Momentum and term structure signals are used to formulate investment strategies, which exhibit positive ex-post returns on average. These investment strategies are used as a tool in portfolio diversification thereby allocating commodity futures to form ex-post portfolios with stocks and bonds. Ex-post Sharpe ratios of constrained portfolios are higher than traditional portfolios in most years. High Sharpe ratios are not observed every year, but in long term, inclusion of commodity futures provides diversification benefits.*

Keywords: commodity futures, momentum strategy, term structure strategy, portfolio

JEL Classification: G11

Introduction

Since early 2000s, the commodity futures market has attracted a large number of institutional investors seeking diversification benefits. Commodity market witnessed a large inflow of money by commodity index investors (index speculators) who often take long position in the commodity market by investing in instruments linked to broad based commodity indices. Commodity index investors consider commodities as an investable asset class, just like stocks and bonds. They seek exposure to commodity prices by acquiring index swap contracts from swap dealers, or purchasing ETFs (Exchange Traded Funds) and ETNs (Exchange Traded Notes) from fund companies. Swap dealers and funds then hedge themselves by taking long positions in individual commodity futures (Cheng and Xiong, 2013). Thus, last decade experienced an increase in commodity index related instruments as well as individual commodity futures. Such popularity of commodity futures among institutional investors has been referred to as the financialization of the commodity market (Tang & Xiong, 2012; Irwin & Sanders, 2012; Silvennoinen & Thorp, 2013).

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A traditional investment portfolio comprise risky and risk free assets consisting of stocks, bonds and cash. The inclusion of an asset to this traditional portfolio is beneficial if it improves the portfolio's reward to risk relationship. Commodities have negative correlation with stocks and bonds, possess unique risk premium, and performs well during inflation - positive correlation with unexpected inflation. These properties make commodities a unique investable asset class that can be included in a traditional portfolio to achieve diversification benefits (Gorton & Rouwenhorst, 2006; Erb & Harvey, 2006). Investing in commodities via commodity futures is one of the ways to participate in the commodity markets. Other ways include - direct investment in physical goods, indirect investment in stocks of natural resource companies, commodity mutual funds and investment in structured products on commodity futures indexes (Fabozzi et al., 2008).

A commodity futures contract is a mutual binding agreement between two parties to deliver or accept and pay (or undertake a cash settlement) a qualitative explicitly determined commodity of a specified quantity at a predetermined price at a fixed date (Fabozzi et al., 2008). The commodity futures market is a zero-sum market - unlike the stock and bond market - where all money flows must by definition net to zero (Irwin et al. 2009). In the commodity market, the amount gained by one participant is equal to the loss made by another (Schneeweis et al., 2008). There is no regular flow of money in commodity futures like dividends in stock market and interest earned in bonds.

Investment via commodity futures enables investors to have direct exposure to commodities without fulfilling logistical and storage requirements connected with a direct purchase. Investors in commodity futures can profit from price movements of the underlying commodity. However, this is only possible if the position is closed before maturity. Though investors can maintain exposure by rolling over the contract - taking position again in the nearest maturity contract. The advantages of futures investments lie especially in the tremendous flexibility and leveraged nature of the futures position due to the low capital requirements (Fabozzi et al., 2008). At the same time, high leverages make investing in commodity futures risky. Profits and losses may be multiple times the money invested. Furthermore, the futures markets are characterized by a high degree of liquidity and low transaction costs (Shen et al., 2007; Marshall et al., 2008).

Commodity futures trading in India started in November 2003 on commodity futures exchanges that are separate and distinct from financial derivative exchanges - regulated by separate laws and regulators (Shah, 2008). Indian commodity futures market has seen an exponential growth since inception. At present, there are several (more than 20) regional commodity exchanges and three national commodity exchanges namely, the National Multi Commodity Exchange (NMCE), Multi-Commodity Exchange (MCX) and National Commodity Derivative Exchange (NCDEX). MCX deals mainly with non-agricultural commodities such as energy, precious metals, base metals, ferrous metals and polymers, whereas NCDEX deals mainly in agricultural commodities such as pulses, grains, oil and oil seeds, spices and non-edible agricultural products (Sahoo and Kumar, 2008). Unprecedented growth of Indian commodity futures market is marked internationally when Mumbai based Multi Commodity Exchange (MCX) became world's third-largest commodity futures exchange based on number of futures contracts traded (Futures Industry Association, 2012).

A number of studies on the Indian commodity futures market includes - issues related to the proper functioning of the commodity market (Kabra, 2007), misconceptions of the commodity market (Sabnavis and Jain, 2007; Nath and Lingareddy, 2008), market efficiency (Bose, 2007) and price discovery (Iyer and Pillai, 2010). However, studies related to the diversification benefits of commodities in a traditional portfolio are sparse. This paper tries to fill this gap by studying the diversification benefits of adding commodity futures (strategic asset allocation (buy and hold strategy) and tactical asset allocation (momentum strategy and term structure strategy)) to a traditional portfolio of stocks and bonds. Therefore, this paper studies the diversification and potential benefits obtained by including commodities in a traditional portfolio for an Indian investor.

Literature Review

Strategic Asset Allocation

Strategic asset allocation decisions essentially involve determining an appropriate long term allocation of funds according to long term expectations about the future risk and return of asset classes, as well as the expected correlation structure between the assets (Rasmussen and Rasmussen, 2003). Woodward (2008) explained numerous strategic motivations for holding passive long-only commodity futures in a portfolio of stocks and bonds. These include the possibility of earning risk premiums, a low correlation of commodities with stocks and bonds and protection against inflation and business cycles.

Initial studies by Dusak (1973) and Bodie and Rosansky (1980) did not observe significant risk premiums for individual commodity futures while Erb and Harvey (2006) observed average annualized excess returns of the average individual commodity futures to be approximately zero. Kat and Oomen (2007) investigated 42 different commodity futures and concluded that most commodity futures did not offer a risk premium. However, a number of studies confirmed equity like performance in the long run (Kaplan and Lummer, 1998) and equity like returns (Gorton and Rouwenhorst, 2006) for commodity futures. Similarly, Greer (2000) concluded that the performance of unleveraged commodity indexes from 1970 to 1999 was on average positive and comparable to equities with regard to return and volatility. The risk premium for individual commodity futures varied (Gorton and Rouwenhorst, 2006; Woodward, 2008) and a number of studies confirmed a time varying seasonal risk premium (Carter et al., 1983; Chang, 1985) but a long run portfolio of commodity futures tends to give a positive risk premium (Bodie and Rosansky, 1980; Fama and French, 1987).

Gibson (1999) found that a commodity futures index (Goldman Sachs Commodity Index) investment has a pattern of returns very dissimilar to the other asset classes (stocks, bonds, and real estate) and accordingly produces the strongest “diversification effect” when combined with other asset classes. A number of studies have considered allocating a significant portion to commodity futures in a traditional portfolio of stocks and bonds. Greer (1978) found that diversified, buy-and-hold, and unleveraged commodities were not as risky as stocks, and the combination of a commodity futures index and a stocks index provided better performance with a high mean return for a given risk level. Bodie and Rosansky (1980) found that an allocation of 40% to commodity futures significantly decreased portfolio risk while increasing the expected return relative to a portfolio of only stocks. Addition of gold futures (Jaffe, 1989), GSCI (Kaplan and Lummer, 1998) increased the return and decreased the risk of a diversified portfolio. However, Fortenbery and Hauser (1990) observed that the addition of futures rarely increased portfolio return; they did provide risk reduction benefits through their ability to diversify nonsystematic risk.

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Egelkraut et al. (2005) observed a significant increase in the Sharpe ratio when GSCI and few commodity futures were added to a portfolio of stocks and bonds. Anson (2006) allocated 10% to commodity futures indexes in a traditional portfolio of stocks and bonds and observed that the addition of futures significantly shifted the frontiers up for almost all risk levels. Woodward (2008) observed that portfolios with GSCI and individual commodity futures provide greater returns with marginally greater risk when compared to a traditional portfolio of stock and bonds. Chong and Miffre (2010) examined conditional correlations between various commodity futures with stock and fixed-income indices. Conditional correlations with equity returns fell over time, which indicates that commodity futures have become better tools for strategic asset allocation.

Tactical Asset Allocation

Tactical opportunities take advantage of the possibility that future returns may vary in response to structural factors and implies that dynamic trading schemes can be formulated in response to macroeconomic conditions and short-term aberrations (Woodward, 2008). Presence of time varying risk premiums in commodity futures (Carter et al., 1983; Chang, 1985) suggests that even in rational and efficient markets it may be optimal to hold futures in some period and not in others (Woodward, 2008). The possibility of time-series and cross-sectional return predictability may make tactical asset allocation with commodity futures attractive to some investors (Erb and Harvey, 2006). A number of tactical strategies have been observed in literature that include tactical trading schemes based on interest rates, monetary policy (Jensen et al., 2000; Jensen et al., 2002), seasonality, momentum and term structure.

A momentum strategy is a simple trading rule whereby one rank-orders past returns on the assets being investigated, then takes long positions in assets that performed relatively well (past winners) and short positions in assets that performed relatively poor (past losers). Following a momentum strategy is a bet that past relative performance will continue into the future (Szakmary et al., 2010). Recent studies reported momentum in commodity futures returns (Pirrong, 2005; Shen, 2007) and momentum returns equal to stock returns (Shen, 2007). Thus, commodity futures could serve as a potential addition to conventional portfolios in generating profits while trading actively. Georgiev (2004) examined the performance of four short-run momentum based strategies for crude oil, natural gas, unleaded gas, and heating oil from the period 1993 to 2004. The actively traded portfolios in all cases performed better than passive buy-and-hold portfolios, and the addition of active strategies to diversified portfolios significantly reduced risk and increased expected returns. Erb and Harvey (2006) investigated the returns to momentum strategies by constructing long-short portfolios based on whether the previous annual return was positive or negative. They reported that a momentum strategy with a 12-month ranking period and a 1-month holding period is profitable in the commodity futures markets. Risk adjusted returns were increased when the Mount Lucas Management Index (MLMI), an index that mimics a 12-month trend following strategy, allocated 10% in a portfolio of stocks and bonds (Anson, 2006).

Miffre and Rallis (2007) studied the presence of short-term continuations and long-term reversals in commodity futures prices. They examined 56 momentum and contrarian strategies and identified 13 profitable momentum strategies that generate an average return of 9.38% per year. Woodward (2008) investigated the impact of intermediate-term momentum by estimating the optimal weights for portfolios that were stratified by whether or not the previous return to crude oil is positive or negative. Individual commodities were heavily weighted for lagged positive crude oil returns, which strongly suggest the presence of momentum in analyzed portfolios. Fuertes et al. (2010) observed significant alphas for momentum strategies. Thus, momentum strategies can be used for trading in commodity futures markets. However, Szakmary et al. (2010) examined trend following trading strategies in commodity futures using the research design of momentum studies and observed that the dual moving average crossover and channel rules yielded hugely significant profits over a full sample period and most sub-periods. Thus, pure trend-following strategies generally produce higher mean returns and Sharpe ratios than momentum strategies. Conover et al. (2010) reported that commodity futures offer equity investors considerable benefits as a diversification tool. They observed that a tactical approach that established commodity exposure only during the periods when the Fed was increasing rates produced a significant increase in portfolio returns, while significantly reducing portfolio risks.

Erb and Harvey (2006) exploited the term-structure signals of 12 commodities to implement a simple long-short strategy that buys the six most backwardated commodities and shorts the six most contangoed commodities. They found that strategies employing short positions based on term structure indicators performed significantly better than long-only positions.

The role of backwardation in the performance of passive long positions in commodity futures was observed by Feldman and Till (2006). Woodward et al. (2008) investigated the impacts of term structure by estimating optimal weights for portfolios that are stratified by whether crude oil is in backwardation or contango previous to the first day of the month. Results showed that the addition of commodities greatly increases portfolio performance for the backwardation portfolios while their inclusion has a slight impact on contango portfolios. Fuertes et al. (2010) found a significant alpha of 12.66% for term structure strategies indicating its potential use in trading commodity futures markets.

Data and Methodology

In India, trading in commodity futures started in November 2003. To investigate the diversification benefits, data from two Indian commodity futures markets, namely, Multi Commodity Exchange (MCX) and National Commodity & Derivatives Exchange Ltd. (NCDEX) was analysed from 2003 through 2012. Initially, data included all the commodity futures traded on these exchanges since inception, which were subsequently removed based on liquidity and trading assumptions. Daily closing prices, trading volume and open interest for commodity futures were downloaded from MCX and NCDEX websites. The most liquid commodity futures contracts were selected each year (January to December) based on trading volume.

After selecting the most liquid commodity futures contract, price series were formed from historical closing prices. For constructing price series data - to be used as input for calculating returns - daily closing prices of commodity futures contracts were converted to monthly frequency by sampling futures price of last trading day of each calendar month. Two price series were formed consecutively on monthly basis, first nearby and second nearby price series. These price series were used to calculate futures return, spot return and roll returns.

Spot return is calculated as percentage change in spot price of the underlying commodity i.e. the price used to mean the nearest (first nearby) future contract (the contract that is closest to maturity). Whereas, futures return is calculated as the percentage change in the futures price i.e. the price used to mean the next nearest (second nearby) futures contract (Hafner and Heiden, 2006; Gorton et al., 2007). Price gap between different-maturity contracts (i.e. price difference

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between the futures return and spot return) is called roll return or implied yield or futures basis. Roll return signals whether a market is in backwardation or contango. A positive roll return indicates that the price of the nearby contract exceeds that of the distant contract, namely, that the term structure of commodity futures prices is downward-sloping and so that the market is in backwardation. Conversely, a negative roll return signals an upward-sloping price curve and a contangoed market (Fuertes et al., 2010).

An investor needs to address two questions before allocating commodities to the traditional portfolio of stocks and bonds. First, which commodity to invest in, from a set of a number of available commodities, and second, how much of the total investment should be allocated to commodities. To answer the first question, we select commodities based on seven different strategies namely, strategic asset allocation (buy and hold strategy) and tactical asset allocation (momentum long, momentum short, momentum long short, term structure long, term structure short and term structure long short). To address second research question, two types of portfolio were analysed, first, the weights obtained in strategic asset allocation were assigned to commodities (optimal portfolio), and second with ten percent of total weights allocated to commodities (constrained portfolio).

We use S&P CNX Nifty Total Returns Index to represent Indian stock market, composite index from Reserve Bank of India (RBI) to represent Indian bond market and Treasury Bill Index to represent risk free rate. Ex-ante and ex-post portfolio were analysed on yearly basis, with and without commodities to know the diversification benefits obtained by incorporating commodity futures to the traditional portfolio of stocks and bonds.

Three portfolios were constructed each year to analyse ex-ante performance under unconstrained and constrained optimization. First, stock and bond returns were used to form optimal portfolios and constrained portfolios (where eighty percent is allocated to stocks and twenty percent is allocated to bonds). Second, stock returns, bond returns, and naïve portfolio returns (equiweighted portfolio of most liquid commodity futures contract) were used to form optimal and constrained portfolios. Finally, stock returns, bond returns and most liquid individual commodity futures returns were used to form optimal and constrained portfolios. The optimal portfolio includes stocks, bonds and a number of commodities with significant weights. The total ex-ante weights allocated to stocks, bonds, and commodities constitutes the basis to allocate similar weights next year to form ex-post optimal portfolios. For the last two set of constrained portfolios, seventy five percent is allocated to stocks, fifteen percent to bonds and ten percent to commodities. Portfolio mean, portfolio standard deviation and Sharpe ratio were calculated for all of these portfolios.

Momentum strategies involve selection of commodities based on previous returns, a bet that past performance will continue into the future (Szakmary et al., 2010). At the end of every year, futures contracts were sorted in increasing order, based on their futures returns in year t. Top and bottom four were selected to form portfolios (equiweighted) in year t + 1. Based on ranking and holding periods, investors can formulate a number of momentum strategies. Ranking period refers to the number of past periods that are considered for calculating average returns and holding period refers to the number of periods an investor holds a portfolio without rebalancing. Present research work consider one year each (January to December - starting from January 2004 until December 2012) as ranking and holding period for analysis (Miffre and Rallis, 2007).

Momentum long strategy involves taking long position in top four commodities in year t+1 that have highest returns in year t. Momentum short strategy involves taking short position in bottom four commodities in year t+1 that have least return (among the top twenty most liquid commodities selected) in year t. Momentum long short strategy involves taking long position in top four and short position in bottom four commodities in year t+1 that have given highest and lowest returns respectively in year t.

Erb and Harvey (2006) introduce a new dynamic asset allocation strategy that seeks to exploit the term structure of commodity futures prices by taking long positions in backwardated contracts and short positions in contangoed ones. Based on ranking and holding period investors can formulate a number of term structure strategies. Present research work consider one year each as ranking and holding period for analysis of backwarded and contangoed strategies. Roll returns of past year determine the term structure of commodities. Positive roll returns exhibit backwarded term structure whereas, negative roll returns shows contangoed term structure. While constructing a portfolio, we consider long (short) position for commodity futures with high (low) past roll returns. Present research work consider one year each (January to December - starting from January 2004 until December 2012) as ranking and holding period for analysis. During holding period, investors hold such portfolio for one year without rebalancing.

Term Structure long strategy involves taking long position in top four commodities in year t+1 that have highest roll returns in year t. Term Structure short strategy involves taking short position in bottom four commodities in year t+1 that have least roll returns (among the top twenty most liquid commodities selected) in year t. Term structure long short strategy involves taking long position in top four and short position in bottom four commodities in year t+1 that have highest and lowest roll returns respectively in year t.

Seven strategies, namely, strategic asset allocation, momentum long, momentum short, momentum long short, term structure long, term structure short, term structure long short were analysed from year 2004 through 2012. Based on futures return and roll return, among the most liquid commodity futures contracts, top and bottom commodity futures were selected to form portfolios next year. Such analysis is based on the notion that the investor use historical data to select commodities and weights that can be applied next year (You and Daigler, 2013). Optimal portfolios analysis is based on the ex-ante generated weights and commodity futures selected in year t that were used to form ex-post portfolios in year t + 1. Constrained portfolios allocate seventy five percent to stocks, fifteen percent to bonds and ten percent to commodity futures. All the trading strategies involve equiweighted commodity futures portfolio with stocks and bonds. A similar analysis was performed on top agricultural commodities where top sixteen commodity futures were selected each year instead of twenty. Analysis spans from year 2005 through 2012.

Markowitz optimization - basic equations

Mean - variance paradigm of Markowitz (1952) is by far the most common formulation of portfolio choice problems (Brandt, 2009). The typical Markowitz model prescribes optimization in a mean-variance framework. Efficient or optimal portfolio can be formed by three ways using mean-variance framework. First, minimize risk for a target return, second, maximize return for a given value of risk and third, maximize risk adjusted return. Optimal portfolios in present research are formed by maximizing risk adjusted returns i.e. Sharpe ratio. Such portfolios are also called Sharpe optimal portfolios.

For a portfolio of n assets, expected return on the portfolio is

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$$E(R_p) = \sum_{i=1}^{n} w_i \, E(R_i)$$

The variance of return on portfolio is

$$\sigma_p^2 = \sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j Cov(R_i, R_j)$$

Maximize Sharpe ratio to form Sharpe optimal portfolio S^*

$$S^* = argmax \left\{\frac{E(R_p) - r_f}{\sigma_p}\right\}$$

Subject to $\sum_{i=1}^{n} w_i = 1$and $w_i \geq 0$ (sum of all the weights equals to one, and all the weights are positive)

Results

Most liquid commodity futures based on volume were selected form MCX and NCDEX. As few contracts were traded at both the exchanges, only unique contracts were selected for analysis. The commodity futures thus selected for analysis represent a broad cross section of agricultural, industrial, precious metal and energy futures markets. These exclude currency futures and financial futures. Most liquid agricultural commodity futures contracts are also analysed subsequently.

Present research work attempts to answer three questions, first, whether commodity futures should be included in the traditional portfolio of stocks and bonds, second, if yes, which commodity futures or a combination of commodity futures to select and third, what percentage of total investment should be allocated to commodity futures.

Optimization that involves short selling sometimes allocates high negative weights to certain assets that are inappropriate for practical investment. Therefore, in present research work it is assumed that short selling is not allowed. Short selling assumption was removed from mean variance portfolio optimization by adding a constraint that portfolio weights should be positive and sums up to one. All the portfolios formed in present research work, which incorporate commodity futures, are uncollateralized and unleveraged. It is assumed that a traditional (conventional) portfolio of stocks and bonds consist of eighty percent stock and twenty percent bonds. Portfolio Performance is measured by Sharpe ratio.

Ex-ante unconstrained and constrained portfolios are formed using mean variance optimization at three levels annually. The unconstrained portfolios formed at three levels includes a portfolio of stocks and bonds, portfolio of stocks, bonds and a naïve portfolio (an equiweighted portfolio of most liquid commodity contracts), and third, a portfolio of stocks, bonds and individual commodity futures. For unconstrained portfolios, assets can be allocated any positive weight but for the constrained portfolios weights are fixed. These fixed weight constrained portfolios were formed at three levels. First, stocks were allocated eighty percent and bonds twenty percent, second, stocks seventy five percent, bonds fifteen percent and naïve portfolio ten percent, and third, stocks seventy five percent, bonds fifteen percent and individual commodity futures ten percent. Results obtained after unconstrained and constrained mean variance optimization are presented in Table 1a (for most liquid commodity futures) and Table 1b (for most liquid agricultural commodity futures contracts).

TABLE 1a: Ex-ante Portfolio weights and Sharpe ratios for unconstrained and constrained mean variance optimization.

Unconstrained optimization				Constrained optimization		
2004	WEIGHTS			WEIGHTS		
Stocks	1.000	1.000	0.364	0.800	0.750	0.750
Bonds	0.000	0.000	0.000	0.200	0.150	0.150
Naïve Portfolio		0.000			0.100	
Commodities			0.636			0.100
Sharpe Ratio	**0.174**	**0.174**	**0.345**	**0.149**	**0.144**	**0.179**
2005						
Stocks	1.000	0.924	0.243	0.800	0.750	0.750
Bonds	0.000	0.000	0.000	0.200	0.150	0.150
Naïve Portfolio		0.076			0.100	
Commodities			0.756			0.100
Sharpe Ratio	**0.416**	**0.417**	**0.572**	**0.406**	**0.408**	**0.486**
2006						
Stocks	1.000	1.000	0.158	0.800	0.750	0.750
Bonds	0.000	0.000	0.000	0.200	0.150	0.150
Naïve Portfolio		0.000			0.100	
Commodities			0.842			0.100
Sharpe Ratio	**0.380**	**0.380**	**0.707**	**0.356**	**0.354**	**0.453**
2007						
Stocks	0.843	0.843	0.311	0.800	0.750	0.750
Bonds	0.157	0.157	0.316	0.200	0.150	0.150
Naïve Portfolio		0.000			0.100	
Commodities			0.373			0.100
Sharpe Ratio	**0.494**	**0.494**	**0.710**	**0.494**	**0.453**	**0.550**
2008						
Stocks	0.000	0.000	0.000	0.800	0.750	0.750
Bonds	1.000	1.000	0.701	0.200	0.150	0.150
Naïve Portfolio		0.000			0.100	
Commodities			0.299			0.100
Sharpe Ratio	**0.239**	**0.239**	**0.325**	**-0.405**	**-0.432**	**-0.378**
2009						
Stocks	1.000	0.153	0.000	0.800	0.750	0.750

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Bonds	0.000	0.000	0.020	0.200	0.150	0.150
Naïve Portfolio		0.847			0.100	
Commodities			0.980			0.100
Sharpe Ratio	**0.565**	**1.115**	**5.006**	**0.551**	**0.585**	**0.792**
2010						
Stocks	1.000	0.485	0.164	0.800	0.750	0.750
Bonds	0.000	0.000	0.000	0.200	0.150	0.150
Naïve Portfolio		0.515			0.100	
Commodities			0.836			0.100
Sharpe Ratio	**0.434**	**0.506**	**4.553**	**0.415**	**0.438**	**0.579**
2011						
Stocks	0.000	0.000	0.202	0.800	0.750	0.750
Bonds	1.000	0.000	0.000	0.200	0.150	0.150
Naïve Portfolio		1.000			0.100	
Commodities			0.798			0.100
Sharpe Ratio	**-0.157**	**0.053**	**0.973**	**-0.341**	**-0.338**	**-0.137**
2012						
Stocks	1.000	1.000	0.208	0.800	0.750	0.750
Bonds	0.000	0.000	0.268	0.200	0.150	0.150
Naïve Portfolio		0.000			0.100	
Commodities			0.524			0.100
Sharpe Ratio	**0.156**	**0.156**	**0.367**	**0.154**	**0.127**	**0.235**

Table 1a show that unconstrained and constrained portfolios that incorporate commodity futures has resulted in higher Sharpe ratios when compared to portfolio of stocks and bonds. Sharpe ratios for portfolios that include naïve portfolio (equiweighted portfolio of most liquid commodity futures contracts) are less than the portfolios that includes individual commodity futures. Similar results were observed for unconstrained and constrained portfolios using agricultural commodities (Table 1b). Increase in Sharpe ratios clearly demonstrate that the inclusion of commodity futures to the conventional portfolio of stocks and bonds provides diversification benefits. Incorporation of individual commodity futures provides more diversification benefits when compared with naïve portfolios.

High Sharpe ratios observed in ex-ante analysis shows that individual commodity futures have potential to get place in a conventional portfolio of stocks and bonds. However, returns and risk from these ex-ante portfolios are not available to investors (You and Daigler, 2012). Nevertheless, investor can use the information revealed from ex-ante portfolios in form of weights and the commodity futures that finds place in optimal portfolios, to form ex-post portfolios. Investor earns returns and risk associated with ex-post portfolios.

Even after ex-ante analysis the foremost question still remains and needs to be answered before investing - which commodity futures to select next year (ex-post), and how much to invest in individual asset class. Certainly, there is no way by which an investor can be definite about asset (stock, bond or commodity futures) future returns and the weights. Optimal weights obtained by mean variance optimization can be used as a proxy for next year (ex-post) investment and becomes the basis for strategic asset allocation. Generally investing in an index is considered as strategic (buy and hold) investment, but the present study considers only those commodities in ex-post portfolio that were allocated weight in ex-ante portfolio. The investment in naïve portfolio (equiweighted portfolio of most liquid commodities) mimics the traditional buy and hold investment in present analysis.

TABLE 1b: Ex-ante Portfolio weights and Sharpe ratios for unconstrained and constrained mean variance optimization (Agricultural Commodities)

Unconstrained optimization				Constrained optimization		
2005	WEIGHTS			WEIGHTS		
Stocks	1.000	0.598	0.442	0.800	0.750	0.750
Bonds	0.000	0.000	0.000	0.200	0.150	0.150
Naïve Portfolio		0.402			0.100	
Commodities			0.558			0.100
Sharpe Ratio	**0.416**	**0.475**	**1.356**	**0.406**	**0.425**	**0.657**
2006						
Stocks	1.000	1.000	0.228	0.800	0.750	0.750
Bonds	0.000	0.000	0.000	0.200	0.150	0.150
Naïve Portfolio		0.000			0.100	
Commodities			0.772			0.100
Sharpe Ratio	**0.380**	**0.380**	**0.573**	**0.356**	**0.353**	**0.657**
2007						
Stocks	0.843	0.843	0.312	0.800	0.750	0.750
Bonds	0.157	0.157	0.315	0.200	0.150	0.150
Naïve Portfolio		0.000			0.100	
Commodities			0.373			0.100
Sharpe Ratio	**0.494**	**0.494**	**0.710**	**0.494**	**0.469**	**0.550**
2008						
Stocks	0.000	0.000	0.000	0.800	0.750	0.750
Bonds	1.000	1.000	0.482	0.200	0.150	0.150
Naïve Portfolio		0.000			0.100	
Commodities			0.518			0.100
Sharpe Ratio	**0.239**	**0.239**	**0.364**	**-0.405**	**-0.415**	**-0.370**
2009						
Stocks	1.000	0.365	0.433	0.800	0.750	0.750
Bonds	0.000	0.000	0.000	0.200	0.150	0.150
Naïve Portfolio		0.635			0.100	
Commodities			0.567			0.100
Sharpe Ratio	**0.565**	**0.791**	**1.948**	**0.551**	**0.587**	**0.792**
2010						
Stocks	1.000	0.250	0.281	0.800	0.750	0.750
Bonds	0.000	0.000	0.000	0.200	0.150	0.150
Naïve Portfolio		0.750			0.100	

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Commodities			0.719			0.100
Sharpe Ratio	**0.434**	**0.893**	**1.681**	**0.415**	**0.481**	**0.685**
2011						
Stocks	0.000	0.000	0.117	0.800	0.750	0.750
Bonds	1.000	0.000	0.000	0.200	0.150	0.150
Naïve Portfolio		1.000			0.100	
Commodities			0.883			0.100
Sharpe Ratio	**-0.157**	**-0.041**	**0.956**	**-0.341**	**-0.348**	**-0.137**
2012						
Stocks	1.000	1.000	0.559	0.800	0.750	0.750
Bonds	0.000	0.000	0.000	0.200	0.150	0.150
Naïve Portfolio		0.000			0.100	
Commodities			0.441			0.100
Sharpe Ratio	**0.156**	**0.156**	**0.353**	**0.154**	**0.145**	**0.235**

Investors can exploit momentum and term structure signals to formulate investment strategies that can be utilized as a portfolio diversification tool (Fuertes et al., 2010; Miffre and Rallis, 2007; Szakmary et al., 2010). Based on ex-ante analysis, top and bottom commodity futures were selected according to momentum and term structure signals. These commodity futures are then used to form ex-post portfolios each representing a different type of investment strategy. Six different investment strategies were formulated based on momentum and term structure signals. Table 2a presents ex-post average monthly returns observed for different investment strategies. All investment strategies report positive returns for atleast five years out of eight years. This shows that momentum as well as term structures signals employed to formulate investment strategies are applicable to Indian Commodity futures market. Specially, last three year witness positive returns for all investment strategies except momentum short only strategy in year 2011. Results show that long only strategies (momentum as well as term structure strategies) perform well when compared to short only and long short strategies. Table 2b presents ex-post average monthly returns observed for different investment strategies that consider agricultural commodity futures contracts. Short strategies (momentum as well as term structure) did not perform well and yielded negative returns in most of the years. At the same time momentum long and momentum long short strategies yielded positive returns. This might be because India witnessed a steep rise in agricultural commodity prices in last few years. Performance of investment strategies that involve most liquid agricultural commodity futures changed noticeably in last three years when compared with similar strategies that consider most liquid commodities (Table 2a). The returns observed for different strategies are based on equiweighted portfolio of top four (long position) and bottom four (short positions) commodity futures.

Table 2a: Ex-post returns per month for different investment strategies

	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
RETURNS								
Momentum Long Only	**1.25%**	-0.76%	-0.68%	-0.62%	**1.20%**	**4.07%**	**1.23%**	**1.23%**
Momentum Short Only	**0.03%**	-1.14%	**0.24%**	**4.58%**	-5.74%	**1.26%**	-0.97%	**0.62%**
Momentum Long Short	**0.64%**	-0.95%	-0.22%	**1.98%**	-2.27%	**2.67%**	**0.13%**	**0.92%**

Term structure Long Only	**0.45%**	-1.24%	**1.45%**	-0.38%	**2.90%**	**4.42%**	**1.46%**	**0.49%**
Term structure Short Only	-0.84%	-0.27%	**0.76%**	**1.62%**	-4.62%	**1.61%**	**0.84%**	**0.96%**
Term structure Long Short	-0.20%	-0.76%	**1.11%**	**0.62%**	-0.86%	**3.01%**	**1.15%**	**0.73%**

Table 2b: Ex-post returns per month for different investment strategies (Agricultural Commodities)

	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
RETURNS							
Momentum Long Only	**1.98%**	-1.00%	**0.10%**	**3.39%**	**5.61%**	-2.09%	**1.23%**
Momentum Short Only	-1.14%	**1.90%**	**2.18%**	-2.55%	-1.95%	-1.69%	**0.29%**
Momentum Long Short	**0.42%**	**0.45%**	**1.14%**	**0.42%**	**1.83%**	-1.89%	**0.76%**
Term structure Long Only	-0.81%	**0.99%**	-0.38%	**3.65%**	**6.23%**	-3.75%	-0.89%
Term structure Short Only	-0.27%	**0.76%**	**1.62%**	-2.21%	-1.51%	-2.68%	-0.55%
Term structure Long Short	-0.54%	**0.88%**	**0.62%**	**0.72%**	**2.36%**	-3.21%	-0.72%

Monthly returns observed for all the investment strategies that include commodity futures are not comparable to the stock returns except for those years when stock market did not perform well (year 2008 and 2011). Therefore, hundred percent allocation of investable money to commodity futures in the form of these strategies is not advisable. However, a portfolio of stocks, bonds and commodities might be beneficial. These strategies can act as a portfolio diversification tool as they present a way to incorporate commodity futures in a traditional portfolio of stocks and bonds.

Equiweighted commodity futures portfolios in form of different investment strategies were combined with traditional portfolio of stocks and bonds each year. These newly formed portfolios are then compared with the traditional (conventional) portfolio of stocks and bonds to know the diversification benefits obtained. Results of optimal and constrained portfolios for different strategies are presented in Table 3 and 4. Ex-ante weights obtained from mean variance optimization are used for investment in the next year to form ex-post optimal portfolios. Conventional portfolio consists of eighty percent stocks and twenty percent bonds while constrained portfolios consist of seventy five percent bonds, fifteen percent bonds and ten percent commodities. Table 3a presents ex-post portfolio returns per month for different investment strategies. In majority of the cases, conventional portfolio returns are more than the returns obtained by a portfolio that incorporate commodities in the form of different strategies. Inclusion of commodities undoubtedly gave better returns when stock market did not perform well (year 2008 and 2011). In general, inclusion of commodities in both optimal and constrained portfolio has shown less returns compared to the conventional portfolio. Optimal and constrained portfolios formed by using agricultural futures contracts also give similar returns (Table 3b). Therefore, diversification benefits realized by incorporating commodities to the conventional portfolio will mainly result from the decrease in standard deviation.

Table 3a: Ex-post portfolio returns per month for different investment strategies

	2005	2006	2007	2008	2009	2010	2011	2012
Conventional portfolio	2.74%	2.36%	3.40%	-3.02%	4.78%	1.85%	-0.99%	1.23%
Optimal Portfolio								
Strategic Asset Allocation	**2.78%**	1.03%	0.83%	**-0.39%**	0.08%	1.04%	**0.45%**	0.78%
Momentum Long Only	2.00%	0.13%	0.08%	**-1.02%**	0.19%	**3.99%**	**0.81%**	**1.25%**

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Momentum Short Only	1.23%	-0.16%	0.85%	**0.92%**	-1.88%	1.24%	-1.03%	0.77%
Momentum Long Short	1.62%	-0.02%	0.46%	**-0.05%**	-0.84%	**2.61%**	**-0.11%**	1.01%
Term Structure Long Only	1.49%	-0.24%	1.88%	**-0.93%**	0.70%	**4.33%**	**1.00%**	0.67%
Term Structure Short Only	0.67%	0.50%	1.29%	**-0.18%**	-1.55%	1.58%	**0.49%**	1.04%
Term Structure Long Short	1.08%	0.13%	1.58%	**-0.56%**	-0.42%	**2.96%**	**0.74%**	0.86%
Constrained Portfolio								
Strategic Asset Allocation	**2.82%**	2.08%	3.22%	**-2.73%**	4.53%	**2.92%**	**-0.70%**	1.20%
Momentum Long Only	2.68%	2.12%	3.10%	**-2.95%**	4.61%	**2.13%**	**-0.82%**	**1.25%**
Momentum Short Only	2.56%	2.09%	3.19%	**-2.44%**	3.91%	1.85%	-1.04%	1.19%
Momentum Long Short	2.62%	2.10%	3.14%	**-2.70%**	4.26%	**1.99%**	**-0.93%**	1.22%
Term Structure Long Only	2.60%	2.08%	3.31%	**-2.93%**	4.78%	**2.17%**	**-0.79%**	1.18%
Term Structure Short Only	2.47%	2.17%	3.24%	**-2.73%**	4.02%	**1.89%**	**-0.86%**	1.22%
Term Structure Long Short	2.54%	2.12%	3.28%	**-2.83%**	4.40%	2.03%	-0.82%	1.20%

Table 3b: Ex-post portfolio returns per month for different investment strategies (agricultural commodities)

	2006	2007	2008	2009	2010	2011	2012
Conventional portfolio	2.36%	3.40%	-3.02%	4.78%	1.85%	-0.99%	1.23%
Optimal Portfolio							
Strategic Asset Allocation	**3.01%**	1.19%	**-0.39%**	1.12%	**7.01%**	-1.13%	0.75%
Momentum Long Only	**2.38%**	0.16%	**-0.75%**	1.64%	**4.17%**	-1.87%	**1.24%**
Momentum Short Only	0.64%	2.40%	**0.03%**	-1.43%	-0.12%	-1.59%	0.41%
Momentum Long Short	1.51%	1.28%	**-0.36%**	0.10%	2.03%	-1.73%	0.83%
Term Structure Long Only	0.82%	1.70%	**-0.93%**	1.78%	**4.52%**	-3.07%	-0.63%
Term Structure Short Only	1.12%	1.53%	**-0.18%**	-1.26%	0.13%	-2.30%	-0.33%
Term Structure Long Short	0.97%	1.61%	**-0.56%**	0.26%	**2.33%**	-2.68%	-0.48%
Constrained Portfolio							
Strategic Asset Allocation	1.97%	3.40%	-3.02%	**5.43%**	**2.92%**	-1.72%	1.23%
Momentum Long Only	**2.40%**	3.06%	**-2.88%**	**4.83%**	**2.29%**	-1.15%	**1.25%**
Momentum Short Only	2.09%	3.35%	**-2.67%**	4.23%	1.53%	-1.11%	1.16%
Momentum Long Short	2.24%	3.21%	**-2.78%**	4.53%	**1.91%**	-1.13%	1.20%
Term Structure Long Only	2.12%	3.26%	**-2.93%**	**4.85%**	**2.35%**	-1.31%	1.04%
Term Structure Short Only	2.17%	3.24%	**-2.73%**	4.27%	1.58%	-1.21%	1.07%
Term Structure Long Short	2.15%	3.25%	**-2.83%**	4.56%	**1.96%**	-1.26%	1.05%

Table 4a presents ex-post Sharpe ratios for different investment strategies. When compared with conventional portfolios, optimal portfolios and constrained portfolios exhibit high Sharpe ratios for most of the years. It is observed that none of the strategies could produce high Sharpe ratios for all the years studied. Both, optimal portfolios and constrained portfolios exhibit mixed results with high Sharpe ratios distributed across years for different strategies, but increase in Sharpe ratios is more pronounced with constrained portfolios. With mixed results, investors cannot confine to a particular strategy to obtain higher Sharpe ratios, but some strategies performed better than other strategies. Term structure long and term structures short strategies in constrained portfolios have performed relatively better than other strategies. Table 4b presents similar results for agricultural commodities. Strategic asset allocation of agricultural commodities with optimal weight performed better when compared to similar results when all commodities are included. Momentum long only, term structure long only and term structure long short have performed well for constrained portfolios.

Table 4a: Ex-post Sharpe ratios for different investment strategies

	2005	2006	2007	2008	2009	2010	2011	2012
Conventional portfolio	**0.406**	**0.356**	**0.494**	**-0.405**	**0.551**	**0.415**	**-0.341**	**0.154**
Optimal Portfolio								
Strategic Asset Allocation	0.506	0.093	0.052	**-0.198**	-0.202	0.254	**-0.042**	0.015
Momentum Long Only	**0.459**	-0.061	-0.137	**-0.325**	-0.144	**0.591**	0.043	0.055
Momentum Short Only	0.262	-0.134	0.102	0.066	-1.303	0.203	-0.473	0.028
Momentum Long Short	0.393	-0.128	-0.062	**-0.169**	-0.872	**0.565**	**-0.214**	0.054
Term Structure Long Only	0.347	-0.215	0.302	**-0.337**	0.289	**0.988**	0.066	-0.004
Term Structure Short Only	0.084	0.000	0.111	**-0.161**	-1.155	0.311	**-0.040**	0.081
Term Structure Long Short	0.250	-0.131	0.393	**-0.264**	-0.923	1.015	0.052	0.039
Constrained Portfolio								
Strategic Asset Allocation	**0.443**	0.303	0.494	**-0.395**	**0.555**	**0.650**	**-0.292**	0.153
Momentum Long Only	**0.417**	0.313	0.460	-0.413	**0.562**	**0.491**	**-0.320**	0.150
Momentum Short Only	0.399	0.323	0.489	**-0.370**	0.477	**0.422**	-0.370	**0.163**
Momentum Long Short	**0.408**	0.319	0.475	**-0.394**	0.520	**0.459**	-0.346	**0.157**
Term Structure Long Only	**0.408**	0.319	**0.500**	-0.414	**0.584**	**0.543**	**-0.318**	0.140
Term Structure Short Only	0.389	0.345	**0.507**	**-0.400**	0.471	**0.441**	**-0.329**	**0.159**
Term Structure Long Short	0.399	0.333	**0.506**	-0.408	0.527	**0.493**	**-0.325**	0.150

Table 4b: Ex-post Sharpe ratios for different investment strategies (agri commodities)

	2006	2007	2008	2009	2010	2011	2012
Conventional portfolio	**0.356**	**0.494**	**-0.405**	**0.551**	**0.415**	**-0.341**	**0.154**
Optimal Portfolio							
Strategic Asset Allocation	**0.435**	0.133	**-0.198**	0.192	**0.842**	**-0.511**	0.007
Momentum Long Only	0.322	-0.089	**-0.294**	0.388	**0.702**	**-0.576**	**0.049**
Momentum Short Only	0.031	**0.790**	**-0.137**	-0.644	-0.158	**-0.408**	-0.034
Momentum Long Short	0.227	0.222	**-0.243**	-0.194	**0.565**	**-0.653**	**0.027**
Term Structure Long Only	0.081	0.186	**-0.337**	0.456	**1.069**	**-0.769**	-0.160
Term Structure Short Only	0.138	0.162	**-0.193**	-0.603	-0.067	**-0.583**	-0.164
Term Structure Long Short	0.141	0.363	**-0.291**	-0.102	**0.721**	**-1.020**	-0.311
Constrained Portfolio							
Strategic Asset Allocation	0.255	0.494	-0.405	**0.669**	**0.650**	**-0.480**	0.154
Momentum Long Only	**0.361**	0.442	**-0.408**	**0.594**	**0.569**	**-0.384**	0.150
Momentum Short Only	0.323	**0.517**	-0.399	0.518	0.357	**-0.375**	0.138

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Momentum Long Short	0.344	0.479	-0.405	**0.557**	**0.472**	**-0.382**	0.150
Term Structure Long Only	0.325	0.484	**-0.414**	**0.588**	**0.600**	**-0.426**	0.100
Term Structure Short Only	0.345	**0.507**	-0.407	0.509	0.374	**-0.392**	0.110
Term Structure Long Short	0.336	**0.499**	**-0.411**	0.549	**0.494**	**-0.411**	0.107

Limitations and future scope of study

To have a comparative analysis among different investment strategies, the present research work holds only for one year ranking and holding period. However, investors can devise a large number of momentum and term structure strategies based on ranking and holding period. It is quite possible that the strategies perform very well with different ranking and holding periods and could lead to much more diversification benefits. Second, present research work analyse momentum and term structure signals separately to form investment strategies. A combination of both momentum and term structure signals can be used to devise trading strategy.

Conclusion

A number of portfolios were constructed ex-ante and ex-post, with and without commodity futures to unveil the diversification benefits offered by commodity futures when incorporated in a traditional portfolio of stocks and bonds. Ex-ante portfolios reveal that incorporation of commodity futures to a traditional portfolio of stocks and bonds leads to higher Sharpe ratios in all the years studied. Mean-variance optimal portfolios perform better than naïve portfolio - consisting of most liquid commodity futures. Ex-ante analysis confirmed that commodity futures have potential to provide better risk return tradeoff.
On average, ex-post returns were positive for most of the investment strategies (based on momentum and term structure signals). It reveals that investors can use these signals to formulate investment strategies for Indian commodity futures market. Investors do not realize ex-ante returns and risk. Therefore, to analyse the realizable returns and risk to investors, ex-post portfolios were formed using ex-ante results. The investment strategies served as a tool in portfolio diversification thereby allocating commodity futures to the traditional portfolios. Returns on the portfolios formed by incorporating commodity futures to the conventional portfolios do not yield higher returns when compared to returns of conventional portfolios. At the same time, increase in Sharpe ratios was observed for a number of portfolios that incorporate commodity futures. The high Sharpe ratios observed results from reduction in overall risk of the portfolio - offered by commodity futures.
Increase in ex-post Sharpe ratios demonstrate that by following simple momentum and term structure signals of commodity futures (ex-ante), an investor can devise profitable investment strategies (ex-post). Commodity futures when allocated to traditional portfolio using these investment strategies results in a better risk return tradeoff. Results show that by allocating ten percent of investable amount to commodity futures, an investor can be better off than investing in just stocks and bonds. Simply, by investing in those commodities that got a place in ex-ante portfolio, an investor can earn diversification benefit – as shown by strategic asset allocation (ex-post) – that illustrate how powerful an asset commodity futures can be, when used for portfolio

diversification. The results show that it is not possible to perform better than conventional portfolio every year, but in the long run, incorporation of commodity futures with conventional portfolio leads to diversification benefits.

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HOW NON-INTEREST LOANS CAN IMPROVE THE FINANCIAL BEHAVIOR OF COMPANIES AND PREVENT ECONOMIC CRISES: TOWARD A SUPPORT VECTOR MACHINE APPROACH

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Abstract. *In recent years, Islamic Finance has grown rapidly with the expectation that it will play an increasingly more important role in the years to come; as such, the appeal of this type of finance stems mainly from its underlying fundamental concept of justice as well as from the sharing of risk and prohibition of interest. We intend in this paper to examine the practice of Islamic Finance and its impact on the financial health of companies.*

Given that a company forms a micro financial system, its good financial health contributes to building a powerful economic engine; this is why we have a greater focus on companies' financial situation, especially the company's debt situation.

Therefore, we have, over 3 years (2009-2011), selected a sample of 20 firms with considerable conventional bank loans. We have also extracted about 40 financial indicators impacting their debt situation in order to set up an intelligent financial solution to measure the impact of interest on the firm's solvency.

Using Support Vector Machine Model (SVM), we have proved the high-impact of interest loans on the financial behavior of companies, and we have concluded through our SVM prediction model that interest loans can highly increase unexpected financial crises.

Keywords: *Interest loans, Intelligent financial solution, Financial health, Islamic Finance, Ethical Finance, Financial crisis, Support Vector Machine.*

Introduction

During the global financial crisis in 2008, the economic world has seen the misdeeds caused by the current financial system which focuses primarily on profits, and began to give importance to ethical finance and to socially responsible economy. This vision noted that profit should not neglect the respect of values--this is exactly the vision of "Islamic finance", which can be regarded as a compartment of ethical finance, because it is characterized by a moral and socially responsible dimension and, as such, can respond to a need that goes far beyond funding.

Over the last few decades, Islamic banking and finance have flourished worldwide. This financial trend was born, symbolically, in 1975 with the advent of the first commercial Islamic bank in Dubai, and it has consistently developed and flourished with the oil crises because of the need for oil-producing countries to deposit accumulating surpluses. As a result, over 300 Islamic financial institutions are currently operating in more than 75 countries with combined total assets in excess of US$ 250 billion.

Having said that, we want to focus on the challenges ahead and, in particular, on the idea how the Islamic system of ethics can influence Islamic banking and finance especially in what regards the sharing of risk and the prohibition of interest.

The prohibition of interest in Islam (which is also the case in the other major religions of the world) and the aspiration of Muslims to see this prohibition practically implemented in their economic reality have led to the establishment of a number of Islamic financial institutions around the world. These financial institutions include Islamic commercial and investment banks, mutual insurance companies, and leasing companies.

In fact, from a historical perspective, taking interest on loans has always been condemned as inherently evil an immoral. Earliest civilizations showed ill feelings toward interest. The prohibition of interest was negatively represented not only all along the Islamic and Christian traditions but also by ancient Greek philosophers. However, the prohibition of interest was not universally observed. Yet, in recent years this moral concept has resurfaced again in the context of Islamic finance as forming what can be considered one of the fundamental pillars of Islamic banking and finance. Interest-free transactions in trade and banking are represented by the proponents of Islamic trade and finance as a key solution to the growing problem of market instability as well as a practical way to help reduce the problems often caused by conventional debt. In many cases, situations of crisis are formed as a result of the higher interest rates applied to delayed payment.

We can therefore conclude that the conventional financial system lacks a great deal of sustainability and allows firms to assume excessive levels of debt and risk, as low interest rates encourage excessive risk-taking; in contrast, the Islamic finance industry allows for risk-sharing instead of risk-shifting; that is why it has been noted to be thriving and gaining more momentum all over the world, and as such their assets have been growing considerably in the last decades.

In essence, Islamic finance is a financial system structured on risk-sharing and the prohibition of transactions that charge interest and shift the entire risk of the transaction to the borrower. Financial intermediation is at the heart of any financial system, and in order for the Islamic finance system to fulfill this mission, it is essential to build a powerful relationship between its financial system and the economic components of the country: companies, investment components, depositors, households, etc.

Given that a company forms a micro financial system, we should not neglect the one-to-one relationship with the Islamic finance system. Unlike the conventional financial system that encourages uncontrolled credit creation, leveraging, interest, and risk-shifting, the Islamic financial system does not allow its credit policy to expand or contract away from the real economic components.

Having said that, this research seeks to prove the high-impact of interest loans on the financial behavior of companies, especially on the firm's solvency through the study of regression and the Support Vector Machine prediction model based on a selected sample of financial indicators over a period of 3 years (2009-2011) of 20 Moroccan firms with considerable conventional bank loans.

This paper is structured as follows. Section 2 presents an overview of the solvency risk in relation to the conventional financial system. Section 3 provides a brief literature review of the building blocks of the Islamic Finance System. Section 4 shows detailed description of the financial indicators which reflect the solvency of the company. Section 5 presents how interest loans can impact negatively on a firm's solvency using the SPSS (Statistical Package for the Social Sciences) linear regression model. Section 6 reviews how these relevant

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attributes can be used to asses and predict the firm's solvency risk using the Support Vector Machine Model. Finally, the last section provides some concluding comments.

Solvency risk in terms of conventional financial system

The Basel III Committee's comprehensive reform package led to the conclusion that many banks were holding insufficient liquidity buffers. During the most severe episode of the crisis, the market lost confidence in the solvency and liquidity of many banking institutions. The weaknesses in the banking sector were rapidly transmitted to the rest of the financial system and, hence, to the real economy.

A strong and resilient banking system is the foundation for sustainable economic growth, as banks are the center of the credit intermediation process between savers and investors. Moreover, banks provide critical services to consumers, small and medium-sized enterprises, large corporate firms and governments who rely on them to conduct their daily business, both at domestic and international levels.

Through The Basel III reform package which builds on the three pillars of the Basel II framework, the committee aims to improve risk management and governance as well as to strengthen bank's transparency and disclosures; as such, it is intended to provide an extra layer of protection against model risk and measurement of solvency risk [5]. To this end, some Islamic banks have attempted to implement Basel III, but there are those who say that Basel III is a reaction to a banking crisis that Islamic banks would not find themselves in and thus should not apply to Islamic Banks. May be this is the case, but standardization in Islamic banking is still elusive, while it is important that the industry of Islamic financial services be completely integrated into the global financial markets while maintaining at the same time its distinguishing nature and unique services. This industry should also be subject to the same level of supervisory control as other financial institutions. So, prudent supervision of Islamic banks is as important as is the supervision of conventional banks. Solvency risk must be managed, and it must be transparent [4].

Solvency risk is the uncertainty surrounding a firm's ability to service its debts and obligations. Prior to default, there is no way to discriminate unambiguously between firms that will default and those that will not. At best, we can only make probabilistic assessments of the likelihood of default.

Although these risks do not seem large, they are in fact highly significant. First, they can increase quickly and with little warning. Second, the margins in corporate lending are very tight, and even small miscalculation can undermine the profitability of lending.

But most importantly, many lenders are themselves borrowers, with the high level of leverage. Unexpected realizations of solvency risk have destabilized and destroyed lenders. Banks, finance institutions, and insurers: none have escaped unscathed.

Solvency risk cannot be hedged away, or structured away. The government cannot insure it away. It is a reflection of the substantial risk in companies' futures. Various schemes exist, and more are coming, which can shift risk, but in the end, someone must bear this risk. It does not "net out" in the aggregate [6].

The risk of firm's crash affects virtually every financial contract [14]. Therefore the pricing of solvency risk has received much attention; both from lenders who have to ensure its claims and from traders who have a strong interest in pricing transactions accurately. For this purpose, it is extremely important to be able to predict the firm's future financial behavior and to assess the degree of the firm's solvency. Thus; the purpose of this exercise is to find how an extended episode of low interest rates also encouraged excessive solvency risk-taking, since the conventional financial system allows individuals and firms to assume excessive levels of debt and risk [15].

Building blocks of the Islamic Finance System

Modern Islamic Finance has taken a while to develop. The macroeconomic concept of Islam spawned the notion of interest free Islamic banking at micro economic levels. The early appearances of this modern concept began with Malaysia in the mid-1940s and Pakistan in the late 1950s, the first two Islamic states which introduced interest free banking systems. The first Islamic financial tradition probably began in Malaysia in 1963 with the establishment of the Muslim Pilgrims Savings Corporation.

Throughout the 1970's, a number of Islamic banks were founded, mostly in the Arab Middle East with the advent of the first commercial Islamic Bank in Dubai (1975), Faisal Islamic Bank of Sudan (1977), Bahrain Islamic Bank (1979), among others [10].

This new concept seemed to be gaining momentum to such an extent that some countries attempted to set up full Islamic banking systems and disconnect themselves from the conventional financial system. For example, Iran and Pakistan have opted for a gradual Islamization of their financial institutions. This new financial system also found its way into some major cities of Europe such as Luxembourg and Copenhagen, among others.

Islamic Finance Jurisprudence

In Islam, the law comes from the religion; therefore, the Islamic law or *Shari'ah* as it is called in Arabic is defined as the body of legal rules developed by Muslim scholars as a result of their interpretation of the Qur'an and the *Sunna*, the religious texts of Islam.

Since its inception, Islamic finance has developed into one of the most significant growth areas in international banking. In addition Islamic finance is the most important area for the application of the Islamic contract law. Compliance with *Shari'ah* principles is what makes Islamic financial transactions different from conventional transactions.

In Islamic finance, Islamic legal principles are introduced as a corrective ethical layer, which implies that Islamic law is in effect reduced to its ethical component which is faced with the question of whether to look at "what you are not allowed to do", or, "what you are allowed to do" [3] [11].

When money was invented and came into broad use, the four major Sunni schools of Islamic law (*Hanbali*, *Hanafi*, *Maliki* and *Shaf'i)* believed that the prohibition should be construed strictly and the majority have agreed that interest, or *riba* in Arabic, as it is known in Arabic, is forbidden in Islamic jurisprudence according to the broad interpretation of the Qur'anic verses and the Prophet's reports. Also, there are other Islamic legal prohibitions that apply to financial transactions. One is uncertainty (or *gharar* in Arabic). Second is the Islamic prohibition of gambling (*maisir* in Arabic) which disallows dealing in futures and options that are speculative. We can also add the prohibition of transactions that include illegal activities or prohibited items [1].

In sum, the Islamic finance law is the foundation for the practice of Islamic finance through the observance of the tenets, conditions and principles espoused by Shari'ah. Comprehensive compliance with Shari'ah principles would bring confidence to the general public and the financial markets on the credibility of Islamic finance operations.

Basic principals of Islamic Banking

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Always, most people are familiar with the Islamic concept of the prohibition of interest charged on loans, but in fact, Islamic banking sustains other key criteria. Essentially, there are four basic axes of Islamic banking:

- The lender does not charge any interest or additional amount over the money lent.
- The borrower shall not bear the entire risk shifting of the transaction; both parties have to share the risk.
- *Gharar* (Uncertainty, Risk or Speculation) is also prohibited.
- Investment loans should only support practices, activities or products that are not forbidden.

In essence, Islamic finance is a financial system structured on risk-sharing and the prohibition of interest [1] [2]. The fundamental reason for the prohibition of interest in Islam is that the depositor should not profit unduly from the hard work and risk bearing of others. Although Islam prohibits interest, it encourages profit and return on investment. It is for this reason that Islamic financial institutions can offer an investor (depositor) a share of their annual profits (and losses) in proportion with the investor's deposit relative to the total assets of the bank.

It is clear today that we must be careful in applying Islamic financial jurisprudence especially that its revival has evolved during a difficult time in history, and it is well accepted that Islamic banks have to be *Shari'ah*-compliant and, therefore, need a *Shari'ah* Supervisory Board of Advisors (of qualified Muslim jurists) which decides (in the form of edicts or *fatwas*) which financial products and services are *Shari'ah*-compliant and which are not.

Having said that, this research seeks to prove the impact of interest loans on the financial behavior of companies, especially on the firm's solvency through the study of regression and the Support Vector Machine prediction model based on a selected sample of financial indicators over a period of 3 years (2009-2011) of 20 Moroccan firms with considerable conventional bank loans.

Financial indicators analysis

Through this study, we demonstrate the use of actual financial data for financial ratio analysis in order to show exactly how interest loans can impact the financial behavior of a company and how we can overcome the difficulties in applying the principles of financial ratio analysis when the data are not homogeneous as is the case in our samples.

The financial analysis is the selection and interpretation of financial data to assist in investment and financial decision-making. Financial analysis may be used internally to evaluate issues such as the efficiency of operations, and credit policies, and externally to evaluate potential investments and the creditworthiness of borrowers.

The primary source from which to draw the financial data needed is the data provided by the company itself in its annual report and required disclosures. The annual report includes the income statement, the balance sheet, and the statement of cash flows.

A financial ratio is a comparison between one bit of financial information and another. Ratios can be classified according to their general characteristics; in this study we have chosen the classification as follow:

- *The Operating ratios:* When we assess a company's operating performance, we want to know if it is applying its assets in an efficient and profitable manner. The operating ratios show the efficiency of a company's management to control the expenses of a firm and to measure its profitability and its financial soundness of a firm. We have selected:

Working Capital ratio: Indicates whether a company has enough short term assets to cover its short term debt. It measures both a company's efficiency and its short term financial health.
Working Capital Requirement: Indicates the minimum amount of resources that a company requires to effectively cover the usual costs and expenses necessary to operate the business.
Cash ratio: It is commonly used as a measure of company liquidity. It can therefore determine if, and how quickly, the company can repay its short term debt.
Cash flow ratio: It is the cash resulting from income generating activities minus expenses and investments. It is a key metric for any entity that handles cash, and it can determine if the company can finance its operations through the cash it generates from ongoing activities.

- *The financial ratios*: When we assess a company's financial condition, we want to know if it is able to meet its financial obligations. It can be used to analyze trends and to compare the firm's financial situation to that of the other firms we have selected:
  Productivity ratio: It represents the efficiency with which physical inputs are converted to useful outputs. It can be computed by the ratio between the value added and the turnover. This is an indicator of company's ability to harness physical and human resources to maximize its production of goods and services.
  Leverage ratio: It measures how much money a company should safely be able to borrow over long periods of time. It does this by comparing the company's total debt and dividing it by the amount of the owner's equity.
  Coverage ratio: A measure of a company's ability to meet its financial obligations; it compares a company's total debt to its cash flow and it provides an indication of the company's ability to cover total debt with its yearly cash flow from operations.
  Solvency ratio: It provides an assessment of the likelihood of a company to continue congregating its debt obligations. It compares a company's owners equity to its total assets. Generally speaking, the lower a company's solvency ratio, the greater the probability that the company will default on its debt obligations.
- *The profitability ratios:* Compare components of income with sales. They give us an idea of what makes up a company's income and are usually expressed as a portion of each dollar of sales. We distinguish:
  Operating Profit Margin: This is a ratio that indicates how much of each dollar of sales is left over after operating expenses and it compares the operating income of a company to its turnover.
  Net Profit margin: This is a ratio of net income to turnover, and indicates how much of each dollar of sales is left over after all expenses.

There are hundreds of ratios that can be formed using available financial statement data. The ratios selected for our study depend on the type of our analysis about the creditworthiness and the type of our sample of firms. We will see in the next section, using these ratios, how interest loans can impact negatively on a firm's solvency using the SPSS (Statistical Package for the Social Sciences) linear regression model.

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Linear Regression Model

Theoretical Model

The multiple linear regression model is used to study the relationship between a dependent variable and one or more independent variables. The generic form of the linear regression model is

$$y = f(x_1, x_2, \dots, x_k) + \varepsilon$$
$$= x_1\beta_1 + x_2\beta_2 + \dots + x_k\beta_k + \varepsilon$$

Where y is the dependent or explained variable and $x_1, x_2, \dots, x_k$ are the independent or explanatory variables. One's theory will specify $f(x_1, x_2, \dots, x_k)$. This function is commonly called the population regression equation of y on $x_1, x_2, \dots, x_k$. In this setting, y is the regression and x_k, $k = 1, \dots$, and K are the regressors or covariates. The underlying theory will specify the dependent and independent variables in the model. It is not always obvious which is appropriately defined as each of these.

The term ε is a random disturbance-- so named because it "disturbs" an otherwise stable relationship. The disturbance arises for several reasons, primarily because we cannot hope to capture every influence on an economic variable in a model, no matter how elaborate. The net effect, which can be positive or negative, of these omitted factors is captured in the disturbance. There are many other contributors to the disturbance in an empirical model. Probably the most significant is errors of measurement. It is easy to theorize about the relationships among precisely defined variables; it is quite another to obtain accurate measures of these variables.

We assume that each observation in a sample $(y_i, x_{i1}, x_{i2}, \dots, x_{ik}), i = 1, \dots, n$, is generated by an underlying process described by

$$y_i = x_{i1}\beta_1 + x_{i2}\beta_2 + \dots + x_{ik}\beta_k + \varepsilon_i$$

The observed value of y_i is the sum of two parts, a deterministic part and the random part,ε_i.Our objective is to estimate the unknown parameters of the model, use the data to study the validity of the theoretical propositions, and perhaps use the model to predict the variable y [9].

Impact of interest on firms' solvency: Linear Regression Model

This research investigates financial data over 3 years 2009-2011, which all come from 20 Moroccan companies that belong to different sectors and have different sizes.

Firstly, we have selected 40 variables, over 3 years, impacting their debt situation in order to set up a model to measure the impact of interest loans on the firm's solvency.

Table 1. Selected Indicators.

V0	Interest				
V1	Turnover	V14	Equity / Total assets	V27	Financial costs / Gross operating profit
V2	Net equity	V15	Working capital / Working capital requirement	V28	Financial costs / Operating cash surplus
V3	Net cash	V16	Leverage ratio	V29	Gross operating profit / Turnover
V4	Net profit	V17	Coverage ratio	V30	Net profit margin ratio
V5	Working capital	V18	Change in debts / Cash flow	V31	Net profit / Net equity
V6	Working capital requirement	V19	Rotation net cash	V32	Net profit / Permanent capital
V7	Value added	V20	Inventory turnover	V33	Long term debts / Cash flow
V8	Gross operating margin	V21	Delay of payment of customers	V34	Net profit / Equity
V9	Gross operating profit	V22	Delay of payment to vendors	V35	Staff costs
V10	Operating cash surplus	V23	Gross margin / Turnover	V36	Lenders
V11	Free cash flow	V24	Cash flow / Turnover	V37	State
V12	Cash flow	V25	Productivity ratio	V38	Current operating income
V13	Solvency	V26	Staff costs / Value added	V39	Non-operating income

When we assess a firm's financial behavior, we want to know if a company is solvent, and if it is capable to resolve its debt situation; this is why we have elaborated our linear regression model, using SPSS 10, using our 40 variables involved and the relevant solvency component, in order to detect the variables that influence the most and to measure the negative impact of interest loans on the firms' financial behavior.

The following model presents 4 relevant variables as the number of variables to be retained instead of 40 variables. The regression model based on the data from 2009-2010 can explain 92% of precision, which means the model has a good measuring effect.

Table 2. Linear Regression Model Coefficients.

Model		Unstandardized Coefficients		Standardized Coefficients	t statistic	Significance level.
		(a) Regression Coefficients	(b) Standard Error	Independent variables	(a)/(b)	
1	(Constant)	,007	,032		,217	,829
	Interest (V0)	-1,99E-007	,000	-,141	-2,600	,012
	Equity / Total assets (V14)	,912	,066	,894	13,829	,000
	Rotation net cash (V19)	,000	,000	,069	1,220	,228
	Gross margin / Turnover (V23)	,011	,041	,015	,271	,787
	Financial costs / Operating cash surplus (V 28)	-,023	,022	-,058	-1,039	,303

So, we can conclude our model equation like:

$$Solvency = -1{,}99\times10^{-7}\times \mathrm{V0} + 0{,}912\times \mathrm{V14} + 0{,}011\times \mathrm{V23} - 0{,}023\times \mathrm{V28} + 0{,}007$$

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Having said that, the interest loans negatively affect the solvency of the company and the risk of large loans becomes increasingly higher.

Thus, when it comes to measuring solvency risk in its entirety, the question is more complicated due to the lack of sufficient historical data as required for analysis; yet, we can use our regression model to reduce our Support Vector Machine input factors dimension to four factors to predict the solvency risk and to help businesses improve solvency as well as assist the financial institution in decision-making.

Support Vector Machine Model

Theoretical Model

Support Vector Machine (SVM) is a powerful method for pattern recognition and classification introduced by Vapink [7]. The SVM maps the input data into a higher dimensional feature space via a nonlinear map and construct a separating hyperplane with maximum margin. It has been proposed as a technique in times series prediction. The key characteristic of SVM is that a nonlinear function is learned by a linear learning machine in a kernel induced feature space while the capacity of the system is controlled by a parameter that does not depend on the dimensionality of the space. The following shows the SVM algorithm [8]:

Consider a given training set $\{x_i, y_i : i = 1, \cdots l\}$ randomly and independently generated from an unknown function, where $x_i \in X \subseteq R^n$, $y \in Y \subseteq R$ and l is the total number of training data.

The SVM approximates the unknown function using the following form:

$$f(x) = \langle w, \Phi(x) \rangle + b \qquad (1)$$

Where $\langle , \rangle$ is the dot product, w and b are the estimated parameters and Φ is a non linear function is used to map the original input space R^n to high dimensional feature space. So, the nonlinear function estimation in original space becomes linear in feature space.
The optimization goal of standard SVM is formulated as:

$$\text{Minimize} \frac{1}{2}\|w\|^2 + C\sum_{i=1}^{l}(\xi_i + \xi_i^*) \quad (2)$$

Subject to:

$$y_i - \langle w, \phi(x_i) \rangle - b \le \varepsilon + \xi_i,$$

$$\langle w, \phi(x_i) \rangle + b - y_i \le \varepsilon + \xi_i^*,$$

$$\xi_i^*, \xi_i \ge 0, i = 1, \ldots\ldots, l.$$

Where the constant $C > 0$ determines the trade off between the flatness of f and the amount up to which deviations larger than are ε tolerated and ξ_i^*, ξ_i are slack variables and they are introduced to accommodate, respectively, the positive and the negative errors on the training data. The formulation above corresponds to dealing with the so called ε-insensitive cost function:

$$|\xi|_\varepsilon := \begin{cases} 0 & \text{if } |\xi| < \varepsilon \\ |\xi| - \varepsilon & \text{otherwise} \end{cases}$$

This constrained optimization problem is dealt with by introducing Lagrange multiplier $\alpha_i, \alpha_i^*, \beta_i, \beta_i^*$:

$$\mathrm{L_P}(\mathrm{w},\xi,\xi^*,\alpha,\alpha^*,\beta,\beta^*) = \frac{1}{2}\langle \mathrm{w.w}\rangle + C.\sum_{i=1}^{l}(\xi_i + \xi_i^*) - \sum_{i=1}^{l}\alpha_i.\langle w,\phi(x_i)\rangle - y_i + b + \varepsilon + \xi_i)$$
$$- \sum_{i=1}^{l}\alpha_i^*.(y_i - \langle w,\phi(x_i)\rangle) - b + \varepsilon + \xi_i^*) - \sum_{i=1}^{l}(\beta_i.\xi_i + \beta_i^*.\xi_i^*) \qquad (3)$$

By minimization the Lagrangian with respect to the primal variables we obtain:

$$w = \sum_{i=1}^{l}(\alpha_i - \alpha_i^*).\phi(x_i) \qquad (3.1)$$

$$\text{And } \sum_{i=1}^{l}(\alpha_i - \alpha_i^*) = 0, \quad 0 \le \alpha_i \le C,\ 0 \le \alpha_i^* \le C,\ i = 1,\ldots\ldots,l$$

The dual problem is obtained by introducing (3.1) in (3) and it is expressed as:

$$\text{maximize } -\frac{1}{2}\sum_{i,j=1}^{l}(\alpha_i - \alpha_i^*).(\alpha_j - \alpha_j^*).K(x,x_i) + \sum_{i=1}^{l}(\alpha_i - \alpha_i^*).y_i - \sum_{i=1}^{l}(\alpha_i - \alpha_i^*).\varepsilon \qquad (4)$$

Subject to constraints:

$$\sum_{i=1}^{l}(\alpha_i - \alpha_i^*) = 0,\ 0 \le \alpha_i \le C,\ 0 \le \alpha_i^* \le C,\ i = 1,\ldots\ldots,l$$

Finally, the nonlinear function is obtained as:

$$f(x) = \sum_{i=1}^{l}(\alpha_i - \alpha_i^*)K(x,x_i) + b \qquad (5)$$

Where $K(x_i,x_j) = \langle \phi(x_i),\phi(x_j)\rangle$ is defined as the kernel function. The elegance of using the kernel function is that one can deal with feature spaces of arbitrary dimensionality without having to compute the map Φ. Any function that satisfies Mercer's condition can be used as the kernel function.

SVM simulation for solvency risk prediction

SVM is a new technique used for regression and classification data, but its efficiency depends in practice on an optimal selection of hyper-parameters. This hyper-parameter estimation is often called the model selection problem [16].

If it is applied to a large data set, however, it requires a long time for training so its performance can be degraded a long time. To speed up training thereby shortening the time for model selection, several methods have been proposed, one of which is to reduce the training set size. That is why we perform our model selection for SVM on the training data selected that is involved on the 4 factors as mentioned above.

To obtain a good performance, we have carefully chosen some parameters that include the regularization parameter C, which determines the trade-off between minimizing the training error and minimizing model complexity, and parameters of the Kernel function.

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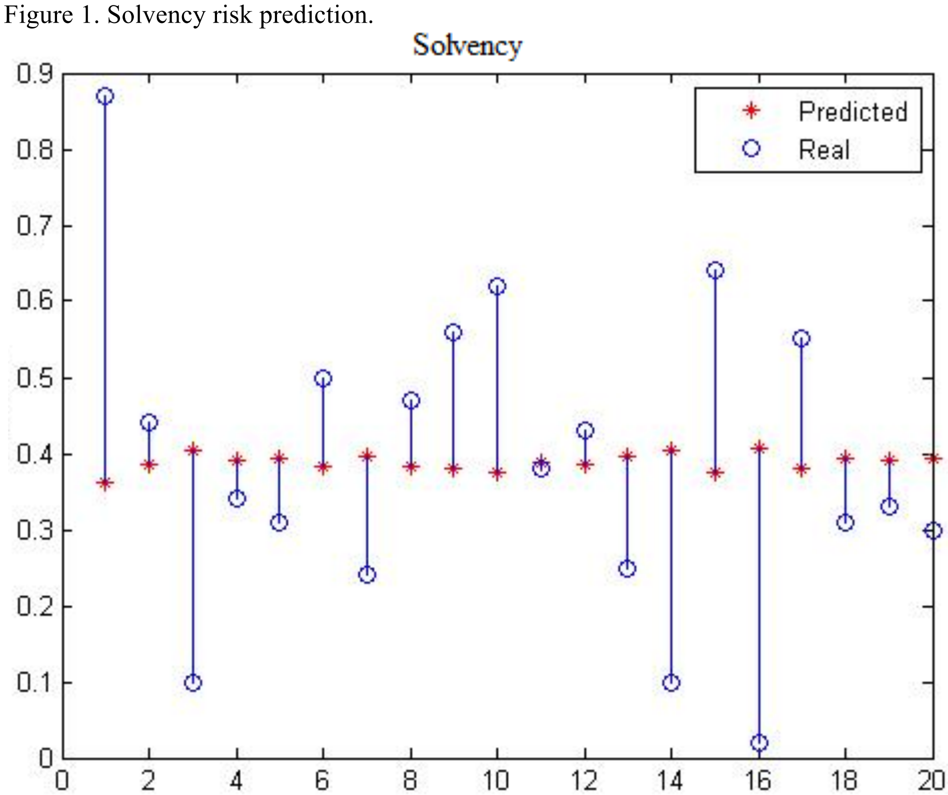
In this simulation we test the classification using the kernel function RBF so two parameters need to be chosen; they are the γ width of the RBF function and the soft margin parameter C of SVM.

One method often used to select the parameters is grid search on the log ratio of the parameters associated with cross-validation. Value pairs (C, γ), respectively was assessed using cross-validation and then we have chosen the pair with highest precision: (C, γ) = (100, 0.1).

According to the architecture of the support vector machine, only the training data near the boundaries are necessary. In addition, because the training time becomes longer as the number of training data increases, the training time is shortened if the data far from the boundary are deleted. Therefore, we have implemented a leave one out method in order to use a single observation from the original sample as the validation data, and the remaining observations as the training data. Then we have applied our SVM model over the training set on a new sample of 20 Moroccan companies whose financial data is selected over (2009-2010), with the purpose to measure the precision of creditworthiness risk prediction as compared to the actual data of 2011 as follows.

Figure 1. Solvency risk prediction.



The aim is to approximate the prediction performance based on the knowledge of the training set, as proved by the results above; the fact that the precision of the creditworthiness risk prediction is about 80% with an error range [0.01, 0.1], means that the model has a good measuring effect even the lack of sufficient historical and training data.

Conclusion and suggestion

This study has selected a sample of financial data of 20 companies between 2009 and 2011 to measure the impact of interest loans on the firm's solvency. We have used a linear regression model in order to build our Support Vector Machine (SVM) Model that includes four relevant factors used as input factors to forecast the Creditworthiness risk of a company.

The simulation results show that if policymakers want to improve firms' solvency and eliminate recurring financial crises, they must discourage excessive borrowing, interest loans, and risk-shifting, and instead encourage risk-sharing and free interest loans. Islamic finance offers a system that prohibits all interest loans, and therefore if properly applied, it can lead to a significant reduction in debt financing in favour of risk-sharing-- thus providing a tool to reduce, if not entirely eliminate, financial crises. Therefore, the current financial and economic crisis may ironically give a boost to Islamic banking, and hence open doors wide open for further expansion in the finance industry.

Having said that, and in order to ensure the availability and the accuracy of data, this research discarded a number of indicators which present difficulties in acquisition or differences in the method of calculation. For example, besides the information that companies are required to disclose through financial statements, other types of information such as Islamic financial statements, corporate case studies of Islamic bank loans, the financial data of securities market prices of publicly-traded corporations and the information on stock price indices for industries and for the market…, all will have a certain degree of precision constraints for measuring interest impact and solvency risk which will require further improvements.

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MEASURING BUSINESS CYCLE FLUCTUATIONS: AN ALTERNATIVE PRECURSOR TO ECONOMIC CRISES

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Abstract. *This study constructs a factor-based model of business cycle identification for the Malaysian economy via the dynamic factor approach. Our central focus is to explore a factor-based business cycle indicator (BCI) that can serve as a good gauge for economic crises. The empirical finding is in harmony with the envisaged objective; the constructed BCI produces satisfactory identification of business cycle turning points and statistically outperforms the traditional non-model-based indicator built by the national statistical institution of Malaysia in terms of predictive accuracy and forecasting performance. Therefore, we reckon that the constructed BCI can serve to identify the business climate and foretell approaching economic crises in a timely manner.*

Keywords: *Business cycle indicator; Dynamic factor model; Turning points*

Introduction

Throughout history, getting a good grip on the current and future states of an economy has been a hard core issue for policymakers, investors, businesspeople and even political parties. Despite countries' best endeavours to presage recurring changes or phase shifts across fluctuating business cycles, business cycle identification is typically challenging as the "state of economy" is rather latent and unobservable. Nevertheless, the literature springing from theoretical and methodological developments in the study of business cycles has mounted since the legendary work on indicator construction in the spirit of Burns and Mitchell (1946) was carried out by the National Bureau of Economic Research (NBER). This growing interest manifested the need for an appropriate measure of business cycle forecasting, in which predictive ability can live up to its goal of characterizing the business cycle condition in a forward-looking manner.

Hitherto, measuring the business cycle and dating its turning points encompassed at least three prominent approaches, starting with the primitive non-parametric NBER methodology, followed Stock and Watson's (1989, 1991) methodology on the factor-based model and, more recently, Hamilton's (1989) approach using the Markov-based regime shifting model. Undeniably, each approach upholds its unique potency in what it is built to be, but the appropriateness of each approach in real-time applications rests with empirical discussion. As far as we are concerned, the extensive literature in this domain is well established across economically developed economies such as the US, European countries, and Organisation for Economic Co-operation and Development (OECD) member countries. Vast numbers of studies, for instance, Bandholz and Funke (2003), Atabek, Coşar and Şahinöz (2005), Carriero and

Marcellino (2007), Schirwitz (2009), Wang, et al. (2009), Poměnková (2010) and Caraiani (2010), as well as others, have investigated various methodologies of indicator construction and diverse techniques for measuring and dating business cycle turning points and embraced continuous innovation in business cycle analysis.

Even though we believe that best practices diffusing across developed nations is a good reference for emerging economies, further exploration into the emerging society per se could be meaningful in describing the utility of indicator construction in business cycle forecasting for the emerging markets. At this point, we are motivated to construct a model-based business cycle indicator (BCI) for the Malaysian economy - one of the bright spots in the developing Asian countries which is also newly industrialized and rapidly emerging. It is obvious that economic transformations along with greater integration into the global market have significantly internationalized Malaysian businesses and impelled greater liberalization in the financial markets. Since risks are inherent in globalization and global interconnectedness plausibly magnifies risk contagion and external shocks, the prospective Malaysian economy presumably would be more prone to economic crises. In light of this concern, the search for a reliable forecasting tool for business cycle identification is crucial to support macroeconomics monitoring activity and risk management in the country.

Moreover, building a country-specific BCI is essential for country-wide economic policymaking and effective policy implementation. This is because policy lags can induce time lags in policy actions, making the full impact of a policy measure unachievable if the degree of foresight is not sufficient to tackle economic problems with instantaneous and correct timing. In this sense, the original policy objective to stabilize an economy could result in destabilization, and therefore worsened economic condition. Thus, it makes great sense for a country's policymakers to be warned by some indicators of the current state and future roadmap of the economy.

The present study includes noteworthy aspects that make it unique and novel to the Malaysian economy; the study also contributes to the literature on business cycle analysis in developing economies. At the outset, we address the potential ability of the factor-based indicator to elicit the cyclical movement of the business cycle in a forward-looking manner. To the best of our knowledge, this is the first attempt to build a factor-based indicator for business cycle forecasting in Malaysia. Previous studies with this focus have relied heavily on the classical approach formulated by Burns and Mitchell (1946) while some studies, for instance, Yap (2009) and Wong et al. (2013), merely evaluated the forecasting performance of the publicly available indicator without adding to indicator construction. For the case of Malaysia, an important reference on indicator construction has been credited to Zhang and Zhuang (2002), who applied the sequential probability model (SPM) proposed by Neftci (1982) to construct a leading indicator for business cycle analysis.

Furthermore, the researchers also considered the potential weaknesses of several detrending procedures and opted for the band-pass filter proposed by Christiano and Fitzgerald (1999) for cycle extraction. This is in some way distinct from a handful of past studies that used the phase average trend (PAT) method or Hodrick and Prescott's (1997) filter[1]. Last but not least, we evaluated the forecasting performance of the constructed BCI against the publicly available

[1] Detailed discussion on the potential drawbacks of the Hodrick-Prescott (HP) filter can be obtained from King and Rebelo (1993), Harvey and Jaeger (1993), Jaeger (1994) and Cogley and Nason (1995).

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composite leading indicator (CLI) based on the probability approach proposed by Greer (2003). On the whole, this paper aims to articulate the potential ability of the factor-based BCI to track the movement in business cycles in a well-timed manner and advocates the indicator as a sound gauge of future approaching crises.

The paper is organised as follows. Section 2 discusses the selection of business cycle reference series and the component variables. Then, Section 3 outlines the model specification and indicator construction and offers a discussion on empirical findings. The subsequent section details the robustness analysis and discusses corresponding findings, while the last section concludes.

Business Cycle and Component Series Selection

Despite extensive development on business cycle analysis, what constitutes a business cycle remains unsettled. Most studies have used real gross domestic product (GDP) as a measure of the business cycle. To provide a more robust result, in addition to real GDP, we also used the Index of Industrial Production (IIP) to test the possibility of obtaining a better benchmark in measuring the business cycle. We ultimately decided on real GDP as it provides a better approximation of the real economic setting in Malaysia; real GDP provides the best representation that covers a broad range of economic activity and adequately reflects each of the real economic sectors in the country.

For component series selection, we considered macroeconomic and financial series, which by nature comprise leading features of the business cycle. In addition, we also accounted for the economic nature, characteristics and country-specific background of the Malaysian economy. At this stage, some of the well-known guidelines, such as those from the Conference Board (2000) and OECD (2001), served as important references for selecting a desirable and representative component series[2]. Correlation analysis and Granger causality tests were applied to support the selection of the component series. We ultimately decided on six component series that had an adequate correlation to the business cycle and a significant Granger cause for the development of the business cycle throughout the investigated period. The final selected variables included domestic stock prices, US stock prices, money supply, exportation, newly registered company and tourist arrivals. The sample period covered from 1995 through 2012.

All the variables of interest, in monthly basic, were adopted from various issues of the International Financial Statistics (IFS) Yearbook published by the International Monetary Fund (IMF). On the other hand, the CLI was compiled from various issues of Malaysian Economic Indicators published by the Department of Statistics Malaysia (DOSM). Since Malaysia does not maintain GDP series in monthly frequency, we performed an interpolation on the quarterly GDP series based on the technique proposed by Gandolfo (1981) and took the ratio of GDP to consumer price index (CPI) to obtain the monthly GDP in real terms. We then examined the stationary properties of the data series via the augmented Dickey-Fuller (ADF) unit root test developed by Dickey and Fuller (1979; 1981)[3].

[2] See, for example, de Leeuw (1991), Yap (2001) and Jones and Ferris (1993) for more economic and statistical criteria on component series selection.

[3] To conserve space, the ADF unit root test result is not presented in the text, but it is available upon request.

Model Specification and Indicator Construction

Economists believe that development in economic activity occurs in a cycle in which an upswing marks the onset of an expansion phase and growth persists until it reaches the peak where downswing takes off, pointing to the period of contraction. The wave of economic activity, or more precisely the business cycle, is commonly accepted as the movement in GDP. However, the state of the business cycle is in fact a shared influence of various macroeconomic aspects. These aspects, when taken together, can concisely sum up the information content into a meaningful business cycle outlook. In this context, it is pertinent to postulate the cyclical movement in business condition as synchronized co-movement between a particular set of macroeconomic variables. Collectively, the shared influence makes up the so-called "state of business cycle".

Intuitively, Stock and Watson's (1989, 1991) parametric factor model is built on the assumption that macroeconomic variables that move together over time possess a common element that can be captured by a single underlying, unobserved component and the unobserved state can be dynamically extracted using a factor-based model. Following Stock and Watson (1991), we modified the specification to accommodate a six-variable dynamic factor model. We denoted the component series as Y_{1t}, Y_{2t}, Y_{3t}, Y_{4t}, Y_{5t} and Y_{6t} for domestic stock prices, US stock prices, money supply, exportation, newly registered company and tourist arrivals, respectively. We followed Stock and Watson (1991) so as to have the model specified under first difference because the unit root testing performed in the earlier stage points to the existence of a stationary state after differencing once. Thus, the first difference specification of the dynamic factor model can be written as follows:

$$\Delta Y_{it} = D_i + \gamma_i \Delta C_t + e_{it}, \quad i = 1,2,3,4,5,6 \tag{1}$$

$$\left(\Delta C_t - \delta\right) = \phi_1\left(\Delta C_{t-1} - \delta\right) + \phi_2\left(\Delta C_{t-2} - \delta\right) + \omega_t, \quad \omega_t \sim i.i.d.N\left(0, \sigma_\omega^2\right) \tag{2}$$

$$e_{it} = \psi_{i1} e_{i,t-1} + \psi_{i2} e_{i,t-2} + \varepsilon_{it}, \quad \varepsilon_t \sim i.i.d.N\left(0, \sigma_\omega^2\right), \quad i = 1,2,3,4,5,6 \tag{3}$$

where ΔC_t is the common component that enters Equation (1) with different weights and σ_ω^2 is set to 1 so as to normalize the common component. All the shocks are assumed to be independent.

Apart from this, Stock and Watson also recommended transforming the model into deviation from means to ensure that the maximum likelihood estimation can be performed without predicament. This is to account for a concern in which the parameters D_i and δ in the first population moment for the *i*-th variable, ΔY_{it}, represented in Equation (4) are not separately identified in the case of the sample first moment, $\Delta \overline{Y}_i$.

$$E\left(\Delta Y_{it}\right) = D_i + \gamma_i \delta \tag{4}$$

From the likelihood function, the model in deviation from means focuses on $D_i + \gamma_i \delta$ terms, where i = 1, 2, 3, 4, 5, 6. We then can re-write the model as follows:

$$\Delta y_{it} = \gamma_i \Delta c_t + e_{it}, \quad i = 1,2,3,4,5,6 \tag{5}$$

$$\Delta c_t = \phi_1 \Delta c_{t-1} + \phi_2 \Delta c_{t-2} + \omega_t, \quad \omega_t \sim i.i.d.N(0,1) \tag{6}$$

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$$e_{it} = \psi_{i1} e_{i,t-1} + \psi_{i2} e_{i,t-2} + \varepsilon_{it}, \quad \varepsilon_t \sim i.i.d.N\left(0, \sigma_\omega^2\right), \quad i = 1,2,3,4,5,6 \tag{7}$$

where $\Delta y_{it} = \Delta Y_{it} - \Delta\overline{Y_i}$ and $\Delta c_t = \Delta C_t - \delta$.

Subsequently, a state-space representation of the deviation from means model can be derived as follows:

Measurement Equation:

$$\begin{bmatrix} \Delta y_{1t} \\ \Delta y_{2t} \\ \Delta y_{3t} \\ \Delta y_{4t} \\ \Delta y_{5t} \\ \Delta y_{6t} \end{bmatrix} = \begin{bmatrix} \gamma_1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \gamma_2 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \gamma_3 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ \gamma_4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ \gamma_5 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ \gamma_6 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} \Delta c_t \\ \Delta c_{t-1} \\ e_{1t} \\ e_{1,t-1} \\ e_{2t} \\ e_{2,t-1} \\ e_{3t} \\ e_{3,t-1} \\ e_{4t} \\ e_{4,t-1} \\ e_{5t} \\ e_{5,t-1} \\ e_{6t} \\ e_{6,t-1} \end{bmatrix} \tag{8}$$

Transition Equation:

$$\begin{bmatrix} \Delta c_t \\ \Delta c_{t-1} \\ e_{1t} \\ e_{1,t-1} \\ e_{2t} \\ e_{2,t-1} \\ e_{3t} \\ e_{3,t-1} \\ e_{4t} \\ e_{4,t-1} \\ e_{5t} \\ e_{5,t-1} \\ e_{6t} \\ e_{6,t-1} \end{bmatrix} = \begin{bmatrix} \phi_1 & \phi_2 & 0 & 0 & \cdots & 0 & 0 \\ 1 & 0 & 0 & 0 & \cdots & 0 & 0 \\ 0 & 0 & \psi_{11} & \psi_{12} & \cdots & 0 & 0 \\ 0 & 0 & 1 & 0 & \cdots & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots & \ddots & 0 & 0 \\ 0 & 0 & 0 & 0 & \cdots & \psi_{61} & \psi_{62} \\ 0 & 0 & 0 & 0 & \cdots & 1 & 0 \end{bmatrix} \begin{bmatrix} \Delta c_{t-1} \\ \Delta c_{t-2} \\ e_{1,t-1} \\ e_{1,t-2} \\ e_{2,t-1} \\ e_{2,t-2} \\ e_{3,t-1} \\ e_{3,t-2} \\ e_{4,t-1} \\ e_{4,t-2} \\ e_{5,t-1} \\ e_{5,t-2} \\ e_{6,t-1} \\ e_{6,t-2} \end{bmatrix} + \begin{bmatrix} \omega_t \\ 0 \\ \varepsilon_{1t} \\ 0 \\ \varepsilon_{2t} \\ 0 \\ \varepsilon_{3t} \\ 0 \\ \varepsilon_{4t} \\ 0 \\ \varepsilon_{5t} \\ 0 \\ \varepsilon_{6t} \\ 0 \end{bmatrix} \quad (9)$$

From Equations (8) and (9), we can estimate the model using the maximum likelihood estimation and extract the unobserved component through Kalman filtering. Kalman filtering is a recursive procedure that provides optimal estimates for the unobserved component and minimizes the forecast error via the maximum likelihood algorithm.

The extracted unobserved component forms the proxy of BCI index. The raw index is then transformed and normalized to facilitate the evaluation of forecasting performance in the later stage. To evaluate the performance of BCI in predicting the movement of real GDP, detrending and cycle extraction with the band-pass filter established by Christiano and Fitzgerald (1999) was then carried out. The resulting cyclical movement is represented in Figure 1, with the shaded area corresponding to major economic episodes that occurred across the period of 1995-2012. Our turning points analysis based on the Bry-Boschan (1971) dating algorithm gives rise to several important implications concerning the validity of BCI in anticipating the business cycle development and the evolution of crises incidents.

We found that the movement in BCI synchronized well with the fluctuations in Malaysia's economic activity as proxied by real GDP. The recurring cycles across the investigated period are persistent but irregular. The average duration for expansion periods is relatively longer, ranging from 20 to 32 months while the length for contraction periods is consistently shorter in each cycle, about 12 to 15 months. The BCI detected four important episodes: the Asian financial crisis 1997/1998, US technology/dot-com bubble 2000/2001, oil price hike incident 2004/2005 and US sub-prime mortgage crisis 2008/2009.

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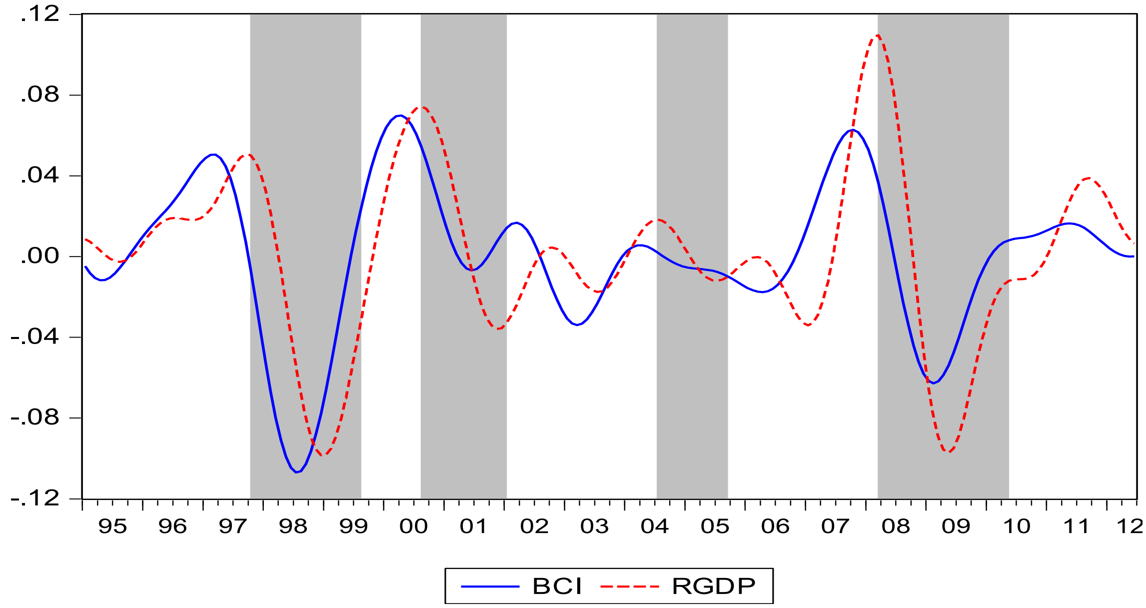
Figure 1: BCI versus Real GDP, 1995-2012



More importantly, the constructed BCI marked the peaks and troughs at a relatively earlier point in time than the chronology of the real business cycle as reflected by real GDP. Of the eight turning points, the factor-based BCI only detected a false signal corresponding to the trough during the oil price hikes incident in 2004/2005. For this case, a slight transition in economic activity is observable, but no significant turning point was dated. We expected the shock from oil price hikes to permeate over the years, yet the real impact of the shock was not prompt. Therefore, the resulting trough reflected real output pass-off in late 2006, rather than mid-2005 as reported by DOSM. Our result is in line with Yap (2009), who also marked the real trough in oil price shocks at mid-2006.

On average, the length of the BCI's early signal is about 4.4 months (see Table 1). In contrast, the CLI, serving as a nationwide reference of economic activity in Malaysia, possesses relatively lower strength with regards to business cycle foresight with only 3.7 months of lead time on average (see Table 2). Despite the arbitrary signal for the oil price hike incident, the rest of the turning points were correctly dated and the duration of early signals was deemed to be sensibly sufficient for preventive measures and policy action. Therefore, the factor-based BCI produced a satisfactory outcome for business cycle forecasting and offered better predictive power for early signals of vulnerability to economic episodes.

Table 1: Tuning Point Dates for Real GDP versus BCI

Incident		**Real GDP**	**BCI**	**Type of Signal**	**Lead/Lag**
Asian Financial Crisis	Peak	1997M09	1997M03	Early Signal	+6
	Trough	1998M12	1998M07	Early Signal	+5
US Dot-com Bubble	Peak	2000M08	2000M04	Early Signal	+4
	Trough	2001M11	2001M06	Early Signal	+5
Oil Price Hike Incident	Peak	2004M07	2004M04	Early Signal	+3
	Trough	2005M07	-	False Signal	-
US Sub-prime Mortgage Crisis	Peak	2008M03	2007M10	Early Signal	+5
	Trough	2009M05	2009M02	Early Signal	+3

Table 2: Tuning Point Dates for Real GDP versus CLI					
Incident		Real GDP	CLI	Type of Signal	Lead/Lag
Asian Financial Crisis	Peak	1997M09	1997M03	Early Signal	+6
	Trough	1998M12	1998M08	Early Signal	+4
US Dot-com Bubble	Peak	2000M08	2000M06	Early Signal	+2
	Trough	2001M11	2001M08	Early Signal	+3
Oil Price Hike Incident	Peak	2004M07	2004M04	Early Signal	+3
	Trough	2005M07	-	False Signal	-
US Sub-prime Mortgage Crisis	Peak	2008M03	2007M10	Early Signal	+5
	Trough	2009M05	2009M02	Early Signal	+3

Predictive Accuracy and Robustness Analyses

With two competing indicators (BCI and CLI) at hand, a more formal statistical approach to analysing the predictive accuracy of the two indicators is particularly meaningful for a more credible study in the field of forecasting. From a forecasting perspective, renewed interest in direction accuracy of macroeconomic forecasts clearly indicates that unreliable forecasts make no sense to users. Greer (2003) even argued that it is the large predicted change that in fact is useful to users. In other words, if a forecasting model comprises predicted changes that are not adequately significant to reveal the underlying impact of the real shock, the resulting forecasts will be susceptible.

Following Greer (2003), we subjected the two competing indicators to directional accuracy testing and complemented the finding with binomial testing. We broke the cyclical changes into three trichotomous scenarios; specifically, a large predicted increase, no significant changes and a large predicted decrease, and applied a threshold point of 5 percent to cut off the small predicted changes. Thus, the directional accuracy rate can be calculated based on the formula below:

$$\text{Directional Accuracy Rate (DAR)} = \frac{C_s}{N_s} \times 100 \qquad (10)$$

where C_s is the number of correct predictions for significant large changes, and N_s refers to the total number of significant large changes in the business cycle as proxied by real GDP.

In addition, we harmonized the binomial testing with the direction accuracy result to verify the robustness of the factor-based BCI against the CLI. In particular, we were keen to know whether the success of the prediction is owing to the predictive power of the forecasting model (indicator) or to mere chance. This verification is crucial to portray that the indicator itself has compelling predictive power and is robust over time. The null hypothesis of binomial testing is: "The probability of correct prediction to direction of change in the forecasting model is 50 percent". Rejection of the null hypothesis will lead to two distinct conclusions, depending on the outcome of direction accuracy testing (DAR). If DAR is over 50 percent, then the forecasting model is independent of wild guess. On the other hand, if DAR is below 50 percent, we can expect that wild guess possibly dominates the source for obtaining correct predictions. Failure in beating the wild guess again implies that the indicator is less likely to be a robust forecasting tool.

The comparative findings on DAR and binomial testing for the two competing indicators were tabulated and are shown in Table 3. The findings show that the factor-based BCI can predict the direction of change in the business cycle with an accuracy rate of up to 84 percent. On the

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other hand, the DAR of the publicly available CLI was at best 25 percent. With the binomial testing results pointing to a rejection of the null hypothesis in all cases, we can infer the robustness of BCI in business cycle forecasting; its compelling predictive ability and statistical robustness in terms of forecasting as the source of the BCI's successful forecasts is attributable to the predictive power of the indicator, and not mere chance.

Table 3: Directional Accuracy and Binomial Testing Results

Lag (month)	Directional Accuracy Rate (DAR)		P(Binomial)	
	BCI	CLI	BCI	CLI
1	61.36%	18.18%	0.039	0.000
2	70.45%	20.45%	0.003	0.000
3	77.27%	22.73%	0.000	0.000
4	84.09%	25.00%	0.000	0.000
5	81.82%	25.00%	0.000	0.000
6	79.55%	22.73%	0.000	0.000

Conclusion

To sum up, the factor-based BCI constructed in the present study has fulfilled our primary aim of building a reliable forecasting tool for business cycle identification in Malaysia. We observed that the reference chorology established on the basis of output growth has traced well the movement of economic activity in Malaysia while the constructed BCI tracked the fluctuations, especially the key turning points, at notably accurate and advanced timing. Essentially, with its capability to generate early signals for up to 4.4 months on average, the constructed BCI is fairly adequate to demonstrate a signalling mechanism that built upon the ideology of indicator construction on top of Stock and Watson's factor-based model.

Seeing that the early signal generated by the constructed BCI is contributory to macroeconomic policy building and crisis prevention, we expect BCI to perform sensibly well as an alternative precursor to economic crises. Besides, the BCI can complement other business cycle forecasting instruments and best practices of macroeconomic risk-monitoring activity. Apart for that, the robustness of the BCI, which statistically outperforms the publicly available CLI, suggests that the nationally owned composite indicator has significant room for further improvement. Thus, we perceive future innovation in indicator-based forecasting tools, especially the upgrading of composition and indicator construction, to be critical in sustaining the competency of the said indicator.

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ASSESSING COUNTRY RISK: A PROBABILITY DEFAULT MODEL BASED ON CREDIT RATINGS

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***Abstract**. The purpose of this study is to examine the main determinants of the sovereign credit ratings provided by the three major rating agencies: Fitch Ratings, Moody's and Standard and Poor's. We follow the Shadow Rating approach in order to model the logit[1] of the Probability of Default (PD) of the ratings, and apply cross section and panel data econometrics to select the most explanatory and robust variables.*

***Key Words:** Sovereign Ratings, Probability of default, rating agencies, shadow rating,*

Introduction

In this article we report on some aspects of the development of the so-called shadow rating approachs found to be important. The shadow rating approach is typically employed when default data are rare and external ratings from the three major rating agencies (Standard & Poor´s, Moody´s or Fitch) are available for a significant and representative part of the portfolio. The shadow rating approach´s objective is to chose and weight the risk factors in such a way as to mimic external ratings as closely as possible when there is insufficient data to build an explicit default prediction model.

Understanding the determinants of the sovereign credit rating is important as it sheds light into what credit rating agencies monitor when they issue a rating. Also, because not all countries have a credit sovereign rating, a model that can be used to assess the credit worthiness of sovereigns is required. This article seeks to produce an econometric model that can use readily available data, in order to assess sovereign credit risk in a way that allows comparisons with well-know international rating scales.

Relevant Literature

A number of empirical studies have examined the impact of economic factors on the sovereign risk (e.g., Feder and Uy (1985), Cantor and Packer (1996), Larrain et al. (1997), Mulder and Perrelli (2001), Alfonso (2003) and Mellios and Paget-Blanc 2006).

The article follows a similar pattern, however the sample used is larger and more recent than those of previous studies. This is important as it allows for greater accuracy and relevance, especially in such a dynamic environment as that of international finance.

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[1] The logit is defined as the log of the odds ratio, that is, log $(p_d/(1-p_d))$

Methodology and Results

The Shadow Rating approach followed Erlenmaier (2006). The notable difference is the use of the logit of the probability of default (PD) as dependent variable, as opposed to the use of the PD directly. The cross section and panel data econometrics modelling followed Wooldridge (2001), Singer and Willett (2003) and Frees (2004).

The shadow rating approach is typically used when default data are scarce and external ratings issued by the major international rating agencies (Standard and Poor's, Moody's or Fitch Ratings) cover significant portion of the loan portfolio of the institution holding the loan. The common purpose to all quantitative methodologies for risk classification is to identify risk factors that provide reliable indications about the probability of default (Moody's Investor Service, 2010).

The shadow rating approach does that indirectly, since there is insufficient data to develop an explicit model for predicting the probability of default, identifying the key factors and estimating weights for each factor in order to estimate external ratings. Furthermore, one must calibrate the model to a probability of default (Erlenmaier, 2006), in order to make the estimated model useful for credit risk management and compliant with regulatory demands.

The development of the statistical model followed six steps:

1. Data collection;
2. Mapping of external ratings to probability of defaults;
3. Analysis of risk factors and variable selection;
4. Model estimation;
5. Model validation; and
6. Model adjustment.

Step 1: Data Collection

We have collected data from the three major credit agencies, covering 123 countries with at least one year rating, from 1999 to 2009. We have also collected data for the same period from the World Economic Outlook database published by the International Monetary Fund, and the World Development Indicators database and Worldwide Governance Index, published by the World Bank.

The sample of sovereign ratings used for mapping the dependent variable was obtained from Bloomberg, taking the history of ratings issued by Standard & Poor's, Moody's and Fitch Ratings from 2000 to 2009. When there were multiple ratings issued by the same rating agency for a given country and year, only the rating at the end of the year was used.

Table 1. Tested Variables

Variable	Sources
Current account balance (% GDP)	WDI, WEO
Net Foreign Direct Investment (% GDP)	WDI
Total Reserves (% External Debt)	WDI
Total Reserves excluding Gold (US$)	WDI
External Debt (% Exports)	WDI
External Debt (% GDP)	WDI
GDP Growth (% Annual)	WDI, WGI
Gross Domestic Savings (% GDP)	WDI

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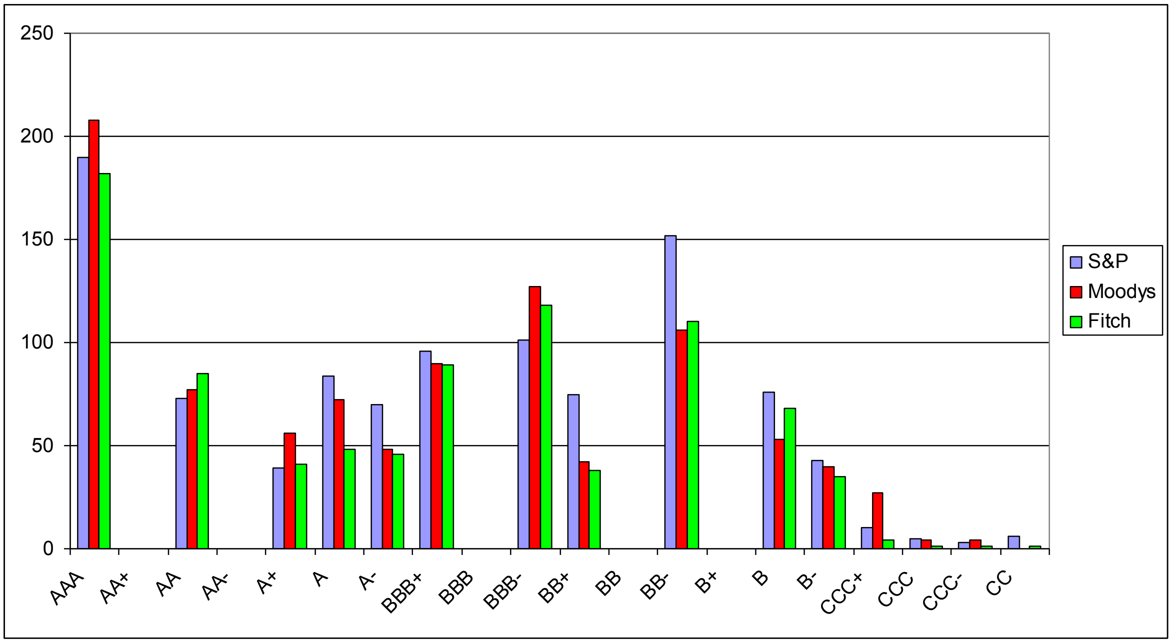
Variable	Sources
Gross Fixed Capital Formation (% GDP)	WDI
International Trade (% GDP)	WDI
Gross Domestic Product (US$)	WDI
GDP per Capita (PPP)	WDI
Domestic Credit to Private Sector ($ GDP)	WDI
Stocks Traded, Total Value (% GDP)	WDI
Real Exchange Rate (REER 2005)	WDI
Real Interest Rate (%)	WDI
Inflation (Consumer Price Index, %)	WDI
Cash Surplus or Deficit (% GDP)	WEO
Central Government Debt (% GDP)	WEO
Gross Public Debt (% GDP)	WEO
Public Sector Primary Surplus (% GDP)	WEO
Public Sector Primary Surplus (%GDP)	WEO
Research & Development Expenses (% GDP)	WDI
Unemployment (% of total labor force)	WDI
Long-term Unemployment (% total unemployment)	WDI
Gini Index	WDI
Voice and Accountability	WGI
Political Stability, No Violence	WGI
Government Effectiveness	WGI
Regulatory Quality	WGI
Rule of Law	WGI
Control of Corruption	WGI

Economic, political and social indicators assessed (Table 1) were obtained from databases such as the World Development Indicators (WDI) and Worldwide Governance Index (WGI) from the World Bank and World Economic Outlook (WEO) from the International Monetary Fund (IMF).

No indicator used was estimated. Observations with missing data were not used for estimation. When indicators were similar in multiple sources, the source selection took in consideration the coverage and periodicity of the series.

Importantly, the number of sovereign ratings is much lower than that of corporate ratings due to a natural limitation in the number of countries. Thus, we used data from 2000 to 2009 so that the sample was large enough to allow the estimation of robust parameters. During this period, at least 123 countries had a rating as can be seen from graph 1 below.

Graph 1 – Sovereign Ratings from the rating agencies 2000 - 2009



Source: Bloomberg

After data collection, we proceeded to the mapping of the dependent variable.

Step 2: Mapping of external ratings to probability of defaults

An important step in building a shadow rating model is to map the ratings issued by rating agencies to associate them with default probabilities. In this procedure we used the unsecured issuer ratings of long-term foreign currency because they indicate the credit risk without mitigants and are consistent with Basel II (BCBS, 2006). Moreover, the long-term ratings in foreign currency are more stable (Moody's Investor Service, 2010), and better aligned with the average term of repayment of the loan portfolio of BNDES.

Table 2. Sovereign ratings and five year PD (%), 1983-2009

Rating Moody's	Rating. S&P	Moody´s PD (*) (%)	Equiv. S&P	Model PD (%)
Aaa	AAA	0.000	AAA	0.002
Aa1	AA+	0.000	AA+	0.306
Aa2	AA	0.000	AA	0.610
Aa3	AA-	0.000	AA-	0.915
A1	A+	0.000	A+	1.219
A2	A	0.000	A	1.524
A3	A-	0.000	A-	1.828
Baa1	BBB+	2.437	BBB+	2.133
Baa2	BBB	2.437	BBB	2.437
Baa3	BBB-	2.437	BBB-	3.848
Ba1	BB+	8.079	BB+	5.258
Ba2	BB	8.079	BB	6.669
Ba2	BB-	8.079	BB-	8.079
B1	B+	10.572	B+	10.572
B2	B	10.572	B	16.044

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Rating Moody’s	Rating. S&P	Moody´s PD (*) (%)	Equiv. S&P	Model PD (%)
B3	B-	10.572	B-	21.515
Caa – C	CCC+ - C	32.458	CCC+	26.987
Caa – C	CCC+ - C	32.458	CCC	32.458
Caa – C	CCC+ - C	32.458	CCC-	49.344
Caa – C	CCC+ - C	32.458	CC	66.229
Caa – C	CCC+ - C	32.458	C	83.115

Source: (*) Moody's Investor Service, 2010

In the mapping process we used the mean five year probability of default (PD), as shown in Table 2. The use of the mean five year PD is important because in shorter time horizons, credit events, especially for sovereign debt, are very rare. In addition, five year PDs show lower volatility (Moody's Investor Service, 2010), and allow better estimation. Finally, we are interested in the Long Run Probability of Default.

As noted, the mean probability of default does not distinguish between modifiers (sublevels) and assigns a zero PD zero to ratings between AAA and A-. In order to distinguish the model PD in this region, a cubic interpolation was used, as reported in the last column of Table 2.

After mapping external ratings into default probabilities, we identified the possible variables to be used in model development.

Step 3: Analysis of risk factors and variable selection

Variable selection was performed by the analysis of various risk factors, from data collected as described in section 2. According to Standard and Poor´s (2011), risk factors related to the probability of default of a country are divided into 5 main categories:

1. Economic;
2. Political;
3. Fiscal;
4. External; and
5. Monetary.

Each explanatory variable can be related to more than one category (eg, related to both economic score and fiscal score). Thus, in order to facilitate the interpretation of the model, we sought to associate each selected variable to the predominant category.

In most cases, explanatory variables were ratios of Gross Domestic Product (GDP) or per capita. This ensures that country size would not a priori influence the credit risk. Furthermore, by using ratios, we avoided the need to treat differences in the value of money and different currencies. The only variable that does not fit the characteristics described previously is the base-10 logarithm of international reserves (in US$).

Given the large number of variables, there were numerous possible combinations of variables to explain the probability of default. Thus, only the variables most strongly correlated with the default probability were considered. In addition, several indicators showed high correlation with each other, suggestion a relationship with the same underlying risk factor. In this case, when two variables showed a correlation greater than 80%, the variable with the highest correlation with the remaining variables was excluded from the analysis in order to reduce multicollinearity.

After treatment of the data and the selection of variables, we estimated a model with seven explanatory variables, six of which are continuous variables and one is dichotomous. Table 3 lists the descriptive statistics of the variables used in the model.

These variables encompass (as proxies) the categories of risk factors previously cited. Balance on Current Account and Foreign Currency Reserves are related to External risk (flow and inventory, respectively), Income per Capita (PPP) is related to Economic risk, and Inflation to Monetary risk.

Table 3. Descriptive Statistics

Variable	*Minimum*	*Maximum*	*Mean*	*s.d.*
Current account balance (cab) (%)	-30.26	44.62	-1.17	9.56
Log_{10} GDP per capita (gdppc)	2.65	4.96	3.95	0.48
Cash surplus or deficit (gsd) (%)	-25.63	39.53	-0.84	5.62
WGI index (wgi) (%)	17.33	90.37	56.23	17.81
Inflation (inflation) (%)	-2.00	30.00	5.80	6.11
Log_{10} International reserves (trc)	6.99	12.38	9.76	0.84

We chose to bound inflation between -2% and 30%, in order to correct a distribution problem and also because we believe that inflation greater than 30% already represents a poor monetary policy. This helps to avoid distortions in countries with very high inflation. Along the same line, this treatment avoids excessively rewarding a large deflation that may not represent good monetary policy.

The WGI index is formed by the simple arithmetic mean of three scores: Government Effectiveness, Regulatory Quality and Rule of Law. The mean was more explanatory than each individual score, and avoided the strong correlation between the three scores. The WGI index in the model represents Political risk.

Cash surplus or deficit was obtained from the IMF WEO and is formed by the simple arithmetic mean of the result in the reference year, the previous year and the estimate for the following year. The use of the 3-year average is important to decrease volatility, and to handle large differences such as those occurring in election years. The score represents Fiscal risk.

Finally, a dichotomous variable was used in order to correct the WGI index distribution, with value one for countries with WGI index greater than 75% (dwgi_m75) and zero otherwise.

Step 4: Model Estimation

Given the structure of the data with observations from the same countries for several years, the entire (pooled) sample violates the premise of independence of observations, as the rating of a country in a year is highly dependent on the rating of the previous year. In such scenario, panel methods are adequate (Wooldridge, 2001; Frees, 2004; Singer & Willett, 2003).

The modeling process employed panel data models with least squares method with random effects for the periods as indicated by the tests suggested by the literature (Hausman, 1978) in order to estimate the parameters that best fit the data.

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Figure 1. Hausman Test

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	68.189097	6	0.0000

Correlated Random Effects - Hausman Test
Equation: Untitled
Test period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	2.993463	6	0.8097

Figure 2. Redundant Fixed Effects

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section and period fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	45.527917	(93,560)	0.0000
Cross-section Chi-square	1436.479290	93	0.0000
Period F	4.605626	(9,560)	0.0000
Period Chi-square	47.771734	9	0.0000
Cross-Section/Period F	41.753539	(102,560)	0.0000
Cross-Section/Period Chi-square	1439.926226	102	0.0000

The Hausman test aims to identify the need to handle random effects in the panel. From Figure 1, the null hypothesis was rejected for the cross section and not discarded for periods. The random effects in periods aims to isolate the effect of the correlation that the ratings of these countries have with each other for various years.

The test of redundant fixed effects aims to verify whether it is necessary to handle fixed effects in the panel. The null hypothesis was rejected for the cross section and the periods, indicating that this effect should not be used (Figure 2).

The dependent variable was defined as the logit of the probability of default associated with ratings. As already mentioned, the logit is defined as the natural logarithm of the odds ratio: LN (pd / (pd-1)), where PD is a probability of default associated with a rating (as per Table 1). In addition, a dummy was included, which is intended to adjust the WGI index distribution which is bimodal (or non-linear in relation to the logit). The final model is given by:

Formula 1. Estimated Model:

$$\text{logit} = \alpha + \beta_1 \cdot \text{cab} + \beta_2 \cdot \text{gdppc} + \beta_3 \cdot \text{gsd} + \beta_4 \cdot \text{wgi} + \beta_5 \cdot \text{inflation} + \beta_6 \cdot \text{trc} + \beta_7 \cdot \text{dwgi\_m75} + \varepsilon$$

and $PD = \dfrac{1}{1 + e^{-\text{logit}}}$

Table 4 presents the selected variables. All variables are statistically significant and show the expected signs. Standard errors calculated for statistical inference are robust to heteroskedasticicty, following White (1980).

Table 4. Model Coefficients (n=886, Adjusted R^2 = 0.892)

Variável	*Coeficiente*	*p-valor*
Constante	α = 5,75	< 0,00001
Current account balance (cab) (% GDP)	$\beta1$ = -1,6467	< 0,00001
Log_{10} GDP per capita (gdppc) (PPP)	$\beta2$ = -0,6478	< 0,00001
Cash surplus or deficit (gsd) (% GDP)	$\beta3$ = -3,3652	< 0,00001
WGI index (wgi) (%)	$\beta4$ = 6,4180	< 0,00001
Inflation (inflation) (%)	$\beta5$ = 2,4554	< 0,00001
Log_{10} International reserves (trc)	$\beta6$ = -0,3434	< 0,00001
WGI dummy : WGI > 75 (dwgi_m75)	$\beta7$ = -2,0206	< 0,00001
Number of observations	-x-	*R^2 adjusted*
886	-x-	0,892

As the scores obtained from the model were in line with the expected default probabilities, it was not necessary to calibrate the estimated PDs, and we proceeded to model validation.

Step 5: Model Validation

The selected model has undergone several tests to assess its capacity to accurately estimate the ratings issued by major international rating agencies.

There are not sufficient sovereign ratings to test the model out-of-sample, since all available data was used to estimate the model. Instead, we used a hit-mismatch matrix, following Grün et al (2010), and verified the ability of the estimated model prior to adjustments, to correctly predict the ratings issued by international rating agencies.

Based on this method, the estimated model shows a hit ratio of 93,0%; within three notches of the observed rating, that was considered satisfactory.

Table 5. Hit-mismatch matrix: predicted vs observed ratings, without modifiers

Predicted	Observed						
	AAA	AA	A	BBB	BB	B	<=CCC
AAA	542	44	17	8	0	0	0
AA	4	36	34	4	0	0	0
A	11	80	313	89	1	0	0
BBB	0	0	60	309	89	14	0
BB	0	0	2	119	230	74	7
B	0	0	0	11	148	164	51
<=CCC	0	0	0	0	9	18	9

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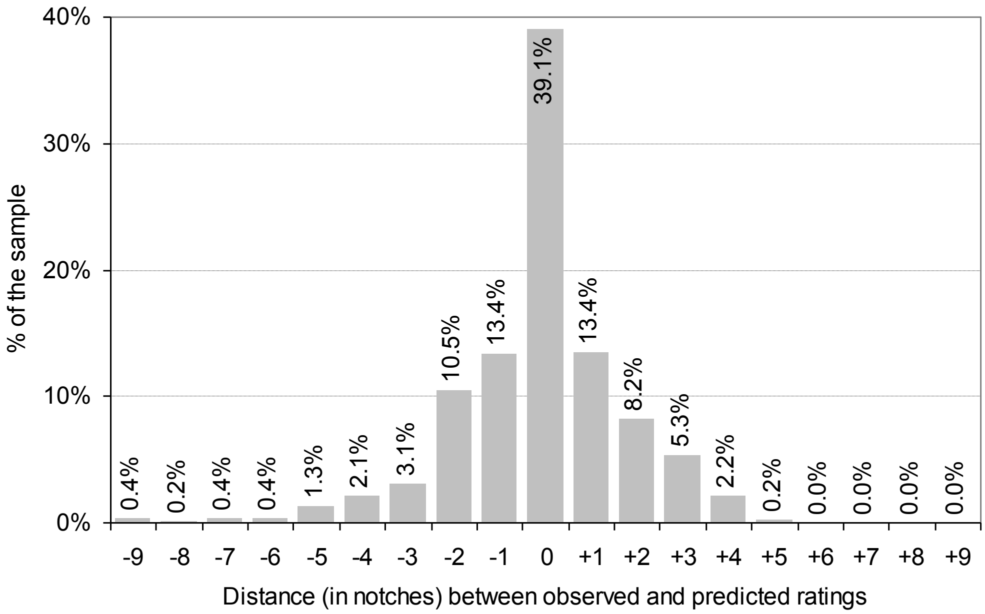
Another similar manner, is to evaluate the distribution of the differences between predicted (model) and observed (agency) ratings. In this analysis, a difference of zero implies an exact match, and each integer represents a distance of one notch between estimated and observed ratings.

Graphic 2. Distribution of differences between predicted and observed ratings



Finally, we evaluated the accuracy of the model. In this evaluation, we used a tool known as continuous receiver operating characteristic (continuous ROC). This diagnostic test (Nguyen, 2007), allows to compare the accuracy of a measurement against a known gold standard, even if the measurement is continuous. Greater values of the area under the ROC curve indicate a better accuracy. The estimated model exhibited an area under the ROC curve of 88.28 %, which represents a good level of accuracy.

According to the above results, the model presented here performs well and yields scores close to the ratings published by international rating agencies.

It should be noted that, as the tests were performed in-sample, it is expected that the out-of-sample accuracy would be somewhat reduced. Such reduction should be minimized by the model adjustments presented in the next step.

Step 6: Model Adjustment

As mentioned in the previous section, the quantitative model does not capture some intrinsic features of certain countries only with political, economic and social variables. These unobserved characteristics sometimes are often responsible for the distance between predicted and observed ratings. Because these issues affect only a handful of countries, it is not possible to include them in the quantitative model (i.e., not statistically significant).

The main qualitative characteristic influencing ratings is the existence of recent default history. Countries that have defaulted recently may experience a difference of up to 9 notches between estimated and observed ratings. A second important influence is the use of hard currency, especially when a country belongs to a multilateral agreement, as the European Union, as inflation is often under control and the country is better protected from major devaluations. Thus, in order to supplement the quantitative model, we proposed the notch adjustments listed in Table 6.

Table 6. Adjustments after the quantitative model

Criteria	Adjustment to predicted rating
Default in the last 2 years?	If yes, move down 6 notches
Default in the last 3-5 years?	If yes, move down 4 notches
Default in the last 6-10 years?	If yes, move down 2 notches
Strong currency (i.e., Euro, US Dollar)	If yes, move up 1 notch

These adjustments significantly improve the ratings estimated from countries with some of the above features, which - in particular - are those outside the range of -3 to 3 sublevels difference in Graphic 2.

Conclusion

The presented model aims to produce ratings and default probabilities in the lack of a database containing a sufficient number of defaults.

The model contains six factors and a dummy variable. For 92% of the pooled sample (grouping the three agencies) the predicted rating is within three notches of the observed rating. Recent country's default (up to 10 years) turns out to influence the sovereign rating, although not statistically significant, because of the small number of defaults. Nonetheless, this credit event explains well most errors larger than 3 notches. The accuracy obtained by the model is good, especially considering that credit agencies uses qualitative judgments that are beyond the scope of this article.

Notwithstanding the limitations, the model presented here, based on the shadow rating approach, is easy to understand and apply, uses readily available information, and satisfactorily predicts country ratings issued by international rating agencies, and can be an useful tool for the assessment of sovereign credit risk.

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ASSESSING CORPORATE RISK: A PD MODEL BASED ON CREDIT RATINGS

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Abstract. *This paper proposes a model which tries to mimic agencies' corporate ratings. Using financial data for more than 1,400 firms across several years, a model based on financial statements was estimated and yielded reasonable accuracy for companies of diverse sizes and industries. The model was able to predict ratings within 3 notches of accuracy for about 90% of the cases.*

Introduction

Rating agencies provide valuable credit information despite suffering widespread criticism since the subprime crisis. Their credit risk assessments are still broadly used by the financial industry globally. However, only about 3,000 corporates are rated, at the same time as most of them are located in the US. This severely limits the applicability of ratings to emerging markets. With this concern in mind, we developed a model that tries to approximate agencies' ratings by using solely financial data. This class of models is usually called shadow rating models.

The text is divided into four major sections. After this brief introduction, we introduce a summary of the methodology and its theoretical references, followed by details of the model development, and the conclusions of the study.

Relevant Literature

There is little literature on the subject of replicating agencies' ratings, but several papers (amongst them papers by rating agencies themselves) aimed at discussing probability of default models and can shed some light on the problem this paper tries to address. Erlenmaier (2006) reported aspects of the development of a corporate rating methodology by KfW. Moody's (2004) also discusses properties of a purely statistical model based solely on financial data.

A larger, well studied, and relevant strand of the credit risk literature, initiated with Altman (1968), relies basically on financial ratios to predict default. Therefore, as ratings reflect expected default rates, an indirect link can be established between firm's financial statements and ratings, since one can infer default rates from these ratings.

The shadow rating approach is typically used when default data is scarce and external ratings of the major rating agencies (Standard and Poor's, Moody's or Fitch Ratings) are available for a significant portion of the loan portfolio. The common purpose to all quantitative methodologies developed for credit ratings is to identify risk factors that provide good information about the probability of default (Moody's Investor Service, 2000).

The shadow rating approach does that indirectly by identifying the most important factors and by estimating the relative weights of each of them in order to mimic external ratings as faithfully as possible. To make the estimated model useful for regulatory purposes and for credit risk management, it is still necessary to calibrate it to a probability of default (Erlenmaier, 2006).

Model Development

The model development process employed five steps:

1. Data management[1]
2. Mapping external ratings to probabilities of default;
3. Analysis of risk factors and variable selection;
4. Model estimation; and
5. Model validation.

Step 1: Data management

Our data comprises a set of financial statements of global non-financial companies along with their credit ratings as issued by international rating agencies. The data is comprehensive and covers a large sample of the rated corporate universe, summing up to 2314 companies.
We considered the financial information of those companies as of December 31st of the year preceding the date of publication of rating. We considered only ratings issued by Standard & Poor's, Moody's and Fitch Ratings.
Financial firms were removed from the database, and the cleaning of missing data left 1614 companies for the model estimation. After collecting and processing the data, we proceeded to the mapping of external ratings to a probability of default.

Step 2: Mapping external ratings to probabilities of default

An important step in building a shadow rating model is mapping the ratings from international agencies to relevant default probabilities. We favored the unsecured long-term issuer ratings, since they do not take in consideration possible credit risk mitigants and are consistent with the Basel Accord II (BCBS, 2004).

Table 1. Corporate ratings and five year PD (%), 1983-2009

Moody's Rating	Equivalent S&P Rating	Default Probability (%)
Aaa	AAA	0.086
Aa1	AA+	0.141
Aa2	AA	0.195
Aa3	AA-	0.324
A1	A+	0.854
A2	A	0.746

[1] We used two different samples. One sample for the development of the model comprised 1614 companies and another sample for validating and testing the model comprised 2053 firms

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Moody's Rating	Equivalent S&P Rating	Default Probability (%)
A3	A-	0.83
Baa1	BBB+	1.18
Baa2	BBB	2.024
Baa3	BBB-	3.081
Ba1	BB+	7.289
Ba2	BB	8.084
Ba3	BB-	16.948
B1	B+	20.077
B2	B	25.211
B3	B-	36.907
Caa1	CCC+	47.262
Caa2	CCC	49.868
Caa3	CCC-	66.96
Ca-C	CC - SD	70.176

Source: (Moody's Investor Service, 2010)

Table 1 depicts the default probabilities. The use of five-year mean probabilities is important because credit events in shorter time horizons are rare, especially for credits of better quality. In particular, according to Keenan, Shtogrin and Sobehart (1999), in periods of one or two years, the main reason for default is some kind of fraud, which is beyond the scope of this paper. In addition, five-year probabilities show lower volatility for both the probabilities given by agencies and for model prediction (Moody's Investor Service, 2000). Finally, Basel II rules require an estimate of a Long Run Probability of Default.

After mapping external ratings to default probabilities (interpolating the only non-monotonicity exhibited by the A1 rating), we proceeded to identify a list of candidate variables to test during the model development.

Step 3. Analysis of risk factors and variable selection

We analyzed several risk factors based on information from balance sheets of the non-financial companies in our sample. The variables are divided into six major categories, namely:

1. Profitability
2 . Leverage
3 . Liquidity
4 . Size
5 . Activity
6 . Debt Coverage

Each of these dimensions is (or should be) related to the probability of default. Following the traditional literature (since Fitzpatrick 1928, Beaver 1966, Altman, 1968), we use, in most cases, financial ratios as explanatory variables. This ensures that the variables are not affected by the size of companies, which was included as a separate factor. Companies' size vary by several orders of magnitude, which make figures like net income look like they are more correlated with firm size than one should expect. In addition, ratios avoid problems regarding comparisons between companies with statements denominated in different currencies. Each explanatory variable has several possible measures (EBIT or EBITDA, for example) and may be related to more than one risk factor (retained earnings / total assets is related both to leverage as to profitability).

Given the large number of variables, combinations of ratios may become numerous. This requires a method for selecting variables so that just the ratios most correlated with the probability of default are considered. Many of these ratios are highly correlated with each other, i.e., both explanatory variables behave similarly so that they are measuring the same risk factor. In order to avoid collinearity issues, when two variables showed a correlation greater than 80%, the one with the highest correlation with the other variables was discarded.

Table 2. Descriptive statistics

Variable	Minimum	Maximum	Mean	s. d.
Net Debt / EBITDA	-8.068	103.094	2.673	4.489
Interest Coverage	-24.457	1788.988	14.563	61.993
ROA	-0.947	0.585	0.038	0.082
Utilities Dummy	0.000	1.000	0.098	0.298
Liabilities /Total Assets	0.000	24.017	0.658	0.599
Size (Ln of Total Assets)	12.284	27.266	22.588	1.462

After data cleaning and the variable selection process, a candidate model with 6 ratios was estimated. Table 2 lists the descriptive statistics of the included variables:

Having identified the risk factors and selected the most appropriate variables, we proceeded to model estimation.

Step 4. Model estimation

The modeling process was carried out using R (R Development Core Team, 2009), and employed least squares methods in order to estimate the parameters.

The dependent variable was defined as the logit of the probability of default associated with ratings issued by international agencies. The logit is defined as the natural logarithm of the odds ratio: log (pd / (pd-1)), where pd is the probability of default associated with any rating. This ensures that the model predictions are within the [0, 1] range.

In addition, we have included a binary variable that serves as an indicator for utilities companies. The inclusion of this variable allows us to take into account the fact that such companies generally have guarantees or government ownership. It grants them with better credit quality on average.[2]

Also, utility firms have operational measures that hide the perils of a strict regulatory environment. Typical companies from this industry have a greater need for fixed capital, which often makes liquidity measures become negative (S&P, 2009).

The final model is given by:

[2] The dummy for utilities assigns a 0 if the firm is not an utility firm and 1 if it is a firm that is a utility firm.

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Formula 1. Estimated model

$$score = \alpha + \beta_1.\frac{Net \quad Debt}{EBITDA} + \beta_2.LnTotal\ Assets + \beta_3.InterestCoverage + \beta_4.\frac{Net \quad Income}{Total \quad Assets} + \beta_5.Dummy \quad Utilities + \beta_6.\frac{Liabilities}{Total \quad Assets} + \varepsilon \qquad \text{and: } PD = \frac{1}{1+e^{-score}}$$

All variables are statistically significant, and the signs of the coefficients are all in the expected direction. It is also worth reporting that the standard errors calculated for statistical inference are robust to heteroscedasticity.[3]

Table 3. Model results

Variables	Coefficient	p-value
Constant	9.9267	< 0.0001
Net Debt / EBITDA	0,0569	< 0.0001
Interest Coverage	-0,0014	0.0008
ROA	-4,4797	< 0.0001
Utilities Dummy	-0,859	< 0.0001
Liabilities /Total Assets	0,9135	< 0.0001
Size	-0,5953	< 0.0001

n=1614, Adjusted R^2=0.564, likelihood ratio test = 1345.17

Following model estimation, we proceeded to model validation.

Step 5. Model validation.

The selected model has undergone several tests to assess its ability to produce ratings close to the ratings of international rating agencies.

The ability of the model to correctly predict agencies' ratings through was tested using a method known as hit-mismatch (or hit-miss-match), following Grün et alli (2010), presented in Table 4. The method allows us to evaluate the ability of a model to correctly predict the ratings we are interested in.[4]

3 Besides the procedure described above to deal with the collinearity, we used the White´s test (1980) to deal with the presence or not of heteroscedasticity.

4 The rating obtained by the model presented here should be limited to one notch above the company´s country rating. For countries that do not have a published rating in a compatible scale, an estimated rating could be obtained using the approach proposed by Guimarães et allii (2013).

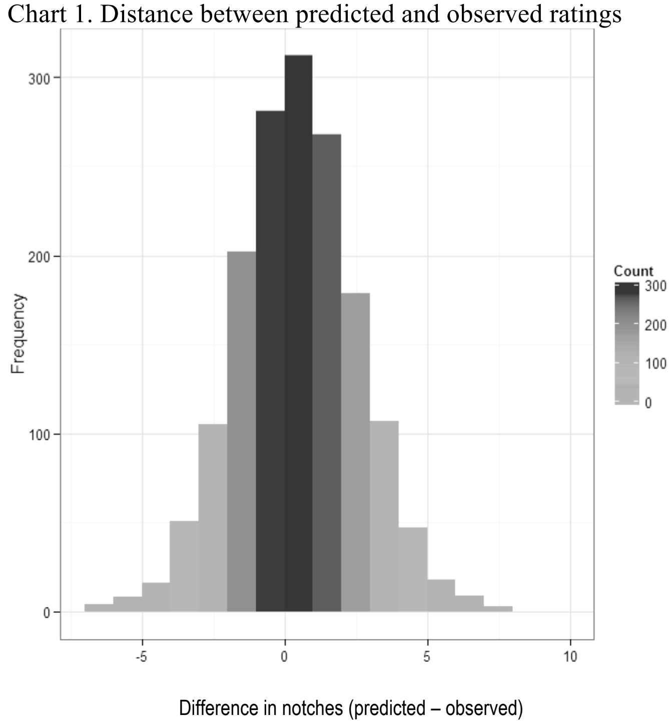
Table 4. Results summary

Distance (notches) between predicted and observed ratings	%	% cumulative
0	19.33	19.33
1	34.02	53.35
2	23.60	76.95
3	13.14	90.09

It is notable that that the estimated model has a hit rate of 90% within the 3 notches range.

In a similar fashion, we evaluated the distribution of the differences between the ratings that were estimated by the model and by those issued by international agencies. The results showed consistency between the measures; albeit the estimated model exhibits a lower output variance.

Chart 1. Distance between predicted and observed ratings



Finally, we tested the model against long-standing ones in order to compare and evaluate their performances against the gold standards provided by the ratings issued by agencies. Our references are: (i) the 4 variables Altman Z-score, also known as Z" (Altman and Saunders, 1998), (ii) the Shumway (1999) model, (iii) the improper linear model, given simply as: Y = (Net Income / Total Assets) - (Total Liabilities / Total Assets), as recommended by Schmidt (1971).

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Table 5. Accuracy as measured by continuous ROC.

Model	Area under ROC curve
Altman	0.59
Shumway	0.60
Improper model	0.61
Proposed model	0.78

In order to test the proposed model against these competitors, we employed a tool known as continuous receiver operating characteristic (continuous ROC). With the help from this diagnostic test (Nguyen, 2007), it is possible to compare the accuracy of a given model against a gold standard, even if it is continuous. Values with a greater area under the ROC curve indicate higher accuracy. The tests (Table 5) allow us to claim that that the model has a good ability to discern good from bad credits, thereby being a decent proxy to the ratings from international agencies.

Conclusion

The presented model aims to produce ratings and default probabilities in the absence of a database with sufficient number of defaults. However, it is well established that rating agencies take into consideration qualitative and quantitative information on the preparation of their ratings. Notwithstanding the limitations, the model presented here, based on the shadow rating approach, performed well in-sample with an area under the Receiver Operating Characteristics Curve of 78%. Accuracy was also noteworthy, with 90% of the predicted ratings located within a distance of three notches of the observed ratings.

Finally, the presented model is easy to understand and apply, requiring only a handful of financial inputs, and is able to satisfactorily predict corporate ratings issued by rating agencies, and can be an useful tool for the assessment of corporate credit risk.

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RISK MANAGEMENT IN THE CONTEXT OF VALUE BASED MANAGEMENT: RESULTS OF AN EMPIRICAL STUDY IN AUSTRIA

Dr. Nikolai Haring and Mag. Oliver Pichler

Abstract. *The ensuing article discusses the significance of risk management in the context of value based management. The focus lies on an empirical study, which was performed in Austria, concerning the topic mentioned just above. This study examined, which instruments are being applied for the purpose of risk measurement, how risks are being integrated into value based management and if risk management itself can be regarded as a value generator. In order to gauge the latter, the ex ante- as well as the ex post-satisfaction of managers was included in the investigation.*
keywords: *Austria, empirical study, risk management, value based management, interdependency between risk and value based management*

Introduction

Relevance of the topic risk management in the context of value based management

The importance of risk management has significantly increased in the last years. The question of how to handle risks is not a completely new one, as companies had to master uncertain changes since ever, in order to secure their successful development in a sustainable way, but the challenge has become much more important due to reasons, which will be illustrated later in this text. In the last years, this circumstance was also taken into account in numerous regulatory regulations.

But change of time has also led to other developments: In the meantime, value based management and an orientation towards value based key performance indicators has become widely applied, in order to support successful economic activities thereby. This shareholder value-thinking is being regarded as state of the art in modern management nowadays, although it is often being discussed quite controversially.

Finally, nowadays the challenge for companies lies not only in mastering the two actual topics risk management and value based management, but also in skillfully combining these two, as the existing risks and the way, management deals with them, are central impact factors on the level of the current shareholder value.

Objective of the paper

Within the framework of the article at hand, the links between value based management and risk management will be shown and - amongst others - the various risk valuation methods analysed.

In the empirical part of this work a number of topics will be explored: the stage of development of value based management as well as of risk management in Austrian companies, the instruments of risk valuation and the satisfaction of managers with their application.

Research methodology and structure of the article

For the inquiry of the empirical data, an anonymised questionnaire has been used.

The following work is divided into two main parts, which are embedded between the introduction and the conclusion. The first part deals with the theoretical foundations, whereas the second part of this article analyses the results of the empirical study.

The second chapter highlights the background of value based management, discusses its goals and functions, deals with the various value enhancement concepts and ends on a critical note regarding these concepts.

Then the terms risk and risk management are defined and the relevance of the topic illustrated with regard to internal and external risk factors, before the goals and functions of a fully integrated risk management system will be worked out finally.

In connection with a value based as well as risk orientated management, the relevance of risk management will be examined in the context of value based management and the various instruments of mapping risks shall be illustrated.

The third chapter is then dedicated to the analysis of the results of the empirical study. Here the development status and the design of risk management in the context of value based management will be explored for the participating Austrian companies. Taking into account the company size, the industry, the legal form, the affiliation to a group of companies and the shareholder structure (stock exchange listing or not), the different methods of mapping risks shall be illustrated and finally the results of the measurement of manager satisfaction will be shown.

Value based management, risk management and the link between them

Value based management

For a long time now, companies not only face the challenge to be competitive in the sales markets, but they also vie on the (international) capital markets for shareholders.

This development induces managers to steer their companies shareholder value-orientated, i. e. to align their decisions with business key performance indicators, which reflect the shareholder value or its change.

This is necessary, as the traditional accounting-orientated measures can serve this purpose only up to a certain extent, because they are deduced from legally standardised, periodic accounts, mainly orientated towards the past, which are moreover characterised by an asymmetric capture of profits and losses (conservatism principle). ([i]) Focussing on value based key performance indicators shall furthermore align the interests of the managers with the interests of the shareholders, so that principal agency-conflicts can be avoided, which is particularly tried to be reached through behavioural incentives in the form of variable management compensation systems, which are directed towards value orientated measures. ([ii])

For the specific design of value based management, various measures can be used, which can be differentiated into cash flow- and accounting-based key performance indicators on the one hand and into value- and change of value-based measures on the other hand. ([iii]) Cash flow Return on Investment (CFROI), Economic Value Added (EVA) and Shareholder Value (Added) (SV(A)) are some examples, in order to mention just the best known. Thereby the basic dilemma lies therein that value orientated key performance indicators have to satisfy the two conditions of relevance and reliability, which partly exclude each other. Whereas the function of providing information, in order to be able to take the best management decisions possible, mainly requires

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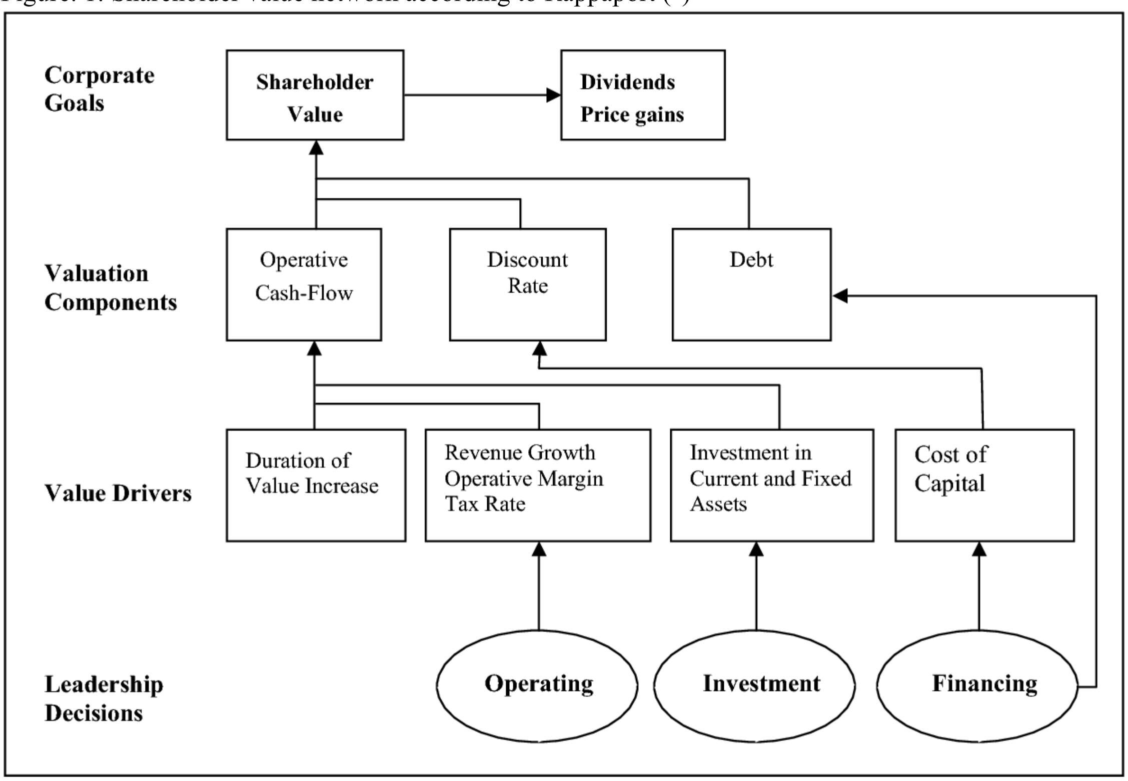
relevance, the reliability of the figures becomes predominant, when it comes to aligning variable management performance systems with value based measures. As both functions shall be served via a unique data set, it becomes clear that both characteristics mentioned above have to be satisfied. This means that one cannot rely only on accounting based measures, as they don't possess enough relevance. But it will also not be feasible, simply to use the shareholder value, which has been deduced from a DCF-model, since this measure will not command the relevance, which is necessary. As a compromise, the value based key performance indicators, which can also be observed quite frequently in practice, are built on accounting based measures, which then have to be modified, in order to enhance the relevance of their information content (such as deducting interest on equity in order to derive the EVA).[iv]

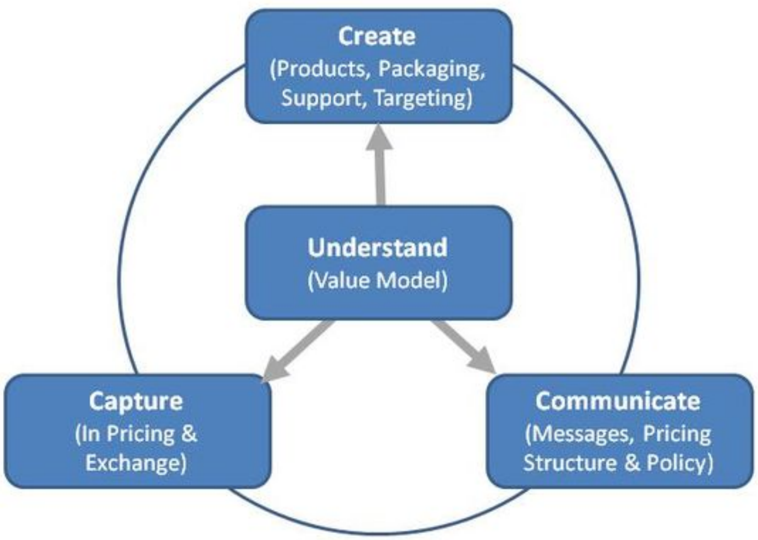
In order to operationalise the shareholder value, *Rappaport* identifies the main factors in his (well known) value driver model as shown below:

Figure. 1: Shareholder value network according to Rappaport ([v])



For to be able to use the uncovered potentials, these have to be realised on the strategic as well as on the operational level in a professional way. Thereby, the complete transfer of the strategy into an operative system of key performance indicators proofs to be the most daunting challenge, as strategies are often not being translated into quantitative objectives, management systems are only partly integrated and planning processes are not directed towards the strategy and considerably inefficient. ([vi]) The inclusion of value based measures in the reporting system and the implementation of management incentive systems alone is not sufficient to enhance the shareholder value in a sustainable way. ([vii]) Rather a complete orientation of the company towards the concept of value management is needed. Fig. 2 shows a model of an integrated value-orientated steering approach, which combines the strategic level of value generation (value creation) with the operative level of value use (value skimming) and the level of communicating with the investors (value communication) in a consistent way, so that the shareholder value rises (e. g. at the capital markets) in the end. ([viii]) In this context, it should be mentioned that different measures have to be applied to these three different levels: Whereas as DCF-based measure such as the shareholder value seems appropriate to measure value creation, the EVA and MVA as well as the CFRoI seem feasible for measuring the capture of the value (as already discussed above) and the total shareholder return (adding up dividends and changes of the share price) finally for the purpose of gauging the success of value communication.

Figure. 2: Levels of an integrated value management - the value management cycle ([ix])



The core elements of a strategic performance management, which should form the link between strategic and operative management, are an integrated strategic and financial objective system, a good project and program portfolio management as well as a strategy-focused mid-term planning. ([x])

In order to fulfill these requirements, a value-orientated management has to look after an universal orientation of its management information systems towards the mentioned value based measures, from planning (goals and measures) up to monitoring. But not only that: Based on this information, the management has to decide in a value-orientated way and consequently also be remunerated value based. The task of the investor relations-department finally consists in communicating all this in a value-orientated way towards the shareholders of the enterprise. ([xi])

Following the findings of a recent empirical study undertaken by *Weber*, value based management has been implemented in many German companies, but there still exist differences regarding the development status of value based management on the one hand and in the selection of the underlying controlling measures on the other hand. The central message thereby is that equity costs money. But value based management systems are often quite complex (in some cases too complex), which puts high cognitive demands on managers and requires a comprehensive training. Finally it is essential, not to follow the value based management model uncritically and also not to expect wonders from it. ([xii])

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Finally, it should be mentioned that in the context of a value based management non-financial key performance indicators should ideally also be taken into account beside financial key performance indicators. An adequate selection of these timely prescient measures of financial success requires the knowledge of the value drivers and its mechanisms. Ideally, such insights result from a strategy map, which has been created on the basis of a balanced scorecard as open system of key performance indicators. ([xiii]) The latest international move towards an integrated reporting ([xiv]) can be viewed as an extended management report, which tries to include not only economic, but also ecological and social factors as well as their interdependencies in showing how value is being generated (triple bottom line performance). ([xv]) Thereby, it should enhance management responsibility towards human and social capital as well as natural and other intangible resources and finally lead to a rethinking of management towards a so called integrated thinking, whereby the concept would have to be taken into account in management accounting and decision making as well. ([xvi])

Risk management

Under the term risk, one understands the measurable uncertainty, whereas the uncertainty, which cannot be measured, can be labelled as pure uncertainty. ([xvii]) Regarding risks, one can further differentiate, whether they are uncertainties, whose effects can only be judged in a subjective manner, or uncertainties, which can be gauged in an objective way.

If one only looks at the possibility of a negative deviation from an objective (respectively a damage), one talks about risk in a narrow sense or a downside risk. ([xviii]) In contrast thereto, the wide term of risk encompasses two-sided (symmetric) risks, i. e. there exist not only negative deviations from objectives, but also positive ones (upside chances). This perspective seems especially meaningful in the context of value based management, as the relation between risk and return is of upmost importance there. In this paper we will therefore use the term risk in the latter definition. ([xix])

Managerial acting always takes place in the context of some uncertainties, which are responsible for goal deviations later on, so that the management of risks necessarily becomes a management task. ([xx]) Ideally, one succeeds in risk management through the integration of an early warning system, to identify weak signals for future chances and risks (as well as trends) in time, in order to be able to take optimal measures, which can lead to a competitive advantage. ([xxi]) Nevertheless, only 10 % of companies think that they are very good at anticipating and measuring emerging risks, whereas at least 27 % regard themselves as good in this respect. ([xxii]) The other side of the coin would be resilience, i. e. the ability to quickly respond to unexpected disasters enabled by the company's risk strategy, which can be found in 55 % of the organisations. ([xxiii])

Furthermore, it is essential that risk management is strategy-concordant especially in steering risks, but also the other way round – that the corporate strategy gets inputs regarding risk identification and valuation as well as monitoring. ([xxiv])

In an advanced development stage of risk management, it will be adequately institutionalised in the organisational structure. Typical questions, which arise with the specific design of the integration of risk management into the organisational structure are line function versus staff position, decentralisation versus centralisation as well as the inclusion into the accounting, controlling and finance department versus an own department. ([xxv]) In a recent empirical study of DAX30-companies conducted by *Diederichs, Fricke & Macke* (2011), the CFO had the professional responsibility for the risk management system in 79 % of all cases. ([xxvi]) If there was maximum one full time equivalent (FTE) available for risk management tasks, then risk management was most often integrated into the controlling department - in 85 % of the interviewed organisations. In case that there was more than one full time equivalent (FTE) employed for risk management tasks, risk management was directly subordinated to the board of directors - in 82 % of the interviewed companies. In 33 % of the enterprises, somebody did risk management beside other tasks. 21 % of the organisations employed one person to fulfil the risk management function. And 46 % of the companies had more than one employee in risk management jobs, 36 % of which had even more than 10 FTEs. ([xxvii]) In addition, an inter-divisional risk board supported the central risk management function in 43 % of the organisations, the most of which (70 %) met quarterly. ([xxviii])

From the point of view of the process-orientated organisation, the single process steps of risk identification, risk analysis and valuation, risk steering and monitoring as well as risk reporting have to be arranged and continuously applied further on. ([xxix])

The tasks of risk management encompassed the following ones at the DAX30-companies:

- securing the proper functioning of the risk management system
- setting methods and standards
- developing risk management and the risk management directive
- coordination of the group wide risk reporting as well as compiling the internal risk report for the company
- advising in all issues concerning risk management
- contact person for the external as well as the internal auditor

In organisations with more than one employee in central risk management, additional tasks were accounted for, especially analyses for steering the company such as analyses of chances and risks, evaluation of strategies and the evaluation of new products, projects and investment decisions. Furthermore there was a stronger support of the operative units with regard to detecting and evaluating risks as well as working out and monitoring (e. g. via plausibility checks) risk-steering measures. ([xxx])

The tasks of an inter-divisional risk board include the discussion of the prevailing risk situation, challenging and determining the controlling and monitoring measures as well as making recommendations to the company board or the operative units. Furthermore, it defines group-wide standards by fixing risk management policies or risk limits. Above that, the monitoring and further development of the risk management system is part of its job. Often, it’s also the task of the risk board to support the central risk management function in working out the internal risk report or to scrutinise and release the report. ([xxxi])

Risk management has interfaces to various other functions, especially to controlling and internal auditing, as the survey of *Diederichs, Fricke & Macke* (2011) clearly shows. ([xxxii])

It is also important to develop a suitable risk culture (e. g. through an integrated corporate communication regarding this topic ([xxxiii])) and adequate risk political principles ([xxxiv]) in the organisation, combined with an appropriate conflict and decision culture with the management as a role model and an implementation of an effective controlling of measures.

Only after having considered all of the aspects mentioned above (also see figure 3 below), one can successfully implement an integrated risk management system.

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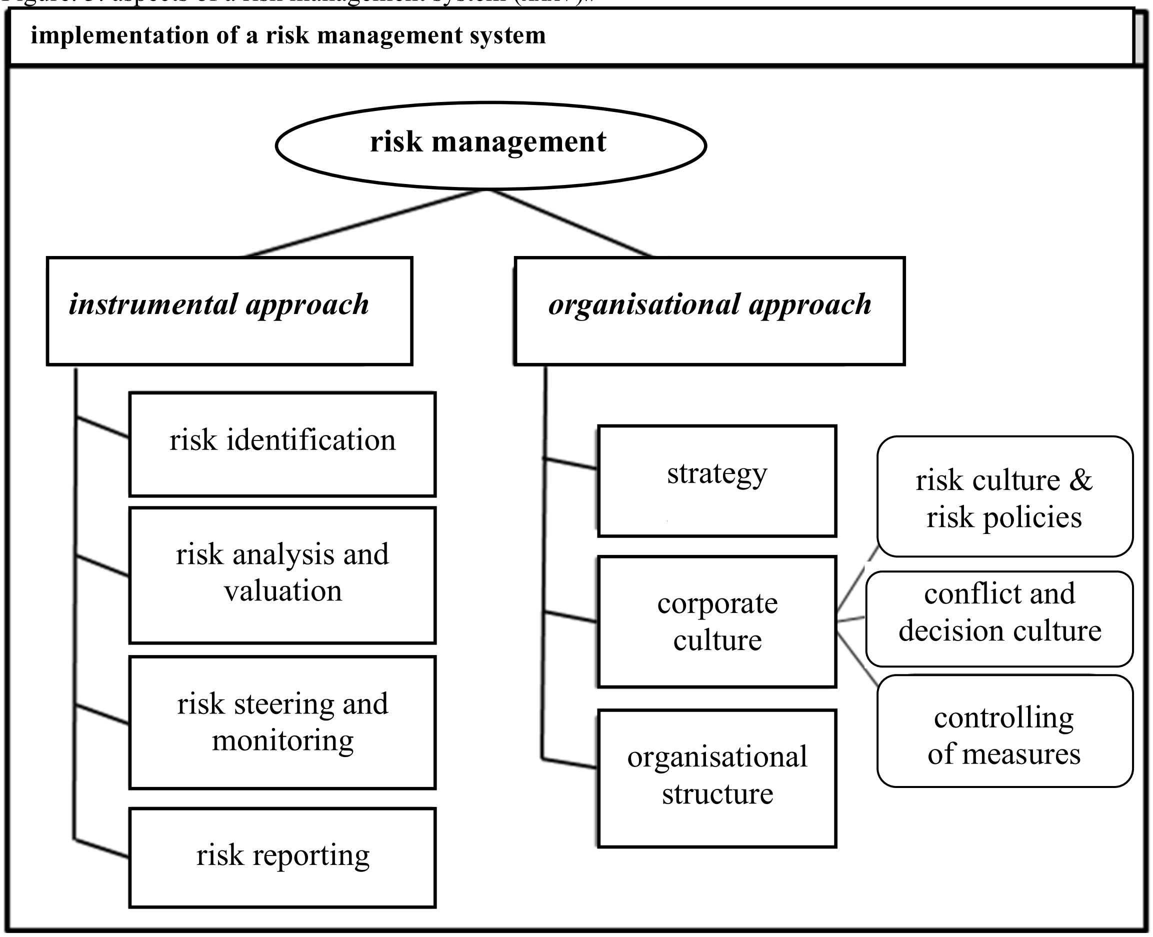
Figure. 3: aspects of a risk management system (xxxv)#



But in the first place, the fundamental question arises, why risk management should be done at all, as there is no reason for it, in case complete capital markets exist (irrelevance theory of risk management). ([xxxvi])

But as there are quite a couple of market incompletenesses in reality, the irrelevance theory of risk management is not applicable in practice:

Risk management can contribute to an enhanced shareholder value for instance by smoothing profits in order to minimise corporate taxes. ([xxxvii])

A further value-enhancing aspect of risk management consists in lowering the costs of financial distress ([xxxviii]) or insolvency respectively. ([xxxix])

Furthermore risk management can contribute to lower the costs, which arise out of principal-agency-relationships, ([xl]) as it can help for example to avoid that the management takes out risks, which lead to a personal enrichment of these managers, but can be disadvantageous for the shareholders.

As the procurement of external capital has rising marginal costs, the company will finally try to get self-financed via the internal cash flows. A group-wide risk management can therefore contribute to enhance the shareholder value in a sustainable way by hedging cash flows (e. g. hedging foreign currency exchange risks). ([xli])

Drivers for the rising relevance of risk management can be found outside as well as inside the market:

Inside the market, the rising pressure from capital markets, the further proceeding globalisation of the world economy, the growing liberalisation of international markets and increasingly uncertain market conditions can be mentioned. ([xlii]) An enhanced risk potential can also arise out of the increasing use of information and telecommunication technologies, modern logistic- and production systems (in the case of the latter two because of their complexity but also due to their intensity of fixed costs) as well as through interorganisational cooperations in the context of strategic partnerships, which serve as an alternative to mergers and acquisitions.

Outside the market, corporate insolvencies and the economic crises caused by them have led to a continuous rise of regulatory prescriptions over time:

E. g. Austrian laws, such as the AktG in § 82, the GmbHG in § 22 para. 1 (in both cases implemented via the so called Insolvenzrechtsänderungsgesetz 1997) and the Austrian commercial code (UGB) in its §§ 243 and 267 (changes were implemented through the ReLÄG 2004) as well as in § 243a para. 2 (introduced via the URÄG 2008) ([xliii]), but for instance also the Austrian corporate governance-codex in its rules 69–70 ([xliv]) require the implementation of internal risk management and monitoring systems ([xlv]) through management incl. corresponding reporting obligations regarding functionalities and results.

In Germany, a regulation was already created in 1998 via the Gesetz zur Kontrolle und Transparenz im Unternehmensbereich (KonTraG), which forced management to implement and operate an enterprise-wide system for the early detection of risks as well as to disclose statements regarding the risk structure of the company in the management commentary of the organisation. ([xlvi]) The Bilanzrechtsmodernisierungsgesetz (BilMoG) put forward new requirements regarding the design of effective monitoring systems. ([xlvii])

Furthermore, the disclosure of risk-related information in the context of the internationally widespread financial statements according to IFRS (e. g. in IFRS 7 regarding financial instruments) shall be mentioned. The IASB published best practice-rules for a management discussion and analysis in 2010, but this report hasn't become binding for companies so far. ([xlviii])

In 2004 the Committee of Sponsoring Organizations of the Treadway Commission (COSO) issued an addition to its initial model, the so called COSO ERM – Enterprise Risk Management Framework. ([xlix])

Not to mention the numerous new regulatory prescriptions, which arose and still arise out of the prolonged current economic and financial crisis (e. g. Basel III).

But the concern to avoid ethical and reputational scandals and the increasing focus on governance from internal and external stakeholders plays a vital role as well. ([l])

Securing the survival of the company and the enlargement of its shareholder value can be counted as superordinate goals of a proactive risk management. In order to reach them, the pursuit of subordinated objectives is necessary, such as the enhancement of strategic options and the build-up of new potentials for success, the lowering of risk-related costs, the optimisation of the capital structure and the risk coverage potential (equity), securing the sustainability of performance objectives as well as protection against surprising future developments. ([li])

The tasks of risk management are essentially derived from the aspects of the holistic risk management approach lined out in fig. 3 above.

The identification of risks can happen in various ways (via brainstormings, risk workshops, standardised questionnaires, risk checklists, etc.) and either be executed top down or bottom up. ([lii]) In the run of this identification of risks, the categorisation of risks takes place. One can generally distinguish between global/institutional risks (legal, political, macroeconomic, natural, social and technological risks), industry-specific risks (referring to the procurement and sales

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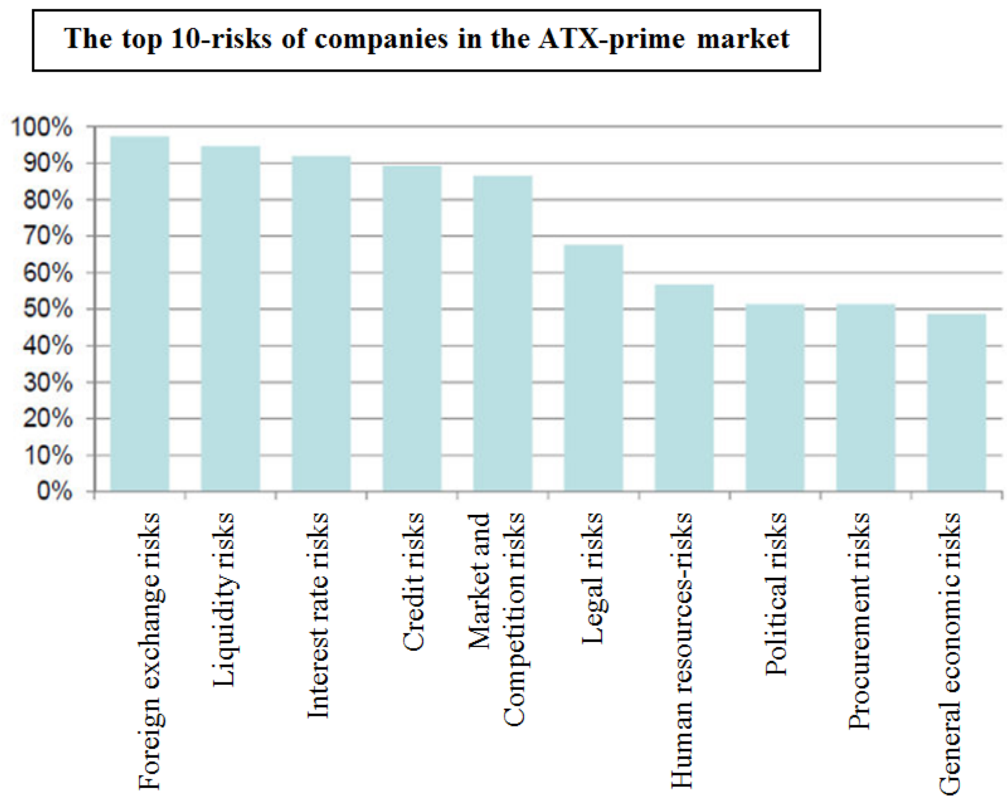
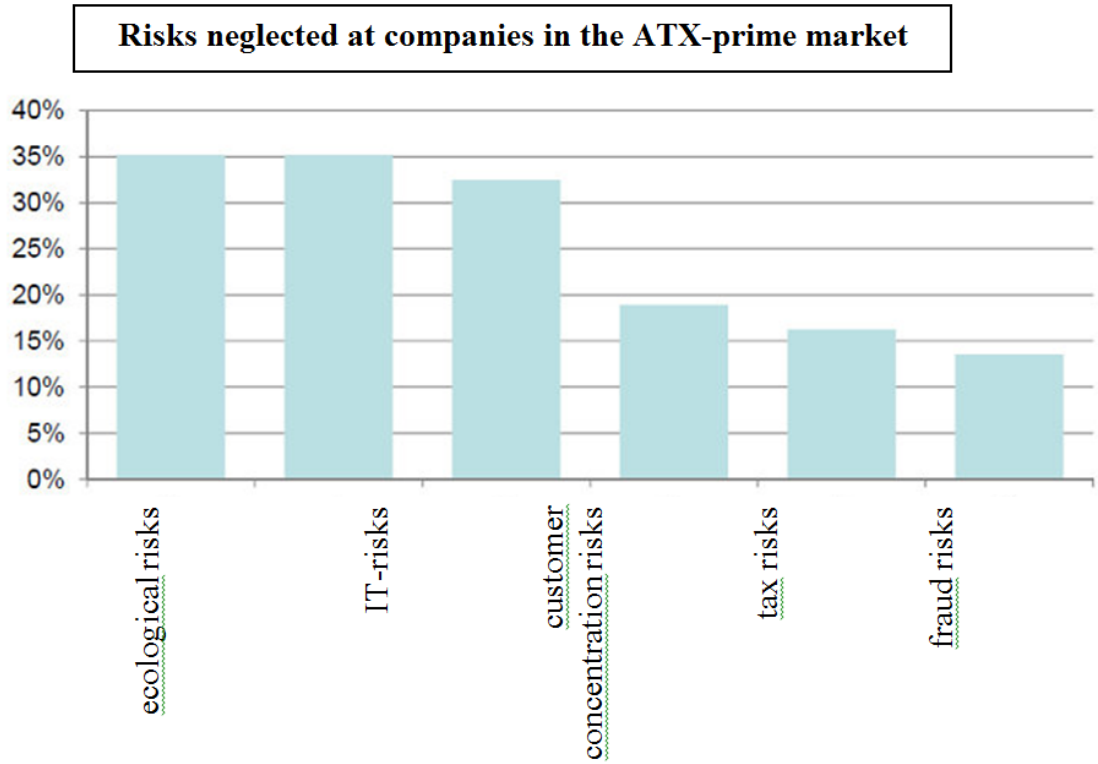
markets as well as to the competition) and company-specific risks (relating to R&D, production, finances (e. g. accounts receivable and debt) or behavioural risks). ([liii]) Another possibility would be to distinguish between operational and financial risks. ([liv]) Anyway, it is essential that risk management concentrates on the most important risks and clearly describes them - materiality limits can help here. ([lv])

Figure 4: top 10-risks of companies in the ATX-prime market *([lvi])*



As can be seen from figure 4 just above, foreign exchange risks seem to be the main concern of the companies listed in the ATX-prime market. These organisations seem to worry also a lot about various financial risks (liquidity risk, interest rate risks, credit risk), which might be due to the current economic and financial crisis as well as the difficulty to understand and to come to terms with this kind of risks. Most enterprises also consider the market and competition risk to be important, followed by legal risks. Almost half of the organisations don't regard human ressources-risks to be crucial to them - it plays a bigger role in industrial and service companies, but interestingly a smaller one at energy and finance companies.

Figure 5: risks of companies in the ATX-prime market, to which not much attention is paid ([lvii])



As figure 5 above shows, there are several risks which are deemed not that important by the organisations and/or which can be handled more easily.

The goal of the analysis and the valuation of risks is the complete quantification of the identified risks (as absolute, relative or index values). ([lviii]) The possibilities of a risk valuation range from sensitivity analyses, scenario analyses and risk portfolios up to simulation methods (incl. such measures as Cash Flow at Risk (CFaR) or Value at Risk (VaR)). ([lix]) Here the question arises, whether such risk based measures, which have originally been developed for banks, can simply be applied to non-banking institutions. Furthermore, one wonders, whether quantitative measures are sufficient for a modern risk management. ([lx]) In this process stage, the aggregation of single risks takes place too, in order to be able to determine the overall risk position of the company. ([lxi]) Thereby, risks cannot only be independent from each other, but they can also enforce or compensate each other. ([lxii]) The question of feasibility as well as taking into account cost and time regularly prove to be the biggest obstacles in the course of the implementation of risk valuation in practice. Interestingly, 25 % of all companies listed in the ATX-prime market still don't report externally, how they measure their risks. ([lxiii])

The objective of steering risks is to optimise the relation between the profit-chance and the loss-risk (risk/return-optimisation). Risks shall therefore either be consciously taken, reduced or – if possible – completely avoided ([lxiv]) and the ensuing results closely monitored. Here it is important to remember that most of the risks, which are relevant on an operative level, are the results of structural characteristics of the relevant environment of the enterprise, the structural design of the organisation itself and strategic decisions taken by the management. ([lxv])

In the course of risk reporting, the results of the risk identification and valuation are disclosed and the stakeholders informed about the planning, the implementation and the results of the measures to mitigate risks or to grasp chances (steering of risks). Thereby one can discern an

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external and an internal reporting, depending on the receiver of the reports. In order to be efficient, organisations are advised to integrate risk management into existing reporting systems. ([lxvi]) The single external and internal risks can for instance be integrated into a balanced scorecard by assigning them to its various goals by defining early warning indicators. ([lxvii]) The external risk reports of companies listed in the ATX-prime market have improved qualitatively and become more comprehensive, yet one cannot discern a clear link to the company performance. Therefore, the effectiveness of risk management should be made more visible in the risk reports. ([lxviii])

With respect to how effectively organisations manage different aspects of governance, risk and compliance, the results shown below are hardly surprising:

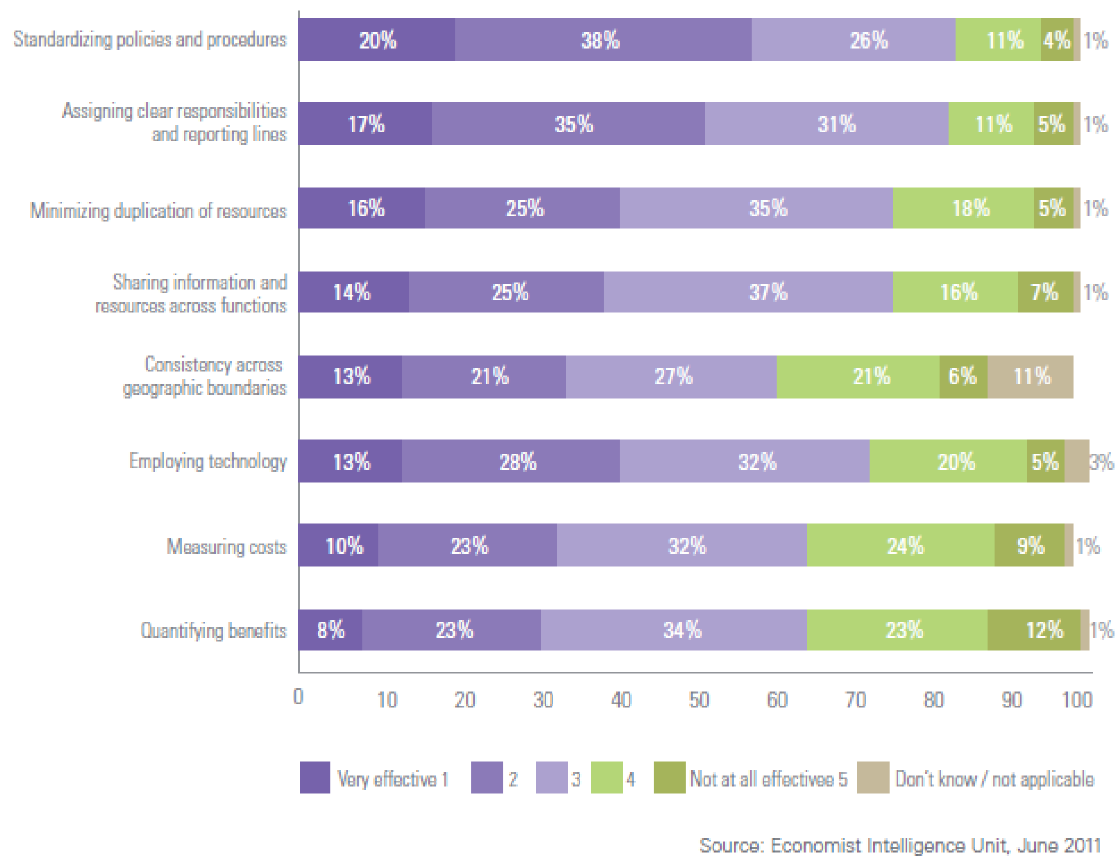

Figure. 6: organisational effectiveness at managing various aspects of governance, risk and compliance *([lxix])*

Companies are good at standardizing policies and procedures as well as assigning clear responsibilities and reporting lines. Regarding the sharing of information and resources across functions and the consistency across geographic bounderies, organisations are middle. Measuring costs and quantifying benefits seems like the hardest thing to do.

The effectiveness of the handling of governance, risk and compliance activities by the interviewed organisations is shown below:

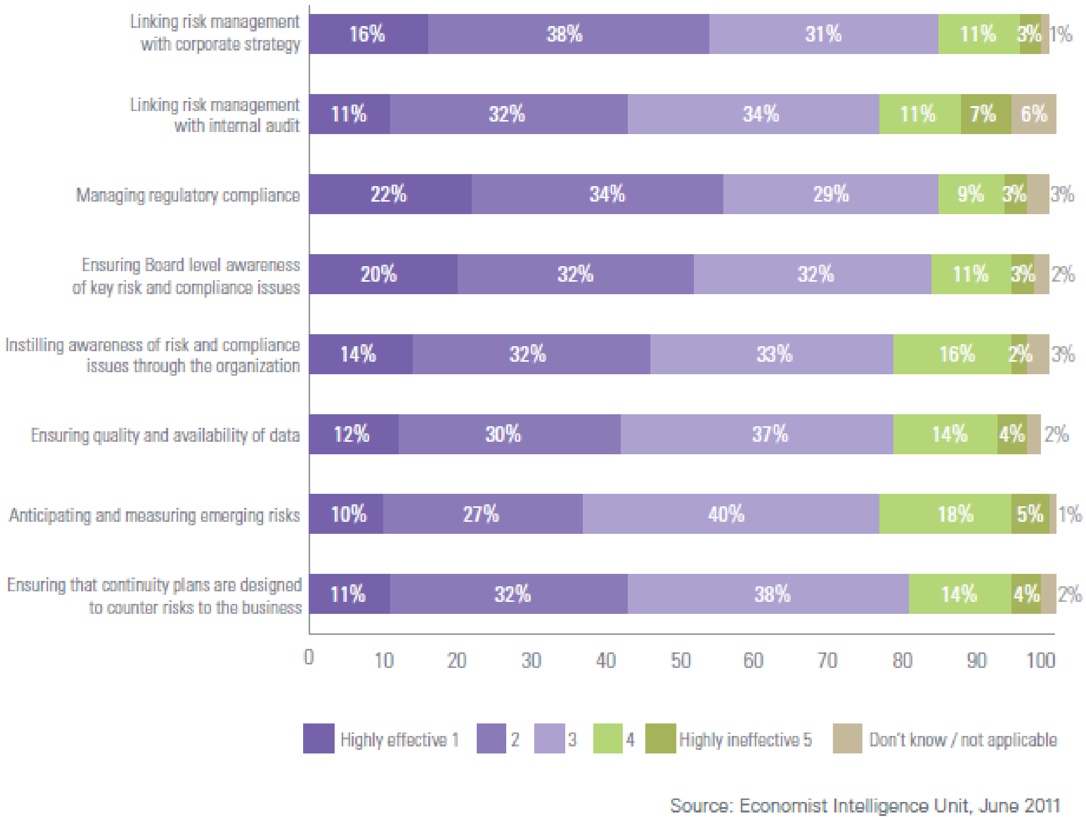

Figure. 7: organisational effectiveness at handling various governance, risk and compliance related activities (lxx)

Some of these activities were already and some will still be discussed at various stages in this text.

The adequacy, the effectiveness and the efficiency of the risk management system as a whole have to be evaluated on a regular basis. ([lxxi]) Companies think that they have become better in managing risks issues over time, with 20 % of them thinking that they are very good at it and 53 % regarding themselves as good in this respect. ([lxxii]) Corresponding to this finding, 85 % of the organisations think that their companies' risk management strategies are closely aligned with their risk profiles. ([lxxiii]) Nevertheless, *Arithmetica Versicherungs- und finanzmathematische Beratungs-GmbH* (2013) thinks that there is still substantial room for improvement with regard to how risk management is dealt with at the companies listed in the ATX-prime market. ([lxxiv])

Finally, it shouldn't come as a surprise that risk management needs support from the top management and well educated risk managers in order to be successful.

Risk management in the context of value based management

With respect to a value-based management, an enhancement of the shareholder value can only happen either if the free cash flows are enlarged or if the weighted average costs of capital are lowered.

In this context, risk management normally tries to reduce the corporate risk by influencing the volatility of the free cash flows, whereby the risk premium of equity and debt holders is lowered. ([lxxv]) The resulting lower costs of capital immediately have a value-enhancing effect.

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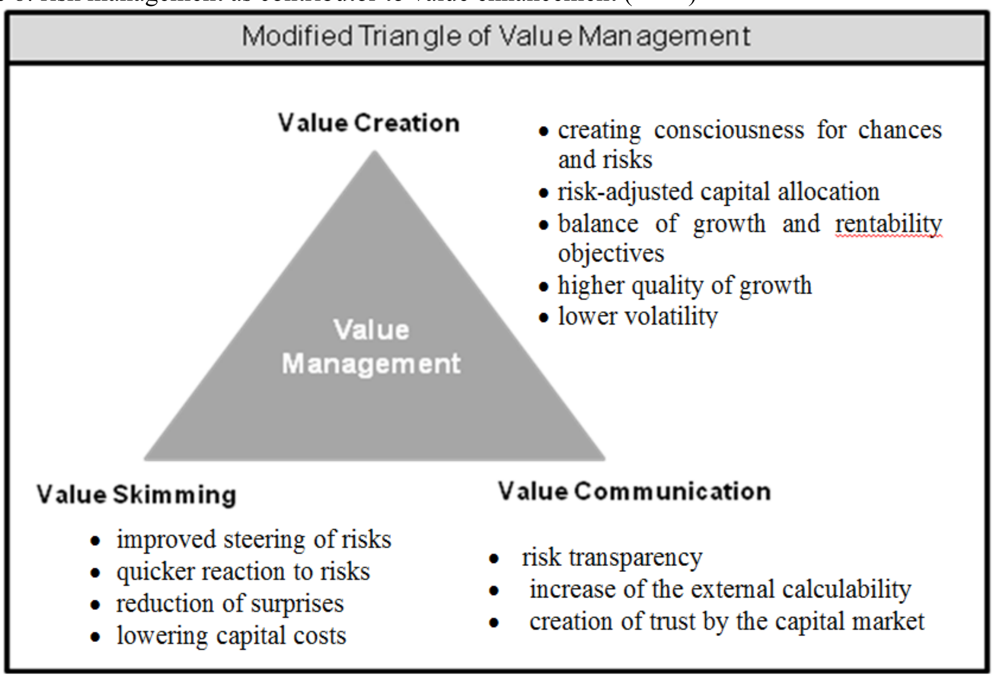
Therefore it is the central aim of risk management, to sustainably enhance the shareholder value by reducing the volatility of the free cash flows as well as by increasing their amounts. ([lxxvi])

In fig. 2, we showed at which levels a holistic value management can be implemented. We can now add the value influencing factors of risk management to this presentation (see fig. 8 below). The modified presentation clearly shows that risk management can contribute in the strategic area of value creation as well as in the operative implementation by skimming value, but also in the course of the value orientated communication of the company, in order to enhance the shareholder value of the company significantly. So one can optimise for instance the sales structure by reducing volatilities over the sales cycle, whereas the early detection of potential cost explosions or underestimated cost drivers can contribute to a profitable cost management. An efficient use of capital through a long-time optimisation of assets under the perspective of chances and risks and reduced capital costs enhance the shareholder value in a sustainable way as well. ([lxxvii])

Figure 8: risk management as contributor to value enhancement ([lxxviii])

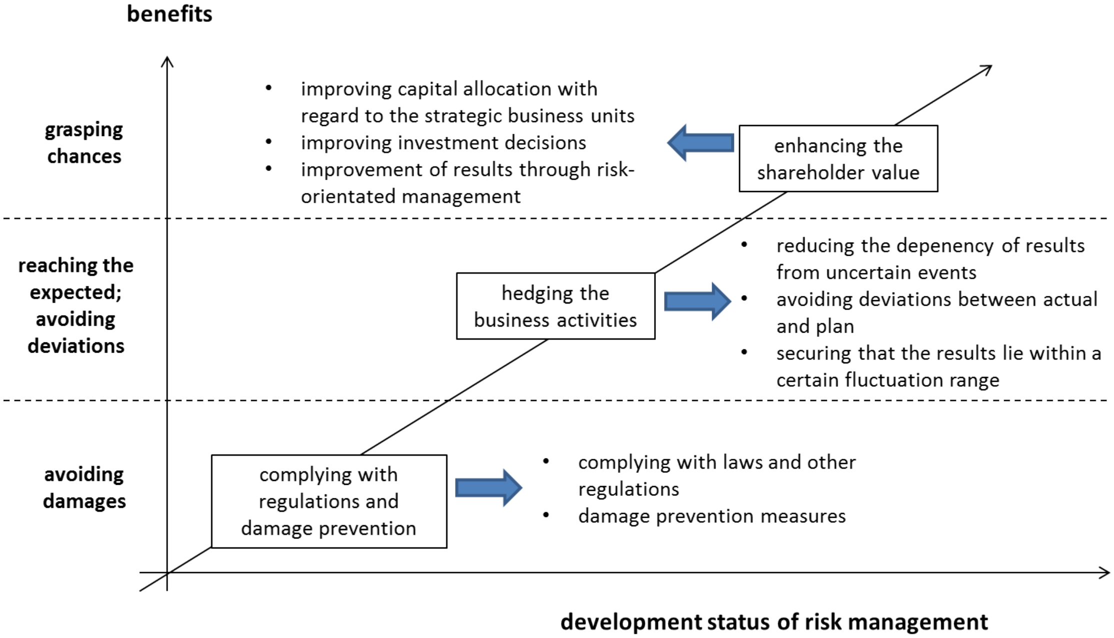


Modern risk management doesn't deal any more with the management of single risks, but tries to figure out the overall risk position of the company and significantly contributes to strategic decision making. The organisations' risk function plays a formal role in providing analysis to support and set the overall corporate strategy in 45 % of enterprises (and has an informal role in 50 % of the cases). ([lxxix]) In the survey of *Diederichs, Fricke & Macke* (2011) however, only 18 % of the DAX30-companies reported to involve the central risk management function in finding appropriate strategies. But in 77 % of the interviewed organisations, there was a general tendency for an involvement in projects with a group-wide importance. In 27 % of the cases, a strong(er) involvement was given with regard to investment decisions and M&A-projects or projects exceeding a certain budget level. ([lxxx])

As the following figure 9 shows, the development path of risk management highlights the growing orientation towards value creation: ([lxxxi])

The link between shareholder value and risk management

Figure 9: development path of risk management ([lxxxii])



Generally, governance, risk and compliance are being taken more seriously according to a recent KPMG-study – in 41 % of all cases nowadays versus only 10 % before the economic and financial crisis, with the company board (executive management) as the main change agent besides regulatory bodies. ([lxxxiii]) This growing importance is underlined by the fact that 55 % of the companies reported to spend 1–5 % of their annual revenues on governance, risk and compliance-activities, whereas 20 % of the organisations spend even 6–10 %. ([lxxxiv])

In the same study, most managers quoted the desire to reduce the exposure of the organization to risks as the strongest influencing factor (51 %) for the convergence of their governance, risk and compliance-activities, whereas the wish to improve corporate performance was named by 32 % of all respondents. ([lxxxv]) This convergence nevertheless faces some substantial obstacles, such as the complexity of the convergence process (in 43 % of all organisations), the lack of human resources and expertise (39 %) and the missing clearness of the benefits (39 %). ([lxxxvi])

Next, the question arises, with the help of which instruments of risk valuation risk management can be integrated in value-orientated management: ([lxxxvii])

One can try to disclose the possible chances and risks with their impact on the shareholder value (represented by key performance indicators such as the DCF, the EVA or the MVA) with the help of a balanced chance- and risk-card. A step further is undertaken by the critical success factor-based balanced scorecard (which has already been mentioned further above), with the help of which it is tried to combine the balanced scorecard with risk management in an integrated value-orientated steering concept. ([lxxxviii])

Scoring-models try to grasp risk through some important criteria. Together with an underlying weighting, the characteristic values of the single criteria allow it to make a statement

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concerning the prevailing risk via the weighted sum. Scoring-models are easily manageable, but depend on subjective estimations, the arbitrariness of which shouldn't be underestimated.

Sensitivity analyses show the change of a goal measure in function of an influencing factor. But we are only talking about a partial observation here, at which the influencing factor is only allowed to vary within a certain range of fluctuation, in order that the resulting statement can stay valid.

In contrast, scenario analyses are mostly more comprehensive and show different typical development scenarios, which normally differ quite a lot from each other, but without covering the whole spectrum of all possibilities and excluding probabilities.

Risk maps or risk portfolios can be of a qualitative or of a quantitative nature and typically look at the damage amount (or the degree of damage) and the probability (range) of occurrence. Thereby one can get an overall picture concerning the positioning of the single risks of the enterprise, but without being able to determine the overall risk position.

More or less in continuation of the approach mentioned just above, the expected value of damage can be determined (for incidence- or distribution-dependent risks) by multiplying the damage amount with the probability of occurrence. The expected value of damage is a more consolidated information, but the data behind it concerning the damage amount and the probability of occurrence get lost thereby. Single risks play a major role in this case too.

Simulation calculations rank among the considerably more advanced instruments. Thereby either data from the past are used as a starting point ([lxxxix]) or known probability distributions (e. g. a triangular or a square distribution) can be used (as an approximation). The advantage of simulation calculations lies in their ability to combine various influencing factors and have an integral look at them, even if their joint probability distribution is not known, and in taking into account mutual interdependencies (which can be quite challenging). Widely applied risk management-software programs (e. g. @risk, Crystall Ball or RiskMetrics, in order to mention just a few) command numerous functionalities and allow for a relatively easy applicability. The disadvantage lies in the complexity of the simulation calculations as well as their costliness and their time-intensity. ([xc]) Even widely spread key performance indicators such as the Cash Flow at Risk and the Value at Risk, which were already mentioned above, result from these probability distributions and are derived from a chosen lower percentile. The same applies for further risk adjusted performance measures, such as the RAROC (Risk Adjusted Return On Capital) and the RORAC (Return On Risk Adjusted Capital), which have been established for the steering of companies especially in the banking sector. ([xci])

Put in a nutshell, the current trends and future challenges in risk management can be summarised as follows: From only avoiding losses to also grasping chances (with manageable risks), from an operative to a strategic and structure-related risk management and from the management of single risks to an overall view of the risk position of the enterprise. ([xcii])

Empirical study

Studies conducted so far

With regard to value based management, one can conclude from many studies, such as „Wertmanagement mittelständischer Unternehmen“ from *Exler* (2006) or „Von Top-Controllern lernen. Controlling in den DAX 30-Unternehmen“ from *Weber* (2008) that the increase of the shareholder value is a high priority for the majority of the interviewees. ([xciii]) Although the effort for implementing a value orientated management system is quite considerable in professional as well as in communicative respect, the investment seems to pay off in the long run.

The empirical research concerning the topic risk management in the context of Austrian companies is still in the fledgling stages. In German-speaking countries, the empirical studies can be exemplified by „Risikocontrolling bei deutschen Kapitalgesellschaften“ from *Hoitsch/Winter/Baumann* (2006), a study of risk management at companies of the ATX-prime market conducted by the actuarial company Arithmetica, „Risikomanagement in Österreichs Großunternehmen“ from *Grof/Pichler* (2002) and „Risikomanagement im Mittelstand“ from *Arnsfeld/Berkau/Frey* (2007). ([xciv])

Austrian companies increasingly pay more attention to risk management. The two most important reasons to implement risk management systems are demands made by the providers of capital and legal requirements. Securing the potential for success and thereby guaranteeing survival, encouraging risk awareness as well as the (minimum) compliance with legal requirements are seen as the most important goals of risk management.

Studies concerning the development status of risk management ([xcv]) show that a sensitisation with respect to risk aspects mainly prevails in big companies, but they also show some aspects, which lead to a significant deviation from the guiding theoretical conception.

At the valuation of risks a trend departing from a qualitative judgement towards a quantification of risk positions can be discerned. With regard to the use of different risk valuation instruments, simple models such as risk portfolios (risk maps) for instance or the scenario technique have a high significance. More elaborated models such as e. g. value at risk or early-warning systems are hardly deployed as they are quite often seen as generating only few additional benefits. This is due to the high complexity of these instruments with regard to the way they calculate, thereby making them time- and cost-intensive, the often still missing know-how for their application, incomplete and/or imperfect data and the lacking acceptance by the top management.

The biggest challenges for the enterprises seem to be the valuation and aggregation of single risks into overall risk positions and the identification of cause-effect relationships. Therefore, the insufficient risk aggregation, which is also mirrored by the seldom application of appropriate instruments for it, can be seen as weakness in corporate practice.

The scale of integration of risk management systems into the value orientated steering mechanism is still developable. The involvement of chances and risks into existing controlling processes is being seen as mediocre by most enterprises. Nevertheless, in contrast, a stronger integration seems to prevail in reporting.

Objective and structure of the study at hand

From April to September 2008 350 Austrian companies were contacted via a questionnaire with regard to the topic value management and risk management. The goal of the survey was to gain insights with respect to the stage of development, the design and the perception of risk management in connection with value orientated management. Taking into account the different corporate circumstances (the industry, the company size, the legal form, the listing on a stock exchange and the affiliation with a group of companies), the possibilities of risk valuation should be surveyed and their usage in practice pointed out.

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The collection of the data was carried out with the help of a standardised multiple-choice-questionnaire, which was structured into four subject areas:

1. General informations regarding the company: the industry, the company size, the legal form, the listing on a stock exchange and the affiliation with a group of companies
2. Informations regarding the risk management in corporations (definition of risk, types and valuation of risks, strategic risk policy and culture, organisational embedding, operative steering of risks and reporting of risks, expectations regarding and realised benefits of risk management)
3. Mapping risk in the value orientated steering of companies regarding the definition of performance goals and the incorporation of risk variables in the underlying key performance indicators
4. Risk valuation/-aggregation incl. supporting instruments as well as surveying the satisfaction of managers with these tools and software solutions for risk valuation

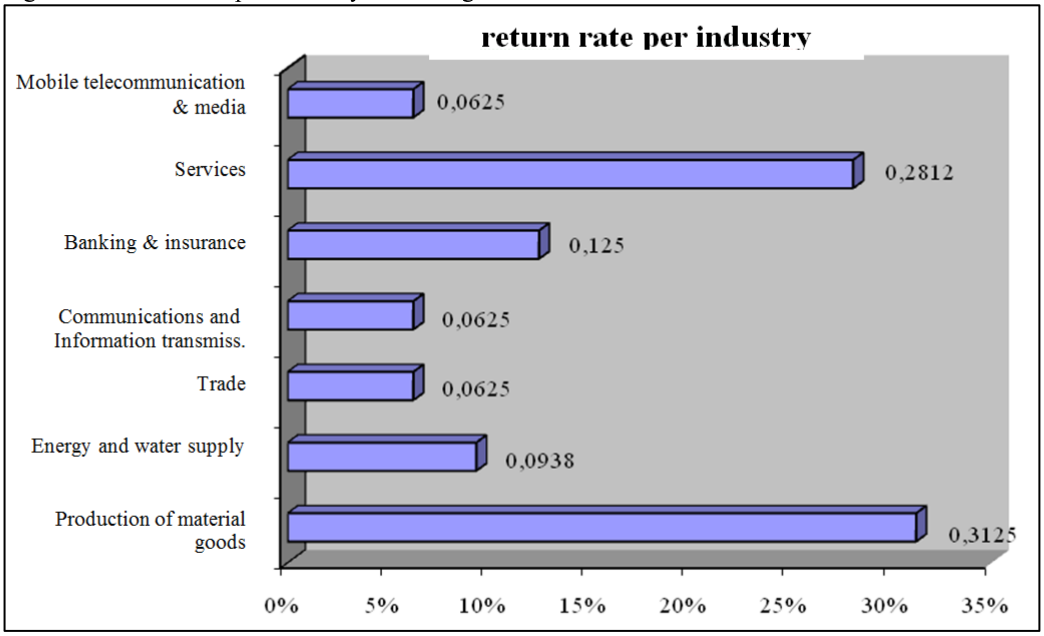
Mainly, closed questions were asked or statements made, which had to be answered in a dichotomous way (yes or no). Nevertheless, around a third of all questions were multiple choice-questions or placements on a scale (five levels from very satisfying to not satisfying at all). Excluding open questions should facilitate the answering by the respondents. Moreover, a standardised analysis of the questionnaire was made possible by this approach. Technical support for the data inquiry was realised via the internet platform www.ask.de, whereas the evaluation of the answers was done with the help of Microsoft Excel.

The participation in the survey was anonymous and was conducted on a voluntary basis. The target group included managers and employees in accounting and finance departments of Austrian companies, which were motivated to participate in the survey by email and partly by phoning them. At the selection of companies, we tried to spread the characteristics broadly, in order to get a heterogeneity as big as possible with regard to the dimensions industry, company size, legal form, listing on a stock exchange and affiliation with a group of companies.

After excluding invalid answers, a return rate of around 9 % could be realised, so that an absolute rate of return of 32 participants out of 350 invited companies was reached.

The industries showing up most prominently in the survey were the production of real assets (31 %), services (28 %) and banking and insurance companies (13 %) (comp. fig. 10).

Figure 10: return rate per industry according to the ÖNACE-classification



Therefrom, 75 % were large companies, 16 % medium-sized enterprises and 9 % small-sized companies. ([xcvi]) Around two thirds of the involved companies are affiliated with a group of companies, whereas only 31 % were listed at a stock exchange. The questions were exclusively answered by managers and employees of capital companies, whereby a balanced representation of private and public limited liability companies was accomplished.

Value based management in Austrian companies

In the survey we conducted, 97 % of the respondents claimed to manage their enterprises by value orientated criteria.

The steering was mainly done with the help of financial key figures (44 %), which were defined on company level, for the strategic business units and the functional areas. Focusing on customers played a major role for one third of the interviewees, whereas the two other perspectives of the balanced scorecard, the process optimisation (16 %) and the employee orientation (9 %), were much less commonly used. Thereby, the steering measures for company success, which were causally as well as timely “upstream”, were still underrepresented.

Furthermore, it could be shown that Austrian companies were mainly steered by using profit & loss-measures (e. g. from the income statement). The agreement and attainment of objectives is quite often being measured by looking at revenues or the operational result (including their development over time). Classical value based measures such as EVA or CFVA are being used less frequently, according to the statements of the respondents.

The development status of risk management in Austrian companies

In the course of the study, it was asserted that 57 % of the sample use a modern understanding of risk, whereby risk can mean a positive as well as a negative deviation from the plan.

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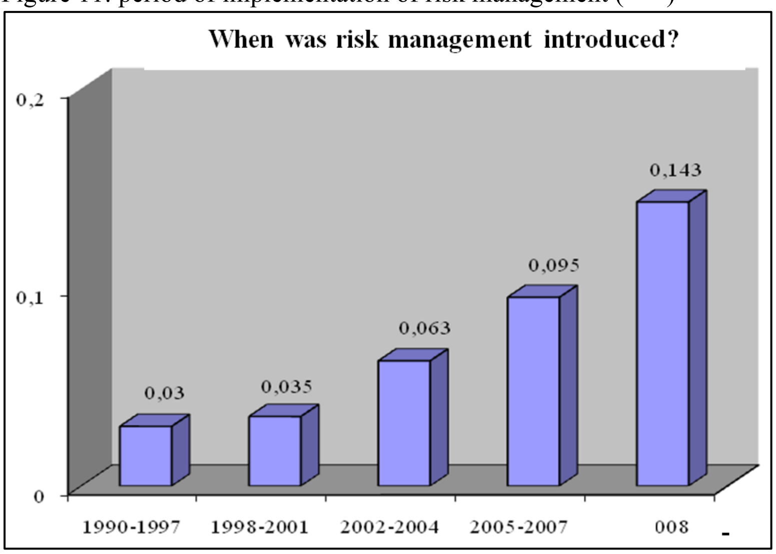
Furthermore, 63 % of the participating companies stated that they already have an institutionalised risk management, around 34 % currently had no risk management system implemented and 3 % planned the implementation of one in the short term.

Due to legal requirements with regard to risk reporting (since the introduction of the so called Rechnungslegungsänderungsgesetz (ReLÄG) and the Unternehmensrechtsänderungsgesetz (URÄG)) and the mounting pressure of the international capital markets, Austrian companies see themselves to be forced to invest in the build-up of risk management systems. The ensuing graphic (fig. 2) shows that enterprises have grasped the importance of a formalised risk management. It is noticeable that risk management was especially set up after the fall of the iron curtain and after the ReLÄG and the URÄG had been enacted.

The growing number of new implementations over time shows on the one hand that risk management has clearly gained importance over the last years, but this growing significance could only be detected at big companies. In the small and medium sized enterprises, institutionalised risk management systems existed only sporadic.

Figure 11: period of implementation of risk management ([xcvii])



On average, six risk categories were reported. Especially external risks, strategic risks and financial risks such as currency and interest rate risks take center stage:

Table 1: top 10-risk-categories in Austrian companies ([xcviii])

rank	Which risks exist in your company?	incidence (in %)
1	external risks (customers, suppliers, regulatory interventions, etc.)	59,4%
2	strategic risks	50,0%
3	currency risks	43,8%
4	interest rate risks	40,6%
5	risks due to volatility in commodity- and product prices	40,6%
6	technological risiks/process risks	40,6%
7	human resources-related risks	34,4%
8	loan default risks	28,1%
9	organisational risks	28,1%
10	share price / security paper risks	18,8%

The strategy of steering risks seems to be quite different in the organisations asked:

45 % of the respondents claimed to try to mitigate potential risk or even to eliminate them completely. 40 % of the companies want to grasp chances by consciously taking risks. The remaining 15 % act risk-averse and try to avoid risks completely.

This result shows that more than half of the Austrian companies didn't yet follow the holistic risk management-approach. Rather, the activities of the managers were being concentrated on avoiding and reducing single risks. Only two fifths pursue the utilisation of chance-potentials as a goal.

Whereas there exist multiple possibilities for positioning risk management in the organisational structure, in practice the integration in a line function is most commonly used. Thereby, the incorporation into the controlling department is the preferred option. Companies see a big advantage in giving risk management direct access to the controlling data on the one hand and in significantly improving controlling information via the integration of risk information on the other hand. Just 25 % of the companies asked organise risk management in the form of an own department.

In order to get a differentiated picture of the development status of risk management in Austrian companies, the following ten criteria were chosen, which should evaluate the development degree and the design of the risk management system:

- risk political principles are fixed in the strategy
- an early warning system for the monitoring of risk developments exists
- risk management is a fixed part of the operative management (incl. proactive participation of the employees in shaping risk management)
- institutionalisation of risk management
- risk consciousness is established in the corporate culture
- qualitative and quantitative risk valuation
- risk aggregation of single risks and taking into account interdependencies between risks
- use of a risk management-software
- internal and external risk reporting
- number of risk classes (more than six categories)

If all elements are present, one can conclude to observe a high development status, whereas the risk management of the company can be assumed to be only lowly developed in case that no element shows up in the organisation looked at. In the following table, the respective frequencies of occurrence are displayed:

Table 2: frequencies of occurrence of the defined criteria for measuring the development status of risk management

development status indicator	implementation rate (in %)
risk political principles are fixed in the strategy	70,0 %
an early warning system for the monitoring of risk developments exists	60,0 %
risk management is a fixed part of the operative management	80,0 %
institutionalisation of risk management	25,0 %
risk consciousness is established in the corporate culture	75,0 %
qualitative and quantitative risk valuation	60,0 %

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risk aggregation of single risks and taking into account interdependencies between risks	43,3 %
use of a risk management-software	40,6 %
internal and external risk reporting	45,0 %
number of risk classes (more than six categories)	42,9 %

In order to give a complete overview of the development status of risk management, we looked at the sum of the ten indicators at company level. The following picture emerged among the interviewees:

Table 3: development status of risk management in Austrian companies

development status	number of implemented elements	number of companies	display in percent
very low	0	1	4,8 %
low	1 to 3	4	19,0 %
middle	4 to 6	8	38,1 %
high	7 to 9	4	19,0 %
very high	10	4	19,0 %

With regard to the respective industry, one could discern that banks and insurance companies, the energy industry and mobile telecommunication companies had a high or very high number of implemented elements. In contrast, companies, which produced material goods, were generally at a middle development stage, whereas especially service organisations and trading enterprises were characterised by a very low level of risk management.

Risk management as value creator

In the literature one finds many links between risk management and value orientated management:

A reduction of the total risk position leads to a smaller capital demand as well as to lower capital cost rates due to the improved rating and thereby altogether to lower capital costs. Furthermore, the protection against liquidity endangering crises leads to a higher growth quality.

With the question regarding the cost-benefit-relation of risk management we could clarify that the majority of participants (76 %) were convinced that a completely integrated risk management system would enhance the company value. 14 % thought that risk management had hardly impacts on the value of the enterprise and less than 10 % view risk management only as cost factor, which would destroy the value of the organisation.

In order to gain insight into the relation of cause and effect between external risk reporting and the cost-benefit-aspect of risk management, the answers of the questions cost/benefit of risk management and external risk reporting were contrasted. With the help of a correlation analysis, it was examined, whether companies, which inform their investors about potential chances and dangers on a regular basis, could observe an increase of their company value. The results show that more than half of the responding enterprises don’t report to their capital owners. By having a closer look, we could nevertheless discern a statistically significant correlation between the value of exchange listed incorporated companies ([xcix]) and the communication with the investors. Transparency of risks apparently creates more trustfulness on the side of the investors. In turn, this security influences the return expectations of capital owners and thereby the capital costs of the company, which influence the company value in a favourable way.

With regard to the display of risk in value orientated management, the following was discovered:

The indirect consideration of risk by determining an adequate target rate is hardly applied (only in 10 % of all cases) in practice. The same applies for general discounts or surcharges. The respondents said – as already stated above – to steer their companies mainly with the help of financial key performance indicators and define their performance targets on the basis of the periodic results. Taking into account risk variables in the goal measures happens through a direct adjustment of the performance figures in 26 % of the cases. Thereby, the risk is allowed for due to quantitative calculation results concerning the measurements such as revenues or operational result. Over one fifth of the companies follows a stand alone-approach and views risk in an isolated way, without inclusion in other systems of financial key performance indicators. Displaying risk in another perspective of the balanced scorecard (customers, internal processes, employees) is of subordinated significance due to its prevalence of only 18 % at Austrian companies. It is striking that more than 16 % of the respondents don’t take risk into account at all when determining their performance objectives.

The bigger part of the responding enterprises valuated risks qualitatively as well as quantitatively (63 %), whereas 23 % only dealt with the quantitative valuation of risks. In 14 % of all cases we found subjective estimates and the attribution to risk classes.

On average, Austrian companies used between two and three different tools in order to valuate risks. The following rank order could be compiled on the basis of the number of uses of the valuation instruments:

Table 4: instruments used for risk valuation

rank	Which instruments were deployed for risk valuation?	incidence rate (in percent)
1	probability of occurrence and degree of damage	26,03 %
2	scenario analysis	16,44 %
3	VaR and CFaR	13,70 %
4	expected loss value	12,33 %
5	Monte-Carlo-simulation	12,33 %
6	strategic risk portfolio	8,22 %
7	sensitivity analysis	8,22 %
8	scoring model	2,74 %

The valuation of risks by means of probability of occurrence and degree of damage was used in a quantitative as well as a qualitative way and plays the most prominent role (26 %), as could be expected ([c]), whereas the expected loss value was being employed only at 12 % of the responding companies. Scenario analysis is listed on the second position with a prevalence of 16 %. This instrument was preferentially applied by companies, which acted on a two-sided understanding of risk and therefore had a higher degree of an integrative consideration of chances within the risk management system. More complex instruments such as VaR and CFaR as well as simulation calculations were applied in 14 % and 12 % of the enterprises, respectively. Sensitivity analyses and strategic risk portfolios seem to be less significant in practice, due to an incidence rate of only 8 % each. Scoring models don’t seem to be widely used at all.

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Furthermore, two instruments were identified during the analysis of the results, whose application frequency varied markedly, depending on the industry looked at. Simplifyingly, only companies in a dynamic environment and such in a stable surroundings shall be distinguished. The differentiation was carried out here in accordance with the well-known criteria of Michael Porter's five forces-model (industry-wide competition, negotiating power of the customers, bargaining power of the suppliers, threat by substitutional goods and services as well as imminence through the entry of new providers). The industries banking and insurance, services, trade and mobile telecommunication & media were clustered to form the category "dynamic", whereas the industry sectors production of material goods, energy and water supply as well as communications and information transmissions were assigned to the category "stable". VaR- and CFaR-models seemed to be appreciated risk valuation-instruments in the dynamic category (their prevalence there amounted to 75 %). Within this group, it could be noted that banks and insurance companies and mobile telecommunication organisations dominate regarding the use of at-Risk-models. In order to calculate the VaR and CFaR, 80 % of the users preferred simulation methods such as the Monte-Carlo-Simulation (e. g. simulations on a historical basis).

In industries with a stable environment, the probability of occurrence and the degree of damage was most widely used. Here it is remarkable that the valuation is quite often done in a qualitative, thus descriptive way. On the contrary, a quantification of risks was hardly conducted in these enterprises.

A capable risk management system can create added value for the company by steering the total risk position. There still seems to be potential for development in Austrian companies regarding the aggregation of single risks in order to identify the total risk position: In around 57 % of the companies, no risk aggregation was carried out at all (see also table 2). With the exception of the banking and insurance sector (where all companies declared to aggregate single risks), industry-specific differences were hardly discernible. The main reasons for not using instruments for risk aggregation are the high degree of complexity (high investments of time and costs, insufficient understandability and reliability) and lacking know how.

Satisfaction of managers with risk management in value orientated business management

The measurement of the contentedness of managers resulted from a five-stage scale (1 = very satisfied, 5 = not satisfied at all). The results are shown below:

In the course of the study, the expected benefits before the implementation of risk management systems as well as the realised benefits concerning this matter were surveyed.

According to the response frequencies, the following ranking could be generated among the possible answers with regard to the expectation of benefits of risk management systems:

Table 5: expectation of benefits before the implementation of risk management systems

rank	expectation of benefits before the implementation of risk management systems	answers in %
1	risk transparency and consciousness is being created	22,9%
2	improved planning quality	18,6%
3	improvement of behavioural steering (in the sense of attainment of corporate objectives)	15,7%
4	profit optimisation	14,3%
5	existence protection	12,9%
6	reducing the volatility of financial key performance indicators	10,0%
7	improvement of the share price performance	5,7%

The results of our investigation in the following table show, up to which degree of satisfaction these expectations were fulfilled. Thereby, the ranking took place on the basis of the arithmetic mean value.

Table 6: satisfaction with the adoption of risk management systems

rank	benefits of risk management	1	2	3	4	5	mean value
1	share price performance improved	50,0%	25,0%	25,0%	0,0%	0,0%	1,75
2	the volatility of financial key performance indicators was reduced	28,6%	42,9%	28,6%	0,0%	0,0%	2,00
3	existence was protected	22,2%	55,6%	22,2%	0,0%	0,0%	2,00
4	profit was optimised	20,0%	60,0%	20,0%	0,0%	0,0%	2,00
5	behavioural steering improved (in the sense of attainment of corporate objectives)	18,2%	54,5%	27,3%	0,0%	0,0%	2,09
6	planning quality improved	23,1%	46,2%	23,1%	7,7%	0,0%	2,15
7	transparency and consciousness of risks was created	18,8%	37,5%	37,5%	6,3%	0,0%	2,31

It can be learned from the table that the expectations regarding the improvement of share price performance where best fulfilled, although this position also had the highest standard deviation. Relatively little satisfaction was achieved with regard to the transparency and consciousness of risks reached. Concerning the other values, no clear statement can be made, as the mean values of the single expectations all lied between 2,00 and 2,15 and a well-grounded ranking order hardly seems reasonable. Nevertheless, we would like to point out that managers were satisfied in general with the fulfilment of their benefit expectations. ([ci])

The results regarding the subjective estimation of the respective quality of the risk valuation instruments show that the participating companies regard their valuation systems only as modestly satisfying on average. The following graphic shows the respective mean values of the valuations:

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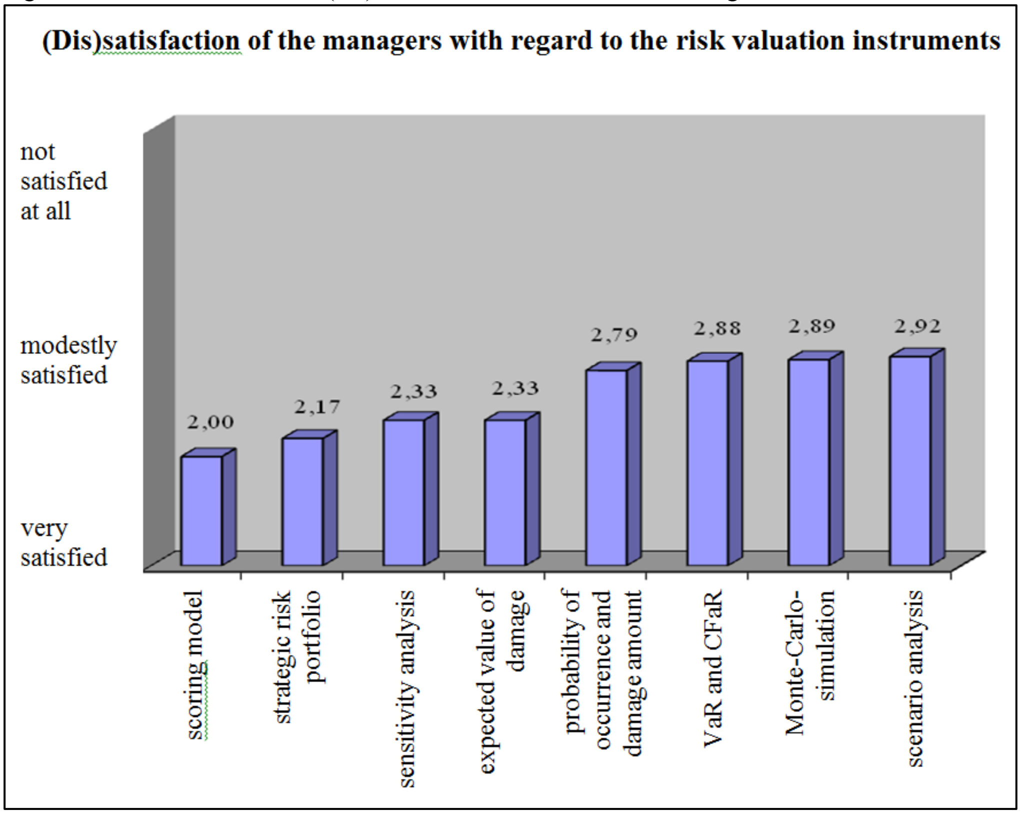
Figure 12: mean values of the (dis)satisfaction measurement with regard to the risk valuation instruments



Regarding the most commonly used method, the valuation of risks on the basis of probability of occurrence and damage amount, surprisingly only an average satisfaction could be observed. Also the second most liked instrument regarding the application frequency, the scenario analysis, was evaluated as only average in the measurement of satisfaction and has the worst value in comparison with the other valuation instruments.

More complex valuation techniques, such as the at-Risk-models and the Monte-Carlo-simulation, are only found in the lower area of the contentedness scale in comparison with the other valuation instruments.

Regarding the satisfaction with scoring-models, it is eye-catching that the average valuation on 2,00 is characterised by extreme values, as this instrument has the biggest standard deviation. This means that companies are either very satisfied or to a lesser extent satisfied when applying them. Strategic risk portfolios show a good marking too.

From the tendentially rather restrained gradings by the participants, one can conclude that there still exists further need for improvements in the quality and acceptance of the instruments mentioned above. For example, companies bemoan in the case of VaR primarily the complexity of the calculation method, the wanting availability of data as well as the bad communicability and the therefore low acceptance at the top management.

Only 41 % of the interviewees stated to use a specific risk management software in their enterprises. Regarding the product choice, especially three software solutions came out on top: Crystall Ball, Microsoft Excel and RiskMetrics. Furthermore, it could be observed that around a quarter of the participants in the study did abstain from using standardised products and favoured a self-provided software solution. Whereas the average total satisfaction stood at 2,5, the evaluation of the software products provided by the market was worse than the one of the self-provided software solutions (the arithmetic mean value lied at 2,8 there). ([cii])

Conclusion and outlook

In this article, the two current topics value based management and risk management were combined and the significance of the latter one was investigated in the context of the first one.

After the basics had been discussed, an empirical study regarding risk management in the context of value based management was presented, which had been conducted in Austria.

With regard to value based management, it was interesting to notice that companies are still being steered with the help of financial key performance indicators, whereas non-financial pre-control factors of organisational success are mostly being neglected so far.

The development of the distribution of risk management over time clearly shows the growing importance in the last years. Regarding the different risk categories, external, strategic and some important financial risks were most important for the companies asked for their opinion. When controlling risk, the avoidance and reduction of risks is of most central importance, although 40 % of the companies also tried to grasp possible chances by consciously taking risks after all. Probably due to this finding, currently only half of the sample asked applies a modern, two-sided definition of risk, which includes positive as well as negative deviations from the plan. From an organisational point of view, the integration of risk management in the controlling department dominates, as synergy effects apparently seem to be expected here. In general, the development status of risk management in Austrian companies can be viewed as average, although it depends on the specific industry the company is part of.

With regard to the instruments used for risk assessment, the two dimensions probability of occurrence and degree of damage are most commonly used for capturing risks. The satisfaction of the participants in the study with the instruments of risk valuation ranges from good to average, depending on the specific assessment instrument looked at (the same applies to the risk management-software solutions used). The integration of the assessed risks into value based management happens either not at all or on the basis of a stand alone-approach. In the case that risks are included in value based key performance indicators, this happens more often directly, by adjusting the relevant performance measures themselves, than indirectly, as by adjusting the risk adequate discount rate for example. Risk management itself seems to generate value from the point of view of the companies themselves, as it is associated with a favourable cost-benefit-ratio. This is also expressed in the finding that managers in the study were satisfied with the use of risk management systems, even though the benefits partly accrued in other areas than had been assumed before the introduction of the risk management systems.

In order to summarise, it is clear that it has become indispensable for companies to deal with existing and impending risks and to manage these risks successfully in the context of value based management, as the benefits of introducing a risk management system seem to be obvious for the executives surveyed.

Whereas the controlling of single risks was the most important topic in the past, today an overall view of the company should prevail ideally, implying the aggregation and consolidation of single risks in a fully integrated risk management system. In this respect however, companies

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have to do some catching up, as well as in the case of the analysis of cause-and-effect-relationships of single risks.

The integration of risk management into value based management - which itself seems to can be extended by the pre-control factors of organisational success mapped in the non-financial perspectives of the balanced scorecard - has to be further improved, as this is currently either not happening at all or only partly, as one can derive from the way risks are displayed in value based key performance indicators.

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Notes

([i]) Regarding the characteristics of external accounting comp. *Ewert/Wagenhofer* (2007), pp. 9-15.

([ii]) The question, whether a company should be managed shareholder- or stakeholder-orientated, can be fitly discussed (see for instance *Speckbacher* (1997)). Whereas the focus is on the shareholder interests in the first approach, the latter approach tries to take into account the interests of various stakeholder groups (employees, tax authorities, outside creditors, customers, suppliers, et al.) as well, in order to reach reasonable and sustainable compromises in this way. The reality will lie somewhere in the middle, with a couple of influential stakeholder groups, of which the shareholders normally are the most dominant group, because of their legally legitimated claims to the company. Thereby, the real power conditions as well as societal conventions determine the relations between the single stakeholder groups. It should be remembered that such claims between the stakeholder groups can generally be exported and imported nowadays due to a worldwide interconnected economy, so that they can be autonomously determined only up to a certain extent. Corporate social responsibility is a matter of negotiation in this sense, although the state feels obliged again and again to reign in regulatorily (such as currently with regard to the variable compensation of managers, which has been discredited recently, in the run of the current economic and financial crisis, due to having granted too big boni to bank managers in the past, often even in the face of failure).

It shouldn't be forgotten that value orientation is only one important point with regard to designing incentive systems: A current survey of the design of incentive systems in big companies in Austria shows that the Great Place to Work-companies let the employees participate in a higher degree in the goal setting process, stress objective performance measures more and forces immaterial incentives (such as career incentives) to a greater extent. Furthermore the communication and implementation of these incentive systems proves to be important as well. Outside the formal incentive systems, the development of long term concepts, which promote the internal socialisation processes, seems to be of central importance, such as measures in order to improve the reconcilability of job and family. Comp. thereto *Feichter, A./Graber, I./Wentges, P.* (2009).

([iii]) Regarding the classification and critical analysis of the key performance indicators, which can be applied in principle for a value based management, comp. *Ewert*/*Wagenhofer* (2000).

([iv]) Nevertheless, the adaptations shoudn't be too numerous, as this would undermine both the reliability, by adding room for manipulation, and the understandability of these performance figures.

([v]) See *Rappaport* (1986), p. 76, fig. 3-1.

([vi]) See *Ruthner* (2013), p. 19 f..

Comp. *Günther/Breiter* (2007), pp. 12-13 regarding the deficits and development trends in strategic controlling.

Anyhow, quite often (in 61 % of all cases) management seems to choose the wrong strategy (have wrong market estimations) in the first place, as a current study of *Institut österreichischer Wirtschaftsprüfer/Kammer der Wirtschaftstreuhänder/Karmasin Motivforschung* (2013) shows. Thereby, this is the single most important reason for economic difficulties of Austrian companies.

([vii]) Comp. *Krammer/Sinn/Weiß/Wieandt* (2001) p. 1447.

([viii]) Comp. *Denk* (2005) pp. 23 ff..

([ix]) Derived from *Denk* (2005) p. 25.

([x]) Comp. *Ruthner* (2013), pp. 20–24.

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([xi]) Vgl. *Velthius/Wesner* (2005). p. 12 f..

([xii]) Comp. *Weber* (2008), pp. 202-223.

([xiii]) Comp. thereto in-depth *Haring/Fleischer* (2009), p. 230.

([xiv]) After issuing a consultation draft on 16.04.2013, the final version of the integrated reporting-framework will be issued by the International Integrated Reporting Council probably in December 2013. Comp. *Haller/Fuhrmann* (2013), p. 244 and *Haller/Zellner* (2013). For a (critical) view of the former discussion paper comp. *Haller/Zellner* (2011).

([xv]) Comp. *Arbeitskreis Externe Unternehmensrechnung der Schmalenbach-Gesellschaft für Betriebswirtschaft e. V. (AKEU)* (2013), p. 876.

([xvi]) Comp. *Arbeitskreis Externe Unternehmensrechnung der Schmalenbach-Gesellschaft für Betriebswirtschaft e. V. (AKEU)* (2013), p. 877 with further references.

Probably, it's no coincidence that measures reaching beyond economic key performance indicators and trying to grasp ecological and societal factors as well, are currently gaining momentum on a macroeconomic level as well. One well-known example for such an effort is the better life index of the OECD. For further details thereto comp. *Haring* (2012).

([xvii]) According to *Keitsch* (2004), p. 4, this conceptual distinction of the two terms was first introduced by *Knight* (1921).

Even nowadays, it would be interesting to argue, whether we encounter more pure uncertainties or risks. Just think about how few foresaw the recent economic and financial crisis …

([xviii]) Comp. *Burger/Buchhart* (2002), p. 3 f..

([xix]) Anyhow, quite often (in 49 % of all cases) management doesn't seem to recognise negative developments in time, as a current study of *Institut österreichischer Wirtschaftsprüfer/Kammer der Wirtschaftstreuhänder/Karmasin Motivforschung* (2013) shows. Thereby, this is the second most important reason for economic difficulties of Austrian companies.

([xx]) Comp. *Romeike* (2013), p. 10.

For a comprehensive review of the history of risk (management) see *Bernstein* (1998).

([xxi]) For approaches to and practical requirements for early warning indicators and thereby early detections of crises comp. *Brokmann/Weinrich* (2012) and *Riegler/Basse/Große* (2012).

([xxii]) Comp. *KPMG* (2012), p. 8, chart 6.

([xxiii]) Comp. *KPMG* (2012), p. 20, chart 13.

([xxiv]) Following *Asel/Posch* (2009), the link between risk and strategy is a constitutive characteristic of a higher developed type of risk management.

([xxv]) Comp. *Pichler* (2008), p. 38f.. Also see *Diederichs/Form/Reichmann (Arbeitskreis Risikomanagement)* (2004), pp. 194-196.

([xxvi]) Comparably, risk management isn't yet a responsibility of a company board member in around 25 % of the companies listed in the ATX-prime market. Comp. *Arithmetica Versicherungs- und finanzmathematische Beratungs-GmbH* (2013).

([xxvii]) Comp. *Diederichs* (2012), pp. 199 - 202.

([xxviii]) Comp. *Diederichs* (2012), p. 204.

([xxix]) Comp. e. g. *Diederichs/Form/Reichmann (Arbeitskreis Risikomanagement)* (2004), pp. 191-194 and 196-197.

([xxx]) The monitoring of risk-steering measures was a task performed by internal auditors in 57 % of all companies. Comp. *Diederichs* (2012), pp. 202-204.

([xxxi]) Comp. *Diederichs* (2012), p. 205.

([xxxii]) Comp. *Diederichs* (2012), p. 203 f..

([xxxiii]) Following *KPMG* (2012), p. 11, chart 9, there is a common understanding and language around risk in 57 % of all enterprises.

It is also important that business managers and risk managers talk to each other. In 59 % of all organisations, business managers are happy to seek advice from the risk function according to *KPMG* (2012), p. 11, chart 9.

([xxxiv]) Comp. *Diederichs/Form/Reichmann (Arbeitskreis Risikomanagement)* (2004), p. 191.

([xxxv]) Derived from *Denk/Exner-Merkelt/Ruthner* (2008), p. 32.

([xxxvi]) In the words of *Stulz* (2003), p. 45: „The major lesson is that a firm cannot create value by hedging risks when it costs the same for the firm to bear these risks directly than to pay the capital markets to bear them."

([xxxvii]) Comp. e. g. *MacMinn* (1987), pp. 1169 ff.. The possibility of tax minimisation nevertheless depends on the structure of the specific tax scale (e. g. there is no advantage in the case of a flat tax rate).

([xxxviii]) The company has to keep some liquid funds, in order to be able to cover potential losses in the future. It might be that investments cannot be realised therefore. Because of this, one has to take into account opportunity costs for foregone profits.

([xxxix]) Comp. *Hachmeister* (2005), p. 135.

([xl]) Comp. *Stulz* (2003), p. 67 f.

([xli]) Comp. *Hachmeister* (2005), p. 139.

([xlii]) Comp. in a similar vein *Ruthner* (2004a), p. 46.

([xliii]) Regarding management reporting in Austria according to the ReLÄG 2004 and the URÄG 2008 comp. in detail *Haring/Fleischer* (2009).

([xliv]) Comp. *Weilinger* (2012), p. 561 f..

([xlv]) In the context of its auditing and consulting activities, the internal auditing shall guarantee that the business activities of the enterprise are being monitored effectively and efficiently. As well, the risk management system is normally being checked out by the internal auditing department. Whereas this monitoring function is orientated towards the past, risk management tries to detect possible future dangers (but also potentials) with the help of early warning systems. Comp. *Wömpener* (2008) for the elements of an internal control system and the corresponding classification of internal auditing as well as risk management, especially fig. 1 at p. 710 regarding the differentiation of an internal monitoring system according to the IDW.

11 % of organisations think they are very good and 31 % view themselves as good at linking internal auditing and risk management. Comp. *KPMG* (2012), p. 8, chart 6.

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([xlvi]) For details comp. *Wolf/Runzheimer* (2009).

([xlvii]) See *Matischiok/Narten* (2012) for details.

([xlviii]) See *International Accounting Standards Board* (2010) for details and e. g. *Haring/Panowitz* (2012) for a critical appraisal.

([xlix]) The Committee of Sponsoring Organizations of the Treadway Commission (COSO) is a voluntary private organisation in the USA, which shall help to qualitatively improve financial reporting through acting in an ethical way, effective internal auditing and a good management.

The following elements were added via the COSO ERM – Enterprise Risk Management Framework: internal control environment, goal setting, identification of incidents, risk evalaution, risk reaction, controlling activities, information and communication as well as monitoring.

For more details see e. g. *Brünger* (2009).

([l]) The former one was important for 28 % of the respondents, the latter one for 19 % of them. Comp. *KPMG* (2012), p. 2, chart 1.

([li]) Comp. *Denk/Exner-Merkelt/Ruthner* (2006), p. 17 f..

([lii]) Comp. *Denk/Exner-Merkelt/Ruthner* (2006), p. 21.

([liii]) Comp. *Ruthner* (2004a), p. 47.

([liv]) Comp. *Diederichs/Form/Reichmann (Arbeitskreis Risikomanagement)* (2004), p. 190 for a representative classification of risk fields, risk groups and single risks.

([lv]) Comp. *Vogler/Gundert* (1998), p. 2381 f. regarding the relevance and the determination of materiality limits.

([lvi]) Comp. *Arithmetica Versicherungs- und finanzmathematische Beratungs-GmbH* (2013).

([lvii]) Comp. *Arithmetica Versicherungs- und finanzmathematische Beratungs-GmbH* (2013).

([lviii]) Comp. *Burger/Buchhart* (2002), p. 48 f..

([lix]) Comp. for these two risk-based measures as well as the two related risk-orientated key performance indicators Return On Risk Adjusted Capital (RORAC) and Risk Adjusted Return On Capital (RAROC) *Ruthner* (2004b), p. 77 f..

([lx]) *Bernstein* (1996), p. 49 rightly warns: „I see three dangers in these trends: the exposure to discontinuity, the arrogance of quantifying the unquantifiable, and the threat of increasing risk instead of managing it. Taken togehter, these three dangers can be lethal."

Nevertheless, *Arithmetica Versicherungs- und finanzmathematische Beratungs-GmbH* (2013) thinks that the use of key risk indicators, which are rooted in financial mathematics, can still be improved at the companies listed in the ATX-prime market.

([lxi]) Comp. *Deutsche Gesellschaft für Risikomanagement e. V.* (2008) regarding the aggregation of risks, illustrated by a lot of case studies of German companies.

([lxii]) Comp. *Burger/Buchhart* (2002), p. 4 f..

If one views single risks only isolated from each other, these interdependencies get lost and possibly lead to an over-insurance or a new risk position. Comp. *Denk/Exner-Merkelt/Ruthner* (2008), p. 118.

([lxiii]) Comp. *Arithmetica Versicherungs- und finanzmathematische Beratungs-GmbH* (2013).

([lxiv]) Comp. *Denk/Exner-Merkelt/Ruthner* (2008), p. 127.

([lxv]) Comp. *Denk/Schrei* (2007), p. 73.

([lxvi]) Comp. *Vogler/Gundert* (1998), p. 2382.

([lxvii]) Comp. *Ruthner* (2004b), p. 78 f..

([lxviii]) Comp. *Arithmetica Versicherungs- und finanzmathematische Beratungs-GmbH* (2013).

([lxix]) Comp. *KPMG* (2012), p. 6, chart 5.

([lxx]) Comp. *KPMG* (2012), p. 8, chart 6.

([lxxi]) Comp. *Ruthner* (2004a), p. 47.

([lxxii]) Comp. *KPMG* (2012), p. 6, chart 4.

([lxxiii]) Comp. *KPMG* (2012), p. 20, chart 13.

([lxxiv]) Comp. *Arithmetica Versicherungs- und finanzmathematische Beratungs-GmbH* (2013).

([lxxv]) Comp. *Huther* (2003), p. 41.

([lxxvi]) Comp. *Gleißner* (2012), p. 205.

([lxxvii]) Comp. *Exner-Merkelt* (2007), p. 29.

([lxxviii]) Comp. *Exner-Merkelt* (2007) p. 27. An integration of risks in the steering of companies leads to an improved ability to be able to act more proactively and sustainably and thereby a higher degree of satisfaction with risk management according to *Asel/Posch* (2009).

([lxxix]) Comp. *KPMG* (2012), p. 9, chart 8.

According to *KPMG* (2012), p. 8, chart 6, 16 % of the organisations are very good at linking risk management with corporate strategy and 38 % regard themselves as good in this respect.

([lxxx]) Comp. *Diederichs* (2012), p. 204.

([lxxxi]) Comp. *Huther* (2003), p. 43 f..

([lxxxii]) Comp. *Huther* (2003), p. 43.

([lxxxiii]) Comp. *KPMG* (2012), p. 15, chart 11 and p. 14, chart 10.

([lxxxiv]) Comp. *KPMG* (2012), p. 4, chart 2.

([lxxxv]) Comp. *KPMG* (2012), p. 2, chart 1.

([lxxxvi]) Comp. *KPMG* (2012), p. 19, chart 12.

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Tips for the implementation of the CGR-convergence process can be found at *KPMG* (2012), p. 24 f. for instance.

([lxxxvii]) See in detail *Pichler* (2008), pp. 45-64.

([lxxxviii]) The balanced scorecard and risk management can of course be combined in various ways, not just the two mentioned in the text. *Krisper* (2009), pp. 31-70 compares five different approaches (the balanced scorecard plus, the enhanced Harvard balanced scorecard, the risk enhanced balanced scorecard, the critical success factor-based balanced scorecard as well as the balanced chance- and risk-card) and concludes with a critical appraisal of them.

The free cash flows are determined from a sales driven market perspective and from the cost driving processes and the employee perspective. The aggregated, overall risk position can approximately be taken into account via the industry-beta in the course of the determination of the cost of equity capital.

([lxxxix]) If data from historical time series are used, the problem lies on the one hand in supplying enough data in order to guarantee the statistical informational value of the results thus obtained. On the other hand, timely data should be used, as older information only insufficiently reflects the current and the future situation.

([xc]) Comp. *Bornhorn* (2012) for a balanced view on the possibilities and limits of mathematical-statistical methods in quantifying risks.

Riebesehl (2012) reminds us of the important fact that model risks always have to be considered together with behavioural risks.

([xci]) In both cases, the capital in the calculation corresponds to the risk capital. Thereby, the risk capital is the lowest possible equity amount, which must be available in order to compensate the effects of potential risks up to a certain occurrence probability. Comp. *Schierenbeck/Lister* (2002), p. 486.

In the case of the RAROC, the risk adjusted return is the periodic gain (or loss) reduced by an expected loss (calculated by multiplying the risk capital by its cost rate).

In contrast, only the invested capital multiplied by the risk-free rate is deducted from the periodic gain (or loss) in the case of the RORAC, which is sometimes assumed to be zero.

Comp. *Ruthner* (2004b), p. 78.

([xcii]) In a similar vein *Exner-Merkelt* (2006), p. 15.

([xciii]) Comp. *Exler* (2006) pp. 549-553 and *Weber* (2008).

([xciv]) Comp. *Arithmetica Versicherungs- und finanzmathematische Beratungs-GmbH* (2013), *Hoitsch/Winter/Baumann* (2006), pp. 69 ff., *Grof/Pichler* (2002) pp. 1017 ff. and *Arnsfeld/Bekau/Frey* (2007) pp. 488 ff..

([xcv]) Comp. for instance the empirical study of *Kajüter* (2011) in German speaking countries.

([xcvi]) The parameter values of company size (large, middle, small) were defined according to the guidelines of the Austrian Chamber of Commerce. These stated the following: a company with up to 49 employees and 10 million euros annual sales is deemed to be small-sized; medium-sized enterprises have 50 – 249 employees and a maximum of 50 million euros annual turnover; large companies have 250 employees or more with revenues per year of more than 50 million euros.

([xcvii]) Because of the better informational value (i. e. comparability) the percentages were represented per year.

([xcviii]) The risk categories were analysed according to multiple dimensions and therefore overlap from time to time.

([xcix]) The stock corporations analysed here were all listed on the stock exchange.

([c]) As expected, because it concerns two central parameters of risk valuation and seems to have a good cost-benefit-relation.

([ci]) A look at the statistical mode shows that scale value two is the most frequently chosen response.

([cii]) It has to be said that the development costs and time weren't taken into account

when measuring satisfaction.

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THE RATIONAL BEHAVIOR IN THE EGYPTIAN STOCK MARKET: EMPIRICAL INVESTIGATION OF HERDING BEHAVIOR

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Abstract. *This study will employ different testing methodologies proposed in the literature in order to investigate the existence of herding behavior in the Egyptian stock market under different market conditions (up-down markets, and high-low trading volume). The data set include daily data from 2006 to 2010 for all stocks listed in EGX100.*

The importance of this study rise from fact that share prices are substantially affected by market participants' behavior . It has been linked to market inefficiencies which cannot be explained by the rational asset pricing model, such as high market volatility and market destabilization. Therefore, examining herding behavior helps investors to understand price formation in financial markets.

The results found no presence of herding behavior at the market level in any studied conditions. On the other side, at the sectors level this behavior appeared in only three sector out of fifteen in all studied conditions. These results are consistent with the results of many studies that indicate to rational behavior of investors and their risk averse in some stock market. Also these results may be due to the high proportion of institutional and foreign investors in the Egyptian stock market that previous studies agreed and described them more degree of rationality in investment behavior

Keywords: *financial behavior, herding behavior, Egyptian stock market.*

Introduction

The definition of herding behavior has evolved and been referred to as a scenario in which individuals abide by the group decision, even when they perceive the group to be wrong (Christie & Huang, 1995). Nofsinger & Sias (1999) defined herding behavior as a group of investors trading in the same direction over a period of time. Raafat, *et al*. (2009) define herding as a form of convergent social behavior that can be broadly defined as the alignment of the thoughts or behaviors of individuals in a group (herd) through local interaction and without centralized coordination. So, understanding herding is particularly pertinent in an increasingly interconnected world.

The main purpose of this study is to examine the presence herding behavior in the Egyption stock market (one of the emerging markets). The study investigates the herding behavior in up-down markets, and high- low trading volume. Furthermore, this study try to help investors either individuals or institutions to understand these phenomena that allow them to make effective capital investment decisions that will be reflected positively on raising the market efficiency. Specially accurate and comprehensive information can help investors to encounter with herding problems.

The importance of this study rise from the following: First: examining herding behavior helps investors to understand price formation in financial markets. Second: there is a paucity of studies that examine herding behavior in the Egyptian stock market and Arab stock markets, therefore this study attempt to investigate the herding behavior in the Egyptian Stock Exchange and determine the different situations that shows this behavior. Third: unlike most global studies which study herding behavior for the aggregate market level; this study examines herding behavior at different sectors level which helps to find out the difference of herding behavior from one sector to another through different market conditions.

The remaining part of this paper is organized as follows: section 2 presents the literature review. Section 3 discusses the data and variables employed in the tests and the methodology of this study in details. Section 4 presents the empirical results. Finally, conclusions and future research directions will be given in Section 5.

Literature Review

According to Efficient Market Hypothesis (EMH), all investors are rational and possess the same set of information and, therefore, form the expected stock price in the same way. As a result, the stock price should reflect the information available in the market and the security's true value (sharp 1964, and Fama, 1970). However Lao & Singh (2011) argue that herding behavior suggests that investors are not necessarily rational and do not always derive the share price by rational analysis of firms, but by observing and following other investors' actions, even though not all market participants are fully informed. Thus, herding behavior may destabilize the market by moving securities away from their fundamental value, as share prices will not only reflect the investors' rational expectations of the shares, but also investors' irrational decisions in the market. Therefore, the existence of herding behavior challenges the validity of the Efficient Market Hypothesis.

Christie & Huan (1995) argue that herding behavior is not necessarily irrational and can be understood in two dimensions—irrational and rational. Irrational herding is a tendency of investors who ignore their own analysis and information and conform to the market consensus, even if they do not agree with it. Empirically, this may lead to observed behavior patterns that are correlated across individuals and that bring about systematic erroneous decision-making by entire populations.

Bikhchandani, *et al*. (1992) and Vaughan & Hogg (2005) demonstrate that investors herd because it reduces their uncertainty and fulfils their need to feel confident**.** In this sense, herding is closely linked to such distinct phenomena as imperfect expectations and it lead to systematic erroneous. While rational behavior occurs commonly among employees or agents (such as traders, fund managers and analysts) in a financial institution because their performance evaluation is done on a comparative basis. They may rationally herd in the direction of others who they believe may be better informed and possess information which is unavailable to the

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market. Antonio (2011) found that herding can cause significant movements of prices and volatilities. This is also supported by Yamamoto (2010) who found that herding behavior by investors has documented asymmetric volatility and volatility clustering in stock markets.

Park (2011) found that there is a significant asymmetric herding effect which observed and appears to be time-varying. Further, the clear link between asymmetric herding and volatility strongly supports the hypothesis of the asymmetric herding effect. Added to that Daniel, *et al.*(2002) investigated the evidence of how imperfect rationality affects trading, expectations and prices in capital markets. They found several recent surveys summarize evidence about psychology of the individual and its relevance for financial and other economists.

Hirshleifer & Teoh(2009) studied the influence of social and information transmission on capital markets, they found that, individuals often process verbal arguments obtained in conversation or from media presentations and observe the behavior of others. They review there evidence about how these activities cause beliefs and behaviors to spread and affect financial decisions and market prices; they also review theoretical models of social influence and its effects on capital markets.

Many studies found that understanding the role of sentiment in investment behavior is very important, such as Chau , *et al.* (2011) who found that the feedback trading tends to increase when investors are optimistic. In addition, the influence of sentiment on feedback trading varies across market regimes. These results are consistent with the view that feedback trading activity is largely caused by the presence of sentiment-driven noise trading. Their empirical analysis suggests that there is a significant positive feedback trading in these markets and the intensity of which is generally linked to investor sentiment. Lee , *et al*. (2002) test the impact of noise trader risk on both the formation of conditional volatility and expected return .Their empirical results show that sentiment is a systematic risk that is priced. Excess returns are contemporaneously positively correlated with shifts in sentiment. Moreover, the magnitude of bullish (bearish) changes in sentiment leads to downward (upward) revisions in volatility and higher (lower) future excess returns.

Tedeschi , *et al.* (2012) assess under which assumptions imitation, among noise traders, can give rise to the emergence of gurus and their rise and fall in popularity over time. They study the wealth distribution of gurus, followers and non followers and show that traders have an incentive to imitate and a desire to be imitated since herding turns out to be profitable. Their findings show that positive intelligence agents cannot invade a market populated by noise traders when herding is high.

Connolly & Stivers (2006) study the cross-sectional dispersion in daily stock returns, or daily return dispersion (RD). Their primary empirical contribution is to demonstrate that RD contains reliable incremental information about the future traditional volatility of both firm-level and portfolio-level returns. Further, their results suggest that RD contains more incremental information about the future volatility of firm-level stock returns than do lagged market-level return shocks.

Thomas & Zheng (2010) examined herding behavior in global markets, by applying daily data for eighteen countries. They found that with the exceptions of the US and Latin American markets, herding is present in both up and down markets, although herding asymmetry is more profound in Asian markets during rising markets. In addition, Lao & Singh (2011) examined herding behavior in the Chinese and Indian stock markets; their findings suggest that herding behavior exists in both markets and the level of herding depends on market conditions. In the Chinese market, herding behavior is greater when the market is falling and the trading volume is high. On the other hand, in India market it occurs during up-swings in market conditions. Herding behavior is more prevalent during large market movements in both markets. In relative terms, a lower prevalence of herding behavior was detected in the Indian stock market. Furthermore, Chiang , *et al.* (2010) examines the herding behavior of investors in Chinese stock markets. Using a least squares method, they find evidence of herding within both the Shanghai and Shenzhen A-share markets and no evidence of herding within both B-share markets. A-share investors display herding formation in both up and down markets. However, they cannot find herding activity for B-share investors in the up market. Barber, Odean, and Zhu (2009) find evidence of the herding behavior by U.S. individual 66 investors. They attribute the correlated trading by individual investors to various psychological biases, such as the representativeness heuristic, the disposition effect, and limited attention.

Data

This study examines the daily stock prices and trading volume data on common stocks listed on Egypt stock exchange. The number of listed firms in 2010 was 210 firms. In literature it is not expected to get reliable results from firms that are only listed for short periods or firms that have fewer than 50% of observations during the sample period. Firms that have negative or missing prices during that period are also could lead to incorrect results. Furthermore, to avoid microstructure biases, the stocks with a closing price that is within five percent of the average sample price must be excluded from the analysis as suggested by Chordia and Swaminathan (2000).

Therefore, data set used in this paper contains the stock prices and trading volume of all stocks listed in EGX100. EGX100 are selected because they are the most representative stock exchanges of Egypt which is composed of the top 100 companies in terms of liquidity and activity, including both the 30 constituent-companies of EGX 30 Index and the 70 constituent-companies of EGX 70 Index. At any time, if the number of observations for any of the listed firms are less than 50% of the whole sample observations it will be substituted by another one in the same industry.

The study period was from the inception of the index in 2006 to 2010. This period is adequate to exclude the effect of the Egyptian revolution 2011 in the stock market. The Egyptian stock exchange plummeted 6.25% following the beginning of the Egyptian Revolution of 2011 on 25 January. The Egyptian Stock Exchange closed at the end of trading on the 27th January after the benchmark EGX 30 Index (EGX30) plunged 16 percent that week amid the uprising. The exchange reopened on Wednesday 23 March after being closed for almost 8 weeks. The market fell by a further 8.9% on reopening. Since the President Ben Ali fled neighboring Tunisia on January 15, the volatility of the EGX 30 Index has proven to be unmatched within the Arab world. Since the close of business on January 13 (7156 volume at closing), the EGX 30 Index has shed 45 percent of its volume - a drop of 3186 points, from 7156 to 3970 on 8 December.

In literature, herding tests are based on the suggestion that a group is more likely to herd if it is sufficiently homogeneous, i.e. each member faces a similar decision problem, and each member can observe the trades of other members in the group. Therefore prior studies have applied the tests on groups of stocks categorized on the basis of industry classification (e.g., Christie and Huang, 1995: Demirer, et al, 2010). Following these studies all firms assigned to one of the following sectors groups: Banks, Basic Resources, Chemicals, Construction and Materials, Food and Beverage, Financial Services excluding Banks, Healthcare and Pharmaceuticals,

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Industrial Goods, Services and Automobiles, Personal and Household Products, Real Estate, Telecommunications, Travel and Leisure, Media, and Utility.

Methodology

Christie and Huang (1995) suggest that the investment decision-making process used by market participants depends on overall market conditions. During normal periods, rational asset-pricing models predict that the dispersion in cross-sectional returns will increase with the absolute value of the market returns, since individual investors are trading based on their own private information, which is diverse. However, during periods of extreme market movements, individuals tend to suppress their own private information, and their investment decisions are more likely to mimic collective actions in the market. Individual stock returns under these conditions tend to cluster around the overall market return. Thus, it can be observed that herding will be more prevalent during periods of market stress, which is defined as the occurrence of extreme returns in a market portfolio. To measure the return dispersion, Christie and Huang (1995) propose the cross-sectional standard deviation (CSSD) method, which is expressed as:

$$CSSD_t = \sqrt{\frac{\sum_{i=1}^{N}(R_{i,t}-R_{m,t})^2}{(N-1)}} \qquad (1)$$

Where, N is the number of firms in the aggregate market portfolio, $R_{i,t}$ is the observed stock return on firm i for day t and $R_{m,t}$ is the cross-sectional average of the n returns in the market portfolio for day t. This measure can be regarded as a proxy to individual security return dispersion around the market average.

Chang et al. (2000) suggested using the Cross - Sectional Absolute Deviation of returns (CSAD) as a measure of return dispersion. CSAD is expressed as:

$$CSAD_t = \frac{1}{N}\sum_{i=1}^{N}\left|R_{i,t} - R_{m,t}\right| \qquad (2)$$

Chang et al. (2000) suggest that during periods of market stress, one would expect the relation between return dispersion and market return to be non-linearly increasing or even decreasing. Therefore, they propose a testing methodology based on a general quadratic relationship between $CSAD_t$ and $R_{m,t}$ and the herding equation will be as following:

$$CSAD_t = \gamma_0 + \gamma_1\left|R_{m,t}\right| + \gamma_2 R_{m,t}^2 + \varepsilon_t \qquad (3)$$

Where $R_{i,t}$ is the individual stock return on firm i at time t, $|Rm,t|$is the average return of the equal-weighted market portfolio at time t, which represents the market return, and γ_1 is the coefficient of $\left|R_{m,t}\right|$. $R_{m,t}^2$ is the square of $\left|R_{m,t}\right|$ and γ_2 is the coefficient of $R_{m,t}^2$

According to this methodology, herding would be evidenced by a lower or less than proportional increase in the CSAD during periods of extreme market movements.

As a result, if herding is present, then the coefficients, γ_2 will be negative and statistically significant; otherwise a statistically positive γ_2 would indicate no evidence of herding.

Chiang Dazhi, (2010) interpret this result by shown that rational asset-pricing models imply a linear relation between the dispersion in individual asset returns and the market portfolio return, but during periods of relatively large movements in market prices, investors may react in a more uniform manner, exhibiting herding behavior. This behavior is likely to increase the correlation among asset returns, and the corresponding dispersion among returns will decrease or at least increase at a less-than-proportional rate with the market return. For this reason, a non-linear market return, $R^2_{m;t}$, is included in the test equation, and a significantly negative coefficient $\gamma_2$in the empirical test would be consistent with the occurrence of herding behavior.

Herding under different market conditions

Herding behavior during increasing and decreasing markets

This method investigates the herding behavior when the market is rising or declining by using the following formulas:

$$CSAD_t^{Up} = \gamma_0 + \gamma_1^{Up}\left|R_{m,t}^{Up}\right| + \gamma_2^{Up}(R_{m.t}^{UP})^2 + \varepsilon_t \qquad \text{if } R_{m,t} > 0 \qquad (4)$$

$$CSAD_t^{Down} = \gamma_0 + \gamma_1^{Down}\left|R_{m,t}^{Down}\right| + \gamma_2^{Down}(R_{m.t}^{Down})^2 + \varepsilon_t \qquad \text{if } R_{m,t} < 0 \qquad (5)$$

Where γ_1^{Down} is the coefficient of the equally weighted market portfolio return at time t when the market declines, $R_{m,t}^{Down}$ is the equally weighted market portfolio return at time t when the market decreases; the case for an up increasing market is similar.

Herding behavior during high and low volume state

This method checked for herding behavior during high and low volume days by using the following formulas:

$$CSAD_t^{V\text{high}} = \gamma_0 + \gamma_1^{V\text{high}}\left|R_{m,t}^{V\text{high}}\right| + \gamma_2^{V\text{high}}\left(R_{m.t}^{V\text{high}}\right)^2 + \varepsilon_t \qquad (6)$$

$$CSAD_t^{V\text{low}} = \gamma_0 + \gamma_1^{V\text{low}}\left|R_{m,t}^{V\text{low}}\right| + \gamma_2^{V\text{low}}\left(R_{m.t}^{V\text{low}}\right)^2 + \varepsilon_t \qquad (7)$$

Where $\gamma_1^{V\text{high}}$ is the coefficient of the equally weighted market portfolio return at time t when the market is in high volume state. $R_{m,t}^{V\text{high}}$ is the equally weighted market portfolio return at time t when the market is in high volume state; the case is similar for a low volume state.

The Results

Descriptive statistics

Table 1 provides summary statistics for average daily returns, return dispersions, and the average number of firms used to compute these statistics for each industry as follow.

Table 1 shown that, the average daily earnings was positive in only six sectors (Banks, Financial Services excluding Banks, Healthcare and Pharmaceuticals, Industrial Goods, Services

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and Automobiles, Real Estate, Retail) , which indicate that the average increasing prices for those sectors were more than the average decreasing prices during the period from 2006 to 2010. The Industrial Goods, Services and Automobiles sectors have achieved the highest positive value for an average daily returns (9.7%). While banks sector has less positive value for average daily returns for the same period. In other hand, the average daily returns were low in the rest of the nine sectors (which indicated a reduction in the average prices of those stocks more than the increases during the same period). The food sector and the tourism sector are the most decrease in the average daily returns (- 2.31 %) as well as the most high return dispersions (CSAD). While Chemicals sector was representing the minimum average daily returns (- 0.0098%)**.**

Table 1: Summary statistics: average daily returns and cross-sectional standard deviations

		Average daily returns		CSAD	
		Mean	Std. Dev.	Mean	Std. Dev.
	Aggregate market	0.00432	9.13	2.55	6. 171
	Sectors:				
1	Banks	0.01%	2.067%	1.53%	2.011%
2	Basic Resources	-.068	7.23	2.53	4.72
3	Chemicals	-0.0098	4.998	2.13	3.011
4	Construction and Materials	- 1.2	9.26	2.5	.0631
5	Food and Beverage	-2.31	11.71	3.3	7.883
6	Financial Services excluding Banks	0.02	6.904	2.30	3.757
7	Healthcare and Pharmaceuticals	0.15	5.641	0.02	1.736
8	Industrial Goods, Services and Automobiles	9.7	6.62	2.8	3.78
9	Personal and Household Products	- 0.08	8.088	2.46	4.757
10	Real Estate	1.75	14.8	2.2	9.68
11	Telecommunications	-0.01	2.827	1.65	1.780
12	Travel and Leisure	-2.31	11.71	3.3	7.883
13	Retail	0.0215	1.82	0.883	1.835
14	Media	-0.07	3.482	1.99	2.078
15	Utilities	-0.13	7.265	2.43	4.912

Herding behavior in the Egyptian stock markets

The study runs three separate regressions for the entire market and for each sector: one using the whole sample, two restricting the data to up (or down), two restricting the data to high (or low) trading volume. The remaining part of this section will discuss the results of these regressions.

Table (2) presents regression results for the model based in Equation (3). The linear coefficient γ_1 was statistically positive value for γ_1 in eleven sectors, but it was negative and significant only in four sectors (Food and Beverage, Industrial Goods, Services and Automobiles, Real Estate, Travel and Leisure). These results indicate no existence of herding behavior at these sectors or at the aggregate market level. Therefore, it is possible to conclude that rational asset pricing models predict the Egyptian market behavior during the studied periods. In addition these results agree with the results of Pettengill et al. (1995) who Used data of US stock market in period 1936–1990 and found a significantly positive (negative) relationship between beta and realized returns where market excess returns are positive (negative). They also found support for a positive risk-return tradeoff and interpreted that by saying, when investors realize that market excess returns are positive, there should be a positive relationship between betas and realized returns. Similarly, when the realized market excess returns are negative, there should be a negative relationship between risk and realized returns .

In other hand , the non- linear coefficient γ_2 was significant and positive in thirteen sectors, while it was significant and negative in only two sectors (Basic Resources, Construction and Materials sectors), in other words the evidence of herding formation was found in only these two sectors.

Accordingly, at market level the regressions statistically shown a significant and positive values for γ_1 and γ_2 coefficients, conducting the disappearance of herding behavior.

Table 2: Regression coefficients for $CSAD_t = \gamma_0 + \gamma_1|R_{m,t}| + \gamma_2 R_{m,t}^2 + \varepsilon_t$

		γ_0	γ_1			γ_2		
			Beta	t-ratios	Sig.	Beta	t-ratios	Sig.
	Aggregate market	0.011	0.242	50.66	0.000***	0.139	29.117	0.000***
	Sectors:							
1	Banks	0.013	0.148	5.750	0.000***	0.424	16.467	0.000***
2	Basic Resources	0.015	0.19	11.9	0.000***	-0.06	- 1.3	0.000***
3	Chemicals	0.014	0.188	10.196	0.000***	0.264	14.303	0.000***
4	Construction and Materials	.006	.383	31.9	0.000***	-.032	-2.7	.000***
5	Food and Beverage	0.028	-.156	-8.108	0.000***	0.389	20.234	0.000***
6	Financial Services excluding Banks	0.015	0.167	8.46	0.000***	0.170	8.609	0.000***
7	Healthcare and Pharmaceuticals	0.019	0.090	4.328	0.000***	0.231	11.075	0.000***
8	Industrial Goods, Services and Automobiles	0.018	-.026	- 1.58	0.000***	0.493	33.86	0.000***
9	Personal and Household Products	0.018	0.057	2.498	0.013**	0.316	13.768	0.000***
10	Real Estate	.023	-0.06	- 3.3	0.001***	0.178	9.7	0.000***
11	Telecommunications	0.008	0.434	17.353	0.000***	0.177	7.071	0.000***
12	Travel and Leisure	0.028	-.237	- 9.82	0.000***	0.89	36.93	0.000***
13	Retail	0.002	0.509	24.63	0.000***	0.341	16.48	0.000***
14	Media	0.012	0.297	6.736	0.000***	0.296	6.716	0.000***
15	Utilities	0.13	0.150	2.492	0.013**	0.261	4.349	0.000***

*** Statistical significance at 1%.
** Statistical significance at 5%.
* Statistical significance at 10%.

Herding behavior during increasing market state

Table (3) presents the regressions results for equation (4). According to the analysis at the sectors level, coefficient γ_1 is positive in six sectors which are Banks, Healthcare and Pharmaceuticals, Travel and Leisure, Telecommunications, Media, and Utility. This agree with the CAPM hypothesis- the linear risk-return tradeoff- as investors achieve similar increase in return per unit increase in beta.

While $\gamma_1$coefficients were negative and significant in five sectors (the Basic Resources, Chemicals, Food and Beverage, Healthcare and Pharmaceuticals, Industrial Goods, Services and Automobiles). These results interpreted by both Tang & Shum (2003) and Pettengill et all,(1995) who found that risk return relationship would be negative when an expected market return is lower than risk free rate. This means that investors acquire lower return compared to risk free rate at market is negative (market prices are down).

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At non- linear coefficient γ_2 all sectors appear significant and positive, while only one sector (Real Estate) shown γ_2 is significant and negative , which indicate to evidence of herding formation only in sector.

Finally, when examining the presence of the herding at the whole market level, the results found no evidence of herding behavior at the market rise condition. Since $\gamma_2$coefficients are significantly positive. This indicate that investors are rational and expect high returns when facing high risk, and they don't like to hold risk-free asset when excess returns are positive or returns of market is higher than risk free rate.

Table 3: Regression coefficients for: $CSAD_t^{Up} = \gamma_0 + \gamma_1^{Up}\left|R_{m,t}^{Up}\right| + \gamma_2^{Up}(R_{m.t}^{UP})^2 + \varepsilon_t$

		γ_0	γ_1			γ_2		
			Beta	t-ratios	Sig.	Beta	t-ratios	Sig.
	Aggregate market	.017	.043	6.87	0.000***	.156	24.95	0.000***
	Sectors:							
1	Banks	0.012	0.111	1.774	0.076*	0.020	0.325	0.745
2	Basic Resources	0.018	- 0.107	-3.283	0.001***	0.367	11.27	0.000***
3	Chemicals	0.014	-0.080	-2.148	0.032**	0.144	3.478	0.001***
4	Construction and Materials	0.016	0.049	0.113	0.000***	.040	2.25	0.020**
5	Food and Beverage	0.032	- 0.224	- 9.66	0.000***	0.371	15.99	0.000***
6	Financial Services excluding Banks	0.015	-0.067	-1.587	0.113	0.107	2.526	0.012**
7	Healthcare and Pharmaceuticals	0.02	-0.386	-32.25	0.000***	0.929	77.74	0.000***
8	Industrial Goods, Services and Automobiles	0.025	-0.103	- 5.38	0.000***	0.781	40.62	0.000***
9	Personal and Household Products	0.017	-0.047	-0.923	0.356	0.072	1.435	0.151
10	Real Estate	.018	0.027	0.859	0.39	-.002	-.062	.050**
11	Telecommunications	0.008	0.007	0.109	0.913	0.179	2.865	0.004***
12	Travel and Leisure	0.019	0.023	0.467	0.64	0.098	1.95	0.040**
13	Retail	0.014	-0.042	0.723	0.320	0.061	1. 35	0.132
14	Media	0.013	-0.198	-1.815	0.07*	0.252	2.307	0.021**
15	Utilities	0.015	0.76	0.561	0.575	0.14	0.105	0.917

*** Statistical significance at 1%.
** Statistical significance at 5%.
* Statistical significance at 10%.

Herding behavior during decreasing market state

Table (4) reports the results of estimating the herding regression represented by equation (5). $\gamma_1$coefficients are significantly positive in eleven sectors, which insure the positive relationship between risk and returns. While γ_1Coefficients are negative in only four sectors (Construction and Materials, Food and Beverage, Industrial Goods, Travel and Leisure).

In addition, no herding behavior is detected in all sectors .Where $\gamma_2$coefficients are significantly positive at the down market.

These results are opposite to Tang and Shum (2003) findings, who argue that during down period there is a negative relationship between risk and return. While this result is agree with Sinaee & Moradi findings (2010) who shown that there was a positive relationship between risk and return, and they ascribed this to investor's rational behavior and their risk averse during period of down market

Finally, when examining the entire market data the results display no herding behavior in the decreasing condition. Comparing this to the increasing market condition it is possible to conclude that the aggregate market display no herding behavior in up and down markets.

Table 4: Regression coefficients for: $CSAD_t^{Down} = \gamma_0 + \gamma_1^{Down}\left|R_{m,t}^{Down}\right| + \gamma_2^{Down}(R_{m.t}^{Down})^2 + \varepsilon_t$

		γ_0	γ_1			γ_2		
			Beta	t-ratios	Sig.	Beta	t-ratios	Sig.
	Aggregate market	0.02	0.088	9.45	0.000***	0.396	42.50	0.000***
Sectors:								
1	Banks	0.13	0.325	8.462	0.000***	0.361	9.414	0.000***
2	Basic Resources	0.016	0.303	10.2	0.000***	.148	5.006	0.000***
3	Chemicals	0.13	0.314	13.107	0.000***	0.208	8.661	0.000***
4	Construction and Materials	0.017	-.076	-2.88	0.004***	0.41	15.7	0.000***
5	Food and Beverage	0.029	-.161	-5.083	0.000***	0.432	13.63	0.000***
6	Financial Services excluding Banks	0.015	0.359	11.484	0.000***	0.073	2.331	0.02***
7	Healthcare and Pharmaceuticals	0.02	0.180	5.555	0.000***	0.238	7.335	0.000***
8	Industrial Goods, Services and Automobiles	0.022	-.135	-3.996	0.000***	0.484	14.384	0.000***
9	Personal and Household Products	0.017	0.214	6.147	0.000***	0.333	9.582	0.000***
10	Real Estate	0.027	0.113	3.813	0.000***	0.208	9.039	0.000***
11	Telecommunications	0.012	0.233	12.00	0.000***	0.712	38.242	0.000***
12	Travel and Leisure	0.033	-0.22	- 6.25	0.000***	0.948	26.06	0.000***
13	Retail	0.005	.003	0.008	0.000***	0.01	0.002	0.000***
14	Media	0.011	0.682	11.636	0.000***	0.078	1.329	0.184
15	Utilities	0.11	0.3	3.207	0.001***	0.198	2.118	0.035**

*** Statistical significance at 1%.
** Statistical significance at 5%.
* Statistical significance at 10%.

Herding behavior during high and low trading volume state

Table (5) reports the results of estimating the herding regression represented by equation (6), where it examine the herding behavior during high trading volume days.

The results found that when the trading volume was high, $\gamma_1$coefficients were negative and significant in nine sectors which are: (Chemicals, Construction and Materials, Food and Beverage, Financial Services excluding Banks, Healthcare and Pharmaceuticals, Real Estate, Industrial Goods, Services and Automobiles, Telecommunications, and Utility). On the other hand, $\gamma_1$coefficients were negative but not significant in the sectors of Basic Resources, Travel and Leisure, and Media.

The results found at the market level, $\gamma_1$coefficients were negative and significant, which indicate to significantly negative relationship between risk and returns and high-beta markets incur higher losses than low-beta markets.

Finally, The results found no herding behavior at the sectors level or at the market level since $\gamma_2$coefficients were positive and significant.

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Table 5: Regression coefficients for: $CSAD_t^{Vhigh} = \gamma_0 + \gamma_1^{Vhigh}\left|R_{m,t}^{Vhigh}\right| + \gamma_2^{Vhigh}\left(R_{m.t}^{Vhigh}\right)^2 + \varepsilon_t$

	γ_0	γ_1			γ_2		
		Beta	t-ratios	Sig.	Beta	t-ratios	Sig.
Aggregate market	0.023	-0,26	-22.8	0.000***	0.88	77.02	0.000***
Sectors:							
1 Banks	0.011	0.201	1.955	0.05**	0.271	2.638	0.009***
2 Basic Resources	0.017	- 0.018	- 0.917	0.087*	1.69	8.573	0.000***
3 Chemicals	0.18	-0.117	-4.117	0.000***	0.396	13.911	0.000***
4 Construction and Materials	0.025	-0.19	- 8.85	.000***	0.744	34.62	.000***
5 Food and Beverage	0.029	-0.148	- 5.374	0.000***	0.315	11.464	0.000***
6 Financial Services excluding Banks	0.20	-0.052	-1.784	0.075*	0.129	4.419	0.000***
7 Healthcare and Pharmaceuticals	0.018	0.110	2.327	0.020**	0.137	2.881	0.004***
8 Industrial Goods, Services and Automobiles	0.028	- 0.202	- 4.43	0.000***	0.43	9.442	0.000***
9 Personal and Household Products	0.018	0.044	0.771	0.441	0.185	3.264	0.001***
10 Real Estate	.024	-0.25	-9.439	.000***	.447	16.9	0.000***
11 Telecommunications	0.13	-0.272	-6.344	0.000***	0.302	7.039	0.000***
12 Travel and Leisure	0.018	-0.091	- 1.275	0.205	0.151	2.169	0.030**
13 Retail	-0.001	0.42	12.5	0.000***	0.358	10.64	0.000***
14 Media	0.017	-0.086	-0.766	0.44	0.539	4.803	0.000***
15 Utilities	0.028	-0.480	-3.682	0.000***	0.829	6.355	0.000***

*** Statistical significance at 1%.
** Statistical significance at 5%.
* Statistical significance at 10%.

Table (6) present regression results for the equation (7), when the trading volume is low, the results showed $\gamma_1$coefficients were negative and significant in only four sectors (Construction and Materials, Food and Beverage, Real Estate, Industrial Goods, Services and Automobile). For the rest sectors in the low volume trading condition, the regressions yield statistically significant with positive γ_1 coefficients.

The results in table (6) did not find herding behavior in any sectors as $\gamma_2$coefficients were positive and significant in all sectors.

Finally, at the market level $\gamma_1$coefficient was negative but not significant and $\gamma_2$coefficient was significantly positive. These results can be interoperated as disappearance of herding at the high volume state.

Table 6: Regression coefficients for: $CSAD_t^{Vlow} = \gamma_0 + \gamma_1^{Vlow}\left|R_{m,t}^{Vlow}\right| + \gamma_2^{Vlow}\left(R_{m.t}^{Vlow}\right)^2 + \varepsilon_t$

		γ_0	γ_1			γ_2		
			Beta	t-ratios	Sig.	Beta	t-ratios	Sig.
	Aggregate market	0.014	-0.001	-0.10	0.92	0.103	8.91	0.000***
Sectors:								
1	Banks	0.00	0.557	15.155	0.000***	0.328	8.919	0.000***
2	Basic Resources	0.015	-0.32	-1.007	0.000***	0.003	0.187	.020***
3	Chemicals	0.13	0.314	13.107	0.000***	0.208	8.661	0.000***
4	Construction and Materials	0.013	0.376	22.2	0.000***	- 0.076	- 4.49	0.000***
5	Food and Beverage	0.029	- 0.15	-5.374	0.000***	0.315	11.464	0.000***
6	Financial Services excluding Banks	0.019	-0.07	-3.514	0.000***	0.076	3.792	0.000***
7	Healthcare and Pharmaceuticals	0.019	0.074	2.684	0.007***	0.289	10.480	0.000***
8	Industrial Goods, Services and Automobiles	0.015	0.433	17.72	0.000***	0.059	2.417	0.016***
9	Personal and Household Products	0.017	0.50	1.648	0.01***	0.393	12.936	0.000***
10	Real Estate	.025	-.034	-1.311	0.19	0.134	5.137	.000***
11	Telecommunications	0.012	0.272	10.635	0.000***	0.253	9.923	0.000***
12	Travel and Leisure	0.032	-0.25	-7.257	0.000***	0.95	27.11	0.000***
13	Retail	-.002	0.521	7.96	0.000***	0.334	11.5	0.000***
14	Media	0.11	0.332	5.818	0.000***	3.25	5.704	0.000***
15	Utilities	0.014	0.162	1.898	0.059*	0.338	3.962	0.000***

*** Statistical significance at 1%.
** Statistical significance at 5%.
* Statistical significance at 10%.

Result interpretation

The results shown no presence of herding behavior at the market level in any studied conditions. At the sectors level herding behavior appeared in few of them. where the evidence of herding formation was found in only these two sectors(Basic Resources, Construction and Materials sectors). Furthermore, the findings suggest herding behavior is present in only one sector out of fifteens studied sectors in the up market (Real state) and in the low market (Construction and Materials).

The disappearance of herding behavior at the market level in high trading volume condition opposed with Lao Paulo& Singh Harminder (2011) results, who examine herding behavior in the Chinese and Indian stock Markets and found that herding behavior is greater when the market is falling and the trading volume is high. Furthermore, the herding behavior is more prevalent during large market movements in both markets. Their findings suggest that the existence of herding behavior depends on the market conditions.

Table (7) presented the percentage of the trading value of coded investors in the Egyptian stock exchange for the period from 2005 to 2010. From the figures in the table, the Egyptian stock market was dominated by individual investors during the period 2006-2009. In 2009 the average of the value traded by individuals was 63% as opposed to 37% during the same period for institutional investors. In 2010, institutional investors dominated the market, accounting for 52% of the value traded, as opposed to 37% in 2009. In the other hand institutional investors was dominated in 2005 and in 2010. the average of the value traded by institutional was 53% and

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52% in 2005 and 2010 respectively as opposed to 47% and 48% during the same period for individuals investors.

The Egyptian investors controlled 78% of the value traded in 2010 compared to 70% in 2005. The remaining 22% were the foreigners, of whom 6% were Arab investors and 16% were non-Arab investors, after excluding deals. While the remaining 30% of the value traded in 2005 was divided between 14% for Arab investors and 16% for non-Arab investors. The number of the value traded by foreign investors (Arab and non-Arab) reflects foreign confidence and interest in the Egyptian market.

Table 7: Trading Value of Coded Investors in EGX

Years	Individuals vs. Institutional		Egyptians vs. Foreigners		
	Individual	Institutional	Egyptians	Foreigners	
				Arab	Non-Arab
2005	0.47	0.53	0.7	0.14	0.16
2006	0.6	0.4	0.7	0.14	0.16
2007	0.61	0.39	0.69	0.12	0.19
2008	0.66	0.34	0.7	0.1	0.2
2009	0.63	0.37	0.81	0.6	0.13
2010	0.48	0.52	0.78	0.6	0.16

Source: Egyptian Stock Exchange, Annual Report, various issues.

From what represented in table (7) it is possible to argued that, however the Egyptian stock market is dominated by domestic individual investors, the proportion of institutional and foreigner investors still high enough to affect the market behaviors.

Theoretically individual investors tend to have less professional knowledge and cannot access information accurately and easily. In a market dominated by domestic individual investors with limited access to information, one might argue that the resulting information asymmetry may lead these individual investors to follow the actions of other investors including more informed domestic and foreign institutional investors. Herding behavior is then more likely to take place.

In the contrary export-oriented institutional investors are more informed, therefore the huge appearance of institutional investors brings more rational security analysis and decreases the overall level of speculative investment activities in the stock market. This argument was supported by (Kaniel et al., 2008; Barber and Odean, 2008) who found that less-informed individual investors rely more on public information, and are more vulnerable to the influence of market sentiment and attention-grabbing events.

It is expected also that the appearance of foreign investors brings more rational to the market, as these foreign investors have access to a broader range of information on the market than domestic investors. This argument was supported by several literatures Which shown differences between the individual investor and trading institutions such as:

Iihara *et al.* (2001) examine the herding behavior observable in three groups of investors – individual, institutional and foreign – in the Tokyo Stock Exchange; their findings illustrate that foreign investors' investment decisions tend to be based on information.

Lin & Swanson (2008) investigated the herding behavior and investment performance of foreign investors in the U.S. market. Their evidence shown that independent of whether the U.S. market is up or down, foreign investors continue to increase their holdings of U.S. equities and these purchasing activities result in superior performance. When the U.S. market experiences extreme ups and downs, foreigners are net purchasers one month before and after the market moves and, in general, they perform well.

Jeona &Moffettb (2010) studied the effect of herding by foreign investors on stock returns in the Korean market. They found that foreign investors tend to buy/sell shares that domestic institutions sell/buy in the herding year.

Lee, *et al.* (1999) examined interdependencies among institutional investors, big individual investors, and small individual investors. Their results imply that, small individual investors are not well informed and are slow learners. While they found that institutional investors follow neither positive-feedback nor negative-feedback trading strategies.

Finally, Ng & Wu (2007) analyzed the trading behavior of 4.74 million individual and institutional investors across Mainland China. Results show that only the trading activities of institutions and of wealthiest individuals can affect future stock volatility, but those of Chinese individual investors at large have no predictive power for future stock returns.

Conclusion

This study examined herding behavior in the Egyptian stock markets. Herding behavior is a recognized psychological concept which is used in the financial world to explain the scenario in which investors, rationally or irrationally, mimic others' decisions. Such behavior is believed to be associated with causing market inefficiency and abnormal market volatility. Investigating herding behavior in the Egyptian stock markets may help to identify the potential risks and guide the formation of proper strategy while investing in this market.

The study use several testing methodology based on a general relationship between Cross-Sectional Absolute Deviation of returns CSAD and the market return. The study investigates the herding behavior in the Egyptian stock market for all stocks listed in EGX100 from the inception of the index in 2006 to 2010.

The analysis of the study based on the data of the entire market, which includes all listed stocks in EGX100. Further analysis have been done by dividing the entire market into fifteen different sectors.

The results shown no presence of herding behavior at the market level in any studied conditions. At the sectors level herding behavior appeared in few of them.Where the evidence of herding formation was found in only two sectors (Basic Resources, Construction and Materials sectors). Furthermore, the findings suggest herding behavior is present in only one sector out of fifteens studied sectors in the up market (Real state) and in the low market (Construction and Materials).

These results interpreted to be due to the high proportion of institutional and foreigner investors which affect the market behavior. It is expected that institutional and foreigner investors bring more rational behavior and decrease the overall level of speculative investment activities in the stock market.

Also during down market this study shown that there is a positive relationship between risk and returns which be in agreement with Sinaee & Moradi findings (2010) who shown that there was a positive relationship between risk and returns, and they ascribed this to investors rational behavior and their risk averse during period of down market .

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These results consistent with many previous studies shown differences between the individual investor and trading institutions, because institutional investors are more informed; have access to a broader range of information on the market than domestic investors, and it is expected that they follow neither positive-feedback nor negative-feedback trading strategies.

These results are useful for modeling stock behavior in the Egyptian market. In addition, the lack of evidence of herd behavior should provide confidence for investors that they do not have to be concerned about potential destabilizing effects.

Future Research

An important extension of this study would be to examine whether herd formation could be identified when we differentiate between domestic and foreign investors or between individuals and institutions investors markets. In addition, the impact of actions and regulations on herd behavior requires further scrutiny.

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SECTORAL HERDING BEHAVIOR IN THE AFTERMARKET OF MALAYSIAN IPOS

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Abstract: *Malaysian IPO market is certainly characterized by substantial uncertainties due to pricing restraints applied by the Capital Issues Committee, fixed-price pricing mechanism and cognitive biases of Asian investors. Hence, all of these characteristics might induce investors to engage in herding behavior in the aftermarket of IPO. This study investigates investors' herding behavior in the IPO aftermarket from 2001 to 2011 using Christie and Huang (1995) method. The findings of this study show that for non-private placement category, a negative and insignificant β_1 coefficient, as an indication of herding is reported for Technology sector. The herding behavior that is only constrained to technological firms during down market may be due to the risky nature of the new issues in the down market, than the uninformed characteristic of the individual investors. The findings of this study also show that for the private placement category, negative and insignificant coefficients of β_1 and β_2 are reported for Consumer Product and Technology sectors respectively. Since the negative coefficients are not limited to the down market, risky and uncertain shares, the results could be an indication of the herding of informed investors in the two mentioned sectors.*

Keywords: *behavioral finance, herding, behavioral (cognitive) decision theory, IPO aftermarket, private placement, non-private placement, cross-section dispersion of return, Bursa Malaysia.*

Introduction

Contrary to the efficient market hypothesis, some behavioral theories support irrational behavior of human being. Based on the Behavioral (Cognitive) Decision Theory, generally, human judgment and choice do not support optimal decision models. Not all human behaviors are cost/benefit efficient and they are different from that dictated by normative models. This is due to the biases that occur during the decision-making process. Herding is such a behavior that could be considered as an irrational behavior because during herding period, individual investors ignores their own information and follow the market consensus. This phenomenon could lead to some negative consequences such as incorrect and poor decision-making made by the whole populations due to the behavior patterns that are correlated across individuals (Bikhchandani, Hirshleifer, & Welch, 1992; Devenow & Welch, 1996). In addition, as prices are influenced by the group decisions, they tend to depart from their equilibrium levels and investors are forced to transact at inefficient prices (Christie & Huang, 1995). In investigating the causes of 1997 financial crisis in Malaysia, Jomo (1998) reports that Asian financial crisis was partly due to the herding behavior of the investors.

The rest of this paper is organized as follows: Section 2 discusses related literature. Section 3 describes the data and methodology employ in this study. Section 4 presents the results and finally section 5 provides the conclusions of this study.

Literature Review

Gleitman (1981) argues that the need for social comparison is large in situations that are ambiguous or uncertain. IPO market is often characterized by substantial ambiguities and uncertainties as reported in the previous literature (Buckland & Davis, 1990; Cassia, Giudici, Paleari, & Redondi, 2004; Chen & Mohan, 2002; Clarkson & Merkley, 1994; Kim, Krinsky, & Lee, 1993; Miller & Reilly, 1987; Reber & Fong, 2006). Fixed pricing method adds to the uncertain IPO market context (Yong 2012) . Consequently, investors are expected to herd in uncertain IPO market context. Moreover, the inefficiency of new issues market, proven in the previous literatures (Husni, 2005; Lai, Guru, & Nor, 2003; Mat Nor, Lai, & Hussin, 2002) makes it appropriate for analyzing the anomalies of this market based on the behavioral theories.

Theoretically and empirically, Asian people experience more cognitive biases than people of other cultures, however there is a dearth of literature regarding this issue (Kim & Nofsinger, 2008). The lack of research in this area is due to the fact that behavioral finance explanation of the investors' behavior in decision-making, imply a violation of standard rationality assumptions. In the situation where investors follow the crowds instead of make use of their private information, the assumption of efficient market hypothesis that is based on the rational of utility maximizing investors is violated. Behavioral finance is still a young field and academic research relating to this area is in its very early stages and remains quite controversial.

Based on the above discussions, there are few studies that have analyzed the Malaysian IPO market using behavioral theories and herding behavior has not yet been tested in the aftermarket of Malaysian IPOs. Therefore, this study would shed light and expand knowledge on this area, especially in the context of developing or emerging capital market. Specifically, this could be the first study that concentrates on herding behavior of private placement and non-private placement investors, in different industries in the aftermarket of Malaysian IPOs from 2001 to 2011 using Christie and Huang (1995) method. The cross-sectional analysis is conducted based on Bursa Malaysia sectoral classification since there is a tendency for a group to act as a herd if it is sufficiently homogeneous (Bikhchandani & Sharma, 2000). In addition, Hirshleifer and Hong Teoh (2003) find that overpricing is observed in the US technology stock in the 1990s. This finding suggests the possibility of herding in certain counters such as technology counter due to its uncertain and risky in natures. Thus, there is high possibility that herd formation to happen at the point of investments in a group of stocks such as firm's stocks categorized by industry or sector.

The division of the data to the proportion of the IPOs subscribed by the institutional/informed investors (private placement investors) as opposed to the proportion of IPOs subscribed by the individual/not well-informed investors (non-private placement investors) allows testing of the herding behavior. The private placement IPOs consist of institutional investors who are well informed. These investors are widely regarded as being sophisticated (Badrinath, Kale, & Noe, 1995; Cohen, Gompers, & Vuolteenaho, 2002;

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Michaely & Shaw, 1994; Nagel, 2005). Chung, Firth, and Kim (2002) and Bos and Donker (2004) indicate that one of the characteristics of the institutional investors is that they are more experience and knowledgeable in processing the information. Empirically, past literatures (Banerjee, 1992; De Long, Shleifer, Summers, & Waldmann, 1990; Hirshleifer, Subrahmanyam, & Titman, 1994; Shleifer & Summers, 1990) mention that more experienced investors are those who are unlikely to behave irrationally or demonstrate cognitive biases element. Institutional investors are expected not to show faddish behavior in their investment decision, as they would rely on their information for decision-making.

Contrary to institutional investors, individuals are considered naïve investors. Thus, their trading behaviors are often regarded as irrational and tend to form market anomalies. They are disadvantaged in information and are more prone to overreact toward new events occurred in the market, thus individual investors are less rational among all investors (Chemmanur, Jordan, Liu, & Wu, 2010). According to Lee, Shleifer, and Thaler, (1991), certain characteristics of individual investors such as ignorant, uninformed and trade based on sentiment are a general features in the herding literature. In addition, according to Shiller (1984) and De Long et al. (1990), fad and fashion, rather than fundamentals play important roles in investments decision making of individual investors as limited source of information is available to them.

Methodology and Sampling

Theoretically, at the time of herding, the dispersion of equity return is concentrated surrounding the market aggregate return with the assumption that individuals ignore their own beliefs and their investment decision is very much related to the market actions. Thus, the individual security return would not diverge much from the overall return of the market. Accordingly, this study employs cross-sectional standard deviation of return method established by Christie and Huang (1995) to measure the individual security's return dispersion level around the average return of the market in order to determine the herding behavior of investors. The following formula is employed to measure the cross-sectional standard deviation of returns:

$$S.D._t = \sqrt{\frac{\sum_{j=1}^{n}(r_{jt}-\overline{r_t})^2}{n-1}} \qquad (1)$$

Where,

n = number of firms in the aggregate market portfolio,

r_{jt} = observed stock return on firm *j* for day *t*, and

$\overline{r_t}$ = cross-sectional average of the *n* returns in the portfolio for day *t*.

The observed stock return on firm *j* for day *t* (r_{jt}) is calculated from the daily closing prices of new issues as the followings:

$$r_{jt} = \frac{P_{jt}-P_{jt-1}}{P_{jt-1}}$$

Where,

P_{jt} = IPO closing price for day *t*, and

P_{jt-1} = IPO closing price for day $t-1$.

The return calculation begins from the second day of the listing as it is based on the closing price of day *t* minus the closing price of the previous day (i.e. day 1 of the listing). For some IPOs the closing prices of the first or the first few days are not available, as a result the first day for which the closing price is available is considered as the first trading day of that IPO and the return calculation is started from that day.

According to Christie and Huang (1995), the probability of herding behavior to occur is high during periods of extreme market movements, as investors would most likely to follow the market consensus during such periods. In the IPO market, there is a lack of historical information regarding the new issues, which can create uncertainty and lead to market stress during new issues. Hence, the behavior of the dispersion of average return as a proxy for investors' behavior at the time of market stress could be examined through the following equation:

$$S.D._t = \alpha + \beta_D D_t^L + \beta_U D_t^U + \varepsilon_t \qquad (2)$$

Where,

D_t^L = 1 if the return on the aggregate market portfolio on day *t* lies in the lower tail of the return distribution and zero otherwise, and

D_t^U = 1 if the return on the aggregate market portfolio on day *t* lies in the upper tail of the return distribution and zero otherwise.

The α coefficient denotes the average dispersion of the sample excluding the regions covered by the two dummy variables. The dummy variables are included in equation (2) with the objective to capture the differences in return dispersions throughout the extreme market movements' period. If the coefficients of β_D (for down market) and β_U (for up market) are negative and statistically significant, then the results signify the presence of herd formation by the market participants.

Since January 2001 till December 2011, Bursa Malaysia statistics report 440 new listings. Out of 440 shares, 55 are labeled as dead and 5 as suspended. Thirteen IPOs that are categorized as REITS, and 8 IPOs that are categorized as right, special, restricted, bonus and closed-end fund issues, are also excluded from this study. IPOs issued under REITS category are excluded due to the different format of presentation for its financial statement. As the occurrence of book built issues is rare in Malaysia and also because the focus of this study is on fixed price IPOs, 5 issues that apply book-built pricing method are also excluded from this study. The closing prices for 7 companies were not available in the Data stream. Eight companies have zero return in ten consecutive days so they also are excluded from the sample. These companies are SKB Shutters Corporation Berhad, NTPM holding Berhad, Oriented Media Group Berhad, Guan Chong Berhad, MQ Technology Berhad, 1 Utopia Berhad, Uzma Berhad and Sunzen Biotech Berhad.

Accordingly, the number of companies with available closing prices narrows down to 339, of which 176 and 163 are categorized as private placement and non private placement IPOs respectively. This study also excludes the rare type of IPOs, for example restricted offer for sale, restricted public issue, offer for sale to eligible employees, restricted offer for sale to Bumiputra investors, special and restricted issue to Bumiputra investors, tender offer and special issue. The reason to exclude these companies with the uncommonly types of offer is due to the fact that the numbers of companies with these issues are very few that lead to less meaningful outcome as suggested in Abdul Rahim and Yong (2010) and Yong (2007).

Based on the theoretical and empirical discussions, it is hypothesized that herding takes place in non private placement (implying by negative coefficients of $D_t^L \text{and} D_t^U$) IPOs and no herding takes place in private placement IPOs (implying by positive coefficients of $D_t^L \text{and} D_t^U$).

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Econometric Issues

The focus of this study is on the short term investors' behavior in the IPO aftermarket. Hair, Black, Babin, and Anderson (2009) note that an appropriate sample size with a strong statistical power and generalizability of results requires five observations for each independent variable. Since the minimum ratio is 5:1, the desired level is between 15 to 20 observations for each independent variable. In addition, they state that a larger sample size reduces the detrimental effects of non normality. Since there are two independent variables in the specified model, the 30 days standard deviation of returns (as a proxy for investor's behavior) meets the desired level of 15 to conduct the analysis.

In this study, only the dependent variable normality is checked as the independent variables are dummies. According to Hair et al. (2009) in the case of non normality for the dependent variable (DV), it should only be transformed if there is a heteroscedasticity problem. They state that violations of homogeneity usually can be corrected by transformation of the DV scores. Interpretation, however, is then limited to the transformed scores. As a result, to check if the transformation should be conducted for the cross section of the standard deviation of returns (the DV), the White heteroscedastisity test of the regression is conducted. If heteroscedastisity exists (the observed R-squared ≤ 0.05), dependent variable will be transformed until it is normalized. Tabachnick, Fidell, and Osterlind (2001) meanwhile indicate that several transformations could be used before one finds the most helpful one.

Besides the heteroscedasticity and normality, linearity is another assumption to be checked. Using dichotomous dummy variables for independent variables can only have a linear relationship with other variables. In this study, the research model includes two independent dummy variables and one continuous dependent variable; accordingly it is assumed that the relationship is linear.

Results and Discussions

In this study, several sectors are excluded for analysis. The excluded sectors under private placement category are Construction (3 IPOs), Plantation (3 IPOs), Properties (11 IPOs) and Finance (4 IPOs). Meanwhile, for non-private placement category, the sectors that are excluded for analysis are Construction (5 IPOs), Plantation (2 IPOs) and Properties (2 IPOs). These sectors with limited number of IPOs might not result in a meaningful analysis. Consequently, in this study, only Consumer, Industrial, Technology and Trading and Services sectors are included in the analysis.

Table 1: Summary Statistics

	Ave Return Dispersion Non PP	SD of Dispersion Non PP	Number of Firms Non PP	Ave Return Dispersion PP	SD of Dispersion PP	Number of Firms PP
Consumer	0.0382	0.0188	37	0.0313	0.0116	19
Industrial	0.0649	0.0771	57	0.0469	0.0302	44
Technology	0.0459	0.0433	21	0.0500	0.0184	58
Trading &Service	0.0354	0.0219	26	0.0532	0.0469	45

Notes:
PP stands for private placement, SD stands for standard deviation and Ave is average.

Table 1 reports the sectoral descriptive statistics both for non private placement and private placement of IPOs. The statistics are 30 days average level of dispersion, its associated standard deviation and the number of firms for each category. Across different sectors for the non-private placement of IPOs, the level of dispersion ranges from 0.0354 for Trading and Services to 0.0649 for Industrial. Meanwhile, for private placement of IPOs, the range is from 0.0313 for Consumer to 0.0532 for Trading and Services. The lowest average return dispersion and associated standard deviation is Consumer sector for private placement category, and the second lowest in the case of non-private placement of IPOs. These statistics reflect the stable nature of this sector. Lai and Lau (2004) confirm these results. They report the lowest average and standard deviation of dispersion for the Consumer sector in their entire samples and by sector over a period of 10 years from January 1992 to December 2001.

Table 2: Non-Private Placement and Private Placement Daily Dispersions (Herding) during Market Stress Categorized by Sectors

10% criterion heteroscedastisity consistent P- value untransformed				**10% criterion heteroscedastisity consistent P-value transformed**		
Panel A: Non-private Placement 30 days						
	α	**β1**	**β2**	**α**	**β1**	**β2**
Consumer	0.0345	0.0340	0.0034			
P-value	0.000	0.002***	0.739			
Industrial				-27.7835	10.3369	25.0599
P-value				0.000	0.027**	0.000***
Technology	0.0470	-0.0131	0.0019			
P-value	0.000	0.635	0.946			
Trading & Services				-36.8834	10.3043	20.9433
P-value				0.000	0.181	0.010***
Panel B: Private Placement 30 days						
	α	**β1**	**β2**	**α**	**β1**	**β2**
Consumer	0.0317	-0.0041	0.0005			
P-value	0.000	0.583	0.947			
Industrial				-27.5345	5.2298	14.0103
P-value				0.000	0.349	0.017**
Technology	0.0470	0.0341	-0.0039			
P-value	0.000	0.001***	0.686			
Trading & Services				-25.3810	2.5774	17.4477
P-value				0.000	0.583	0.001***

Notes:
β1denotes dispersion in the down market
β2 denotes dispersion in the up market
*** Significant at 1 percent level
** Significant at 5 percent level
* Significant at 10 percent level

Table 2 presents regression estimates across different sectors over 30 day period. The heteroscedastisity consistent P-values reported based on 10 percent criterions during extreme

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market movement. The β_1 coefficients indicate how much the changes in return dispersion when the return of the market lies in the bottom 10 percent of the return distribution of the market, which is also known as lower market stress. Meanwhile, the β_2 coefficients indicate how much the changes in return dispersion during upper market stress. Since there is an arbitrary definition for an extreme market return (Christie & Huang, 1995), then this study adopts 10 percent criterion for the analysis. .

In non-private placement and private placement IPOs, heteroscedasticity regression results are reported for the transformed dependent variable, except for Consumer and Technology sectors. For these two sectors, coefficients' heteroscedasticity consistent P-value reported for untransformed data, as there were no heteroscedasticity problem and as a result no data transformation are conducted. For Industrial and Trading and Services sectors, the dependent variable reaches the desirable level of normality using the inverse values of the variable. Inverse transformation (1/x) makes very small numbers very large and very large numbers very small. This transformation allows reversing the order of the scores. Thus, in order for the result interpretation not to be affected after inversing, the inversed value is multiplied by -1, and then a constant (1.0) is added to bring the minimum value back above 1.0. As a result, the ordering of the values will be identical to the original data (Osborne, 2002).

Based on the results in Panel A of Table 2, during down market, not well informed investors act significantly rational in investing in the Consumer sector as indicated by positive and significant β_1 coefficient of 0.0340 (0.002). During up market, they remain rational but not significant as indicated by positive and insignificant β_2 coefficient of 0.0034 (0.739). In the industrial sector, investors are significantly rational during down and upward movement of the market as shown by positive and significant β_1 and β_2 coefficients of 10.3369 (0.027) and 25.0599 (0.000) respectively. Technology sector's not well informed investors tend to herd and follow the market based on the negative β_1 coefficient of –0.0131 (0.635) during down market movement. During up market, positive though not significant coefficient of 0.0019 (0.946), for not well informed investors assert their reluctance to follow the herd in investing in the Technology sector. Not well informed investors in the Trading and Services sector tend to be rational during down market condition as insignificant positive β_1 coefficient of 10.3043 (0.181) indicates. During up market, not well informed investors investing in the Trading and Services sector, act rationally and significantly shown by positive and significant β_2 coefficient of 20.9433 (0.010).

The result of sectoral analysis for not well informed investors indicate that they show rational behavior during down market in Consumer, Industrial and Trading and Services sectors. Their rational behavior is significant regarding the Consumer and Industrial sectors as significant positive $\beta 1$ coefficients indicates. This result is in contrast with the suggestion of Bikhchandani and Sharma (2000) where a group is more likely to herd if it is sufficiently homogeneous. During down market condition, not well informed investors only show tendency to follow the market in investing in technology sector based on insignificant negative $\beta 1$ coefficient, which confirms the finding that the possibility of occurring of herding in some sectors such as technology, as the nature of the companies listed in the Technology sector, which are small sized and risky ones, cause them to be more uncertain and lead investors to an imitating behavior. However, during upward movement of the market, this irrationality also fades away which is in line with the findings of Christie and Huang (1995) and Demirer and Kutan (2006) that herding is more expected during market downturn rather than upturn. The herding behavior reported in Technology sector is consistent with the findings by Lai and Lau (2004) who report a negative $\beta 1$ coefficient in 10 sectors during period of market downturn of the Malaysian stock market, both based on 5 percent and 10 percent criterion. They also find no evidence of herding during market upturn.

According to the results in Panel B of Table 2, Consumer sector's well informed investors, tend to herd and follow the market based on the negative but non significant β1 coefficient of 0.0041 (0.583) during down market movement. During up market, Consumer sector's investors tend to be rational, though not significant as shown by β2 coefficient of 0.0005 (0.947). Reported β1 coefficient of 5.2298 (0.349) during down market movement for well informed investors in the Industrial sector shows the rational tendency of these investors in the mentioned situation. During up market, investors who invest in Industrial sector act rationally and significantly at 5 percent level as shown by β2 coefficient of 14.0103 (0.017). During down market, well informed investors act significantly rational in investing in the Technology sector as indicated by a positive and significant β1 coefficient of 0.0341(0.001). Surprisingly, well informed investors tend to herd in the Technology sector during up market as indicated by a negative but not significant β2 coefficient of -0.0039 (0.686). Well informed investors in the Trading and Services sector tend to be rational during down market condition as an insignificant positive β1 coefficient of 2.5774 (0.583) indicates. During up market well informed investors investing in the Trading and Services sector, act rationally and significantly as shown by β2 coefficient of 17.4477 (0.001).

In summary, for private placement category, well informed investors of Industrial, Technology and Trading and Services sectors demonstrate the tendency to act rationally during down market as shown by the positive β1 coefficients. However, the investors' rational behavior is only remarkable for Technology sector as indicates by significant positive β1 coefficients. On the other hand, well informed investors of Consumer sector show a tendency to follow the market as shown by an insignificant negative β1 coefficient. During upward market movements, the well informed investors of Industrial and Trading and Services sectors behave rationally. The investors who buy IPO stock categorized by Consumer counter also behave rationally as the market condition improves during upward market and investors are less likely to herd (Christie & Huang, 1995; Demirer & Kutan, 2006). However, the rational behavior of the Technology sector investors turn to irrational during up market, as negative β2 coefficient indicates.

Conclusions

This study examines the short term herding behaviors of not well informed (non-private placement) and informed (private placement) investors in the IPO immediate aftermarket during periods of market stress, or exaggerated price movements. The findings of this study reveal that the not well informed investors exhibit a rational behavior during market downturn for Consumer, Industrial and Trading and Services sectors. However, the not well informed investors of Technology sector tend to follow the market movement during down market condition. This scenario signifies the possibility of herding in some sectors such as technology, as the nature of the companies listed in the Technology sector of Bursa Malaysia are smaller in size which makes them to be considered as risky ones by the investors.

The results of this study reveal that the well informed investors have the tendency to demonstrate herding behavior particularly for Consumer and Technology sectors during down and up market respectively. It can be implied that these investors have the tendency to follow the market because negative coefficient is not limited to the down ward market and to the risky and uncertain shares. Previous literatures also support that institutional investors often follow other institutional investors (Agudo, Sarto, & Vicente, 2008; Andreu, Ortiz, & Sarto, 2009; Grinblatt & Hwang, 1989; Nofsinger & Sias, 1999; Walter & Moritz Weber, 2006; Wermers, 1999; Wylie, 2005) and such a trend is particularly apparent in the emerging market (Lobao & Serra, 2002; Tan, Chiang, Mason, & Nelling, 2008; Voronkova & Bohl, 2005). As IPO market is volatile and risky in comparison to seasoned equity market, this situation can lead to herding behavior of the institutional investors. Furthermore, Shiller and Pound (1989) report that institutional investors place significant weight on the advice of other professionals on their buy and sell decisions in volatile stocks. There is a common phenomenon whereby an investor's behavior influences other investors' behavior. In this scenario, investors may forego their own rational analysis. They tend to adopt behavior that is similar to the group.

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THE USE OF ISLAMIC HEDGING INSTRUMENTS AS NON SPECULATIVE RISK MANAGEMENT TOOLS

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Abstract: *The objectives of this research are firstly, to examine how an Islamic hedging instrument can be used as a risk management tool, secondly, to identify the factors that influence the demand for Islamic hedging and thirdly to examine the challenges faced by an Islamic Financial Institution (IFI) in promoting the use of Islamic hedging instruments. This research is an exploratory study and involves a qualitative research methodology using case study analysis. Data was gathered using published literature and information from official websites as well as interviews with industry practitioners on Islamic hedging instruments from Bank Muamalat Malaysia Berhad (BMMB) and CIMB Islamic Berhad. The two banks are selected because they are among the major players in the Islamic hedging market in Malaysia. This study reveals that the Islamic hedging instruments offered to corporate clients by the two Islamic banks under study are Islamic Forex, cross currency and profit rate swaps and commodity hedging instruments. This study also suggests that price, documentation, bank reputation, awareness and ownership are factors that influence the demand for Islamic hedging products. Islamic Shariah compliant hedging instruments are meant to appeal more to clients who are looking for Shariah compliant hedging instruments to hedge their risk exposure and less to investors who are looking for speculative ventures to gain huge returns much like investing in hedge funds. Its use is still limited and it appears that it is more a question of marketing and branding as Islamic hedging is still unknown even though the needs for it could easily be established to many corporate clients.*

Key words: *Islamic hedging, Shariah compliant, non speculative, profit rate swaps, Islamic Forex*

Introduction

In the midst of the huge market volatility and uncertainty, the rise of Islamic Finance in the new global financial play ground offers some interesting innovations which provide alternatives to the ways of thinking and meeting the needs of a modern society. One such innovation is in the realm of hedging. The Islamic financial risk management market is still at the stage of infancy and the use of hedging instruments is found to be rather limited. This is mainly due to the incompatibility of various financial risk management tools, namely, derivatives with the fundamental principles of the Islamic law which is the *Shariah*.

Islamic hedging is used to mitigate risk which arises from a real transaction such as a sale, lease, or investment. There are two main differences between Islamic and conventional derivative instruments. First, Islamic derivative instruments are motivated by real risks and not speculative ventures with the purpose of benefiting from market performance. Second, Islamic derivative instruments are not tradable unlike options, swaps, forwards, and futures. Although *Shariah* scholars agree that Islamic hedging tools are permissible as part of risk management, the tools are to be used purely for hedging purposes. They are still essentially asset-based transactions which are supposed to be free from speculation.

The rapid developments in the Islamic finance industry, have led to an increasing number of *Shariah* compliant products which represent the progress and advances made in the Islamic finance sector. Even though Islamic derivatives are still a controversial issue, Islamic scholars have recognized the need for hedging. In Malaysia banks have developed various innovative Islamic *Shariah* compliant products (Mohamad *et al*., 2011) to meet hedging needs of business.

The objectives of this research are firstly, to examine how an Islamic hedging instrument can be used as a risk management tool, secondly, to identify the factors that influence the demand for Islamic hedging and thirdly to examine the challenges faced by an Islamic Financial Institution (IFI) in promoting the use of Islamic hedging instruments. This research is an exploratory study and involves a qualitative research methodology using case study analysis. Data was gathered using published literature and information from official websites as well as interviews with industry practitioners on Islamic hedging instruments from Bank Muamalat Malaysia Berhad (BMMB) and CIMB Islamic Berhad. The two banks are selected because they are among the major players in the Islamic hedging market in Malaysia.

Literature Review

Conventional versus Islamic hedging

Islam is not only a religion but also an absolute code of life. It gives resolution to all the problems of humanity from personal, social, political and economic life. Despite the fact that Islamic economists had written about Islamic banking and finance from the beginning of nineteenth century, it got its framework at the beginning of 1960's with small mutual saving project in Egypt (Schoon, 2009). It started to take off from 1990's and it is a trillion dollar business now growing at the rate of 15%-20% annually. But in terms of product development it is facing significant obstacles because of the lack of expert human resources with the combination of both banking and *Shariah* skills.

For a long time since travel has been made possible and especially during modern times, no countries can endure independently without international trade of export and import. International trade almost always requires exchange of foreign currency. Due to distance and nature of business, it takes more than a month before any actual exchange is required. Thus most international businesses are exposed to exchange rate risks. However, forecasting of future requirement of foreign exchange and taking prior actions to hold the favorable exchange risk, could save business from any adverse consequences. Therefore, conventional banks have FX

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hedging instrument to lessen foreign exchange risk and facilitate future exchange among traders. But Islamic banks because of *Shariah* issues, can not engage in any future trade, and the Islamic finance space seems to lack foreign exchange (FX) hedging instruments (Dusuki, 2009). In terms of hedging facilities then, Islamic Banks do not and could not offer comparable risk management tools as their counterpart. To remain competitive and sensitive to market needs, Islamic banks in Malaysia are eager to develop *Shariah* compliant hedging instruments which can fulfill the demand of the market. The differences between Conventional Hedging and Islamic Hedging can be illustrated as follows:

Table 1: Differences between Conventional Hedging and Islamic Hedging

Characteristics	Conventional Hedging	Islamic Hedging
Business framework	Function and operating modes are based on the secular principles and not based on any religious laws or guidelines.	Function and operating modes based on *Shariah* laws and comply with the *Shariah* requirements.
Principles	Riba(interest), Gharar(uncertainty) and Maysir(gambling/speculative)	*Shariah* principles
Legal	Malaysia / Common Law	*Shariah* Law
Contract/documentation	International Swap and Derivative Association (ISDA)	Wa'ad
Classification of contract	Bilateral - Bound to strict rulings and guidelines since it requires the consent of both parties to a contract.	Unilateral - Gratuitous in character which does not require the consent of recipient.

Source: Kamal Khir, (2008), retrieved from: *www.cimb.com*

Islamic Hedging in Malaysia

One of the important instruments for risk management in the operations of financial institutions is hedging (Dusuki, 2012). Hedging can be defined as a set of strategies aimed at avoiding (or planning for contingencies in) a situation in which states cannot decide upon more straightforward alternatives such as balancing, bandwagoning, or neutrality, (Goh, 2006). The concept of hedging in the conventional framework is one strategy for managing and minimizing risk in an economic activity, such as business, investment and services. The Competitive banks prefer financial hedging instruments to firm specific risk transforming arrangements to control their exposure to investment risk from asset management (Broll and Wahl, 2007).

Hedging is an important risk management tool for a large range of attracting parties including fund managers, corporate treasurers, individual businesses, portfolio managers, pension fund managers, and bank managers. Furthermore, hedging is also needed for importers to hedge accounting payable and exporters to hedge accounting receivable which are denominated in foreign currency (Ameer, 2010).

In principle, Islamic banks are different from conventional due to the prohibition of *riba* and the need to comply with the *Shariah*. As such the nature and characteristics of risks that Islamic banks are exposed to should be different from conventional banks. Islamic financial institutions have come up with various structures as Islamic versions of hedging instruments to minimize the risk of market fluctuation including foreign currency exchange rate risk and other market risk (Dusuki, 2012).

Islamic hedging instruments which follow a long-short strategy are often discussed but do not have widespread use among Muslim investors. Over many years, speeches have been made and many articles on Islamic hedging have been published but Muslim investor continues to distain Islamic hedging (Islamic Wealth Management Report, 2012).

Hedging products under the Islamic space is still limited and more needs to be done, not only in Malaysia but also around the world (Rahman, 2010). There is a perception that not many Islamic products are hedged in accordance to the *Shariah*, thus creating doubts for serious Islamic investors who are looking for truly shariah compliant instruments. Moreover, due to the low liquidity, not many people seems to be attracted to Islamic hedging, thus making the prices or the cost for participation in the instrument more expensive compared to conventional hedging instruments. Furthermore, Islamic Financial Institution (IFI) which offers Islamic hedging instruments may need to cover the risk themselves to bring in profit.

Islamic financial institutions have risen with various structures of Islamic versions of hedging instruments to lessen the risk of market fluctuation including foreign currency exchange rate risk and other market risk (Khan, 2011). According to Dusuki (2009), Islamic financial instruments are based on the principles that they exclude interest (*riba*), not possess major uncertainty (*gharar*) and not have gambling features (*maysir*). Due to the prohibition of interest, Islamic banks or traditional banks with windows for Islamic products cannot have fixed interest debt instruments. According to Al-Suwailem (2006), the Islamic financial system proposes equity participation and risk sharing on the part of banks and debtors (investors).

There are a few types of Islamic hedging: Islamic Profit Rate Swap (IPRS), Islamic Forward Rate Agreement (IFRA), Islamic Cross Currency Profit Swap (ICCPS) and Islamic Foreign Exchange (FX) Risk Hedging. Under Islamic Profit Rate Swap these study only focus on Commodity *Murabahah* structured profit rate swap while under FX risk, this research focus on Back to Back Interest-free loans and FX Forward. The following section describes these various products which are available in the market in Malaysia.

Islamic Profit Rate Swap (IPRS)

According to Mutalip (2009) Islamic Profit Rate Swap (IPRS) is defined as an agreement to exchange profit rates between a fixed rate party and a floating rate party or *vice versa*. This type of instrument is applied through the implementation of a series of primary contracts to trade certain assets and each party's payment requires computing using a different pricing formula. In IPRS, the notional principal is never exchanged as it is netted-off. Mutalip (2009) also said that the objective of IPRS is to match funding rates with return rates (from investment) and it is to assist banks and corporate companies in manage their profit rate risk.

Uberoi and Evans (2008), said that by using reciprocal *Murabahah* transactions, which accepted by *Shariah* scholars, the Profit Rate Swap can be used to achieve *Shariah* compliance. *Murabahah* known as a sale arrangement where a financier purchases goods from a supplier (at the cost price) and then sells them to a counterpart at a deferred price that is marked-up to include the financier's profit margin (Uberoi and Evans, 2008). This profit margin is deemed justified since the financier takes little to the goods, albeit possibly only briefly, and hence accepts the commercial risk of their own.

In the current market, a further contract called the *Wa'ad* contract is being utilized to ensure the swap reaches maturity. A *Wa'ad* is a binding unilateral promise and is binding one way only (Mohamad, *et al.,* 2011). Before each commodity *Murabahah* stage and reverse *Murabahah* stage in the following structure takes place, a *Wa'ad* is given by each counterpart respectively (Noor and Aripin, 2010). The *Wa'ad* ensures that the promise undertakes to enter into that relevant commodity *Murabahah* or reverse commodity *Murabahah* trade. This will continue until

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the swap expires. There is an instruments under IPRS, which is *commodity Murabahah structured profit rate swap.*

According to Hussain (2007), the most common underlying structure for a profit rate swap is linked with a *Shariah* asset-backed structure using a commodity *Murabahah* and it must be free from any elements of *riba* (usury), *gharar* (uncertainty) and *maysir* (gambling). Aziz (2007) added that each party's payment obligation can be calculated using a different pricing formula. There are two stages involved in on this commodity *Murabahah* structure which is fixed profit rate and floating profit rate.

Islamic Forward Rate Agreement (IFRA)

Islamic Forward Rate Agreement (IFRA) is an agreement between two parties to exchange one payment of profit denominated in a single currency for another payment based on a notional principal amount, at single specified period (Mutalip, 2009). IFRA actually differs from IPRS as in IFRA only one payment of profit is a trade while in IPRS, it involves a series of profit payments (Dusuki, 2009). Each party's payment obligations are computed using a different pricing formula.

Ramasamy, *et al.* (2011) said main objective of IFRA is to assist banks and corporate companies in the management of profit rate risk. IFRA can also be structured to hedge a series of amortized cash flow. In addition, IFRA can be used as a tool of risk management where it is usually used to reduce cost of raising resources by identifying the appropriate investment opportunities with a better asset-liability management (Omar, 2007).

Islamic Cross Currency Profit Swap (ICCPS)

Mutalip (2009) defined Islamic Cross Currency Profit Rate Swap (ICCPR) as an agreement to exchange profits rates between a fixed rate party and a floating rate party or v*ice versa* and this apply through the implementation of a series of fundamental contracts to trade certain assets. In addition to the transaction of assets, there is a component of spot foreign exchange contract, applying the *Shariah* concept of *Sarf* (foreign exchange) (Aziz, 2007). Each party's payment requirement is computed using a different pricing formula. In ICCPRS, the estimated key is never exchanged as it is netted-off and the role of ICCPRS is serving as a tool of risk management.

According to Aziz (2007), to hedge currency risk, ICCPRS enable counter-party to switch their asset or liability from one currency to another. In addition, Omar (2007) added that the agreement to exchange currency between two counter-parties can be either between fixed profit rate with fixed profit rate, fixed rate with floating rate or floating rate with floating rate. Implementation is by the execution of a series of underlying *Murabahah* contracts on commodities.

Foreign Exchange (FX) hedging

FX Hedging can be defined as any individual or institution having operations in currencies other than their local currency will face currency risk (Iqbal, 2010) .Currency risk is the risk that foreign currency assets or liabilities will result in a loss (or profit) as a consequence of changes in foreign exchange rates. Currency risk or exchange rate risk is a form of monetary risk that arises from the feasible change in the exchange rate of one currency against another. Investors or businesses face an exchange rate risk when they have assets or operations across national borders or if they have loans or borrowings in a foreign currency.

According to Hussain (2007), Forward FX involves essentially with the dissimilar *ribawi* which is the interest based items. This is means it has two different currencies. Forward FX entails that the rate of exchange is locked in today (the day of contract) but delivery of two counter values is being deferred to a future date where the delivery of these two counter values will be made on spot basis (Iqbal, 2010).

In addition, there are also some argument from *Shariah* scholar that requires the delivery should be made on the day of the contract, which means hand to hand and as we know that it is not the practice in the current FX market (Iqbal, 2010). However, Islamic law does not prohibit promise to buy and sell currencies on one date and delivery to be made on another date because the proper contract only concludes on the day of delivery. Hussain (2007), said that under the *Wa'ad* structure, only one party (obligor/promisor) promises to buy/sell as the case may be where bind with the promise while the other party/ promisee/oblige is not bound to proceed with the promise undertaken by the promisor. Under *Shariah* binding, promise from only one party is not deemed as a contract and therefore, this can facilitate Islamic FX contracts (Iqbal, 2010). There are two instruments under FX contract which is back to back interest free loan and FX forward.

Back to back interest free loan

A very simple approach has been execute a *Shariah*-compliant FX hedge which is the execution of two back-to-back interest-free loans of different currencies that refer to means of the loans do not carry any interest or any other benefit (Lawrence, et.al, 2010). The agreements involve in this type of instrument are separate and one cross references to the other. This is a very simplistic FX hedge, and does not conform to the conventional FX hedging, as the conventional hedging mechanism takes into account the forward FX rates, the tenor etc. Moreover, this simplistic method has been used in day-to-day dealings between local traders and in small amounts.

Foreign Exchange (FX) Forward

In conventional finance, Foreign Exchange (FX) forward has been used predominantly to manage and hedge against risk of variation in currency exchange rate risk. FX forward is basically a derivative instrument that involves an agreement by two parties to conduct a sale in the future at a price fixed today. Both payment and delivery will only happen at future agreed dates while the contract is preserved today (Dusuki, 2009).

From the *Shariah* viewpoint, the dilemma with the conventional FX forward structure occur when the parties involved want to exchange the currency for a time in the future but have already fixed a rate today while the contract is also preserved today (Hussain, 2007). This has breached the basic *Shariah* rules on currency trading (*bay' al-sarf*) which requires for *bay' al-sarf* involving an exchange of two different currencies that it be transacted on a spot basis (Dusuki, 2009).

Methodology, Methods and Data Collection

This study is an exploratory study and involves a qualitative research methodology. The data collection methods were gathered from primary and secondary data. For primary data, the data

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gathered from a face-to-face interview session with the issuer which is Bank Muamalat Malaysia Berhad and CIMB Islamic Bank while for secondary data, data were gathered from internet, books, journals and *etc*. Expert opinion is obtained from two banks practitioners of Bank Muamalat Malaysia Berhad and CIMB Islamic Bank which are used as case studies of Islamic Finance Institution that provide Islamic hedging instruments. The actual data collection of the interviews is from July 2012 to December 2012. The objective of the interview is to gather information on the various aspects of the Islamic hedging practices in Malaysia.

In this research the process of qualitative content analysis begins at the early stages of data collection. This early involvement in the analysis phase will help to direct our data collection toward sources that are more useful by addressing the research questions. To support valid and reliable inferences, qualitative content analysis involves a set of systematic and transparent procedures for processing data. Some of the steps overlap with the traditional quantitative content analysis procedures while others are unique to this method. Depending on the goals of our study, content analysis may be more flexible or more standardized and it can be divided into the following steps, beginning with preparing the data and proceeding through writing up the findings in a report.

A code in qualitative inquiry is most often a word or short phrase that symbolizes assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data (Saldana, 2009). The data may involve the interview transcripts, journals, written documents, artifacts, participant observations, video and so on. The code is to arrange the data in systematic order, to make something to be part of the system, classifying or categorize the data (Saldana, 2009). Analysis of qualitative data can be facilitated by organizing the data in tables that can be sorted by respondent, question, and other characteristics (In Sites, 2007). Hence, the researcher organize and code the data into tables.

In this study, both primary and secondary data is used. Primary data was collected using an interview method. Interviews were made with expert practitioners of Bank Muamalat Malaysia Berhad and CIMB Islamic Berhad. Data was also gathered from official documents, various reports and official websites.

Findings

This section reports the findings from a qualitative analysis where the data collected is based on interviews with the practitioners from the two selected Islamic banks that are Bank Muamalat Malaysia Berhad and CIMB Islamic Berhad.

As Islamic finance grows, the need for hedging mechanisms become important since Islamic investors are also exposed to similar kind of global risks including foreign currency risks. Islamic financial institutions have come out with various structures as Islamic versions of hedging instruments to minimize the risk of market fluctuation including foreign currency exchange rate risk and other market risk. The prominent Islamic hedging instrument which are currently being structured and widely used in treasury include Islamic FX Forward, Islamic FX Swap, Islamic Cross Currency Swap, Islamic Profit Rate Swap and Islamic Option.

Research Objective 1 : To examine how Islamic hedging can be used as a risk management tool

Table 2 below report the responses to questions concerning the use of Islamic hedging instruments at the two banks. Further a discussion of what and how specific hedging instruments are being used at the particular banks is reported.

Table 2: Responses to questions on the use of Islamic instruments for risk management

Questions	Bank Muamalat Malaysia Berhad	CIMB Islamic Berhad
1. How can companies manage their risk using Islamic hedging in terms of currency exchange and price?	Company have manage their risk through Cash flow where they calculate the BEP for foreign exchange (forex). Timing of the payment-Forecasting the time when the clients have to pay. Depends on the company's discussion and management.	Company can manage their risk based on four options: Do nothing FX Forward Option SWAP Profit Rate
2. In Islamic banking, do we have enough hedging mechanism to protect the bank exposure against risk?	Bank Muamalat has enough hedging mechanism. In Islamic hedging the bank have to hedge crude palm oil and using Islamic Cross Currency Swap (ICCS) and Islamic Profit Rate Swap (IPRS) to hedge the currency locally or internationally.	CIMB is a market leader in Islamic banking product. The bank already has Islamic Cross Currency Rate Swap (CCRS), Islamic Profit Rate Swap (IPRS), Islamic Foreign Exchange and Islamic Commodity Hedging.
3. What type of documentation involve in Islamic hedging?	Unilateral contract	Legal documentation such as: IDMA & ISDA Wa'ad Agreement Tahawwut Master Agreement Board Resolution

Bank Muamalat Malaysia Berhad

Bank Muamalat Malaysia Berhad has identified two areas that clients normally involve in hedging which are Crude Palm Oil (CPO) and currency. Therefore, Bank Muamalat has come out with two types of Islamic hedging instruments that can be used as a tool of risk management. These two types of instruments are Islamic Cross Currency Swap (ICCS) and Islamic Profit Rate Swap (IPRS). The bank found that with these two types of Islamic hedging instruments, it can fit enough for their clients' needs to reduce the risks. Bank Muamalat Malaysia Berhad offers this two types of instruments to their clients in order to reduce the risk of currency exchange rates locally as well as internationally. The Islamic Cross Currency Swap (ICCS) and Islamic Profit Rate Swap (IPRS) can be explained below.

Islamic Cross Currency Swap (ICCS)

Islamic Cross Currency Swap is usually done by investors who wish to make a long-term investment in a foreign currency instrument but do not want to be exposed to foreign currency risk. Most of the clients of the Bank Muamalat Malaysia Berhad choose this Islamic hedging instrument as a tool of risk management because of their main business activities that involve two different currencies and this exposes the company to high risk of foreign exchange currency

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fluctuations. For instance the company that involves in exchange of currency rate industries such as import and export companies, investment companies, trading companies etc.

Similar to the FX Swap product, the cross-currency swap product is also meant to protect investors from currency-fluctuation risk. For instance, an investor has USD100 million. The currency rate at the initiation is USD/€ = 1.50. If on the first day, the investor changes the USD into €, he will obtain €66.67 million. If after 3 years, the USD/€ rate is 1.40, the investor will suffer losses, but if the USD/€ rate is 1.60, the investor will gain profit. To ensure there is no loss or profit, he will enter into a crosscurrency swap so that he will get back the same principal value as at the initial investment. The funds are also exchanged before the maturity period. Therefore, the investor is not exposed to the currency-fluctuation risk (Dusuki and Mokhtar, 2010)

Islamic Profit Rate Swap (IPRS)

Another product of Islamic hedging that available and being used by the bank's clients is Islamic Profit Rate Swap (IPRS). IPRS is basically an agreement to exchange profit rates between a fixed rate party and a floating rate party or *vice versa* implemented through the execution of a series of underlying contracts to trade certain assets under the *Shariah* contracts. The agreement that has been used for this instrument is unilateral which is gratuitous in character which does not require the consent of recipient. This types of instruments normally are involved with one or same currency during the transaction. For example Ringgit Malaysia (MYR) with Ringgit Malaysia (MYR).

CIMB Islamic Berhad

Most of the clients at CIMB Islamic Berhad (CIMB), who purchase hedging instruments are from financial and non-financial institutions that are involved in foreign exchange currency and commodity business. The bank identified several options that their clients normally manage their risks through hedging which are foreign exchange forward (hedge for future but pay now using at par, premium or discount), option (call and put) and swap profit rate. Islamic law outlined strict principles to ensure the legality of the contract of currency exchange and to free the contract from elements of *riba, gharar and maysir*. Hence, a concept of unilateral promise (*Wa'ad*) was introduced to facilitate the exchange of currencies. As a result, the bank offers several types of Islamic hedging instruments, however most preferable Islamic hedging instruments by the clients are the Cross-Currency Profit Rate Swap (CCPRS-i), Islamic Profit Rate Swap (IPRS), Islamic Foreign Exchange and Commodity Hedging (CH-i). This can be explained further below.

Cross Currency Profit Rate Swap (CCPRS-i)

As mentioned earlier Islamic Cross Currency Profit Rate Swap (CCPRS-i), it consists of two distinct financial transactions which are foreign exchange of profit rates and foreign exchange of notional principal. This is means that it allows a client to effectively swap a liability or asset in one currency into another currency. For example, the transaction of buying US dollar (USD) of *sukuk*. The investor aims to pick up the credit spread without being exposed to foreign exchange risk. Most of the company manage their risk through this kind of instruments because most of their main business activity are dealing with the exchange currency rates hence, they use to hedge as a tool to manage their risks.

According to the staff, Islamic law has outlines strict principles to ensure the legality of the contract of currency exchange and to free the contract from *ribawi* elements. This has goes back into realization of the *Maqasid Shariah* which tend to educate the individuals, provide justice and fairness and promote *maslahah* (public interest). As a result, a concept of unilateral promise (*Wa'ad*) was introduced to facilitate the forward exchange of currencies. Under *Wa'ad* the transaction flows as follows:

- Buyer or a seller (promisor) of currency will make an offer to buy or sell respectively on the required currency
- Based on the agreeable pricing, the bank will make an acceptance on the offer and enter into a unilateral contract with clients. Only one party is bound by the contracts i.e., the promisor
- On the delivery date, the promisor will buy or sell the respective currency at the pre-agreed price as if the transaction was entered on the same value date.

Islamic Profit Rate Swap (IPRS)

The transaction of CIMB Islamic Berhad's Islamic Profit Rate Swap (IPRS) is similar with the IPRS of Bank Muamalat Malaysia Berhad as mentioned earlier. IPRS means an exchange of floating profit rate payment for a fixed profit rate payment in the same currency or single currency. This types of instrument uses *Shariah* concepts such Commodity *Murabahah* and Commodity M*usawamah*.

Islamic Foreign Exchange

In 2008, CIMB Islamic had launched the Islamic Foreign Exchange with *Shariah* compliant Option Features (FXOP-i), a pioneer Islamic instrument that allows clients to hedge their foreign exchange risk. FXOP-i enables clients to lock in a foreign exchange rates in advance by engaging in a *Shariah* compliant financial transaction with CIMB Islamic. For Islamic FX Swap, there are two structures in the market that are based on *Tawarruq* contract and *Wa'ad* contract. According to the Shafie school of thought, *Tawarruq* means selling something on deferred payment, and then buy it back in cash, at a lower price than the deferred price, (Khayat, 2009). Meanwhile, *Wa'ad* means promise which connotes an expression of willingness of a person or a group of persons on a particular subject matter. In a commercial transaction, a promise has a dual meaning. This is because, in a unilateral contract, the offer of the offeror is known as promise, while in a bilateral contract, the acceptance of the offeree is known as promise as well. The following illustrates how *Wa'ad* can be used as a tool of risk management:

The Islamic FX swap based on *Wa'ad* structure involves exchange of currencies based on principle of *bay' al-sarf* at the beginning. After that, it involves *Wa'ad* to carry out another b*ay' al-sarf* at the future date based on the rate determined today. At the expiry date, the second *bay' al-sarf* will be implemented to get back the original currency. Meaning that, at the beginning of FX swap, the investor can sell this USD to the bank on spot basis to obtain RM. This complies to *bay' al-sarf* principles which requires transaction to be done on spot. Thereafter the investor will enter into *Wa'ad* to enter into a contract of currency exchange based on the principle of bay' al-sarf at a future time. The future exchange of currencies will be based on an exchange rate that is

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referred to today's rate. So at the future time, the investor will get back the USD without being exposed to the risks of currency fluctuation.

Commodity Hedging (CH-i)

Commodity Hedging-i occurred when a company offsets risks arising out of fluctuations in raw-material prices. For example, if a producer of Crude Palm Oil (CPO) expects the CPO price to rise in the next three months, he will buy a position in the futures market at current prices to offset the likely price increase. Similarly, if the prices are likely to fall, he will sell in the futures market at current prices against the physical goods he holds.

Research Objective 2: To identify factors that influence the demand for Islamic hedging

From the interview with both staffs from Bank Muamalat and CIMB Islamic, Table 3 shows the answer for the reason why company choose conventional instead of Islamic hedging in Malaysia.

Table 3: Factors that influence the demand for Islamic hedging

Questions	**Bank Muamalat Malaysia Berhad**	**CIMB Islamic Bank**
1.Reason why company choose conventional instead of Islamic hedging	The reason why company choose conventional because: Banks reputation Cost/ price Management decision Size and volume	The reason why company choose conventional because: Ownership Price/Cost Documentation Awareness
2. The proportion of Islamic from the total hedging	There are almost 10% to 15% of Islamic hedging out of total hedging in Malaysia.	The demands are still low but the awareness is currently increasing.

According to the staff from from Bank Muamalat, the proportion of Islamic hedging from the total hedge fund in Malaysia is only 10% to 15%. This indicates that Islamic hedging in Malaysia is still lower than conventional which may in a way affect to the low demand of Islamic hedging instruments. In the interview, the staff was asked on factors why clients prefer to use conventional hedging rather than Islamic hedging which researchers believe may result to the low demand of Islamic hedging. Through this interview, the staff have pointed out **four** key areas:

Awareness of Islamic hedging products

This is probably the most important factor that explain why the demand and use of Islamic hedging is still low. There is only about 2% of Islamic hedging usage out of the total hedging (Eurekahedge, 2012). Clients do not use Islamic hedging products because they are not aware about the existence of the products. This lack of awareness is probably due to low marketing on Islamic hedging by the Islamic financial institutions that provide Islamic hedging products. They are the one who need to look for their potential clients and educate their clients about the importance of using Islamic hedging so that clients will be more aware about the benefits of using Islamic hedging products.

When clients are not aware about the availability of Islamic hedging, they tend to not enquire about such products. Product ignorance especially on how Islamic instruments can function to replace conventional products is also coupled with the lack of confidence for Islamic hedging products as tools of risk management because they think that Islamic hedging is still new in the market.

Management decision

Decisions of top management influences the demand for Islamic hedging instruments. Management decisions can be influenced on many factors such as product awareness of decision makers within the company and the level of confidence that potential clients have regarding the Islamic bank which offers the product as well as the product itself. Management needs to decide whether or not the company needs to engage in hedging and if yes, whether thy would go fro conventional or Islamic. If they think that hedge is the best tools to reduce their risk, then they will look for hedging products. Hedging is very expensive therefore management need to consider carefully what is the best decision they should make in order to reduce their cost subsequently to avoid company from losses. It is important that top management as well as Boards of Directors are convinced regarding the need to hedge and that they could appreciate and understand the differences and net benefits of Islamic instruments before making the decision from not hedging to Islamic hedging or from conventional hedging to Islamic hedging.

Bank and product reputation

Bank reputation is one of the factors that affect client decisions to choose an Islamic hedging product. Bank reputation is important because bank with good reputation will reflect a good profile of the company. Bank reputation can be measured through their financial performance such as liquidity ratio, current ratio, leverage and market ratio. If they have good ratio, company will have more confidence to use their Islamic hedging product. This supported by Tyler and Stanley (1999) found that bank size, reputation and reliability were the crucial factors to gain clients' confidence.

Bank reputation is associated with the level of confidence towards the bank and the performance of the bank. Clients will feel more secure if the banks have good reputation. Demand for Islamic hedging instruments is still low as conventional banks are thought to have better performance and are better at managing risks than Islamic banks because conventional banks are more established and have longer market experience. Even for banks which offer both types of financial services, conventional and Islamic such as CIMB, the fact the Islamic space is relatively a new phenomena particularly in the area of hedging, Islamic finance bank personnel often find it difficult to convince clients to switch to Islamic hedging.

Pricing

Hedging is used as a security for companies to reduce risk but hedging adds cost to any company, unless the risks of hedging is high, small companies would probably just take the risks of not hedging. Product preference depends highly on pricing This is supported by Ahmad and Haron, (2002) which in the case of corporate clients for example, they believe that cost and benefit element is the most important factor when selecting financial institution.. Based on the Ahmad and Haron, (2002), they have stated that the most important factors perceived by corporate clients in selecting their banks is the cost of the products.

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However for those companies where hedging activities are established, to switch to Islamic instruments require a motivation. Cost and pricing is certainly a factor that can influence the switch. Conventional hedging instruments can in fact be used to obtain high returns and therefore the demands are not just based on hedging needs. To preserve shariah compliance, Islamic hedging instruments should solely be used for hedging. As such the requirement that it not only could function as risk management tools but it is also price competitive is crucial. However it is possible that the requirement for some companies to be truly shariah compliant or that it might have an Islamic mandate, pricing may prove to be less of an issue, as clients are choosing within the Islamic space and not from the entire universe comprising both conventional and Islamic products. This later category of clients may be ready to accept higher price due to higher costs associated with new innovative products from the Islamic space. Part of the higher costs include the added cost of meeting the regulators' requirements for the process of shariah compliance and the human capital costs including that of shariah scholars in product structuring, advising and screening.

Bank size

Some companies may require huge amount of exposure to be hedged and thus are only interested with banks that are large in size and with a big capacity to hedge at any one time. Smaller new Islamic banks are often at a disadvantage because more established bigger conventional banks which also include branches of foreign banks can outcompete them in this aspect. Thus Islamic banks while they might have suitable products for hedging purposes may have to turn away big clients because of the limited ability to hedge large amounts of exposure..

Documentation

One of the important factors that can explain the low demand of Islamic hedging is related to the documentation. Client prefers conventional rather than Islamic hedging because they think that the Islamic hedging is hard to understand. Other than that, as the contracts are Islamic contracts, the terms used in the contract are usually in Arabic. Clients especially those who are non Muslim might not understand those terms and this could make it difficult for them to understand the contracts.

Shariah compliance requires documentations and procedures which some people might find it cumbersome. In Islamic hedging, the company needs to sign a few contracts before and after the transaction. In addition, they also need to read and understand the whole document that is more rigid than conventional hedging documentation and for some client, they may not understand the Islamic terms used in the contracts.As the industry is relatively new and shariah resolutions vary across jurisdictions, it is important that global harmonization especially with regard to documentations is established as many of businesses involved in hedging activities are those with cross border transactions. The documentation needs to be harmonized with global standards so that it can be accepted in all jurisdictions. By having harmonization in type of documentation use, this may benefit both the issuers and the clients.

Ownership of the client company

Preferences to switch to Islamic hedging might also depends on the ownership of the client company. If the owner of the company is non Muslim, there is a tendency to not choose Islamic because of the apparent familiarity with conventional and lower level of consciousness and need to be shariah compliant. Clients will also look out for products that can give more profit to them. As for clients, that is non Muslim, they are not attach with *Shariah* compliant regulation so it is not a problem for them if they want to use conventional hedging if they think that they can gain profit from that. This is not to rule out on the possibility that companies with non muslim owners choosing Islamic hedging instruments. The image and reputations of Islamic products in Malaysia are basically good and this is illustrated in the high patronage of non muslims being clients to Islamic banks, in fact many of the banks claim to have a higher percentage of their clients being non muslims. The onus then lies Islamic banks to pursue a more aggressive marketing and product awareness campaigns.

Objective 3: Examining the challenges in Islamic Hedging

Limited hedging purposes, whereas conventional derivatives can be used for speculation

Apparently, the most important aspect which differentiates hedging instruments in the Islamic financial system compared to the conventional system is the need for these instruments and operations to comply with all the principles of the *Shariah* (Dusuki, 2012). Even though the implications and economic effects of these products introduced in the Islamic financial system appear to be very similar to those of conventional products, what is more important is that the substance of the structure must be in line with the principles and objectives of the *Shariah*. This is to avoid any kind of divergence or abusive use of this instrument for a purpose that is not allowed in *Shariah*, such as for speculation.

According to the staff from Bank Muamalat, they already have enough hedging mechanism to be used by companies in Malaysia, which are Islamic Profit rate Swap (IPRS) to hedge palm oil and Islamic Cross Currency Swap (ICCS) to hedge the currency locally or internationally. However, in order to stay competitive in the market they need to produce or develop more Islamic hedging instruments for the future. Nonetheless the staff did suggest that Bank Muamalat should move in depth into the market in order to be the price maker, thus giving them an advantage to quote better price than conventional hedging.

Speculation in the derivatives market is done in view of profit and not to assist trading or a real business activity, the real delivery of the underlying asset rarely occurs. This kind of speculation can be highly destabilizing and the danger of excessive speculation has been well documented for example in relation to currency and financial crises and recently in the oil price hike (Mohamad and Tabatabaei, 2008). The grounds of this danger is caused by the fact that speculative activities may no longer be attached to real economic activities and may distort the demand and supply conditions of the real economy.

The growth of Islamic hedging is picking up as a non speculative risk management tool. Even though its demand is limited compared to the speculative conventional instruments where many of the products do not really serve the purpose of hedging but rather as tools to gain huge returns, Islamic hedging can be positions as “real” products that support the growth of the real economy. Banks such as CIMB is among the market leader in Islamic banking products in Malaysia, as well as the ASEAN region, it is gaining strength and reputation including in the hedging products. The role of Islamic banks such as CIMB in making product innovations will move the global Islamic hedging industry forward. Some Islamic banks may not choose to be so

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involved with the deepening of hedging products as its use is still controversial. Some may be involved only in so far as it is needed by their regular clients and do not see this as contributing substantially to their business profits and hence are less willing to spend time and effort for product improvements and awareness.

Conventional hedging is more established, whereas Islamic hedging is more recent.

Conventional derivatives instruments have potential abuse for speculation and the violation of the Islamic tenets of distributive justice and equal risk sharing. These instruments seem to satisfy the needs of financial institutions and investors who are already familiar with the established conventional derivative products, which form an intrinsic and lucrative component of their day-to-day transactions (Dusuki, 2012). However, the challenge for Islamic finance is to ensure strict compliance with the principles of the *Shariah* and the purpose for which these products were structured.

It was mentioned that one of the reason why company choose conventional rather than Islamic is because conventional hedging market exist longer than Islamic hedging. Even though Islamic hedging is recent in Malaysia, the proportion of Islamic hedging is very promising, which is almost 10% to 15% out of total hedging in Malaysia. It is also mentioned that although the existence of Islamic hedging instruments in Malaysia is still recent and the demand are still low but the awareness of the product is increasing. This is because if they want to hedge usually it will depend on economic environment. Islamic financial sector is evolving, and its development and future will depend on its ability to integrate into the global economy. Although it must distinguish itself from conventional, interest-based activities, it must also be able to provide viable, alternative solutions (Dusuki, 2009). Thus, it must meet the demands of Islamic clients and also be acceptable to conventional institutions and regulators because they will play an important role in the growth of the sector.

Conclusion

As Islamic finance is taking centre stage in the financial landscape in Malaysia and its rise in the global markets demands a more complete range of financial instruments to complete cross border business activities, many companies are looking for Islamic hedging products in order to provide for shariah compliant risk management tools.

This study reveals the types of Islamic hedging products and how they are used for hedging purposes in two of the leading Islamic banks in Malaysia Bank Muamalat Malaysia Berhad BMBB and CIMB Islamic Bank's. The main products used as risk management tools to reduce risk exposures are Islamic Foreign Exchange, Cross Currency Swap and Commodity Hedging instruments. More specific products which are variants from these main types have been discussed in this paper.

The paper has also identified based on interviews with relevant practitioners from the two selected banks the factors that that influence the demand for hedging. These are product awareness, management decision, documentation, ownership, size and bank and product reputation. According to BMMB and CIMB product awareness, and pricing appears to be the most important factors because clients will choose a product with lower cost and price. Documentation in Islamic hedging is also an important issue to resolve so that harmonization and clarity is established not only in Malaysia but across the global Islamic finance industry as the major players in the hedging activities are those involved with cross border transactions who are often faced with various international laws and different shariah jurisdictions. Hence, financial institutions need to come out with more convenient documentation that is easily understood by the client.

The usage of Islamic hedging is still limited because there is lack of awareness regarding Islamic hedging. Clients need to be introduced about the existence of Islamic hedging instruments because many people are still not aware about it. This is where financial institutions especially Islamic banks need to come out with a new strategy on how to attract more corporate clients to use Islamic hedging product.

The success of Islamic hedging instruments will also depend on the *Shariah* scholars. Although the concept may not be straightforward, *Shariah* scholars will need to provide guidance in a way to meet both Islamic and business requirements. If the Islamic finance sector can seriously challenge the conventional sector and proved that it can be a practical alternative, this can help lift up Islamic finance to the next level. Thus Islamic banks have to understand the needs, preferences and behavior of their targeted group of clients in order to stay competitive. Therefore, an effective marketing strategy should be properly addressed in order to tailor to client requirement so that it establish a strong competitive position and gain competitive advantage.

For further study on the same topic in future, researchers can perform a more quantitative study to validate the factors identified in this paper. This study represents an early study on hedging in a leading global Islamic finance market of Malaysia where Islamic banks have started to offer Islamic hedging instruments despite it being still a controversial issue globally. However recent international initiatives such as moves toward shariah harmonization and global standards for example in the establishment of an international master agreements ie the *tahawwut* master agreement are some of the steps that could bring the Islamic hedging activity to the next level.

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FORECASTING VALUE AT RISK: A STRATEGY TO MINIMIZE DAILY CAPITAL COSTS

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***Abstract**. Reporting daily risk estimates by banks to the monetary authorities is re-affirmed in the Basel III Accord. The risk estimates can be computed from an approved internal Value-at-Risk (VaR) model, among others.*

It is well-noted that reporting either too high or too low risk estimates can lead to high capital costs. For profit-seeking banks, there is an unambiguous incentive to hold a minimum capital reserve in order to minimize capital costs. This is a typical financial trade-off problem.

In this paper, we suggest a modification to a previously proposed decision rule to tackle the problem in a more realistic way. The results show less capital costs for banks under the condition of restricting the number of violations.

Key words: *risk estimates, value-at-risk, capital reserves, capital charges, market risk, internal models, GARCH, RiskMetrics*

Introduction

The capital adequacy principle forms the foundation of bank risk regulations. It is pre-emptive in the sense of preventing future bank failures. The Basel Committee on Banking Supervision (BCBS) issued the Basel Capital Accord in 1988, known as Basel I, which required banks to hold minimum capital in reserve for protection against credit risk (Basel Committee on Banking Supervision, 1988). The 1995 amendment to the Accord, called the internal models amendment, required banks to hold capital for market risk as well (Basel Committee on Banking Supervision, 1995). The amendment distinguished a bank's banking book from its trading book. The banking book is composed of loans that are not called for revaluation regularly. The required capital for the credit risk embedded in banking book has been set up as a fixed percentage of assets weighted according to their nature. The so-called Cooke ratio stipulates that the capital charge should be at least 8% of weighted assets.

The trading book, on the other hand, is composed of portfolios of trading instruments that need to be revalued daily. To compute risk measures of their trading books, banks are allowed to use proprietary internal VaR models, pending approval from regulators, as alternatives to the standardized approach which was found to have certain drawbacks. In 1996, another amendment further required that banks must go through back-testing procedures in conjunction with the internal models, for checking that the internal VaR models are in agreement with the historical deviations of values (Basel Committee on Banking Supervision, 1996).

The New Basel Accord (Basel II), which was enforced in 2007, required banks to communicate their daily risk estimates to the regulators at the beginning of the trading day (Basel Committee on Banking Supervision, 2005). Reporting daily risk estimates to the monetary authorities is re-affirmed in the 2010 Basel III Accord (Basel Committee on Banking Supervision, 2011). The fundamental idea of Basel III is to enhance the banks' capital basis, rather than improving the methods and processes of their internal risk management. The risk estimates are to be computed from the approved internal Value-at-Risk (VaR) model, selected by the bank from various available models.

It is well-documented that reporting either too high or too low risk estimates can lead to high capital costs. Reporting risk estimates too high implies high capital costs since the risk estimates are used to calculate the capital that banks are required to hold in reserve for protection against possible losses of their trading portfolios. Capital reserves incur opportunity costs to banks, as the capital can be put to better uses. On the other hand, reporting risk estimates too low may result in violations with penalty of more capital reserves, also incurs capital costs. For profit-seeking banks, there is an unambiguous incentive to hold a minimum capital reserve in order to minimize the total costs associated with the market risk reporting. This is a typical financial trade-off problem.

In this paper, we suggest a modification to a previously proposed decision rule to tackle the problem in a more realistic way. In the next section, a brief description of VaR is presented. The third section describes the capital requirements for banks. The fourth section is our proposal of a refined decision rule for banks to minimize capital charges. The fifth section gives the VaR forecasting models we use to test the decision rule and the sixth section presents the testing results. A final summary then follows.

Value-at- risk (VaR)

The VaR is a measure of the maximum expected loss over a period, given a statistical confidence limit. In other words, it is the upper bound potential loss not exceeded with pre determined low probability, called a confidence level (see, for example, Bessis (2010) for details):

$$VaR_t = E(r_t \mid F_{t-1}) - z_t \sigma_t \qquad (1)$$

where, $E(r_t \mid F_{t-1})$ is the expected return on the bank's trading portfolio at time t, F_{t-1} is the information set at time t – 1, z_t is the critical value from the distribution of r_t at time t to obtain the appropriate confidence level, and σ_t is the standard deviation of the portfolio at time t. It measures potential adverse move of the trading portfolio value.

There are various categories of models used to estimate the conditional variances in Eq. (1). Under the category of the Variance-Covariance (VC) VaR Approach, there are Autoregressive Conditional Heteroskedasticity (ARCH) model, the Exponentially Weighted Moving Average (EWMA) model, the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model, and the Glosten Jagannathan Runkle (GJR) model, among others. These models rely on

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parametric distributions, such as normal or student-t distribution, for information on volatility and correlation in order to construct a variance-covariance matrix. The approach is popular because it is simple to implement.

Other categories include the Historical VaR Approach and the Simulation VaR Approach. The Historical VaR Approach provides an empirical distribution which is non-parametric. Using the historical method, banks simply keep a historical record of profits and losses within the portfolio and calculate the fifth percentile for a 95 percent VaR, or the first percentile for a 99 percent VaR. This approach is also a common practice because it is easy to understand and is viewed as fairly realistic. The disadvantage of the historical method is that it is complicated and time consuming, if the portfolio composition changes over time.

The Simulation VaR Approach usually conducts Monte Carlo simulation. It requires a program to generate all risk factor processes, and all instrument revaluations for the simulation period. This method may be particularly suitable for a trading portfolio that contains complex derivative transactions.

The required minimum capital

The market risk forecasted from the internal model of a bank is calculated as VaR which in turn becomes the basis for determining the required capital charges. The charge is set at the higher of the previous day's VaR or the average VaR over the last 60 days, multiplied by a factor (3+k). The variable k is determined according to the number of violations over the previous 250 business days where a violation is defined as the actual loss exceeds the forecasted VaR on a business day. If a bank's internal model generates violations less than 4 times, the bank is said to fall in the green zone. Its model is considered accurate and k is zero. If the number of violations is between 5 and 9 times, the bank is said to fall in the yellow zone, and k varies progressively with the number of violations, as the following table shows.

Table 1:

Number of violation	k
5	0,4
6	0,5
7	0,65
8	0,75
9	0,85

Finally, if the number of violations exceeds 10 times, the bank is said to fall in the red zone and its model is deemed unacceptable. In this case, the bank must adopt the standardized approach for assessing capital charges. The standardized approach relies on standard percentage of values for assessing potential losses. Capital charge is 8% of net balances for bonds, equities, foreign exchanges and commodities. This approach is conservative as diversification effects are not fully captured. As a result, it usually leads to more capital charges than the alternative internal risk models, or VaR models.

A decision rule to minimize capital charges

McAleer, Jimenez-Martin and Perez-Amaral (2009) suggest a decision rule, called Dynamic Learning Strategy (DYLES), that responds to violations in an instantaneous way, to minimize capital charges. Applying the strategy to Standard & Poor's 500 Index data, they show there can be substantial savings in daily capital charges, while restricting the number of violations to within the Basel II penalty limits. The DYLES is a flexible learning strategy in the spirit of Benjaarfar et al. (1995). It can be described as follows. A bank would report the market risk disclosure (MRD):

$$\mathrm{MRD_t} = \mathrm{P}_t \times VaR_t$$

where, by using the 250-day testing period, the dynamic learning function P_t is obtained by:

$$\mathrm{P}_t = \mathrm{P}_0 + \theta^P \times nov_{t-1} - \theta^R \sum_{s=1}^{t} I_{25,s} \qquad (2)$$

where θ^P is the penalty parameter for each violation, nov_{t-1} the number of violations up to day t-1 in the 250-day testing period, and θ^R is the reward parameter for a 25-day period without any violation.

$\mathrm{I}_{25,t}$ is an indicator function; it is one when no violation occurs between day t and day t-25, and zero otherwise. Note that the 250-day testing period has been divided into 10 fixed periods of 25 days. If no violations occur during the period, the reward is defined as decreasing the penalty by θ^R.

Both θ^P and θ^R are obtained from a calibration procedure, as described in McAleer, Jimenez-Martin and Perez-Amaral. However, it can be seen that the reward-penalty structure in the decision rule DYLES is not related to the market costs of capital. This may be a significant deficiency as the daily risk reporting rule is meant to capture the immediate market risk exposure of an individual asset or a portfolio.

Allen, Chan, Milne and Thomas (2012) have suggested that the Basel III reforms to banking regulation might force banks into a massive balance sheet contraction. There is a real danger that reforms will limit the availability of credit. The problem is not higher capital and liquidity requirement since these have limited impact on the fundamental cost of banking. Rather, the challenges are from structural adjustment that threatens to deplete credit in the economy. Already, some banks have expressed the concern that they might have difficulty to raise the long-term debt and equity funding implied by the reforms. This viewpoint highlights the need to take into account the current costs of capital for market risk management.

In this research, we incorporate the current market cost of capital into the DYLES rule in order to better reflect the problem faced by banks. Namely, we propose a modified version of the DYLES rule, called MOD-DYLES strategy:

$$\mathrm{P}_t = \mathrm{P}_0 + (\theta^P \times nov_{t-1} - \theta^R \sum_{s=1}^{t} I_{25,s}) \times (1 + OIR_t) \qquad (3)$$

Where OIR_t denotes an overnight investment return on day t.

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McAleer et al. (2009) use the closing daily S&P 500 Index data from January 3, 2000 to December 31, 2007 for the calibration of DYLES parameters. Because S&P 500 Index data are also used in this study, we apply the same parameters as calibrated by McAleer et al. for comparison purpose. Namely, we assume the penalty parameter for each violation θ^P is 0.12, and the reward parameter θ^R is 0.3.

Calculating cost of capital

Two kinds of costs of capital are involved in the risk management procedure. The first is the penalty incurred by violation, which is calculated by:

$$\sum_{t=1}^{250}(MRD_t - |r_t|) \times (3+k) \times R_t \times N \tag{4}$$

where, r_t is the portfolio rate of return on day t.

R_t denotes a penalty interest rate.

N is a nominal investment amount, such as $1,000,000.

Eq. (4) means that when real loss amount $N \times r_t$ is larger than the market risk disclosure (MRD) amount $N \times MRD_t$, the difference is charged by $(3 + k) \times R_t$ for penalty.

The second is the opportunity cost. It stems from funding the required capital. We assume banks give up overnight interbank interest incomes. Eq. (3) shows that, in addition to the penalty interest rate R_t, we incorporate the opportunity cost of capital requirement, OIR_t, which can be considered as the interbank offer rate.

Note that in the MOD-DYLES decision rule, the reward-penalty structure is designed on daily basis.

Da Veiga, Chan and McAleer (2011), using the S&P 500 Index data from January 14, 1964 to November 11, 2009 and several VaR thresholds forecasting methods, show that within the current constraints and the penalty structure of the Basel Accord, the lowest capital charges arise when using VaR models that under-report risk and lead to excessive violations. As a result, they conclude that current penalty structure is not severe enough to encourage banks to conduct adequate risk management. The proposed new MOD-DYLES decision rule may be an effective way to circumvent this awkward situation.

The VaR methods used

In this research, for the purpose of simple comparisons, we use two Variance-Covariance (VC) VaR computation methods to compare the decision rules. The first is the VC-constant method that uses the past 250 observations to produce a "constant" variance estimate :

$$\sigma_t^2 = \sum_{s=t-249}^{t}(r_s - E(r_t \mid F_{t-1})^2 / 250 \tag{5}$$

The VC-constant method assumes that variances exhibit autocorrelation. If the previous period was one of high volatility, the next period is likely to be a high volatility day. It is an easy way to capture this phenomenon by letting next the period's variance be the simple average of the most recent *t* observations, as shown in Eq. (5).

However, in the real world, recent returns may contain more information for the next period's variance estimates than distant returns. The VC-constant method puts equal weights on the past *t* observations, thus may not be able to capture the more relevant recent information. Hence, the second VC VaR computation method used is the VC-GARCH method, based on the GARCH model of Bollerslev (1986):

$$\sigma_t^2 = \beta_0 + \beta_1\sigma_{t-1}^2 + \beta_2(r_t - \mu)^2 \tag{6}$$

where $\beta_1 + \beta_2 < 1$, and $\beta_0/(1-\beta_1-\beta_2)$ is the long-run average unconditional variance, meaning in the long run, the variances will revert to an average value.

In particular, our VC-GARCH method uses the same parameter settings as in the JP Morgan's RiskMetrics (1996) model that can be viewed as a special case of the GARCH model, if we assume $\beta_1 = 0.94, \beta_2 = 0.06$, and further $\beta_0 = 0$. RiskMetrics asserts that parameter estimates are similar across assets, so it simply sets these values for all assets in daily variances forecasting. By so doing, no estimation is necessary. This is considered an advantage when dealing with large portfolios.

The empirical study

We proceed with the following steps:

STEP 1: First, we consider a portfolio investing in S&P 500 index. The returns at time t are defined as $r_t = (SNP_t - SNP_{t-1})/SNP_{t-1}$, where SNP_t is the S&P 500 index at time t. we compare the actual portfolio return r of the day with the VaR on the previous day. If r is larger than the VaR on day s, a violation does not occur, and $I_{25,s}$ is set as one. Otherwise, $I_{25,s}$ is zero.

STEP 2: Next, we define nov_{t-1} as the sum of $I_{25,s}$ over the previous 200 days.

STEP 3: Calculate the value of P_t using Eq. (3), and $MRD_t(=P_t \times VaR_t)$, where VaR_t are obtained in STEP 1.

STEP 4: Calculate the capital requirement: $CRq_t = MRD_t \times (3+k)$, where MRD_t are obtained from STEP 3.

STEP 5: If on a particular day, the MRD_t cannot cover the actual losses of the portfolio, then the losses should be paid immediately. We assume the payments will be borrowed with a higher penalty rate R_t.

STEP 6: In addition to the violation penalty parameter θ^P defined in Eq. (2), we take into consideration two kinds of capital costs in the decision rule: the penalty costs and the opportunity costs. This step calculates the penalty cost in Eq. (4) and the opportunity cost $\sum_{t=1}^{250} CRq_t \times OIR_t$, where CRq_t is calculated from STEP 4. After summing up the penalty and the opportunity costs

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for each VaR strategy, we can then compare the performances of the three strategies used in our research.

We use the daily S&P 500 Index data to compute the portfolio rate of return. The data used are from July 1, 1995 to June 30, 2013. The monthly interbank offer rates are used to calculate the value of P_t and the cost of capital. Figure 1 shows that the S&P 500 index returns series exhibits clustering, that can be captured by an appropriate GARCH time series model. Figure 2 shows the descriptive statistics for the S&P 500 Index returns. As expected, the mean is close to zero, and the range is between -9.035% and 11.58%. The Jarque-Bera Largrange multiplier test for normality rejects the normally distributed returns. This is confirmed by the skewness measure and the excess kurtosis of 8.15308. Excess kurtosis can arise from serial dependence of consecutive returns, or jumps in the stock prices which make extreme observations more frequent.

Figure 1: S&P 500 Index returns from July 1, 1995 to June 30, 2013

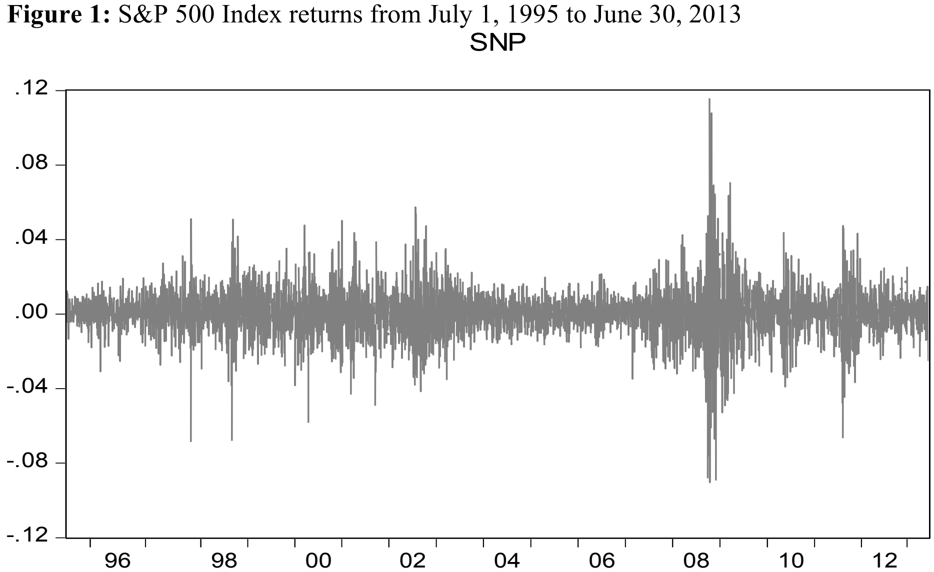
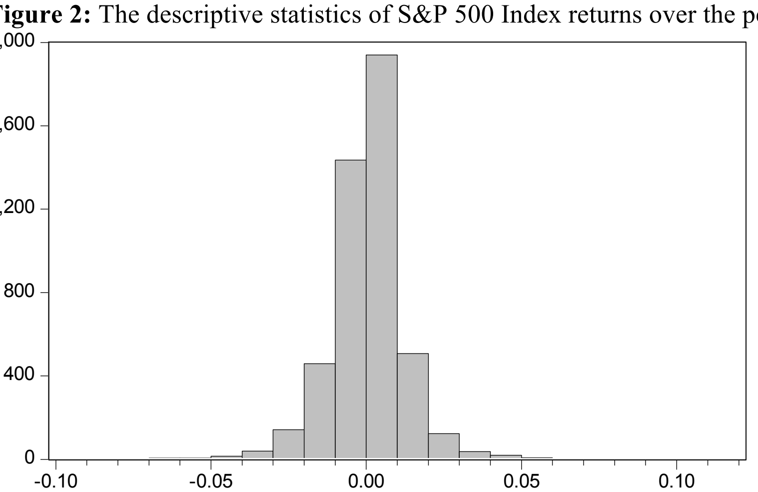


Figure 2: The descriptive statistics of S&P 500 Index returns over the period from July 1, 1995 to June 30, 2013



Series: SNP
Sample 7/03/1995 6/28/2013
Observations 4746

Mean	0.000305
Median	0.000188
Maximum	0.115800
Minimum	-0.090350
Std. Dev.	0.012378
Skewness	-0.046751
Kurtosis	11.15308
Jarque-Bera	13146.71
Probability	0.000000

Table 2 shows the comparison of three decision rules, the Traditional Passive Rule, DYLES, and the MOD-DYLES, using the VC-constant method to compute VaR for the last two. Table 3 shows the improvements of MOD-DYLES over Passive and DYLES respectively. It can be seen from Table 3 that the new MOD-DYLES produced 54 less violations than the traditional passive strategy and reduced the costs of capital by 136bp on average per year. Comparing with the DYLES, the MOD-DYLES saved 10bp per year on average although the numbers of violation are the same. This is not surprising since they have the same basic model design in that matter. That is, both models restrict the number of violations to within the Basel II penalty limits.

Table 2: Comparison of three decision rules using the VC-constant VaR method

	The Traditional Passive Rule		DYLES		MOD-DYLES	
Year	Violations	Ave. Costs	Violations	Ave. Costs	Violations	Ave. Costs
1997	8	4.85%	4	2.54%	4	2.73%
1998	5	3.40%	3	2.64%	3	2.87%
1999	1	0.36%	0	0.37%	0	0.61%
2000	5	2.53%	4	1.38%	4	1.78%
2001	3	1.43%	3	0.70%	3	0.81%
2002	5	1.17%	1	0.46%	1	0.29%
2003	0	0.35%	0	0.41%	0	0.15%
2004	1	0.17%	0	0.20%	0	0.09%
2005	3	0.25%	0	0.17%	0	0.07%
2006	4	0.69%	1	0.20%	1	0.31%
2007	17	5.39%	6	1.92%	6	2.06%
2008	20	14.18%	6	5.41%	6	5.26%
2009	0	0.71%	0	1.04%	0	0.05%
2010	7	1.98%	3	1.27%	3	0.93%
2011	10	6.30%	5	4.28%	5	3.95%
2012	1	0.43%	0	0.46%	0	0.02%
2013	2	1.12%	2	0.45%	2	0.27%
Average*	-	2.66%	-	1.41%	-	1.31%
Total	92	-	38	-	38	-

*The geometric mean is used to calculate average yearly cost rates.

Table 3: The Improvements of MOD-DYLES over passive Strategy and DYLES using the VC-constant VaR method

	Improvements Over Passive Strategy		Improvements Over DYLES	
Year	Reductions of Violation	Costs of Capital Saved (bp)	Reductions of Violation	Costs of Capital Saved (bp)
1997	4	212	0	-19
1998	2	52	0	-24
1999	1	-26	0	-24
2000	1	75	0	-40

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2001	0	62	0	-11
2002	4	88	0	17
2003	0	20	0	26
2004	1	8	0	11
2005	3	18	0	10
2006	3	38	0	-11
2007	11	333	0	-14
2008	14	892	0	15
2009	0	66	0	98
2010	4	105	0	33
2011	5	235	0	33
2012	1	40	0	44
2013	0	85	0	18
Average	-	136	-	10
Total	54	-	0	-

Table 4 shows the comparison of three decision rules, the Traditional Passive Rule, DYLES, and the MOD-DYLES, using the VC-GARCH method to compute VaR for the last two. Table 5 shows the improvements of MOD-DYLES over Passive and DYLES respectively. It can be seen from Table 5 that the new MOD-DYLES produced 59 less violations than the traditional passive strategy and reduced the costs of capital by 109bp on average per year. Comparing with the DYLES, the MOD-DYLES saved 6bp per year on average although the numbers of violation are the same. As stated above, this is because they have the same basic model design in that matter.

Table 4: Comparison of three decision rules using the VC-GARCH VaR method

	The Traditional Passive Rule		DYLES		MOD-DYLES	
Year	Violations	Ave. Costs	Violations	Ave. Costs	Violations	Ave. Costs
1997	8	4.54%	4	2.14%	4	2.37%
1998	8	3.93%	4	1.87%	4	2.12%
1999	3	0.55%	0	0.34%	0	0.55%
2000	6	2.77%	3	1.61%	3	1.99%
2001	3	1.89%	2	1.40%	2	1.50%
2002	2	0.85%	1	0.58%	1	0.39%
2003	1	0.30%	0	0.29%	0	0.11%
2004	5	0.46%	1	0.20%	1	0.10%
2005	3	0.38%	0	0.17%	0	0.07%
2006	6	0.85%	2	0.45%	2	0.55%
2007	12	3.27%	3	1.22%	3	1.37%
2008	9	3.87%	3	1.81%	3	1.62%

2009	2	0.76%	2	0.72%	2	0.09%
2010	9	2.32%	2	0.53%	2	0.23%
2011	8	4.29%	5	2.01%	5	1.67%
2012	5	1.06%	2	0.43%	2	0.17%
2013	4	1.79%	1	0.57%	1	0.40%
Average*	-	1.99%	-	0.96%	-	0.90%
Total	94		35		35	

*The geometric mean is used to calculate average yearly cost rates.

Table 5: The Improvements of MOD-DYLES over passive Strategy and DYLES using the VC-GARCH VaR method

	Improvements Over Passive Strategy		Improvements Over DYLES	
year	Reductions of Violation	Costs of Capital Saved (bp)	Reductions of Violation	Costs of Capital Saved (bp)
1997	4	217	0	-23
1998	4	181	0	-25
1999	3	0	0	-21
2000	3	77	0	-38
2001	1	39	0	-10
2002	1	46	0	19
2003	1	19	0	19
2004	4	35	0	9
2005	3	31	0	10
2006	4	30	0	-10
2007	9	190	0	-14
2008	6	225	0	20
2009	0	67	0	63
2010	7	209	0	30
2011	3	262	0	34
2012	3	89	0	26
2013	3	140	0	18
Average	-	109	-	6
Total	59		0	

In comparison with the traditional passive rule and the VC-constant VaR model, the VC-GARCH VaR model yields lower costs of capital in our empirical results. For example, average costs in Table 4 using the VC-GARCH VaR model are 1.99%, 0.96%, and 0.90%, , respectively, which are less than those costs of 2.66%, 1.41%, and 1.31% in Table 2. It is conjectured that the VC-

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GARCH VaR model puts more weights on recent returns volatility, thus can provide a timely and informative measure of risk.

Conclusions

In order to comply with the daily risk estimates reporting rules required by the Basel Accord, banks choose a VaR model and adopt a strategy to minimize capital costs which result from excessive capital reserves. In this paper we propose a modification to a strategy that attempts to minimize the daily capital charges, while restricting the number of violations to below the penalty limit. Although methodologically sound, the original strategy ignores the impact of market-driven cost of capital, thus reduces its immediate relevance. We modify the model by incorporating the current cost of capital into the decision process. The new strategy is shown to be superior in terms of cost savings. Furthermore, It can be easily extended to other VaR computation methods to facilitate financial institutions to choose the optimal VaR reporting strategy.

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FVA MODELLING AND NETTING ARBITRAGE

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Introduction

After the Lehman Brothers default and the Euro Crisis, funding became a major issue in the industry. The fear of default was a major concern. CVA as the collateralisation of derivatives became a standard. In this stressed context, liquidity and funding turned into a huge management issue for market participants. Funding risk, which used to be the concern only of the treasury, was pushed to the trading desk. The industry has not yet clarified a standard practice regarding funding risk. The adding of this as a charge has been the subject of intense debate. Two main points of view have emerged: one that champions the inelastic assumption (fixed funding rate), and another that does the same for the elastic assumption (funding rate adjusted immediately after each transaction).

The definition of FVA is controversial, and not yet clarified. The literature is not well supplied with discourse about the actual mathematical definition of FVA. We can refer to [11], [12] and [13], but we prefer to define the term ourselves, and to present other points of view. To this effect, we present a valuation hedging methodology derived from various cases.

More than CVA, FVA relates to hedging strategies. As Kamtchueng [4], Piterbarg [7] and Burgard et al. [9] note, the hedging portfolio can also provide some cash. We can end up with different sources of funding. Piterbarg [7] has developed a PDE that takes into account the derivative seller's funding spread. Its results are based on the use of risky asset as collateral, which allows for cheaper funding than that available from the treasury.

The nature of the hedging security matters. Indeed, some of them can provide cash flow, and should therefore be considered also as a source of funding. But in practice, its is more a netting effect than a proper funding source. Indeed, if our hedging securities provide us with cash flows, our hedge sellers should charge us for the funding costs they generate.

Our main results are the following: First, we advance our default risk definition of FVA. Then we describe the impact of hedging strategy on the value and computation of FVA. FVA is a function of our funding spread, and in some cases, a function of hedge-seller funding.

Notation

$\mathbf{D}$ set of derivatives
$\mathbf{D}^+$ set of positive derivative
$\mathbf{D}_C^+$ set of positive derivative which can be used as collateral
$\mathbf{D}^-$ set of negative derivative
$\mathbf{r}$ is the risk free rate (supposed OIS rate)
$\mathbf{r}^\mathbf{L}$ is the Libor rate
$\mathbf{s}_\mathbf{A}^\mathbf{f}$ funding spread of the entity A
$\mathbf{r}_\mathbf{A}^\mathbf{f} = \mathbf{s}_\mathbf{A}^\mathbf{f} + \mathbf{r}^\mathbf{L}$ funding rate of the entity A
$\mathbf{r}_\mathbf{A}^\mathbf{f} = \mathbf{x}_\mathbf{A}^\mathbf{f} + \mathbf{r}$ funding rate of the entity A

$\boldsymbol{r^R}$ repo rate

$\boldsymbol{D^f(t_0, T) = E^Q\left[e^{\int_{t_0}^{T} r_s^f ds}\right]}$

$\boldsymbol{D\ \ (t_0, T) = E^Q\left[e^{\int_{t_0}^{T} r_s\ ds}\right]}$

$\boldsymbol{FVA^{(A\to B)}(P)}$ the FVA charged by A to B concerning the contingent claim P.

$\boldsymbol{P^C}$ it is the collateralized contingent claim $\boldsymbol{P}$

$\boldsymbol{\widehat{P}}$ it is no actualised premium related to $\boldsymbol{P}$

$\boldsymbol{\Psi^+}$ it is the positive value of the payoff $\boldsymbol{\Psi}$

$\boldsymbol{\Psi^-}$ it is the positive value of the payoff $-\boldsymbol{\Psi}$

$\boldsymbol{C_{t_i}(t_j)}$ value of the collateral at time ti of the collateral posted at time tj

Definition of FVA

There is no well established definition of FVA. The scope of its adjustment is itself the source of debate (see [14], [15], [16] and [17]). However, we can agree on this form of working definition in the context of a collateralised portfolio $\boldsymbol{\pi_t^C}$:

$$\boldsymbol{FVA^{\pi^C}(t_0, T) = E^Q\left[\int_{t_0}^{T} e^{-\int_{t_0}^{t} r_s\ ds}\ \pi_t^{C-}\ x_t^f \alpha_t dt\right]}$$

We do not want an explicit $\boldsymbol{\alpha_t}$ for the different points of view available in the literature. Some authors consider FVA a default risk-free measure. They propose this form:

$$\boldsymbol{x_t^f = r_t^L - r_t}$$

We do not support this definition. Our FVA definition includes liquidity funding risk (specific to the seller). This funding charge makes sense, and avoids the DVA concern.

Remark: Some authors consider symmetric FVA. Others prefer a credit risk component with _t = $1_{\{\tau>t,\tau_c>t\}}$ as the joint survival distribution. We shall consider two cases:-one with CSA, and another without-CSA.

With CSA

We do not want to be focus on the collateral modelling. In a case of perfect collateralization, we have an immediate readjustment of the collateral:

$$\boldsymbol{P_t^C := P_t - C_t\ (t)}$$

We could also consider $\boldsymbol{\delta_{t_i}^{P^C}(t_j)}$ the exposure resulting from the imperfect collateral assumption:

$$\boldsymbol{\delta_t^{\pi^C}(t^-) := \pi_t - \pi_{t^-} + C_t\ (t^-) - C_t^-(t^-)}$$

Basically, the not-perfect-collateralisation exposes the seller (or the buyer) to the change of portfolio _ market value, and to change of risky collateral value. In addition, regarding the unknown market risk, the seller and buyer are agreed via the CSA terms to allow a certain amount to be put at risk:

$$\boldsymbol{FVA^{\pi^C}(t_0, T) = E^Q\left[\int_{t_0}^{T} e^{-\int_{t_0}^{t} r_s\ ds}\ \delta_t^{P^C}(t^-)^- x_t^f \alpha_t dt\right]}$$

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By considering rebalancing dates $(t_i)_{1\leq i\leq N^C}$, we have:

$$FVA^{\pi^C}(t_0,T) = E^Q\left[\sum_{i=1}^{N^C} e^{-\int_{t_0}^{t_i} r_s\, ds}\delta_{t_i}^{P^C}\left(t_{i-1}\right)^{-} x_{t_i}^{f}\alpha_{t_i}\eta_i\right]$$

with η_i the rebalancing period or margin period.

Without CSA

Remark: the definition of FVA depends on the relationship between the trading desk and the treasury. The trading desk can decide to hedge its funding in the option market if its funding exposure is liquid enough. For liquidity reasons, we have to distinguish the risk-neutral value of the funding risk and its market value.

European Payoff

Considering a European option $\pi_t \in D$ maturing at T without any CSA:

$$\pi_{t_0}(T) = E\left[e^{-\int_{t_0}^{T} r_s\, ds}\Psi_T\right]$$

FVA can be expressed as follows:

$$FVA^{\pi}\ (t_0,T) = E^Q\left[\left(e^{\int_{t_0}^{T} r_s^f ds} - e^{\int_{t_0}^{T} r_s\, ds}\right)e^{-\int_{t_0}^{T} r_s\, ds}\Psi_T^{-}\right]$$

We prefer to introduce two different proxies, one market related, the other computation related:

$$\overline{FVA^{\pi}}$$

Market Proxy

In practice, the trading desk could decide, regarding the liquidity of the funding-risk exposure, to cover it via the option market.
Remark: This methodology implies an increase of credit risk for the selling counterparty (see [10]), and is subject also to liquidity market risk.

$$\overline{FVA^{\pi}}(t_0,T) = \pi_{t_0}^{mkt}\left(D^f(t_0,T) - D\ \ (t_0,T)\right)$$

The contingent claim seller decides to take a position collateralised on the funding exposure liquid market, and to finance his long position with a loan from the treasury, until maturity. There–is still some residuals risk, the funding resulting of the collateral call and credit risk being more or less negligible (depending on the counterparty's default probability and the exposure variation during the margin call).

$$FVA_{\perp}^{\pi}$$

Independent Proxy

To facilitate the computation of FVA, a common practice is to consider the independence of the process x_t^f t and the payoff Ψ_T :

$$FVA_{\perp}^{\pi}(t_0,T) = E^Q[\Psi_T^{-}]E^Q\left[\left(e^{\int_{t_0}^{T} x_s^f ds} - 1\right)\right]$$

Remark: If $\overline{FVA^{\pi}}$ and $FVA^{\pi}_{\perp}$ are similar, we have to mention the singularity of the market proxy. Indeed, we evaluate our FVA by our market-observation of our funding exposure. Therefore we are subject to other risks, such as liquidity market risk and credit risk. Secondly, in case of uncollateralised transaction, the hedging seller is entitled to charge us for his funding risk. Our derivation can be generalised easily to a multi-cash-flows-exchange-date contingent claim.

Perfectly Hedged without Cash Position

As a perfectly hedged portfolio, the cash flow that we owe to our buyer is replicated by the hedging portfolio. Therefore there is no apparent funding issue coming from the self-financing property of the hedging portfolio. (We assume the involvement no dynamic cash position.)

As an example, we can consider the statically replicable derivative (a subset of the perfectly replicable derivative, with no dynamic cash position involved in the hedging strategy). In this simple case, it is clear, as it shown in Appendix 7.1, that we are subject to the funding charges pursuant to our decomposed hedge portfolio:

$$\boldsymbol{FVA^{(A\to B)}(P) = FVA^{(Y\to A)}(P^{+}) - FVA^{(A\to X)}(P^{-})}$$

To avoid netting arbitrage, the seller derivative has to take into account the FVA of his hedging portfolio. Therefore, our FVA should be a function of $\boldsymbol{s_A^f}$ and $\boldsymbol{s_Y^f}$. One major result is that our FVA can be sensitive to other funding spreads.

Perfect Hedge with Cash position

In this context, a hedging strategy with a dynamic cash position, we need to consider a founding strategy. The hedging strategy can be self-financing, with negative cash position. Therefore we need to find a way to fund this negative position.

The classical way is to borrow money from our Treasury at rate $\boldsymbol{r^f}$. An option would be to use a part of our long position on risky asset as collateral, which is a cheaper way of funding ourselves. So, considering the Repo Market, we are able to diversify our funding sources, as shown in Appendix 7.3.

We have to make some comments regarding the way we are willing to handle our risky asset position (see Appendix 7.2):

First of all, this is a choice. The trading desk can choose to lend the asset to fund itself at the rate r_R. This choice is not only a dependant of the Repo Market but also a utility of the desk regarding the other frictions implied by this trade –frictions such as repo management, credit-risk limit, etc.

As noted by Kamtchueng in [10], there are many ways of using our security or contingent claim as collateral. Some options can be added to the trade regarding the transfer of dividends or ownership of coupons. As the result, the repo rate will be impacted according to ownership as established by the deal.

The controversy about FVA applies at this level in the sense that the security or contingent claim can be more valuable in our Equity (assets of the firm) than outside it (in the Repo Market). Indeed, on the elasticity assumption, our funding rate $\boldsymbol{r_A^f}$ will be modified automatically. On the other hand, inelasticity in the Repo Market can value the collateral quality of the asset at the rate $\boldsymbol{r^R}$.

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We can note that if it were always beneficial to add the security or contingent claim to Equity, the Repo Market would be useless, in the sense that the security would have more impact on our funding rate.

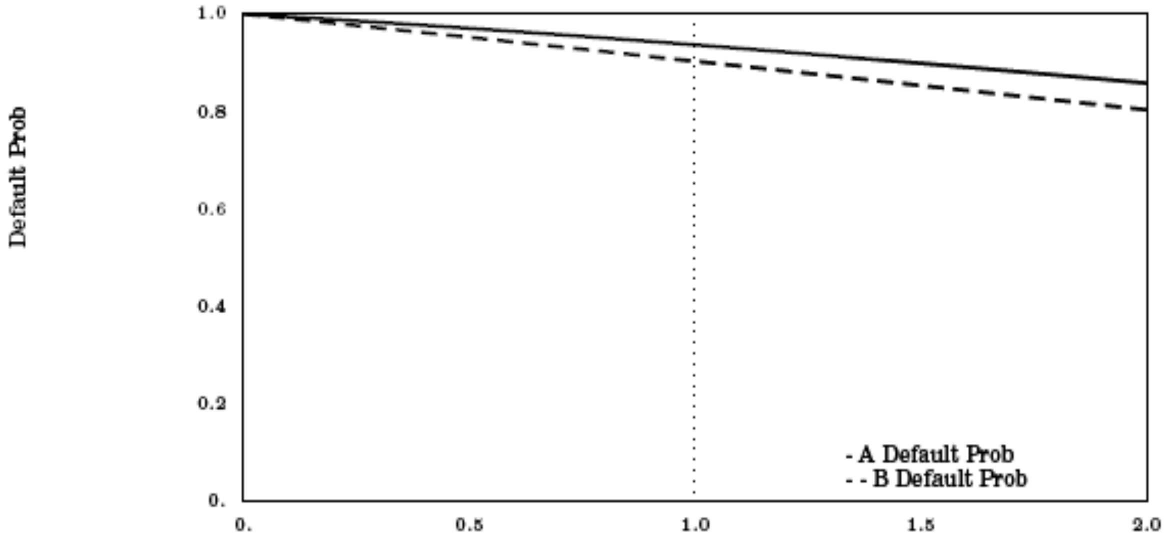
Application to a Synthetic Forward

A synthetic forward can be replicated by a static position on a long $\boldsymbol{Call_{t_0}(T,K)}$ and short $\boldsymbol{Put_{t_0}(T,K)}$:

- $\boldsymbol{FVA^{FwdS}\ (t_0,T) = E^Q\left[\left(e^{\int_{t_0}^{T} x_s^f ds} - 1\right)\Psi_T^{Put}\right]}$
- $\boldsymbol{\overline{FVA}^{FwdS}(t_0,T) = Put_{t_0}^{mkt}\left(D^f(t_0,T) - D\ \ (t_0,T)\right)}$
- $\boldsymbol{FVA_{\perp}^{FwdS}(t_0,T) = \widehat{Put}_{t_0}E^Q\left[\left(e^{\int_{t_0}^{T} x_s^f ds} - 1\right)\right]}$

We have seller A, who has taken a long position on a Call with B and short one on a Put to X, having ventured a static hedging on short fwds. To perform our numerical test, we need to identify the funding spreads of A and B (see Figure 1).

Figure 1: Default Probability Term Structure



FVA was discussed in terms of its definition and relevance as pricing adjustment. We implemented the following FVA methodologies:

To establish the FVA netting arbitrage, we consider the standard method.

Table 1: FVA for Synthetic Fwd without CSA, strike=120, Maturity 2Y

Adjustment Type	$\boldsymbol{\overline{FVA}(P)}$	$\boldsymbol{FVA(P)}$	$\boldsymbol{FVA(P) - VaR}$
A- Seller	1.9107	5.9404	24.808
B- Seller	3.3827	8.8978	35.527
A- Buyer	5.7194	12.845	119.16
B- Buyer	10.1256	12.135	180.45

$\boldsymbol{\overline{FVA}(P)}$is the market-based proxy defined in 3.2.1.
$\boldsymbol{FVA(P)}$ is abstracted via a Monte Carlo, and is based on the definition advanced at 3.2.1.
$\boldsymbol{FVA(P) - VaR}$ is a percentile of the above Monte Carlo methodology (99% for our tests):

Using the result shown in Table 1, we obtain the following result:

$$\boldsymbol{FVA}^{(A\to X)}(\boldsymbol{FwdS}) = \boldsymbol{FVA}^{(B\to A)}(\boldsymbol{Call}) - \boldsymbol{FVA}^{(A\to C)}(\boldsymbol{Put})$$

$$\boldsymbol{FVA}^{(A\to X)}(\boldsymbol{FwdS}) = 19.135 - 5.940 = 13.195$$

To hedge his position statically, the seller is sensitive to an unbounded funding exposure, the aggregated funding cost of 13.195, whereas the standard proxy is 5.490. This result will be a major issue in the negotiating process between the seller and the buyer. In our example, the seller is exposed to a bounded funding exposure. That is not the case for the buyer. The aggregate funding cost is a dependant of the identity of our hedge-seller B, and of the way he will charge A for funding costs.

Remark: Kamtchueng [10] has established a PDE for the CVA premium that takes into account different funding strategies. This is another example of the funding implication of the New Pricing Theory.

Conclusion

We have shown in this paper that FVA is very sensitive to our hedging strategies. Indeed, it was established that the choice regarding our potential funding sources can impact our funding valuation adjustment in many ways:

Even in case of the perfect self-financing strategy, we can be subject to the FVA cost produced by our hedging portfolio, and therefore to other funding spreads.

The trading desk decides whether to use the liquidity of our hedging risky assets as collateral.

As it has been proved with CVA in [4],[5] and [6], the industry should take more note of hedging strategy before computing adjustments based on mathematical risk measures. Communication between traders and quants is essential in the achievement of a relevant quantification of risks.

The definition of FVA implies an asymmetric fair value that will impact the entire market business. The trading desks have to find a consensus on what can be a benefit or a cost in derivative. A conceptual remark has to be made about the measure computes FVA: If it is treated as a cost, there is no reason to consider the risk-neutral measure. This subjectivity is another source of debate that will be analysed in another study.

The pricing status of the FVA is one of the subjects of The 'Default' Fear Pricing Theory – CVA and LVA [14].

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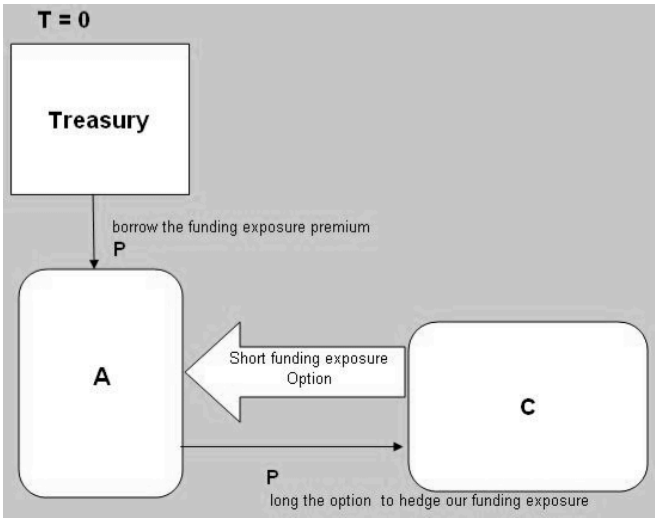
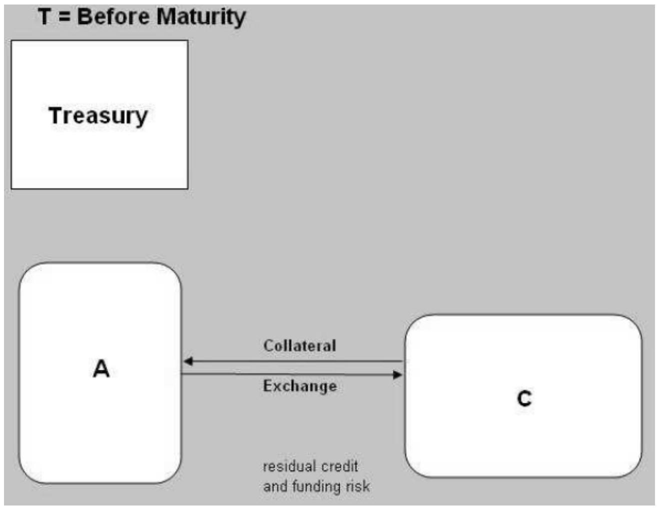
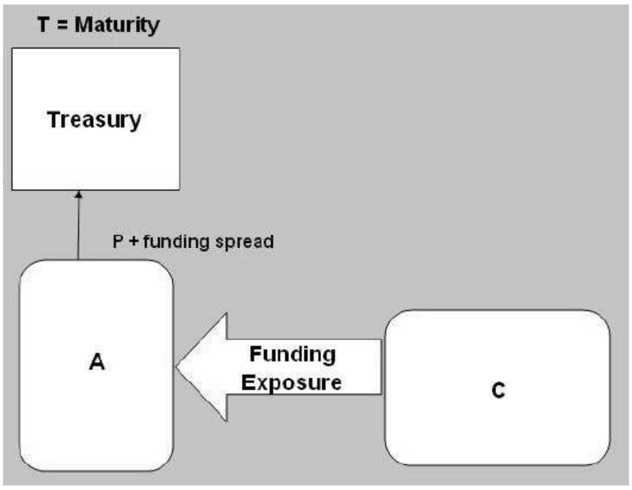
Appendix

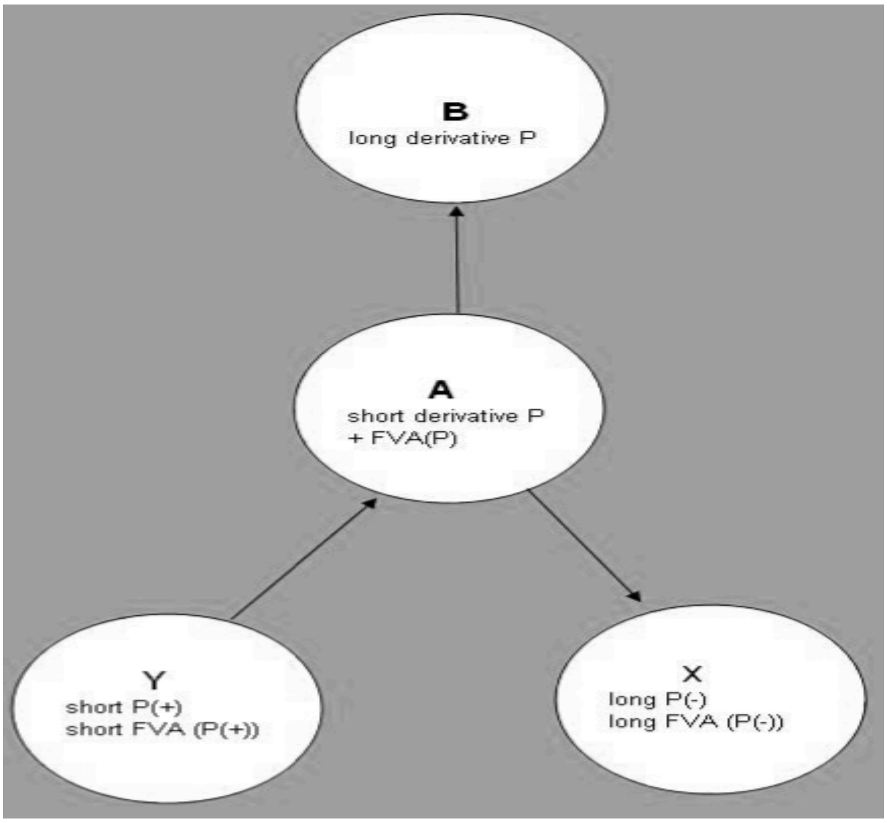
FVA Market Proxy Strategy



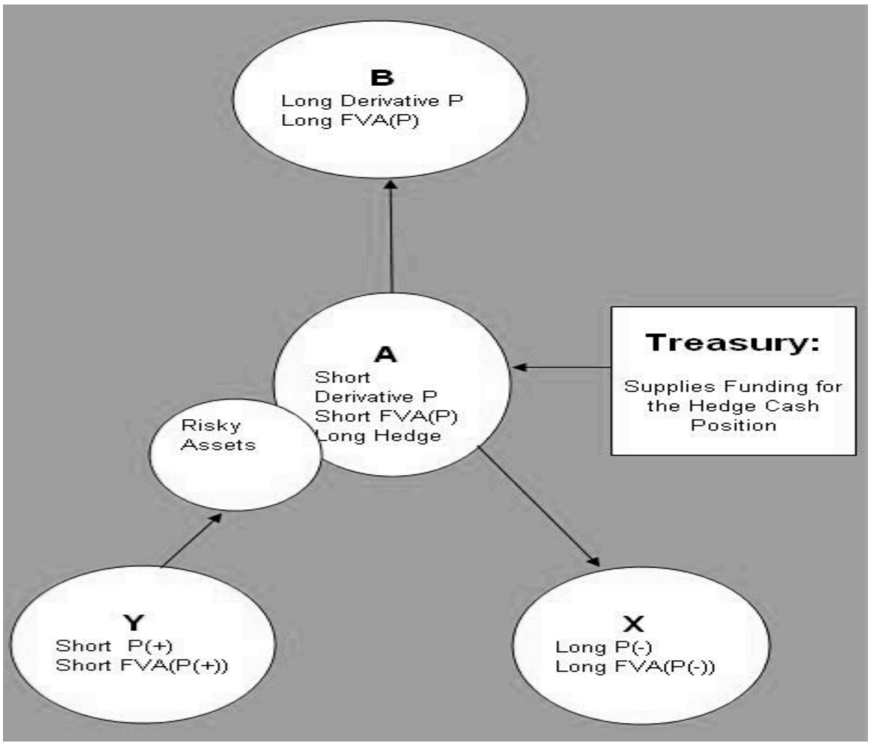




FVA Perfect Hedge without Cash



FVA Perfect Hedge with Cash Position with Risky Asset



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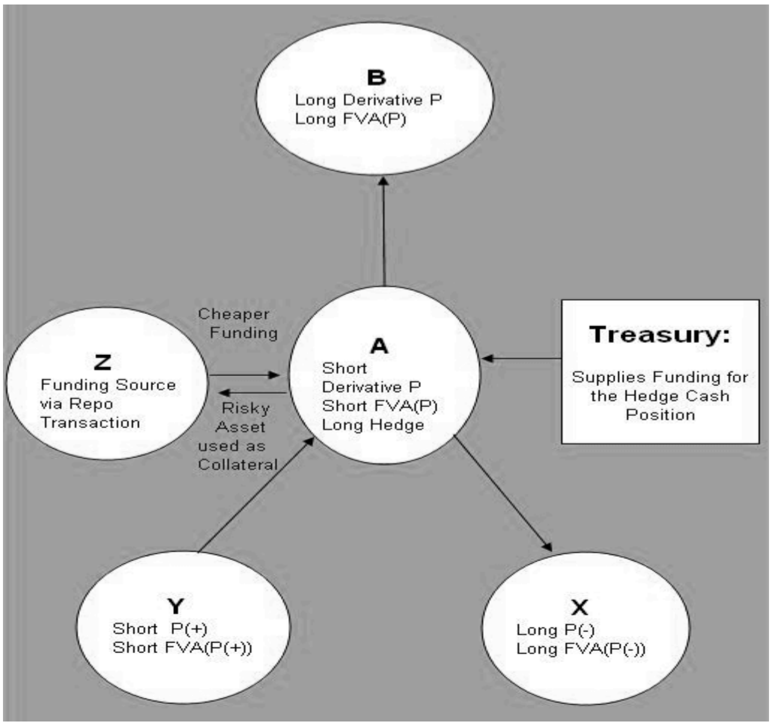
FVA Perfect Hedge with Cash Position



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FIRST STEPS IN HYBRID-MONTE CARLO METHODS FOR CREDIT RISK MANAGEMENT

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***Abstract**. The system "CreditMetrics" of J.P.Morgan is one of the most well known frameworks for credit risk management. This system is used to calculate - amongst other things - the expected value of a credit portfolio of a bank in one year, the variance of this value and the 1^{st} - percentile level of this value, on the basis of certain model assumptions. The calculation of the 1^{st} - percentile level is based on the use of Monte Carlo methods. In many applications it has turned out that quasi-Monte Carlo methods outperform plain Monte Carlo methods.*

The new idea in this work is to combine the benefits of the two methods for CreditMetrics and to generate a "hybrid-Monte Carlo method". In this paper we give the basics of Monte Carlo and quasi-Monte Carlo simulations, we introduce the setting for the hybrid-Monte Carlo method in CreditMetrics, and we compare the performance of the different simulation methods in CreditMetrics for a lot of representative examples.

***Keywords**: Monte Carlo, Quasi-Monte Carlo, CreditMetrics, Credit Risk Management*

Introduction and Aim of the Paper

One of the most well-known credit risk management systems is "CreditMetrics" by J.P.Morgan. This system can be used to calculate - amongst other things - the expected value of a credit portfolio of a bank after one year, the variance of this value and the 1^{st} - percentile level of this value, on the basis of certain model assumptions. The system also takes into account the reliability of the single credits in the portfolio as well as the correlation between credits. In particular the derived value for the 1^{st} - percentile level is used to meet the regulations for the minimum capital requirements for the banks or financial institutions required by the Basel accords.

The calculation of the 1^{st} - percentile level in the CreditMetrics system is based on the use of Monte Carlo (MC) methods. The use of MC simulation methods is fundamental in financial problems like pricing of derivatives and risk management (see for example [4]). In CreditMetrics the scenarios which are simulated by pseudo-random numbers represent the possible changes of the asset values of the borrower companies after one year. That is, the dimension of the simulation problem equals the number of credit products in the credit portfolio, and hence usually is a very high dimensional problem.

An alternative to MC simulation methods is the use of quasi-Monte Carlo (QMC) methods. The use of QMC sequences to financial problems is very common, above all in derivative pricing (see for example [3]). In many applications it has turned out that QMC methods outperform plain MC methods. In plain MC (pseudo-) random numbers are used to simulate possible scenarios, whereas in QMC methods quasi-random point sets, i.e. deterministic suitable chosen point sets, are used for the simulation.

The typical situation is the following: if the number of scenarios used in the simulation is "rather small compared with the dimension of the problem", then MC usually is better than QMC. If the number of scenarios used in the simulation is "rather large compared with the dimension of the problem" then usually QMC outperforms MC.

Even if it is generally not used to measure portfolio risk, QMC seems to be very adequate for this kind of problems (see for example [2]). So our new idea is to combine the benefits of the two methods for CreditMetrics. The use of "mixed" sequences is not new for financial problems. For example in [1] the author describes an application of mixed sequences to (different types of) options pricing. The results [1] confirm that "hybrid sequences" can give good results in the case of high dimensional finance problems.

Hence, in the first step we define what "high dimensional" means in our problem. For the second step we identify the credits with most influence on the value of the portfolio (i.e., credits with large face value and/or bad rating and/or low security class). Then we use quasi-Monte Carlo for these "few" credits and plain Monte Carlo for the many remaining, less influential credits. We will call this approach a "hybrid-Monte Carlo method".

In this paper we give the basics of QMC simulation, we introduce the setting for the hybrid-Monte Carlo method in CreditMetrics, and we compare the performance of the different simulation methods in CreditMetrics for a number of representative examples (based on a program implemented in the software Mathematica).

The paper is organised as follows: In section 2 we give a short overview of the CreditMetrics system. In section 3 we illustrate the differences and characteristics of the MC and QMC methods that give rise to the idea of a hybrid-Monte Carlo method for our purposes. Furthermore, we give the details of our choice of the hybrid method. In Section 4 we discuss some representative examples. Section 5 concludes the paper.

Short Overview of the CreditMetrics System

In this section we give a very short overview of the CreditMetrics system with focus on our purposes. CreditMetrics aims to calculate the risk of a credit portfolio through two risk measures: the standard deviation and the 1st percentile level of the portfolio value in one year time horizon. The starting point is a known portfolio of credit products (the system can be used with each type of credit product but, following [5], we will only consider the "bond" type. For more details in this direction see [5]). This could be the credit portfolio of a bank or a financial institution so its dimension is generally high. The dimension of this portfolio is the dimension of our problem. CreditMetrics computes the risk of this credit portfolio in one year (other time horizons can be chosen but we restrict ourselves to this case). One of the most distinctive features of CreditMetrics is that the portfolio risk is not intended only as the risk of default of the credit products in the portfolio but also the risk caused from changes in the rating class of each credit. The up or downgrade of the issuer of a credit implies a change of the value of the corresponding credit product and that influences the entire portfolio value.

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The three essential steps to computing the portfolio risk are: to calculate the expected value of the portfolio in one year, to calculate the standard deviation of this value in one year and to calculate the 1st percentile level of this value. To calculate these measures taking into account the possible credit quality changes, a lot of data concerning each single credit product, correlations between each two bonds, and general data from the market are needed.

CreditMetrics assumes that all necessary parameters are known. For each bond, the necessary parameters are: face value, coupon, rating class, recovery rate (depending on the security class of the credit), maturity. Further, the following market parameters are also needed: the probabilities of credit quality migration (including the default probability), the correlation between each two rating classes, and the forward zero rates for each rating category (from these we can derive the implied forward rates for each rating category). To take into account the correlations between credit products is a characteristic point in CreditMetrics that makes it a useful system for its aims. However in this paper, we will always work with zero correlation. The reason for this is that the focus of our study is the construction of a better simulation method and not the exactness of the calculation of the expected value and the volatility of the portfolio. With these data the first step is to calculate the mean of the portfolio value on the basis of certain model assumptions.

The second step is to calculate the standard deviation. In this article our results will above all be concerned with the expected value of the portfolio. We think that similar conclusions hold even for the standard deviation.

The third step is to calculate the 1st percentile level of the portfolio value distribution, that is, the level below which the portfolio value will decline in one year with probability 1%. Or, in other words, the portfolio value will stay over this value at year end with 99% probability. To calculate the 1st percentile level we need the distribution of the portfolio values. As credit portfolio value are neither normally distributed nor distributed like other well known distributions, the distribution of the portfolio value has to be found. CreditMetrics uses the MC simulation procedure to find this distribution. Simulation in CreditMetrics is carried out by generating a large number of future possible scenarios of the portfolio, i.e. generating a large number of possible developments of the credit products contained in the portfolio. This simulation is in the center of the interest of this article.

Monte Carlo, Quasi-Monte Carlo and Hybrid-Monte Carlo Simulations

The simulation method in CreditMetrics is the MC simulation method. That means that we generate the future possible scenarios of each credit product by generating the possible future rating class of each bond with the help of pseudo-random number sequences. With this “new rating class” we can calculate the new value of the portfolio in one year time horizon. This, for a large number of scenarios, approximately produces the distribution of the portfolio value after one year. This process is very time expensive if we work with very large portfolios (for example 5,000 credit products and 100,000 scenarios) and the following large number of parameters involved, not in the generation of the new rating class but in the calculation of the new portfolio values. For this reason we always look for more accurate and efficient simulation methods.

As noted in the introduction, an alternative to MC simulation methods is the use of QMC methods. These methods are based on “well-chosen” deterministic sequences instead of randomly generated points. In this article we do not want to go into mathematical details concerning these sequences. For precise mathematical definitions see [7]. The geometric (intuitive) idea behind them is that the points are uniformly distributed in a certain area. Very informally stated: the more regularly the points cover the area the better the sequence. Among the different QMC sequences those that seem to be more appropriate for credit risk management are Niederreiter and Sobol sequences. After an initial analysis, in this work we will only use Niederreiter sequence. In many financial applications it is observed that QMC methods outperform MC methods. The main disadvantage (in our problem) seems to be that QMC may be not as good as MC in very high dimensional problems.

From these considerations follows the idea of creating hybrid methods that combine MC and QMC methods. In [1] the author describes applications of mixed sequences to options pricing. He denotes with

$$\mathrm{mixed}(s, d)$$

a s −dimensional sequence $(s > d)$ obtained by concatenating d −dimensional QMC vectors with $(s - d)$-random vectors.

The findings of [1] are that hybrid sequences can give good results in the case of high dimensional finance problems. But two points appear delicate: the first question is how to determine when a dimension is a “high” dimension. That is, when the performance of plain QMC simulation begins to decline compared with plain MC. In such cases it can be appropriate to use hybrid sequences. It is probably not possible to give an answer valid for all problems. “High” depends on the problem itself. At the beginning of the treatment of a problem, one should perform numerical analysis and then decide what is meant by “high”.

The second open question is how to choose the QMC part of the hybrid sequence. In [1] the author suggests that instead of using the first d components one may investigate any d components that will be simulated with QMC.

We begin our analysis of our hybrid sequences with the number of simulations. We limit ourselves to a number of simulations that can be carried out on a standard computer. Thinking of possible users of CreditMetrics, we create only examples of simulations with a “rather small” number of scenarios: 1,000, 5,000 and 10,000. From our numerical analysis for these numbers of simulations in our problem, we find that we can consider the dimensions of 10, 25, or 50 credit products “small enough” for 1,000, 5,000 or 10,000 simulations to be carried out with QMC simulations. This means that, for example, for 50 credit products and 10,000 scenarios QMC (Niederreiter sequence) methods perform better, or at least “no worse” than MC methods. So “high dimension” for us is every portfolio size bigger than 10 or 25 or 50 for 1,000, 5,000 or 10,000 simulations.

Following [1], we denote our hybrid sequences as

$$h(s, d)$$

where $s > d$ is the total number of credit products in the portfolio, $(s - d)$ is the number of credit products that we simulate with MC method and d is the number of credits that will be simulated with QMC methods.

Now it remains to decide which d of the s credits should be simulated with QMC methods. Because of the nature of our problem, we want to identify the riskiest credit products in the portfolio, i.e. the bonds that have the most influence over the portfolio value. These are on the one hand, those with higher face value and on the other hand, those with lower rating classes, because they have higher default probability. To combine these two aspects we re-order the credit products in our portfolio according to the role:

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(face value * default probability)

This means that we extract the bonds with more "weight" in the portfolio. The first d bonds are the more weighted and exactly these will be simulated with QMC methods.
For our tests we first generate two portfolio types of credit products. We call the first type a "homogeneous portfolio": the bonds included are "realistically" distributed, i.e. they could make up a realistic portfolio of a bank under "normal market situations".

We define an "inhomogeneous portfolio" to be a homogeneous portfolio where 10 (or 25 or 50) credit products, according to the number of the simulations, are particularly risky. We choose for these bonds the worst possible rating class and a very high face value in comparison with the other credit products in the portfolio. Again these credits could make up a realistic portfolio of a bank but under "more extreme market situations".

The reason for the choice of two types of portfolios is that of course we want to test hybrid methods for real life examples under normal market situations. But they are even more interesting if they work well in extreme cases.

To investigate the different simulation methods, as comparison values, we calculate the exact expected value of the portfolio value after one year (under the model assumption of CreditMetrics, for detail in this direction see [5]) and we simulate the 1st percentile level of this value with MC simulation for a greater number of simulations (20,000) than the number of the simulations in our examples to have an "almost correct" value for comparison of the simulation results. This will be done only once for each portfolio.

In the following section we give some examples as illustration of our findings.

Results

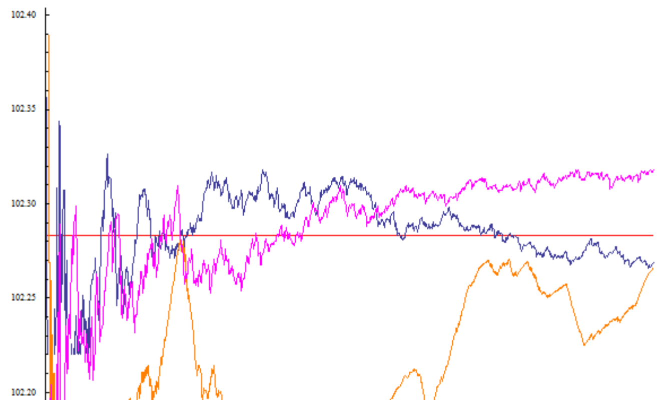
In this section we can provide only some examples of the different simulation methods explained in section 3 applied to portfolios of different size. We will discuss in this paper only the mean of the portfolio values in the different examples and the 1st percentile level of this value. We think that for the standard deviation similar remarks hold as well. We will give only a qualitative interpretation of the graphics.

The first example concerns a homogeneous portfolio of size $s = 100$ for which we generate 1,000 simulations with all three simulation methods: MC, QMC (Niederreiter), and hybrid. Our hybrid sequence in this case is:

$$h(100,10)$$

where 90 credit products are simulated with MC methods and 10 with Niederreiter sequences. Figure 1 shows the different lines for the different methods:

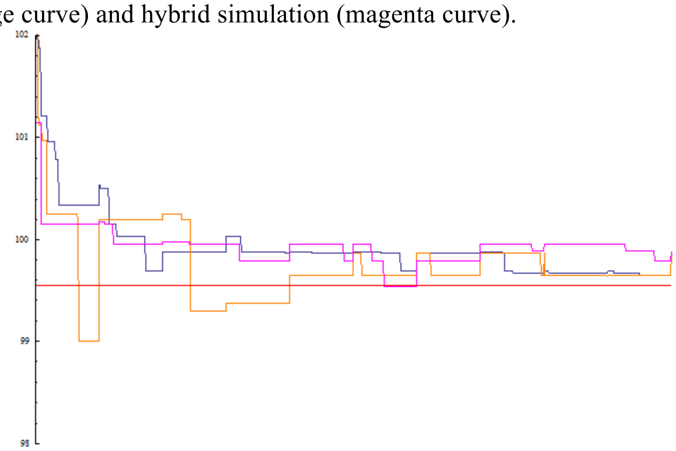
Figure 1: The case of a size 100 homogeneous portfolio and 1,000 simulations, MC (blue line), QMC (orange line) and hybrid simulation (magenta line).



The y-axis indicates the possible expected values of the portfolio and the x-axis the number of simulations (in this case 1,000). The red line represents the exact expected value of the portfolio for the chosen 100 credit products that is 102.283. In the figure we can see the MC (blue), QMC-Niederreiter (orange) and hybrid (magenta) lines of the different simulation methods. From this figure we observe that MC and hybrid simulations in this case perform very similarly and both clearly outperform plain QMC simulation. QMC oscillates much more than the other two methods and even if it converges to the same value, it needs many more scenarios that the other two methods to reach it.

Figure 2 shows for the same portfolio the 1st percentile level that is represented by the y-axis. The red line (value 99.55) represents the 1st percentile value simulated with MC methods and 20,000 simulations to have as accurate a value as possible.

Figure 2: 1st percentile level of the portfolio value of a homogeneous portfolio of size 100 and 1,000 simulations, MC (blue curve), QMC (orange curve) and hybrid simulation (magenta curve).



From Figure 2 we can see that the three simulation methods perform very similarly.

We compare these results with the example of an inhomogeneous portfolio of the same size. The 10 credit products that we simulate here with QMC sequences are now particularly heavily weighted in comparison with the others in the portfolio. In Figure 3 we can see again the three lines for the three simulation methods. The exact expected value of the portfolio is 89.9212 (red line).

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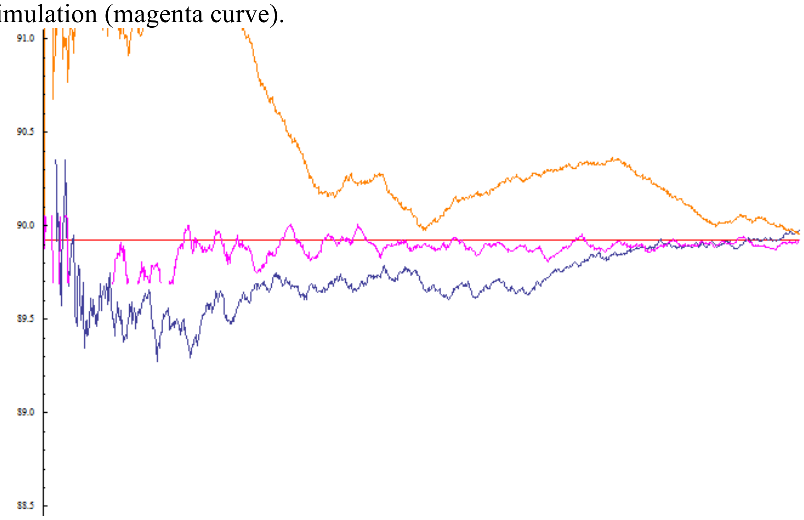
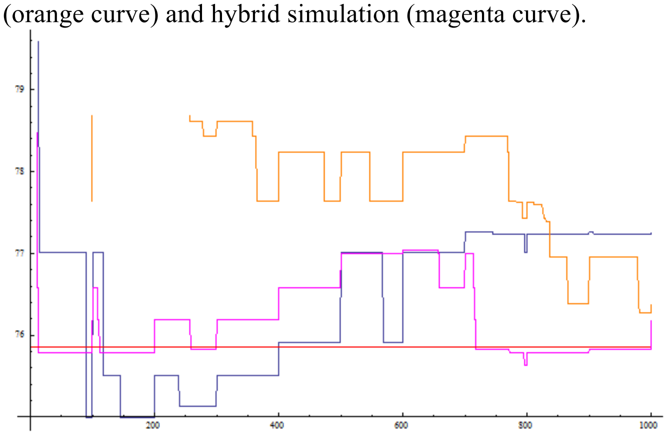
Figure 3: The case of a size 100 inhomogeneous portfolio and 1,000 simulations, MC (blue curve), QMC (orange curve) and hybrid simulation (magenta curve).



In this case it appears immediately that hybrid sequences outperform not only plain QMC simulation but also plain MC simulation.

The following Figure 4 shows the 1st percentile value of the same inhomogeneous portfolio. Compared to the value of 75.85 of the MC simulation with 20,000 scenarios for the "correct value" of the 1st percentile, our hybrid method is no worse or even slightly better that the MC method.

Figure 4: 1st percentile level of the portfolio value of a inhomogeneous portfolio of size 100 and 1,000 simulations, MC (blue curve), QMC (orange curve) and hybrid simulation (magenta curve).

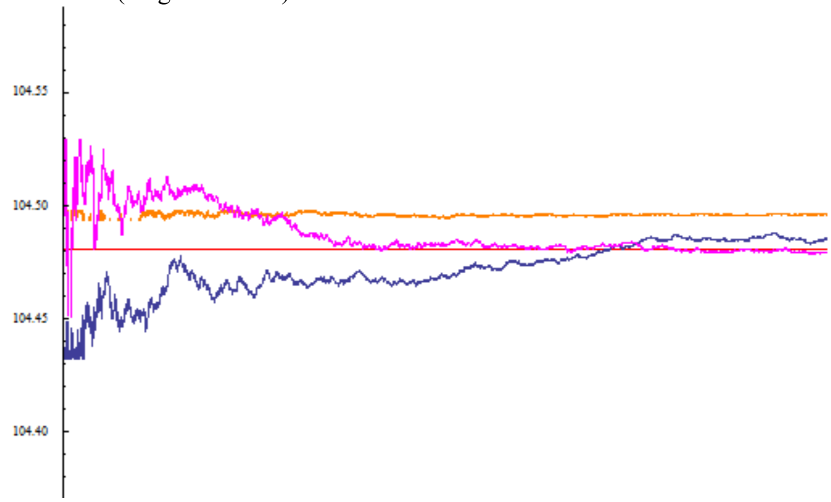


The third example concerns a homogeneous portfolio of size $s = 500$ for which we generate 5,000 simulations with all three simulation methods. Our hybrid sequence in this case is:

$$h(500,25)$$

where 475 credit products are simulated with MC methods and 25 with Niederreiter sequences. The x-axis represents the number of simulations as before but in this case we simulate 5,000 scenarios. Figure 5 shows the different curves for the different methods.

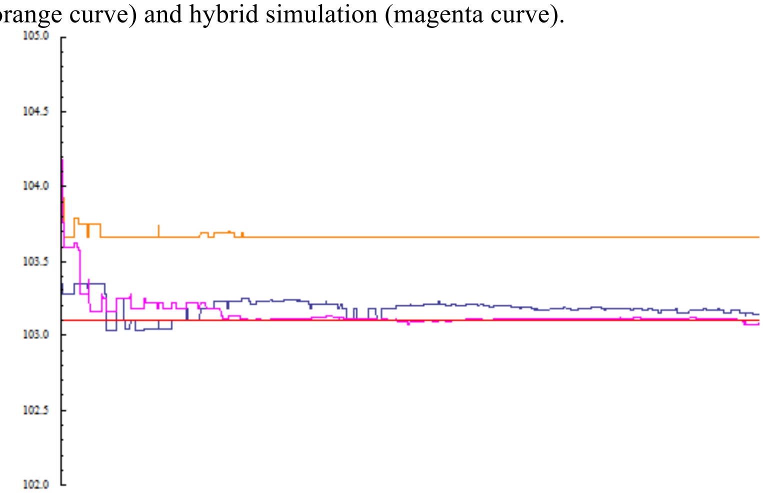
Figure 5: The case of a size 500 homogeneous portfolio and 5,000 simulations, MC (blue curve), QMC (orange curve) and hybrid simulation (magenta curve).



As expected the MC and hybrid simulations converge quicker to the exact expected value of 104.481 than the QMC method. It also seems that the hybrid method performs even better than plain MC simulation.

The following Figure 6 shows the 1st percentile value of the same homogeneous portfolio. Compared to the value of 103.103 of the MC simulation with 20,000 scenarios for the "correct value" of the 1st percentile, both, our hybrid method and the MCmethod, perform better than the QMC method.

Figure 6: 1st percentile level of the portfolio value of a homogeneous portfolio of size 500 and 5,000 simulations, MC (blue curve), QMC (orange curve) and hybrid simulation (magenta curve).



We compare these results with the example of an inhomogeneous portfolio of the same dimension 500. Now 25 credit products are particularly heavily weighted in comparison with the others in the portfolio. The exact expected value of the portfolio is 95.8394 (red line). In Figure 7 we see only the two curves for the MC and hybrid methods.

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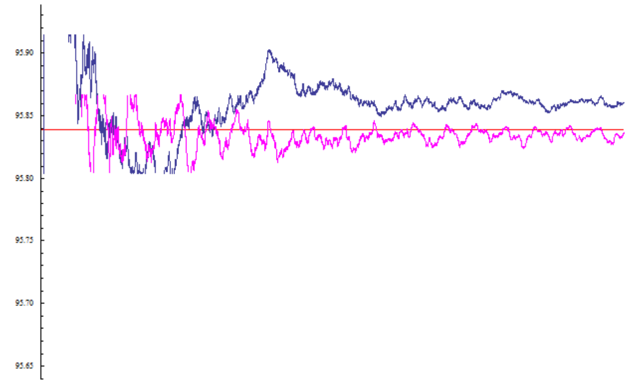
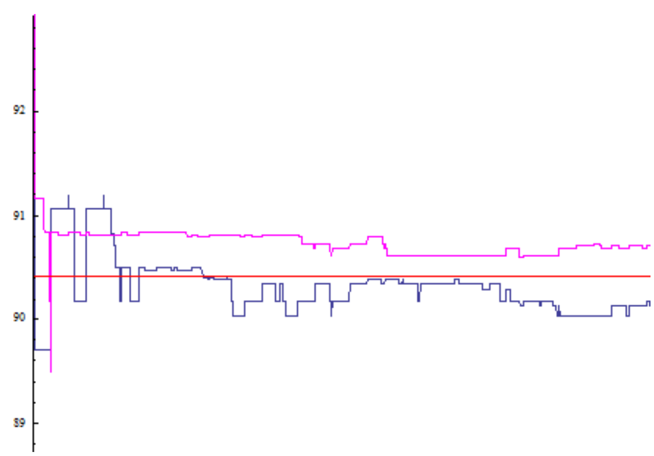
Figure 7: The case of a size 500 inhomogeneous portfolio and 5,000 simulations, MC (blue curve) and hybrid simulation (magenta curve).



The third curve (orange) of the QMC method is not in the figure because it is so far away from the other two that it would make the graph difficult to read. Dimension 500 is too high to be simulated by plain QMC sequences and 5,000 scenarios for the case of an inhomogeneous portfolio.

The following Figure 8 shows the 1st percentile value of the same inhomogeneous portfolio. Compared to the value of 90.41 of the MC simulation with 20,000 scenarios for the "correct value" of the 1st percentile, our hybrid method performs very similarly to the MC method.

Figure 8: 1st percentile level of the portfolio value of a inhomogeneous portfolio of size 500 and 5,000 simulations, MC (blue curve) and hybrid simulation (magenta curve).

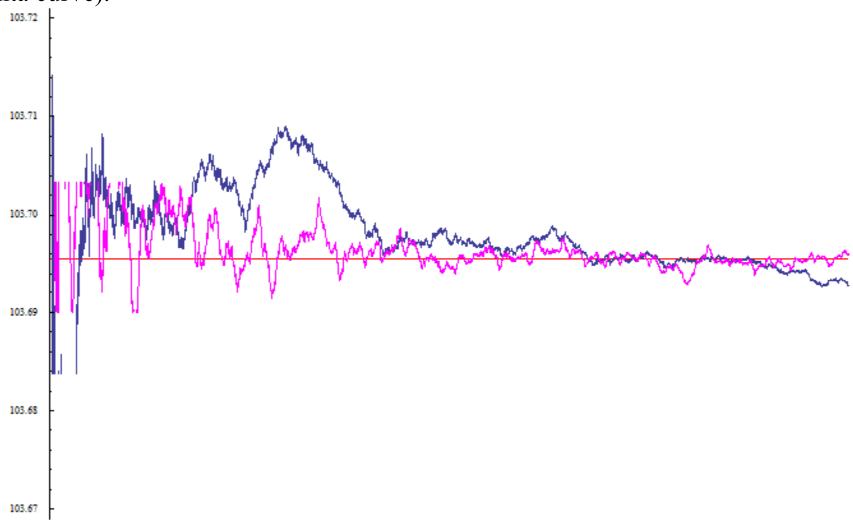


The fifth example concerns a homogeneous portfolio of size $s = 1{,}000$ for which we generate 10,000 simulations with all three simulation methods. Our hybrid sequence in this case is:

$$h(1000,50)$$

where 950 credit products are simulated with MC methods and 50 with Niederreiter sequences. The x-axis represents again the number of simulations but in this case we simulate 10,000 scenarios. Figure 9 shows the different curves for the different methods:

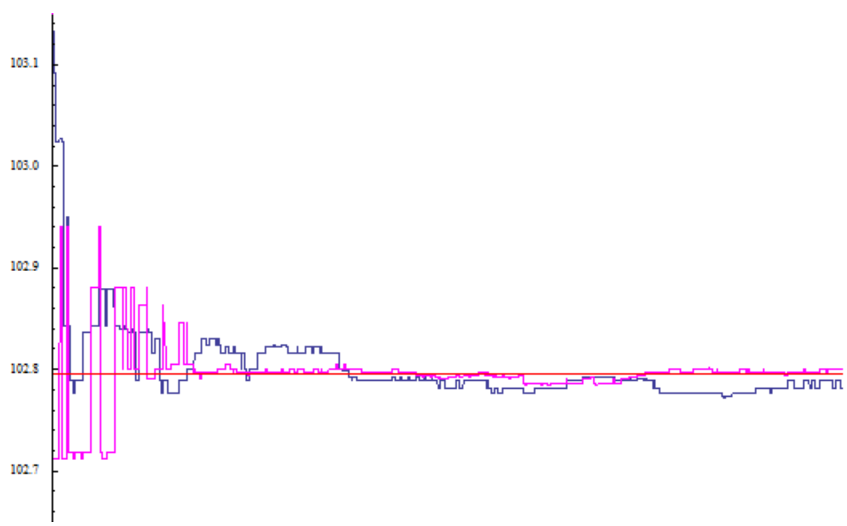
Figure 9: The case of a size 1000 homogeneous portfolio and 10,000 simulations, MC (blue curve), and hybrid simulation (magenta curve).



Here we see only the curves of the MC and hybrid methods and it appears immediately that the hybrid method performs better than the MC because it is always closer to the exact expected value of the portfolio. Again the third curve (orange) for the QMC method is not in the graph: dimension 1,000 is too high to be simulated by plain QMC sequences and 10,000 scenarios and be close enough to the other two methods to appear in the same graph.

Figure 10 shows for the same portfolio the 1st percentile level that is represented by the y-axis. The red line (value 102.796) represents the 1st percentile value simulated with MC methods and 20,000 simulations to have as accurate a value as possible. The MC and hybrid methods perform both very well.

Figure 10: 1st percentile level of the portfolio value of a homogeneous portfolio of size 1,000 and 10,000 simulations, MC (blue curve) and hybrid simulation (magenta curve).



We compare these results with the example of an inhomogeneous portfolio of the same dimension 1,000. Now 50 credit products are particularly heavily weighted in comparison with

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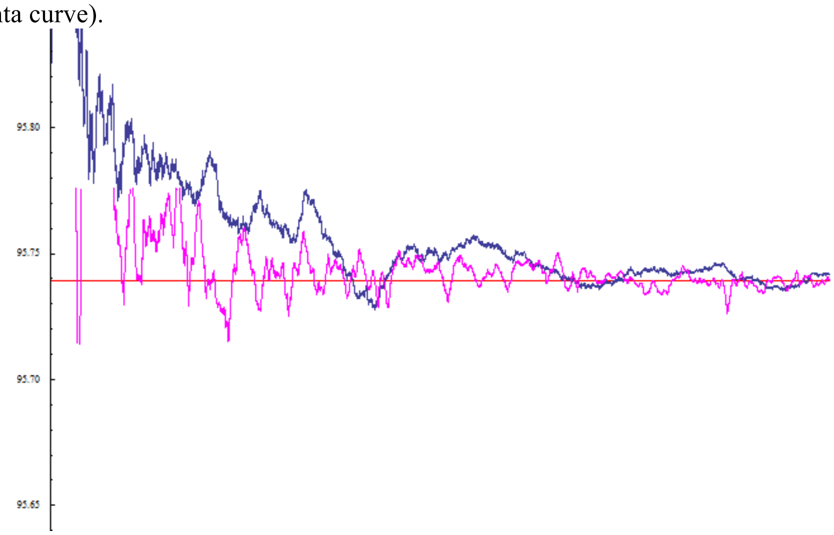
the others in the portfolio. The exact expected value of the portfolio is 95.73 (red line). In Figure 11 we see again only the two curves for the MC and hybrid methods.

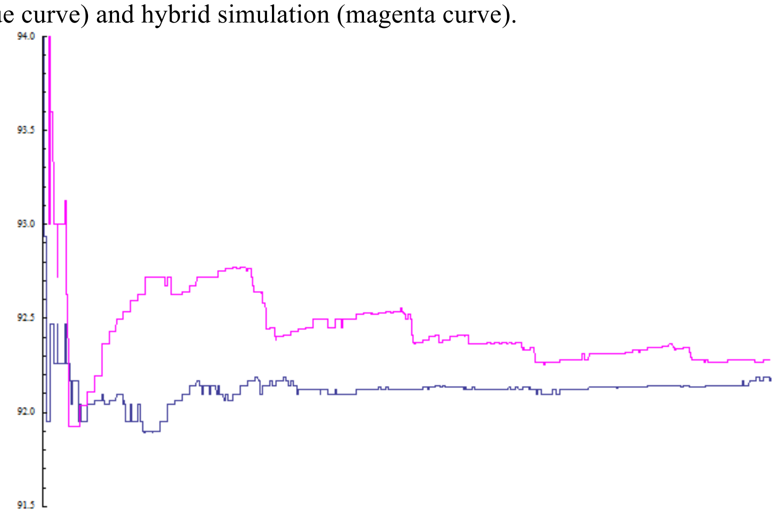
Figure 11: The case of a size 1,000 inhomogeneous portfolio and 10,000 simulations, MC (blue curve) and hybrid simulation (magenta curve).



It appears immediately that in this case the hybrid method performs better than the MC method because it is always closer to the exact expected value of the portfolio.

For the sake of completeness, for the same portfolio, Figure 12 shows the 1st percentile level that is represented by the y-axis. We do not show in the graphic the red line that represents the 1st percentile value simulated with MC method and 20,000 simulations. This number of simulations is now insufficient to give an exact value that can be compared with our example of 10,000 simulations in the case of an inhomogeneous portfolio. In this case one should calculate this value with the MC method and at least 100,000 simulations.

Figure 12: 1st percentile level of the portfolio value of a inhomogeneous portfolio of size 1,000 and 10,000 simulations, MC (blue curve) and hybrid simulation (magenta curve).



Conclusions and further work

In this paper we intend to illustrate the first steps in development of a hybrid- Monte Carlo method for CreditMetrics. We find these results very promising and maybe such hybrid methods can be used in other fields of credit risk management. However, even in CreditMetrics itself a lot of further work is necessary to make this analysis more complete.
First of all, one could discuss whether the choice

(face value * default probability)

is the best to identify the credit products with more weight in the portfolio. Probably using

((face value-(face value*recovery rate)) * default probability)

would reflect better the needs of CreditMetrics by considering not the entire face value of the credit but the amount that, on average, gets lost in the case of default.

Second, in this paper we generate portfolios with fixed number of “higher weighted” credit products. These bonds will then be simulated with QMC sequences. It would be very interesting to make this number variable with the size of the portfolio, the number of simulations, and the weight of the credit products. This could automatically decide if the simulation will be done with plain MC or with hybrid-Monte Carlo sequences.

A third very important point is to carry out extensive suitable statistical tests to complete the analysis.

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SUPERSTATISTICAL FLUCTUATIONS IN TIME SERIES OF LEVERAGE RETURNS.

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Abstract. *We verify that fat-tailed distributions of daily log-leverage-returns of North American industrial companies that survive default and de-listing during the financial crisis, 2006-2012, belong to the class of q-Gaussian distributions. We analyze to what extent emergence of these distributions can be described by superstatistics. To this end, we compare mean values of the Tsallis entropic parameter q obtained by two independent methods: i) direct fitting of q-Gaussians to distributions of log-leverage-returns and ii) derived from shape parameters of Gamma distributions fitted to histograms of inversed realized variances of these returns. For a vast majority of companies, we observe the striking consistency of average values of q obtained by both methods. This finding supports the applicability of superstatistical hypothesis, which assumes that q-Gaussians result from the superposition of locally Normal distributions with Gamma-distributed precision (inversed variance). Notably, for a small group of firms having distributions with a divergent second moment, the mean values of q derived by both methods are very different. It is likely that in this group of issuers, fluctuations of daily log-leverage-returns are so violent that the superstatistical model assumptions are not applicable. Our findings are important for single-name default forecasting and pricing of credit products as well as valuations of portfolio credit risk and economic capital, which might be underestimated by the classic theory of diversified portfolio optimization.*

Keywords: *Superstatiscs, leverage returns, stochastic volatility, q-Gaussian and Gamma distributions, credit risk.*

Introduction.

During the last decade there is a growing interest in modeling non-stationary financial time series within the framework of non-extensive statistics (Borland (2002), Ausloos and Ivanova (2003), Tsallis et al.(2003), Borland and Bouchaud (2004), Biro and Rosenfeld (2007), Tsallis (2009)) and superstatistics (Beck (2001), Beck and Cohen (2003), Gerig et al. (2009), Van der Straeten and Beck (2009), Vamos and Craciun (2010), Camargo et al.(2013), Katz and Tian (2013)). The superstatistical approach significantly simplifies the description of a temporal evolution of log-asset-returns, x. Briefly, the model is based on the assumption that the typical relaxation time of a local dynamics τ is much shorter than the time scale T_β of externally driven fluctuations of its realized variance $1/\beta$. One assumes that a given discrete time series

1 The views expressed in this paper are those of the authors, and do not necessary represent the views of S&P Capital IQ. Authors have no financial interest or benefit arising from the direct application of this research.

of x containing n data points can be divided into $N = n/T_\beta$ time slices with locally equilibrium Gaussian distribution of x and a distinct value of the realized local variance. Consequently, for $N >> 1$, the long-term, $t >> T_\beta$, unconditional probability distribution of x is approximated by the superposition of two distributions (therefore, superstatistics): locally normal distribution of x and the stationary probability distribution $f(\beta)$ of the inversed variance:

$$p(x) = \int_0^\infty \sqrt{\beta/2\pi}\exp(-\beta x^2/2) f(\beta)d\beta. \qquad (1)$$

In fact, marginalization over β expressed by this formula has a longer history. It has been shown by Praetz (1972) that an infinite mixture of Gaussian PDFs of stock log-returns with the Gamma distributed precision β (inverse of the variance):

$$f(\beta) = \frac{b^a}{\Gamma(a)}\beta^{a-1}\exp(-b\beta), \qquad (2)$$

yields the scaled Student's *t*-distribution, which provides a much better fit to empirical data than the normal distribution. Here $\Gamma(a)$ is the Gamma function, a and b are the shape and the scale parameters of the Gamma distribution, respectively. Praetz (1972) provided a pure probabilistic justification of Eq.(1). From the probabilistic point of view, it results from the Bayes theorem in a continuous space, with $f(\beta)$ representing a prior distribution for the unknown parameter β. In the Bayesian context, whenever the conjugate prior distribution for the precision β of a normal distribution is given by the Gamma distribution, the scaled *t*-distribution is emerging on the left hand side of Eq.(1); see, e.g., Gelman et al. (2003).

The mixture of distributions hypothesis gains further support in works of Clark (1973) and Blattberg and Gonedes (1974), who applied Bochner's (1960) concept of subordinated stochastic process to explain leptokurtic empirical distributions of stock price returns. The premise of a subordinated process with different modeling assumptions regarding the random time change was employed in different generalizations of Brownian motion as a model for the dynamics of log-equity-prices. For example, Madan and Seneta (1990), and Madan, Carr, and Chang (1998) proposed the "Variance Gamma" process for Brownian motion with a random time change given by an independent Gamma distributed variable. Generally, a model-free *realized* variance of a time series is estimated in terms of measurements made on x during certain period of time. Thus, any non-model estimator of a local variance is fluctuating in time and strongly depends on the length of a sampling period. To simplify analysis, the autoregressive conditional heteroskedastic (ARCH) and generalized ARCH models assume that the time evolution of a system is resulting from the instantaneous stochastic modulation of a variance of the Gaussian white noise process, see Bollerslev et al. (1994) and Shephard (2005). Consequently in the limit of slow modulation, $\tau << T_\beta$, β can be considered as locally constant with the global distribution over the long-time period characterized by $f(\beta)$. In this regime, the global distribution of x is determined by the weighted mixture of Gaussian distributions, Eq.(1), which depends on the functional form of $f(\beta)$.

As Praetz (1972) pointed out, by analogy with Brownian motion, variance of price changes over unit time interval (diffusion coefficient) is proportional to a slowly changing "… 'temperature' of the share market …, which represents the degree of activity or energy of the markets". His insight and formulation of the problem are still incredibly valuable for the modern field of superstatistics. Indeed, the scaled Student's *t*-distribution may result from superstatistical fluctuations in time series described by Eq.(1) with $f(\beta)$ given by Eq.(2).

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Furthermore, it is now a common knowledge that this distribution is identical to the q-Gaussian distribution, for values of the Tsallis entropic parameter within the interval $1 \le q \le 3$, see de Souza and Tsallis (1997). The q-Gaussian distribution has recently been a topic of increasing interest in physics and information theory. It has deep roots in the non-extensive statistical mechanics, i.e., nonstandard statistics for which the entropy of a system made up of two independent subsystems is not a sum of the entropies of these subsystems. The q-Gaussian distribution maximizes the Tsallis form of non-additive entropy generalizing the standard Boltzmann-Gibbs statistical mechanics, which corresponds to $q = 1$, to a wide spectrum of complex non-equilibrium systems, including financial markets; see Tsallis (2009) for details.

Evidently, not every financial time series fulfils the conditions of applicability of superstatistical model assumptions. For example, intraday DJIA index returns were found locally non-Gaussian and globally exponential, which rejects the superstatistical hypothesis; see Camargo et al. (2013). Andersen et al. (2001) reported approximately lognormal distributions of realized variance of intraday stock returns. On the other hand, for intraday log-equity-returns Micciche et al. (2002), Gerig et al. (2009), Takaishi (2010), and Camargo et al. (2013) have reported that empirical distributions of β are close to the Gamma distribution. In particular, Gerig et al. (2009) have shown that the observed q-Gaussian distributions of intraday log-returns of several companies are described by superstatistics, with T_β naturally determined by one trading day. Van der Straeten and Beck (2009) have studied the daily time series of DJIA and S&P 500 indices for the period 03/1950 to 09/2008. They have reported that after elimination of outliers the relevant time series pass all superstatistical validation tests with $T_\beta = 17 \div 19$ trading days and $f(\beta)$ close to the Gamma distribution.

Recently, Katz and Tian (2013) have shown that q-Gaussian distributions fit well to distributions of daily log-leverage-returns of 520 public North American industrial companies that survive default and de-listing during the financial crisis, 2006 – 2012. This observation is consistent with findings on equity markets, see Bouchaud and Potters (2000), Mantegna and Stanley (2000), and is not surprising. Note, however, that fat tails of q-Gaussian distributions of log-leverage-returns imply a much higher likelihood of extreme movements in a company's leverage ratios and, hence, elevated credit risk at short time-horizons and/or large initial distances to the default barrier than forecasted by traditional structural models with constant variance; see, e.g., Duffie and Singleton (2003), Lando (2004) for details. For recent econometric studies relating high leverage ratios and large volatility of leverage fluctuations to a high risk of default see Löffler and A. Maurer (2008), Flannery et al. (2012). Therefore, analysis of temporal fluctuations of leverage returns and distributions of their realized variance extracted out of empirical time series is essential for a single-name default forecasting as well as valuations of a portfolio's credit risk. An important question that we want to address here is whether an emergence of fat-tailed q-Gaussian distributions of daily log-leverage-returns can be explained by superstatistics. If this is the case, conventional structural models of default can be easily generalized to accommodate slow fluctuations of β, leading to better valuations of credit risk.

To this end, we consider the same dataset as in Katz and Tian (2013) and compare mean values of q obtained by two independent methods: i) direct fitting of q-Gaussians to individual distributions of daily log-leverage-returns and ii) derived from the shape parameters of Gamma distributions, Eq.(2), fitted to histograms of β calculated with the rolling window of 60 trading days. Additionally, we verify manifestation of q-Gaussians with non-parametric Kolmogorov-Smirnov (KS) goodness of fit test. For a vast majority of companies, we observe a striking consistency of the average values of *q,* converging to 1.47, obtained by both methods. This finding supports the applicability of superstatistical hypothesis, which assumes that q-Gaussians result from locally normal fluctuations with Gamma distributed precision. Notably, for a small group of firms (~8%) having distributions with divergent second moment, $q \geq 5/3$, the mean values of q derived by both methods are very different. It is likely that in this group of issuers more "turbulent" dynamics and larger fluctuations of leverage returns violate the key superstatistical assumption, $\tau << T_\beta$.

Empirical analysis.

We consider the same dataset as in Katz and Tian (2013). It is composed of time series of daily leverage returns of public North American industrial (GIC 20) companies that survive default or de-listing from July 11, 2006 through June 21, 2012. To avoid any additional assumptions inherent in traditional estimations of the market value of firm's assets using Black-Scholes-Merton option-theoretical framework, we consider a firm's *book value* of leverage *R.* The latter is defined as the ratio, *R = L/V*, between two *observable* variables: the accounting value of its total liabilities *L* and the market price of aggregate assets, $V = L + E$, where *E* is the market capitalization of a firm at the end of a trading day. We collect all firm-specific financial data from the S&P Capital IQ database and smooth quarterly jumps in reported total liabilities of issuers by linear interpolation. After filtering out companies with multiple empty entries in financials, the final dataset contains 520 public companies, which correspond to circa 7.8×10^5 data points.

For each firm *j* and for each trading day *i* we calculate leverage returns defined as the forward daily changes in the logarithm of a firm's leverage ratio $r_{i,j} = \ln(R_{i,j}/R_{i-1,j})$. We calculate the piece-wise de-trended leverage returns by subtracting the best-fitted linear drift, $x_{i,j} = r_{i,j} - A_j - B_j * i$. The fitting parameters A_j and B_j are determined by the Gaussian least squared method with the time window of 60 trading days. The time scale of the local trend is one of the local properties of the data. Variability cycles with approximately 60 trading days corresponding to quarterly filings appear to be quite stable through the entire period of observations for all 520 firms. We use the maximum likelihood method to fit the empirical distributions of $x_{i,j}$ to q-Gaussian PDFs, which for $1 \leq q_j \leq 3$ has the following form:

$$p(x_j) = \frac{\sqrt{\beta_j}}{C_{q_j}} e_{q_j}(-\beta_j x_j^2). \tag{3}$$

Here β is the scale parameter, $e_q(\bullet)$ is the q-Gaussian function and C_q is the normalization q-dependent factor determined as follows

$$e_q(-\beta x^2) = \left[1 + (q-1)\beta x^2\right]^{-\frac{1}{q-1}}, \qquad C_q = \sqrt{\frac{\pi}{q-1}} \frac{\Gamma\left[\frac{3-q}{2(q-1)}\right]}{\Gamma\left[\frac{1}{q-1}\right]}. \tag{4}$$

The q-Gaussian distribution, Eq.(3), provides a natural generalization of the normal distribution, corresponding to $q \to 1$. We find that for all firms in the sample the fitted values of the Tsallis entropic parameter are within the interval $1.27 \leq q \leq 1.8$. It is important to stress here that the variance of the distribution Eq.(3), $\sigma_q^2 = 1/[(5-3q)\beta]$, has a finite value for

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$1 \le q < 5/3$ and is divergent for $q \ge 5/3$. Note that substitution of Eq.(2) into Eq.(1) yields the q-Gaussian distribution, Eq.(3), with the following identification of parameters

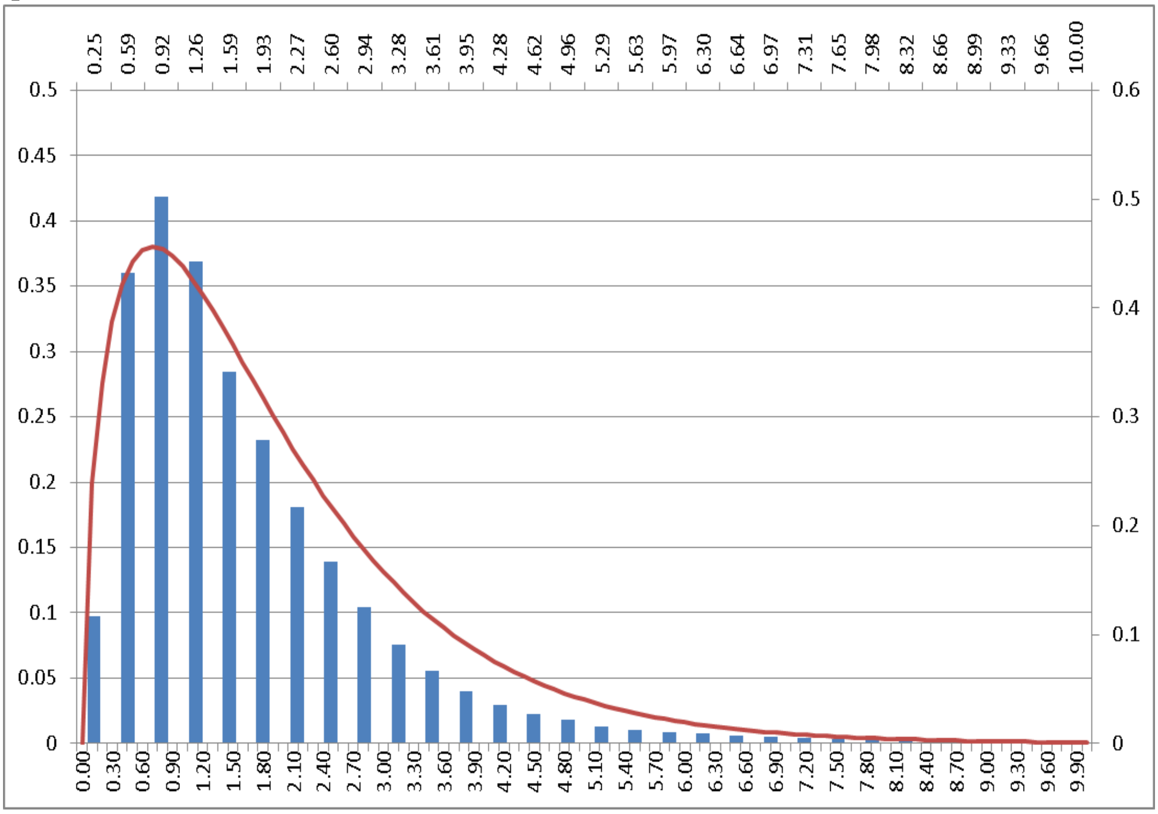
$$q = (2a+3)/(2a+1) \ , \tag{5a}$$

$$\beta = \beta_0 /(3-q), \tag{5b}$$

where $\beta_0 = a/b = \int_0^\infty \beta f(\beta) d\beta$ represents a mean value of the Gamma distribution. Thus, if the individual time series at hand can be described by Eq.(1), the values of q obtained by direct fitting of q-Gaussians to individual distributions of log-leverage-returns should be consistent with those derived from the shape parameters of Gamma distributions fitted to the histograms of inversed realized variances of these returns.

To verify this assumption, we arrange all 520 companies by the descending order of values of the individual parameters q_j obtained by direct fitting of empirical distributions of daily log-leverage-returns. We divide the interval between the maximum and minimum values of q in s = 45 equal segments and calculate the mean values of q with the growing number of segments and, hence, firms involved. Thereby, we obtain s mean values $\overline{q}_k$, $k = 1..s$, from the direct fitting of q-Gaussians to individual distribution of daily log-leverage returns. The first computation of $\overline{q}_1$ includes the segment with $5/3 \le q_j \le 1.8$, which contains only 41 companies. The last calculation includes *all* segments and, hence, fitted q's of all issuers. It yields the mean value $\overline{q}_s = 1.47$, which has been already reported by Katz and Tian (2013). Next, we repeat the same procedure with the values of q_j derived from the fitted shape parameters a_j. We proceed as follows: for each company j in the segment k and for each trading day i, we use the rolling window of past 60 trading days to obtain s = 45 matrices of model-free realized variances $(1/\beta_{ij})_k$. To improve statistics, for each company j in the segment k we rescale the obtained values of $(1/\beta_{ij})_k$ to its average value over the entire period of observations $<(1/\beta_j)>_k$. Then we fit parameters of Gamma distributions, Eq.(2), to histograms of the normalized variables $(\beta^{\#}_{ij})_k = \left[\frac{(1/\beta_{ij})_k}{<(1/\beta_j)>_k} \right]^{-1}$. Note that, according to Eq.(5a), individual parameters $(q_j)_k$ depend only on the fitted values of the shape parameters $(a_j)_k$ in the segment k and are not affected by scaling. Finally, we calculate s mean values $\overline{q}_k$ with the growing number of companies involved. Once again, the last calculation includes *all* segments and, hence, all firms in the sample. In Fig.1 we present the empirical distribution of normalized precisions of daily log-leverage-returns of 520 issuers collected at the last step of our algorithm. The solid line represents the fitted Gamma distribution with the average shape parameter corresponding to $\overline{q}_s = 1.47$.

Figure 1. Empirical distribution of normalized precisions of daily log-leverage returns of 520 North American industrial companies from July 11, 2006 through June 21, 2012, calculated with the rolling window of past 60 trading days. The solid line represents the fitted Gamma distribution with the shape parameter corresponding to $\overline{q} = 1.47$. *Source: S&P Capital IQ.*



We plot the results of both independent methods in Fig.2. Remarkably, for $\overline{q}_k$ < 5/3 we observe a striking consistency of the values of mean Tsallis parameters, converging to 1.47, obtained by both methods. This observation supports applicability of the superstatistical approach to a simplified description of the global evolution of daily leverage returns for majority of companies in our sample. It is easy to see, however, that for the small group of 41 firms with strongly non-Gaussian distributions of daily leverage returns, a mean $q \geq 5/3$, which corresponds to q-Gaussian distributions with the divergent variance, the average values of q obtained by these two methods are rather different and, hence, the superstatistical approach is not applicable

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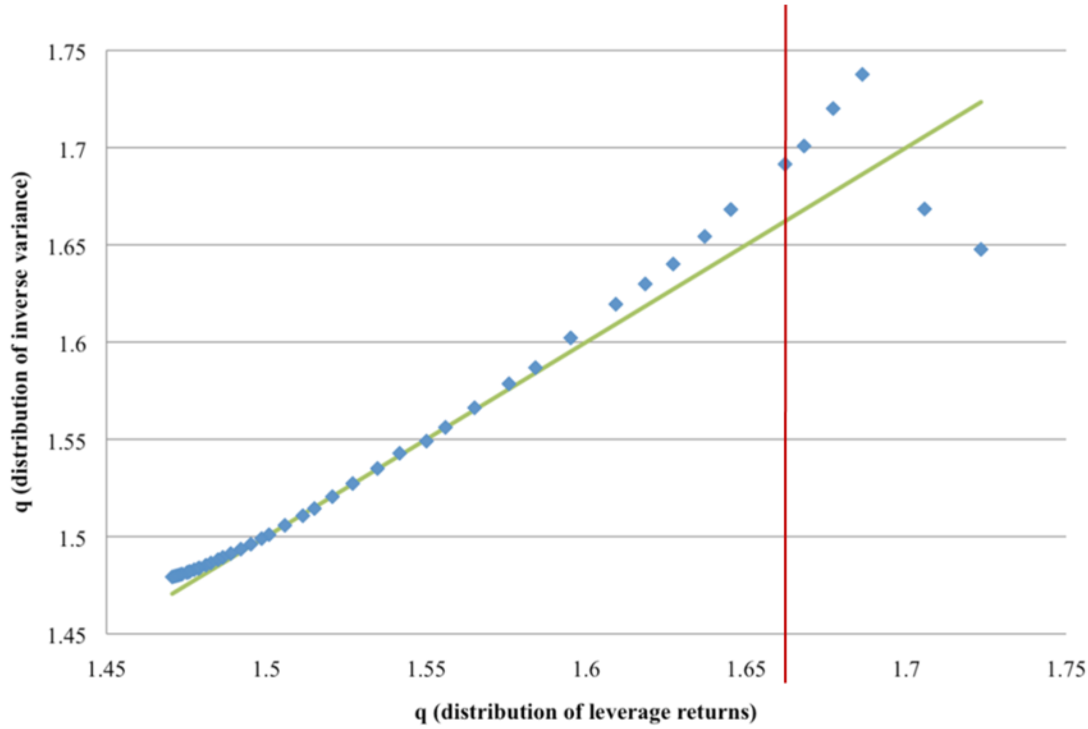
Figure 2. Comparison of the mean values of Tsallis entropic parameters obtained from i) the direct fitting of q-Gaussians to distributions of daily leverage returns of individual issuers and ii) derived from the fitted shape parameters of Gamma distributions of their normalized historical precisions (see text for details). Straight lines are visual guides: one has 45 degrees slope, another marks the critical value q = 5/3 on the abscise-axis.

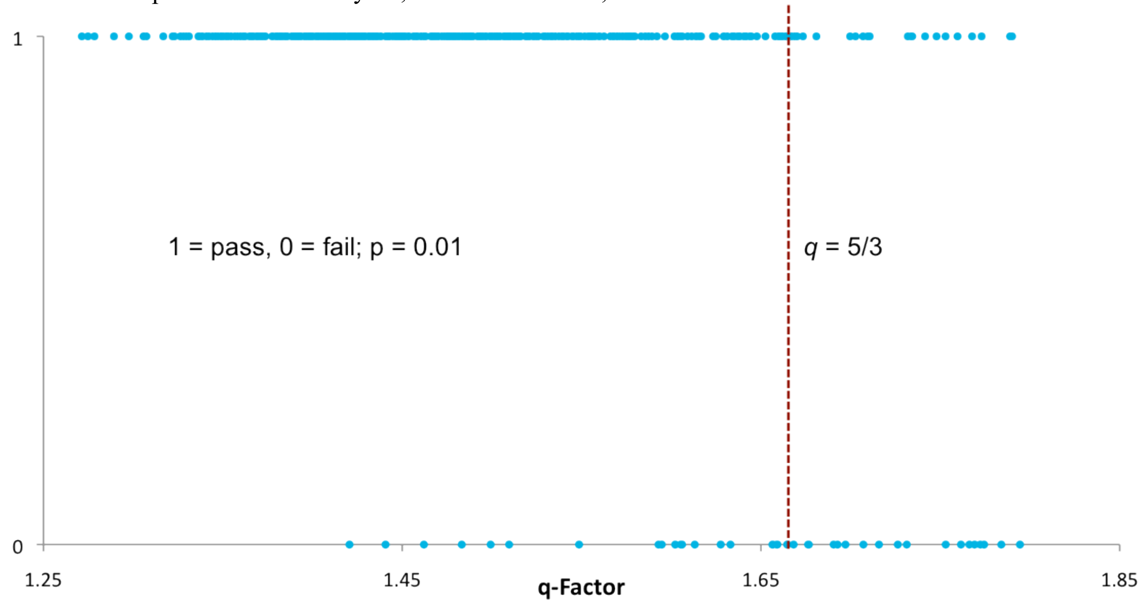


Furthermore, for each company in the sample we apply the non-parametric KS test with p = 0.01 and use the 95% confidence interval to check the goodness of fit of the q-Gaussian distribution to the set of observable frequencies of daily log-leverage-returns. We find that q-Gaussian distributions of returns with finite second moment fit well the vast majority of issuers, 479 or 92.1%. Moreover, among these distributions, only 21 or 4.4% of distributions with $q < 5/3$ failed the KS test. On the other hand, within the small group of 41firms having fitted distributions with divergent second moment, 19 or 46.3% of distributions with $q \geq 5/3$ do not pass the KS test, see Fig.3 and Table I. Clearly, the drastically higher ratio of q-Gaussian distributions failing the KS test with $q \geq 5/3$ strongly correlates with much fatter tails of these distributions, which reflect more violent fluctuations of daily leverage returns in this group of companies.

Table I. Results of the KS test of q-Gaussians to distributions of daily log-leverage returns of 520 North American industrial companies between July 11, 2006 and June 21, 2012. Percentage is calculated relative to the total number of firms in the sample.

Tsallis parameter	Number of firms	Pass KS test	Fail KS test
q => 5/3	41 (7.9%)	22 (4.2%)	19 (3.7%)
q < 5/3	479 (92.1%)	458 (88.1%)	21 (4.0%)
Total:	520	480 (92.3%)	40 (7.7%)

Figure 3. Results of the KS test for q-Gaussian distributions of daily log-leverage returns of 520 North American industrial companies between July 11, 2006 and June 21, 2012.



Discussion.

To validate applicability of superstatistics for a relatively large pool of 520 individual time series of daily log-leverage-returns, we propose a simple verification technique based on comparison of the mean values of the Tsallis entropic parameter obtained by two independent methods: i) direct fitting of q-Gaussians, Eqs.(3) and (4), to distributions of individual returns and ii) derived from the shape parameters of Gamma distributions, see Eqs.(2) and (5a), fitted to empirical histograms of realized precisions of these returns. Remarkably, we observe a striking consistency of the values of average q's, converging to 1.47, obtained by both methods. This finding provides a strong evidence that for the vast majority of companies in the sample (92.3% of distributions pass the KS test) leptokurtic q-Gaussian distributions of daily log-leverage-returns result from the superpositions of local Gaussians with Gamma-distributed precision, see Eqs.(1) and (2). This result is broadly consistent with empirical studies of equity markets. Our focus on the time-series of leverage returns clarifies (in most cases) the origin of a power-law decay of large fluctuations of leverage ratios. It helps to demonstrate inadequacy of the commonly used methodologies of credit risk valuation, which are based on the classic assumption of constant volatility of log-asset-returns.

A word of caution is due here. Notably, for 7.9% of all firms in the sample, which have strongly non-Gaussian distributions of log-leverage returns with divergent second moments, the mean values of fitted q's obtained by both methods are very different. Moreover, within this small group of issuers, the fitted q-Gaussian distributions of log-leverage-returns do not pass the KS goodness of fit test in 46% of cases vs. only 4.4% within the main group with $q < 5/3$. These 41 companies have substantially higher statistical weight of large local variance than the rest of firms in the sample. It is highly likely that within this subset of issuers, fluctuations of daily leverage returns are so violent that the key superstatistical assumption $\tau << T_\beta$ is not valid and the dynamics of leverage return cannot be approximated by a "laminar" flow with slowly modulated diffusion coefficient.

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In general, account of the anomalous diffusion process with a randomly distributed variance drastically changes the probability distribution of a first hitting time and its intensity. In particular, it has been shown by Katz and Tian (2013) that due to the greater weight of extreme events captured by fat tails of q-Gaussians, even a slightly leptokurtic (q = 1.5) distribution of log-leverage-returns leads to much higher credit risk at short time-horizons and/or large initial distances to the default barrier than forecasted by traditional structural models of default. Hence, valuations of credit risk based on the stochastic dynamics of the issuer's leverage ratio strongly depend on the functional form and parameters of both distributions: $p(x)$ and $f(\beta)$, extracted out of a given time series. These findings are important for practical implementations of credit risk management and pricing of credit securities.

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AN ECONOMICS PREMIUM PRINCIPLE UNDER THE SMOOTH AMBIGUITY AVERSION

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Abstract. *This paper considers a pure exchange economy of ambiguity loss and extends the economic premium principle of Bühlmann (1980, 1984) to an economic premium principle under the ambiguity. In the economy, the agent follows the dual version of the smooth ambiguity model advocated by Klibanoff, Marinacci and Mukerji (2005). This paper also conducts some comparative statics and demonstrates the effect of ambiguity on equilibrium insurance premium.*

Keywords: *Ambiguity, Economic premium principle, Equilibrium, Smooth ambiguity model*

Introduction

As to premium calculation principle in the risk theory, Bühlmann (1980, 1984) develop the so-called economic principle. It is a standard premium principle in a pure exchange economy under the expected utility. However, many experiments provide clear evidence that the expected utility (EU) model cannot capture actual behavior under uncertainty[1]. One of the most famous classical experiments was conducted by Ellsberg (1961), who showed that a unique probability might not be used for decision making under uncertainty. Many preference functions, including Gilboa and Schmeidler (1989), Schmeidler (1989) and so on, have been proposed to explain the choices in Ellsberg's experiment. Segal (1987) explains these choices are based on second-order probabilities, that is, probabilities over possible probabilities. The paper, Klibanoff, Marinacci and Mukerji (2005), henceforth KMM, develops a preference functional based on this idea, named the smooth ambiguity model. KMM represent preferences by a double expected utility form with respect to first-order probabilities (risk) and second-order probabilities (ambiguity). Compared with other models that are consistent with Ellsberg's experiment, the smooth ambiguity model has a distinct advantage in

[1] Uncertainty is used to an umbrella term for both *risk* and *ambiguity*. *Risk* is defined as a condition in which the event to be realized *a-priori* is unknown, but the odds of all possible events are perfectly known. *Ambiguity* refers to conditions in which not only the event to be realized *a-priori* is unknown, but the odds of the events are also either not uniquely assigned or are unknown.

tractability. Since the smooth ambiguity model has a similar functional form to EU, it is easier to apply existing EU results for ambiguity. Thus, for example, Gollier (2011) shows how comparative statics techniques in EU can be applied to the smooth ambiguity model. For the original smooth ambiguity model, Iwaki and Osaki (2012) develops a ``dual" theory of the smooth ambiguity model. In the theory, preferences under ambiguity are represented by distorted second-order probabilities of first-order expected utilities. They also show the preferences can be rewritten as EU under distorted second-order probabilities.

In the paper, based on the dual theory of the smooth ambiguity model (Iwaki and Osaki 2012), we extend Bühlmann's economic premium principle in a pure exchange economy to an economic premium principle under ambiguity. In addition to derivation of the premium principle in equilibrium under ambiguity, we make some comparative statistics of our model. We consider the effect of ambiguity aversion on the optimal demand for the insurance. We also compare the economic premium principle under the smooth ambiguity aversion with the economic premium principle without ambiguity aversion. We show a sufficient condition that market participants or agents with ambiguity aversion make a price of the risk higher than they with ambiguity neutral.

The model for the market

We consider a single period pure exchange economy that consists of agent i, $i = 1,2,\cdots,n$. The commodities to be traded are quantities of money, conditional on the random outcome $\omega \in \Omega$ with a measurable space $(\Omega, \mathcal{F})$. Let $Y_i(\omega)$ denote payment received by the agent i. That is, it stands for an insurance policies and reinsurance contracts bought or sold by i. On the other hand, let $X_i(\omega)$ denote loss of the money the agent i faces. That is, it stands for the risk of the agent i before (re-)insurance. Let $\Pi = \{\pi(\omega,\theta); \theta \in \Theta\}$ be a set of probability measures on $(\Omega, \mathcal{F})$, where Θ is an arbitrarily real-valued index set. Ambiguity is represented by a cumulative distribution function (c.d.f.) μ on Θ, which is assumed to be the same among the all agents for simplicity.

Each agent is characterized by his utility function $u_i : (-\infty,\infty) \to [0,1]$, a function $\varphi_i : [0,1] \to [0,1]$, which represents his attitude toward the ambiguity, and his initial wealth w_i. The utility function u_i is assumed to be strictly increasing, strictly concave and twice continuously differentiable with the properties $u_i'(\infty) = \lim_{x\to\infty} u_i'(x) = 0$ and $u_i'(-\infty) = \lim_{x\to-\infty} u_i'(x) = \infty$. We also assume φ_i is twice continuously differentiable.

Let E denotes the expectation under the ambiguity neutral probability measure P define by $P(\omega) = \int_{\theta\in\Theta} \pi(\omega,\theta)\mathrm{d}\mu(\theta)$. We assume that Y_i can be bought or sold by the agent at a price

$$p(Y_i) = \mathrm{E}[Y_i\phi] = \int_{\omega\in\Omega} Y_i(\omega)\phi(\omega)\mathrm{d}P(\omega),$$

where $\phi : \Omega \to \mathbb{R}$ is the state price density which satisfies $\mathrm{E}[\phi] = 1$.

For a given (w_i, X_i, Y_i), a terminal wealth W_i of the agent i is assumed to be given by

$$W_i = w_i - X_i + Y_i - p(Y_i). \tag{1}$$

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For a given $\theta \in \Theta$, let $u_i^\pi(W_i,\theta)$ denote the expected utility of the terminal wealth W_i of the agent i, that is defined by $u_i^\pi(W_i,\theta) = \int_{\omega\in\Omega} u_i(W_i(\omega))\mathrm{d}\pi(\omega,\theta)$. We assume that, for each W, $u_i^\pi(W,\theta)$ is strictly increasing with respect to (w.r.t.) θ without loss of generality. Then, assuming that the conditions of Theorem 1 of Iwaki and Osaki (2012) hold, the welfare of the agent i is given by

$$V_i(W_i) = \int_0^1 \varphi_i\left(1-\mu\left(\theta; u_i^\pi(W_i,\theta)=t\right)\right)\mathrm{d}t,$$

where $\mu\left(\theta; u_i^\pi(W_i,\theta)=t\right)$ denotes the value of the c.d.f. μ of θ satisfying $u_i^\pi(W_i,\theta)=t$. Let μ_i be a c.d.f. on Θ, that is defined by

$$\mu_i(\theta) = 1-\varphi_i\left(1-\mu(\theta)\right).$$

Then from Corollary 1 of Iwaki and Osaki (2012), the welfare of the agent can be rewritten as

(2) $$V_i(W_i) = \int_{\theta\in\Theta}\int_{\omega\in\Omega} u_i(W_i(\omega))\mathrm{d}\pi(\omega,\theta)\mathrm{d}\mu_i(\theta).$$

Let $\mathrm{E}^{(i)}$ denote the expectation under the probability measure Q_i defined by $\mathrm{d}Q_i(\omega) = \int_{\theta\in\Theta}\mathrm{d}\pi(\omega,\theta)\mathrm{d}\mu_i(\theta), \quad \omega\in\Omega$. Then the welfare (2) of the agent can be represented by the expected utility as follows.

(3) $$V_i(W_i) = \mathrm{E}^{(i)}[u_i(W_i)].$$

We consider such a problem that each agent i controls amount Y_i so as to maximize the welfare $V_i(W_i)$. Since W_i depends on Y_i through (1), we denote the welfare $V_i(Y_i)$ instead of $V_i(W_i)$.

Equilibrium and the Economic Premium Principle

We define an equilibrium in the economy described in the previous section as follows.

Definition 1. $(\phi, Y_1, \ldots, Y_n)$ is an *equilibrium* if

(a) **Optimization condition:** $Y_i = \mathrm{argmax} V_i(Y_i) \quad \forall i$,

(b) **Market clearing condition:** $\sum_{i=1}^n Y_i = 0.$

From (3), we can readily show that the following lemma holds.

Lemma 1. Condition (a) of Definition 1 is satisfied if and only if

$$\begin{aligned} & u_i'\left(w_i - X_i(\omega) + Y_i(\omega) - \int_{\omega'\in\Omega} Y_i(\omega')\phi(\omega')\mathrm{d}P(\omega')\right)\frac{\mathrm{d}Q_i(\omega)}{\mathrm{d}P(\omega)} \\ (4) \qquad = \; & \phi(\omega)\int_{\omega\in\Omega} u_i'\left(w_i - X_i(\omega) + Y_i(\omega) - \int_{\omega'\in\Omega} Y_i(\omega')\phi(\omega')\mathrm{d}P(\omega')\right)\mathrm{d}Q_i(\omega) \\ = \; & C_i\phi(\omega) \quad \text{a.e. } \omega\in\Omega, \end{aligned}$$

where C_i is a constant defined by

$$C_i = \int_{\omega\in\Omega} u_i'\left(w_i - X_i(\omega) + Y_i(\omega) - \int_{\omega'\in\Omega} Y_i(\omega')\phi(\omega')\mathrm{d}P(\omega')\right)\mathrm{d}Q_i(\omega).$$

Remark 1. *From* (4) *we see that* $\mathrm{E}[\phi] = \int_{\omega\in\Omega} \phi(\omega)\mathrm{d}P(\omega) = 1$.

From (4) we can see that Y_i is only determined up to an additive constant, hence we can assume that $\int_{\omega\in\Omega} Y_i(\omega)\phi(\omega)\mathrm{d}P(\omega) = 0, \ \ \forall i$, without loss of generality. For convenience we write $Z_i(\omega) = X_i(\omega) - Y_i(\omega)$, and $L_i(\omega) = \mathrm{d}Q_i(\omega)/\mathrm{d}P(\omega)$. Then we can rewrite (4) as

(5) $$u_i'(w_i - Z_i(\omega))L_i(\omega) = C_i\phi(\omega).$$

As Bühlmann (1984) says, it is important to note that the random variables Z_i, L_i, and ϕ can be and very often must be chosen to depend on ω only through the aggregate risk $Z(\omega) = \sum_{i=1}^{n} X_i(\omega)$. This assertion can be partially supported by the same argument as Bühlmann (1984) as follows. Assume a Pareto optimal risk exchange $\hat{Z}_i$ with $\mathrm{E}^{(i)}[u_i(w_i - \hat{Z}_i)] \geq \mathrm{E}^{(i)}[u_i(w_i - Z_i)]$ and the market clear condition;

(6) $$\sum_{i=1}^{n} \hat{Z}_i(\omega) = \sum_{i=1}^{n} X_i(\omega) = Z(\omega) \quad \text{a.e. } \omega\in\Omega.$$

For each i, let $Z_i|_Z$ denote the conditional expectation of $\hat{Z}_i$ given Z under μ_i, that is, $Z_i|_Z = \mathrm{E}^{(i)}[\hat{Z}_i \mid Z]$. $Z_i|_Z$ also satisfies the market clear condition (6). From Jensen's inequality for the conditional expectation given Z we conclude that $Z_i|_Z$ is at least as good as $\hat{Z}_i$ for all i. That is,

$$\mathrm{E}^{(i)}[u_i(w_i - \hat{Z}_i) \mid Z] \leq u_i(w_i - Z_i|_Z) \quad \forall i$$

and hence $\mathrm{E}^{(i)}[u_i(w_i - \hat{Z}_i)] \leq \mathrm{E}^{(i)}[u_i(w_i - Z_i|_Z)] \ \ \forall i$. The inequality is strict unless either $\hat{Z}_i = Z_i|_Z$ and/or u_i is linear on the support of $\hat{Z}_i$. Excluding linearity of u_i for all but one agent, $\hat{Z}_i$ must depend on ω through Z for all i. In the case of linearity of u_i for several agents there is indifference of splitting the risks among them. In this case we may therefore assume that $\hat{Z}_i$ depends on ω through Z for all i.

From the above arguments and (5), we also assume that L_i, and ϕ are functions of Z. Because of this, we use the notation $Z_i(\zeta)$, $L_i(\zeta)$, and $\phi(\zeta)$, where ζ is the generic element of the measurable space obtained by the mapping $Z : \Omega \to \mathbb{R}$.

Now, we rewrite (5) as

(7) $$u_i'(w_i - Z_i(\zeta))L_i(\zeta) = C_i\phi(\zeta)$$

with $\sum_{i=1}^{n} Z_i(\zeta) = \zeta$. An economic premium principle under ambiguity is given by the following theorem.

Theorem 1. The state price density is given in equilibrium as

(8) $$\phi(Z(\omega)) = \frac{\exp\int_0^{Z(\omega)}(1+\Lambda(\zeta))\rho(\zeta)\mathrm{d}\zeta}{\mathrm{E}\left[\exp\int_0^{Z(\omega)}(1+\Lambda(\zeta))\rho(\zeta)\mathrm{d}\zeta\right]}.$$

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Proof. Taking the logarithmic derivative on both sides of (7) we obtain

$$-\frac{u_i''(w_i - Z_i(\zeta))}{u_i'(w_i - Z_i(\zeta))} Z_i'(\zeta) + \frac{L_i'(\zeta)}{L_i(\zeta)} = \frac{\phi'(\zeta)}{\phi(\zeta)}.$$

Introducing the index of absolute risk aversion $\rho_i(x) = -\frac{u''(x)}{u'(x)}$, we have

$$Z_i'(\zeta) = \left(\frac{\phi'(\zeta)}{\phi(\zeta)} - \frac{L_i'(\zeta)}{L_i(\zeta)}\right)\frac{1}{\rho_i(w_i - Z_i(\zeta))}. \tag{9}$$

Since $\sum_{i=1}^{n} Z_i'(\zeta) = 1$, we obtain $1 = \frac{\phi'(\zeta)}{\phi(\zeta)}\sum_{i=1}^{n}\frac{1}{\rho_i(w_i - Z_i(\zeta))} - \sum_{i=1}^{n}\frac{L_{i'}(\zeta)}{L_i(\zeta)\rho_i(w_i - Z_i(\zeta))}$. Hence if we define $\frac{1}{\rho(\zeta)} = \sum_{i=1}^{n}\frac{1}{\rho_i(w_i - Z_i(\zeta))}$ and

$$\Lambda(\zeta) = \sum_{i=1}^{n}\frac{L_i'(\zeta)}{\rho_i(w_i - Z_i(\zeta))L_i(\zeta)}, \tag{10}$$

finally we have

$$\frac{\phi'(\zeta)}{\phi(\zeta)} = (1 + \Lambda(\zeta))\rho(\zeta), \tag{11}$$

and

$$Z_i'(\zeta) = \left((1 + \Lambda(\zeta))\rho(\zeta) - \frac{L_i'(\zeta)}{L_i(\zeta)}\right)\frac{1}{\rho_i(w_i - Z_i(\zeta))}.$$

From (11) and the normalizing condition $\mathrm{E}[\phi] = 1$, we obtain (8). □

We note that if $\Lambda(\zeta) = 0$ or all agents are ambiguity neutral, our economic premium principle (8) coincides with the economic premium principle of Bühlmann (1984) since $L_i = 1$ if agent i is ambiguity neutral by the definitions of P, Q_i and L_i.

Some Comparative Statics

For simplicity, we assume that $u_i = u$ and $w_i = w_0$ for all i. That is, each agent is different only in φ_i that represents agent i's attitude toward the ambiguity aversion.

First, we show such a sufficient condition that the likelihood ratio L_i / L_j is monotone. Hereafter we assume $\pi(\zeta,\theta)$ is twice differentiable w.r.t. ζ.

Lemma 2. If an inequality;

$$\frac{\int \frac{\partial^2 \pi(\zeta,\theta)}{\partial \zeta^2}\varphi_i'(1-\mu(\theta))\mathrm{d}\mu(\theta)}{\int \frac{\partial \pi(\zeta,\theta)}{\partial \zeta}\varphi_i'(1-\mu(\theta))\mathrm{d}\mu(\theta)} \geq \frac{\int \frac{\partial^2 \pi(\zeta,\theta)}{\partial \zeta^2}\varphi_j'(1-\mu(\theta))\mathrm{d}\mu(\theta)}{\int \frac{\partial \pi(\zeta,\theta)}{\partial \zeta}\varphi_j'(1-\mu(\theta))\mathrm{d}\mu(\theta)} \qquad \forall\theta\in\Theta \tag{12}$$

holds, the likelihood ratio $L_i(\zeta) / L_j(\zeta)$ *is monotone increasing w.r.t.* ζ.

Proof. From the definition of $L_i(\zeta)$, we have

$$
\begin{aligned}
\frac{\mathrm{d}L_i(\zeta)/\mathrm{d}\zeta}{L_i(\zeta)} = & \Bigg(\int\frac{\partial^2\pi(\zeta,\theta)}{\partial\zeta^2}\varphi_i'(1-\mu(\theta))\mathrm{d}\mu(\theta)\int\frac{\partial\pi(\zeta,\theta)}{\partial\zeta}\mathrm{d}\mu(\theta) \\
& -\int\frac{\partial\pi(\zeta,\theta)}{\partial\zeta}\varphi_i'(1-\mu(\theta))\mathrm{d}\mu(\theta)\int\frac{\partial^2\pi(\zeta,\theta)}{\partial\zeta^2}\mathrm{d}\mu(\theta)\Bigg) \\
& \Bigg/\Bigg(\int\frac{\partial\pi(\zeta,\theta)}{\partial\zeta}\varphi_i'(1-\mu(\theta))\mathrm{d}\mu(\theta)\int\frac{\partial\pi(\zeta,\theta)}{\partial\zeta}\mathrm{d}\mu(\theta)\Bigg) \\
= & \frac{\int\frac{\partial^2\pi(\zeta,\theta)}{\partial\zeta^2}\varphi_i'(1-\mu(\theta))\mathrm{d}\mu(\theta)}{\int\frac{\partial\pi(\zeta,\theta)}{\partial\zeta}\varphi_i'(1-\mu(\theta))\mathrm{d}\mu(\theta)}-\frac{\int\frac{\partial^2\pi(\zeta,\theta)}{\partial\zeta^2}\mathrm{d}\mu(\theta)}{\int\frac{\partial\pi(\zeta,\theta)}{\partial\zeta}\mathrm{d}\mu(\theta)}.
\end{aligned}
\tag{13}
$$

Furthermore, since

$$
\frac{\mathrm{d}}{\mathrm{d}\zeta}\left(\frac{L_i(\zeta)}{L_j(\zeta)}\right)=\left(\frac{\mathrm{d}L_i(\zeta)/\mathrm{d}\zeta}{L_i(\zeta)}-\frac{\mathrm{d}L_j(\zeta)/\mathrm{d}\zeta}{L_j(\zeta)}\right)\left(\frac{L_i(\zeta)}{L_j(\zeta)}\right)
$$

and $L_i(\zeta)>0$ for each ζ and each i, we obtain the result. □

Proposition 1. *Assume that agent i is more ambiguity averse than agent j. Let $\mathrm{E}_\mu^{(i)}$ denote the expectation w.r.t. $\theta\in\Theta$ under the c.d.f. μ_i*, that is,

$$
\mathrm{E}_\mu^{(i)}\left[\frac{\partial\pi(\zeta,\theta)}{\partial\zeta}\right]=\int_{\theta\in\Theta}\frac{\partial\pi(\zeta,\theta)}{\partial\zeta}\varphi_i'(1-\mu(\theta))\mathrm{d}\mu(\theta).
$$

If

$$
\mathrm{E}_\mu^{(i)}\left[\frac{\partial\pi(\zeta,\theta)}{\partial\zeta}\right]=\mathrm{E}_\mu^{(j)}\left[\frac{\partial\pi(\zeta,\theta)}{\partial\zeta}\right],\qquad i,j=1,\ldots,n,
\tag{14}
$$

and $\frac{\partial^2\pi(\zeta,\theta)}{\partial\zeta^2}$ *is decreasing w.r.t.* $\theta\in\Theta$, *the inequality* (12) *holds.*

Proof. Let φ_i^{-1} denote the inverse function of φ_i and define $h=\varphi_j\circ\varphi_i^{-1}$. Since $\frac{\mathrm{d}}{\mathrm{d}\theta}\frac{1}{h'(\varphi_i(1-\mu(\theta)))}=\frac{h''(\varphi_i(1-\mu(\theta)))\varphi_i'(1-\mu(\theta))\mu'(\theta)}{h'(\varphi_i(1-\mu(\theta)))^2}$ and from Theorem 2 of Iwaki and Osaki (2012), h is concave if agent i is more ambiguity averse than agent j, the ratio $\frac{\varphi_i'(1-\mu(\theta))}{\varphi_j'(1-\mu(\theta))}=\frac{1}{h'(\varphi_i(1-\mu(\theta)))}$ is decreasing w.r.t. θ. Hence, θ under μ_j dominates θ under μ_i in the sense of monotone likelihood ratio (MLR). Therefore, from (13), if the providing conditions hold, (12) holds. □

Since $\partial\pi(\zeta,\theta)/\partial\zeta$ can be considered a p.d.f. of Z for each $\theta\in\Theta$, the condition (14) says that means of the p.d.f. w.r.t $\theta\in\Theta$ coincide among all the agents. Hence, Proposition 1 states if the derivative of the p.d.f. of Z is a decreasing function of $\theta\in\Theta$ in the case that (14) holds, the inequality (12) holds.

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Next proposition says the effect of ambiguity aversion on the demand for insurance.

Proposition 2. Assume the same assumptions of Proposition 1 hold. Then if

(15) $$\frac{\phi'(\zeta)}{\phi(\zeta)} - \frac{L_i'(\zeta)}{L_i(\zeta)} \leq 0 \quad \forall \zeta,$$

an increase in smooth ambiguity aversion increase the demand for insurance.

Proof. Taking expectation under P, the F.O.C. for the optimal demand of insurance is written as $\mathrm{E}[u'(w - Z_j(\zeta))L_j(\zeta)] = 0$. We can easily confirm that $u'(w - Z_j(\zeta))$ is increasing w.r.t. $Z_j(\zeta)$ for each ζ and that $Z_j(\zeta)$ is decreasing w.r.t. ζ if (15) holds from (9). Hence, if any agent i is more ambiguity averse than the agent j, from Lemma 2 and Proposition 1, we obtain the result. □

Remark 2. ϕ is the state price density under the ambiguity neutral measure P and L_i is a likelihood ratio of agent i's subjective probability measure Q_i to P. So that (15) can be interpreted that the market evaluates ambiguous states lower than agent i in terms of the marginal log-price.

Next, we consider the effect of ambiguity aversion on the economic premium principle. Let

(16) $$\phi_0(Z(\omega)) = \frac{\exp\int_0^{Z(\omega)} \rho(\zeta)\mathrm{d}\zeta}{\mathrm{E}\left[\exp\int_0^{Z(\omega)} \rho(\zeta)\mathrm{d}\zeta\right].}$$

That is, $\phi_0(Z(\omega))$ denotes the economic premium principle of Bühlmann (1984) where there exists no ambiguity or all of the agents are ambiguity neutral.

Proposition 3. We assume that all agents are ambiguity neutral or ambiguity averse and at least one of agents is strictly ambiguity averse. Then under the same assumptions of Proposition 1,

(17) $$\mathrm{E}[Z\phi(Z)] > \mathrm{E}[Z\phi_0(Z)].$$

Proof. Since $\mathrm{E}[\phi(Z)] = \mathrm{E}[\phi_0(Z)] = 1$, we show

(18) $$\mathrm{E}[(Z-1)\phi(Z)] > \mathrm{E}[(Z-1)\phi_0(Z)]$$

in order to show (17) holds. From the diffidence theorem (see Corollary 6.1 of Gollier (2001)), (18) holds if the following inequality holds. $(\zeta - 1)\phi(\zeta) > \frac{\phi(1)}{\phi_0(1)}(\zeta - 1)\phi_0(\zeta)$, or equivalently, $(\zeta - 1)\left(\frac{\phi(\zeta)}{\phi_0(\zeta)} - \frac{\phi(1)}{\phi_0(1)}\right) > 0$. That is, we have only to show that sign of $\zeta - 1$ and that of $\left(\frac{\phi(\zeta)}{\phi_0(\zeta)} - \frac{\phi(1)}{\phi_0(1)}\right)$ coincide. For this, it is sufficient to show that the ratio $\phi(\zeta)/\phi_0(\zeta)$ is increasing w.r.t. ζ. From (8) and (16),

(19) $$\left(\frac{\phi(\zeta)}{\phi_0(\zeta)}\right)' = \left(\frac{\phi'(\zeta)}{\phi(\zeta)} - \frac{\phi_0'(\zeta)}{\phi_0(\zeta)}\right)\frac{\phi(\zeta)}{\phi_0(\zeta)} = \Lambda(\zeta)\rho(\zeta)\frac{\phi(\zeta)}{\phi_0(\zeta)}.$$

Here we note that if agent i is ambiguity neutral, φ_i is a linear function. Hence, under the same assumptions of Proposition 1, $L'_i(\zeta)/L_i(\zeta) \geq 0$ from (13). The inequality, holds strictly if agent i is strictly ambiguity averse. So that, since $\Lambda(\zeta) > 0$ from (10), we obtain the result from (19). □

Proposition 3 says that if all agents are ambiguity neutral or ambiguity averse and at least one of agents is ambiguity averse, the aggregate risk is priced higher in the equilibrium compared with the market where all the agent are ambiguity neutral or where there exists no ambiguity.

We immediately obtain the following corollary.

Corollary 1. Under the same assumption of Proposition 3, if the individual risk X_i is positively correlated with the aggregate risk Z, $\mathrm{E}[X_i\phi(Z)] > \mathrm{E}[X_i\phi_0(Z)]$.

Conclusion

In this paper, we derive an equilibrium insurance premium in a pure exchange economy with ambiguity, where agents follow the dual version of the smooth ambiguity model by Iwaki and Osaki (2012). Our premium principle is an extension of the economic premium principle by Bühlmann (1980, 1984) under ambiguity. We conduct some comparative statics on that premium and display such conditions that the presence of ambiguity increases both insurance demand and premium.

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DOING BUSINESS IN COMPREHENSIVE INTERACTIVE INTERDISCIPLINARY MICRO-MACRO ECONOMIC INTERNATIONAL ACCOUNTING ARCHITECTURE OF SERIAL WELL KNOWN GENERAL-GREAT THEORIES

Y=[C+S]=[C+I]=R=PQ=[1/K]{[G-T]+[F-O][1+E]^N}=[1/Z]([X-M]+L-[A/V]{[1+V]^U-1})

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Abstract. *After 2007, volatile market is our global real-life's fact, that must be count for future survival. Turbulence does really predictable, as correction of economic imbalances. Mutually interactive economic factor's algebra will always correcting any dis-equilibrium, soon after perfect information gained. Millions of world's capable arbitragers will quickly come together, to get fast profits, and leave all regressioners at new (stable but no profit) equilibrium.*

Multiple regression is not valid for mutually interactive algebra identity of economic facts. Graphical similarities [P=a+bQ+cQ'+eQ"+fLnQ+eQ^f], is less useful than shorter [Y=C+S=G-T+X-M=PQ]. Sustainable investment, social financing and venture capital need more of: 1)Strong explanable Field Marshall's comprehensive economic architecture, 2)On-line real-time valid data required, 3)Regulated to be exposed and automatically computed.

There is nothing wrong with great economic laws, as the Keynessian "General Theory of Employment, Interest and Money", Paccioli's "Dual Entries T-Account", Adam Smith's "Supply-Demand's Price vs Quantity Tables" with inter-currency "Purchasing Power Parity" in "Fiscal Budget" or "T-Bills vs Monetary Bonds" financing on exponential "Compounding Rates". Now the business suggests attested comprehensive model that able to managing all of factors together, as general of the generals (Field Marshall) dynamic economic architecture, for mutual online real-time global demands:

Y=[C+S]=[C+I]=R=PQ=[1/K]{[G-T]+[F-O][1+E]^N}=[1/Z]([X-M]+L-[A/V]{[1+V]^U-1})

Abbreviations: *A= Achievement or payments (in USD); C= Consumptions; E= Expected interest of local debt; F= Financial bonds; G= Government spending; I= Investments; K= Kind of local reserve; L= Loan or foreign debts (in USD); M= Imports (in USD); N= Number of local debt period; O= Obligation of treasurer; P= Price on weighted average; Q= Quantity of economic agents; R= Revenue or sales; S= Savings; T= Taxes; U= Utilized foreign debt period; V= Valued foreign interest; X= Exposed exports (in USD); Y= Yield or income; Z= Zoned reserve for foreign currency.*

***Keywords**: Interactive, interdisciplinary, comprehensive, global finance risk*

INTRODUCTION

Doing Business in the Global Economy: Sustainable Investment, especially for Venture Capital and Social Financing in our era and the future after 2014, required: 1)More comprehensive General of the generals (Field Marshall) architecture of all the-124 mutually interactive economic models, 2)Mandatory valid public economic data exposed, 3)Published on-line and real-time using Telematics, 4)Automatically computerized and balance adjusted to give the valid, strong and reliable guidances on global economic decision making. 5)Infocomtech*,* now is unavoidable necessity.

Compared to another countries, the *United Kingdom,* BOE (2013) and *United States,* BEA (2013) have larger amounts of detailed economic data, but not yet cross-checked and some times conflicting to other theoretical economic findings. It is clear that all of the bulky data had been provided as addition of facts as [**Y**= **C**+**S**] and rarely derived from other economic implications as [**C**= **Y**-**S**]. If the data are accurate, then we could learn the real economic facts as [**Y** > **[C**+**S**] > [**C**+ **I**]. On the contrary, the in-correct data will mislead us like [**C**] > [**Y**], which is seldom true.

Most of the *respected data* comes from gigantic observation and high speed computer technology, S&P (2013). The S&P 100 Index, a sub-set of the S&P 500®, measures all performances of large top companies in the United States. The Index consist of 100 major, blue chip companies across many industry groups. Individual stock options are listed for each index entity. Standard & Poor's (S&P) is an American financial information company, a division of McGraw Hill financial that publishes potential research and analysis on stocks and bonds. S&P is respected for its stock market indices such as the U.S. based S&P 500, the Canadian S&P/TSX, the Australian S&P/ASX 200, and India's S&P CNX Nifty. S&P is one of the big three credit-rating institution, like the Moody's investor service and Fitch ratings.

PROBLEM STATEMENT:

Lehner's Millenium Economic Problem: The millenium problem, MIT (2013) in economics; had raised by university of Cambridge, Lehner (2012) Hughes Hall ACRN-FRAP 13th: as also said in Cambridge by Yale university expert, Samuelson, L (2013) stated that both econometric and calculus for Economic decision making are obsolete, compared to current information and communication technologies. The *Infocomtech* now is not just a necessity, but could not be avoided to survive, in extremely competitive current and future Telematics global business' circumstances.

Global financial crisis of 2007-2009 and its aftermath have shown us the important interactions between macro-micro economic policies, to establishing the accounting stability, and then also working to construct financial market stability. Creative monetary balance and other policy interventions that proven successful to solve the crisis and establishing the economic recovery, bringing high impact on financial markets and banking institutions. They change financial regulations and legal supervision, including minimum capital and liquidity for financial institutions. They must also transfer their successful monetary strategies to influence the greater macro-micro economic accounting architecture with relevant regulating policies.

Turbulent markets as a context. Over the years 2007-2011, market volatility has risen very rapidly and quickly fell without understandable rational explanation, remaining only high levels of uncertainty and potential volatility, Lehner (2012). As a consequence, traditional planning and forecasting methods are no longer useful, or even erroneous. Increasing complexity in player constellation and market structure causing a fatal and lethal impacts, which make people agree that its risk is at high degree of uncertainty, because existing reliable deterministic models on the micro and macro level could not work on current market reality.

Surprisingly, there is *nothing wrong* with current general great economic theories, which are perfectly accurate at their specific parts. So, what needed now is a more comprehensive general of generals (Field Marshall) interactive practical economic decision making, IJCB (2013), beyond the standard model of both numerical regressions and existing economic theories, Samuelson, L (2013).

Beyond the Standard Model in Economic Behaviour, as stated by expert in 15 August 2013, at Larry Samuelson's Economic discussion series and interviews with Cambridge-INET Institute, exploring today's most challenging economic problems and the need to develop a General of general theories as fututre model. The Millennium Prize problems (that inspiring them) are seven problems in mathematics, stated by the Clay Mathematics Institute in 2000, MIT (2013). Until end of 2013, six of the problems remain unsolved. Correct solution to any of the problems resulting the US$1,000,000 prize each (as a Millennium Prize) awarded by the institute.

LITERATURE REVIEW

Marshall's Microeconomic Market Matrix:

Economic started by purchasing power, that creates [**R**= *Revenue*] matrix, which dictates the [**P**=*Price*] and [**Q**= *Quantity*] matrices, as [**R**=**PQ**]. So then more [**Q**] like in harvest at equal [**R**], will makes prices go down, Marshall (2013). The current [**R**= *Revenues*] are *always less* than maximum *purchasing power*, even though aimed by every economies.

Alfred Marshall optimization was one of the most influential economc idea of his time. In his book, *Principles of Economics* (1890), he taught the simple but dominant economic teachings, which later applied in UK for many years after. It brings the ideas of supply and demand, marginal utility, and costs of production into a comprehensive whole. He is known as one of the founders of economic sciences.

Keynessian IS-LM Money Market:

Similar thing does happen at Keynessian money market, that use [**E**= *Expected Interest*] as the *price of money* at vertical axis and [**Y**= *Income*= gross domestic products or GDP] as *quantity of money* at its horizontal axis for the crossing of both [**IS**= *investment savings*] and [**LM**= *liquidity of money*] curves valid for both transaction, pecuniary and speculative motives, Keyness (2013). There is a strong need for greatly refined of his earlier work on the causes of business cycles, to be widely considered as one of the modern macro economics and the most influential principles.

The Keynesian economics published right after the Great Depression. It brings a revolution, in the economic thinking. Especially challenge the proposition that a market economy tends naturally to restore itself to full employment on its own. As the main idea of Keynesian thought, this effort replace the established classical economics and introduced new concepts. It remains a significant topic of debate until today, (more radical than ever). In the economic turmoil of recent years, this debate is now heated. Now the Keynesian model of economics of Bush and Obama, favors bailouts and other government intervention to try to stabilize the market. On the contrary the Austrian school of economics said, that government intervention is detrimental and favors to let the market solve itself out on its own, with minimum government intervention.

Pigou's Fiscal Political Economy:

In fiscal policy, [**G**= *Government Spending*] is the public cost and [**T**= *Tax*] is the income. 1)More cost than income [**G>T**] is deficit, 2)Equal cost to income [**G=T**] is balance, and 3)Less cost than income [**G<T**] is surplus. [**G<T**] is a better condition even country is not for profit only, Pigou (2013). This fiscal [**G-T**] is a permanent local money supply, resulting strategic impacts. Fiscal budget are commonly need the Parliament's approval.

Pigou taught and influenced many of Cambridge economists, who went on to fill chairs of economics all over the world. His works are particularly on welfare economics, but also include industrial fluctuations, unemployment, public finance, index numbers, and measurement of national output. His reputation was mostly against influential public writers, who use his works to define their own opposing economic ideas. It build the two opposing main economic streams till today.

Friedman's Monetary Liquidity:

If the economic needs more money (expansion), then its treasurer will buy [**F**= *Financial Assets*]. On the contrary when its needs less money (contraction) then it will issue [**O**= *Obligations. of Treasury*]. The [**F-O**] use compound [**E**= *Expected interest*] mechanism at [**N**= *Number*] of effective monetary outstanding period, constructed as [**1**+**E**]^**N**. So then total local monetary liquidity is [**F-O**][1+**E**]^**N,** Friedman (2013). These treasury bills' auction and lender of the last resort function on its contrast, are both important.

Friedman's researches on consumption analysis, monetary history theory, and complex stabilization policy, had made Chicago school of economics, significantly influencing the research agenda of all the economic professions. A survey of economists ranked his work as the second most popular of the twentieth century after Keynes, and The Economist described his work as "the most influential economic ideas of the 20th century, possibly for 21st century also."

Tobin's Money Multiplier:

Surprisingly the total [**G-T**]+**F-O**][1+**E**]^**N** of both Fiscal and Monetary government money are jus a *minority* from the total local money in a country, since most of money are created by its commercial banks while utilizing [**K**= *Kind Fractional Reserve*] with [1/**K**] as multiplier of money, making a total local money of [**1**/**K**]{[**G-T**]+**F-O**][1+**E**]^**N**}, Tobin (2013). This total Government and Commercial Bank's local money is the *purchasing power* and could be used for buying commodities.

Tobin in his work time, served on the council of Economic Advisors and the board of Governors of the Federal Reserve system, and taught both at Harvard and Yale Universities. He developed the ideas of Keynesian economics, and advocated government intervention to stabilize output and avoid recessions. His academic work included fundamental contributions to the study of investment, monetary and fiscal policy and financial markets. He propose

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an econometric model for censored endogenous variables, the well-known "Tobit model", that is seen as useful and received the economic Nobel in 1981.

Smith-Ricardo's Balance of Trade:

Most of the foreign money earned from the Balance of Trade, that [***X***= *Export*] is bigger than [***M***= *Import*]. Smith said that [***X***>***M***] is caused by absolute advantage, Smith (2013), while Ricardo proves that it also work with comparative advantage, Ricardo (2013). In our era the foreign trades are mostly valued in ***USD***, for the US and the rest of the world (including the UK).

Smith was a Scottish moral philosopher and a pioneer of political economy, is best known for two classic works: The Theory of Moral Sentiments (1759), and An Inquiry into the Nature and Causes of the Wealth of Nations (1776). The latter, commonly abbreviated as The Wealth of Nations, is considered his master piece and the first modern work of economics. He is cited as the "father of modern economics" and is still among the most influential thinkers in that field until today.

Ricardo was a UK political economist, one of the most influential of the classical economists, along with Thomas Malthus, Adam Smith, and John Stuart Mill. He was a broker, financial market speculator, who amassed a considerable personal fortune and later, after buying a seat be a member of Parliament. His most important idea was the theory of comparative advantage which suggests that a nation must concentrate solely on industries, in which it is most competitive, then trading with other countries to obtain products which are not produced nationally. His theory contrasts with old free trade concept of absolute advantage, where a nation retains all competitive industries and abandons only those which are not internationally competitive. He promoted the idea of extensive industry specialization by country, to gain competitive and profitable national production.

Fisher's Balance of Debts:

A country might borrow [***L***= *Loan* or *Foreign Debt*], that could be repaid later as [***A***= *Achieved Payment*] at [**V**= *Valued Foreign Interest*] for **U**= [*Utilized Debt Period*] in serial compounded interest of ***L***-[***A***/**V**]{[1+**V**]^**U**-1}. Debt comes only as principal but must be paid as principal plus interest, bigger loan and longer terms will sacrifice the national forex, Fisher (2013).

Fisher works as American neo-classical economist (even later working on debt deflation and been known as the Post-Keynesian). He demosntrates the importance of utility theory and general equilibrium from large rigorous data of multiple free choices in markets, which leading to the development of a theory on capital and interest rates. His research on quantity theory of money, resulting new school of macro economic thoughts called "monetarism." Both Irving Fisher, Milton Friedman and James Tobin are leaders in market mechanism for monetary liquidity stream.

Stiglitz' Balance of Payment:

Together both balance of debt and balance of trade, make a balance of payment as country's cash flow for a basic measure of country survival and sovereignty [***X***-***M***]+***L***-{***A***/**V**]{[1+**V**]^**U**-1}. It is important that improvement in Balance of Trade is bigger than sacrifices in the Balance of Debt, Stiglitz (2013). Foreign debt is useful for short tenure, but dangerous for long period.

Stiglitz was a former senior vice president and chief economist of the World Bank, is a former member and chairman of the Council of Economic Advisers, he also chairman of the U.N. Commission on Reforms of the International Monetary and Financial System (where he oversaw suggested proposals, and commissioned a report on reforming the international monetary and financial system). His work on balance of payment research, granted him the economic Nobel at 2001.

Krugman's Foreign Exchange Reserve:

The balance of payment also follows the [**Z**= *Zoned Forex Reserve Requirement*] with [1/**Z**] as its multiplier effect. So then the forex money in any host country is= [1/**Z**]([***X***-***M***]+***L***-{***A***/**V**] {[1+**V**]^**U**-1}). Only ***A***, ***L***, ***M*** and ***X*** are really a useful foreign exchange, Krugman (2013). Krugman is praised for his contributions to new Trade Theory and new Economic Geography. According to the Nobel committee, the prize was given for his work in explaining patterns of international trade and the geographic concentration of wealth, by examining the effects of economies of scale and of consumer preferences for diverse commodities and currencies available.

Samuelson's Purchasing Power Parity

Based on Keynessian ideas, then the *equilibrium* of local to foreign exchange in its home country for exchange rate is [1/**K**]{[**G**-**T**]+**F**-**O**][1+**E**]^**N**}=[1/**Z**]([***X***-***M***]+***L***-{***A***/**V**]{[1+**V**]^**U**-1}). Fair balance is watched by world-wide arbitrage traders that rapidly come at seconds of imbalances and runaway with profit after seeing a new equilibrium, Samuelson, P (2013).

Samuelson is the first American winning the economic Nobel, that he "has done more than any other common economist to elevate the level of scientific method in economic analyses". They call him as "father of modern economics" and "foremost academic economist of the 20th century". He served as an advisor to Presidents John F. Kennedy and Lyndon B. Johnson, and was a consultant to the United States Treasury, the Bureau of the Budget and the President's Council of Economic Advisers. Samuelson share weekly column for *Newsweek* magazine along with Chicago School economist's Milton Friedman, where they represent opposing sides: Samuelson took the Keynesian perspective on the purchasing power parity, while Friedman represented the Monetarist equilibrium management perspective.

Hayek's General Macroeconomic Model:

On the famous general macro economic model **S**+**T**=**I**+**G**+[***X***-***M***], Hayek suggested differently than Keynessian, although approve its theoretical background, Hayek (2013). Please keep in mind that only the United States had all the numbers in ***USD***, all others always using local currency except for the ***A***, ***L***, ***M*** and ***X*** for their international finance operations.

Hayek's work is best known for strong intention on classical liberalism and with Gunnar Myrdal "pioneering research in the theory of money, on economic fluctuations and penetrating analysis of interdependence economic, as a social and institutional phenomena". He made a major political thoughts for the twentieth century, and its explanation on how changing prices communicate information which enables individuals to synchronize their plans. His work is widely regarded as an important achievement in comprehensive interactive economics.

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HYPOTHESIS:

Lehner-Samuelson's Hypothesis to Millenium Economic Problem

Null Hypothesis, Lehner (2012)

Field Marshall comprehensive economic model is still difficult to construct. Traditional planning and forecasting tools have turned out to be not always applicable, or even erroneous. Inherent complexity in structures and agent relations caused fatal and unforeseen impacts, and some tend to agree that in cases risk once again became uncertainty, because formerly reliable deterministic models on the micro and macro level were invalidated.

Alternative Hypothesis, Samuelson, L (2013)

Yes, the Field Marshall as a comprehensive interactive economic model will be completed soon, beyond the standard model in economic behaviour (Conversations in economics as interviews with Cambridge-INET Institute visitors). The distinguished economists explore some of today's most challenging economic questions and motivating viewers on their exciting research. There is a possibility of the more general than general models.

EXPERIMENT: [2 x 124] Millenium Economic Experiments

(Apppendix 100-120 and Appendix 200-220)

The Findings, after some Theoretical, Causal and Empirical Studies resulting:
Y=[C+S]=[C+I]=R=PQ=[1/K]{[G-T]+[F-O][1+E]^N=[1/Z]([*X*-*M*]+*L*-[*A*/V]{[1+V]^U-1})

For [**A-Z**] abbreviations, except [**B**], [**D**]. [**H**], [**J**], and [**W**], representing mutually interactive impacts between Income, Consumption, Saving, Investments, local Fiscal, local Monetary, local Reserve requirement, balance of Trade, Foreign reserve requirement and balance of foreign Debt, (ECB (2012), Eurostat (2013), Guardian (2013), JSTOR (2013), Llyods (2010), ONS (2013)), in GBP and ***USD*** *rounded magnitudes,* for easier conceptual acceptance (using the ***UK*** in ***Appendix 100-120*** and then later ***US*** Economic figures in ***Appendix 200-220***).

A= Achievement or periodic installment (repayment) of foreign debts= 14.5%**Y**
=14.5% x 1407 Billion **USD**= 204 Billion **USD,** Moody (2013)
C= Consumptions= [**Y**-**S**], according to the Economic theory
=1353 GBP Billion x [1-4.2%]= 1296 GBP Billion, UK (2013)
E= Expected periodic interest of local currency debt, according to the Economic theory= *43 GBP Billion/1407 GBP Billion= 6.00% p.a.,* UK (2013)
F= Financial sector's borrowings from central bank= *228* GBP *Billion,* NAO (2013)
G= Government expenditures= *682* GBP *Billion,* UK (2013)
I= Investments= *30* GBP *Billion,* NAO (2013)
K= Kind of reserve for local currency= *1.50% Average Reserve,* Reserve (2013)
L= Loan principal of foreign debts= *9836 Billion* ***USD,*** UK (2013)
M= Imports of commodities (goods and /or services)= *646 Billion* ***USD,*** UK (2013)
N= Number of local currency debt period, as common practices = *1.5 years (1-2).*
O= Outstanding of local debt of the central bank= *1185* GBP *Billion,* Debt (2013)
P= Price of commodities (goods and /or services) on weighted average,

according to the Economic theory= [**R**/Q]= *2097* GBP/*Pax,* Debt (2013)
Q= Quantity of commodities (goods or services) = *63.23 Million Pax,* UK (2013)
R= Revenue or sales of transaction purchased, [**C+I**]= *1326* GBP *Billion.* UK(2013)
S= Savings, as the Economic theory=1353 GBP Billion x 4.2%= 57 GBP Billion
T= Taxes= *592* GBP *Billion,* UK (2013)
U= Utilized periodic of foreign debts, as common *UK > 20 years.*
V= Valued interest= 42.9 GBP Billion/1.1 GBP Trillion= *3.90% p.a.,* Debt (2013)
X= Exports of commodities (goods and /or services)= *481 Billion* ***USD*****,** UK (2013)
Y= Yield or total income (gross domestic products), = *1353* GBP *Billion,* UK (2013)
Z= Zoned reserve required for reference foriegn currency
=3.00% Average Reserve US, Reserve (2013)

Interactive & Comprehensive Global Macro Economic Architecture

Y= The Impact Interactive Factor Changes to Income

Income, is the consumption and savings chances gained by an agent in a specified period, which is normally expressed in terms of money, Income (2013). In short, for agent as households and individuals, "income is the sum of all the wages, salaries, profits, interests payments, rents and other forms of earnings received, in a specific period of time." In the field of public economics, the term may refer to the accumulation of both monetary and non-monetary consumption ability, which the first (monetary) considered as a proxy for total income.

Interactive macro consumption and saving income utilization had been famous, Dornbusch, Fischer & Startz (2010). The teachings has been a long-standing, leading intermediate macroeconomic theory text since 1978. The latest theories retain most of the text's traditional ideas, including a balanced approach and newest research, to update and simplify the explanation. The new ideas are focused on making the concept even easier to understand. It is a pre-requisite as part of the fundamental principle and important base for the whole economics.

Y= [C+S]=[C+I]=R=PQ=[1/K]{[G-T]+[F-O][1+E]^N=[1/Z]([***X***-***M***]+***L***-[***A***/V]{[1+V]^U-1})

C= The Impact Interactive Factor Changes to Consumption

Consumption, is a very dominant concept in economics and is also learned by many other sciences, Consumption (2013). Economists are specifically focus on the relationship between consumption and income, and therefore in economics the consumption function plays a significant role. Different streams of economists see production and consumption as vary. According to common economists, only the final usage of goods and services by individuals defined as consumption, while other types of cash outflows as fixed investment, intermediate consumption, and government spending etc, are placed in different categories (as consumer choice). Other school of thought see consumption as broad, being the aggregate of all economic activities, except the design, production and marketing of goods and services (selection, adoption, use, disposal and recycling of commodities).

Consumption is the most economic act that people do, but the less recorded as accurate data, Romer (2011). It is always mentioned in the standard text and be a starting point for graduate macroeconomic courses. It helps set the groundwork for students to start doing research in macroeconomics and monetary economics. Formal consumption models are used to present and analyze key ideas and issues, with theoretical analyses supplemented by examples of relevant empirical work, illustrating the ways that theories can be applied and

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tested. This well-respected and well-known consumption concept is very important in the marketplace.

$$\mathbf{C}= [Y-S]= [Y-I]= [R-S]= [R-I]= [PQ-S]= [PQ-I]= [1/K]\{[G-T]+[F-O][1+E]^{N}\}-S$$
$$= [1/K]\{[G-T]+[F-O][1+E]^{N}\}-I= [1/Z]([\underline{\boldsymbol{X}}-\underline{\boldsymbol{M}}]+\underline{\boldsymbol{L}}-[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\})-S$$
$$= [1/Z]([\underline{\boldsymbol{X}}-\underline{\boldsymbol{M}}]+\underline{\boldsymbol{L}}-[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\})-I$$

S= The Impact Interactive Factor Changes to Savings

Saving, is earnings that not spent, or for deferred usages, Saving (2013). Methods of saving include placing money aside in a bank or retirement plan. Saving also includes less expenditure, such as lower costs. In personal finance, saving means low-risk stores of money, as a deposit, against investment (that is more risky). "Saving" differs from "savings". Saving refers to an increase in one's assets or an increase in net worth, whereas the Savings refers to one part of one's assets, usually deposits in bank accounts. It refers to an activity exist over time, as flowing variable. On the contrary savings refers to something that exists at only at one time, as stock variable. Savings is closely tends to investment. By not spending income to buy consumer commodities, it is possible for resources to be used as fixed capital, for factories and machineries. Savings can be vital to increasing the amount of fixed capital sources, which contributes to economic growth.

The UK savings are regularly presented as part of UK's GDP in annual reports, Economics (2012). **S**= **Total Savings**= Disposable Income -Household consumption. The latest UK household savings ratio: Q1 2013 = **4.2%.** This is quite a significant fall from Q3 2012. It is the weakest since Q1 2009 when it was 3.4%.

$$\mathbf{S}= [Y-C]= I= [R-C] =[PQ-C]= [1/K]\{[G-T]+[F-O][1+E]^{N}\}-C=[1/Z]([\underline{\boldsymbol{X}}-\underline{\boldsymbol{M}}]+\underline{\boldsymbol{L}}-[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\})-C$$

I= The Impact Interactive Factor Changes to Investments

Investment, has different function in finance and economics. In economics, it is the accumulation of newly gained physical entities, like factories, machinery, houses, or goods inventories, Investment (2013). In finance, investment is placing money into asset with expectation of value appreciation, dividends, and/or interest gains. This not always be backed by research and analysis. Most or all types of investment involve some type of risks, such as placement in equities, property, and even fixed earning securities are also facing the inflation risk. It is a must for project investors to identify and manage the risks possibilities of the investment.

All UK investment data could be found at the office of national statistics, ONS (2013). **I**= Investments= Business investment in seasonally adjusted terms rose by £0.3 billion to £30.1 billion (0.9 per cent) when compared with the previous quarter. Business investment increased by £0.9 billion (3.1 per cent) when compared with the second quarter of 2011. Total manufacturing investment rose by £0.2 billion to £3.1 billion (5.9 per cent) when compared with the previous quarter. Total non-manufacturing investment rose by £0.1 billion to £27.0 billion (0.3 per cent) when compared with the previous quarter. Compared with the second quarter of 2011, total manufacturing investment fell by 1.5 per cent; total non-manufacturing investment rose by £0.9 billion (3.6 per cent). All data vailable as tables ofsource.

$$\mathbf{I}= [Y-C]= S= [R-C] =[PQ-C]= [1/K]\{[G-T]+[F-O][1+E]^{N}\}-C=[1/Z]([\underline{\boldsymbol{X}}-\underline{\boldsymbol{M}}]+\underline{\boldsymbol{L}}-[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\})-C$$

Interactive & Comprehensive Global Micro Economic Architecture

R= The Impact Interactive Factor Changes to Revenue or Sales

Revenue, or sales in business is turnover or income that a entity receives from its normal operational activities, usually from the sale of commadities to customers, Revenue (2013). In many countries, revenue is referred to as cashflow. Some business receive revenue from interest, royalties, or other fees. Revenue may refer to accounting income in general, or it may refer to the amount, in terms of money, received within a specific time, as in "Previous year, firm B had sales of $42 million." Profits or net earnings generally imply total income minus total cost in a refered period. In accounting, income is often placed to as the "top line" because its position in the income statement is above and before all. This is against the "bottom line" which means as profit.

There is a strong need to cobine the finance equilibrium to build a more comprehensive accounting balance, Baker, Lembke & King (2010). Advanced Financial Accounting should be an up-to-date, comprehensive, and highly illustrated presentation of the accounting and reporting principles used in a variety of business entities. The explanation should provide strong coverage based on continuous examples that tie all of the disparate details of Advanced Accounting together. It must be more illustrated than just a complete presentations of worksheets, schedules, and financial states. So that readers can see the concept of each topic, including all recent FASB and GASB formats and the continuing willingness of the authoritative bodies provide a current and contemporary text related to the the accounting exam and current practices. The idea is building block approach introduces concepts with simple examples and then gradually adding complexity, while allowing readers to easily keep pace with the material.

$$\mathbf{R}= Y=[C+S]=[C+I]=PQ= [1/K]\{[G-T]+[F-O][1+E]^N\}= [1/Z]([\underline{\boldsymbol{X}}-\underline{\boldsymbol{M}}]+\underline{\boldsymbol{L}}-[\underline{\boldsymbol{A}}/V]\{[1+V]^U-1\})$$

P= The Impact Interactive Factor Changes to Weighted Average Price

Price in common terms is the quantity of payment or exchange given by one party to another in return for commodities, Price (2013). In current economies, it is generally expressed in units of some reference currencies. (For goods and /or services, they are expressed as currency per unit weight of the commodity, e.g. pounds per troy ounce). Even though prices could be stated as amount of other commodities, this sort of barter transaction is rarely occur. Prices are sometimes quoted in terms of notes such as trading stamps and air miles. In some conditions, cigarettes have been used as medium of payment, for example in jails, at times of high inflation, and in some places during Wars. In black market economies, as the stable currency could not be found, barter becomes more common.

Understanding price volatility is also a big problem in the quick changing global market, VIX (2013). **VIX** is a branded symbol, first started by the Chicago Board Options Exchange market volatility index, as common measure of the price volatility of S&P 500 index options. It also refer as *fear index* or as *fear gauge*. It represents measures of market's expectation in stock market volatility for the next 30 days. Beside of their sophisticated composition, critics claim that predictive power of most volatility forecasting models is similar as plain-vanilla measures, which just a simple past volatility. Some works shows that criticizers are failed to implement these complicated models properly. Lot of practitioners and portfolio managers almost ignore or dismiss this volatility predicting models. They remind us that "models are only metaphors or analogies that describe one thing relative to another" and VIX just tracks the inverse of price (as after the fact data) and it has never proven as a reliable predicting tool.

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P= [Y/Q]=[C+S]/Q=[C+I]/Q=[R/Q]= [1/K]{[G-T]+[F-O][1+E]^N}/Q
=[1/Z]([***X***-***M***]+***L***-[***A***/V]{[1+V]^U-1})/Q

Q= The Impact Interactive Factor Changes to Average Quantity

Quantity, is a number that can exist as amount or size. Quantities can be relatively be "more", "less" or "equal", or by employing a numerical value in its unit of measurement, Quantity (2013). Quantity is the basic attribute of things along with quality, substance, change, and relation. In the old term, quantity is refer to any type of numerical properties or status of goods. Some quantities are exist as their inner nature (as amount of UK population), while others functioning as numbers (properties, dimensions, attributes) of cathegory such as heavy and light, long and short, broad and narrow, small and great, or much and little.

Quantity plays important role in the microeconomy, Jehle & Reny (2011). All classic teachings in advanced microeconomic theory, revised and expanded while discussing it. Quantity remains a rigorous, up-to-date element in micro economics, as focus of all the core mathematics and modern theory the advanced economy. Careful development of complex theory, together with clear, patient explanation, search for an efficient theorem-proof ideas regarding its relation to General equilibrium with contingent commodities. Expanded treatment of social choices needs a simplified proof of quantity theorem (in Gibbard-Satterthwaite theorem or Bayesian games). It also needs efficient mechanism design in the quasi-linear utility matrix, for private value environments.

Q= [Y/P]=[C+S]/P=[C+I]/P=[R/P]= [1/K]{[G-T]+[F-O][1+E]^N}/P

=[1/Z]([***X***-***M***]+***L***-[***A***/V]{[1+V]^U-1})/P

Interactive & Comprehensive Local Monetary and Fiscal Architecture

K= The Impact Interactive Factor Changes to Kind of Local Reserve

Both local and foreign money are subject to the fractional reserve requirement, that manage its multiplier effect, Reserve (2013). **K**= Kind of Reserve in UK= 1.5%, **Z**= Zoned Fractional Reserve in US= 3%. The reserve requirement (or cash reserve ratio) is a central bank regulation that implemented by most, but not all, of world's central banks, that sets the minimum fraction of customer deposits and notes that each commercial bank must be deposited as reserves (rather than lend out). These required reserves are mostly in the form of cash stored physically in a bank vault (shelves cash) or deposits made with a central bank. The required reserve ratio is commonly used as a tool in monetary policy, influencing the country's borrowing and interest rates by setting the amount of funds available for banks to make lending.

Fractional-reserve multiplier is the practice whereby a bank retains only a part of its customers' deposits as steadily quick reserves from which to fulfil demands for withdrawals, Kind (2013). Reserves are stored at the bank as currency or recorded as deposits in the bank's receivable at the central bank. The rest of customer-deposited money is used to finance investments or lending that the bank credited to its debtors. Most of these disbursed funds must later redeposit at other banks, for financing another loans. Since bank deposits are seen as money in their own right, fractional-reserve banking allows the money supply to be multiplied (as multiplier of money) adding to the deposited base money originally created and stored at the central bank.

$$\mathbf{K}=\{[G-T]+[F-O][1+E]^{N}\}/Y=\{[G-T]+[F-O][1+E]^{N}\}/\{C+S\}=\{[G-T]+[F-O][1+E]^{N}\}/[C+I]$$
$$=\{[G-T]+[F-O][1+E]\}^{N}/R=\{[G-T]+[F-O][1+E]^{N}\}/[PQ]$$
$$=Z\{[G-T]+[F-O][1+E]^{N}/([\underline{\boldsymbol{X}}-\underline{\boldsymbol{M}}]+\underline{\boldsymbol{L}}-[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\})$$

G= The Interactive Factor Changes to Government Expenditures

Government budgeting had been much more a political balancing rather than economic productive tool, Wessel (2012). A Pulitzer prize-winning columnist, and bestselling author of In Fed we trust, disscus the federal budget: a topic that is fiercely debated today in the halls of congress and media, and yet misunderstood by the American public. In a sweeping narration about the people and the politics behind the budget, he looks at the 2011 fiscal year (which ended September 30). He investigate where all the money actually spent, and why the budget process has grown wildly out of control. He describe it through the eyes of key people: Jacob Lew (White House director of the Office of Management and Budget), Douglas Elmendorf (director of the Congressional Budget Office; Blackstone founder and former Commerce Secretary Pete Peterson); and more. Wessel explains an inside look at the making of the unsustainable US budget.

Moody's analytics debt service ratio for the U.K., Moody (2013), shown that it is improved in the second quarter, falling to 14.1% from 14.5% at the first quarter. A rebound in disposable income helped reduced UK debt servicing burden. Record lower borrowing costs are also helping. The UK ratio is likely to trend lower at coming quarters. It mostly work for forex money, but influencing the larger than necessary local debts committed by the UK treasury.

$$\mathbf{G}=T+KY-[F-O][1+E]^{N}=T+K[C+S]-[F-O][1+E]^{N}=T+K[C+I]-[F-O][1+E]^{N}$$
$$=T+KR-[F-O][1+E]^{N}=T+KPQ-[F-O][1+E]^{N}$$
$$=T+[K/Z]([\underline{\boldsymbol{X}}-\underline{\boldsymbol{M}}]+\underline{\boldsymbol{L}}-[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\})-[F-O][1+E]^{N}$$

T= The Impact Interactive Factor Changes to Taxes

Taxation is far more than just data. It is a dynamic competitive comparison as a result of the political strategy, Kaplow (2010). There is a strong need of a unified conceptual framework for analyzing taxation: It is important as been systematically developed in several decades. Sincere treatment of the subject is far than just a textbook synthesis. Some needs new analysis that generates novel results, including some that change the long-standing conventional wisdom. The fresh approach should change the tax thinking, research, and teaching for decades to come. Combining the work of James Mirrlees, Anthony Atkinson and Joseph Stiglitz, in the spirit of A. C. Pigou, William Vickrey, and Richard Musgrave, it must steps back to particular lines of inquiry to consider the field as a whole, including the relationships among different fiscal possibility options.

It also need a progressive framework that makes it able to rigorously examine both distributive and distortionary effects of specific policies beside their complex interactions to others. Various changing, ranging from commodity or estate needed to translate taxation to regulation. Public matter provision, must be combined with a fair adjustment of income tax. The distribution-neutral reform package could be much more constant to play the distinctive aspects of the policy for achieving that. Applying this common methodology on disparate items, could resulting significant cross-benefits and income solutions to help previously unsolvable taxation problems.

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T =G-{KY-[F-O][1+E]^N}= G-{K[C+S]-[F-O][1+E]^N}= G-{K[C+I]-[F-O][1+E]^N}
=G-{KR-[F-O][1+E]^N}= G-{KPQ-[F-O][1+E]^N)}
=G-[K/Z]([***X-M***]+***L***-[***A***/V]{[1+V]^U-1}) +[F-O][1+E]^N

F= The Impact Interactive Factor Changes to Financial Bonds

The UK treasury had shown the monetary lending figure, NAO (2013). F= Financial Investments= As at March 2012, the total outstanding support stood at £228 billion (down from the year before of £456 billion and peak of £1.2 trillion). Modelling the monetary financing is challenging, Champ, Freeman & Haslag (2011). The approach of this model is to explain monetary economics using the classical paradigm of rational players in a market setting.

Very often monetary economics has been seen as a collection of facts about existing institutions to be memorized. On the contrary, the expert aim to explain not only its monetary policies and institutions that exist today, but also in what policies and institutions may or should exist in the future. The need is simple and clear monetary frame work, then apply this model consistently to a wide variety of monetary questions. Experts add new function of money as a tool to replacing imperfect social record keeping, to stronger role of currency in banking, with descriptions of the policies implemented to deal with banking crises after 2007.

F =O+{KY-[G-T]}/[1+E]^N= O+{K[C+S]-[G-T]}/[1+E]^N= O+{K[C+I]-[G-T]}/[1+E]^N
= O+{KR-[G-T]}/[1+E]^N= O+{KPQ-[G-T]}/[1+E]^N
= O+[K/Z]([***X-M***]+***L***-[***A***/V]{[1+V]^U-1})/[1+E]^N -[G-T]/[1+E]^N

O= The Impact Interactive Factor Changes to Organized T-Bills

Country treasurer might pull significant money out from the economy (contraction) by selling the government bonds to public, Debt (2013). UK Debts Clock, a Complete Guide to Britain's National Debt Crisis, **O**= Obligation Bonds= The UK public debt is the total quantity of money borrowed by the Government of the United Kingdom at any one time through the issue of securities by the UK Treasury and other government agencies. As of Q1 2013 UK government debt amounted to £1,377 billion, or 91% of total GDP.

Obligation of government local debt is the government bonds created as local currency obligation, sold as monetary auction in money market, Local (2013). Government debt (also known as public obligation and local debt) is the debt owed by a central government (except in U.S. and other federal states, "government debt" also refer to the debt of a state or provincial government, municipal or local government). An annual "government deficit" mean bigger difference between government receipts and spending in a single year (increase of debt over a specific year). Government obligation is also a method of financing government operations, among many others. Governments can also create money to monetize their debts, and avoiding the need to pay interest. This practice simply reduces government interest costs rather than truly canceling government debt, but will suffer hyper inflation if used on significant magnitude.

O = F-{KY-[G-T]}/[1+E]^N= F-{K[C+S]-[G-T]}/[1+E]^N= F-{K[C+I]-[G-T]}/[1+E]^N
= F-{KR-[G-T]}/[1+E]^N= F-{KPQ-[G-T]}/[1+E]^N
= F-[K/Z]([***X-M***]+***L***-[***A***/V]{[1+V]^U-1})/[1+E]^N +[G-T]/[1+E]^N

E= The Impact Interactive Factor Changes to Expected Local Interests

Monetary authority may pull the money out (contraction) or injecting more money (expansion), using the interest market mechanism, Debt (2013). Again UK Debts Clock, mentioned that Interest on UK Debt= 42.9 GBP/year, on **O**= Obligation Bonds= The UK public deb**t,** as the total quantity of money borrowed by the Government of the United Kingdom at any time through issue of bonds by the UK Treasury and other government agencies.

Expected interest is the process in which the monetary authority of a nation manage its supply of money, often expectting a basic rate of interest for the purpose of promoting economic growth and stability, Monetary (2013). The main goals usually to stabilize the prices and more employment. Basic interest provides insight into how to act optimal in the specific monetary condition. Expected interest use for both expansionary or contractionary option. Expansionary policy adding the total supply of money in the economy more rapidly than normal, while contractionary policy reduce the money supply to be less than usual or even shrinking. Expansionary is used to reduce unemployment by lowering interest rates, hoping that easy credit make businesses expanding. Contractionary strategy aimed to slow inflation to avoid distortions of more expensive asset values.

E= ({KY-[G-T]}/[F-O])^[1/N]-1 =({K[C+S]-[G-T]}/[F-O])^[1/N]-1= ({K[C+I]-[G-T]}/[F-O])^[1/N]-1
= ({KR-[G-T]}/[F-O])^[1/N]-1= ({KPQ-[G-T]}/[F-O])^[1/N]-1
=(([K/Z]([***X-M***]+***L***-[***A***/V]{[1+V]^U-1})-[G-T])/[F-O]})^[1/N]-1

N= The Impact Interactive Factor Changes to Number of Bonds' Period

Number of debt tenor is very important in both local and foreign financing, Tenor (2013). The number of time left for the repayment of a loan or contract or the initial periodic length of a loan. Number of period can be expressed in years, months or days. Period is used interchangeably with "maturity", although tenure is not commonly used to describe the terms of fixed-income instruments such as government bonds and corporate bills. Instead, non-standardized policies like insurance contracts and bank credits tend to be described in terms of tenure.

Timing is extremely important, Amin & Asikin (2011, 1). Time, whether people like it or not, is essential as a non renewable resource. It is the necessary ingredient of life, but should be managed very-very well, because no addition could be given to it. So then, please use it very carefully. On the other hand, the management plans, do, act and re-check their activities within time. The higher means more importance they do, more responsibility and consequences involved.

N= Ln({KY-[G-T]}/[F-O])/Ln[1+E]= Ln({K[C+S]-[G-T]}/[F-O])/Ln[1+E]
= Ln({K[C+I]-[G-T]}/[F-O])/Ln[1+E]= Ln({KR-[G-T]}/[F-O])/Ln[1+E]
= Ln({KPQ-[G-T]}/[F-O])/Ln[1+E]= Ln(([K/Z]([***X-M***]+***L***-[***A***/V]{[1+V]^U-1})-[G-T])/[F-O])/Ln[1+E]

Interactive & Comprehensive Inter Currency Finance Architecture

Z= The Impact Interactive Factor Changes to Zoned Foreign Reserve

At the time being, no fractional reserve applied by both US and UK, but at the average past data US= 3% and Uk= 1.5% (US 2013). Z= Zoned Fractional Reserve= US Reserve Requirement= 3% at the average. Of less than $12.4 million have no minimum reserve requirement; Between $12.4 million and $79.5 million must have a liquidity ratio of 3%;

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Exceeding \$79.5 million must have a liquidity ratio of 10%. The global finance risk could be understood as accounting perspective of multiple T-accounts in a single M-account, Hoyle, Schaefer & Doupnik (2012). We must have a well-balanced appreciation of the Accounting phenomenon.

The field is containing many aspects, although often focuses on past controversies than future solutions. We must continues to show the development of financial reporting as myriads of products of intense and considered debate that continues today and into the future. We must comprehend a wider financial concepts because they already dominated by T-accounts. We have to make every effort to ensure that the various data styles remains interacting, and consistent with leading text in the Advanced Accounting reports, including an increase integration of IFRS as well as the updated GAAP accounting standards.

$$\mathbf{Z}= ([\underline{X}-\underline{M}]+\underline{L}-[\underline{A}/V]\{[1+V]^{U}-1\})/Y= ([\underline{X}-\underline{M}]+\underline{L}-[\underline{A}/V]\{[1+V]^{U}-1\})/[C+S]$$
$$=([\underline{X}-\underline{M}]+L-[\underline{A}/V]\{[1+V]^{U}-1\})/[C+I]= ([\underline{X}-\underline{M}]+\underline{L}-[\underline{A}/V]\{[1+V]^{U}-1\})/R$$
$$=([\underline{X}-\underline{M}]+\underline{L}-[\underline{A}/V]\{[1+V]^{U}-1\})/[PQ]= K([\underline{X}-\underline{M}]+\underline{L}-[\underline{A}/V]\{[1+V]^{U}-1\}) /\{[G-T]+[F-O][1+E]^{N}\}$$

X= The Impact Interactive Factor Changes to Export (in Forex)

Export means selling the goods and services out of the port of a country. The shipper of such goods and services is referred to as an "exporter" who is based in the country that selling whereas the overseas based buyer is referred to as an "importer". In International Trade, "exports" refers to selling commodities produced in the home country to other markets, Export (2013).

Comparison of exports had been widely provided, even though very vary with some that are conflicting, JSTOR (2013). There is a digital library containing some digitized printed issues. It includes books, primary references, and current issues of journals. It provides full-text searches of almost 2,000 journals. More than 8,000 institutions in more than 160 countries have access to JSTOR; most access is by subscription, but some older public domain content is freely available to anyone, and in 2012 JSTOR launched a program providing limited no-cost access to old articles for individual scholars and researchers who register.

$$\underline{\boldsymbol{X}}= \underline{\boldsymbol{M}}+ZY-\underline{\boldsymbol{L}}+[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\}= \underline{\boldsymbol{M}}+Z[C+S]-\underline{\boldsymbol{L}}+[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\}$$
$$= \underline{\boldsymbol{M}}+Z[C+I]-\underline{\boldsymbol{L}}+[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\}= \underline{\boldsymbol{M}}+ZR-\underline{\boldsymbol{L}}+[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\}= \underline{\boldsymbol{M}}+ZPQ-\underline{\boldsymbol{L}}+[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\}$$
$$= \underline{\boldsymbol{M}}+[Z/K]\{[G-T]+[F-O][1+E]^{N}\}-\underline{\boldsymbol{L}}+[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\}$$

M= The Impact Interactive Factor Changes to Imports (in Forex)

Import is commodity brought into a jurisdiction, especially across a trade border, from an external source, Import (2013). Buyer of the exotic commodity is called *importer*. An import in the buying country is an export from the selling country. Importation and exportation are the defining forex transactions of balance of trade. In international trade, export-import are limited by import quotas and mandates from the customs authority. Some importing and exporting jurisdictions impose a tariff (tax) on the items. Importation and exportation of goods are subject to trade agreements between the international trading jurisdictions.

Best-selling exports need in-depth theory and practical applications of forex comparison, Madura (2011). It includes the fundamental principles of corporate finance in international arena, to provide the timely information and contemporary insights needed to prosper in today's global business environment. It needs discussions on a wide range of managerial topics using a strong corporate perspective, especially the financial reform and its impact on the international finance today. Strong emphasis on the most recent financial changes and industry trends further preparing all the market players to understand and effectively manage within the dynamic field of international finance.

$$\underline{\boldsymbol{M}}= \underline{\boldsymbol{X}}-(ZY-\underline{\boldsymbol{L}}+[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\})= \underline{\boldsymbol{X}}-(Z[C+S]-\underline{\boldsymbol{L}}+[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\})$$
$$= \underline{\boldsymbol{X}}-(Z[C+I]-\underline{\boldsymbol{L}}+[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\})= \underline{\boldsymbol{X}}-(ZR-\underline{\boldsymbol{L}}+[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\})$$
$$=\underline{\boldsymbol{X}}-(ZPQ-\underline{\boldsymbol{L}}+[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\})= \underline{\boldsymbol{X}}-([Z/K]\{[G-T]+[F-O][1+E]^{N}\}-\underline{\boldsymbol{L}}+[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\})$$

L= The Impact Interactive Factor Changes to Foreign Loans (Debts)

Loan or external debt (or foreign debt) is that part of the total country debt that is will be collected by creditors outside the country. The debtors could be a government, corporations or private households, Loan (2013). The debt includes money owed to private commercial banks, other governments, or international institutions such as the International Monetary Fund (IMF) and World Bank. Note that the use of gross liability figures greatly distorts the ratio for countries which contain major money centers. It applied for United Kingdom, because of London's role as a major money centre, with its net international investment position.

Bank of England provide a more detail UK financial data, BOE (2013). Even though too formal and leee used, the ***UK International Reserves and Foreign Currency Liquidity*** data are published on a monthly basis in accordance with the IMF/G10's Special Data Dissemination Standard (SDDS) using the IMF International Reserves Template. Summary data are published by HMT in a monthly press release, and on third working day every month.

$$\underline{\boldsymbol{L}}= ZY-[\underline{\boldsymbol{X}}-\underline{\boldsymbol{M}}]+[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\}= Z[C+S]-[\underline{\boldsymbol{X}}-\underline{\boldsymbol{M}}]+[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\}$$
$$= Z[C+I]-[\underline{\boldsymbol{X}}-\underline{\boldsymbol{M}}]+[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\}= ZR-[\underline{\boldsymbol{X}}-\underline{\boldsymbol{M}}]+[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\}= ZPQ-[\underline{\boldsymbol{X}}-\underline{\boldsymbol{M}}]+[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\}$$
$$= [Z/K]\{[G-T]+[F-O][1+E]^{N}\}-[\underline{\boldsymbol{X}}-\underline{\boldsymbol{M}}]+[\underline{\boldsymbol{A}}/V]\{[1+V]^{U}-1\}$$

A= The Impact Interactive Factor Changes to Achieved Loan Installments

Achievement of foreign debt productivity to make repayment in foreign currency is essential, Eichengreen (2008). *Globalized Capital* remains an indispensable part of the economic practices today. Leading economist as Barry Eichengreen, emphasizes the importance of the international monetary system for understanding the international economy. Brief and lucid, *Globalizing Capital* is the current fact for economists, but also a general audience of historians, political scientists, professionals in government and business, and anyone with a broad interest in international relations.

Economist demonstrates that the international monetary system can be understood and effectively governed, only if it is seen as a historical phenomenon from the period of the gold standard to today's world of fluctuating prices. This extension gives the effect of floating exchange rates and contains a new chapter on the Asian financial crisis, the birth of euro, future of the dollar, and related topics. Our economic shows how these and other recent developments can be put in perspective only once their political and historical contexts are understood.

$$\underline{\boldsymbol{A}}= V\{[\underline{\boldsymbol{X}}-\underline{\boldsymbol{M}}]+\underline{\boldsymbol{L}}-ZY\}/\{[1+V]^{U}-1\}= V\{[\underline{\boldsymbol{X}}-\underline{\boldsymbol{M}}]+\underline{\boldsymbol{L}}-Z[C+S]\}/\{[1+V]^{U}-1\}$$
$$= V\{[\underline{\boldsymbol{X}}-\underline{\boldsymbol{M}}]+\underline{\boldsymbol{L}}-Z[C+I]\}/\{[1+V]^{U}-1\}= V\{[\underline{\boldsymbol{X}}-\underline{\boldsymbol{M}}]+\underline{\boldsymbol{L}}-ZR\}/\{[1+V]^{U}-1\}= V\{[\underline{\boldsymbol{X}}-\underline{\boldsymbol{M}}]+\underline{\boldsymbol{L}}-ZPQ\}/\{[1+V]^{U}-1\}$$
$$= V([\underline{\boldsymbol{X}}-\underline{\boldsymbol{M}}]+\underline{\boldsymbol{L}}-[Z/K]\{[G-T]+[F-O][1+E]^{N}\})/\{[1+V]^{U}-1\}$$

U= The Impact Interactive Factor Changes to Utilized Period of Debts

Utilized period of loans and financial obligations lasting over one year. Long-term debt for a firm would include any financing or leasing installment that are to come due in a greater than

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12-month period. Such obligations would include corporate bond issues or long-term leases that have been capitalized on a firm's balance sheet, Utilized (2013). Bank loans and financing loans, in addition to bonds and notes that have maturities greater than one year, would be considered long-term debt. Other securities such as repos and commercial papers would not be long-term debt, because their maturities are typically shorter than one year.

The great eternal mystery in human live time is the sacred purpose as our mission to utilize this life time as the place for both: (1)Worship, (2)Wealth and (3)Warfare. In doing the Worship, we must do the ZIKR= Zerobase, Iman (Faith), Konsisten (Consistency) and R= Result Oriented. (Amin & Asikin, 2011,2)

U= Ln(1+[V/***A***]{[***X***-***M***]+***L***-ZY})/Ln[1+V]= Ln(1+[V/***A***]{[***X***-***M***]+***L***-Z[C+S]})/Ln[1+V]

= Ln(1+[V/***A***]{[***X***-***M***]+***L***-Z[C+I]})/Ln[1+V]= Ln(1+[V/***A***]{[***X***-***M***]+***L***-ZR})/Ln[1+V]

=Ln(1+[V/***A***]{[***X***-***M***]+***L***-ZPQ})/Ln[1+V]=Ln(1+[V/***A***]([***X***-***M***]+L-[Z/K]{[G-T]+[F-O][1+E]^N}))/Ln[1+V]

EXPERIMENTAL PRIMARY RESULT

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from [2x124] experiments (***Appendix 100-120*** and ***Appendix 200-220***), show that both ***UK*** and ***US*** economic problems are basically economic dis-Equilibrium, caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No Automatic computerized real time input for Field Marshall teleconomatics

DEEPER EXPERIMENTS:

The 7 Finance Risk and Accounting Perspectives

Econometric Rex' 6666 Formulas:

Common Econometric Conceptual Error is forgetting MEASURE *dimensions,* IBWM (2013). Saying Revenue (in GBP) as function of Price (GBP/Unit), Promotion (GBP), Population (Pax), Competitor (Firms), SP100 (S&P 2013) and Value index, VIX (2013), are Numerically and Econometrically logic, but Its dimensional measure [GBP+Pax+Unit+Firm] is *totally wrong*. Econometric has 6,666 formulas of Six Sigma quality of Linear, Square and Cubic regression possibilities, Asikin (2013 a), similar to Econometric books' suggestions, Acemoglu (2013), it is clear that only unclear relations could be regressed. Then certain interactive comprehensive economic model relations such as

Y=[C+S]=[C+I]=R=PQ=[1/K]{[G-T]+[F-O][1+E]^N}=[1/Z]([*X*-*M*]+*L*-[*A*/V]{[1+V]^U-1})

must be constructed in precise constellation in interactive algebraic format, Amemiya (1985). Main features of a thorough treatment of cross-section models, including qualitative response models, censored and truncated regression models, and Markov and duration models, as well as a rigorous presentation of large sample theory, classical least-squares and generalized least-squares theory, and nonlinear simultaneous equation models, could not help much. Although the treatment is mathematically rigorous, there is no theorem-proof method with simple, intuitively accessible assumptions to enable readers understand the basic structure of each theorem and to generalize it for themselves, depending on their needs and abilities. No simple applications of theorems exist in the form of examples in order to demonstrate their essential points.

None of the standard 6666 econometric formulas in ***Econometric Rex*** could be applied there, neither of papers and commentaries presented at invited symposium sessions of the tenth World Congress of the econometric society, held in Shanghai in August 2010 relevant to summarize and interpret this key developments in economics and econometrics. Especially its future directions, covering both theory and application. Leading specialists in this field, still have problem to provide a unique, accessible survey of progress on the discipline. The applied economics, with specific focuses on finance, political economy, trade and firm dynamics, economic growth, are still fragmented and not yet integrated.

Technoeconomistat's 21 Factors:

The engineering statistics feasibility seen that this Field Marshall comprehensive economics with many mutual influence factors

Y=[C+S]=[C+I]=R=PQ=[1/K]{[G-T]+[F-O][1+E]^N}=[1/Z]([$\underline{X}$-$\underline{M}$]+$\underline{L}$-[$\underline{A}$/V]{[1+V]^U-1})

could be computed and distributed globally as a valid on-line real time public data expose, Asikin (2013 b). Today's information and communication technologies had enable an on-line real-time global world.

For almost a hundred years, "The General Theory of Employment, Interest and Money" from Keyness had fantastically works in Macroeconomics, while three hundred years "Dual Entries T-Account" from Paccioli still dominates the Accounting, also another three hundred years of "Supply-Demand's Price vs Quantity Tables" dominates the Microeconomics, then comes the decade's "Purchasing Power Parity" dominates the inter currency economics. In partial Macroeconomic, ideas of "Fiscal Budget" and "T-Bills vs Monetary Bonds" powerfully works, while "Marketing" reshaping Microeconomics and "Compounding Rates" influencing Accounting and "Linear Regression" be the Econometric statistical background. Although they work impacting each other, people always get surprised when the problem goes to another discipline's.

State Economics' Macro-Micro Accounting:

The valid real time global Economics data should be regulated to be exposed to public, so then

Y=[C+S]=[C+I]=R=PQ=[1/K]{[G-T]+[F-O][1+E]^N}=[1/Z]([$\underline{X}$-$\underline{M}$]+$\underline{L}$-[$\underline{A}$/V]{[1+V]^U-1})

can meet the standard of country governances for the public Economic prosperity purposes, Asikin (2011). It is proven that microeconomic market works in the money supply of macroeconomic fiscal and monetary.

Here is the one line economic constellation but it is the complete most ever! Please kindly look at table of abbreviation+ and browse to some items. It is the only constellation explaining all economic logic and wisdom. This essay is significantly against to any other economic thoughts, dedicated only for all the geniuses and novices in statesmanship as well as politicians. This essay is prohibited and extremely dangerous to people who has only average or medium skills in economics, because this will tell them only the truth of comprehensive fiscal-monetary export-import accouting, integrated supply-demand managerial economic algebra, forex gold marketing and socio-econometric.

Investment Algebra's 69 Models:

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The relevant on-line economics data must be regulated to be exposed in public, so then interactive mutual factor management
$Y=[C+S]=[C+I]=R=PQ=[1/K]\{[G-T]+[F-O][1+E]^\wedge N\}=[1/Z]([\underline{X}-\underline{M}]+\underline{L}-[\underline{A}/V]\{[1+V]^\wedge U-1\})$
would be useful for global sustainable investment and venture capital social financing, Asikin (2010 a). It is clear that multiplication with compounding exponentials (both single and serial) influence the causal economy, works more stronger than any multiple linear regression's complex econometries possible.

Investment experts must deal with the future value, internal rate of return, sinking funds etc. Packaged in complex investment schemes, with just giving few formulas, without proofing the truth of them. As myths, we adopt them without asking. It's even worse now, since the computer had programmed them. So then investors just get shaped to limited options of computerized formats, that they could not check! The most common, but normal unsolvable condition are unexpected changes in rate of growth or in number of investment periods. Those could not be fairly justified by the computerized programs, raising deadly conflicts with investors that had made many managers and front-liners, killed by the unsatisfied investors! This need is not just explaining those formulas, but to advancing them as compact Interactive Investment models, which can make a double or triple complex investment scheme be much easier, shorter, sharper, more accurate, profitable and algebraically proven as mutual interlocking influences between all of its factors!

Finance Architecture's 39 Stock Exchange Drivers

Stock Exchange's Requirement of this Field Marshall comprehensive interactive economics
$Y=[C+S]=[C+I]=R=PQ=[1/K]\{[G-T]+[F-O][1+E]^\wedge N\}=[1/Z]([\underline{X}-\underline{M}]+\underline{L}-[\underline{A}/V]\{[1+V]^\wedge U-1\})$
would be possible to be computed and used by the global public listed firms at stock exchanges, Asikin (2010 b). Its accounting T-balance, must also adjusted to the global market, money and forex equilibriums.

Why finance architectures taught more by McKinsey, than by AIA? (American Institute of Architects)? Architects normally know a little finance and keep quiet. On the contrary, financial expert knows no architecture, but confident to teach finance architecture, without any construction skill, like 5 honest blind men, describing elephant! This is an "Egg of Columbus" on "Picture=1000 words" of Finance "Paccioli's law"! Against and contrast, to many others, we must use IFRS graphics and plenty of box diagrams, making both architects and finance experts, understand the substance better. Now they can exactly composing blue-prints and constructing the 13 (thirteen) sharp finance ratios as required! An easy and simple educational proof of evidences are needed, based on real and current financial facts.

Geometric Finance's Mergers and Acquisitions:

Valid Telematic Economics data should be supportive for corporate merger and acquisition, so then all of
$Y=[C+S]=[C+I]=R=PQ=[1/K]\{[G-T]+[F-O][1+E]^\wedge N\}=[1/Z]([\underline{X}-\underline{M}]+\underline{L}-[\underline{A}/V]\{[1+V]^\wedge U-1\})$
factors would be sufficient for combining two or more firms in mergers and acquisition, Asikin (2010 c). Money, (whether people like it or not) is the most important thing on earth. Of course, money is not everything, but without it everything will be very difficult. Because of that, the finance or money matters, becomes the most dominant factor of our world economy today.

The most important subject in economy is considered to be accounting, neither macro concepts nor managerial tricks and methods. Regretfully this fact is denied by the most prestigious authority. The Sveriges Riksbank prize in economic sciences in memory of Alfred

Nobel has been awarded 41 times to 64 Laureates between 1969 and 2009. Most of them are macro economists or even just mathematicians who developed mostly complex but irrelevant serial statistical analysis of regressions and correlation which just approximating but could not significantly solving our important real economic and financial problems. To make our world better, we must CARE the real finance and economic CADREX, which are now buried below difficult unwieldy complex formats.

Treasury Planology's Multiple Currencies:

Banking design of many currencies needs more comprehensive formula and adjustment of the management
$Y=[C+S]=[C+I]=R=PQ=[1/K]\{[G-T]+[F-O][1+E]^N\}=[1/Z]([\underline{X}-\underline{M}]+\underline{L}-[\underline{A}/V]\{[1+V]^U-1\})$
could be useful to enable better treasury management for optimum banking accounting risk, (Asikin 2010 d).

Our financial future is a very serious matter. Treasury planology and traditional financial analysis is a mutual complimentary matter like the rail-way train and horse rider delivery service. The best courier is the horse rider on a train. Together we could claim for the most beneficial achievement in economic that impacting most of human life is finance. Let give the economic noble to a finance guys, who has relevantly contribute more than the theoretical macro economist. Giving an economic Nobel price for the financial researcher and scientist is an important thing, but we could not just stop there.

The world needs more planned financial improvements. It is our sacred duty to deliver it. Let all of the finance personnel from all over the world join altogether in our holy financial missionaries. We have no resources to fight each other. We still have so many common enemies: poverty, unknown future, mis-management, reporting complexities, difficult and painful financial learning, one or two factors sensitivity analysis, less-useful accounting items, after the fact finance analysis, non-causal linear regression etc.

DEEPER EXPERIMENTAL RESULT

The Field Marshall Comprehensive Interactive Economic Architecture
$Y=[C+S]=[C+I]=R=PQ=[1/K]\{[G-T]+[F-O][1+E]^N\}=[1/Z]([\underline{X}-\underline{M}]+\underline{L}-[\underline{A}/V]\{[1+V]^U-1\})$
had met the other practical Telematic Economic requirements of 1)Econometric Rex' 6666 Formulas, 2)Technoeconomistat's 21 Factors, 3)State Economics' Macro-Micro Accounting, 4)Investment Algebra's 69 Models, 5)Finance Architecture's 39 Stock Exchange Drivers, 6) Geometric Finance's Mergers and Acquisitions, 7)Treasury Planology's Multiple Currencies.

The global financial crisis of 2007-2009 and its aftermath have highlighted the important interactions between macroeconomic policies aimed at fostering economic stability and those aimed at fostering financial market stability, IJCB (2013). Unconventional monetary policies and other policy interventions that have been used to stem the crisis and promote economic recovery have had an impact on financial markets and institutions, while changes to financial regulation and supervision,

including new capital and liquidity requirements for financial institutions, are likely to affect the transmission of monetary policy and interact with other macroeconomic.

Common Econometric Conceptual Error is forgetting MEASURE *dimensions,* IBWM (2013). Saying Revenue (in GBP) as function of Price (GBP/Unit), Promotion (GBP), Population (Pax), Competitor (Firms), SP100, S&P (2013) and Value index, VIX (2013) are numerically and econometrically logic, but their dimensional measure [GBP+Pax+Unit+Firm] is totally wrong. So then this Field Marshall equilibrium will make a *more* and *quicker profit* thru *immediate arbitrages*. The International Bureau of Weights and Measures (French: *Bureau international des poids et mesures*), is an international standards organization, one of three such organisations established to maintain the International System of Units (SI) under the terms of the Metre Convention (*Convention du Mètre*). The organisation is usually referred to by its French initialism, BIPM. The metre-kilogram-second-coulomb (MKSC) and metre-kilogram-second-ampere (MKSA) systems are examples of such systems.

Financial econometric use more financial measures and accounting, than common econometrics, Rachev & Fabozzi (2006), Comprehensive financial econometrics is a quest for models that describe financial time series such as prices, returns, interest rates, and exchange rates. In Financial econometrics, researchers will be introduced to this growing discipline and the concepts and theories associated with it, including background material on probability theory and statistics. The experienced research team uses real-world data where possible and brings in the results of published research provided by investment banking firms and journals. Financial Econometrics clearly explains the techniques presented and provides illustrative examples for the topics discussed.

RESEARCH CONCLUSION

Alternative hypotheses, Samuelson, L (2013), should be accepted and Null hypotheses, Lehner (2012), must rejected, since all the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that [A, C, E, F, G. J, K, L, M, N, O, P, Q, R, S, T, U, V, X, Y and Z) magnitude could be found by average 4 (four) different mutual cross-checked ways with the equal result in the most possible interactive construct to manage all of them:

Y=[C+S]=[C+I]=R=PQ=[1/K]{[G-T]+[F-O][1+E]^N}=[1/Z]([X-M]+L-[A/V]{[1+V]^U-1})

It must be done together with 1)Comprehensive integrated Field Marshall economic architecture (items &standards), 2)Centralized and legal useful valid real-time on-line reliable data sources for business decision, 3)Automatic computerized real time Decision support to use Field Marshall teleconomatics architecture (Teleconomatics). If and only if all the data are correct, all numbers could be precisely known), proven at Appendix 100-120 (UK) and Appendix 200-220 (US):

If and only if all the data are correct: UK's main economic problem are (Fact/Ideal): low-[A=204/279], low-[C=1296/1555], high-[E=5.5%/5%], high-[F=228/178], high-[G=682/592], low-[I=30/778], no-[K=1.5%/4%], equal-[L=9836 /9836], high-[M=646/481], long-[N=1.5/1], high-[O=1185/89], high-[P=2097/1845], low-[Q=63.2/136.4], low-[R=1326/2333], low-[S=57/778], equal-[T=592/592], same-[U=20/20], high-[V=3.9%/3%], same-[X=481/481], low-[Y=1353/2333], and equal-[Z=3%/3%]. It must gradually adjusted to the ideal dynamic proportion, of Field Marshall interactive integrated economic construction, consistently managed:

Y=[C+S]=[C+I]=R=PQ=[1/K]{[G-T]+[F-O][1+E]^N=[1/Z]([<u>*X*</u>-<u>*M*</u>]+<u>*L*</u>-[<u>*A*</u>/V]{[1+V]^U-1})

<u>The better planned proportion suggested by this research for UK economy</u>: 1)The UK economic improvement could starts from [**C**= consumption], that could be increased by 20% to [**C**'= 1256 GBP Billion]; 2)But its saving must be increased from [**S**= 57 GBP Billion] to [**S**'= 778 GBP Billion], 3)So its [**Y**'= **C**'+**S**'= 2333 GBP Billion]. 4)Then its investment [**I**'= **S**'= 778 GBP Billion], 5)With revenue [**R**'= **Y**'= 2333 GBP Billion] as its maximum purchasing power, 6)Since business firms, added to population then its quantity becomes double [**Q**'= 2**Q**= 126 Million Pax], 7)Its average price [**P**'= **Y**'/**Q**'= 1845 GBP /Pax], 8)Its tax assumed as equal [**T**'= **T**= 592 GBP Billion], 9)Then its government spending [**G**'= **T**'= 592 GBP Billion], 10)It gives lower interest base [**E**'= 5% p.a.], 11)At shorter local debts [**N**'= 1 year], 12)At reserve [**K**'= 4%], 13)Its treasurer coul buy finacial instruments [**F**'= 178 GBP Billion], 14)Its treasury obligation [**O**'= 89 GBP Billion], 15)Assuming its export still equal [***X***'= ***X***= 481 Billion ***USD***], 16)With lower import [***M***'= 481 Billion ***USD***], 17)Lower foreign interest [**V**'= 3% p.a.], 18)At equal foreign debt tenure [**U**'= **U**= 20 years], 19)On equal foreign debt [***L***'= ***L***= 9836 Billion ***USD***], at 20)Equal forex reserve [**Z**'= **Z**= 3%], and periodic repayment achieved [***A***'= ***A***= 279 Billion ***USD***]. *Quod erat demonstrandum* in good portion that could be manageable.

If and only if all the data are correct: US's main economic problem are (Fact/Ideal): *high*-[***A***=415/122], *low*-[**C**=10,728/12,874], *high*-[**E**=6.1%/5%], *high*-[**F**=7,346/1,471], *low*-[**G**=1,841/2,293], *low*-[**I**=992/6,437], *no*-[**K**=3%/4%], *double*-[***L***=1,020/2,040], *high*-[***M***=233/193], *long*-[**N**=10/1], *high*-[**O**=7,803/736], *high*-[**P**=35,000/31,000], *low*-[**Q**=314/628], *low*-[**R**=10,952/19,310], *low*-[**S**=372/6,437], *equal*-[**T**=2,293/2,293], *long*-[**U**=20/10], *low*-[**V**=2.1%/4%], *same*-[***X***=193/193], *low*-[**Y**=7,747/19,310], and *equal*-[**Z**=3%/3%]. It must gradually adjusted to the ideal dynamic proportion of Field Marshall interactive integrated construction:
$Y=[C+S]=[C+I]=R=PQ=[1/K]\{[G-T]+[F-O][1+E]^N=[1/Z]([\underline{X}-\underline{M}]+\underline{L}-[\underline{A}/V]\{[1+V]^U-1\})$

The better planned proportion, suggested by this research for US economy: 1)The US economic improvement could starts from [**C**= consumption], that could be increased by 20% to [**C**'= 12,874 Billion ***USD***]; 2)But its saving must be increased from [**S**= 372 Billion ***USD***] to [**S**'= 6,437 Billion ***USD***], 3)So its [**Y**'= **C**'+**S**'= 19,310 Billion ***USD***]. 4)Then its investment [**I**'= **S**'= 6,437 Billion ***USD***], 5)With revenue [**R**'= **Y**'= 19,310 Billion ***USD***] as its maximum purchasing power, 6)Since business firms added to population then its quantity becomes double [**Q**'= 2**Q**= 628 Million Pax], 7)Its average price [**P**'= **Y**'/**Q**'= 31,000 ***USD*** /Pax], 8)Its tax assumed as equal [**T**'= **T**= 2,293 Billion ***USD***], 9)Then its government spending [**G**'= **T**'= 2,293 Billion ***USD***], 10)It gives higher interest base [**E**'= 5% p.a.], 11)At shorter local debts [**N**'= 1 year], 12)At reserve [**K**'= 4%], 13)Its treasurer coul buy finacial instruments [**F**'= 1,471 Billion ***USD***], 14)Its treasury obligation [**O**'= 736 Billion ***USD***], 15)Assuming its export still equal [***X***'= ***X***= 193 Billion ***USD***], 16)With lower import [***M***'= 193 Billion ***USD***], 17)Lower foreign interest [**V**'= 4% p.a.], 18)At equal foreign debt tenure [**U**'= **U**= 10 years], 19)On equal foreign debt [***L***'= ***L***= 2,040 Billion ***USD***], at 20)Equal forex reserve [**Z**'= **Z**= 3%], and periodic repayment achieved [***A***'= ***A***= 122 Billion ***USD***]. *Quod erat demonstrandum* in good proportion.

It is proven that telematic economic confirming all requirements of the: 1)*Econometric Rex*' 6666 Formulas, 2)*Technoeconomistat*'s 21 Factors, 3)*State Economics*' Macro-Micro Accounting, 4)*Investment Algebra*'s 69 Models, 5)*Finance Architecture*'s 39 Stock Exchange Drivers, 6)*Geometric Finance*'s Mergers and Acquisitions, 7)*Treasury Planology*'s Multiple Currencies data.

If exist dis-equilibrium, (both at UK and /or US optimization), it caused by:
1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics.

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APPENDIX 100-120: UK Data Analyses *for the Field Marshal (general of generals) Economic Construction:*

The UK Data 2013

Findings, after some Theoretical, Causal and Empirical test, resulting construct:
Y=[C+S]=[C+I]=R=PQ=[1/K]{[G-T]+[F-O][1+E]^N=[1/Z]([X-M]+L-[A/V]{[1+V]^U-1})

For **A-Z** abbreviation (Except the **B, D, H, J**), representing Interactive Relation between Income, Consumption, Saving, Investments, Local Fiscal, Local Monetary, Local Reserve Requirement, Balance of Trade, Foreign Reserve Requirement and Balance of Foreign Debt. (CIA (2011), Debt (2013), ECB (2012), Eurostat (2013), Guardian (2013), JSTOR (2013), Llyods (2010), ONS (2013)), in GBP and ***USD*** *rounded number* for easier conceptual acceptance. In this research, we ***assume that all the official data are correct***.

A= Achievement or periodic installment of foreign debts= 14.5%Y=*14.5% x 1407 Billion USD =204 Billion USD,* (Moody (2013)
C= Consumptions= [Y-S], according to the Economic theory=*1353 GBP Billion* x *[1-4.2%] = 1296 GBP Billion*
E= Expected periodic interest of local currency debt, according to the Economic theory= *43 GBP Billion/1407 GBP Billion= 6.00 % p.a.*
F= Financial sector's borrowings from the central bank= *228* GBP *Billion,* NAO (2013)
G= Government expenditures= *682* GBP *Billion,* UK (2013)
I= Investments= *30* GBP *Billion,* NAO (2013)
K= Kind of reserve required for reference local currency= *1.50% Average Reserve,* Reserve (2013)
L= Loan principal of foreign debts= *9836 Billion USD,* UK (2013)
M= Imposed total imports of commodities (goods and /or services)= *646 Billion USD,* UK (2013)
N= Number of local currency debt period, as common practices= *1.5 years (1-2 years).*
O= Outstanding of local currency debt of the central bank=*1185* GBP *Billion,* Debt (2013)
P= Price of commodities (goods and /or services) on weighted average, according to the Economic theory= [R/Q]= *2097* GBP*/Pax,* Debt (2013)
Q= Quantity of commodities (goods and /or services) for UK population *= 63.23 Million Pax,* UK (2013)
R= Revenue or sales of transaction purchased, [C+I]=*1326* GBP *Billion,* UK (2013)
S= Savings, according to the Economic theory=*1353 GBP Billion* x *4.2%= 57 GBP Billion*
T= Taxes=*592* GBP *Billion,* UK (2013)
U= Utilized periodic of foreign debts, as common *UK >20 years.*
V= Valued periodic interest of foreign debts= 42.9 GBP Billion/1.1 GBP Trillion = *3.90% p.a.,* Debt (2013)
X= Exposed total exports of commodities (goods and /or services)= *481 Billion USD,* UK (2013)
Y= Yield or total income (gross domestic products)= *1353* GBP *Billion,* UK (2013)
Z= Zoned reserve required for reference foriegn currency=*3.00% Average Reserve US,* Reserve (2013)

If and only if all the data are correct: ***UK***'s main economic problem are (Fact/Ideal): *low*-[**A**=204/279], *low*-[**C**=1296/1555], *high*-[**E**=5.5%/5%], *high*-[**F**=228/178], *high*-[**G**=682/592], *low*-[**I**=30/778], *no*-[**K**=1.5%/4%], *equal*-[**L**=9836/9836], *high*-[**M**=646/481], *long*-[**N**=1.5/1], *high*-[**O**=1185/89], *high*-[**P**=2097/1845], *low*-[**Q**=63.2/136.4], *low*-[**R**=1326/2333], *low*-[**S**=57/778], *equal*-[**T**=592/592], *same*-[**U**=20/20], *high*-[**V**=3.9%/3%], *same*-[**X**=481/481], *low*-[**Y**=1353/2333], and *equal*-[**Z**=3%/3%]. It must gradually adjusted to the ideal dynamic proportion of Field Marshall interactive integrated economic construction:

Y=[C+S]=[C+I]=R=PQ=[1/K]{[G-T]+[F-O][1+E]^N=[1/Z]([*X*-*M*]+*L*-[*A*/V]{[1+V]^U-1})

The better planned proportion, suggest by this research for UK economy:1)The UK economic improvement could starts from [**C**= consumption], that could be increased by 20% to [**C**'= 1256 GBP Billion]; 2)But its saving must be increased from [**S**= 57 GBP Billion] to [**S**'= 778 GBP Billion], 3)So its [**Y**'= **C**'+**S**'= 2333 GBP Billion]. 4)Then its investment [**I**'= **S**'= 778 GBP Billion], 5)With revenue [**R**'= **Y**'= 2333 GBP Billion] as its maximum purchasing power, 6)Since business firms added to population then its quantity becomes double [**Q**'= 2**Q**= 126 Million Pax], 7)Its average price [**P**'= **Y**'/**Q**'= 1845 GBP /Pax], 8)Its tax assumed as equal [**T**'= **T**= 592 GBP Billion], 9)Then its government spending [**G**'= **T**'= 592 GBP Billion],

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10)It gives lower interest base [**E**'= 5% p.a.], 11)At shorter local debts [**N**'= 1 year], 12)At reserve [**K**'= 4%], 13)Its treasurer coul buy finacial instruments [**F**'= 178 GBP Billion], 14)Its treasury obligation [**O**'= 89 GBP Billion], 15)Assuming its export still equal [***X***'= ***X***= 481 Billion ***USD***], 16)With lower import [***M***'= 481 Billion ***USD***], 17)Lower foreign interest [**V**'= 3% p.a.], 18)At equal foreign debt tenure [**U**'= **U**= 20 years], 19)On equal foreign debt [***L***'= ***L***= 9836 Billion ***USD***], at 20)Equal forex reserve [**Z**'= **Z**= 3%], and periodic repayment achieved [***A***'= ***A***= 279 Billion ***USD***]. *Quod erat demonstrandum* in good portion.

The UK Income 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [**Y**= *Income or GDP*] magnitude could be found by 3 (three) or 4 (four) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data), then all the 3 (three) different method stated that [**Y**= 1326 GBP Billion]. Only the income data source, monetary and international equilibrium give different result, because neither of them seriously managing the [**Y**= Income]. If exist dis-Equilibrium for [**Y**], it might be caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **Y=[C+S]** rule: *To motivate the UK increasing its GDP income*

If all of these known data are true: The UK [**Y**= Income]= [**C+S**]= 1296 GBP Billion + 57 GBP Billion= 1353 GBP Billion.

Benefit of **Y=[C+I]** rule: *To motivate the UK utilizing its income*

If all of these known data are true: The UK [**Y**= Income]= [**C+I**]= 1296 GBP Billion +30 GBP Billion= 1326 GBP Billion.

Benefit of [**Y=R**] rule: *To show possibility of UK maximum puchasing power*

If all of these data are true: Since the UK has [**C+I**] smaller than [**C+S**], then its maximum purchasing power is [**Y=R**]= [**C+I**]= 1326 GBP Billion.

Benefit of [**Y=PQ**] rule: *To show the opportunity to distribute the UK income*

If all of these data are true: [**Y**= Income]= 2097 GBP /Pax x 63.2 Million Pax= 1326 GBP Billion.

Benefit of **Y=[1/K]{[G-T]+[F-O][1+E]^N}** rule: *Shows UK income placebo*

If all of these data are true: Then [**Y**= Income]= [1/1.5%] x {[682 GBP Billion -592 GBP Billion] +[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5}= -63,135 GBP Billion

Benefit of **Y=[1/Z]([*X-M*]+*L*-[*A*/V]{[1+V]^U-1})** rule: *UK forex*

If all of these data are true: [**Y**= Income]= [1/3%] x ({[481 Billion ***USD*** -646 Billion ***USD***] +9836 Billion ***USD*** -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1})= 121,964 Billion ***USD***

The UK Consumption 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [**C**= *Consumption*] magnitude could be found by 4 (four) or 6 (six) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then all the 5 (five) different method stated that [**C**= 1296 GBP Billion]. Only the monetary and international equilibrium give different result, because neither of them seriously managing the [**C**= Consumption]. If exist dis-Equilibrium for [**C**], it might be caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **C=[Y-S]** rule: *To motivate the UK erradicating its consumptions*

If all of these known data are true: The UK [**C**= Consumption]= [**Y-S**]= 1353 GBP Billion - 57 GBP Billion= 1296 GBP Billion.

Benefit of **C=[Y-I]** rule: *To prevent the UK increasing consumptions*

If all of these known data are true: The UK [**C**= Consumption]= [**Y-I**]= 1353 GBP Billion -30 GBP Billion= 1323 GBP Billion.

Benefit of **C=[R-S]** rule: *To motivate the UK controlling its consumptions*

If all of these known data are true: The UK [**C**= Consumption]= [**R-S**]= 1323 GBP Billion -57 GBP Billion= 1269 GBP Billion.

Benefit of **C=[R-I]** rule: *To motivate the UK limiting its consumptions*

If all of these known data are true: The UK [**C**= Consumption]= [**R-I**]= 1323 GBP Billion -30 GBP Billion= 1293 GBP Billion.

Benefit of **C=[PQ-S]** rule: *To manage the UK consumptions*

If all of these data are true: The UK [**C**= Consumption]= [**PQ-S**]= 2097 GBP/Pax x 63.23 Million Pax -57 GBP Billion = 1269 GBP Billion.

Benefit of **C=[PQ-I]** rule: *To make the UK consumption efficient*

If all of these data are true: The UK [**C**= Consumption]= [**PQ-I**]= 2097 GBP/Pax x 63.23 Million Pax -30 GBP Billion = 1296 GBP Billion.

Benefit of **C=[1/K]{[G-T]+[F-O][1+E]^N}-S** rule: *UK limit consumption*

If all of these data are true: [**C**=Consumption]= [1/1.5%] x {[682 GBP Billion -592 GBP Billion] +[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5} -57 GBP Billion = -63,192 GBP Billion

Benefit of **C=[1/K]{[G-T]+[F-O][1+E]^N}-I** rule: *UK utilizes consumptions*

If all of these data are true: [**C**= Consumption]= [1/1.5%] x {[682 GBP Billion -592 GBP Billion] +[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5} -30 GBP Billion= -63,165 GBP Billion

Benefit of **C=[1/Z]([*X-M*]+*L*-[*A*/V]{[1+V]^U-1})-S** rule: *UK forex consume*

If all of these data are true: Then [**C**= Consumption]= [1/3%] x ({[481 Billion ***USD*** -646 Billion ***USD***] +9836 Billion ***USD*** -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) -57 GBP Billion= 121,964 Billion ***USD*** -57 GBP Billion= 121,861 Billion ***USD*** (at GBP= 1.8 USD rate)

Benefit of **C=[1/Z]([*X-M*]+*L*-[*A*/V]{[1+V]^U-1})-I** rule: *UK forex consume*

If all of these data are true: Then [**C**= Consumption]= [1/3%] x ({[481 Billion ***USD*** -646 Billion ***USD***] +9836 Billion ***USD*** -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) -30 GBP Billion= 121,964 Billion ***USD*** -30 GBP Billion= 121,910 Billion ***USD*** (at GBP= 1.8 USD rate)

The UK Savings 2013

It is proven that alternative hypothesis, Samuelson, L 2013, should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [**S**= *Savings*] magnitude could be found by 3 (three) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then all the 3 (three) different method stated that [**S**= 30 GBP Billion]. Only the saving data source, monetary and international equilibrium give different result, because neither of them seriously managing the [**S**= Savings]. If exist dis-Equilibrium for [**S**], it caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid Real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **S=[Y-C]** rule: *To motivate the UK increases its savings*

If all of these known data are true: The UK [**S**= Savings]= [**Y-C**]= 1353 GBP Billion -1296 GBP Billion= 57 GBP Billion.

Benefit of **[S=I]** rule: *To motivate the UK invested savings*

If all of these known data are true: The UK [**S**= Savings]= 30 GBP Billion.

Benefit of **S=[R-C]** rule: *To motivate the UK retains its savings*

If all of these known data are true: The UK [**S**= Savings]= [**R-C**]= 1326 GBP Billion -1296 GBP Billion= 30 GBP Billion.

Benefit of **S= [PQ-C]** rule: *To motivate the UK utilizing its savings*

If all of these data are true: The UK [**S**= Savings]= [**PQ-C**]= 2097 GBP/Pax x 63.23 Million Pax -1296 GBP Billion= 30 GBP Billion.

Benefit of **S=[1/K]{[G-T]+[F-O][1+E]^N}-C** rule: *Help UK gain savings*

If all of these data are true: Then [**S**= Savings]= [1/1.5%] x {[682 GBP Billion -592 GBP Billion] +[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5} -1296 GBP Billion= -64,431 GBP Billion

Benefit of **S=[1/Z]([*X-M*]+*L*-[*A*/V]{[1+V]^U-1})-C** rule: *UK forex savings*

If all of these data are true: Then [**S**= Savings]= [1/3%] x ({[481 Billion ***USD*** -646 Billion ***USD***] +9836 Billion ***USD*** -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) -1296 GBP Billion= 121,934 Billion ***USD*** -1296 GBP Billion= 119,631 Billion ***USD*** (at GBP= 1.8 USD rate)

The UK Investments 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [**I**= *Investments*] magnitude could be found by 4 (four) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 2 (two) method stated that [**I**= 57 GBP Billion] and the other 2 (two) method stated that [**I**= 30 GBP Billion], which means that only 53% of UK's [**S**=Savings] are actually invested. Only the monetary and international equilibrium give different result, because neither of them seriously managing the [**I**= Investments]. If exist dis-Equilibrium for [**I**], might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **I=[Y-C]** rule: *To motivate the UK increases its investments*

If all of these known data are true: The UK [**I**= Investments]= [**Y-C**]= 1353 GBP Billion -1296 GBP Billion= 57 GBP Billion.

Benefit of **[I=S]** rule: *To motivate the UK increases its investments*

If all of these known data are true: UK [**I**= Investments]= 57 GBP Billion.

Benefit of **I= [R-C]** rule: *To motivate the UK allocate its investments*

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If all of these data are true: The UK [**I**= Investments]= [**R**-**C**]= 1326 GBP Billion -1296 GBP Billion= 30 GBP Billion.

Benefit of **I= [PQ-C]** rule: *To motivate the UK elevates its investments*

If all of these data are true: The UK [**I**= Investments]= [**PQ-C**]= 2097 GBP/Pax x 63.23 Million Pax -1296 GBP Billion = 30 GBP Billion.

Benefit of **I=[1/K]{[G-T]+[F-O][1+E]^N}-C** rule: *UK stronger investments*

If all of these data are true: [**I**= Investments]= [1/1.5%] x {[682 GBP Billion -592 GBP Billion] +[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5}-1296 GBP Billion = -64,431 GBP Billion

Benefit of **I=[1/Z]([*X-M*]+*L*-[*A*/V]{[1+V]^U-1})-C** rule: *Help UK get forex* ***If all of these data are true:*** Then [**I**= Investments]= [1/3%] x ({[481 Billion ***USD*** - 646 Billion ***USD***] +9836 Billion ***USD*** -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) -1296 GBP Billion= 218,239 Billion ***USD*** (at GBP= 1.8 USD rate)

The UK Revenue 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [**R**= *Revenue*] magnitude could be found by 4 (four) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 2 (two) method stated that [**R**= 1353 GBP Billion] and the other 2 (two) method stated that [**R**= 1326 GBP Billion], which is more realistic, since only 53% of UK's Savings are invested. Only the monetary and international equilibrium give different result, because neither of them seriously managing the [**R**= Revenue]. If exist dis-Equilibrium for [**R**], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **R=[Y]** rule: *To increase the UK market revenue*

If all of these known data are true: UK [**R**= Revenue]= 1326 GBP Billion.

Benefit of **R=[C+S]** rule: *To motivate the UK elevate its revenue*

If all of these known data are true: UK [**R**= Revenue]= [**C+S**]= 1296 GBP Billion +57 GBP Billion= 1353 GBP Billion.

Benefit of **R=[C+I]** rule: *To motivate the UK gaining more revenue*

If all of these known data are true: UK [**R**= Revenue]= [**C+I**]= 1296 GBP Billion +30 GBP Billion= 1326 GBP Billion.

Benefit of **R= [PQ]** rule: *To motivate the UK elevates its market revenue*

If all of these known data are true: The UK [**R**= Revenue]= [**PQ**]= 2097 GBP/Pax x 63.23 Million Pax= 1326 GBP Billion.

Benefit of **R=[1/K]{[G-T]+[F-O][1+E]^N** rule: *UK strengthen its revenue*

If all of these known data are true: UK [**R**= Revenue]= [1/1.5%] x {[682 GBP Billion -592 GBP Billion] +[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5}= -63,135 GBP Billion

Benefit of **R=[1/Z]([*X-M*]+*L*-[*A*/V]{[1+V]^U-1})** rule: *UK better revenue*

If all of these known data are true: UK [**R**= Revenue]= [1/3%] x ({[481 Billion ***USD*** -646 Billion ***USD***] +9836 Billion ***USD*** -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1})= 121,964 Billion ***USD***

The UK Price 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [**P**= *Prices*] at average could be found by 4 (four) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 2 (two) method stated that [**P**= 2140 GBP /Pax] and the other 2 (two) method stated that [**P**= 2097 GBP /Pax], which is more realistic, since only 53% of UK's Savings are invested.. Only the monetary and international equilibrium give different result, because neither of them seriously managing the [**P**= Prices]. If exist dis-Equilibrium for [**P**], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **P=[Y/Q]** rule: *To identify the UK price quotation*

If all of these known data are true: The UK [**P**= Prices]= [**Y/Q**] = 1353 GBP Billion /63.23 Million Pax= 2140 GBP /Pax.

Benefit of **P=[C+S]/Q** rule: *To motivate the UK control its prices*

If all of these known data are true: The UK [**P**= Prices]= The UK [**P**]= Prices= [**C+S]/Q**= [1296 GBP Billion +57 GBP Billion] /63.23 Million Pax= 2140 GBP /Pax.

Benefit of **P=[C+I]/Q** rule: *To motivate the UK manage its prices*

If all of these known data are true: The UK [**P**= Prices]= [**C+I]/Q**= [1296 GBP Billion +30 GBP Billion] /63.23 Million Pax= 2097 GBP/Pax.

Benefit of **P= [R/Q]** rule: *To the UK elevates its price competitiveness*

If all of these known data are true: The UK [**P**= Prices]= [**R/Q**]= 1326 GBP Billion /63.23 Million Pax= 2097 GBP Billion/Pax.

Benefit of **P=[1/K]{[G-T]+[F-O][1+E]^N}/Q** rule: *help UK attract buyers*

If all of these known data are true: [**P**= Prices]= [1/1.5%] x {[682 GBP Billion -592 GBP Billion] +[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5} /63.2 Million Pax= -99,850 GBP /Pax

Benefit of **P=[1/Z]([*X-M*]+*L*-[*A*/V]{[1+V]^U-1})/Q** rule: *UK manage*

If all of these known data are true: The UK [**P**= Prices]= [1/3%] x ({[481 Billion ***USD*** -646 Billion ***USD***] +9836 Billion ***USD*** -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) /63.2 Million Pax= 192,889 ***USD*** /Pax

The UK Quantity 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [**Q**= *Quantity*] at average could be found by 4 (four) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 2 (two) method stated that [**Q**= 64.5 Million Pax] and the other 2 (two) method stated that [**Q**= 63.2 Million /Pax] , which is more realistic, since only 53% of UK's Savings are invested. Only the monetary and international equilibrium give different result, because neither of them seriously managing the [**Q**= Quantity]. If exist dis-Equilibrium for [**Q**], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **Q=[Y/P]** rule: *To identify the UK quantity size*

If all of these known data are true: The UK [**Q**= Quantity]= [**Y/P**] = 1353 GBP Billion /2097 GBP /Pax= 64.5Million Pax.

Benefit of **Q=[C+S]/P** rule: *To motivate the UK control its quantity offers*

If all of these known data are true: The UK [**Q**= Quantity]= [**C+S**]/**P**= [1296 GBP Billion +57 GBP Billion] /2097 GBP/Pax= 64.5Million Pax.

Benefit of **Q=[C+I]/P** rule: *To motivate the UK manage its quantity packages*

If all of these known data are true: The UK [**Q**= Quantity]= [**C+I**]/**P**= [1296 GBP Billion +30 GBP Billion] /2097 GBP/Pax= 63.2 Million Pax.

Benefit of **Q= [R/P]** rule: *To motivate the UK utilize its market quantiy*

If all of these known data are true: The UK [**Q**= Quantity]= [**R/P**]= 1326 GBP Billion /2097 GBP /Pax= 63.2 Million Pax.

Benefit of **Q=[1/K]{[G-T]+[F-O][1+E]^N}/P** rule: *UK providing choices*

If all of these known data are true: [**Q**= Quantity]= [1/1.5%] x{[682 GBP Billion -592 GBP Billion] +[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5} /2097 GBP/Pax= -30,107 Million Pax

Benefit of **Q=[1/Z]([*X-M*]+*L*-[*A*/V]{[1+V]^U-1})/P** rule: *UK forex quantity*

If all of these known data are true: The UK [**Q**= Quantity]= [1/3%] x ({[481 Billion ***USD*** -646 Billion ***USD***] + 9836 Billion ***USD*** -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) /2097 GBP /Pax= 104,690 Million Pax (at GBP= 1.8 USD rate)

The UK Local Reserve 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [**K**= *Kind of local reserve*] at average could be found by 5 (five) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 3 (three) method stated that [**K**= -71%] and the other 2 (two) method stated that [**K**= -70%], which mean that UK's economi needs to turn its direction and set greater fractional reserve. Only the international equilibrium give different result, because neither of them seriously managing the [**K**= Kind of local reserve]. If exist dis-Equilibrium for [**K**], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **K={[G-T]+[F-O][1+E]^N}/Y** rule: *To set UK effective multiplier*

If all of these known data are true: [**K**= Kind of local reserve]= {[682 GBP Billion -592 GBP Billion] +[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5} /1353 GBP Billion= -70%.

Benefit of **K={[G-T]+[F-O][1+E]^N}/(C+S)** rule: *UK control its multiplier*

If all of these known data are true: The UK [**K**= Kind of local reserve]= {[682 GBP Billion -592 GBP Billion] + [228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5} /[1296 GBP Billion +57 GBP Billion]= -70%.

Benefit of **K={[G-T]+[F-O][1+E]^N/(C+I)** rule: *UK use its multiplier*

If all of these known data are true: The UK [**K**= Kind of local reserve]= {[682 GBP Billion -592 GBP Billion] +[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5} /[1296 GBP Billion +30 GBP Billion]= -71%.

Benefit of **K={[G-T]+[F-O][1+E]^N/R** rule: *UK manage its multiplier*

If all of these known data are true: [**K**= Kind of local reserve]= {[682 GBP Billion -592 GBP Billion] +[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5} /1326 GBP Billion= -71%.

Benefit of **K={[G-T]+[F-O][1+E]^N/(PQ)** rule: *UK stabilize its multiplier*

If all of these known data are true: The UK [**K**= Kind of local reserve]= {[682 GBP Billion -592 GBP Billion] +[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5} /[63.2 Million Pax x 2097 GBP /Pax]= -71%.

Benefit of **K=Z{[G-T]+[F-O][1+E]^N}/([X-M]+L -[A/V]{[1+V]^U-1})**

If all of these known data are true: The UK [**K**= Kind of local reserve]= 3% x {[682 GBP Billion -592 GBP Billion] +[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5} /({[481 Billion ***USD*** -646 Billion ***USD***] +9836 Billion ***USD*** -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1})= -1.40%. (at GBP= 1.8 USD rate)

The UK Government Spending 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [**G**= *Government spending*] magnitude could be found by 5 (five) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), 5 (five) method stated that [**G**= 1649 GBP Billion] is better for UK's economy. Only the international equilibrium give different result, because neither of them seriously managing the [**G**= Government spending]. If exist dis-Equilibrium for [**G**], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **G=T+KY-[F-O][1+E]^N** rule: *To set UK optimum public expense*

If all of these known data are true: [**G**= Government spending]= 1.5% x 1353 GBP Billion - [228 GBP Billion - 1185 GBP Billion] x [1+5.5%]^1.5 + 592 GBP Billion= 1649 GBP Billion

Benefit of **G=T+K[C+S]-[F-O][1+E]^N** rule: *Let UK financing its market*

If all of these known data are true: The UK [**G**= Government spending]= 1.5% x [1296 GBP Billion +57 GBP Billion] -[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5 + 592 GBP Billion= 1649 GBP Billion

Benefit of **G=T+K[C+I]-[F-O][1+E]^N** rule: *UK's government purchase*

If all of these known data are true: The UK [**G**= Government spending]= 1.5% x [1296 GBP Billion +30 GBP Billion] -[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5} +592 GBP Billion= 1649 GBP Billion

Benefit of **G=T+KR-[F-O][1+E]^N** rule: *Help UK utilize its purchase*

If all of these known data are true: The UK [**G**= Government spending]= 1.5% x 1326 GBP Billion -[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5} +592 GBP Billion= 1649 GBP Billion

Benefit of **G=T+KPQ-[F-O][1+E]^N** rule: *Help UK empower spending*

If all of these known data are true: The UK [**G**= Government spending]= 1.5% x [2097 GBP /Pax +63.2 Million Pax] -[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5} +592 GBP Billion= 1649 GBP Billion

Benefit of **G=T+[K/Z]([X-M]+L-[A/V]{[1+V]^U-1}) -[F-O][1+E]^N** rule:

If all of these known data are true: The UK [**G**= Government spending]= [1.5% /3%] x ({[481 Billion ***USD*** -646 Billion ***USD***] +9836 Billion ***USD*** -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) -{[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5} +592 GBP Billion}= 4762 Billion ***USD*** (at GBP= 1.8 USD rate)

The UK's Tax 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [**T**= *Tax*] magnitude could be found by 5 (five) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 5 (five) method stated that [**T**= -375 GBP Billion], which means that current UK's does not need to be taxed. Only the international equilibrium give different result, since neither of them seriously managing the [**T**= Tax]. If exist dis-Equilibrium for [**T**], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **T=G-{KY-[F-O][1+E]^N}** rule: *To set UK optimum tax collection*

If all of these known data are true: The UK [**T**= Tax]= 682 GBP Billion -{1.5% x 1353 GBP Billion -[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5}= -375 GBP Billion

Benefit of **T=G-{K[C+S]-[F-O][1+E]^N}** rule: *To let UK utilizing its taxes*

If all of these known data are true: [**T**= Tax]= 682 GBP Billion -{1.5% x [1296 GBP Billion +57 GBP Billion] -[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5}= -375 GBP Billion

Benefit of **T=G-{K[C+I]-[F-O][1+E]^N}** rule: *To help the UK's productive*

If all of these known data are true: [**T**= Tax]= 682 GBP Billion -{1.5% x [1296 GBP Billion +30 GBP Billion] -[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5}= -375 GBP Billion

Benefit of **T=G-{KR-[F-O][1+E]^N}** rule: *The UK implement fair taxes*

If all of these known data are true: The UK [**T**= Tax]= 682 GBP Billion -{1.5% x 1326 GBP Billion - [228 GBP Billion - 1185 GBP Billion] x [1+5.5%]^1.5} = -375 GBP Billion

Benefit of **T=G-{KPQ-[F-O][1+E]^N}** rule: *UK increase its productivity*

If all of these known data are true: [**T**= Tax]= 682 GBP Billion -{1.5% x [2097 GBP /Pax x 63.2 Million Pax] - [228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5}= -375 GBP Billion

Benefit of **T=G -[K/Z]([X-M]+L-[A/V]{[1+V]^U-1})+[F-O][1+E]^N** rule:

If all of these known data are true: The UK [**T**= Tax]= {682 GBP Billion +[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1.5} -[1.5% /3%] x ({[481 Billion ***USD*** -646 Billion ***USD***] +9836 Billion ***USD*** – [204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1})= -2469 Billion ***USD*** (at GBP= 1.8 USD rate)

The UK's Financial Bonds 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [**F**= *Financial bonds*] magnitude could be found by 5 (five) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 5 (five) method stated that [**F**= 1120 GBP Billion] financing could better for UK. Only the international equilibrium give different result, since neither of them seriously managing the [**F**= Financial bonds]. If exist dis-Equilibrium for [**F**], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards

2)No centralized legal useful valid real-time on-line reliable data for decision

3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **F=O+{KY-[G-T]}/[1+E]^N** rule: *Set UK optimum finance bond*

If all of these known data are true: [**F**= Financial instruments]= 1185 GBP Billion +{1.5% x 1353 GBP Billion - [682 GBP Billion -592GBP Billion]} /[1+5.5%]^1.5= 1121 GBP Billion

Benefit of **F=O+{K[C+S]-[G-T]}/[1+E]^N** rule: *Let the UK utilizing lending*

If all of these known data are true: The UK [**F**= Financial instruments]= 1185 GBP Billion +{1.5% x [1296 GBP Billion +57 GBP Billion] -[682 GBP Billion -592GBP Billion]} /[1+5.5%]^1.5= 1121 GBP Billion

Benefit of **F=O+{K[C+I]-[G-T]}/[1+E]^N** rule: *The UK's fair financing*

If all of these known data are true: The UK [**F**= Financial instruments]= 1185 GBP Billion +{1.5% x [1296 GBP Billion +30 GBP Billion] -[682 GBP Billion -592GBP Billion]} /[1+5.5%]^1.5= 1120 GBP Billion

Benefit of **F=O+{KR-[G-T]}/[1+E]^N** rule: *To motivate the UK lending*

If all of these known data are true: [**F**= Financial instruments]= 1185 GBP Billion +{1.5% x 1326 GBP Billion - [682 GBP Billion -592GBP Billion]} /[1+5.5%]^1.5= 1120 GBP Billion

Benefit of **F=O+{KPQ-[G-T]}/[1+E]^N** rule: *Help UK set liquidity*

If all of these known data are true: The UK [**F**= Financial instruments]= 1185 GBP Billion +{1.5% x [2097 GBP /Pax x 63.2 Million Pax] -[682 GBP Billion -592GBP Billion]} /[1+5.5%]^1.5= 1120 GBP Billion

Benefit of **F=O +([K/Z]([X-M]+L-[A/V]{[1+V]^U-1})-[G-T])/[1+E]^N**

If all of these known data are true: The UK [**F**= Financial instruments]= {1185 GBP Billion +([1.5% /3%] x {[481 Billion ***USD*** -646 Billion ***USD***] +9836 Billion ***USD*** -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1} -{[682 GBP Billion -592 GBP Billion]}) /[1+5.5%]^1.5= 3672 Billion ***USD*** (at GBP= 1.8 USD rate)

The UK's Obligation of Treasurer 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [**O**= *Obligation of treasurer*] magnitude could be found by 5 (five) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 5 (five) method stated that [**O**= 292 GBP Billion] is enough for UK. Only the international equilibrium give different result, since neither of them seriously managing the [**O**= Obligation of treasurer]. If exist dis-Equilibrium for [**O**], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards

2)No centralized legal useful valid real-time on-line reliable data for decision

3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **O=F-{KY-[G-T]}/[1+E]^N** rule: *To set UK optimum obligation*

If all of these known data are true: UK [**O**= Obligation of treasurer]= 228 GBP Billion -{1.5% x 1353 GBP Billion -[682 GBP Billion -592 GBP Billion]} /[1+5.5%]^1.5= 292 GBP Billion

Benefit of **O=F-{K[C+S]-[G-T]}/[1+E]^N** rule: *UK utilizing its obligation*

If all of these known data are true: UK [**O**= Obligation of treasurer]= 228 GBP Billion -{1.5% x[1296 GBP Billion +57 GBP Billion] -[682 GBP Billion -592GBP Billion]} /[1+5.5%]^1.5= 292 GBP Billion

Benefit of **O=F-{K[C+I]-[G-T]}/[1+E]^N** rule: *Help UK's local obligation*

If all of these known data are true: [**O**= Obligation of treasurer]= 228 GBP Billion -{1.5% x [1296 GBP Billion +30 GBP Billion] -[682 GBP Billion -592GBP Billion]} /[1+5.5%]^1.5= 292 GBP Billion

Benefit of **O=F-{KR-[G-T]}/[1+E]^N** rule: *UK implement fair obligation*

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If all of these known data are true: UK [**O**= Obligation of treasurer]= 228 GBP Billion -{1.5% x 1326 GBP Billion -[682 GBP Billion -592GBP Billion]} /[1+5.5%]^1.5= 293 GBP Billion

Benefit of **O=F-{KPQ-[G-T]}/[1+E]^N** rule: *UK manage its obligation*

If all of these known data are true: [**O**= Obligation of treasurer]= 228 GBP Billion -{1.5% x [2097 GBP /Pax x 63.2 Million Pax] -[682 GBP Billion -592GBP Billion]} /[1+5.5%]^1.5= 293 GBP Billion

Benefit of **O=F-([K/Z]([*X-M*]+*L*-[*A*/V]{[1+V]^U-1})-[G-T])/[1+E]^N** rule:

If all of these known data are true: The UK [**O**= Obligation of treasurer]= 228 GBP Billion - ([1.5% /3%] x {[481 Billion ***USD*** -646 Billion ***USD***] +9836 Billion ***USD*** -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1} -{[682 GBP Billion -592 GBP Billion]})/[1+5.5%]^1.5= -1128 Billion ***USD*** (at GBP= 1.8 USD rate)

The UK's Expected Interest 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [**E**= *Obligation of treasurer*] magnitude could be found by 5 (five) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 5 (five) method stated that [**E**= -83%], which means UK interest is too high. Only the international equilibrium give different result, since neither of them seriously managing the [**E**= Obligation of treasurer]. If exist dis-Equilibrium for [**E**], it caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **E=({KY-[G-T]}/[F-O])^[1/N]-1** rule: *UK optimum basic interest*

If all of these known data are true: [**E**= Expected interest]= ({1.5% x 1353 GBP Billion -[682 GBP Billion -592 GBP Billion]} /[228 GBP Billion -1185 GBP Billion])^[1/1.5]-1= -83% p.a.

Benefit of **E=({K[C+S]-[G-T]}/[F-O])^[1/N]-1** rule: *UK keep local interest*

If all of these known data are true: The UK [**E**= Expected interest]= ({1.5% x [1296 GBP Billion + 57 GBP Billion] -[682 GBP Billion -592 GBP Billion]} /[228 GBP Billion -1185 GBP Billion]) ^[1/1.5]-1= -83% p.a.

Benefit of **E=({K[C+I]-[G-T]}/[F-O])^[1/N]-1** rule: *UK's monetary interest*

If all of these known data are true: The UK [**E**= Expected interest]= ({1.5% x [1296 GBP Billion +30 GBP Billion] -[682 GBP Billion -592 GBP Billion]} /[228 GBP Billion -1185 GBP Billion]) ^[1/1.5]-1= -82% p.a.

Benefit of **E=({KR-[G-T]}/[F-O])^[1/N]-1** rule: *The UK interest safety*

If all of these known data are true: [**E**= Expected interest]= ({1.5% x 1326 GBP Billion -[682 GBP Billion -592 GBP Billion]} /[228 GBP Billion -1185 GBP Billion])^[1/1.5]-1= -82% p.a.

Benefit of **E=({KPQ-[G-T]}/[F-O])^[1/N]-1** rule: *Help UK local interest*

If all of these known data are true: The UK [**E**= Expected interest]= ({1.5% x [2097 GBP /Pax x 63.2 Million Pax] -[682 GBP Billion -592 GBP Billion]} /[228 GBP Billion -1185 GBP Billion]) ^[1/1.5]-1= -82% p.a.

Benefit of **E=(([K/Z]([X-M]+L-[A/V]{[1+V]^U-1})-[G-T])/[F-O])^[1/N]-1**

If all of these known data are true: The UK [**F**= Financial instruments]= 228 GBP Billion -([1.5% /3%] x {[481 Billion ***USD*** -646 Billion ***USD***] +9836 Billion ***USD*** – [204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1} -{[682 GBP Billion -592 GBP Billion]}) /[228 GBP Billion -1185 GBP Billion])^[1/1.5]-1= 49% p.a. (at GBP= 1.8 USD rate)

The UK's Number of Debt Period

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [**N**= *Number of debt period*] magnitude could be found by 5 (five) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 5 (five) method stated that [**N**= -49 years] are better for the UK's economy. Only the international equilibrium give different result, since neither of them seriously managing the [**N**= Number of debt period]. If exist dis-Equilibrium for [**N**], it caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **N=Ln({KY-[G-T]}/[F-O])/Ln[1+E]** rule: *UK local debt's period*

If all of these known data are true: [**N**= Number of period]= Ln({1.5% x 1353 GBP Billion -[682 GBP Billion -592 GBP Billion]} /[228 GBP Billion -1185 GBP Billion]) /Ln[1+5.5%]= -49 years.

Benefit of **N=Ln({K[C+S]-[G-T]}/[F-O])/Ln[1+E]** rule: *UK local tenure*

If all of these known data are true: The UK [**N**= Number of period]= Ln({1.5% x [1296 GBP Billion +57 GBP Billion] -[682 GBP Billion -592 GBP Billion]} /[228 GBP Billion -1185 GBP Billion]) /Ln[1+5.5%]= -49 years.

Benefit of **N=Ln({K[C+I]-[G-T]}/[F-O])/Ln[1+E]** rule: *Keep UK's tenure*

If all of these known data are true: The UK [**N**= Number of period]= Ln({1.5% x [1296 GBP Billion +30 GBP Billion] - [682 GBP Billion -592 GBP Billion]} /[228 GBP Billion -1185 GBP Billion]) /Ln[1+5.5%]= -49 years.

Benefit of **N=Ln({KR-[G-T]}/[F-O])/Ln[1+E]** rule: *Keep UK local period*

If all of these known data are true: [**N**= Number of period]= Ln({1.5% x 1326 GBP Billion -[682 GBP Billion -592 GBP Billion]} /[228 GBP Billion -1185 GBP Billion]) /Ln[1+5.5%]= -49 years.

Benefit of **N=Ln({KPQ-[G-T]}/[F-O])/Ln[1+E]** rule: *UK keep debt term*

If all of these known data are true: The UK [**N**= Number of period]= Ln({1.5% x [2097 GBP /Pax x 63.2 Million Pax] -[682 GBP Billion -592 GBP Billion]} /[228 GBP Billion -1185 GBP Billion]) /Ln[1+5.5%]= -49 years.

N=Ln(([K/Z]([X-M]+L-[A/V]{[1+V]^U-1}) -[G-T])/[F-O])/Ln[1+E] rule:

If all of these known data are true: The UK [**N**= Number of period]= Ln(([1.5% /3%] x {[481 Billion ***USD*** -646 Billion ***USD***] +9836 Billion ***USD*** -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) -{[682 GBP Billion -592 GBP Billion]}) /[228 GBP Billion -1185 GBP Billion]) /Ln[1+5.5%]= 11 years. (at GBP= 1.8 USD rate)

The UK's Forex Multiplier 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [**Z**= *Zoned forex multiplier*] magnitude could be found by 5 (five) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 5 (five) method stated that [**Z**= 150%], means too low forex fraction reserve. Only the international equilibrium give different result, sine neither of them seriously managing the [**Z**= Zoned multiplier]. If exist dis-Equilibrium for [**Z**], it caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid Real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **Z=([X-M]+L-[A/V]{[1+V]^U-1})/Y** rule: *UK foreign reserve*

If all of these known data are true: [**Z**= Zoned reserve]= (481 Billion ***USD*** -646 Billion ***USD*** +9836 Billion ***USD*** -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) /1353 GBP Billion= 150 %.

Benefit of **Z=([X-M]+L-[A/V]{[1+V]^U-1})/[C+S]** rule: *UK forex fraction*

If all of these known data are true: The UK [**Z**= Zoned forex reserve]= (481 Billion ***USD*** -646 Billion ***USD*** +9836 Billion ***USD*** -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) /[1296 GBP Billion +57 GBP Billion]= 150%.

Benefit of **Z=([X-M]+L-[A/V]{[1+V]^U-1})/[C+I]** rule: *UK's fx multiplier*

If all of these known data are true: The UK [**Z**= Zoned forex reserve]= (481 Billion ***USD*** -646 Billion ***USD*** +9836 Billion ***USD*** -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) /[1296 GBP Billion +30 GBP Billion]= 153%.

Benefit of **Z=([X-M]+L-[A/V]{[1+V]^U-1})/R** rule: *UK foreign reserve*

If all of these known data are true: [**Z**= Zoned reserve]= (481 Billion ***USD*** -646 Billion ***USD*** +9836 Billion ***USD*** -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) /126 GBP Billion= 153 %.

Benefit of **Z=([X-M]+L-[A/V]{[1+V]^U-1})/[PQ]** rule: *UK use fx reserve*

If all of these known data are true: The UK [**Z**= Zoned forex reserve]= (481 Billion ***USD*** -646 Billion ***USD*** +9836 Billion ***USD*** -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) /[2097 GBP/Pax x 63.2 Million Pax]=153%.

Benefit of **Z=K([X-M]+L-[A/V]{[1+V]^U-1}) /{[G-T]+[F-O][1+E]^N}**

If all of these known data are true: The UK [**Z**= Zoned forex reserve]= 1.5% x (481 Billion ***USD*** - 646 Billion ***USD*** +9836 Billion ***USD*** -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) /{[682 GBP Billion -592 GBP Billion] +[228 GBP Billion -1185 GBP Billion x [1+5.5%]^1,5= -8%. (at GBP= 1.8 USD rate)

The UK's Export 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [***X***= *Export*] magnitude could be found by 5 (five) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 5 (five) method stated that [***X*** = -11416 Billion ***USD***], means UK better not to be cheated in its export. Only the international equilibrium give different result, since neither of them seriously managing the [***X*** = Export]. If exist dis-Equilibrium for [***X***], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of ***X*= *M* +ZY-*L*+[*A*/V]{[1+V]^U-1}** rule: *To keeping UK export*

If all of these known data are true: The UK [***X***= Export]= 3% x1353 Billion ***USD*** +[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) -9836 GBP Billion +204 Billion ***USD***= -11416 Billion ***USD***

Benefit of ***X*= *M* +*Z*[C+S] -*L* +[*A*/V]{[1+V]^U-1})** rule: *Strengthen UK export*

If all of these known data are true: The UK [***X***= Export]= 3% x [1296 GBP Billion +57 GBP Billion] +[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) -9836 GBP Billion +204 Billion ***USD***= -11416 Billion ***USD***

Benefit of ***X*= *M* +*Z*[C+I] -*L* +[*A*/V]{[1+V]^U-1})** rule: *To let UK's export*

If all of these known data are true: [***X***= Export]= 3% [1296 GBP Billion+30 GBP Billion]+ [204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1})-9836 GBP Billion+204 Billion ***USD*** = -11417 Billion ***USD***

Benefit of **X= *M* +ZR-*L* +[*A*/V]{[1+V]^U-1})** rule: *Better UK's export*

If all of these known data are true: The UK [***X***= Export]= 3% x1326 Billion ***USD*** +[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) -9836 GBP Billion +204 Billion ***USD*** = -11417 Billion ***USD***

Benefit of **X= *M* +ZPQ-*L* +[*A*/V]{[1+V]^U-1})** rule: *Help UK earning forex*

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If all of these known data are true: The UK [***X***= Export]= 3% x [2097 GBP/Pax x 63.2 Million Pax]+ [204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) -9836 GBP Billion +204 Billion ***USD*** = -11417 Billion ***USD***

Benefit of **X= *M* +[Z/K]{[G-T]+[F-O][1+E]^N}-*L* +[*A*/V]{[1+V]^U-1}** rule:

If all of these known data are true: The UK [***X***= Export]= [3%/1.5%] x {[682 GBP Billion - 592 GBP Billion] +[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1,5} +[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1] -9836 Billion ***USD*** +646 Billion ***USD*** = -14456 Billion ***USD***. (at GBP= 1.8 USD)

The UK's Import 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [***M***= *Import*] magnitude could be found by 5 (five) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 5 (five) method stated that [***M*** = 12101 Billion ***USD***] is better for UK current economic constellation. Only the international equilibrium give different result, because neither of them seriously managing the [***M*** = Import]. If exist dis-Equilibrium for [***M***], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of ***M*=*X*+*L*-[*A*/V]{[1+V]^U-1})-ZY** rule: *Cover UK import problems*

If all of these known data are true: The UK [***M***= Import]= 481 Billion ***USD*** -3% x1353 GBP Billion -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) +9836 GBP Billion= 12101 Billion ***USD***

Benefit of ***M*=*X*+*L*-[*A*/V]{[1+V]^U-1})-Z[C+S]** rule: *Strengthen UK forex*

If all of these known data are true: The UK [***M***= Import]= 481 Billion ***USD*** -3% x [1296 GBP Billion +57 GBP Billion] - [204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) +9836 GBP Billion= 12101 Billion ***USD***

Benefit of ***M*=*X*+*L*]-[*A*/V]{[1+V]^U-1})-Z[C+I]** rule: *UK's strengthen trade*

If all of these known data are true: The UK [***M***= Import]= 481 Billion ***USD*** -3% x [1296 GBP Billion +30 GBP Billion] -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) +9836 GBP Billion= 12102 Billion ***USD***

Benefit of ***M*=*X*+*L*-[*A*/V]{[1+V]^U-1})-ZR** rule: *Limit the UK's import*

If all of these known data are true: The UK [***M***= Import]= 481 Billion ***USD*** -3% x1326 GBP Billion -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) +9836 GBP Billion= 12102 Billion ***USD***

Benefit of ***M*=*X*+*L*-[*A*/V]{[1+V]^U-1})-ZPQ** rule: *UK make less import*

If all of these known data are true: UK [***M***= Import]= 481 Billion ***USD*** -3% x [2097 GBP/Pax x 63.2 Million Pax] - [204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) +9836 GBP Billion= 12102 Billion ***USD***

Benefit of ***M*=*X*+*L*-[*A*/V]{[1+V]^U-1}-[Z/K]{[G-T]+[F-O][1+E]^N}** rule:

If all of these known data are true: UK [***X***= Export]= 481 Billion ***USD*** -[3%/1.5%] x {[682 GBP Billion -592 GBP Billion]+ [228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1,5} +[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1] +9836 Billion ***USD*** = 27607 Billion ***USD***. (at GBP= 1.8 USD rate)

The UK's Foreign Debt 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [***L***= *Loan or foreign debt*] magnitude could be found by 5 (five) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 5 (five) method stated that [***L*** = -5774 Billion ***USD***], mean UK does not need foreign loan. Only the international equilibrium give different result, since neither of them seriously managing the [***L*** = Loan]. If exist dis-Equilibrium for [***L***], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of ***L*= ZY+[*A*/V]{[1+V]^U-1})-[*X*-*M*]** rule: *Solving UK foreign loans*

If all of these known data are true: [***L***= Loan]= 3% x 1353 GBP Billion -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) -[481 Billion ***USD*** - 646 Billion ***USD***]= -5774 Billion ***USD*** (at GBP= 1.8 USD)

Benefit of ***L*= Z[C+S]+[*A*/V]{[1+V]^U-1})-[*X*-*M*]** rule: *UK foreign loan*

If all of these known data are true: The UK [***L***= Loan]= 3% x [1296 GBP Billion +57 GBP Billion] -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) -[481 Billion ***USD*** -646 Billion ***USD***]= -5774 Billion ***USD*** (at GBP= 1.8 USD rate)

Benefit of ***L*= Z[C+I]+[*A*/V]{[1+V]^U-1})-[*X*-*M*]** rule: *UK's forex debts*

If all of these known data are true: The UK [***L***= Loan]= 3% x [1296 GBP Billion +30 GBP Billion] -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) -[481 Billion ***USD*** -646 Billion ***USD***]= -5775 Billion ***USD*** (at GBP= 1.8 USD rate)

Benefit of ***L*= ZR+[*A*/V]{[1+V]^U-1})-[*X*-*M*]** rule: *Limit UK's foreign debt*

If all of these known data are true: [***L***= Loan]= 3% x 1326 GBP Billion -[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) -[481 Billion ***USD*** -646 Billion ***USD***]= -5775 Billion ***USD*** (at GBP= 1.8 USD)

Benefit of ***L*=ZPQ+[*A*/V]{[1+V]^U-1})-[*X*-*M*]** rule: *UK securing forex debt*

If all of these known data are true: The UK [***L***= Loan]= 3% x [2097 GBP/Pax x 63.2 Million Pax] - [204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) -[481 Billion ***USD*** -646 Billion ***USD***]= -5775 Billion ***USD*** (at GBP= 1.8 USD rate)

Benefit ***L*=[Z/K]{[G-T]+[F-O][1+E]^N}+[*A*/V]{[1+V]^U-1}-[*X-M*]** rule:

If all of these known data are true: The UK [***L***= Loan]= [3%/1.5%] x {[682 GBP Billion -592 GBP Billion] +[228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1,5} +[204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1}) -[481 Billion ***USD*** -646 Billion ***USD***]= 2768 Billion ***USD*** (at GBP= 1.8 USD)

The UK's Debt Repayment 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [***A***= *Achievement or repayment*] magnitude could be found by 5 (five) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 5 (five) method stated that [***A*** = 326 Billion ***USD***], means UK must pay its foreign debt faster. Only the international equilibrium give different result, because neither of them seriously managing the [***A*** = Loan or foreign debt]. If exist dis-Equilibrium for [***A***], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of ***A*= V{[*X-M*]+*L*-ZY}/{[1+V]^U-1}** rule: *To solve UK payment*

If all of these known data are true: The UK [***A***= Achievement]= 3.9% x {[481 Billion ***USD*** -646 Billion ***USD***] +9836 Billion ***USD*** -3% x 1353 GBP Billion} /{[1+3.9%]^20-1}= 326 Billion ***USD*** (at GBP= 1.8 USD rate)

Benefit of ***A*= V{[*X-M*]+*L*-Z[C+S]}/{[1+V]^U-1}** rule: *UK foreign payment*

If all of these known data are true: The UK [***A***= Achievement]= 3.9% x {[481 Billion ***USD*** -646 Billion ***USD***] +9836 Billion ***USD*** -3% x [1296 GBP Billion +57 GBP Billion]} /{[1+3.9%]^20-1}= 326 Billion ***USD*** (at GBP= 1.8 USD rate)

Benefit of ***A*= V{[*X-M*]+*L*-Z[C+I]}/{[1+V]^U-1}** rule: *UK's better payment*

If all of these known data are true: The UK [***A***= Achievement]= 3.9% x {[481 Billion ***USD*** -646 Billion ***USD***] +9836 Billion ***USD*** -3% x [1296 GBP Billion +30 GBP Billion]} /{[1+3.9%]^20-1}= 326 Billion ***USD*** (at GBP= 1.8 USD rate)

Benefit of ***A*= V{[*X-M*]+*L*-ZR}/{[1+V]^U-1}** rule: *UK's foreign payment*

If all of these known data are true: The UK [***A***= Achievement]= 3.9% x {[481 Billion ***USD*** -646 Billion ***USD***] +9836 Billion ***USD*** -3% x 1326 GBP Billion} /{[1+3.9%]^20-1}= 326 Billion ***USD*** (at GBP= 1.8 USD rate)

Benefit of ***A*= V{[*X-M*]+*L*-ZPQ}/{[1+V]^U-1}** rule: *UK does more payment*

If all of these known data are true: The UK [***A***= Achievement]= 3.9% x {[481 Billion ***USD*** -646 Billion ***USD***] +9836 Billion ***USD*** -3% x [2097 GBP/Pax x 63.2 Million Pax]} /{[1+3.9%]^20-1}= 326 Billion ***USD*** (at GBP= 1.8 USD rate)

Benefit of ***A*= V([*X-M*]+*L*-([Z/K]{[G-T]+[F-O][1+E]^N})/{[1+V]^U-1}**

If all of these known data are true: UK [***A***= Achievement]= 3.9% x [481 Billion ***USD*** -646 Billion ***USD***] +9836 Billion ***USD*** -[3%/1.5%] x {[682 GBP Billion -592 GBP Billion]+ [228 GBP Billion - 1185 GBP Billion] x [1+5.5%]^1,5}/[1+3.9%]^20-1}= 12796 Billion ***USD*** (at GBP= 1.8 USD rate)

The UK's Debt Period 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***UK***'s [**U**= *Utilize debt period*] magnitude could be found by 5 (five) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 5 (five) method stated that [**U** = 27.2 years], or UK take unecessary foreign debt. Only the international equilibrium give different result, neither of them seriously managing the [**U** = Utilize debt period]. If exist dis-Equilibrium for [**U**], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **U=Ln(1+[V/*A*]{ZY-[*X-M*]-*L*})/Ln[1+V]** rule: *UK pay schedule*

If all of these known data are true: The UK [***A***= Achievement]= Ln(-[3.9%/204 Billion ***USD***] x {3% x 1353 GBP Billion -[481 Billion ***USD*** -646 Billion ***USD***] -9836 Billion ***USD***}-1) /Ln[1+3.9%]= 27.2 years (at GBP= 1.8 USD rate)

Benefit of **U=Ln(1+[V/*A*]{Z[C+S]-[*X-M*]-*L*})/Ln[1+V]** rule: *UK pay period*

If all of these known data are true: The UK [***A***= Achievement]= Ln(-[3.9%/204 Billion ***USD***] x {3% x [1296 GBP Billion +57 GBP Billion] -[481 Billion ***USD*** -646 Billion ***USD***] -9836 Billion ***USD***}-1) /Ln[1+3.9%]= 27.2 years (at GBP= 1.8 USD rate)

Benefit of **U=Ln(1+[V/*A*]{Z[C+I]-[*X-M*]-*L*})/Ln[1+V]** rule: *To guard UK's*

If all of these known data are true: The UK [***A***= Achievement]= Ln(-[3.9%/204 Billion ***USD***] x {3% x [1296 GBP Billion +30 GBP Billion] -[481 Billion ***USD*** -646 Billion ***USD***] -9836 Billion ***USD***}-1) /Ln[1+3.9%]= 27.2 years (at GBP= 1.8 USD rate)

Benefit of **U=Ln(1+[V/*A*]{ZR-[*X-M*]-*L*})/Ln[1+V]** rule: *To assure the UK's*

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If all of these known data are true: The UK [***A***= Achievement]= Ln(-[3.9%/204 Billion ***USD***] x {3% x 1326 GBP Billion -[481 Billion ***USD*** -646 Billion ***USD***] -9836 Billion ***USD***}-1) /Ln[1+3.9%]= 27.2 years (at GBP= 1.8 USD rate)

Benefit of **U=Ln(1+[V/*A*]{ZPQ-[*X*-*M*]-*L*})/Ln[1+V]** rule: *To help the UK*

If all of these known data are true: The UK [***A***= Achievement]= Ln(-[3.9%/204 Billion ***USD***] x {3% x [2097 GBP/Pax x 63.2 Million Pax] -[481 Billion ***USD*** -646 Billion ***USD***] -9836 Billion ***USD***}-1) /Ln[1+3.9%]= 27.2 years (at GBP= 1.8 USD rate)

U=Ln(1+[V/*A*]([Z/K]{[G-T]+[F-O][1+E]^N}-[*X*-*M*]-*L*)/Ln[1+V] rule:

If all of these known data are true: The UK [***A***= Achievement]= Ln(-[3.9%/204 Billion ***USD***] x {[3%/1.5%] x [682 GBP Billion -592 GBP Billion]+ [228 GBP Billion -1185 GBP Billion] x [1+5.5%]^1,5 -[481 Billion ***USD*** -646 Billion ***USD***] -9836 Billion ***USD***}-1) /Ln[1+3.9%]= 32.7 years (at GBP= 1.8 USD rate)

APPENDIX 200-220: US Data Analyses *for the Field Marshal (general of generals) Economic Construction:*

The US Data 2013

Findings, after some Theoretical, Causal and Empirical test, resulting construct:
Y=[C+S]=[C+I]=R=PQ=[1/K]{[G-T]+[F-O][1+E]^N=[1/Z]([*X*-*M*]+*L*-[*A*/V]{[1+V]^U-1})

For **A-Z** abbreviation (Except the **B, D, H, J**), representing Interactive Relation between Income, Consumption, Saving, Investments, Local Fiscal, Local Monetary, Local Reserve Requirement, Balance of Trade, Foreign Reserve Requirement and Balance of Foreign Debt. (BEA (2013), Mundi (2013), Trading (2013), Treasury (2013), Wiki (2013), Source (2010), Research (2013), Reserve (2013)), all in ***USD*** *rounded number* for easier conceptual acceptance. In this research, we ***assume that all the official data are correct***.

A= Achievement or periodic installment of foreign debts= *415 Billion **USD**,* Treasury (2013)
C= Consumptions= [**Y-S**], according to the Economic theory= *10728 Billion **USD**,* Trading (2013)
E= Expected periodic interest of local currency debt, according to the Economic theory= *6.10 % p.a. **USD**,* Trading (2013)
F= Financial sector's borrowings from the central bank= *7346 Billion **USD**,* Trading (2013)
G= Government expenditures= *1841 Billion **USD**,* Trading (2013)
I= Investments= *992 Billion **USD**,* Mundi (2013)
K= Kind of reserve required for reference local currency= *3.00%*, Trading (2013)
L= Loan principal of foreign debts= *1020 Billion **USD**,* (Wiki 2013)
M= Imposed total imports of commodities (goods and /or services)= *233 Billion **USD**,* Trading (2013)
N= Number of local currency debt period, as common practices= *10 years*, Trading (2013).
O= Outstanding of local currency debt of the central bank=*4803 Billion **USD**,* Trading (2013)
P= Price of commodities (goods and /or services) on average= 35000 ***USD**/Pax*, Trading (2013)
Q= Quantity of commodities (goods and /or services) for US = *313.9 Million Pax,* Source (2013)
R= Revenue or sales of transaction purchased, [**C+I**]=*10952 Billion **USD**,* (Trading 2013)
S= Savings, according to the Economic theory=*372 Billion **USD**,* Research (2013)
T= Taxes=*2293* GBP *Billion*, Wiki (2013)
U= Utilized periodic of foreign debts, as common *US >20 years.*
V= Valued periodic interest of foreign debts= 38.7 Billion ***USD***/[G] = *2.1% p.a.,* Treasury (2013)
X= Exposed total exports of commodities (goods and /or services)= *193 Billion **USD**,* Trading (2013)
Y= Yield or total income (gross domestic products)= *7747 Billion,* Trading (2013)
Z= Zoned reserve required for reference foriegn currency=*3.00% Average Reserve US,* Reserve (2013)

If and only if all the data are correct: US's main economic problem are (Fact/Ideal): *high*-[***A***=415/122], *low*-[**C**=10,728/12,874], *high*-[**E**=6.1%/5%], *high*-[**F**=7,346/1,471], *low*-[**G**=1,841 /2,293], *low*-[**I**=992/6,437], *no*-[**K**=3%/4%], *start*-[***L***=1,020/2,040], *high*-[***M***=233/193], *long*-[**N**=10/1], *high*-[**O**=7,803/736], *high*-[**P**=35,000/31,000], *low*-[**Q**=314/628], *low*-[**R**=10,952/19,310], *low*-[**S**=372/6,437], *equal*-[**T**=2,293/2,293], *high*-[**U**=20/10], *low*-[**V**=2.1%/4%], *same*-[***X***=193/193], *low*-[**Y**=7,747/19,310], and *equal*-[**Z**=3%/3%]. It must gradually adjusted to the ideal dynamic proportion of Field Marshall interactive integrated economic construction:

Y=[C+S]=[C+I]=R=PQ=[1/K]{[G-T]+[F-O][1+E]^N=[1/Z]([*X*-*M*]+*L*-[*A*/V]{[1+V]^U-1})

The better planned proportion, suggest by this research for US economy: 1)The US economic improvement could starts from [**C**= consumption], that could be increased by 20% to [**C**'= 12,874 Billion ***USD***]; 2)But its saving must be increased from [**S**= 372 Billion ***USD***] to [**S**'= 6,437 Billion ***USD***], 3)So its [**Y**'= **C**'+**S**'= 19,310 Billion ***USD***]. 4)Then its investment [**I**'= **S**'= 6,437 Billion ***USD***], 5)With revenue [**R**'= **Y**'= 19,310 Billion ***USD***] as its maximum purchasing power, 6)Since business firms added to population then its quantity becomes double [**Q**'= 2**Q**= 628 Million Pax], 7)Its average price [**P**'= **Y**'/**Q**'= 31,000 ***USD*** /Pax], 8)Its tax assumed as equal [**T**'= **T**= 2,293 Billion ***USD***], 9)Then its government spending [**G**'=

T'= 2,293 Billion ***USD***], 10)It gives higher interest base [**E**'= 5% p.a.], 11)At shorter local debts [**N**'= 1 year], 12)At reserve [**K**'= 4%], 13)Its treasurer coul buy finacial instruments [**F**'= 1,471 Billion ***USD***], 14)Its treasury obligation [**O**'= 736 Billion ***USD***], 15)Assuming its export still equal [***X***'= ***X***= 193 Billion ***USD***], 16)With lower import [***M***'= 193 Billion ***USD***], 17)Lower foreign interest [**V**'= 4% p.a.], 18)At equal foreign debt tenure [**U**'= **U**= 10 years], 19)On equal foreign debt [***L***'= ***L***= 2,040 Billion ***USD***], at 20)Equal forex reserve [**Z**'= **Z**= 3%], and periodic repayment achieved [***A***'= ***A***= 122 Billion ***USD***]. *Quod erat demonstrandum* in good portion.

The US Income 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [**Y**= *Income or GDP*] magnitude could be found by 6 (six) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data), then all the 3 (three) different method averaged that [**Y**= 11,000 Billion ***USD***]. Only the income data source, monetary and international equilibrium give different result, because neither of them seriously managing the [**Y**= Income]. If exist dis-Equilibrium for [**Y**], it might be caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **Y=[C+S]** rule: *To motivate the US increasing its GDP income*
If all of these known data are true: The US [**Y**= Income]= [**C+S**]= 10728 Billion ***USD*** +372 Billion ***USD***= 7,747 Billion ***USD***.

Benefit of **Y=[C+I]** rule: *To motivate the US utilizing its income*
If all of these known data are true: The US [**Y**= Income]= [**C+I**]= 10728 Billion ***USD*** +992 Billion ***USD***= 11,100 Billion ***USD***.

Benefit of [**Y=R**] rule: *To show possibility of US maximum puchasing power*
If all of these data are true: Since the US has [**C+I**] bigger than [**C+S**], then its maximum purchasing power is [**Y=R**]= [C+S]= 11,720 Billion ***USD***.

Benefit of [**Y=PQ**] rule: *To show the opportunity to distribute the US income*
If all of these known data are true: The US [**Y**= Income]= [**PxQ**]= 35000 ***USD*** /Pax x 313.9 Million Pax= 10,952 Billion ***USD***.

Benefit of **Y=[1/K]{[G-T]+[F-O][1+E]^N}** rule: *Shows US income placebo*
If all of these data are true: Then [**Y**= Income]= [1/3%] x {[1841 Billion ***USD*** - 2293 Billion ***USD***] +[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10}= 138,164 Billion ***USD***.

Benefit of **Y=[1/Z]([*X-M*]+*L*-[*A*/V]{[1+V]^U-1})** rule: *US foreign balance*
If all of these data are true: [**Y**= Income]= [1/3%] x ({[193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1})= -306,886 Billion ***USD***

The US Consumption 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [**C**= *Consumption*] magnitude could be found by 4 (four) or 6 (six) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), all the 5 (five) different method average that [**C**= 10,000 Billion ***USD***]. Only the monetary and international equilibrium give different result, because neither of them seriously managing the [**C**= Consumption]. If exist dis-Equilibrium for [**C**], it might be caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **C=[Y-S]** rule: *To motivate the US erradicating its consumptions*
If all of these known data are true: The US [**C**= Consumption]= [**Y-S**]= 7747 Billion ***USD*** -372 Billion ***USD*** = 7,375 Billion ***USD***.

Benefit of **C=[Y-I]** rule: *To prevent the US increasing consumptions*
If all of these known data are true: The US [**C**= Consumption]= [**Y-I**]= 7747 Billion ***USD*** -992 Billion ***USD*** = 6,755 Billion ***USD***.

Benefit of **C=[R-S]** rule: *To motivate the US controlling its consumptions*
If all of these known data are true: The US [**C**= Consumption]= [**R-S**]= 10952 Billion ***USD*** -372 Billion ***USD*** = 10,580 Billion ***USD***.

Benefit of **C=[R-I]** rule: *To motivate the US limiting its consumptions*
If all of these known data are true: The US [**C**= Consumption]= [**R-I**]= 10952 Billion ***USD*** -992 Billion ***USD*** = 9,960 Billion ***USD***.

Benefit of **C=[PQ-S]** rule: *To manage the US consumptions*
If all of these data are true: The US [**C**= Consumption]= [**PQ-S**]= 35000 ***USD***/Pax x 313.9 Million Pax -372 Billion ***USD*** = 10,580 Billion ***USD***.

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Benefit of **C=[PQ-I]** rule: *To make the US consumption efficient*

If all of these data are true: The US [**C**= Consumption]= [**PQ-I**]= 35000 ***USD***/Pax x 313.9 Million Pax -992 Billion ***USD*** = 9,960 Billion ***USD***.

Benefit of **C=[1/K]{[G-T]+[F-O][1+E]^N}-S** rule: *US limit consumption*

If all of these data are true: Then [**Y**= Income]= [1/3%] x {[1841 Billion ***USD*** -2293 Billion ***USD***] + [7346 Billion ***USD*** - 4803 Billion ***USD***] x [1+6.1%]^10} -372 Billion ***USD*** = 137,792 Billion ***USD***

Benefit of **C=[1/K]{[G-T]+[F-O][1+E]^N}-I** rule: *US utilizes consumptions*

If all of these data are true: Then [**Y**= Income]= [1/3%] x {[1841 Billion ***USD*** -2293 Billion ***USD***] + [7346 Billion ***USD*** - 4803 Billion ***USD***] x [1+6.1%]^10} -992 Billion ***USD*** = 137,172 Billion ***USD***

Benefit of **C=[1/Z]([*X-M*]+*L*-[*A*/V]{[1+V]^U-1})-S** rule: *US forex consume*

If all of these data are true: Then [**Y**= Income]= [1/3%] x ({[193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) -372 Billion ***USD*** = -317,614 Billion ***USD***

Benefit of **C=[1/Z]([*X-M*]+*L*-[*A*/V]{[1+V]^U-1})-I** rule: *US forex consume*

If all of these data are true: Then [**Y**= Income]= [1/3%] x ({[193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) -992 Billion ***USD*** = -307,878 Billion ***USD***

The US Savings 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [**S**= *Savings*] magnitude could NOT be found by 6 (six) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then at least 3 (three) different method stated the [**S**] in equal results. Here exist dis-Equilibrium for [**S**], it caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **S=[Y-C]** rule: *To motivate the US increases its savings*

If all of these known data are true: The US [**S**= Savings]= [**Y-C**]= 7747 Billion ***USD*** -110728 Billion ***USD*** = -2,981 Billion ***USD***.

Benefit of **[S=I]** rule: *To motivate the US invested savings*

If all of these known data are true: The US [**S**= Savings]= 992 Billion ***USD***.

Benefit of **S=[R-C]** rule: *To motivate the US retains its savings*

If all of these known data are true: The US [**S**= Savings]= [**R-C**]= 10952 Billion ***USD*** -110728 Billion ***USD*** = -148 Billion ***USD***.

Benefit of **S= [PQ-C]** rule: *To motivate the US utilizing its savings*

If all of these data are true: The US [**S**= Savings]= [**PQ-C**]= 35000 ***USD***/Pax x 313.9 Million Pax -10728 Billion ***USD***= 224 Billion ***USD***.

Benefit of **S=[1/K]{[G-T]+[F-O][1+E]^N}-C** rule: *Help US gain savings*

If all of these data are true: [**Y**= Income]= [1/3%] x {[1841 Billion ***USD*** -2293 Billion ***USD***] +[7346 Billion ***USD*** - 4803 Billion ***USD***] x [1+6.1%]^10} -10728 Billion ***USD*** = 127,436 Billion ***USD***

Benefit of **S=[1/Z]([*X-M*]+*L*-[*A*/V]{[1+V]^U-1})-C** rule: *US forex savings*

If all of these data are true: Then [**Y**= Income]= [1/3%] x ({[193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) -10728 Billion ***USD*** = -317,614 Billion ***USD***

The US Investments 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [**I**= *Investments*] magnitude could NOT be found by 6 (six) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then at least 3 (three) different method stated the [**I**] in equal results. Here exist dis-Equilibrium for [**I**], it caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid Real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **I=[Y-C]** rule: *To motivate the US increases its investments*

If all of these known data are true: The US [**I**= Investments]= [**Y-C**]= 7747 Billion ***USD*** -110728 Billion ***USD*** = -2,981 Billion ***USD***.

Benefit of **[I=S]** rule: *To motivate the US increases its investments*

If all of these known data are true: US [**I**= Investments]= -372 Billion ***USD***

Benefit of **I= [R-C]** rule: *To motivate the US allocate its investments*

If all of these data are true: The US [**I**= Investments]= [**R-C**]= 10952 Billion ***USD*** -110728 Billion ***USD*** = 224 Billion ***USD***.

Benefit of **I= [PQ-C]** rule: *To motivate the US elevates its investments*

If all of these data are true: The US [**I**= Investments]= [**PQ-C**]= 35000 ***USD***/Pax x 313.9 Million Pax -10728 Billion ***USD*** = 224 Billion ***USD***.

Benefit of **I=[1/K]{[G-T]+[F-O][1+E]^N}-C** rule: *US stronger investments*

If all of these known data are true: The US [**Y**= Income]= [**C+S**]= 10728 Billion ***USD*** +372 Billion ***USD***= 7,747 Billion ***USD***.

Benefit of **I=[1/Z]([*X-M*]+*L*-[*A*/V]{[1+V]^U-1})-C** rule: *Help US get*

If all of these known data are true: The US [**Y**= Income]= [**C+I**]= 10728 Billion ***USD*** +992 Billion ***USD***= 11,100 Billion ***USD***.

The US Revenue 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [**R**= *Revenue*] magnitude could be found by 6 (six) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data), then all the 3 (three) different method averaged that [**R**= 11,000 Billion ***USD***]. Only the revenue data source, monetary and international equilibrium give different result, because neither of them seriously managing the [**R**= Income]. If exist dis-Equilibrium for [**R**], it might be caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **R=[Y]** rule: *To increase the US market revenue*

If all of these known data are true: US[**R**= Revenue]= 10,952 Billion ***USD***.

Benefit of **R=[C+S]** rule: *To motivate the US elevate its revenue*

If all of these known data are true: US [**R**= Revenue]= [**C+S**]= 10728 Billion ***USD*** +372 Billion ***USD***= 10,100 Billion ***USD***.

Benefit of **R=[C+I]** rule: *To motivate the US gaining more revenue*

If all of these known data are true: US [**R**= Revenue]= [**C+I**]= 10728 Billion ***USD*** +992 Billion ***USD***= 11,720 Billion ***USD***.

Benefit of **R= [PQ]** rule: *To motivate the US elevates its market revenue*

If all of these known data are true: The US [**R**= Revenue]= [**PQ**]= 35000 GBP/Pax x 313.9 Million Pax= 347,519 Billion ***USD***.

Benefit of **R=[1/K]{[G-T]+[F-O][1+E]^N** rule: *US strengthen its revenue*

If all of these data are true: Then [**Y**= Income]= [1/3%] x {[1841 Billion ***USD*** -2293 Billion ***USD***] + [7346 Billion ***USD*** - 4803 Billion ***USD***] x [1+6.1%]^10}= 138,164 Billion ***USD***.

Benefit of **R=[1/Z]([*X-M*]+*L*-[*A*/V]{[1+V]^U-1})** rule: *US better revenue*

If all of these data are true: [**Y**= Income]= [1/3%] x ({[193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** - [415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1})= -306,886 Billion ***USD***

The US Price 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [**P**= *Prices*] at average could be found by 4 (four) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 3(three) method averaged that [**P**= 36,000 USD /Pax].. Only the monetary and international equilibrium give different result, because neither of them seriously managing the [**P**= Prices]. If exist dis-Equilibrium for [**P**], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **P=[Y/Q]** rule: *To identify the US price quotation*

If all of these known data are true: The US [**P**= Prices]= [**Y/Q**] = 7747 Billion ***USD*** /313.9 Million Pax= 25,000 ***USD*** /Pax.

Benefit of **P=[C+S]/Q** rule: *To motivate the US control its prices*

If all of these known data are true: The US [**P**= Prices]= The UK [**P**]= Prices= [**C+S]/Q**= [10728 Billion ***USD*** +372 Billion ***USD***] /313.9 Million Pax= 35,000 ***USD*** /Pax.

Benefit of **P=[C+I]/Q** rule: *To motivate the US manage its prices*

If all of these known data are true: The US [**P**= Prices]= The UK [**P**]= Prices= [**C+I]/Q**= [10728 Billion ***USD*** +992 Billion ***USD***] /313.9 Million Pax= 37,000 ***USD*** /Pax.

Benefit of **P= [R/Q]** rule: *To the US elevates its price competitiveness*

If all of these known data are true: The US [**P**= Prices]= [**R/Q**]= 10952 Billion ***USD*** /313.9 Million Pax= 35,000 ***USD*** /Pax.

Benefit of **P=[1/K]{[G-T]+[F-O][1+E]^N}/Q** rule: *help Us attract buyers*

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If all of these data are true: Then [**P**= Prices]= [1/3%] x {[1841 Billion ***USD*** -2293 Billion ***USD***] +[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10} /313.9 Million Pax= -40,000 ***USD***/Pax.

Benefit of **P=[1/Z]([*X-M*]+*L*-[*A*/V]{[1+V]^U-1})/Q** rule: *Us manage*

If all of these data are true: Then [**P**= Prices]= [1/3%] x ({[193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) /313.9 Million Pax= 978,000 ***USD***/Pax.

The US Quantity 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [**Q**= *Quantity*] at average could be found by 4 (four) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 3 (three) method averaged that [**Q**= 320 Million Pax], which is more realistic, since US's current [**Q**= 320 Million Pax],. Only the monetary and international equilibrium give different result, because neither of them seriously managing the [**Q**= Quantity]. If exist dis-Equilibrium for [**Q**], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **Q=[Y/P]** rule: *To identify the US quantity size*

If all of these known data are true: The US [**Q**= Quantity]= [**Y/P**] = 7747 Billion ***USD*** /35000 ***USD*** /Pax= 222 Million Pax.

Benefit of **Q=[C+S]/P** rule: *To motivate the US control its quantity offers*

If all of these known data are true: The US [**Q**= Quantity]= [**C+S**]/**P**= [10728 Billion ***USD*** +372 Billion ***USD***] /35000 ***USD*** /Pax= 318 Million Pax.

Benefit of **Q=[C+I]/P** rule: *To motivate the US manage its quantity packages*

If all of these known data are true: The US [**Q**= Quantity]= = [**C+I**]/**P**= [10728 Billion ***USD*** +992 Billion ***USD***] /35000 ***USD*** /Pax= 336 Million Pax.

Benefit of **Q= [R/P]** rule: *To motivate the US utilize its market quantiy*

If all of these known data are true: The US [**Q**= Quantity]= [**R/P**]= 10952 Billion ***USD*** /35000 ***USD*** /Pax= 314 Million Pax.

Benefit of **Q=[1/K]{[G-T]+[F-O][1+E]^N}/P** rule: *US providing choices*

If all of these known data are true: [**Q**= Quantity]= Then [**Q**= Quantity]= [1/3%] x {[1841 Billion ***USD*** -2293 Billion ***USD***] + [7346 Billion ***USD*** - 4803 Billion ***USD***] x [1+6.1%]^10} /35000 ***USD*** /Pax= 3,960 Million Pax.

Benefit of **Q=[1/Z]([*X-M*]+*L*-[*A*/V]{[1+V]^U-1})/P** rule: *US forex quantity*

If all of these data are true: [**Q**= Quantity]= [1/3%] x ({[193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** – [415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) /35000 ***USD*** /Pax= -8,796 Million Pax.

The UK Local Reserve 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [**K**= *Kind of local reserve*] at average could be found by 5 (five) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 4 (four) method averaged that [**K**= 37%], which mean that US's economi needs to turn its direction and set greater fractional reserve. Only the international equilibrium give different result, because neither of them seriously managing the [**K**= Kind of local reserve]. If exist dis-Equilibrium for [**K**], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **K={[G-T]+[F-O][1+E]^N}/Y** rule: *To set US effective multiplier*

If all of these known data are true: [**K**= Kind of local reserve]= {[1841 Billion ***USD*** -2293 Billion ***USD***] + [7346 Billion ***USD*** - 4803 Billion ***USD***] x [1+6.1%]^10} /7747 Billion ***USD*** /Pax= 54%.

Benefit of **K={[G-T]+[F-O][1+E]^N}/(C+S)** rule: *US control its multiplier*

If all of these known data are true: The US [**K**= Kind of local reserve]= {[1841 Billion ***USD*** -2293 Billion ***USD***] +[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10} /[10728 Billion ***USD*** +372 Billion ***USD***]= 37%.

Benefit of **K={[G-T]+[F-O][1+E]^N/(C+I)** rule: *US use its multiplier*

If all of these known data are true: The US [**K**= Kind of local reserve]= {[1841 Billion ***USD*** -2293 Billion ***USD***] +[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10} /[10728 Billion ***USD*** +372 Billion ***USD***]= 35%.

Benefit of **K={[G-T]+[F-O][1+E]^N/R** rule: *US manage its multiplier*

If all of these known data are true: [**K**= Kind of local reserve]= {[1841 Billion ***USD*** -2293 Billion ***USD***] +[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10} /10952 Billion ***USD*** /Pax= 38%.

Benefit of **K={[G-T]+[F-O][1+E]^N/(PQ)** rule: *US stabilize its multiplier*

If all of these known data are true: The US [**K**= Kind of local reserve]= {[1841 Billion ***USD*** -2293 Billion ***USD***] +[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10} /[35000 GBP/Pax x 313.9 Million pax]= 38%.

Benefit of **K=Z{[G-T]+[F-O][1+E]^N}/([X-M]+L -[A/V]{[1+V]^U-1})**

If all of these known data are true: US [**K**= Kind of local reserve]= 3% x {[{[1841 Billion ***USD*** -2293 Billion ***USD***] +[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10} /({[193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1})= -1.4%.

The US Government Spending 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [**G**= *Government spending*] magnitude could be found by 5 (five) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), 5 (five) method averaged that [**G**= -1920 Billion ***USD***] is better for UK's economy. Only the international equilibrium give different result, because neither of them seriously managing the [**G**= Government spending]. If exist Dis-Equilibrium for [**G**], it caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **G=T+KY-[F-O][1+E]^N** rule: *To set US optimum public expense*

If all of these known data are true: The US [**G**= Government spending]= 3% x 7747 Billion ***USD*** -[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10 +2293 Billion ***USD*** = -2071 Billion ***USD***

Benefit of **G=T+K[C+S]-[F-O][1+E]^N** rule: *Let US financing its market*

If all of these known data are true: The US [**G**= Government spending]= 3% x [10728 Billion ***USD*** +372 Billion ***USD***] -[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10 + 2293 Billion ***USD*** = -1971 Billion ***USD***

Benefit of **G=T+K[C+I]-[F-O][1+E]^N** rule: *US's government purchase*

If all of these known data are true: The US [**G**= Government spending]= 3% x [10728 Billion ***USD*** +372 Billion ***USD***] -[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10 +2293 Billion ***USD*** = -1952 Billion ***USD***

Benefit of **G=T+KR-[F-O][1+E]^N** rule: *Help US utilize its purchase*

If all of these known data are true: The US [**G**= Government spending]= 3% x 10952 Billion ***USD*** - [7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10 +2293 Billion ***USD*** = -1975 Billion ***USD***

Benefit of **G=T+KPQ-[F-O][1+E]^N** rule: *Help US empower*

If all of these known data are true: The US [**G**= Government spending]= 3% x [35000 GBP/Pax x 313.9 Million Pax] -[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10 +2293 Billion ***USD*** = -1975 Billion ***USD***

Benefit of **G=T+[K/Z]([X-M]+L-[A/V]{[1+V]^U-1})-[F-O][1+E]^N** rule:

If all of these known data are true: The US [**G**= Government spending]= [3% /3%] x ({[193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) -{[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10} +2293 Billion ***USD***}= -11510 Billion ***USD***

The US's Tax 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [**T**= *Tax*] magnitude could be found by 5 (five) different mutual cross-checked ways with the equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 5 (five) method averaged that [**T**= -300 Billion ***USD***], which means that current UK's does not need to be taxed. Only the international equilibrium give different result, since neither of them seriously managing the [**T**= Tax]. If exist dis-Equilibrium for [**T**], it caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **T=G-{KY-[F-O][1+E]^N}** rule: *To set US optimum tax collection*

If all of these known data are true: The US [**T**= Tax]= 1841 Billion ***USD*** -{3% x 7747 Billion ***USD*** -[7346 Billion ***USD*** - 4803 Billion ***USD***] x [1+6.1%]^10} = -2,998 Billion ***USD***

Benefit of **T=G-{K[C+S]-[F-O][1+E]^N}** rule: *To let US utilizing its taxes*

If all of these known data are true: US [**T**= Tax]= 1841 Billion ***USD*** -{3% x [10728 Billion ***USD*** -372 Billion ***USD***] -[7346 Billion ***USD*** - 4803 Billion ***USD***] x [1+6.1%]^10}= -3,089 Billion ***USD***

Benefit of **T=G-{K[C+I]-[F-O][1+E]^N}** rule: *To help the US's productive*

If all of these known data are true: US [**T**= Tax]= 1841 Billion ***USD*** -{3% x [10728 Billion ***USD*** -992 Billion ***USD***] -[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10}= -3,108 Billion ***USD***

Benefit of **T=G-{KR-[F-O][1+E]^N}** rule: *The US implement fair taxes*

If all of these known data are true: The US [**T**= Tax]= 1841 Billion ***USD*** -{3% x 10952 Billion ***USD*** -[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10}= -3,085 Billion ***USD***

Benefit of **T=G-{KPQ-[F-O][1+E]^N}** rule: *US increase its productivity*

If all of these known data are true: The US [**T**= Tax]= 1841 Billion ***USD*** -{3% x [35000 GBP/Pax x 313.9 Million Pax] -[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10} = -3,085 Billion ***USD***

Benefit of **T=G+[F-O][1+E]^N-[K/Z]([X-M]+L-[A/V]{[1+V]^U-1})** rule:

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If all of these known data are true: The UK [**T**= Tax]= {1841 Billion ***USD*** +[7346 Billion ***USD*** - 4803 Billion ***USD***] x [1+6.1%]^10}–[3% /3%] x ({[193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** -[204 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1})= 17,452 Billion ***USD***

The US's Financial Bonds 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [**F**= *Financial bonds*] magnitude could be found by 5 (five) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), all the 6 (six) method stated that [**F**= -4800 Billion] financing could better for UK. None of the international equilibrium give different result, since neither of them seriously managing the [**F**= Financial bonds]. If exist dis-Equilibrium for [**F**], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **F=O+{KY-[G-T]}/[1+E]^N** rule: *Set US optimum finance bond*

If all of these known data are true: The US [**F**= Financial instruments]= 4803 Billion ***USD*** +{3% x 7747 Billion ***USD*** -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[1+6.1%]^10= 4,862 Billion ***USD***

Benefit of **F=O+{K[C+S]-[G-T]}/[1+E]^N** rule: *Let the US utilizing lending*

If all of these known data are true: The US [**F**= Financial instruments]= 4803 Billion ***USD*** +{3% x [10728 Billion ***USD*** +372 Billion ***USD***] -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[1+6.1%]^10= 4,913 Billion ***USD***

Benefit of **F=O+{K[C+I]-[G-T]}/[1+E]^N** rule: *The US's fair financing*

If all of these known data are true: The US [**F**= Financial instruments]= 4803 Billion ***USD*** +{3% x [10728 Billion ***USD*** +992 Billion ***USD***] -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[1+6.1%]^10= 4,748 Billion ***USD***

Benefit of **F=O+{KR-[G-T]}/[1+E]^N** rule: *To motivate the US lending*

If all of these known data are true: The US [**F**= Financial instruments]= 4803 Billion ***USD*** +{3% x 10952 Billion ***USD*** -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[1+6.1%]^10= 4,735 Billion ***USD***

Benefit of **F=O+{KPQ-[G-T]}/[1+E]^N** rule: *Help US set liquidity*

If all of these known data are true: The US [**F**= Financial instruments]= 4803 Billion ***USD*** +{3% x [35000 ***USD***/Pax x 313.9 Million Pax] -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[1+6.1%]^10= 4,735 Billion ***USD***

Benefit of **F=O +([K/Z]([X-M]+L-[A/V]{[1+V]^U-1})-[G-T])/[1+E]^N**

If all of these known data are true: The US [**F**= Financial instruments]= {4803 Billion ***USD*** +([3% /3%] x {[193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1} -{[1841 Billion ***USD*** -2293 Billion ***USD***]})/[1+6.1%]^10= -4112 Billion ***USD***

The US's Obligation of Treasurer 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [**O**= *Obligation of treasurer*] magnitude could be found by 6 (six) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then all 6 (six) method averaged that [**O**= 7500 Billion ***USD***] is enough for UK. Only the international equilibrium give different result, since neither of them seriously managing the [**O**= Obligation of treasurer]. If exist dis-Equilibrium for [**O**], it caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **O=F-{KY-[G-T]}/[1+E]^N** rule: *To set US optimum obligation*

If all of these known data are true: The US [**O**= Obligation of treasurer] 7346 Billion ***USD*** +{3% x 7747 Billion ***USD*** -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[1+6.1%]^10= 7,468 Billion ***USD***

Benefit of **O=F-{K[C+S]-[G-T]}/[1+E]^N** rule: *US utilizing its obligation*

If all of these known data are true: The US [**O**= Obligation of treasurer]= 7346 Billion ***USD*** +{3% x [10728 Billion ***USD*** +372 Billion ***USD***] -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[1+6.1%]^10= 7,412 Billion ***USD***

Benefit of **O=F-{K[C+I]-[G-T]}/[1+E]^N** rule: *Help UK's local obligation*

If all of these known data are true: The US [**O**= Obligation of treasurer]= 7346 Billion ***USD*** +{3% x [10728 Billion ***USD*** +992 Billion ***USD***] -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[1+6.1%]^10= 7,402 Billion ***USD***

Benefit of **O=F-{KR-[G-T]}/[1+E]^N** rule: *UK implement fair obligation*

If all of these known data are true: The US [**O**= Obligation of treasurer]= 10952 Billion ***USD*** +{3% x 7747 Billion ***USD*** -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[1+6.1%]^10= 7,414 Billion ***USD***

Benefit of **O=F-{KPQ-[G-T]}/[1+E]^N** rule: *UK manage its obligation*

If all of these known data are true: The US [**O**= Obligation of treasurer]= 10952 Billion ***USD*** +{3% x [35000 ***USD***/Pax x 313.9 Million Pax] -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[1+6.1%]^10= 7,414 Billion ***USD***

Benefit of **O=F-([K/Z]([*X-M*]+*L*-[*A*/V]{[1+V]^U-1})-[G-T])/[1+E]^N** rule:

If all of these known data are true: The UK [**O**= Obligation of treasurer]= 7346 Billion ***USD*** -([3% /3%] x {[193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1} -{[1841 Billion ***USD*** -2293 Billion ***USD***]})/[1+2.1%]^10= 7749 Billion ***USD***

The US's Expected Interest 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [**E**= *Obligation of treasurer*] magnitude could be found by 6 (six) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 4 (four) method stated that [**E**= -44%], which means UK interest is too high. Only the international equilibrium give different result, since neither of them seriously managing [**E**= Obligation of treasurer]. If exist Dis-Equilibrium for [**E**], caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **E=({KY-[G-T]}/[F-O])^[1/N]-1** rule: *US optimum basic interest*

If all of these known data are true: US [**E**= Expected interest]= ({3% x 7747 Billion ***USD*** -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[7346 Billion ***USD*** -4803 Billion ***USD***])^[1/10]-1= -51% p.a.

Benefit of **E=({K[C+S]-[G-T]}/[F-O])^[1/N]-1** rule: *US keep local interest*

If all of these known data are true: US [**E**= Expected interest]= ({3% x [10728 Billion ***USD*** +372 Billion ***USD***] -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[7346 Billion ***USD*** -4803 Billion ***USD***])^[1/10]-1= -44% p.a.

Benefit of **E=({K[C+I]-[G-T]}/[F-O])^[1/N]-1** rule: *US's monetary interest*

If all of these known data are true: US [**E**= Expected interest]= ({3% x [10728 Billion ***USD*** +992 Billion ***USD***] -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[7346 Billion ***USD*** -4803 Billion ***USD***]) ^[1/10]-1= -43% p.a.

Benefit of **E=({KR-[G-T]}/[F-O])^[1/N]-1** rule: *The US interest safety*

If all of these known data are true: US [**E**= Expected interest]= ({3% x 10592 Billion ***USD*** -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[7346 Billion ***USD*** -4803 Billion ***USD***])^[1/10]-1= -44% p.a.

Benefit of **E=({KPQ-[G-T]}/[F-O])^[1/N]-1** rule: *Help US local interest*

If all of these known data are true: US [**E**= Expected interest]= ({3% x [35000 ***USD***/Pax x 313.9 Million Pax] -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[7346 Billion ***USD*** -4803 Billion ***USD***]) ^[1/10]-1= -44% p.a.

Benefit of **E=(([K/Z]([X-M]+L-[A/V]{[1+V]^U-1})-[G-T])/[F-O])^[1/N]-1**

If all of these known data are true: US [**E**= Expected interest]= ({[3% /3%] x ([193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[7346 Billion ***USD*** -4803 Billion ***USD***])^[1/10]-1= -87% p.a.

The US's Number of Debt Period

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [**N**= *Number of debt period*] magnitude could be found by 5 (five) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 5 (five) method stated that [**N**= -25 years] are better for the US's economy. Only the international equilibrium give different result, since neither of them seriously managing the [**N**= Number of debt period]. If exist dis-Equilibrium for [**N**], it caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall deleconomatics

Benefit of **N=Ln({KY-[G-T]}/[F-O])/Ln[1+E]** rule: *US local debt's period*

If all of these known data are true: [**N**= Number of period]= Ln({3% x 7747 Billion ***USD*** -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[7346 Billion ***USD*** -4803 Billion ***USD***]) /Ln[1+6.1%]= -22 years.

Benefit of **N=Ln({K[C+S]-[G-T]}/[F-O])/Ln[1+E]** rule: *US local tenure*

If all of these known data are true: [**N**= Number of period]= Ln({3% x [10728 Billion ***USD*** +372 Billion ***USD***] -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[7346 Billion ***USD*** -4803 Billion ***USD***]) /Ln[1+6.1%]= -20 years.

Benefit of **N=Ln({K[C+I]-[G-T]}/[F-O])/Ln[1+E]** rule: *Keep US's tenure*

If all of these known data are true: [**N**= Number of period]= Ln({3% x [10728 Billion ***USD*** +992 Billion ***USD***] -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[7346 Billion ***USD*** -4803 Billion ***USD***]) /Ln[1+6.1%]= -28 years.

Benefit of **N=Ln({KR-[G-T]}/[F-O])/Ln[1+E]** rule: *Keep US local period*

If all of these known data are true: [**N**= Number of period]= Ln({3% x 10952 Billion ***USD*** -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[7346 Billion ***USD*** -4803 Billion ***USD***]) /Ln[1+6.1%]= -20 years.

Benefit of **N=Ln({KPQ-[G-T]}/[F-O])/Ln[1+E]** rule: *US keep debt term*

If all of these known data are true: [**N**= Number of period]= Ln({3% x 35000 ***USD***/Pax x 313.9 Million Pax -[1841 Billion ***USD*** -2293 Billion ***USD***]} /[7346 Billion ***USD*** -4803 Billion ***USD***]) /Ln[1+6.1%]= -28 years.

N=Ln(-([K/Z]([X-M]+L-[A/V]{[1+V]^U-1})-[G-T])/[F-O])/Ln[1+E] rule:

If all of these known data are true: [**N**= Number of period]= Ln({[3% /3%] x ([193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1} -[1841 Billion ***USD*** -2293 Billion ***USD***]) /[7346 Billion ***USD*** -4803 Billion ***USD***]) /Ln[1+6.1%]= 42 years.

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The US's Forex Multiplier 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [**Z**= *Zoned forex multiplier*] magnitude could be found by 5 (five) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 5 (five) method averaged that [**Z**= 1250%], means too low forex fraction reserve. Only the international equilibrium give different result, sine neither of them seriously managing the [**Z**= Zoned multiplier]. If exist dis-Equilibrium for [**Z**], it caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **Z=([X-M]+L-[A/V]{[1+V]^U-1})/Y** rule: *US foreign reserve*

If all of these known data are true: [**Z**= Zoned forex reserve]= (193 Billion ***USD*** -233 Billion ***USD*** +1020 Billion ***USD*** -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) /7747 Billion ***USD***= 1783%.

Benefit of **Z=([X-M]+L-[A/V]{[1+V]^U-1})/[C+S]** rule: *UK forex fraction*

If all of these known data are true: [**Z**= Zoned forex reserve]= (193 Billion ***USD*** -233 Billion ***USD*** +1020 Billion ***USD*** -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) /[10728 Billion ***USD*** +372 Billion ***USD***]= 1245%.

Benefit of **Z=([X-M]+L-[A/V]{[1+V]^U-1})/[C+I]** rule: *UK's fx multiplier*

If all of these known data are true: [**Z**= Zoned forex reserve]= (193 Billion ***USD*** -233 Billion ***USD*** +1020 Billion ***USD*** -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) /[10728 Billion ***USD*** +992 Billion ***USD***]= 1179%.

Benefit of **Z=([X-M]+L-[A/V]{[1+V]^U-1})/R** rule: *UK foreign reserve*

If all of these known data are true: [**Z**= Zoned forex reserve]= (193 Billion ***USD*** -233 Billion ***USD*** +1020 Billion ***USD*** -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) /10952 Billion ***USD***= 1262%.

Benefit of **Z=([X-M]+L-[A/V]{[1+V]^U-1})/[PQ]** rule: *UK use fx reserve*

If all of these known data are true: [**Z**= Zoned forex reserve]= (193 Billion ***USD*** -233 Billion ***USD*** +1020 Billion ***USD*** -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) /[35000 ***USD***/Pax x 313.9 Million Pax]= 1262%.

Benefit of **Z=K([X-M]+L-[A/V]{[1+V]^U-1}) /{[G-T]+[F-O][1+E]^N}**

If all of these known data are true: [**Z**= Zoned forex reserve]= (193 Billion ***USD*** -233 Billion ***USD*** +1020 Billion ***USD*** -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) /{[1841 Billion ***USD*** -2293 Billion ***USD***] +[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10}= 3333%.

The US's Export 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [***X***= *Export*] magnitude could be found by 5 (five) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 5 (five) method averaged that [***X*** = 9700 Billion ***USD***], means US better not to be cheated in its export. Only the international equilibrium give different result, since neither of them seriously managing the [***X*** = Export]. If exist Dis-Equilibrium for [***X***], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of ***X=M+ZY-L+[A/V]{[1+V]^U-1})*** rule: *To keeping US export*

If all of these known data are true: US [***X***= Export]= 3% x 7747 Billion ***USD*** +[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) -1020 Billion ***USD*** +233 Billion ***US*** = 9,630 Billion ***USD***

Benefit of ***X=M+Z[C+S]-L+[A/V]{[1+V]^U-1})*** rule: *Strengthen US export*

If all of these known data are true: The US [***X***= Export]= 3% x [10728 Billion ***USD*** +372 Billion ***USD***] + [415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) -1020 Billion ***USD*** +233 Billion ***US*** = 9,733 Billion ***USD***

Benefit of ***X=M+Z[C+I]-L+[A/V]{[1+V]^U-1})*** rule: *To let US's export*

If all of these known data are true: The US [***X***= Export]= 3% x [10728 Billion ***USD*** +992 Billion ***USD***] + [415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) -1020 Billion ***USD*** +233 Billion ***US*** = 9,751 Billion ***USD***

Benefit of **X=*M*+ZR-*L*+[*A*/V]{[1+V]^U-1})** rule: *Better US's export*

If all of these known data are true: US [***X***= Export]= 3% x 10952 Billion ***USD*** + [204 Billion ***USD*** /3.9%] x {[1+3.9%]^20-1})-9836 Billion ***USD*** +233 Billion ***USD*** = 9,728 Billion ***USD***

Benefit of **X=*M*+ZPQ-*L*+[*A*/V]{[1+V]^U-1})** rule: *Help US earning forex*

If all of these known data are true: The US [***X***= Export]= 3% x [35000 ***USD***/Pax x 313.9 Million Pax] + [204 Billion ***USD*** /2.1%] x {[1+3.9%]^20-1}) -9836 Billion ***USD*** +233 Billion ***USD*** = 9,728 Billion ***USD***

Benefit of **X=*M*+[Z/K]{[G-T]+[F-O][1+E]^N}-*L*+[*A*/V]{[1+V]^U-1}** rule:

If all of these known data are true: The UK [***X***= Export]= [3%/3%] x {[1841 Billion ***USD*** -2293 Billion ***USD***] +[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10} + [204 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) -9836 Billion ***USD*** +233 Billion ***USD*** = -480 Billion ***USD***

The US's Import 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [***M***= *Import*] magnitude could be found by 5 (five) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 5 (five) method stated that [***M*** = -9200 Billion ***USD***] is better for UK current economic constellation. Only the international equilibrium give different result, because neither of them seriously managing the [***M*** = Import]. If exist Dis-Equilibrium for [***M***], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of ***M*=X-ZY-[*A*/V]{[1+V]^U-1})+*L*** rule: *Cover US import problems*

If all of these known data are true: [***M***= Import]= 233 Billion ***USD*** -3% x 7747 Billion ***USD*** -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) +1020 Billion ***USD***= -9164 Billion ***USD***

Benefit of ***M*=X-Z[C+S]-[*A*/V]{[1+V]^U-1})+*L*** rule: *Strengthen US forex*

If all of these known data are true: [***M***= Import]= 233 Billion ***USD*** -3% x [10728 Billion ***USD*** +372 Billion ***USD***] -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) +1020 Billion ***USD***= -9264 Billion ***USD***

Benefit of ***M*=X-Z[C+I]-[*A*/V]{[1+V]^U-1})+*L*** rule: *US's strengthen trade*

If all of these known data are true: [***M***= Import]= 233 Billion ***USD*** -3% x [10728 Billion ***USD*** +992 Billion ***USD***] -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) +1020 Billion ***USD***= -9283 Billion ***USD***

Benefit of ***M*=X-ZR-[*A*/V]{[1+V]^U-1})+*L*** rule: *Limit the US's import*

If all of these known data are true: [***M***= Import]= 233 Billion ***USD*** -3% x 10952 Billion ***USD*** -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) +1020 Billion ***USD***= -9260 Billion ***USD***

Benefit of ***M*=X-ZPQ-[*A*/V]{[1+V]^U-1})+*L*** rule: *US make less import*

If all of these known data are true: [***M***= Import]= 233 Billion ***USD*** -3% x [35000 ***USD***/Pax x 313.9 Million Pax] -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) +1020 Billion ***USD***= -9261 Billion ***USD***

Benefit of ***M*=X-[Z/K]{[G-T]+[F-O][1+E]^N}-[*A*/V]{[1+V]^U-1}+*L*** rule:

If all of these known data are true: US [***M***= Import]= 233 Billion ***USD*** -[3%/3%] x {[1841 Billion ***USD*** -2293 Billion ***USD***] +[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10} -[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) +1020 Billion ***USD***= 13,077 Billion ***USD***

The US's Foreign Debt 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [***L***= *Loan or foreign debt*] magnitude could be found by 5 (five) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 5 (five) method averaged that [***L*** = 10500 Billion ***USD***], mean US does not need foreign loan. Only the international equilibrium give different result, since neither of them seriously managing the [***L*** = Loan]. If exist Dis-Equilibrium for [***L***], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of ***L*= ZY+[*A*/V]{[1+V]^U-1})-[*X-M*]** rule: *Solving US foreign loans*

If all of these known data are true: The US [***L***= Loan]= 3% x 7747 Billion ***USD*** +[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) –[193 Billion ***US*** -233 Billion ***USD***]= 10,457 Billion ***USD***

Benefit of ***L*= Z[C+S]+[*A*/V]{[1+V]^U-1})-[*X-M*]** rule: *US foreign loan*

If all of these known data are true: The US [***L***= Loan]= 3% x [10728 Billion ***USD*** +372 Billion ***USD***] +[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) –[193 Billion ***US*** -233 Billion ***USD***]= 10,557 Billion ***USD***

Benefit of ***L*= Z[C+I]+[*A*/V]{[1+V]^U-1})-[*X-M*]** rule: *US's forex debts*

If all of these known data are true: The US [***L***= Loan]= 3% x [10728 Billion ***USD*** +992 Billion ***USD***] +[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) –[193 Billion ***US*** -233 Billion ***USD***]= 10,576 Billion ***USD***

Benefit of ***L*= ZR+[*A*/V]{[1+V]^U-1})-[*X-M*]** rule: *Limit US's foreign debt*

If all of these known data are true: The US [***L***= Loan]= 3% x 10952 Billion ***USD*** +[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) –[193 Billion ***US*** -233 Billion ***USD***]= 10,553 Billion ***USD***

Benefit of ***L*=ZPQ+[*A*/V]{[1+V]^U-1})-[*X-M*]** rule: *UK securing forex debt*

If all of these known data are true: The US [***L***= Loan]= 3% x 35000 ***USD*** /Pax x 313.9 Million Pax +[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) –[193 Billion ***US*** -233 Billion ***USD***]= 10,553 Billion ***USD***

Benefit ***L*=[Z/K]{[G-T]+[F-O][1+E]^N}+[*A*/V]{[1+V]^U-1}-[*X-M*]** rule:

If all of these known data are true: The US [***L***= Loan]= [3%/3%] x {[1841 Billion ***USD*** -2293 Billion ***USD***] +[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10} +[415 Billion ***USD*** /2.1%] x {[1+2.1%]^20-1}) –[193 Billion ***US*** -233 Billion ***USD***]= 14,369 Billion ***USD***

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The US's Debt Repayment 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [***A***= *Achievement or repayment*] magnitude could be found by 5 (five) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 5 (five) method averaged that [***A*** = 27 Billion ***USD***], means US must pay its foreign debt faster. Only the international equilibrium give different result, because neither of them seriously managing the [***A*** = Loan or foreign debt]. If exist dis-Equilibrium for [***A***], it might caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of ***A*= V{[*X-M*]+*L*-ZY}/{[1+V]^U-1}** rule: *To solve UK payment*

If all of these known data are true: The US [***A***= Achievement]= 2.1% x {[193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** -3% x 7747 Billion ***USD***} /{[1+2.1%]^20-1}= 30 Billion ***USD***

Benefit of ***A*= V{[*X-M*]+*L*-Z[C+S]}/{[1+V]^U-1}** rule: *US foreign payment*

If all of these known data are true: The US [***A***= Achievement]= 2.1% x {[193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** -3% x [10728 Billion ***USD*** +372 Billion ***USD***]} /{[1+2.1%]^20-1}= 26 Billion ***USD***

Benefit of ***A*= V{[*X-M*]+*L*-Z[C+I]}/{[1+V]^U-1}** rule: *US's better payment*

If all of these known data are true: The US [***A***= Achievement]= 2.1% x {[193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** -3% x [10728 Billion ***USD*** +992 Billion ***USD***]} /{[1+2.1%]^20-1}= 26 Billion ***USD***

Benefit of ***A*= V{[*X-M*]+*L*-ZR}/{[1+V]^U-1}** rule: *US's foreign payment*

If all of these known data are true: The US [***A***= Achievement]= 2.1% x {[193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** -3% x 10952 Billion ***USD***} /{[1+2.1%]^20-1}= 27 Billion ***USD***

Benefit of ***A*= V{[*X-M*]+*L*-ZPQ}/{[1+V]^U-1}** rule: *US does more payment*

If all of these known data are true: The US [***A***= Achievement]= 2.1% x {[193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** -3% x [35000 ***USD*** /Pax x 313.9 Million Pax]} /{[1+2.1%]^20-1}= 27 Billion ***USD***

Benefit of ***A*= V([*X-M*]+*L*-[Z/K]{[G-T]+[F-O][1+E]^N})/{[1+V]^U-1}**

If all of these known data are true: US [***A***= Achievement]= 2.1% x {[193 Billion ***USD*** -233 Billion ***USD***] +1020 Billion ***USD*** -[3%/3%] x {[1841 Billion ***USD*** -2293 Billion ***USD***] +[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10} /{[1+2.1%]^20-1}= -129 Billion ***USD***

The US's Debt Period 2013

It is proven that alternative hypothesis, Samuelson, L (2013), should be accepted and null hypothesis be rejected, since the comprehensive interactive general of the generals (Field Marshall) model is possible. Findings from this part show that ***US***'s [**U**= *Utilize debt period*] magnitude could be found by 5 (five) different mutual cross-checked ways with almost equal result. ***If and only if all the data are correct*** (they should be: as official data for famous economic theory), then the 5 (five) method averaged that [**U** = -1.6 years], or US take unecessary foreign debt. Only the international equilibrium give different result, neither of them seriously managing the [**U** = Utilize debt period]. If exist dis-Equilibrium for [**U**], it caused by:

1)No comprehensive integrated Field Marshall economic architecture standards
2)No centralized legal useful valid real-time on-line reliable data for decision
3)No automatic computerized real time input for Field Marshall teleconomatics

Benefit of **U=Ln(1+[V/*A*]{[*X-M*]+*L*-ZY})/Ln[1+V]** rule: *US pay schedule*

If all of these known data are true: [***A***= Achievement]= Ln(1-[2.1%/415 Billion ***USD***] x {3%*7747 Billion ***USD*** -[193 Billion ***USD*** -233 Billion ***USD***] -1020 Billion ***USD***}) /Ln[1+2.1%]= 1.8 years

Benefit of **U=Ln(1+[V/*A*]{[*X-M*]+*L*-Z[C+S]})/Ln[1+V]** rule: *US pay period*

If all of these known data are true: The US [***A***= Achievement]= Ln(1-[2.1%/415 Billion ***USD***] x {3%*[10728 Billion ***USD*** +372 Billion ***USD***] -[193 Billion ***USD*** -233 Billion ***USD***] -1020 Billion ***USD***}) /Ln[1+2.1%]= 1.6 years

Benefit of **U=Ln(1+[V/*A*]{[*X-M*]+*L*-Z[C+I]})/Ln[1+V]** rule: *To guard US's*

If all of these known data are true: The US [***A***= Achievement]= Ln(1-[2.1%/415 Billion ***USD***] x {3%*[10728 Billion ***USD*** +992 Billion ***USD***] -[193 Billion ***USD*** -233 Billion ***USD***] -1020 Billion ***USD***}) /Ln[1+2.1%]= 1.5 years

Benefit of **U=Ln(1+[V/*A*]{[*X-M*]+*L*-ZR-1)/Ln[1+V]** rule: *To assure the US's*

If all of these known data are true: The US [***A***= Achievement]= Ln(1-[2.1%/415 Billion ***USD***] x {3%* 10952 Billion ***USD*** -[193 Billion ***USD*** -233 Billion ***USD***] -1020 Billion ***USD***}) /Ln[1+2.1%]= 1.6 years

Benefit of **U=Ln(1+[V/*A*]{[*X-M*]+*L*-ZPQ})/Ln[1+V]** rule: *To help the US*

If all of these known data are true: The US [***A***= Achievement]= Ln(1-[2.1%/415 Billion ***USD***] x {3%*[35000 ***USD*** /Pax x 313.9 Million Pax] -[193 Billion ***USD*** -233 Billion ***USD***] -1020 Billion ***USD***}) /Ln[1+2.1%]= 1.6 years

U=Ln(1+[V/*A*]([*X-M*]-*L*-[Z/K]{[G-T]+[F-O][1+E]^N}))/Ln[1+V] rule:

If all of these known data are true: The US [***A***= Achievement]= Ln(1-[2.1%/415 Billion ***USD***] x {[3%/3%] x {[1841 Billion ***USD*** -2293 Billion ***USD***] +[7346 Billion ***USD*** -4803 Billion ***USD***] x [1+6.1%]^10} -[193 Billion ***USD*** -233 Billion ***USD***] -1020 Billion ***USD***}) /Ln[1+2.1%]= -3 years

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PORTFOLIO THEORY AS A PATTERN OF TIMELESS MOMENTS

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***Abstract**: Quantitative finance traces its roots to modern portfolio theory. Despite the deficiencies of modern portfolio theory, mean-variance optimization nevertheless continues to form the basis for contemporary finance. The term postmodern portfolio theory expresses many of the theoretical advances in financial learning since the original articulation of modern portfolio theory. Any complete overview of financial risk management must address all aspects of portfolio theory, from the beautiful symmetries of modern portfolio theory to the disturbing behavioral insights and the vastly expanded mathematical arsenal of the postmodern critique. This article surveys portfolio theory, from its modern origins through more sophisticated, "postmodern" incarnations, according to the first four moments of any statistical distribution: mean, variance, skewness, and excess kurtosis. Mastery of these quantitative tools and associated behavioral insights holds the key to the efficient frontier of risk management.*

Introduction

… for history is a pattern. Of timeless moments.— T.S. Eliot, Little Gidding1

Quantitative finance traces its roots to modern portfolio theory. Although modern portfolio theory suffers from well known deficiencies, mean-variance optimization nevertheless continues to form the basis for contemporary finance. The term *postmodern portfolio theory* expresses many of the theoretical advances in financial learning since the original articulation of modern portfolio theory. Any complete overview of financial risk management must therefore address all aspects of portfolio theory, from the beautiful symmetries of modern portfolio theory to the disturbing behavioral insights and the vastly expanded mathematical arsenal of the postmodern critique.

Part I of this article expounds modern portfolio theory as a framework for assessing risk-adjusted financial returns. Conventional mean-variance analysis, the foundation of modern portfolio theory, emphasizes expected return and standard deviation (or beta, a close surrogate based on covariance among asset classes). These quantitative measures are drawn from the lower moments of statistical distributions.

Part II extends portfolio theory from its modern origins into a more comprehensive, postmodern model. The foundational theory of contemporary finance is riddled not only with

[1] T.S. ELIOT, *Little Gidding*, *in* FOUR QUARTETS 49, 58 (Harcourt, Brace & Co. 1971; 1st ed. 1943).

mistakes in measurement, but also with mistakes in perception. At its most ambitious, the postmodern critique seeks ways to account for the destructive potential of systemic coordination and cascades. At its most modest, postmodern portfolio theory respects fundamental limits on human knowledge. A postmodern agenda for legal management of risk and uncertainty therefore emphasizes two higher statistical moments beyond mean and variance.

Higher statistical moments bedevil the conventional tools associated with modern portfolio theory and other cognate approaches to risk management. Part III addresses *skewness* relative to a target benchmark — the cumulant of the third standardized statistical moment — as the inspiration for alternative measures of risk-adjusted performance.

Part IV tackles the problem of fat tails, a special case of *excess kurtosis* as the cumulant of the fourth standardized statistical moment. It examines parametric value-at-risk (VaR) analysis, a leading form of financial risk assessment. By conducting parametric VaR analysis with the logistic distribution, a leptokurtic analog of the Gaussian distribution, I hope to show what hangs in the balance when statistical models of risk fail to account for all sources of financial peril.

Quantitative risk management harmonizes the making of policy in a wide range of domains, from the regulation of systemically important financial institutions to natural disaster prevention, mitigation, and recovery. Postmodern portfolio theory exploits the full range of sophisticated quantitative methods known in contemporary finance. Perhaps as importantly, postmodern portfolio theory acknowledges its own methodological limits. Comprehensive understanding of these tools, from their origins in early modern finance through contemporary postmodern critiques, places quantitative finance on the efficient frontier of risk management.

Modern Portfolio Theory

Portfolio theory may be the most fecund intellectual export from quantitative finance to other sciences. Social sciences outside the strictly financial domain have applied portfolio theory to subjects as diverse as regional development,[2] social psychology,[3] and information retrieval.[4] Proper understanding of portfolio theory and its place in finance and cognate sciences begins with a return to the origins of modern portfolio theory. For "the end of all our exploring / Will be to arrive where we started / And know the place for the first time."[5]

Modern portfolio theory offers a mathematically informed approach to financial risk management.[6] Modern portfolio theory assumes that investors are rationally risk averse.[7] Given two portfolios with the same expected return, investors prefer the less risky one.[8] Although idiosycratic risks are hard to identify, let alone manage, diversification reduces the

[2] *See*, *e.g.*, MICHAEL E. CONROY, REGIONAL ECONOMIC GROWTH: DIVERSIFICATION AND CONTROL (1975); Siddharth Chandra, *Regional Economy Size and the Growth-Instability Frontier: Evidence from Europe*, 43 J. REGIONAL SCI. 95 (2003).

[3] *See* Siddharth Chandra & William G. Shadel, *Crossing Disciplinary Boundaries: Applying Financial Portfolio Theory to Model the Organization of the Self-Concept*, 41 J. RESEARCH IN PERSONALITY 346 (2007).

[4] *See* Jun Wang & Jianhan Zhu, *Portfolio Theory of Information Retrieval*, *in* SIGIR '09: PROCEEDINGS OF THE 32ND INTERNATIONAL ACM SIGIR CONFERENCE ON RESEARCH AND DEVELOPMENT IN INFORMATION RETRIEVAL, at 115 (2009).

[5] ELIOT, *supra* note 1, at 59.

[6] *See* Edwin J. Elton & Martin J. Grumer, *Modern Portfolio Theory, 1950 to Date*, 21 J. BANKING & FIN. 1743 (1997); Harry M. Markowitz, *Portfolio Selection*, 7 J. FIN. 77, 87-91 (1952).

[7] *See* Harry M. Markowitz, *Foundations of Portfolio Theory*, 46 J. FIN. 469, 469-70 (1991).

[8] On risk aversion, see generally STEVEN SHAVELL, FOUNDATIONS OF ECONOMIC ANALYSIS OF LAW 52 (2004).

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systemic risk that market forces will swamp an entire portfolio of highly correlated assets.[9] Reward follows risk:[10] though a riskier investment is not necessarily more rewarding, modern portfolio theory does predict that an investor will demand a higher expected return in exchange for accepting greater risk.[11]

Measurements of risk abound within modern portfolio theory. Harry Markowitz's original formulation used the variability of returns, as measured by their standard deviation, as a proxy for risk.[12] William Sharpe proposed a measure of "reward to variability" that relied squarely on standard deviation:[13]

$$Sharpe\ ratio = \frac{R - R_f}{\sigma}$$

where R represents expected return, R_f represents the return from a risk-free baseline such as Treasury bonds, and σ represents standard deviation. The Sharpe ratio bears an obvious resemblance to the definition of a standard score in ordinary statistics:[14]

$$z = \frac{x - \mu}{\sigma}$$

An alternative measure for risk, beta, compares returns on an individual asset or a portfolio of assets with returns realized from a broader benchmark, based on the entirety or at least some significant portion of the financial market.[15] The beta of an asset within a portfolio measures the (1) the covariance between the rate of return on the asset and the rate of return on the portfolio as a whole, (2) divided by the variance of returns on the portfolio.[16] More formally:

$$\beta_a = \frac{Cov(r_a, r_p)}{Var(r_p)}$$

Alternative names for beta — financial elasticity or correlated relative volatility — indicate its use as a measure of sensitivity to market returns.[17] Because beta measures nondiversifiable, systemic risk, it indicates volatility and liquidity in the broader marketplace.[18] By measuring covariance between a single security and the market as a a whole, beta presents the simplest model of market behavior that does not "assum[e] away the existence of interrelationships among securities," but nevertheless "captures a large part of such interrelationships."[19] In this sense beta is less comprehensive than standard deviation, which, as used in the Sharpe ratio, captures both systemic risk and the idiosyncratic risk inherent in a single asset.[20] This limitation on beta can prove useful in fund management,

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[9] *See* RICHARD A. BREALY, STEWART C. MYERS & FRANKLIN ALLEN, PRINCIPLES OF CORPORATE FINANCE 160-62 (8th ed. 2006).

[10] *See* EUGENE F. FAMA, FOUNDATIONS OF FINANCE 361 (1976); Eugene F. Fama & James D. MacBeth, *Risk, Return and Equilibrium: Empirical Tests*, 81 J. POL. ECON. 607, 624 (1973).

[11] *See* Markowitz, *Foundations of Portfolio Theory*, *supra* note 7, at 469-70.

[12] *See* HARRY M. MARKOWITZ, PORTFOLIO SELECTION: EFFICIENT DIVERSIFICATION OF INVESTMENTS 17 (2d ed. 1991) (1st ed. 1959).

[13] *See* William F. Sharpe, *Mutual Fund Performance*, 39 J. BUS. 119, 123 (1966); William F. Sharpe, *Adjusting for Risk in Portfolio Performance Measurement*. 1:2 J. PORTFOLIO MGMT. 29 (Winter 1975).

[14] *See* http://en.wikipedia.org/wiki/Standard_score.

[15] *See* MARK LEVINSON, GUIDE TO FINANCIAL MARKETS 145-46 (4th ed. 2006).

[16] *See* Irwin Friend & Marshall Blume, *Measure of Portfolio Performance Under Uncertainty*, 60 AM. ECON. REV. 561, 565 (1970).

[17] *See* http://en.wikipedia.org/wiki/Beta_(finance).

[18] *See id.*

[19] William F. Sharpe, *A Simplified Model for Portfolio Analysis*, 9 MGMT SCI. 277, 281 (1963).

[20] *See* http://en.wikipedia.org/wiki/Sharpe_ratio#Strengths_and_weaknesses.

since a measurement of beta may help separate an active portfolio manager's skill from her or his willingness to take risk.[21]

Zero beta indicates a lack of correlation between an asset and its benchmark.[22] Negative beta indicates inverse correlation; positive market movement means a loss in value for the asset, and vice versa.[23] For certain assets, negative beta may represent successful performance. For instance, over an appropriately limited time frame, an inverse exchange-traded fund that uses derivatives to profit from a decline in the Standard & Poor's 500 would report complete success in that endeavor if it is able to report a beta of −1 relative to the S&P 500. By holding that ETF, an investor can hedge against a decline in the S&P 500 without carrying the margin account needed to engage in the short-selling of securities.

Although there is no upper or lower bound on the value of beta, a useful analytical baseline is represented by a beta of 1. Beta of 1 indicates an asset whose systemic volatility, or sensitivity to risk, is exactly the same as that of the broader market.[24] Positive values for beta below 1 — that is, $0 < \beta < 1$ — indicate an asset that moves along with the broader market, but is less volatile. Values for beta greater than 1 indicate greater volatility.[25]

Beta plays a pivotal role in one of the most important expressions of modern portfolio theory, the capital asset pricing model.[26] The capital asset pricing model expresses return on an asset as a function of risk, which in turn can be expressed as the volatility embodied in a measure such as beta.[27] The capital asset pricing model also quantifies the premium demanded by the market for shouldering that asset's volatility over a benchmark represented by the return on a risk-free investment:

$$R_a = R_f + \beta_a (R_m - R_f)$$

where R_a, R_m, and R_f respectively represent returns on the asset, on the broader market of comparable investments, and on a risk-free investment, and where β_a represents the individual asset's beta *vis-à-vis* a portfolio based on the broader market.[28] This formula takes the form

[21] *See* Jack L. Treynor, *How to Rate Management of Investment Funds*, 43 HARV. BUS. REV. 63 (1965); http://en.wikipedia.org/wiki/Beta_(finance).

[22] At least in theory. Complete lack of correlation with the market yields a beta of zero, even if the underlying asset is quite volatile in absolute terms. *See* Chris Tofallis, *Investment Volatility: A Critique of Standard Beta Estimation and a Simple Way Forward*, 187 EUR. J. OPERATIONAL RESEARCH 1358 (2008). In these unusual circumstances, beta would report no risk, while standard deviation would report a palpable degree of risk. Formally: $\beta \approx 0$; $\sigma \gg 0$.

[23] *See* LEVINSON, *supra* note 15, at 148.

[24] *See id.*

[25] *See id.*

[26] See, e.g., Fischer Black, Capital Market Equilibrium with Limited Borrowing, 45 J. BUS. 444 (1972); John Lintner, The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets, 47 REV. ECON. STAT. 13 (1965); Jan Mossin, Equlibrium in a Capital Asset Market, 34 ECONOMETRICA 768 (1966); William F. Sharpe, Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk, 19 J. FIN. 425 (1964); Jack L. Treynor, Toward a Theory of Market Value of Risky Assets, in ASSET PRICING AND PORTFOLIO PERFORMANCE: MODELS, STRATEGY AND PERFORMANCE METRICS 15 (Robert A. Korajczyk ed., 1999).

[27] Even more sophisticated measures of volatility abound. Perhaps the most celebrated measure of volatility is the Chicago Board Option Exchange's Volatility Index (VIX), see generally Chicago Board Options Exchange, The CBOE Volatility Index — VIX (2009) (available online at http://www.cboe.com/micro/vix/vixwhite.pdf), which forecasts the expected movement in the S&P 500 index over the next 30-day period according to the square root of the par variance swap rate. See Menachem Brenner & Dan Galai, New Financial Instruments for Hedging Changes in Volatility, 45:4 FIN. ANALYSTS J. 61, July/August 1989; Menachem Brenner & Dan Galai, Hedging Volatility in Foreign Currencies, 1:1 J. DERIVATIVES 53 (Fall 1993). But see Daniel Goldstein & Nassim Taleb, We Don't Quite Know What We are Talking About When We Talk About Volatility, 33:4 J. PORTFOLIO MGMT. 84 (Summer 2007).

[28] See Robert A. Korajczyk, Introduction, in ASSET PRICING AND PORTFOLIO PERFORMANCE, supra note 26, at viii, xv.

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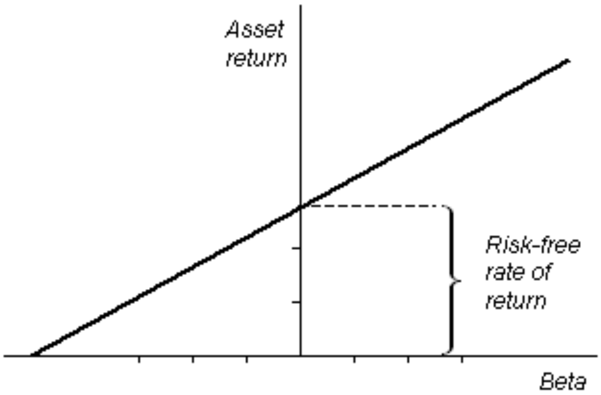
of a linear equation where the return on an asset (R_a) is expressed as a function of the premium over a risk-free baseline ($R_m - R_f$).[29] Within the capital asset pricing model, beta (β_a) represents the slope of the linear function, and the risk-free return (R_f) is a constant that defines the function's *y*-intercept.[30] This graphical representation of the capital asset pricing model is known as the security market line:[31]

Figure 1: Security market line



Source: Wikipedia, *Security market line*, http://upload.wikimedia.org/wikipedia/en/d/d9/SecMktLine.png, as displayed at http://en.wikipedia.org/wiki/Capital_asset_pricing_model

Modest algebraic rearrangement of the capital asset pricing model yields the following relationship:

$$R_m - R_f = \frac{R_a - R_f}{\beta_a}$$

The left side of the foregoing equation represents the *risk premium* demanded for the entire asset class represented by a particular segment of the market.[32] Modern portfolio theory expresses the risk premium as the difference between returns on a specific investment or class of investments and some sort of risk-free benchmark.[33] A very common application of the capital asset pricing model compares an index of equities designed to track the Standard and Poor's 500 against the putatively risk-free baseline of short-term Treasury bills.[34] This market-wide risk premium is equivalent to the risk-adjusted premium expressed on the right side of the equation — namely, the risk premium for the asset *vis-à-vis* a risk-free investment, divided by the individual asset's beta.[35]

This ratio between risk-adjusted return and volatility bears closer examination. Recall that the foregoing equation is merely an algebraically reformulated version of the basic capital asset pricing model:

$$R_a = R_f + \beta_a (R_m - R_f)$$

The ratio of (1) the premium over a baseline return to (2) the volatility associated with that asset or portfolio demonstrates how market returns are adjusted for risk, or for some surrogate such as volatility:

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[29] See id.
[30] See id.
[31] See Philip H. Dybvig & Stephen A. Ross, Differential Information and Performance Measurement Using a Security Market Line, 40 J. FIN. 383 (1985).
[32] *See* Korajczyk, *supra* note 28, at xv.
[33] *See* William F. Sharpe, *Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk*, 19 J. FIN. 425, 426-27 (1964).
[34] *See* 1 HANDBOOK OF QUANTITATIVE FINANCE AND RISK MANAGEMENT 10 (Cheng-Few Lee et al. eds., 2010).
[35] *See* Korajczyk, *supra* note 28, at xv.

$$Treynor\ ratio = \frac{R_a - R_b}{\beta_a}$$

Algebraic manipulation, in one direction or another, connects the Treynor ratio of reward to volatility with the more general capital asset pricing model. Indeed, the Treynor ratio restates the capital asset pricing model. Although mathematical congruence undermines the contribution of the Treynor ratio to the testing of the capital asset pricing model as a scientific hypothesis,[36] this definitional unity does make the Treynor ratio a convenient tool for evaluating and understanding the broader model of asset pricing. The Treynor ratio demonstrates that the general risk premium of a class of investments (such as the broader market of all publicly traded equities in the United States) is equivalent to the premium for a specific investment over risk-free return, discounted by the volatility of returns on that specific asset relative to returns on the benchmark class as a whole. In other words, we can extrapolate the Treynor ratio from the capital asset pricing model, and the capital asset pricing model from the Treynor ratio.

The Treynor ratio measures reward as return on an asset, R_a, above some benchmark return, R_b, relative to the volatility of that asset's return as expressed by its beta, β_a.[37] The benchmark return, R_b, often is but need not be equivalent to the risk-free baseline, R_f. The Treynor ratio closely resembles a generalized version of the Sharpe ratio of reward to variability (as measured by the standard deviation of portfolio returns):[38]

$$Generalized\ Sharpe\ ratio = \frac{R_a - R_b}{\sigma}$$

What unites the Sharpe and Treynor ratios is the evaluation of portfolio returns — or portfolio manager performance — according to the relationship between returns and some proxy for risk, whether variability as measured through standard deviation or volatility as measured through beta.[39]

Ratios of return (or reward) to risk share a common aim: to adjust raw financial performance for risk. Financial managers evaluated under one of the traditional measures of risk-adjusted performance — typically, either the Treynor or Sharpe ratio — may improve their standing in one of two ways. Let us begin with a more comprehensive restatement of the capital asset pricing model:

$$R_p - R_f = \beta_p (R_m - R_f) + \alpha_p$$

In ordinary language, investment return on a portfolio (R_p) consists of (1) the baseline, risk-free rate of return (R_f), plus (2) the overall capital market's systemic premium for risk relative to that baseline, adjusted for the portfolio's idiosyncratic risk [β_p ($R_m - R_f$)], plus (3) excess return (α_p). Algebraic rearrangement highlights the two distinctive components of risk-adjusted performance over a risk-free baseline:

$$R_p - R_f = \beta_p (R_m - R_f) + \alpha_p$$

This statement of risk-adjusted performance, like the capital asset pricing model, is rendered as a linear equation. This so-called security characteristic line enables us to model the relationship of alpha and beta as a line whose slope is beta and whose *y*-intercept is alpha:[40]

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[36] See Richard Roll, A Critique of the Asset Pricing Theory's Tests, 4 J. FIN. ECON. 129 (1977).

[37] See Treynor, supra note 26, at 16-17.

[38] See Sharpe, Mutual Fund Performance, supra note 13; Sharpe, Adjusting for Risk, supra note 13.

[39] See J.D. Jobson & Bob M. Korkie, Performance Hypothesis Testing with the Sharpe and Treynor Measures. 36 J. FIN. 888 (September 1981); Sharpe, Mutual Fund Performance, supra note 13, at 121-22.

[40] See Marvin McClay, The Penalties of Incurring Unsystematic Risk, 4:3 J. PORTFOLIO MGMT. 31, 32 (Spring 1978).

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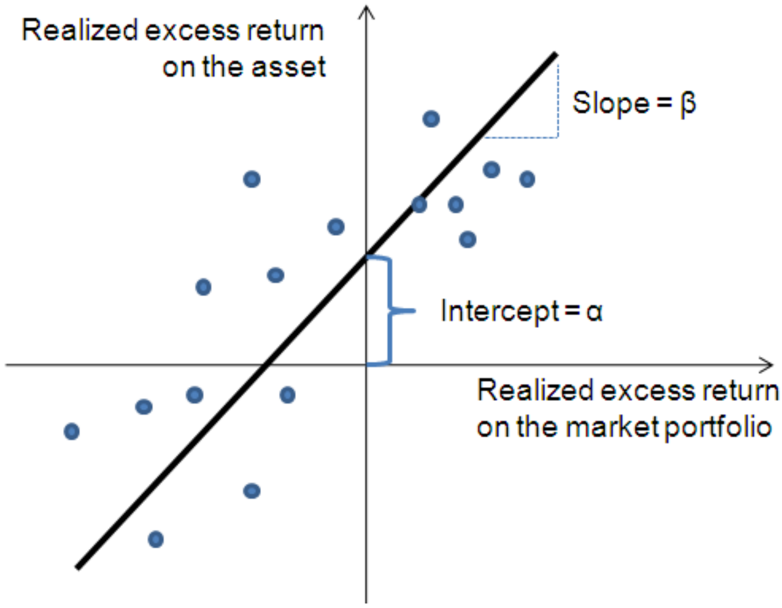
Figure 2: Security characteristic line



Source: Wikipedia, *Security characteristic line*, http://en.wikipedia.org/wiki/File:SCL-plot.PNG, as displayed at http://en.wikipedia.org/wiki/Security_characteristic_line.

Alpha is the holy grail of portfolio management. It consists of return in excess of the systemic risk-based premium for capital investments that carry any risk of failure exceeding the risk-free baseline:[41]

$$\alpha_p = R_p - [R_f + \beta_p (R_m - R_f)]$$

Alpha is presumably attributable to the portfolio manager's skill. In theory, the derivation of alpha from the more general formulation of the capital asset pricing model illustrates the two strategies for enhancing risk-adjusted performance. One is to increase alpha, presumably through the application of superior financial skill, or what the Supreme Court in a distant context has called "business acumen."[42] The other is to decrease beta by managing risk.

As portfolio theory has matured, its proponents have questioned the very existence of alpha. The strong form of the efficient capital markets hypothesis posits that the prices of securities reflect all information, public and private, and the prevalence of this knowledge prevents investors from earning excess returns.[43] Empirical measures of actual investment outcomes suggest that efficient capital markets do eliminate any opportunity to sustain alpha over meaningful stretches of time,[44] at least with respect to individual securities or other small samples of the market. In a market that is "micro efficient" over the short run (albeit "macro inefficient" over the long run),[45] excess return arises by chance. In practical terms, complete

[41] See Michael C. Jensen, The Performance of Mutual Funds in the Period 1945-1964, 23 J. FIN. 389 (1968).

[42] United States v. Grinnell Corp., 384 U.S. 563, 570-71 (1966) (defining monopolization under section 2 of the Sherman Act, 15 U.S.C. § 2, as "the willful acquisition or maintenance of that power as distinguished from growth or development as a consequence of a superior product, business acumen, or historic accident").

[43] See Eugene F. Fama & Kenneth R. French, The Cross-Section of Expected Stock Returns, 47 J. FIN. 427, 427-29 (1992).

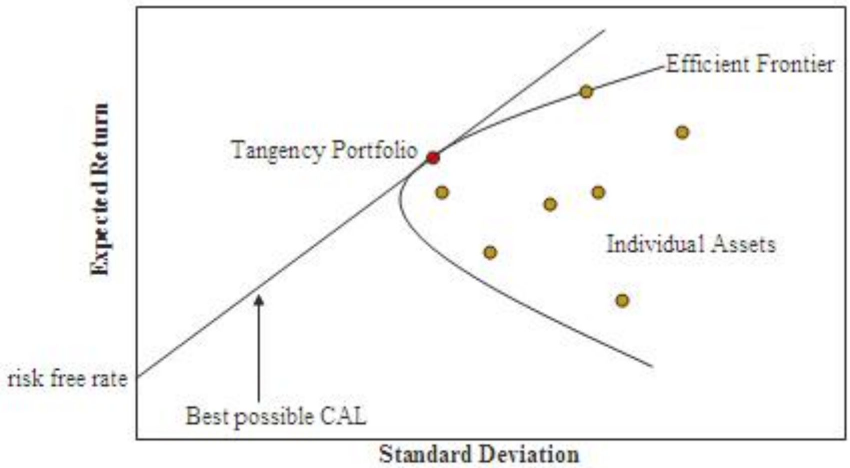
[44] See Eugene F. Fama & Kenneth R. French, Luck Versus Skill in the Cross-Section of Mutual Fund Returns, 65 J. FIN. 1915 (2010).

[45] Paul A. Samuelson is celebrated for distinguishing between the "micro efficiency" and the "macro inefficiency" of capital markets:

Modern markets show considerable micro efficiency (for the reason that the minority who spot aberrations from micro efficiency can make money from those occurrences and, in doing so, they tend to wipe out any intellectual commitment to modern portfolio theory demands the forswearing of returns from active management or any other method designed to squeeze out excess investment returns.[46] Risk management is all that remains.

If we plot every possible combination of risky assets, to the exclusion of assets representing the risk-free baseline, we can define a region of risk-adjusted returns within the space representing all possible portfolios.[47] This region resembles a hyperbola opening to the right. The upper left edge of this hyperbola (often called the Markowitz bullet) is known as the *efficient frontier*:

Figure 3:



Source: Wikipedia, *Markowitz frontier*, http://upload.wikimedia.org/wikipedia/en/e/e1/Markowitz_frontier.jpg, as displayed at http://en.wikipedia.org/wiki/Efficient_frontier.

By drawing a capital allocation line so that it is tangent to the efficient frontier at the point where the Sharpe ratio is at its highest, a manager can generate the portfolio with the highest risk-adjusted return as measured by the Sharpe ratio:[48]

$$E(R_c) = R_f + \sigma_c \cdot \frac{E(R_p) - R_f}{\sigma_p}$$

In its most aggressive manifestation, modern portfolio theory defines the efficient frontier as a single portfolio consisting of the equity market as a whole, coupled with a single decision to borrow or to lend cash, based strictly on an individual investor's willingness and ability to bear risk.[49] This complete separation of portfolio design into two unconnected investment decisions — holding a single equity portfolio reflecting the market as a whole, versus borrowing (or lending) cash — unites modern portfolio theory with the strong form of the efficient capital markets hypothesis.[50] Assuming unity in wealth effects, tax rate, and cost of capital, all investors confront the efficient frontier at a single, common point of optimal efficiency: holding a portfolio containing shares in all publicly traded companies according to

persistent inefficiencies). In no contradiction to the previous sentence, I had hypothesized considerable macro inefficiency, in the sense of long waves in the time series of aggregate indexes of security prices below and above various definitions of fundamental values.

ROBERT J. SHILLER, IRRATIONAL EXUBERANCE 43 (2d ed. 2001) (quoting Samuelson). For empirical evidence supporting this dictum, see Jeeman Jung & Robert J. Shiller, *Samuelson's Dictum and the Stock Market*, 43 ECON. INQUIRY 221 (2005).

[46] *See* William F. Sharpe, *The Arithmetic of Active Management*, 47 Fin. Analysts J. 7, 7 (1991).

[47] *See* Edwin J. Elton & Martin J. Gruber, Investments and Portfolio Performance 382–83 (2011); Steven Roman, Portfolio Management and the Capital Asset Pricing Model 53-67 (2004).

[48] *See* André F. Perold, *The Capital Asset Pricing Model*, 18 J. ECON. PERSP. 3, 10-12 (2004).

[49] *See* James Tobin, *Liquidity Preference as Behavior Towards Risk*, 67 REV. ECON. STUD. 65 (1958).

[50] *See* Eugene F. Fama, *Efficient Capital Markets: A Review of Empirical Work*, 25 J. FIN. 383 (1970).

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their relative market capitalization.[51] Given that the entire purpose of the capital asset pricing model is to reduce systemic risk through diversification, we should expect investors to encounter the efficient frontier at the point where their portolios are the most thoroughly diversified.[52] Differences in cash holdings (or borrowing) would then serve the lone purpose of bridging differences among individual investors' need for liquidity.[53]

Postmodern Portfolio Theory

An Orderly Walk Through the Postmodern Critique

Modern portfolio theory, its name notwithstanding, in many respects needs a thorough renovation. The reaction of an informed contemporary critic to this venerable model of financial analysis would be comparable to that of a postmodern architect who encounters the naked geometry of a Brutalist monument for the first time: The edifice has nice "bones," so to speak, but it needs to be rebuilt with human needs and emotions in mind before anyone will live in it.[54] Nevertheless, modern portfolio theory is ubiquitous throughout contemporary finance. Virtually every act of financial advice or analysis, whether broadcast to all subscribers within a retail investing platform or individually crafted for institutional investors, includes the ratios and metrics that have defined modern portfolio theory since its inception. Mean-variance analysis remains the coin of the financial realm.

Beset with known defects, modern portfolio theory has invited a host of critiques and competing economic models. A litany of shortcomings undermines modern portfolio theory within its own domain, to say nothing of its utility to other disciplines. We must reconcile the highly rational and formal world of modern portfolio theory with the asymmetrical, horribly inelegant distribution of risk. We must also account for the behavioral quirks that bedevil investors and portfolio managers. Human behavior routinely undermines the quest for optimal returns at the efficient frontier of personal and corporate finance.[55]

Modern portfolio theory fails to accurately describe the distribution of risks and rewards in financial markets. It severely underestimates the probability of extreme events. Much of this inaccuracy stems from modern portfolio theory's mathematically elegant but practically unrealistic construction of "beautifully Platonic models on a Gaussian base."[56] These limitations undermine the reliability of modern portfolio theory and all models of risk and return derived from it. Many of the risks of greatest interest to financiers and their regulators follow decidedly non-Gaussian distributions.[57] In reality, large swings of 3σ to 6σ occur with far greater frequency than the standard normal distribution would predict, so much so that "[e]xtreme price swings are the norm in financial markets — not aberrations."[58] Empirically

[51] *See* Sharpe, *Arithmetic of Active Management*, *supra* note 46, at 7-8.
[52] *See* Lawrence A. Cunningham, *From Random Walks to Chaotic Rashes: The Linear Genealogy of the Efficient Capital Markets Hypothesis*, 62 GEO. WASH. L. REV. 546, 568-70 (1994).
[53] *See* Sharpe, *Arithmetic of Active Management*, *supra* note 46, at 7-8.
[54] *See*, *e.g.*, CHRISTOPHER ALEXANDER, SARA ISHIKAWA & MURRAY SILVERSTEIN, A PATTERN LANGUAGE: TOWNS, BUILDINGS, CONSTRUCTION (1977); CHRISTOPHER ALEXANDER, THE TIMELESS WAY OF BUILDING (1979).
[55] *See*, *e.g.*, Daniel C. Goldie & Gordon S. Murray, The Investment Answer 13-15 (2011); Carl Richards, The Behavior Gap: Simple Ways to Stop Doing Dumb Things with Money (2012).
[56] Nassim Nicholas Taleb, The Black Swan: The Impact of the Highly Improbable 279 (2007).
[57] *See* Daniel A. Farber, *Probabilities Behaving Badly: Complexity Theory and Environmental Uncertainty*, 37 U.C. Davis L. Rev. 145 (2003).
[58] Benoit Mandelbrot & Richard L. Hudson, The (Mis)behaviour of Markets: A Fractal View of Risk, Ruin, and Reward 18 (2004).

determined departures from predicted relationships between returns and volatility, variance, or covariance take "a shot straight at the heart" of capital asset pricing theories.[59]

In addition, modern portfolio theory relies to its detriment on historical measures of risk without tracing the causes of risk. Portfolio theory and other models of financial risk assessment pale in comparison with probabilistic risk assessment, a structural approach favored by engineers and natural scientists.[60] Probabilistic risk assessment is not merely content to describe losses as a historical matter, but seeks to explain, as a causal matter, *why* losses occur.[61] By contrast, portfolio theory makes "no attempt to explain [the] underlying structure [of] price changes."[62] Portfolio theory goes no further than "simply" to "give[] probabilities" for "[v]arious outcomes."[63] At its weakest, modern portfolio theory tautologically restates the capital asset pricing model, insofar as *any* mean-variance efficient portfolio is mathematically equivalent to the expected return predicted by the capital asset pricing model:[64]

$$E(R_i) = R_f + \beta_{ip}[E(R_p) - R_f]$$

This objection to modern portfolio theory, called Roll's critique, is better known for a second claim. The second half of Roll's critique asserts that the true market portfolio is unobservable, inasmuch as it fails to address all components of net worth. Capital asset pricing model neglects assets that cannot be easily liquidated and marked-to-market on a publicly regulated exchange. That model therefore omits every alternative source of wealth, from real estate to jewelry and other personal effects. The capital asset pricing model is thus left to test its hypothesis about mean-variance efficiency on the publicly traded fraction of an individual's entire portfolio.[65] There is an analogous critique of conventional econometrics as a baseline for evaluating environmental policy. Conventional measures of social welfare such as gross domestic product, it is alleged, give little or no weight to ecosystem services.[66]

Critically, modern portfolio theory fails to account for investor behavior. The goal of correcting this defect animates all commentary assembled under the banner of *postmodern portfolio theory*.[67] Modern portfolio theory's greatest pitfalls arise from its symmetrical view of all deviations from expected return, positive or negative, as if investors viewed excess returns to be as troubling as failures to meet a targeted level of returns. Real humans harbor

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[59] Eugene F. Fama & Kenneth R. French, *The Cross-Section of Expected Stock Returns*, 47 J. Fin. 427, 438 (1992).

[60] *See generally* Hiromitsu Kumamoto & Ernest J. Henley, Probabilistic Risk Assessment and Management for Engineers and Scientists (1996).

[61] For an application of probabilistic risk assessment to the problem of estimating the average annual loss of buildings in Taipei to earthquakes, see Daigee Shaw et al., *A Probabilistic Seismic Risk Assessment of Building Losses in Taipei: An Application of HAZ-Taiwan with Its Pre-Processor and Post-Processor*, 30 J. Chinese Inst. Eng'rs 289 (2007) (available online at http://r203-2.crt.ntust.edu.tw/www/index.php/JCIE/article/viewFile/49/43).

[62] *See* Douglas W. Hubbard, The Failure of Risk Management 67 (2009) (distinguishing the simple assignment of probabilities in modern portfolio theory from more comprehensive structural analyses of risk in probabilistic risk assessment).

[63] *Id.* These qualifications notwithstanding, Hubbard uses modern portfolio theory to measure the financial worth of *anything* that might be assigned a business value. *See* DOUGLAS W. HUBBARD, HOW TO MEASURE ANYTHING: FINDING THE VALUE OF INTANGIBLES IN BUSINESS (2007).

[64] *See* Roll, *supra* note 36.

[65] *See id.*

[66] *See*, *e.g.*, Karl-Göran Mäler, Sara Aniyar & Åsa Jansson, *Accounting for Ecosystem Services as a Way to Understand the Requirements for Sustainable Development*, 105 PNAS 9501 (2008); Sheng Zhao, Huasheng Hong & Luoping Zhang, *Linking the Concept of Ecological Footprint and Valuation of Ecosystem Services: A Case Study of Economic Growth and Natural Carrying Capacity*, 15 INT'L J. SUSTAINABLE DEV'T & WORLD ECOL. 448 (2008).

[67] *See* Brian M. Rom & Kathleen W. Ferguson, *Post-Modern Portfolio Theory Comes of Age*, 2:4 J. INVESTING 27 (Winter 1993).

no fears of returns exceeding expectations. If anything, the real danger of surplus returns lies in unrealistic expectations of runaway gains (a special concern in "ground floor" investment opportunities perceived as offering lottery-like returns, such as venture capital, business development companies, initial public offerings, and crowdfunding).

This glaring inaccuracy in modern portfolio theory is an artifact of its reliance on the Gaussian distribution, which crudely treats all variance as equally detrimental. The defect was known to the architects of modern portfolio theory,[68] many of whom nevertheless adopted statistical convention in grudging acceptance of the computational limitations on their ability to process market data. Harry Markowitz's theoretical call "for calculating the covariances of every security" initially posed a "monumental" barrier to practical implementation of modern portfolio theory: under the constraints on computing power during the 1960s, "[c]alculating a single portfolio could eat up tens of thousands of dollars in computer time."[69] As William Sharpe noted in 1964: "Under certain conditions the [mean-variance analysis] can be shown to lead to unsatisfactory predictions of [investor] behavior. Markowitz suggests that a model based on the semivariance would be preferable; in light of the formidable computational problems, however, he bases his analysis on the mean and the standard deviation."[70] To this day, Markowitz defends modern portfolio theory in its classic formulation over more theoretically comprehensive methods for maximizing utility on grounds of "economically significant difficulties in cost and convenience": "The only inputs required for a mean-variance analysis are the means, variances, and covariances of the securities or asset classes" at issue.[71]

One behaviorally sophisticated defense of assigning negative value to upward departures from the arc of expected returns lies in the demonstrable and demonstrated propensity of investors to overreact to *all* swings in asset value, up or down. At the highest levels of abstraction, the two editions of Robert Shiller's *Irrational Exuberance* accurately predicted, on the basis of excessive investor demand, the bursting of the technology stock bubble in 2000 and of the housing bubble in 2007.[72] Investors' propensity to buy high, sell low, and chase returns — all in response to the endowment effect, loss aversion and other well documented behavioral phenomena[73] — is estimated to reduce fund investor returns, relative to a purely passive buy-and-hold strategy, by an annual average of 1.56 percent.[74] Likewise,

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[68] *See*, *e.g.*, Fred D. Arditti, *Risk and the Required Return in Equity*, 22 J. FIN. 19 (1967) (analyzing the relationship between skewnewss in the distribution of returns and the expected return of a security); Merton H. Miller & Myron S. Scholes, *Rates of Return with Relation to Risk: A Reexamination of Some Recent Findings*, *in* STUDIES IN THE THEORY OF CAPITAL MARKETS 47 (Michael C. Jensen ed., 1972) (subjecting one capital asset pricing model to testing in response to asymmetry in the distribution of returns).

[69] Justin Fox, The Myth of the Rational Market: A History of Risk, Reward, and Delusion on Wall Street 86 (2009).

[70] Sharpe, *Capital Asset Prices*, *supra* note 33, at 428 n.8.

[71] Harry Markowitz, *The "Great Confusion" Concerning MPT*, 4 Aestimatio 8, 14 (2012). *See generally* Harry Markowitz, *Mean-Variance Approximations to Expected Utility*, 234 Eur. J. Operational Research 346 (2014); Harry M. Markowitz & Erik Van Dijk, *Single-Period Mean-Variance Analysis in a Changing World*, 59 Fin. Analysts J. 30 (2003).

[72] *See* Robert J. Shiller, Irrational Exuberance (1st ed. 2000); Robert J. Shiller, Irrational Exuberance (2d rev. ed. 2005); *see also* Shiller, *supra* note 45. The phrase "irrational exuberance" originated in a 1996 speech by Federal Reserve chairman Alan Greenspan. *See* Alan Greenspan, *The Challenge of Central Banking in a Democratic Society* (Dec. 5, 1996) (available online at http://www.federalreserve.gov/boarddocs/speeches/1996/19961205.htm).

[73] *See*, *e.g.*, Niels van de Ven, Marcel Zeelenberg & Eric van Dijk, *Buying and Selling Exchange Goods: Outcome Information, Curiosity and the Endowment Effect*, 26 J. Econ. Psych. 459 (2005).

[74] *See* Geoffrey C. Friesen & Travis R.A. Sapp, *Mutual Fund Flows and Investor Returns: An Empirical Examination of Fund Investor Timing Ability*, 31 J. Banking & Fin. 2796, 2798, 2802 (2007). For

the risk of excessive social consumption in disregard for environmental disruption and other long-term consequences appears to reach its apex during periods of apparent, nominal economic growth. Aesop's fable of the ant and the grasshopper,[75] alas, has doubled back from its origins as a didactic allegory from the natural kingdom to human society, into a projection of human disregard of the world whose "'unfathomable complexity [and] sublime beauty'" gave rise to the "human thirst for new ideas" in the first place.[76]

Ideally, however, we would directly measure irrational exuberance instead of relying crudely on the equal treatment by conventional mean-variance analysis of upward and downward departures from expected returns.[77] Given its propensity for mathematical neologisms, portfolio theory undoubtedly would accommodate a new measure known by the Greek letter psi (ψ) the initial letter of *ψυχή*, the root of the English term *psychology*. The simplest value for ψ could be the gap between hypothetical, idealized *investment* returns in a security or a portfolio and the actual, empirically determined *investor* returns realized by those who actually bought and sold that same security or portfolio.

In addition, modern portfolio theory assumes that all actors are rational and aim to maximize their own welfare in a universal, objective way. Again, actual market data belies such sanguine assumptions about human behavior. If anything, overconfidence in personal business acumen explains a meaningful measure of price movements in capital markets.[78] There is a pronounced sex-based difference in investor overconfidence, and it lopsidedly impairs men's returns.[79] Hence the hilarious (but not inaccurate) title, *Warren Buffett Invests Like a Girl: And Why You Should, Too*.[80] Fluctuations in security prices according to the time of year[81] or even the day of the week[82] belie any confidence that rationality rather than human frailty rules the market. At a broad level of generality, behavioral limits such as these undermine the assumption of rationality that permeates not merely modern portfolio theory,

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proprietary applications of this widely observed phenomenon, see DALBAR, Inc., Research & Communications Division, *Quantitative Analysis of Investor Behavior: Volatility Unchecked* (March 2012) (described at http://www.qaib.com/public/about.aspx; previewed at http://www.qaib.com/public/downloadfile.aspx?filePath=freelook&fileName=fulleditionfreelook.pdf); *Morningstar Investor Return: Morningstar Methodology Paper* (Aug. 31, 2010) (available at http://corporate.morningstar.com/us/documents/MethodologyDocuments/MethodologyPapers/InvestorReturnMethodology.pdf). *See also Fact Sheet: Morningstar® Investor Return™* (2006) (available at http://corporate.morningstar.com/US/documents/MethodologyDocuments/FactSheets/InvestorReturns.pdf).

[75] *See*, *e.g.*, AESOP'S FABLES 65-66 (Laura Gibbs trans., 2003).

[76] Jim Chen, *Webs of Life: Biodiversity Conservation as a Species of Information Policy*, 89 IOWA L. REV. 495, 603 (2004) (quoting DAVID TAKACS, THE IDEA OF BIODIVERSITY: PHILOSOPHIES OF PARADISE 255 (1996)).

[77] The work of Brad Barber and Terrance Odean provides a promising foundation for this sort of research into behavioral finance. *See*, *e.g.*, Brad M. Barber & Terrance Odean, *All That Glitters: The Effect of Attention and News on the Buying Behavior of Individual and Institutional Investors*, 21 REV. FIN. STUD. 758 (2008); Brad M. Barber & Terrance Odean, *The Behavior of Individual Investors*, http://www.ssrn.com/abstract=1872211 (Sept. 2011).

[78] *See* Kent Daniel, David Hirshleifer & Avanidhar Subrahmanyan, *Overconfidence, Arbitrage, and Equilibrium Asset Pricing*, 56 J. FIN. 921 (2001).

[79] *See* Brad M. Barber & Terrance Odean, *Boys Will Be Boys: Gender, Overconfidence, and Common Stock Investment*, 116 Q.J. ECON. 261 (2001); *see also* MICHAEL LEWIS, BOOMERANG: TRAVELS IN THE NEW THIRD WORLD 37 (2011) ("Single men traded less sensibly than married men, and married men traded less sensibly than single women: the less the female presence, the less rational the approach to trading in the markets.").

[80] *See* LOUANN LOFTON, WARREN BUFFETT INVESTS LIKE A GIRL: AND WHY YOU SHOULD, TOO (2011).

[81] *See*, *e.g.*, Sven Bouman & Ben Jacobsen, *The Halloween Indicator, "Sell in May and Go Away": Another Puzzle*, 92 AM. ECON. REV. 1618 (2002); Seha M. Tinic & Richard R. West, *Risk and Return: January Versus the Rest of the Year*, 13 J. FIN. ECON. 561 (1984).

[82] *See*, *e.g.*, Kenneth R. French, *Stock Returns and the Weekend Effect*, 8 J. FIN. ECON. 55 (1980).

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but all of neoclassical economics.[83] Real consumers and real investors simply do not behave like the stylized actors of neoclassical economics' rational expectations hypothesis.[84]

Despite their shortcomings, modern portfolio theory and mathematical models derived from it continue to wield considerable influence. A wide range of policy judgments continue to rest on the assumption that market returns and risks follow the visually supple and analytically pliable curves of the standard normal distribution. Indeed, the metaphysical arc of modern portfolio theory and its intellectual successors exhibits the seductive symmetry of "beauty supreme — a beauty cold and austere, like that of sculpture, without any appeal to any part of our weaker nature, without the gorgeous trappings of painting or music, yet sublimely pure, and capable of a stem perfection such as only the greatest art can show."[85] The attraction in law and finance to formal elegance reflects a love affair with the Gaussian mathematics that dominates the culture of contemporary business and science.[86]

In this period of scientific transition, quantitative finance often finds that it "can no longer understand [itself] because the theories … of [its] former age no longer work and the theories of the new age are not yet known."[87] We have exactly one path forward: to "start afresh as if [we] were newly come into a new world."[88] We have no choice but to subject the comforting mirage of modern portfolio theory to a withering postmodern critique. The law's preference for ordered liberty must give way to pragmatic exigencies. When at last we grasp the uncomfortable truth that Gaussian models of risk and return belong to "a system of childish illusions," our affair with the seductive symmetry of traditional risk modeling shall pass "like first love … into memory."[89]

A Future of a Movement in Two Moments

Modern portfolio theory as an expression of first-generation quantitative finance failed to account for the actual movements of markets. It ignored the behaviorally mediated responses of investors and regulators. It said nothing about fundamental limits on the reach of knowledge. The postmodern revitalization of portfolio theory has spurred an intellectual quest for a more descriptively complete and pragmatically persuasive account of market behavior. A theory of disaster law and policy inspired by quantitative finance and cognate disciplines must reflect developments in this parallel intellectual world. A truly comprehensive approach to risk management and disaster law must build upon the Gaussian foundations of modern portfolio theory and incorporate the full intellectual apparatus of postmodern portfolio theory and other branches of quantitative finance.

By contrast with its modern predecessor, postmodern portfolio theory emphasizes the behavioral and predictive limitations of mathematical models. In a very real sense, postmodern portfolio theory completes a tour of the four mathematical moments of a statistical distribution: mean, variance, skewness, and excess kurtosis.[90] Mean-variance analysis, the heart of modern portfolio theory, focuses strictly on the first two of those

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[83] *See*, *e.g.*, GARY S. BECKER, AN ECONOMIC APPROACH TO HUMAN BEHAVIOR (1976); RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW (7th ed. 2007).
[84] *See* John A. Muth, *Rational Expectations and the Theory of Price Movements*, 29 ECONOMETRICA 315 (1961).
[85] BERTRAND RUSSELL, *The Study of Mathematics*, *in* MYSTICISM AND LOGIC, AND OTHER ESSAYS 58, 60 (1988); *accord* Jim Chen, *Truth and Beauty: A Legal Translation*, 41 U. TOLEDO L. REV. 261, 265 (2010).
[86] *See* TALEB, *supra* note 56, at 278.
[87] WALKER PERCY, *The Delta Factor*, *in* THE MESSAGE IN THE BOTTLE 3, 3 (1986).
[88] *Id.* at 7.
[89] DAVID BERLINSKI, A TOUR OF THE CALCULUS 239 (1995).
[90] *See* http://en.wikipedia.org/wiki/Moment_(mathematics).

moments. To complete our mathematically informed tour of contemporary finance, we must extend this organizing principle to its logical conclusion. Postmodern portolio theory emphasizes the mathematical properties associated with the third and fourth standardized moments of statistical distributions:[91] skewness and excess kurtosis. Respectively, skewness and excess kurtosis each correspond with a known limitation on the accuracy, reliability, and utility of conventional economic analysis. Although I will deal with them separately, if only for purposes of isolating the unique challenges that each phenomenon poses for disaster law and policy, I hasten to add that many high-risk, high-stakes phenomena exhibit both skewness and fat-tail effects.[92]

Skewness quantifies the lopsidedness of a distribution. In its quest for measures of downside risk, postmodern portfolio theory strives to detect skewed outcomes and to guide investor behavior accordingly. Moreover, disasters of all sorts, from financial crises to environmental breakdowns of the greatest magnitude, exhibit tail risks far in excess of those projected by standard normal distributions. Applied mathematics teems with responses to this problem of leptokurtosis. From the perspective of science or of policy, none of these solutions is fully satisfactory. A postmodern approach to disaster theory will place heavy reliance on the entire class of super-Gaussian probability distributions. Those distributions ultimately offer little comfort, because they open the door to the most corrosive postmodern critique imaginable: the most spectacular risks defy accurate statistical prediction.

Skewness and Postmodern Measures of Risk-Adjusted Performance

Skewness is the mathematical property that defines the asymmetry of a probability distribution. It is formally defined as the ratio of the third moment about the mean to the third power of the standard deviation:[93]

$$\gamma_1 = E\Big[\Big(\frac{x-\mu}{\sigma}\Big)^3\Big] = \frac{\mu_3}{\sigma^3}$$

In postmodern portfolio theory, actual skewness matters less than asymmetrical evaluation of downside risk versus upside potential. The deepest criticism of modern portfolio theory does not rest on the assertion that losses outpace gains in capital markets, in absolute terms and over the long run. Nor could it, for American equity markets, over a sufficiently long time horizon, have consistently increased in value, exceeding the return on Treasury bonds by a geometrically compounded average of 4 percent per year.[94] The true postmodern concern has

[91] *See generally* http://en.wikipedia.org/wiki/Moment_(mathematics); http://en.wikipedia.org/wiki/Moment-generating_function; http://mathworld.wolfram.com/RawMoment.html.

[92] *See, e.g.,* SVETLOZAR T. RACHEV, CHRISTIAN MENN & FRANK J. FABOZZI, FAT-TAILED AND SKEWED ASSET RETURN DISTRIBUTIONS: IMPLICATIONS FOR RISK MANAGEMENT, PORTFOLIO SELECTION, AND OPTION PRICING (2005).

[93] *See* http://en.wikipedia.org/wiki/Skewness.

[94] *See* Roger G. Ibbotson & Peng Chen, *Long-Run Stock Returns: Participating in the Real Economy*, 59 FIN. ANALYSTS J. 88 (2003). In fairness, there is disturbing evidence undermining this conclusion. *See* Robert D. Arnott & Peter L. Bernstein, *What Risk Premium Is "Normal"?*, 58:2 FIN. ANALYSTS J. 64 (March/April 2002) (arguing that historic expectations of 8 percent real returns on stock and 5 percent risk premium over bonds are not supported by evidence of long-run dividend growth and inflation expectations and concluding instead that the long-term, forward-looking risk premium may be near zero or even negative); Robert Arnott, *Bonds: Why Bother?*, JOURNAL OF INDEXES, May/June 2009, at 10 (available online at http://www.indexuniverse.com/publications/journalofindexes/joi-articles/5710-bonds-why-bother.html) (discovering 10-, 20-, and even 40-year periods during which real returns on bonds have beaten real returns on stocks); *cf.* Luboš Pastor & Robert F. Stambaugh, *Are Stocks Really Less Volatile in the Long Run?*, 67 J. FIN. 431 (2012) (observing that while reversion to the mean strongly reduces long-horizon variance, this stabilizing effect is neutralized and overcome by the investor's uncertainties, especially uncertainty about the expected return).

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lain in *reporting* losses with greater emphasis than corresponding gains. Even if gains on balance outweigh losses, postmodern portfolio theory will still emphasize the investor's downside exposure. Because investors care disproportionately about downside risk, and especially because investors are behaviorally prone to exercise bad judgment in response to fear of lopsided losses, a model that aspires to provide investors with useful guidance should place greater weight on downside risk, without entirely ignoring upside potential.

Postmodern portfolio theory's emphasis on downside risk aligns it with the most celebrated evaluation of asymmetry in contemporary economics. Prospect theory posits that most individuals, as an expression of innate risk aversion, fear potential losses far more than they covet potential gains.[95] As the Supreme Court of the United States recognized, decades before the rise of behavioral economics, "[t]hreat of loss, not hope of gain, is the essence of economic coercion."[96] Losing hurts worse than winning feels good.[97]

Vigilance against downside risk also aligns postmodern portfolio theory with the most temperamentally (if not politically) conservative principle in environmental law and safety regulation. As a counterweight to conventional cost-benefit analysis, the precautionary principle discourages risk-taking that may hurt the public at large, or an especially vulnerable segment of it.[98] The need to accumulate and safeguard wealth for immediate, safety- or survival-oriented consumption is likelier to consume a deeper portion of a poor family's total wealth. This sensitivity to unforeseen, even unforeseeable, risk and to wealth effects give postmodern portfolio theory a welcome home in the normative toolkit of many economists.

Even if losses are proportional to the wealth of all members of society, two manifestations of postmodern portfolio theory would still counsel precaution. Unlike modern portfolio theory, which lacks an explicit mechanism for accommodating the impact of behavioral psychology on financial decisionmaking, a more psychologically sophisticated approach explicitly incorporates behavioral factors into portfolio theory. Among the chief innovations of behavioral portfolio theory[99] is the accommodation of separate sub-portfolios corresponding to different psychological needs and different life phases. The separation theorem[100] and the two mutual fund theorem,[101] among other facets of the modern paradigm,

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[95] *See* Daniel Kahneman & Amos Tversky, *Prospect Theory: An Analysis of Decision under Risk*, 47 ECONOMETRICA 263 (1979). *See generally* DANIEL KAHNEMAN, THINKING, FAST AND SLOW (2011).

[96] United States v. Butler, 297 U.S. 1, 82 (1936).

[97] LEWIS GRIZZARD, KATHY SUE LOUDERMILK, I LOVE YOU: A GOOD BEER JOINT IS HARD TO FIND, AND OTHER FACTS OF LIFE (1979); *accord* JOE GARAGIOLA, IT'S ANYONE'S BALLGAME (1988).

[98] *See*, *e.g.*, U.N. Conference on Environment and Development, Rio de Janeiro, June 3-14, 1992, Rio Declaration on Environment and Development, U.N. Doc. A/CONF. 151/26 (vol I), annex 1, principle 15 (Aug. 12, 1992) ("Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."). For efforts to reconcile the precautionary principle with cost-benefit analysis, see Daniel H. Cole, *Reconciling Cost-Benefit Analysis with the Precautionary Principle* (March 5, 2012) (available online at https://www.law.upenn.edu/blogs/regblog/2012/03/reconciling-cost-benefit-analysis-with-the-precautionary-principle.html); Douglas A. Kysar, *It Might Have Been: Risk, Precaution and Opportunity Costs*, 22 J. LAND USE & ENVTL. L. 1 (2006).

[99] *See generally* GREG DAVIES & ARNAUD DE SERVIGNY, BEHAVIORAL INVESTMENT MANAGEMENT: AN EFFICIENT ALTERNATIVE TO MODERN PORTFOLIO THEORY (2012); Hersh Shefrin & Meir Statman, *Behavioral Portfolio Theory*, 35 J. FIN. & QUANT. ANALYSIS 127 (2000); Hersh Shefrin & Meir Statman, *Behavioral Capital Asset Pricing Theory*, 29 J. FIN. & QUANT. ANALYSIS 323 (1994).

[100] *See* Tobin, *supra* note 49.

[101] *See* Robert Merton, *An Analytic Derivation of the Efficient Portfolio Frontier*, 7 J. FIN. & QUANT. ANALYSIS 1851 (1972). In principle, the mean and variance of any efficient portfolio can be duplicated through the combination of two other funds or portfolios lying along the efficient frontier. In theory, an investor may achieve perfect efficiency at any point of the frontier by investing in a combination of these two and only these two funds.

aspire to comprehend any investor's entire wealth within a single portfolio. The countervailing approach of Maslowian portfolio theory[102] aligns asset allocation and portfolio design with the hierarchy of human needs articulated by the legendary psychologist, Abraham Maslow,[103] from simple physiology to love and esteem through self-actualization. The resulting infusion of behavioral realism gives portfolio theory its own potential shot at greatness: an opportunity to transcend its limits as a strictly *descriptive* theory and to become a powerfully accurate *predictive* theory, perhaps even a politically persuasive *prescriptive* theory.

Modern portfolio theory's traditional measurements of risk-adjusted performance, particularly the Sharpe ratio, give dangerous guidance during bear markets because they effectively treat upside and downside potential as equal constituents of risk.[104] Roy's safety-first criterion, announced in 1952, consciously embraced a goal of minimizing the probability that an investor would realize actual returns (R_a) below some minimally acceptable baseline (R_b):[105]

$$Safety\ first\!: Minimize\ P(R_a < R_b)$$

Roy's safety-first criterion is readily reconciled with modern portfolio theory's ubiquitous Sharpe ratio. Roy merely substitutes the minimally acceptable baseline for the risk-free rate of the Sharpe ratio:

$$Maximize\ \frac{E-d}{\sigma}$$

where E is the expected return and d represents "some disastrous level of return."[106]

Harry Markowitz, generally credited as the founder of modern portfolio theory, credits Roy's safety-first criterion as one of the "two papers published in 1952" that heralded the opening of the "era of modern portfolio theory."[107] As the field adopted mean-variance optimization as the primary measure of risk-adjusted performance, William Baumol later demonstrated that Roy's safety-first criterion could be satisfied by minimizing $E - k\sigma$.[108] The quantity $E - k\sigma$, structurally identical to the definition of a normal distribution's mean by reference to its standard deviation and its standard score ($\mu = x - z\sigma$), was alleged to be "a more reasonable measure of risk than σ itself."[109] Consistent with modern portfolio theory's focus on events near the mean, Markowitz and Baumol conditioned their reconciliation of Roy's safety-first criterion with the assumption that k would be pegged at "2 or 3."[110]

Roy's safety-first criterion, in retrospect, rested comfortably within modern portfolio theory's emphasis on variance near the mean. It works well, in other words, for events in the range of 2σ and 3σ. As subsequent developments in financial markets and in academic assessments of those markets have exposed the perils of hewing too close to the mean, we

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[102] *See* Phillipe J.S. de Brouwer, *Behavioural Finance and Decision Making in Financial Markets*, *in* PRINCIPLES OF MODELLING, FORECASTING, AND DECISION-MAKING 24 (Wladislaw Milo & Piotr Wdowinski eds., 2006); Phillipe J.S. de Brouwer, *Maslowian Portfolio Theory: An Alternative Formulation of the Behavioral Portfolio Theory*, 9 J. ASSET MGMT. 359 (2009).

[103] *See generally* Abraham H. Maslow, *A Theory of Human Motivation*, 50 PSYCH. REV. 370 (1943).

[104] *See* Hendrik Scholz, *Refinements to the Sharpe Ratio: Comparing Alternatives for Bear Markets*, 7 J. ASSET MGMT. 347 (2007).

[105] *See* Arthur D. Roy, *Safety First and the Holding of Assets*, 20 ECONOMETRICA 431 (1952).

[106] HARRY M. MARKOWITZ, MEAN-VARIANCE ANALYSIS IN PORTFOLIO CHOICE AND CAPITAL MARKETS 37 (1987).

[107] *Id.* The other paper was Markowitz, *Portfolio Selection*, *supra* note 6. Other sources trace the origins of portfolio selection to Helen Makower & Jacob Marschak, *Assets, Prices and Monetary Theory*, 5 ECONOMICA 261 (1938) and Jacob Marschak, *Money and the Theory of Assets*, 6 ECONOMETRICA 311 (1938). *See* FOX, *supra* note 78, at 347.

[108] *See* William J. Baumol, *An Expected Gain-Confidence Limit Criterion for Portfolio Selection*, 10 MGMT. SCI. 174 (1963).

[109] MARKOWITZ, MEAN-VARIANCE ANALYSIS, *supra* note 106, at 38.

[110] *Id.*

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may regard Roy's emphasis on avoidance of catastrophic loss as the harbinger of later economists' concern with minimizing downside risk.

What we now call postmodern portfolio theory began in earnest with Frank Sortino's development of a ratio measuring the ratio of reward to downside risk, as expressed through target semideviation:[111]

$$Sortino\ ratio = \frac{R_a - R_b}{\sigma_D}$$

We should recall, that semivariance, the square of semideviation, is what Markowitz originally envisioned as modern portfolio theory's appropriate surrogate for risk, but ultimately forswore in favor of full standard deviation because of the formidable computational obstacles. When it becomes feasible to gather and process large amounts of data, the ability to engage in raw computation of market outcomes deprecates simpler analytical shortcuts. At the very least, we have an obligation to explore alternatives to the stalwart metrics of modern portfolio theory, the Sharpe and Treynor ratios. Moore's Law all but dictates consideration of empirically derived alternatives to modern portfolio theory's computationally convenient but behaviorally deficient surrogates for risk.[112]

The crucial innovation in the Sortino ratio is the substitution of downside risk (σ_D) for standard deviation or beta as surrogates for risk in the Sharpe and Treynor ratios. Downside risk, in turn, is defined as semideviation, the square root of the target semivariance:

$$\sigma_D = \sqrt{\int_{-\infty}^{\tau} (\tau - x)^2 f(x)\, dx}$$

where τ represents a targeted minimum acceptable rate of return (equivalent to *d*, Roy's minimally acceptable "disastrous" rate of return), and *f(x)* represents the probability density function of the returns. The integration function within the downside risk formula may be formally described as the second-order lower partial moment about τ.[113]

This formal definition of the Sortino ratio enables us to redefine the three leading risk-adjusted metrics of modern and postmodern portfolio theory according to a shared set of formal mathematical definitions. Let us restate the Treynor, Sharpe, and Sortino ratios in the simplest terms possible:

Treynor ratio	$\frac{R_a - R_b}{\beta}$	$\frac{\mu - \tau}{\beta}$
Sharpe ratio	$\frac{R_a - R_b}{\sigma}$	$\frac{\mu - \tau}{\sigma}$
Sortino ratio	$\frac{R_a - R_b}{\sigma_D}$	$\frac{\mu - \tau}{\sigma_D}$

[111] *See* Frank A. Sortino & Robert van der Meer, *Downside Risk*, 17:4 J. PORTFOLIO MGMT. 27, 27-31 (Summer 1991). *See generally* FRANK A. SORTINO & STEPHEN SATCHELL, MEASURING DOWNSIDE RISK IN FINANCIAL MARKETS: THEORY, PRACTICE AND IMPLEMENTATION (2001).

[112] "Moore's law is the observation that over the history of computing hardware, the number of transistors on integrated circuits doubles approximately every two years." http://en.wikipedia.org/wiki/Moore's_law. Computing power is often assumed to double every 18 months, based on "a doubling in chip performance," which in turn combines the effects of more transistors and greater processing speed. *Id.* For a journalistic assessment of the economic and sociological impact of Moore's law, see Jonathan Rauch, *The New Old Economy: Oil, Computers, and the Reinvention of the Earth*, ATLANTIC MONTHLY, January 2001, at 35 (available online at http://www.theatlantic.com/past/docs/issues/2001/01/rauch.htm).

[113] *See* http://en.wikipedia.org/wiki/Moment_(mathematics)#Partial_moments.

Note that the numerators of all three ratios are set forth in the second column as $R_a - R_b$, or the return on an asset minus the baseline return. The third column restates all three ratios in more formal terms as $\mu - \tau$, or expected return (μ) minus target return (τ). Whatever the notation, all three ratios have the same numerator. All three ratios begin with the difference between actual returns and some sort of target, whether it is the "disastrous" minimum acceptable return of Roy's safety-first criterion or the broader market-based benchmark (S&P 500, Russell 2000) by which a professional manager measures her performance.

The structural similarity between the Sharpe ratio, in particular, and the formula for a standard score is transparent:

Sharpe ratio	$\frac{\mu - \tau}{\sigma}$
Standard score	$z = \frac{x - \mu}{\sigma}$

We must overcome the superficial confusion arising from competing uses of the parameter μ. In the Sharpe ratio (and, for that matter, the Treynor and Sortino ratios), μ represents the expected return. It is the difference between that value and the baseline, τ, that counts. The definition of a standard score also uses the parameter μ, in its more sense as the mean of a distribution. But the determination of a standard score z depends on a parallel process of seeking the difference between some independent variable and a fixed point of reference. In the risk-adjusted performance metrics, μ represents the relevant independent variable of expected returns. In standard scoring, μ represents the point of reference, a role assumed by τ in the Treynor, Sharpe, and Sortino ratios. Once we overcome this potential source of confusion, we can readily see that the Sharpe ratio is nothing more than a stylized application of standard scoring techniques to the problem of evaluating capital market returns. In mathematical jargon, the Sharpe ratio is a special case — a contextually applied version — of the more general formula for standard scoring.

The equivalence of the numerators in these three ratios invites comparative analysis of the only meaningful difference among them, their denominators. We know that both the Treynor and Sharpe ratios rely on variance. β is the more complicated measure, being the ratio of (1) the covariance of an asset with the overall portfolio to (2) the variance of the portfolio as a whole. σ is straightforwardly the standard deviation, which is in turn the positive square root of the variance: $\sigma = |\sqrt{\sigma^2}|$.

How, then, can we express the downside risk concept in the denominator of the Sortino ratio, especially in terms that connect it to the Sharpe ratio? We should exploit the formal definitions of mean, variance, and standard deviation as mathematical moments. The nth moment of a distribution $f(x)$ about the value c is defined as:[114]

$$\mu'_n = \int_{-\infty}^{\infty} (x - c)^n f(x)\, dx$$

The mean of a distribution is the first raw moment (the first moment about 0). The variance is the second moment about the mean; the standard deviation is the square root of that value. Inasmuch as all risk-adjusted measures of performance turn on the expected value of a portfolio relative to a baseline, the numerator is uniformly $\mu - \tau$, or expected return (μ) minus target return (τ). $\mu - \tau$ can be expressed as the first moment about the target return:

$$\mu - \tau = \mu'_1(\tau) = \int_{-\infty}^{\infty} (\mu - \tau)^1 f(x)\, dx$$

[114] *See* http://en.wikipedia.org/wiki/Moment_(mathematics).

In a 1994 reconsideration of his own ratio after nearly three decades of widespread use and commentary, William Sharpe acknowledged that the risk-free return — the target return baseline of his index — could vary over time.[115] The effect of this revision was that the denominator, σ, would formally represent the positive square root of the variance about τ (or R_f) *as a variable rather than a presumed constant of 0.*[116] This revision effectively enabled both the numerator and the denominator of the Sharpe ratio to be expressed as transformations of the second moment about τ, the target return. In the most formal terms possible, the denominator of the Sharpe ratio is the positive square root of the second moment about τ:

$$\sigma = \sqrt{\mu_2'(\tau)} = \sqrt{\int_{-\infty}^{\infty} (\mu - \tau)^2 f(x)\, dx}$$

The Sortino ratio makes use of partial moments, particularly the lower partial moment about the target return about τ. The *n*th order lower partial moment with respect to reference point r is defined as:[117]

$$\mu_n^-(r) = \int_{-\infty}^{\tau} (r - x)^n f(x)\, dx$$

Substituting μ for r and τ for x and then taking the square root of the second moment about τ yields the definition of downside risk, the denominator of the Sortino ratio:

$$\sigma_D = \sqrt{\mu_2^-(\tau)} = \sqrt{\int_{-\infty}^{\tau} (\tau - \mu)^2 f(x)\, dx}$$

Comparing the definitions of the Sharpe and Sortino ratio at multiple levels of mathematical formality reveals the closeness — and the distinctiveness — of these celebrated measures of risk-adjusted performance in modern and postmodern portfolio theory:

Sharpe	$\frac{\mu - \tau}{\sigma}$	$\frac{\mu_1'(\tau)}{\sqrt{\mu_2'(\tau)}}$	$\frac{\int_{-\infty}^{\infty} (\mu - \tau)^1 f(x) dx}{\sqrt{\int_{-\infty}^{\infty} (\mu - \tau)^2 f(x) dx}}$
Sortino	$\frac{\mu - \tau}{\sigma_D}$	$\frac{\mu_1'(\tau)}{\sqrt{\mu_2^-(\tau)}}$	$\frac{\int_{-\infty}^{\infty} (\mu - \tau)^1 f(x) dx}{\sqrt{\int_{-\infty}^{\tau} (\tau - \mu)^2 f(x) dx}}$

[115] *See* William F. Sharpe, *The Sharpe Ratio*, 21:1 J. PORTFOLIO MGMT. 49 (Fall 1994).
[116] *See id.*
[117] *See* Vijay S. Bawa, *Optimal Rules for Ordering Uncertain Prospects*, 2 J. FIN. ECON. 95 (1975); Peter C. Fishburn, *Mean-RiskAnalysis with Risk Associated with Below-Target Returns*, 67 AM. ECON. REV. 116 (1977); W.V. Harlow, *Asset Allocation in a Downside Risk Framework*, 47:5 FIN. ANALYSTS J. 28, 30 (Sept.-Oct. 1991); http://en.wikipedia.org/wiki/Moment_(mathematics).

This is one sense, though by no means the only one, in which all measurements of risk-adjusted performance converge into a single class of distributions, represented by the original and still iconic Sharpe ratio.[118]

The Sortino ratio has spawned a host of comparable — indeed, mathematically related — measures, all designed to measure the ratio between upside potential and downside risk. These measures' common objective is to interpret, if not necessarily to report, skewness in the distribution of returns. These measures share a primary goal of anticipating the reaction of investors to losses and a secondary goal of retaining sensitivity to prospective gains. In other words, the postmodern quest in portfolio theory is heightened vigilance against downside risk, without complete sacrifice of upside potential.

One possibility is a direct comparison of the upper and lower partial moments of a single probability distribution, each defined according to a shared point of reference. William Shadwick and Con Keating have developed what they call the omega measure, consisting of the ratio of the first-order upper and lower partial moments of the distribution of returns, each about the target return, τ:[119]

$$\Omega(\tau) = \frac{\int_{\tau}^{\infty} [1 - F(x)]dx}{\int_{-\infty}^{\tau} F(x)dx}$$

where τ is the target return and *F(x)* is the cumulative distribution function of returns about that target. Rendering this equation in the terms I have used to define other measures of risk-adjusted performance requires the decomposition of the denominator and the numerator into moments (partial and complete) of the probability density function.[120]

$$\Omega(\tau) = \frac{\int_{\tau}^{\infty} (\mu - \tau) f(x)dx}{\int_{-\infty}^{\tau} (\tau - \mu) f(x)dx}$$

The omega ratio is a straightforward comparison of the first-order upper and lower partial moments for returns. $\Omega(\tau) > 1$ indicates a bias in favor of upside gains, while $\Omega(\tau) < 1$ indicates a preponderance of losses. The mythical symmetrical distribution, with τ set at μ itself, would return an omega ratio of $\Omega(\tau) = 1$.

The numerator of the omega ratio introduces the upper partial moment, the mirror image of the lower partial moment that figures so prominently in postmodern portfolio theory:[121]

$$\mu_n^+(r) = \int_{-\infty}^{\tau} (x-r)^n f(x)\, dx$$

It should be transparent that the omega ratio, for any targeted reference point, τ, is simply the ratio of the upper partial first moment about τ to the lower partial first moment about τ:

[118] See Li Chen, Simai He & Shuzhong Zhang, When All Risk-Adjusted Performance Measures Are the Same: In Praise of the Sharpe Ratio, 11 QUANT. FIN. 1439 (2011).

[119] See William F. Shadwick & Con Keating, A Universal Performance Measure, 6:3 J. PERFORMANCE MEASUREMENT 59 (Spring 2002).

[120] *See* Paul D. Kaplan & James A. Knowles, *Kappa: A Generalized Downside Risk-Adjusted Performance Measure* 15 (2004) (available online at http://corporate.morningstar.com/NO/documents/MethodologyDocuments/ResearchPapers/KappaADownsideRisk_AdjustedPerformanceMeasure_PK.pdf).

[121] *See* http://en.wikipedia.org/wiki/Moment_(mathematics).

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$$\Omega(\tau) = \frac{\int_{-\tau}^{\infty} (\mu - \tau) f(x) dx}{\int_{-\infty}^{\tau} (\tau - \mu)^n f(x) dx} = \frac{\mu_1^+(\tau)}{\mu_n^-(\tau)}$$

In mathematical terms, the omega ratio and the Sortino ratio are very closely related. Paul Kaplan and James Knowles have restated the omega ratio in terms of the lower partial moments used to define the Sortino ratio:[122]

$$\Omega(\tau) = \frac{\mu - \tau + \int_{-\infty}^{\tau} (\tau - \mu) f(x) dx}{\int_{-\infty}^{\tau} (\tau - \mu) f(x) dx} = \frac{\mu - \tau}{\int_{-\infty}^{\tau} (\tau - \mu) f(x) dx} + 1$$

Kaplan and Knowles treat the Sortino ratio as a specialized, second-order case of a more general family of downside risk-adjusted performance measures called kappa:

$$\kappa_n(\tau) = \frac{\mu - \tau}{\sqrt[n]{\int_{-\infty}^{\tau} f(r) dr}}$$

By this definition, the Sortino ratio is simply κ_2. The omega ratio is $\kappa_1 + 1$.[123] A third measure, designated by its creators as the "Sharpe-omega ratio,"[124] turns out to be, straightforwardly, κ_1.[125]

Like omega, kappa can be stated in terms of complete and partial moments about τ. Kappa to any degree uses the same numerator as the Sharpe, Treynor, and Sortino ratios: $\mu - \tau$. As I have already demonstrated, that expression may be rendered as the first complete moment about τ, or $\mu_1'(\tau)$. Kappa's denominator is a generalized version of the Sortino ratio's denominator.

$$\kappa_n(\tau) = \frac{\int_{-\infty}^{\infty} (\tau - \mu)^1 f(x) dx}{\sqrt[n]{\int_{-\infty}^{\tau} (\tau - \mu)^n f(x) dx}} = \frac{\mu_1'(\tau)}{\sqrt[n]{\mu_n^-(\tau)}}$$

The relationship between the omega ratio and first-order kappa arises from the fact that the complete first moment about τ is the upper partial first moment *minus* the lower partial first moment:

$$\mu - \tau = \mu_1'(\tau) = \int_{-\infty}^{\infty} (\mu - \tau)^1 f(x)\, dx$$

$$\int_{-\infty}^{\infty} (\mu - \tau)^1 f(x) dx = \int_{\tau}^{\infty} (\mu - \tau)^1 f(x) dx + \int_{-\infty}^{\tau} (\mu - \tau)^1 f(x) dx$$

$$\int_{-\infty}^{\infty} (\mu - \tau)^1 f(x) dx = \int_{\tau}^{\infty} (\mu - \tau)^1 f(x) dx - \int_{-\infty}^{\tau} (\tau - \mu)^1 f(x) dx$$

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[122] *See* Kaplan & Knowles, *supra* note 120, at 15.
[123] *See id.* at 3.
[124] *See* Hossein Kazemi, Thomas Schneeweis & Raj Gupta, *Omega as a Performance Measure* (June 15, 2003) (available at http://faculty.fuqua.duke.edu/~charvey/Teaching/BA453_2006/Schneeweis_Omega_as_a.pdf) (developing a closely related metric called Sharpe-Omega).
[125] *See* Kaplan & Knowles, *supra* note 120, at 3 n.1

$$\therefore \mu_1'(\tau) = \mu_1^+(\tau) - \mu_1^-(\tau)$$

$$\kappa_1(\tau) = \frac{\mu_1'(\tau)}{\mu_1^-(\tau)}$$

$$\kappa_1(\tau) = \frac{\mu_1^+(\tau) - \mu_1^-(\tau)}{\mu_1^-(\tau)}$$

$$\kappa_1(\tau) = \frac{\mu_1'(\tau)}{\mu_1^-(\tau)} - 1$$

$$\kappa_1(\tau) = \Omega(\tau) - 1$$

$$\Omega(\tau) = \kappa_1(\tau) + 1$$

Kappa is readily scaled. Kappa enables a portfolio manager to calibrate the degree to which downside risk can, will, or should affect decisionmaking. κ_n need not be adjusted by integers. A value of $n = 1.5$, for instance, achieves some but not all of the magnification of downside risk that takes place under the Sortino ratio, where $n = 2$.

The following table provides a complete overview of risk-adjusted measures of financial performance:

Sharpe	$\frac{\mu - \tau}{\sigma}$	$\frac{\mu_1'(\tau)}{\sqrt{\mu_2'(\tau)}}$	$\frac{\int_{-\infty}^{\infty} (\mu - \tau)^1 f(x)dx}{\sqrt{\int_{-\infty}^{\infty} (\mu - \tau)^2 f(x)dx}}$
Sortino	$\frac{\mu - \tau}{\sigma_D}$	$\frac{\mu_1'(\tau)}{\sqrt{\mu_2^-(\tau)}}$	$\frac{\int_{-\infty}^{\infty} (\mu - \tau)^1 f(x)dx}{\sqrt{\int_{-\infty}^{\tau} (\tau - \mu)^2 f(x)dx}}$
Kappa$_n$	$\frac{\mu - \tau}{\sqrt[n]{\sigma_D^n}}$	$\frac{\mu_1'(\tau)}{\sqrt[n]{\mu_n^-(\tau)}}$	$\frac{\int_{-\infty}^{\infty} (\mu - \tau)^1 f(x)dx}{\sqrt[n]{\int_{-\infty}^{\tau} (\tau - \mu)^n f(x)dx}}$
Omega	$\frac{UPM_1(\tau)}{LPM_1(\tau)}$	$\frac{\mu_1^+(\tau)}{\mu_1^-(\tau)}$	$\frac{\int_{\tau}^{\infty} (\mu - \tau) f(x)dx}{\int_{-\infty}^{\tau} (\tau - \mu) f(x)dx}$

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Among these measures, the unfiltered omega ratio provides the most information about skewness within a distribution of returns. $\Omega(\tau)$ is a direct measure of the ratio of the skewness of a distribution about a chosen target, τ. As a ratio, $\Omega(\tau)$ communicates by reference to the intuitive baseline of 1 whether a distribution is skewed toward gains or toward losses. As a guide to downside risk-adjusted performance, omega has proved quite productive in the literature on quantitative finance.[126] To be sure, postmodern portfolio theory and its counterpart in disaster policy both strive to account for the impact of behavioral psychology on the perception of risk and on the formulation of appropriate responses to risk. To the extent that we wish to apply some sort of magnifying glass to account for behavioral reactions to risk or, by contrast, to achieve the opposite in order to neutralize the impact of behavior psychology, we can borrow Kaplan and Knowles's twist of applying exponents to convert a special-case ratio into a generalized family of risk-adjusted measurements of performance capable of being calibrated separately for risk-seeking and risk-averse behavior. These adjustments may provide us a more finely grained account of the full range of conduct predicted by prospect theory:

$$\Omega_{\varsigma,\alpha}(\tau) = \frac{[\int_{\tau}^{\infty} (\mu - \tau) f(x) dx]^{\varsigma}}{[\int_{-\infty}^{\tau} (\tau - \mu) f(x) dx]^{\alpha}}$$

where the exponent $\varsigma \geq 1$ in the numerator indicates risk-seeking behavior motivated by a desire for gains over a target benchmark, and the exponent $\alpha \geq 1$ in the denominator indicates risk-averse behavior motivated by fear of downside risk of failure to attain gains matching or exceeding the same benchmark.[127]

Leptokurtosis, Fat Tails, and Super-Gaussian Distributions

Leptokurtosis: The Statistical Skinny on Fat Tails

I turn now to the problem of excess kurtosis. This exercise in many ways is the mirror image of our treatment of skewness. Much of the intellectual energy in risk assessment and management has been spent on ways to emphasize the disproportionate behavioral impact of skewed returns and risks. Accurate measurement of skewness matters, of course, but financial recordkeeping has little trouble keeping precise track of gains and losses and the balance between the two. Perception is what matters. As a result, most of the methodological innovation has manifested itself in creative ways to predict how investors and others react to risk, and perhaps to prescribe how they should react.

By contrast, excess kurtosis eludes detection where it counts most — in its fat tails. What we perceive or expect, it is feared, may underestimate the most extreme risks by a

[126] *See*, *e.g.*, Helmut Mausser, David Saunders & Luis Seco, *Optimising Omega*, RISK, Nov. 2006, at 88; Theofanis Darsinos & Stephen Satchell, *Generalising Universal Performance Measures*, Risk, June 2004, at 80 (available online at http://www.risk.net/data/Pay_per_view/risk/technical/2004/0604_tech_investment.pdf) (proposing an entire family of measures, like the omega ratio, that directly compare upper and lower partial moments of the same degree).

[127] *Cf.* Denisa Cumova & David Nawrocki, *Portfolio Optimization in an Upside Potential and Downside Risk Framework* 9 (Oct. 2003) (available online at http://www90.homepage.villanova.edu/michael.pagano/DN%20upm%20lpm%20measures.pdf) (proposing the possibility of applying separate exponents to upper and lower partial moments to reflect different levels of risk-seeking or risk-averse behavior in individual investors).

significant margin. Consequently, the overarching goal in treatments of excess kurtosis, particularly the problem of leptokurtosis and "fat tails," is to devise some sort of statistical measure that accurately forecasts extreme events. Simple accuracy in description, if attainable and attained, would be a fantastic accomplishment.

In the hierarchy of statistical moments,[128] excess kurtosis follows skewness as a revealing measure of the shape of a probability distribution. Formally, excess kurtosis is "defined as the fourth cumulant divided by the square of the second cumulant, which is equal to the fourth moment around the mean divided by the square of the variance of the probability distribution minus 3":[129]

$$\gamma_2 = \frac{\kappa_4}{\kappa_2^2} = \frac{\mu_4}{\sigma^4} - 3$$

One way to tame this formidable mathematical definition is to render it slightly more manageable with Greek neologisms. Excess kurtosis describes the shape of a probability distribution. *Mesokurtic* distributions have precisely the excess kurtosis of the standard normal distribution, which is 0. *Platykurtic* distributions have less excess kurtosis relative to the Gaussian baseline. Sub-Gaussian, platykurtic distributions include the uniform distribution (continuous or discrete) and the Bernoulli distribution. The class of distributions of greatest interest in disaster law and policy is the super-Gaussian class of *leptokurtic* distributions. These distributions are characterized by a thin "peak" surrounding the mean and fat tails. "Examples of leptokurtic distributions include the Cauchy distribution, Student's *t*-distribution, Rayleigh distribution, Laplace distribution, exponential distribution, Poisson distribution and the logistic distribution."[130]

Even this nomenclature has the potential to confuse. *Λεπτός*, the root of *leptokurtic* and *leptokurtosis*, means "slender," the very opposite of the trait that matters most to us: the fatness of a leptokurtic distribution's tails. An alternative taxonomy, mercifully rendered in plain English, emphasizes the tails.[131] A thin-tailed distribution such as the uniform distribution has a finite upper limit. A medium-tailed distribution such as the Gaussian distribution has exponentially declining tails. A fat-tailed distribution such as Student's *t* or the logistic distribution has power-law tails. Again, this final category is of greatest interest to disaster law and policy.

Leptokurtosis matters because neither intuition nor conventional statistics prepares decisionmakers to properly evaluate low-probability, high-impact events. We underestimate the likelihood and the impact of such events at our peril. Power-law relationships — such as those that characterize the size of extinction events and the number of species in a habitat — are pervasive throughout economics, geology, and biology.[132] The "exponentially decaying tail" of the normal distribution exhibits "a much faster decrease than displayed by a power law."[133] Many distributions, whether characterized by a power law, exhibit both leptokurtosis and a strongly positive skew. One of the oldest and most celebrated of these right-skewed, leptokurtic distributions is Zipf's law, which describes the rank-frequency of words in natural

[128] *Cf.* http://en.wikipedia.org/wiki/Method_of_moments_(statistics).
[129] http://en.wikipedia.org/wiki/Kurtosis.
[130] http://en.wikipedia.org/wiki/Kurtosis.
[131] *See* Eugene F. Schuster, *Classification of Probability Laws by Tail Behavior*, 79 J. AM. STAT. ASS'N 936 (1984).
[132] *See*, *e.g.*, PER BAK, HOW NATURE WORKS: THE SCIENCE OF SELF-ORGANIZED CRITICALITY (1996); SIMON A. LEVIN, FRAGILE DOMINION: COMPLEXITY AND THE COMMONS 55 (1999); MANFRED SCHROEDER, FRACTALS, CHAOS, POWER LAWS: MINUTES FROM AN INFINITE PARADISE 103-19 (1991); Pablo Marquet, *Of Predators, Prey, and Power Laws*, 295 SCIENCE 2229, 2229 (2002) (hailing the "vast number of biological power laws"); M.E.J. Newman, *Power Laws, Pareto Distributions and Zipf's Law*, 46 CONTEMP. PHYSICS 323, 327-30 (2005).
[133] ALBERT-LÁSZLÓ BARABÁSI, LINKED: THE NEW SCIENCE OF NETWORKS 68 n.1 (2002).

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languages.[134] Earthquakes,[135] city sizes,[136] meteorites,[137] personal incomes,[138] for-profit businesses,[139] pages on the World Wide Web,[140] and legal precedents[141] have also been shown to follow right-skewed distributions. Many, indeed most, of these distributions follow power laws.

Regardless of their underlying causal mechanism, leptokurtic "probability distributions are inherently difficult to estimate."[142] Indeed, when "events are rare," the sheer lag time between iterations often makes it "impossible to estimate just how quickly the tail tapers off."[143] Because "fat tails bring with them an epistemic problem,"[144] it is wholly unsurprising that we lack "a commonly accepted economic framework for dealing with … thick-tailed extreme disasters."[145] The problem is so severe that we may need to concede that the entire class of problems best modeled by fat-tailed distributions transcends the category of *risk*, where probability is quantifiable, and enters the distinct category of *uncertainty*, where probability is unquantifiable.[146] Fat tails sweep us into a zone of "[t]rue uncertainty," where risks "are not well understood, where the range of outcomes is potentially very large, and where probabilities cannot be assigned with confidence."[147]

T.S. Eliot, the great twentieth century Anglo-American poet, makes a fine patron saint for leptokurtosis. Critics of Eliot's literary legacy insist that "[h]is range as a poet is limited, and his interest in the great middle ground of human experience (as distinct from the extremes of saint and sinner) [is] deficient."[148] In fairness, Eliot's "limited range" was broad enough to embrace "some verse that was pyrotechnically allusive and economical and some verse that

[134] *See* GEORGE KINSLEY ZIPF, HUMAN BEHAVIOR AND THE PRINCIPLE OF LEAST EFFORT: AN INTRODUCTION TO HUMAN ECOLOGY (1949); GEORGE KINSLEY ZIPF, SELECTIVE STUDIES AND THE PRINCIPLE OF RELATIVE FREQUENCY IN LANGUAGE (1932).

[135] *See* DONALD L. TURCOTTE, FRACTALS AND CHAOS IN GEOLOGY AND GEOPHYSICS (1997); Didier Sornette *et al.*, *Rank-Ordering Statistics of Extreme Events: Application to the Distribution of Large Earthquakes*, 101 J. GEOPHYS. RESEARCH 13,883 (1996).

[136] *See* PAUL KRUGMAN, DEVELOPMENT, GEOGRAPHY, AND ECONOMIC THEORY 42-46 (1997); Felix Auerbach, *Das Gesetz der Bevölkerungskonzentration*, 59 PETERMANNS GEOGRAPHISCHE MITTEILUNGEN 74 (1913); Xavier Gabaix, *Zipf's Law for Cities: An Explanation*, 114 Q.J. ECON. 739 (1999).

[137] *See* A.Z. Mekjian, *Model of a Fragmentation Process and Its Power-Law Behavior*, 64 PHYS. REV. LETTERS 2125 (1990).

[138] *See* VILFREDO PARETO, COURS D'ECONOMIE POLITIQUE (1896); David G. Champernowne, *A Model of Income Distribution*, 63 ECON. J. 318 (1953).

[139] *See* Robert L. Axtell, *Zipf Distribution of U.S. Firm Sizes*, 293 SCIENCE 1818 (2001); M.H.R. Stanley *et al.*, *Zipf's Plots and the Size Distribution of Firms*, 49 ECON. LETTERS 453 (1995).

[140] *See* BERNARDO A. HUBERMAN, THE LAWS OF THE WEB: PATTERNS IN THE ECOLOGY OF INFORMATION 19-31 (2001); *see also* Bernardo A. Huberman & Lada A. Adamic, *Growth Dynamics of the World-Wide Web*, 401 NATURE 131 (1999); Albert Reka *et al.*, *Diameter of the World-Wide Web*, 401 NATURE 130 (1999).

[141] *See* David G. Post & Michael B. Eisen, *How Long Is the Coastline of the Law? Thoughts on the Fractal Nature of Legal Systems*, 29 J. LEG. STUD. 545 (2000); Daniel A. Farber, *Earthquakes and Tremors in Statutory Interpretation: An Empirical Study of the Dynamics of Interpretation*, 89 MINN. L. REV. 848 (2005).

[142] Martin L. Weitzman, *A Review of* The Stern Review on the Economics of Climate Change, 45 J. ECON. LIT. 703, 723 (2007).

[143] Daniel A. Farber, *Uncertainty*, 99 GEO. L.J. 901, 926 (2011).

[144] *Id.*

[145] *Id.* at 925.

[146] This is a distinction originating in FRANK KNIGHT, RISK, UNCERTAINTY, AND PROFIT 231-35 (1921); *accord*, *e.g.*, Farber, *Uncertainty*, *supra* note 143, at 903 & n.5. *But cf.* Fox, *supra* note 69, at 84-85 (noting that "Fox was proposing to throw out something that could be measured [risk] and replace it with something that couldn't [uncertainty] — no help at all to someone trying to calculate the cost of capital").

[147] Farber, *Uncertainty*, *supra* note 143, at 906.

[148] 2 THE NORTON ANTHOLOGY OF ENGLISH LITERATURE 2163 (M.H. Abrams et al. eds., 3d ed. 1974).

was deliberately flat and prosaic."[149] Eliot covered the waterfront: "He wrote poetry of pain and alienation and at least one straightforward love poem … . He wrote plays, monologues, choruses, religious verse, satirical portraits, and cat poems. What more could you want in a poet?"[150] But the genius of *The Waste Land*, *The Love Song of J. Alfred Prufrock*, and *Four Quartets* truly did understand the extremes of human existence. Those extremes comprise the natural habitat of fat-tailed risks that hound our universe:

> The detail of the pattern is movement,
> As in the figure of the ten stairs.
> Desire itself is movement
> Not in itself desirable;
> Love is itself unmoving,
> Only the cause and end of movement,
> Timeless, and undesiring
> Except in the aspect of time
> Caught in the form of limitation
> Between un-being and being.[151]

However baffling or even aloof Eliot might be from the quotidian stuff of everyday life, his poetry is the literature of first resort in times of leptokurtic terror.

Parametric Value-at-Risk (VaR) Analysis

To illustrate the problem that leptokurtosis poses for the economically informed evaluation of financial or environmental risk, I will take a closer look at a widely used tool for assessing financial risk: value-at-risk analysis, or VaR.[152] Like modern portfolio theory, VaR assumes that risk is randomly distributed, not correlated.[153] This assumption exposes VaR and the firms and regulators who wield it to levels of tail risk that these actors have not foreseen. Worse yet, the overriding allure of VaR — that it reports risk as a single number, either a percentage or a fixed dollar amount — invites reliance on a measure that may in fact severely underestimate tail risk.

Despite its flaws and limitations,[154] VaR analysis arguably represents the most important tool for evaluating market risk as one of several threats to the global financial system. Many systems of risk management, whether through regulation or through voluntarily adopted sets of best practices, have embraced some form of VaR analysis.[155] For instance, Basel II, the second of three comprehensive sets of global guidelines for regulating systemically important

[149] XIROS COOPER, T.S. ELIOT'S ORCHESTRA: CRITICAL ESSAYS ON POETRY AND MUSIC 302 (2000).
[150] Id.
[151] T.S. ELIOT, Burnt Norton, in FOUR QUARTETS, supra note 1, at 13, 19-20.
[152] See generally LINDA ALLEN, JACOB BOUDOUKH & ANTHONY SAUNDERS, UNDERSTANDING MARKET, CREDIT, AND OPERATIONAL RISK: THE VALUE AT RISK APPROACH 1-19 (2004); SIMON BENNINGA & ZVI WIENER, VALUE AT RISK (1998); PHILIPPE JORION, VALUE AT RISK: THE NEW BENCHMARK FOR MANAGING FINANCIAL RISK (3d ed. 2006). The original VaR guidelines, RiskMetrics, have been made available for nonproprietary use and are widely circulated. See Jorge Mina & Jerry Yi Xiao, Retern to RiskMetrics: The Evolution of a Standard (2001) (available at http://www.wu.ac.at/executiveeducation/institutes/banking/sbwl/lvs_ws/vk4/rrmfinal.pdf). For a glimpse at the calculation and application of exceedance probability curves, the casualty insurance industry's analog of VaR, see Patricia Grossi, Howard Kunreuther & Don Windeler, An Introduction to Catastrophe Models and Insurance, in CATASTROPHE MODELING: A NEW APPROACH TO MANAGING RISK 23, 29-34 (Patricia Grossi & Howard Kunreuther eds., 2005); Shaw, supra note 71, at 290-95.
[153] See Charles K. Whitehead, Destructive Coordination, 96 CORNELL L. REV. 323, 341 & n.85 (2011).
[154] See, e.g., Michael C. Macchiarola, Beware of Risk Everywhere: An Important Lesson from the Current Credit Crisis, 5 HASTINGS BUS. L.J. 267, 294-97 (2009).
[155] See Whitehead, supra note 153, at 343-44.

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financial institutions,[156] identifies a version of VaR analysis as the accord's preferred tool for assessing banks' exposure to market risk.[157] Authorities around the world have endorsed VaR, either as a regulator standard or as a best practice.[158] Even absent regulatory compulsion, private firms routinely use VaR as an internal risk management tool, often directing traders to reduce exposure below the level prescribed by those firms' own VaR limits.[159]

Meanwhile, the nearly global embrace of VaR analysis has resulted in an internally contradictory and potentially destructive "conflict — the uniform application of a risk measure that presumes independence and randomness."[160] It behooves regulators to heed the old adage: In unruly markets, the only thing that rises is correlation.[161] By "promot[ing] coordination" within financial markets, uniformity in regulatory safeguards against market risk "can erode management tools premised on randomness and independent action and alter the dynamics that make risk management effective."[162] Legal efforts to coordinate markets, paradoxically and perversely, amplify financial risks and deepens the scale of losses when they accrue.[163]

Let us begin by performing a simplified version of parametric VaR analysis. Suppose that an investor stakes $1 million on an index fund tracking the Standard & Poor's 500.[164] She asks her financial advisor, "If capital markets go down to an extent witnessed only once in a hundred trading days, what can I lose by tomorrow's market close?" Magnified as appropriate, this problem stands in the place of virtually every question of market risk in finance. VaR analysis has supplied financial actors and their regulators with a facile tool for calculating the portion of a portfolio that may decline over some interval of time.

In its simplest form, parametric VaR analysis assumes normally distributed returns.[165] In other words, notwithstanding serious (and empirically warranted) doubts about the accuracy of this shortcut, parametric VaR analysis relies on the mathematics of the Gaussian

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[156] *See generally* CHRISTOPHER J. BRUMMER, SOFT LAW AND THE GLOBAL FINANCIAL SYSTEM: RULE-MAKING IN THE TWENTY-FIRST CENTURY (2011), Jim Chen, Book Review, *Soft Law and the Global Financial System: Rule-Making in the Twenty-First Century*, 25 EMORY INT'L L. REV. 1561 (2011).

[157] *See* Basel II: International Convergence of Capital Measurement and Capital Standards: A Revised Framework, part 2, ¶¶ 178-181 (June 2004) (available online at http://www.bis.org/publ/bcbs107.pdf and http://www.bis.org/publ/bcbs107b.pdf).

[158] *See*, *e.g.*, Risk-Based Capital Standards: Market Risk, 64 Fed. Reg. 19,034, 19,035 (April 19, 1999) (codified at 12 C.F.R. pt. 325); European Commission, *Internal Markets & Services DG, "Solvency II": Frequently Asked Questions*, available at http://ec.europa.eu/insternal_market/insurance/docs/solvency/solvency2/faq_en.pdf. *See generally* Whitehead, *supra* note 153, at 343-44 (listing authorities in different jurisdictions that have adopted VaR for regulatory purposes).

[159] *See* Whitehead, *supra* note 153, at 342.

[160] *Id.* at 346.

[161] *See*, *e.g.*, John Drzik, Richard J. Herring & Francis X. Diebold, T*he New Role of Risk Management: Rebuilding the Model*, Knowledge@Wharton, http://knowledge.wharton.upenn.edu/article.cfm?articleid=2268 (June 24, 2009) ("The only thing that rises in falling markets is correlations."); *see also* François Longin & Bruno Solnik, *Extreme Correlation of International Equity Markets*, 56 J. FIN. 649 (2001) (observing that correlation increases in bear markets, but not in bull markets, which implies that holding different asset classes acts may act as a drag on returns in bull markets without providing adequate diversification in bear markets).

[162] Whitehead, *supra* note 153, at 347.

[163] *See id.* at 346-52.

[164] This example is drawn from ALLEN, BOUDOUKH & SAUNDERS, *supra* note 152, at 6-7. The ensuing discussion in text also draws upon (and considerably simplifies) the analysis outlined in JORION, *supra* note 152, at 106-13.

[165] *See* ALLEN, BOUDOUKH & SAUNDERS, *supra* note 152, at 8; JORION, *supra* note 152, at 110; ÖSTERREICHISCHE NATIONALBANK, FIVE GUIDELINES ON MARKET RISK: STRESS TESTING 3-4 (Wolfdietrich Grau ed., 1999).

distribution. To compound the method's problems, VaR often relies on strictly historical data.[166] To answer our investor's question, an advisor using conventional parametric VaR analysis may assume mean daily return of 0, with a standard deviation over that interval of 100 basis points (equal to 1 percent). On those assumptions, that advisor will report a one-day value of $VaR_{1\%}$ as \$23,260 for a \$1 million portfolio. $VaR_{1\%}$ = \$23,260 is a fancy, technocratic way of telling this investor that she faces a 1 percent chance of losing \$23,260 or more on her S&P 500 index fund on any given trading day. Equivalently, the advisor could tell the investor client that her portfolio has a 99 percent chance tomorrow (after a single trading day) of being worth at least \$976,740 (\$1,000,000 − \$23,260).

In formal terms, VaR for a certain risk or confidence level is the quantile that solves the following equation:[167]

$$\epsilon = \int_{-\infty}^{-VaR} f(x)\,dx$$

ϵ represents the confidence level. In the case of the investor with a \$1 million portfolio invested in an S&P 500 index fund, $\epsilon = 1 - .01$, or .99. *f(x)* refers to the probability density function — in this case, of the distribution of returns on the investor's S&P 500 fund. As with the exercise of using lower and upper partial moments to calculate postmodern measures of risk-adjusted performance, such as the Sortino and omega ratios, parametric VaR relies on the calculation of a definite integral of a probability density function.

VaR may also be defined as the greatest lower bound (infimum) on the cumulative distribution function *F* of any financial position *Y*, expressed as a real-valued, random variable:[168]

$$VaR_{\alpha}(Y) = -\inf\{x \in \Re \mid F_Y(x) \geq \alpha\}$$

Parametric VaR analysis requires the computation of statistical quantiles.[169] The quantile function of a distribution is the inverse of its cumulative distribution function. As such, the quantile function is designated by the inverse of the capital phi symbol that designates the cumulative distribution function: $\Phi^{-1}(p)$. The quantile function of the standard normal distribution, also known as the probit function,[170] is expressed as a transformation of the inverse error function:[171]

$$z_p = \Phi^{-1}(p) = \sqrt{2} \cdot erf^{-1}(2p-1)$$

Conventional notation in VaR analysis designates the quantile function as z_p. Devising four alternate ways for referring to the same mathematical concept — quantile function, inverse cumulative distribution function, probit, and z_p — may, somewhat surprisingly, give an affirmative, intuitive boost to the understanding of the quantitative mechanics at work. Formally, "[t]he quantile z_p represents such a value that a standard normal random variable X has the probability of exactly p to fall inside the $(-\infty, z_p]$ interval."[172] In effect, we are asking what standard score, or *z*,[173] corresponds to the value of the cumulative distribution function

[166] *See* KEVIN DOWD, BEYOND VALUE AT RISK: THE NEW SCIENCE OF RISK MANAGEMENT 22 (1998).

[167] *See* Jón Daníelsson & Jean-Pierre Zigrand, *On Time Scaling of Risk and the Square-Root-of-Time Rule* 2 n.1 (Department of Accounting and FInance, Financial Markets Group, London School of Economics, March 2003) (available online at http://eprints.lse.ac.uk/24827/1/dp439.pdf), 30 J. BANKING & FIN. 2701, 2702 n.1 (2006).

[168] *See* Johanna F. Ziegel, *Coherence and Elicitability*, at 1 (March 8, 2013) (available at http://arxiv.org/pdf/1303.1690v2).

[169] *See* http://en.wikipedia.org/wiki/Quantile_function.

[170] *See* http://en.wikipedia.org/wiki/Probit.

[171] http://en.wikipedia.org/wiki/Normal_distribution.

[172] *Id.*

[173] *See* http://en.wikipedia.org/wiki/Standard_score.

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representing a certain percentage of the total under the curve that defines the probability density function of the returns on an investment.

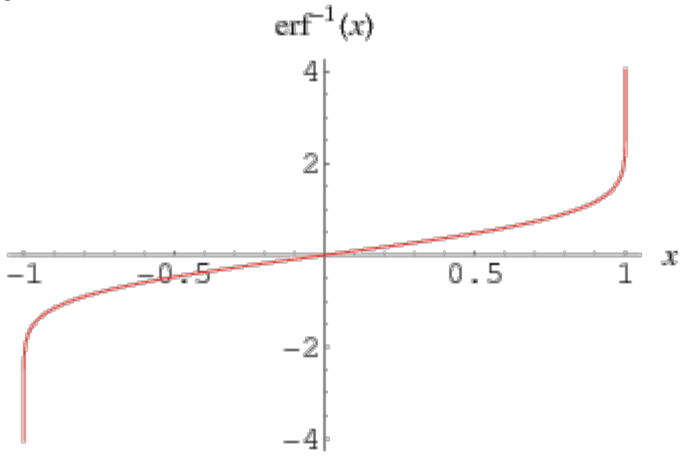
The pivotal mathematical function that does most of the work at issue, the inverse error function, warrants a brief discussion of its own.[174] In spite of its notation, erf^{-1}, is not the reciprocal of the error function, *erf*. Formally if somewhat tautologically, erf^{-1} is defined as the function that satisfies these two identities:[175]

$$erf[erf^{-1}(x)] = x, -1<x<1$$

$$erf^{-1}[erf(x)] = x, x \in \Re$$

Neither *erf* nor erf^{-1} has a closed form solution; both functions must be solved computationally.[176] The inverse error function looks like this:

Figure 4:



Source: http://mathworld.wolfram.com/images/eps-gif/InverseErf_1000.gif, as displayed in http://mathworld.wolfram.com/InverseErf.html.

We have now assembled the tools needed to complete our simple VaR analysis.[177] Recall that we have assumed our investor has staked $1 million in an S&P 500 index fund, where mean daily return (μ) is 0 and the standard deviation of that mean return (σ) is 100 bps (.01). The variable VaR_p expresses the value at risk given a particular probability of a loss as the product of $-z_p$, standard deviation σ, and the total value of the portfolio (v):[178]

$$VaR_p = -z_p \cdot \sigma \cdot v$$

The negative sign before $-z_p$ allows us to state value at risk as a positive sum at risk of loss. For σ = 100 bps and v = $1,000,000:

$$VaR_{.01} = -z_{.01} \cdot \sigma \cdot v$$

$$VaR_{.01} = -z_{.01} \cdot 100\,bps \cdot \$1{,}000{,}000$$

So far we have omitted any consideration of time. As long as returns are independent and identically distributed (a crucial assumption of any distribution obeying the central limit

[174] *See* http://en.wikipedia.org/wiki/Error_function.
[175] *See* http://mathworld.wolfram.com/InverseErf.html.
[176] *See* http://en.wikipedia.org/wiki/Error_function.
[177] The inverse error function, unfortunately, is not readily found on calculators. Nor is it supported in Google calculator or in Excel. Online inverse erf calculators do exist. To calculate erf^{-1}, I have used Casio's "Ke!san" high-accuracy calculation service at http://keisan.casio.com/has10/SpecExec.cgi?id=system/2006/1180573448.
[178] *See* ALLEN, BOUDOUKH & SAUNDERS, *supra* note 152, at 7. This formula is a simplified version of the algorithm for computing parametric VaR relative to the mean for a single time interval. *See* JORION, *supra* note 152, at 111 (equation 5.10).

theorem),[179] "variances are additive over time, which implies that volatility grows with the square root of time."[180] To account for variance over time, we typically multiply VaR by the square root of time:[181]

$$VaR_{p,t} = -z_p \cdot \sigma \cdot v \cdot \sqrt{t}$$

Adopted the simplifying assumption of a single trading day, $\sqrt{t} = 1$, enables us to forgo the potential complications that may arise from the inclusion of a temporal factor in VaR analysis.[182]

All that stands between us and a complete calculation of $VaR_{.01}$ is the value of $z_{.01}$. That value in turn requires the application of the quantile function:

$$z_{.01} = \Phi^{-1}(.01) = \sqrt{2} \cdot erf^{-1}(2 \cdot .01 - 1) \approx -2.326$$

Inserting this value of $z_{.01}$ into the formula for $VaR_{.01}$ yields the conclusion that $VaR_{.01}$ for this asset, over a trading interval of a single day, is approximately $23,260. The following table expresses cumulative probabilities for the foregoing exercise in parametric VaR analysis at commonly used intervals:[183]

p	.1%	.5%	1.0%	2.5%	5.0%	10%
z_p	−3.090	−2.576	−2.326	−1.960	−1.645	−1.282
VaR_p	$30,900	$25,760	$23,260	$19,600	$16,450	$12,820

Parametric VaR analysis "generalizes to other distributions as long as all the uncertainty is contained in σ."[184] If we are concerned that reliance on the Gaussian distribution systematically and inappropriately underestimates tail risk, we could substitute any "distribution [with] fatter tails than the normal."[185] To be sure, there is an irreducible arbitrariness in the choice of a statistical distribution as the basis for a model of risk, financial or otherwise. *Any* distribution of returns could serve as the basis for the neoclassical account of market behavior, at the heart of modern portfolio theory or parametric VaR, as long as that

[179] *See* http://en.wikipedia.org/wiki/Independent_and_identically_distributed_random_variables.

[180] JORION, *supra* note 152, at 108.

[181] *See id.* at 111 (equation 5.10).

[182] *Compare* Daniélsson & Zigrand, *supra* note 167 (demonstrating that scaling by the square root of time systematically *underestimates* risk, with greater downward bias as the time horizon increases, when the underlying risk factor follows a jump diffusion process) *with* Francis X. Diebold, Andrew Hickman, Atsushi Inoue & Til Schuermann, *Scale Models*, 11 RISK 104 (1998); Francis X. Diebold, Andrew Hickman, Atsushi Inoue & Til Schuermann, *Converting 1-Day Volatility to h-Day Volatility: Scaling by √h Is Worse than You Think* (July 3, 1997) (available at http://economics.sas.upenn.edu/~fdiebold/papers/paper18/dsi.pdf); Vikentia Provizionatou, Sheri Markose & Olaf Menkens, *Empirical Scaling Rules for Value-at-Risk (VaR)* (April 15, 2005) (available at http://web.econ.ku.dk/fru/conference/Programme/friday/a4/provizionatou_empirical%20scaling%20rule.pdf) (demonstrating that scaling by the square root of time systematically *overestimates* volatility over long time horizons when risk factors follow a GARCH(1,1) [generalized autoregressive conditional heteroskedasticity] process). The absence of "immediate alternatives to square-root of time scaling" has led the Basel Committee on Banking Supervision to acknowledge "the practical usefulness of square-root of time scaling" in spite of these theoretical limitations. Basel Committee on Banking Supervision, *Messages from the Academic Literature on Risk Measurement for the Trading Book*, at 8 (Jan. 31, 2011) (working paper no. 19) (available at http://www.bis.org/publ/bcbs_wp19.pdf).

[183] *See* ALLEN, BOUDOUKH & SAUNDERS, *supra* note 152, at 7.

[184] JORION, *supra* note 152, at 113.

[185] *Id.* (recommending Student's t-distribution with six degrees of freedom).

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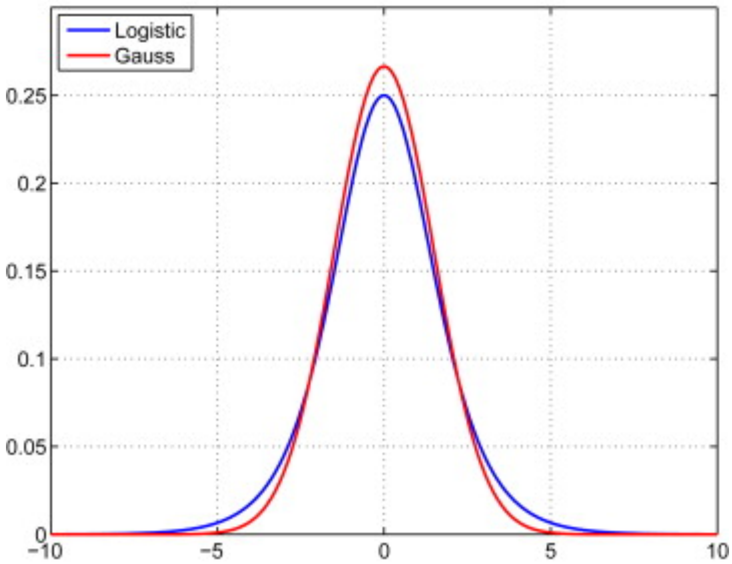
distribution is jointly elliptical and consequently symmetrical.[186] The use of elliptical distributions enables analysts to characterize all portfolios entirely by location and scale, so that a single synthetic portfolio of a particular location and scale can model any actual portfolio predicted to have those parameters.[187] The most basic statistical parameters associated with location and scale are those drawn, respectively, from the first and second mathematical moments of any distribution: the mean and the standard deviation (as the square root of variance, σ^2).

The entire family of multivariate logistic distributions belongs to this class of elliptical distributions.[188] If only for purposes of illustration, I shall substitute a simple logistic distribution[189] for the Gaussian distribution in our stylized VaR analysis of a $1 million equity portfolio. The logistic distribution looks like the Gaussian distribution, except with heavier tails:

Figure 5



Source: http://ars.els-cdn.com/content/image/1-s2.0-S0360544210000617-gr24.jpg

My purpose is not to conduct a clinic on the use of the logistic distribution and other alternatives to the Gaussian distribution. Rather, I wish solely to illustrate how statistically informed evaluations of risk might proceed in an analytical environment that takes conscious account of the limits of neoclassical economic analysis. For these purposes, the logistic distribution offers three principal advantages over its Gaussian counterpart. The first advantage is one of similarity. Both distributions are symmetrical. Formally, skewness for both distributions is 0. Although the real-world demands of risk assessment will often dictate strict reliance on empirical evidence of risk and return, modeling still matters. Of course, there are statistical distributions that exhibit both skewness and leptokurtosis relative to the

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[186] See Gary Chamberlain, A Characterization of the Distributions That Imply Mean-Variance Utility Functions, 29 J. ECON. THEORY 185 (1983); Joel Owen & Ramon Rabinovitch, On the Class of Elliptical Distributions and Their Applications to the Theory of Portfolio Choice, 37 J. Fin. 745 (1983). On the use of elliptical distributions to generalize the multivariate normal distribution, see generally KAI-TAI FANG, SAMUEL KOTZ & KAI WANG NG, SYMMETRIC MULTIVARIATE AND RELATED DISTRIBUTIONS (1990); ALEXANDER MCNEIL, RÜDIGER FREY & PAUL EMBRECHTS, QUANTITATIVE RISK MANAGEMENT: CONCEPTS, TECHNIQUES, AND TOOLS 72-78 (2005).

[187] See sources cited supra note 186.

[188] See Zinoviy M. Landsman & Emiliano A. Valdez, Tail Conditional Expectations for Elliptical Distributions, 7 N. AM. ACTUARIAL J. 55, 59-60 (2002).

[189] See http://en.wikipedia.org/wiki/Logistic_distribution.

Gaussian baseline. It is entirely possible to conduct parametric VaR analysis using a three-parameter lognormal distribution[190] or a log-logistic/Fisk distribution,[191] both of which can generate distributions that are at once asymmetrical and fat-tailed. Indeed, it is possible to organize entire families of statistical distributions according to mean, standard deviation, and skewness[192] — or even according to mean, standard deviation, skewness, and kurtosis[193] — and to select among these distributions according to algorithms that report the best fit for a given data set.[194] For the purpose of articulating the basics of quantitative finance as a model for assessing disaster policy, we are better served, at least initially, to isolate issues of excess kurtosis, wholly apart from skewness, and evaluate models on the sole basis of differences in excess kurtosis.

The second, and primary, advantage of the logistic distribution over the Gaussian distribution is head-to-head leptokurtosis. The logistic distribution's tails are fatter. In the illustration above, the logistic distribution opens up perceptibly, relative to the Gaussian distribution, at values for *z* between $\pm 3\sigma$ to $\pm 6\sigma$. By contrast with the normal distribution's excess kurtosis of 0, the degree of excess kurtosis in the logistic distribution is 6/5.[195]

The final advantage favoring the logistical distribution is ease of analysis. By contrast with the Gaussian distribution, the inverse cumulative distribution function of the logistic distribution has a closed-form solution and can be solved analytically:[196]

$$F^{-1}(p;\mu,s) = \mu + s\,ln(\frac{p}{1-p})$$

$F^{-1}(p)$ is the logistic function's analog to the notation for the inverse cumulative distribution function of the normal distribution, $\Phi^{-1}(p)$. As always, μ represents the mean. s is not quite standard deviation σ, but rather a parameter proportional to it. The proportion of s to σ can be calculated from the variance of the logistic function (which, as with other distributions, is the square of standard deviation σ):[197]

$$\sigma^2 = \frac{\pi^2}{3}s^2$$

$$\sigma = \frac{\pi}{\sqrt{3}}s$$

$$s = \frac{\sqrt{3}}{\pi}\sigma$$

The ratio $\sqrt{3}/\pi$ is approximately .5513.

Let us suppose that the advisor to our hypothetical \$1 million investor's advisor, upon further reflection, fears that simple parametric VaR analysis, conducted using a normal distribution, understates the risk to the client's portfolio. After all, "it is often the case that the simplicity of VaR measures used … is in large part obtained with assumptions not

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[190] *See* J. Aitchison & J.A.C. Brown, The Lognormal Distribution, with Special Reference to Its Use in Econometrics (1957); Hal Forsey, *The Mathematician's View: Modelling Uncertainty with the Three Parameter Lognormal*, *in* Managing Downside Risk in Financial Markets 51 (Frank A. Sortino & Stephen Satchell eds., 2001); Eckhard Limpert, Werner A. Stahel & Markus Abbt, *Log-Normal Distributions Across the Sciences: Keys and Clues*, 51 BioScience 341 (2001).

[191] *See* Peter R. Fisk, *The Graduation of Income Distributions*, 29 Econometrica 171 (1961).

[192] *See* N.L. Johnson, *Systems of Frequency Curves Generated by Methods of Translation*, 36 Biometrika 149 (1949).

[193] *See* I.D. Hill, R. Hill & R.L. Holder, *Fitting Johnson Curves by Moments*, 25 Applied Stat. 180 (1976).

[194] *See* Steven E. Posner & Moshe Arye Milevsky, *Valuing Exotic Options by Approximating the SPD with Higher Moments*, 7 J. Fin. Eng'g 109 (1998).

[195] *See* http://en.wikipedia.org/wiki/Logistic_distribution.

[196] *See* http://en.wikipedia.org/wiki/Logistic_distribution#Quantile_function.

[197] *See* http://en.wikipedia.org/wiki/Logistic_distribution.

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supported by empirical evidence."[198] Of these assumptions, the "most important (and most problematic) … is that returns are normally distributed."[199] And sure enough, there is very strong reason to believe that stock market returns, whatever else they do, do not follow the normal distribution.[200] Departures from expected value, especially in the tails of a distribution, put a premium on statistical robustness — the resistance of a statistical model to outliers or other deviations from the assumptions underlying the model.[201] One quick way to heighten the robustness of parametric VaR analysis, given the newly acknowledged fear that our first attempt at parametric VaR may not have properly identified tail risks, is to recalculate VaR according to a more leptokurtic distribution.

If we now recalculate parametric VaR according to a logistic distribution of returns, even as we retain the value of 0 for μ and 100 bps for σ, we witness a systematic shift in our VaR analysis:

Gaussian VaR

p	.1%	.5%	1.0%	2.5%	5.0%	10%
z_p	−3.090	−2.576	−2.326	−1.960	−1.645	−1.282
VaR_p	$30,900	$25,760	$23,260	$19,600	$16,450	$12,820

Logistic VaR

p	.1%	.5%	1.0%	2.5%	5.0%	10%
z_p	−3.808	−2.918	−2.533	−2.020	−1.623	−1.211
VaR_p	$38,080	$29,180	$25,330	$20,200	$16,230	$12,110
ΔVaR_p	+$7,180	+$3,420	+$2,070	+$600	−$220	−$710

Bell curves come in different configurations. The logistic distribution belongs to the same class of jointly elliptical distributions that also includes the standard normal distribution. Skewness, the obsessive object of performance metrics emphasizing downside risk, has no impact on any of these perfectly symmetrical distributions. As even this highly stylized and simplified exercise demonstrates, however, excess kurtosis does matter. The relative fatness of the logistic distribution's tails raises VaR estimates by ever increasing margins, relative to the corresponding VaR estimates under a Gaussian model, as we move further into the realm of extreme outcomes. At modest levels such as $p = .01$, the substitution of a logistic model for a normal model results in an 8.9 percent increase in VaR. At $p = .001$, however, the difference arising from the substitution of what is, visually speaking, a nearly congruent curve becomes 23.2 percent. That is a far larger amount of risk that a portfolio manager must hedge, either through diversification of assets or (more likely in treacherous market conditions or under the pressure of a demanding regulatory stress test) through aggressive reduction in the overall size of the portfolio.

Greater caution against heightened forecasts of risk is precisely what many bankers do *not* want to implement. Caution in whatever form — whether diversification, portfolio

[198] ALLEN, BOUDOUKH & SAUNDERS, *supra* note 152, at 8.
[199] *Id.*
[200] *See*, *e.g.*, Szilard Páfka & Imre Kondor, *Evaluating the RiskMetrics Methodology in Measuring Volatility and Value-at-Risk in Financial Markets*, 299 PHYSICA A 305, 309 (2001).
[201] *See*, *e.g.*, PETER J. HUBER, ROBUST STATISTICS 1 (1981); Stephen Portnoy & Xuming He, *A Robust Journey in the New Millennium*, 95 J. AM. STAT. ASS'N 1331 (2000).

reduction, or hedging through futures and options — always comes at a price. Recall also that we have compressed the time horizon for the Gaussian and logistic versions of our simplified parametric VaR analysis to a single day. A longer time horizon expands the gap between Gaussian and logistic VaR analysis, and with it, the portfolio manager's reluctance to adopt a measure of risk that can be reliably expected to reduce profitability. Over any time horizon, the risk of multiple occurrences within a single test period also compounds the propensity to *underestimate* aggregate losses.[202] What we should expect to observe in real-world regulatory settings is a systematic failure to implement sufficient safeguards against market risk to the balance sheets of individual investors, of nonprofit endowments, and of systemically important financial institutions.

If we shove both curves to the sort of black swan event that arrives in one out of a million trading days, roughly once every 4,000 years, the difference becomes even more dramatic. A Gaussian model evaluates VaR_{1e-6} as nearly a 5σ event and contemplates \$47,530 in value at risk from an event that would happen only once since the Middle Kingdom ruled Egypt.[203] But the logistic model calculates VaR_{1e-6} as \$76,170. A Gaussian approach to parametric VaR would evaluate a potential loss of \$76,170 as an event falling just shy of 8σ. As we probe ever deeper risks and seek ever higher confidence levels, we discover to an even greater extent how "we lack good analytic techniques for quantifying total risk when the distribution has a fat tail."[204]

Although adopting a more leptokurtic statistical distribution improves the robustness of our exercise in parametric VaR analysis, we have strong reason to believe that no historic model of economic risk can predict extreme tail events. It bears remembering that the record of monthly fluctuations in American stock market prices from 1871 through 2010 has reported 10σ events in both directions,[205] even though we have already surmised (quite erroneously) that a 5σ event happens once every 4,000 years. September 1939, the opening month of World War II, recorded a 9σ departure from the history of correlations between market returns and beta from 1955 through 1968.[206] A 50-year survey of oil prices, from 1960 through 2010, has revealed a 37σ event in 1973.[207] 37σ! It would not have been unreasonable for an oil trader or even a casual economic observer to believe that "the economic world as we knew it was coming to an end."[208]

The literal end of the world is not too far fetched. We must now accept the nonzero probability of catastrophic climate change.[209] The geologic record shows that the annual risk of a collision with an asteroid or comet at least 10 kilometers in diameter, of the sort found at the Cretaceous/Tertiary boundary and "credited" with ending the Mesozoic Era of geologic history, should be evaluated at 1×10^{-8}.[210] Risks associated with losses of a magnitude

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[202] *See* Shaw *et al.*, *supra* note 61, at 290.
[203] One million divided by 252, the number of trading days in a year, is just under 4000.
[204] Farber, *Uncertainty*, *supra* note 143, at 927.
[205] *See* William D. Nordhaus, *The Economics of Tail Events with an Application to Climate Change*, 5 REV. ENVTL. ECON. & POL'Y 240, 242-43 (2011).
[206] *See* Juan Salazar & Annick Lambert, *Fama and MacBeth Revisited: A Critique*, 1 AESTIMATIO 48, 64 (2010).
[207] *See* Nordhaus, *supra* note 205, at 243.
[208] *Id.*
[209] *See*, *e.g.*, Andreas Schmittner et al., *Climate Sensitivity Estimated from Temperature Reconstructions of the Last Glacial Maximum*, 334 SCIENCE 1385 (2011).
[210] *See* Clark R. Chapman & David Morrison, *Impacts on the Earth by Asteroids and Comets: Assessing the Hazard*, 367 NATURE 33 (1994). Some sources suggest that the implied interval of 100 million years between catastrophic bolide strikes is too conservative. Natural historians in this camp have identified cycles of 26 to 30 million years between mass extinctions of marine invertebrates. *See* Marc Davis, Piet Hut & Richard A. Muller, *Extinction of Species by Periodic Comet Showers*, 308 NATURE 715 (1984); David M. Raup & J. John Sepkoski, Jr., *Periodicity of Extinctions in the Geologic Past*, 81 PNAS 801 (1984); David M. Raup & J. John Sepkoski, Jr., *Periodic Extinction of Families and Genera*,

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sufficiently grandiose to portend the end of civilization, possibly even the survival of humans as a species, have given rise to a "dismal theorem": "the catastrophe-insurance aspect of such a fat-tailed unlimited-exposure situation, which can never be fully learned away, can dominate the social-discounting aspect, the pure-risk aspect, and the consumption-smoothing aspect."[211] In plainer language, the dismal theorem posits that "under limited conditions concerning the structure of uncertainty and societal preferences, the expected loss from certain risks such as climate change is infinite and that standard economic analysis cannot be applied."[212]

The history of portfolio theory may provide a scintilla of comfort, though not much more.[213] In 1963, both Benoit Mandelbrot[214] and Eugene Fama[215] hypothesized that stock prices follow a stable Paretian distribution. Within two years, Fama could and did assert that "[t]he presence, in general of leptokurtosis in the empirical distributions seems indisputable."[216] Seemingly as indisputable was the mounting evidence that the best statistical model for capital asset prices was indeed the stable Paretian distribution.[217]

The trouble is that for any value of shape parameter $\alpha < 2$, the stable Paretian distribution has infinite variance.[218] When $\alpha = 2$, we encounter a special case of the stable Paretian distribution called the normal distribution.[219] For most other stable Paretian distributions, the usual statistical parameters, from mean and standard deviation to skewness and excess kurtosis, are mathematically undefined.[220] It could be worse. The Cauchy distribution, with an undefined mean, infinite variance, no finite moments of order greater than zero, and no moment-generating functions, is statistics' "canonical example of a 'pathological' distribution."[221] The Cauchy distribution also happens to be a special case of the stable Paretian distribution, with scale parameters $\alpha = 1$ and $\beta = 0$.[222] These are the traits that have

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231 Science 833 (1986). But see Antoni Hoffman, Patterns of Family Extinction Depend on Definition *and Geological Timescale*, 315 Nature 659 (1985); Richard A. Kerr, *Periodic Extinctions and Impacts Challenged*, 227 SCIENCE 1451 (1985).

In the interest of thoroughness, it should be noted that the traditional names of the most recent periods of geologic history, the Tertiary and the Quaternary, have been officially deprecated by the International Commission on Stratigraphy and replaced by the terms Paleogene and Neogene. *See Whatever Happened to the Tertiary and Quaternary?*, http://www.stratigraphy.org/bak/geowhen/TQ.html. Old habits die hard, and certain geologists seem determined to retain the traditional nomenclature. *See* James G. Ogg & Brad Pillans, *Establishing Quaternary as a Formal International Period/System*, 31 EPISODES 230 (2008); Amos Salvador, *The Tertiary and the Quaternary Are Here to Stay*, 90 AAPG BULL. 21 (2006). No one speaks of the Cretaceous/Paleogene boundary; the popular imagination, for the foreseeable future, will continue to speak of the K/T, or the Cretaceous/Tertiary boundary.

[211] *See* Martin L. Weitzman, *On Modeling and Interpreting the Economics of Catastrophic Climate Change*, 91 REV. ECON. & STAT. 1, 1 (2009).

[212] Nordhaus, *supra* note 205, at 240.

[213] *Compare* ICC v. Union Pacific Railroad, 222 U.S. 541, 548 (1912) (requiring more than "a mere scintilla of evidence) *with* NLRB v. Columbian Enameling & Stamping Co., 306 U.S. 292, 299 (1939) (demanding truly "substantial" evidence).

[214] *See* Benoit Mandelbrot, *The Variation of Certain Speculative Prices*, 36 J. BUS. 394 (1963).

[215] *See* Eugene F. Fama, *Mandelbrot and the Stable Paretian Hypothesis*, 36 J. BUS. 420 (1963).

[216] Eugene F. Fama, *The Behavior of Stock-Market Prices*, 38 J. BUS. 34, 42 (1965).

[217] *See id.* at 43-45.

[218] *See* http://en.wikipedia.org/wiki/Stable_Paretian_distribution.

[219] *See* JOHN P. NOLAN, STABLE DISTRIBUTIONS: MODELS FOR HEAVY TAILED DATA 13 (2009).

[220] *See* http://en.wikipedia.org/wiki/Stable_Paretian_distribution.

[221] http://en.wikipedia.org/wiki/Cauchy_distribution.

[222] *See* Fama, *The Behavior of Stock-Market Prices*, *supra* note 216, at 102; http://en.wikipedia.org/wiki/Stable_distribution.

led Mandelbrot to conclude that financial markets have infinite variance, perhaps even infinite expected value.[223]

Undefined statistical parameters subject evaluators of risk to considerable inconvenience. We may be tempted to seek solace in the law of large numbers and in the central limit theorem: a sufficiently large number of independent and identically distributed random variables, each with finite mean and variance, will be approximately normally distributed.[224] There are two problems with this strategy. First, the central source of fragility in our statistical assumptions, that returns must be either normally distributed or else infinitely variable, arises from portfolio theory's own self-imposed methodological precommitments and constraints.[225] Second, the data stubbornly refuse to exhibit finite variance.[226] Finally, we lack the time to wait on a sufficient large number of iterations. The economic maxim, "In the long run we are all dead,"[227] is also a biological imperative.

The most extreme disaster scenarios leave us the question of what to do in the face of "infinite disutility."[228] In the case of portfolio theory, the threat of infinite variance has not blocked half a century of refinement of a model known by its designers to be wrong, or at least dangerously flawed. In risk management as in administrative law, "muddling through" may not deliver crisp, definitive answers, but it is a coping mechanism.[229] To be sure, the prospect of wealth may have provided motivation to financial theorists, particularly those who became prophets of VaR in pursuit of outsized trading profits. By comparison, saving the planet from a nonzero probability of civilization-destroying cataclysm should be motivation enough. The arrow of possibility points in the opposite direction. That should pose a low hurdle. Postmodern portfolio theory's treatment of skewness rests on the defensible assumption that investors respond to upside potential, even when they focus on minimizing downside risk.

The presence of fat tails, especially when they are fat enough to push probability distributions toward the intractable extreme of infinite variance, thrusts us into "ignorance about both the exact form of the distribution (*e.g.*, normal, Pareto, or exponential) and the exact parameters of the distribution."[230] The future of postmodern disaster theory is a future of staggering data with diminished confidence in beautiful but deceptive statistical models. We may anticipate a parade of imperfectly articulated hypotheses and efforts at verification or falsification that will likely lead neither to elegant closed-form solutions nor to pathological functions. Ours after all is a world whose fundamental forces defy analog definition, but do

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[223] Benoit B. Mandelbrot, The Fractal Geometry of Nature 337-38 (1983).

[224] *See* Olav Kallenberg, Foundations of Modern Probability 275 (1997); C.C. Heyde, *Central Limit Theorem*, *in* 4 Encyclopedia of Statistical Sciences 651 (Samuel Kotz *et al.* eds., 1983). On nonparametric methods for testing departures from the central limit theorem's assumption of independent and identically distributed random variables, see generally Sidney Siegel & N. John Castellan, Jr., Nonparametric Statistics for the Behavioral Sciences (2d ed. 1988); A.N. Kolmogorov, *Sulla determinazione empirica di unna legge di distribuzione*, 4 G. Ist. Ital. Attuari 83 (1933); N. Smirnov, *Table for Estimating the Goodness of Fit of Empirical Distributions*, 19 Annals Math. Stat. 279 (1948); William H. Kruskal & W. Allen Wallis, *Use of Ranks in One-Criterion Variance Analysis*, 47 J. Am. Stat. Ass'n 583 (1952); Robert G. Mogull, *The One-Sample Runs Test: A Category of Exception*, 19 J. Educ. & Behav. Stud. 296 (1994).

[225] Markowitz, *supra* note 12, at ix; *accord* Salazar & Lambert, *supra* note 206, at 53 n.13.

[226] *See* Farber, *Uncertainty*, *supra* note 143, at 923-24 n.95 (explaining why the law of large numbers does not operate to "shrink down" the sample mean of a Cauchy distribution even as sample size increases).

[227] John Maynard Keynes, A Tract on Monetary Reform 80 (1924); *see also* John Irving, The World According to Garp 688 (1998) ("[I]n the world according to Garp, we are all terminal cases.") (1st ed. 1978).

[228] *See* Nordhaus, *supra* note 205, at 253-54.

[229] *See* Charles E. Lindblom, *The Science of "Muddling Through,"* 19 Pub. Admin. Rev. 79 (1959); Charles E. Lindblom, *Still Muddling, Not Yet Through*, 39 Pub. Admin. Rev. 517 (1979).

[230] Nordhaus, *supra* note 206, at 256-57.

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invite quantification while leaving ample room to pursue theories of everything.[231] Probability is all there is.

A Summary

The following table charts the progression of portfolio theory from its "modern" origins through "postmodern" innovations responding to concerns over skewness and leptokurtosis according to the mathematical moments of any statistical distribution and the risk management concerns associated with each moment:

1	μ α	mean alpha	equity premium, growth rate
2	σ $\sigma 2$ β	standard deviation variance beta (proxy for risk)	variability or volatility as a risk proxy
2+	β $R2$	beta (covariance) correlation	violations of IID, central limit theorem → normal distribution is no longer valid
3	$\gamma 1$	skewness	inequality, downside risk
3+	ψ	psi (*investment* returns minus *investor* returns)	wealth effects: prospect theory, endowment effect, disposition effect
4	$\gamma 2$	(excess) kurtosis	leptokurtosis, fat tails, super-Gaussian distributions
4+	$r=\rho+\eta g$	Ramsey equation	long-term social discount rate; dismal hypothesis

The Efficient Frontier of Risk Management

No less than the portfolios held by investors and financial institutions, contemporary economics' portfolio of quantitative rules should be evaluated according to criteria to measure the performance of financial portfolios and their managers. The fulfillment of the promise of postmodern portfolio theory's promise as a guide to policy lies in perfecting the mathematical toolkit used to manage risk in all domains.

The postmodern critique of portfolio theory frames a coherent agenda for risk management. We know the pitfalls of the Gaussian mathematics of modern portfolio theory and other products of the neoclassical tradition in economics. In addition to showing some contemporary tools for navigating the statistical challenges posed by skewness and excess kurtosis, this article has shown the stark contrast between devising behaviorally sensitive ways to manage known skewness and muddling through the uncertainty of the fat tails that define the world's most potentially cataclysmic risks. Seizing the moment, mathematically speaking, represents our best hope of navigating problems that defy existing statistical understandings of mean, variance, skewness, and kurtosis.

[231] At the risk of overstepping disciplinary boundaries even more egregiously than I have throughout this article, I speak of the irreducibly probabilistic nature of quantum mechanics. *See*, *e.g.*, GEORGE GREENSTEIN & ARTHUR ZAJONC, THE QUANTUM CHALLENGE: MODERN RESEARCH ON THE FOUNDATIONS OF QUANTUM MECHANICS 215 (2d ed. 2006).

Finance and cognate fields informed by finance comprise a single, theoretically coherent exercise in societal risk management. These are lessons that find ready application in a wide range of settings, from systemically important financial institutions to the heightened instability of food production and ecological systems under pressure from human intrusion and anthropogenic climate change.

The relationship between performance and systemic risk inspired portfolio theory and placed it at the forefront of contemporary financial science. Mastery of the quantitative tools and the psychological insights of the postmodern critique promises access to the efficient frontier of risk management.

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RISK-ADJUSTED PRICING OF BANK'S ASSETS BASED ON CASH FLOW MATCHING MATRIX

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Abstract. *To price bank's assets correctly, it is important to know cost of funds. But funding cost calculation is complicated due to the fact that banks fund long-term assets through short-term liabilities. As a result, assets with a given time to maturity are usually financed by several liabilities with different maturities. To calculate funding cost it needs to know how cash flows are matched between assets and liabilities. For this it`s used cash flow matching matrix or funding matrix. In the paper, a new algorithm of filling of a two-dimensional funding matrix that is based on the golden rule of banking and modified RAROC-approach is proposed. It provides positive definiteness and uniqueness of the matrix. The matrix shows terms to maturity and amounts of liability cash flows which fund the asset cash flow with a given term to maturity. Examples of partially and fully filled matrices are presented. It is proposed an approach to risk-adjusted pricing that is based on this funding matrix and RAROC-approach adapted to cash flows. The developed approach to pricing integrates organically credit and liquidity risks. It takes into consideration expected credit losses and economic capital (unexpected credit losses) for all lifetime of asset cash flows and not one-year period traditionally used in RAROC.*

Key words: *asset pricing, funding matrix, economic capital, cash flow at risk, risk-adjusted return on capital (RAROC), cash flow matching, interest rate, asset, liability*

Introduction

To price bank's assets correctly, it is important to know cost of funds. But funding cost calculation is complicated due to the fact that banks fund long-term assets through short-term liabilities (Haan and End, 2012). As a result, assets with a given time to maturity are usually financed by several liabilities with different maturities. In general case, assets-liabilities mismatch is defined by accessibility of funds with different maturities in different markets or, in other words, prevalent supply of term funding.

To calculate interest rates for funding follow to use cash flow matching matrix or funding matrix. Note that to build a funding matrix the entire range of assets and liabilities maturities are grouped into N time buckets.

A one-dimensional funding matrix (row vector) is broadly known. This is the simplest matrix which shows only excess or shortfall of funding (liquidity gap, gap_i) in each i-th time bucket (Bessis, 1988; Sinkey, 2002; Deutsche bank, 2012):

$gap_i = CFA_i - CFL_i$,

where CFA_i, CFL_i are cash flows of bank's assets and liabilities belonging to i-th time bucket.

However, such a matrix does not give a clear understanding of these important parameters:

- how much assets are financed according to the golden rule of banking: "assets and liabilities should not have mismatched maturities" (Hübner, 1853) or, in other words, about closed liquidity positions. Herewith, the closed liquidity position for each *i*-th time bucket is equal to minimal value of cash flows of assets (CFA_i) and liabilities (CFL_i) correspondently, and;
- what amount of liabilities with what maturities funds asset with a given maturity.

However, for right asset pricing, it is crucial to know these parameters. That is why it is essential to use advanced two-dimensional funding matrix.

It should be noted that literature concerning to building the two-dimensional funding matrix is very limited. Only some investigators and practitioners are interested in construction of such a funding matrix (see, for example, Skyrta and Stovbchatiy, 1997; Veselov, 2012). The main lack of these approaches is that the maturities of assets and liabilities are not taken explicitly into consideration.

Meanwhile, there is a need for such a two-dimensional funding matrix which gives a full picture of assets funding and a clear understanding of the liabilities' financing the assets of the given maturity. Such matrices were developed by Derkach, Smoliy and Linder (2000), Voloshyn (2002). In such matrices, time to maturity of assets increases from top to bottom (with *i*-th row) and the one of liabilities does from left to right (with *j*-th column). Herewith, time buckets of assets and liabilities with the same numbers of row and column are identical.

An element $a_{i,j}$ of funding matrix shows a partial or full sum of liabilities belonging to *j*-th bucket that funds assets belonging to *i*-th bucket. To build the matrix, follow to aggregate:

- asset cash flows into each *i*-th time bucket and create the column vector CFA_i of size N, and;
- liability cash flows into each *j*-th time bucket and create the row vector CFL_j of size N.

By the funding matrix, aggregated cash flows of liabilities CFL_j are matched with the aggregated cash flows of assets CFA_i.

There are at least two approaches to building a two-dimensional matrix taking explicitly into consideration time to maturity (Derkach, Smoliy and Linder, 2000; Voloshyn, 2002). The principle of the first approach (Derkach, Smoliy and Linder, 2000) is the following: liability with the longest term to maturity should first fund asset with the longest term to maturity. If after this an excess of the liability remains, then it should finance the asset with shorter term to maturity, i.e. belonging to the nearest time bucket and etc. After matching the longest liability, the liability with shorter term to maturity (in the next time bucket) should be matched and etc. until all the liabilities will be treated.

The disadvantage of this approach is the mistaken calculation of closed liquidity positions, i.e. those that are corresponding to the golden rule of banking (Hübner, 1853). Note that ignorance of the closed liquidity positions does not allow correct estimating of funding cost and, accordingly, price of assets.

To overcome this shortfall Voloshyn (2002) proposed two-stage approach to cash flow matching. During the first stage the liabilities are matched by the following principle: the liability belonging to the given time bucket should first finance the asset belonging to the same time bucket. Thus, the diagonal elements that correspond to assets and liabilities with the same time to maturity (being in row and column with the same number i=j) are first filled.

During the second stage the remaining non-diagonal elements of the matrix are filled in accordance with the first approach by Derkach, Smoliy and Linder (2000), i.e. the excess of

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the liability with the longest term to maturity should finance the asset with the longest term to maturity and etc.

The downside of both approaches (Derkach, Smoliy and Linder, 2000; Voloshyn, 2002) is that capital is first allocated on the longest-term assets. However, the capital could be allocated between assets with different maturities, for example, as according to *RAROC*-approach (Bessis, 1988). Besides, these approaches use book value of assets and liabilities, but not cash flows.

In this paper, the task of risk-adjusted pricing of term fixed-rate assets that are funded through term fixed-rate liabilities under cash flow mismatch is stated. The developed approach to asset pricing is fully based on undiscounted cash flows and utilizes the golden rule of banking and *RAROC*-approach adapted to cash flows.

Cash flows and cash flows at risk

Before considering the new approach to building a funding matrix, concern what kinds of cash flows and cash flows at risk are generated by assets and liabilities (CorporateMetrics, 1999; Yan, Hall and Turner, 2011).

Assets and liabilities generate the following cash flows:

- CFA_i and $CFL_j \geq 0$ is contractual cash flows belonging to *i*-th bucket for assets and *j*-th bucket for liabilities correspondently;
- $CFA_i^{\exp} \geq 0$ is expected cash flow of assets belonging to *i*-th bucket, i.e. cash flow that a bank plans to receive taking into account credit losses of cash flow;
- $CFA_i^{worst}(p) \geq 0$ is the worst-case cash flow of assets belonging to *i*-th bucket and calculated with the given confidence level p (CorporateMetrics, 1999).

Theoretically, there are also catastrophic cash flows which will not be considered here.

Thus, expected and unexpected cash flows are examined from the downside risk point of view, i.e. risk of decreasing cash flows less than contractual ones.

Further, if required, the cash flows could be split into cash flows of principals and interests.

Let the deviation of asset cash flow from the contractual value be caused by credit risk. So, the one is expected cash flow at credit risk and, at the same time, equal to undiscounted expected credit losses:

$$cfar_i^{\exp} = CFA_i - CFA_i^{\exp} \equiv EL_i, \quad (1)$$

where $cfar_i^{\exp}$ is expected cash flow at risk for *i*-th bucket (during period m_i), EL_i is undiscounted expected credit losses for *i*-th bucket (during period m_i) forming column vector.

Using results by Bohn and Stein (2009), and expressing the undiscounted expected credit losses through cash flows, write it in the following form:

$$EL_i = pd_i \times ldg_i \times CFA_i,$$

where pd_i is a probability of borrower's default during the time m_i, lgd_i is loss given default.

The deviation of the unexpected cash flow of assets from expected value is an unexpected cash flow at risk and, at the same time, equal to undiscounted economic capital:

$$cfar_i^{un\exp} = CFA_i^{\exp} - CFA_i^{un\exp}(p) \equiv EC_i, \qquad (2)$$

where $cfar_i^{un\exp}$ is unexpected cash flow at risk for i-th bucket (during period m_i), EC_i is undiscounted economic capital for i-th bucket (during period m_i) forming column vector.

Using results by Bohn and Stein (2009) and expressing the undiscounted unexpected credit losses through cash flows, write it in the following form:

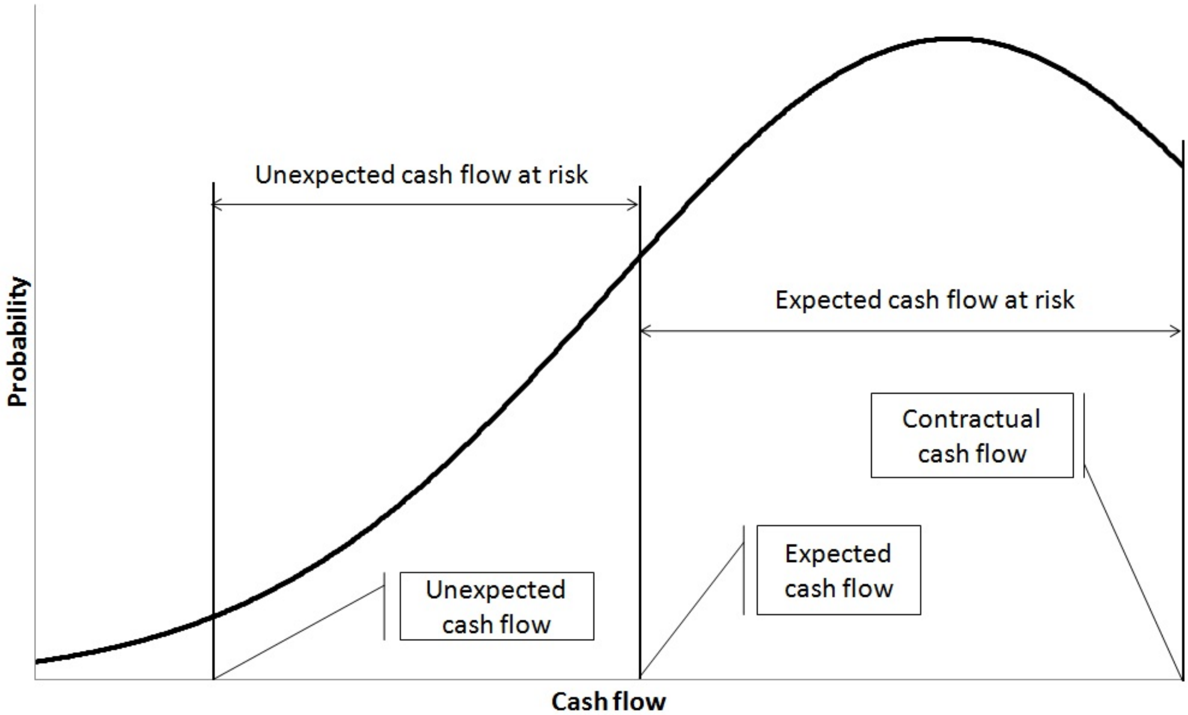
$$EC_i = k_p \times \sqrt{pd_i \times (1 - pd_i)} \times CFA_i,$$

where k_p is a quantile of order p.

It is worth to note that there are expected and unexpected cash flows from liabilities caused by deposit risk. But they will not be investigated here.

The above-mentioned kinds of cash flows and cash flows at risk are presented on Fig. 1 (using results of Bessis, 1988).

Figure 1. Density of probability of cash flows and cash flows at risk for i-th bucket (charted using results of Bessis, 1988).



Further, for brevity, the word "undiscounted" in terms of "expected credit losses" and "economic capital" will be omitted.

New funding matrix

The cash flows of interests from the liabilities do not fund the assets as the liability principals do, and the cash flows of interests from the assets do not absorb liquidity as the asset principals do. Therefore, the funding matrix should be based on **principal** cash flows of the assets and liabilities. But, naturally, the interest cash flows influence on bank's liquidity. In the funding matrix, this influence is taken into account through capital that includes profit.

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Note that the full matching of cash flows is achieved by taking into consideration the economic capital.

Without loss of generality, the book capital is assumed to be equal to the economic one. Thus, a bank fully uses its capital for extracting profit from the risky activity.

To take into account credit risk in the funding matrix, utilize the economic capital and the expected principal cash flows of assets. The expected principal cash flow of assets is equal to the contractual principal cash flow of assets after the undiscounted expected credit losses of the asset principals (see formula (1)).

A funding matrix may be constructed as of current date as well as of future one. Then, the existing or predicted cash flows of principals are applied. Correspondently, it is dealt with estimation of risk-adjusted performance or pricing of assets.

Note that a funding matrix is a positively defined square one $A=[a_{i,j}]$ with size *N*x*N*, where *N* is the total number of time buckets. For the correctly filled matrix the following balance constraints exist:

$$\sum_j a_{i,j} + EC_i = CFA_i^{\exp},$$

$$\sum_i a_{i,j} = CFL_j \text{ for all } i, j = 1, \dots, N,$$

where $CFA_i^{\exp}$ is expected principal cash flow of assets belonging to *i*-th bucket, CFL_j is contractual principal cash flow of liabilities belonging to *j*-th bucket.

When the matrix is not yet filled, the following imbalances of assets (dbA_i>0) and liabilities (dbL_j>0) may be present:

$$dbA_i = CFA_i^{\exp} - \sum_j a_{i,j} - EC_i, \quad (3)$$

$$dbL_j = CFL_j - \sum_i a_{i,j} \text{ for all } i, j = 1, \dots, N. \quad (4)$$

The following algorithm is proposed to resolve these imbalances and provide positive definiteness and uniqueness of the matrix. The algorithm is based on three principles.

According to *RAROC*-approach capital could be allocated on each risky asset. But each asset has the certain term to maturity. So, from this the capital term structure arises. Thus, the first principle says: an asset cash flow with some term to maturity should be funded by capital allocated on this cash flow.

The second one is the rephrased the golden rule of banking (Hübner, 1853): an asset cash flow with some term to maturity should second be funded by a liability cash flow with the same time to maturity. Usage of this rule allows to accurately define closed liquidity positions.

Then, the united principle is the following: the asset cash flow with some term to maturity should be first funded through both economic capital on this asset cash flow and the liability cash flow with the same term to maturity. Note that using formula (2) the economic capital on the asset cash flow could be allocated with respect to its term to maturity.

The proposed approach differs from the existing ones due to the fact that it uses:

- undiscounted principal cash flows of assets and liabilities;

- expected cash flows of assets, i.e. decreased on expected credit losses;
- economic capital allocated on each asset cash flow.

Consider the algorithm of building the funding matrix. The diagonal elements that define the closed liquidity positions are equal to:

$$a_{i,i} = \min\left(CFA_i^{\exp} - EC_i, CFL_i\right). \quad (5)$$

Calculate new imbalances (formulæ (3 and 4)) and fill non-diagonal matrix elements using the third principle: the excess of the liability cash flow with the given term to maturity should fund the remaining unfunded residual of the asset cash flow with the longest term to maturity and etc.

So, beginning from the last column ($j=N$) find the first j-th column with the liability imbalance $dbL_j>0$. Then seek for the first i-th row from below where the asset imbalance $dbA_i>0$ exists. Decrease or resolve the liability imbalance dbL_j by assigning the following value to the matrix element $a_{i,j}$:

$$a_{i,j} = \min\left(dbA_i, dbL_j\right). \quad (6)$$

Running up from $i=N$ to $i=1$, fill the remaining matrix elements until dbL_j imbalance becomes equal zero. Then go over to the next j-th column where the liability imbalance is above zero ($dbL_j>0$) and repeat the procedure until next imbalance dbL_j will be liquidated. As a result, full cash flow matching will be achieved.

The matrix filled by such a procedure may be named the "golden" funding matrix because it corresponds to the golden rule of banking.

Keep in mind that the proposed approach assumes: short-term liabilities which fund long-term assets will be renewed (rolled over).

The examples of partially and fully filled by the proposed algorithm matrices are presented in Tables 1 and 2 correspondently.

Table 1. Example of the partially filled (after filling diagonal elements) funding matrix with 5x5 size, mln. USA dollars

Time to maturity	Less than 1 month (j=1)	1 to 3 months (j=2)	3 to 12 months (j=3)	1 to 2 years (j=4)	2 to 3 years (j=5)	*Economic capital, EC_i*	*Total asset expected cash flows, $CFA_i^{\exp}$*	*Asset imbalances dbA_i*
Less than 1 month (i=1)	32 200					*2 800*	*35 000*	*0*
1 to 3 months (i=2)		25 000				*5 600*	*70 000*	*39 400*
3 to 12 months (i=3)			9 200			*800*	*10 000*	*0*
1 to 2 years (i=4)				10 000		*2 800*	*35 000*	*22 200*
2 to 3 years (i=5)					5 000	*2 348*	*29 348*	*22 000*
Total liability cash flows, CFL_j	*85 000*	*25 000*	*40 000*	*10 000*	*5 000*	*14 348*	*179 348*	*0*

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Table 2. Example of the fully filled (by algorithm (3-6)) funding matrix with 5x5 size, mln. USA dollars

Time to maturity	Less than 1 month (j=1)	1 to 3 months (j=2)	3 to 12 months (j=3)	1 to 2 years (j=4)	2 to 3 years (j=5)	*Economic capital, EC_i*	*Total asset expected cash flows, $CFA_i^{\exp}$*	*Asset imbalances dbA_i*
Less than 1 month (i=1)	32 200					*2 800*	*35 000*	*0*
1 to 3 months (i=2)	39 400	25 000				*5 600*	*70 000*	*0*
3 to 12 months (i=3)			9 200			*800*	*10 000*	*0*
1 to 2 years (i=4)	13 400		8 800	10 000		*2 800*	*35 000*	*0*
2 to 3 years (i=5)			22 000		5 000	*2 348*	*29 348*	*0*
Total liability cash flows, CFL_j	*85 000*	*25 000*	*40 000*	*10 000*	*5 000*	*14 348*	*179 348*	*0*
Liability imbalances, dbL_j	*0*	*0*	*0*	*0*		*0*	*0*	
Liability imbalances, dbL_j	*52 800*	*0*	*30 800*	*0*		*0*	*0*	

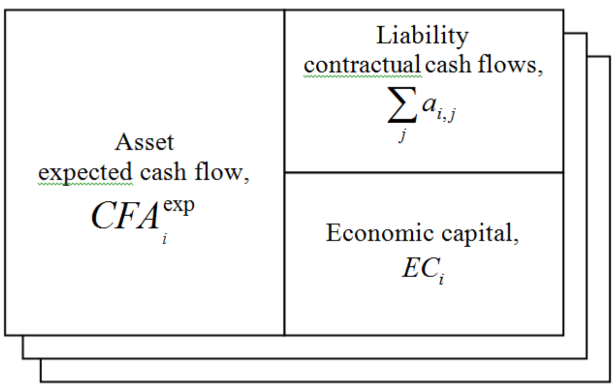
In the given examples (Table 1 and 2) economic capital is allocated supposing that the specific economic capital (on one unit of assets cash flow) is equal to ec=8%. Then:

$$EC_i = 8\% \times CFA_i^{\exp} . \quad (7)$$

Note that for simplicity in the expression (7) differences between expected and contractual cash flows of assets were neglected.

Only on base of the funding matrix it becomes possible to build a local balance of cash flows for each i-th time bucket (Fig. 2).

Figure 2. A local balance of undiscounted cash flows from assets and liabilities belonging to i-th time bucket



Risk-adjusted pricing of assets based on funding matrix

New approach to risk-adjusted pricing of assets will be based on the funding matrix and *RAROC* approach adapted to cash flows.

Note that the difference between the proposed and *RAROC* approaches lies in using of undiscounted cash flows, expected and unexpected credit losses.

The suggested approach to pricing employs the modified *RAROC* principle: for period of time m_i, the expected to **receive** interest income from assets should cover the interest expense on liabilities that fund assets (funding cost), operating cost, undiscounted expected credit losses, and provide target return on economic capital:

$$RA_i = \frac{\sum_j a_{i,j} \times RL_j + OC_i + EL_i + EC_i \times RoEC}{CFA_i^{\exp}}, \quad (8)$$

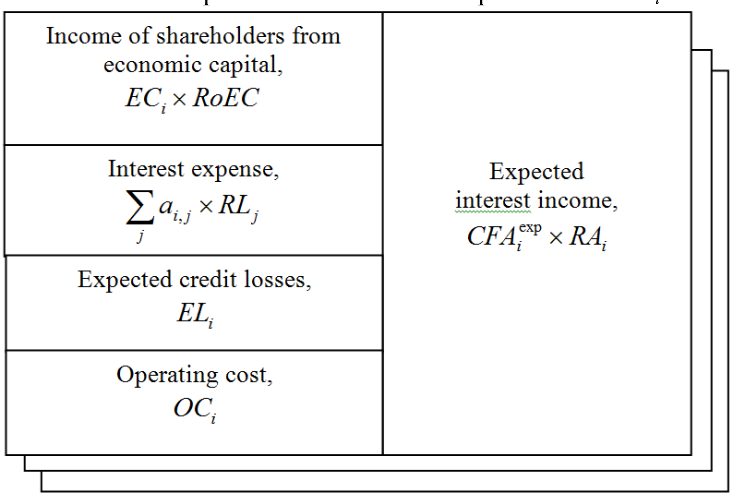
where RA_i is a zero-coupon interest rate on the asset cash flow with time to maturity m_i belonging to *i*-th bucket, RL_j is a zero-coupon interest rate on the liability cash flow with time to maturity m_j belonging to *j*-th bucket, OC_i is operating cost for asset cash flow lifetime m_i, EL_i is undiscounted expected credit losses of principal cash flow of assets for period m_i, EC_i is undiscounted economic capital on the asset cash flow belonging to *i*-th bucket, *RoEC* is target return on economic capital, $CFA_i^{\exp}$ is undiscounted expected principal cash flow of assets belonging to *i*-th bucket. In expression (8) taxation is neglected.

An interest rate calculated by the proposed approach fully reflects unique features of activity of a certain bank: bank's possibility to attract facilities from markets, target return on economic capital, prevalent operating cost and undiscounted expected credit losses of cash flows.

Comparing the calculated interest rate with the market one, the bank may define its own advantages and weaknesses: on which maturity the bank wins market and on which maturity it loses. Thus, the clear understanding of what price on assets should be set is achieved.

It follows to notice that only two-dimensional funding matrix allows forming local balance of incomes and expenses for *i*-th bucket (Fig. 3). Such a balance is a part of cash flow statement, namely "Net cash used in operating activities before changes in operating assets and liabilities".

Figure 3. A local balance of incomes and expenses for *i*-th bucket for period of time m_i



Further, compare the proposed approach to assets pricing and *RAROC*-approach. Results are presented in Table 3.

Table 3. Comparison of proposed and *RAROC* approaches to assets pricing

Parameters	**The proposed approach**	***RAROC*-approach**
Period (horizon)	All lifetime of assets	Traditional one year
Exposure	Cash flows	Traditional book (present) value
Cash flows	Undiscounted	Discounted
Term structure of funds	Taken into account	May be taken into account but method is not discussed

The proposed approach has the following advantages.

- It allows direct estimating zero-coupon yield curve on assets. Applying such a curve assets with complex structure of cash flows, for example, mortgage loans may be priced.
- It`s fully based on cash flow approach and organically integrates credit and liquidity risks since it uses undiscounted cash flows.
- The approach may be also applied to pricing of liabilities. In this regard, the funding matrix is employed to calculate the interest rate on which the liability cash flow with the given term to maturity works.

Remind that in this approach the short-term liabilities that fund the long-term assets are assumed to be renewed (rolled over). Besides, note that the proposed approach is based on estimation of expected credit losses and economic capital (unexpected credit losses) for all lifetime of assets and not one-year period traditionally used in *RAROC*.

Example of calculation of zero-coupon interest rate on risky assets

Bring example of calculation of zero-coupon interest rate on risky assets (bullet loans) with term to maturity belonging to “1 to 2 years” or i=4-th bucket. Average term of existing of assets is equal to m_i=1.5 year.

Despite of the fact that incomes, costs, expenses and losses required for calculation are considered for all lifetime of assets in order to estimate an interest rate, it is convenient to utilize these annualized parameters: incomes, costs, expenses and losses.

Let annual return on economic capital be equal to *RoEC*=20%, annual specific operating cost (on one unit of assets cash flow) *oc*=2%, annual specific undiscounted expected credit losses (on one unit of assets cash flow) *el*=0.64%.

The zero-coupon yield curve, the liability cash flows that fund the asset cash flow belonging to i=4-th bucket and annual interest expense are presented in Tables 2 (see i=4-th row) and 4.

Table 4. Result of calculation of interest expense per one year for assets pricing

Parameters	Less than 1 month (j=1)	1 to 3 months (j=2)	3 to 12 months (j=3)	1 to 2 years (j=4)	2 to 3 years (j=5)	Total
Interest rate on the liability cash flow	6.00%	8.00%	10.00%	12.00%	13.00%	8.96%
Liability cash flow, mln. USA dollars	13 400		8 800	10 000		32 200

Parameters	Less than 1 month (j=1)	1 to 3 months (j=2)	3 to 12 months (j=3)	1 to 2 years (j=4)	2 to 3 years (j=5)	Total
Interest expense, mln. USA dollars	804	0	880	1 200	0	2 884

Input data for calculation and result of calculation of zero-coupon interest rate on risky assets with term to maturity belonging to i=4-th bucket are given in Table 5.

Table 5. Calculated zero-coupon interest rate on risky assets (formula (8))

Items	Exposure, mln. USA dollars	Rate	Income/ Expense, mln. USA dollars
	(1)	(2)	(1x2)
Liability cash flow that fund assets cash flow	32 200	8.96%	2 884
Economic capital	2 800	20.00%	560
Operating cost, % of asset cash flow	35 000	2.00%	700
Expected credit losses, % of asset cash flow	35 000	0.64%	224
Asset expected cash flows	35 000	12.48%	4 368

Calculating the interest rates for all buckets it may define the zero-coupon yield curve on risky assets. This yield curve may be used to price assets with complex structure of cash flows, for example, mortgage loans, etc.

As a result of using undiscounted cash flows, the computed interest rate is higher than the one calculated by applying *RAROC*-approach. The difference between these interest rates is equal to premium for liquidity risk (Voloshyn, 2013).

Shortly consider some consequences of utilizing the proposed approach. Firstly, it reveals the drawback of widely used approach when the price of assets is calculated from price of liabilities with the same maturity. In practice the deficit of long-term liabilities exists. Under normal (positive) yield curve a bank must use cheaper short-term liabilities to fund its long-term assets. So, the usage of traditional approach is resulting to **overpricing** of long-term assets because funding cost appears to be lower.

Secondly, the proposed approach can be applied to funds transfer pricing owing to knowledge what liabilities finance assets with a certain maturity.

Conclusion

To price the risky assets it`s necessary to employ a two-dimensional funding matrix. The proposed three rules for building such a matrix provide its positive definiteness and uniqueness. Among this rules the golden rule of banking plays a significant role and helps to define closed liquidity positions. This point is crucial for right pricing.

This matrix gives the clear understanding about distribution of cash flows between assets and liabilities. Only this matrix allows forming the local balances of principals and interest income & expense for each time bucket.

The offered principle for asset pricing guarantees that expected to receipt (not accrual) interest income from asset cash flows over its lifetime period will cover the funding and

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operating costs, undiscounted expected credit losses and provide target return on economic capital.

The proposed approach has the following advantages. Firstly, it allows direct estimating zero-coupon yield curve on assets and yield curve on assets with complex structure of cash flows. Secondly, it organically integrates credit and liquidity risks since it uses undiscounted cash flows. Thirdly, the approach may be also applied to liability pricing.

Further investigation can be directed on development of pricing methodology taking into account liabilities risk (early withdrawal and rollover risks), multicurrency cash flows, off-balance-sheet facilities (drawdown risk), cash flows from new business, and how maturity mismatch affects interest rate margin.

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WEATHER DERIVATIVE PRICING WITH NONLINEAR WEATHER FORECASTING

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Abstract. *In recent years we witnessed a rapid growth of weather derivatives market. These derivatives are used to hedge energy contracts and distribute weather risk. While most derivative markets are complete and contingent climes replications are standard procedure, this special market is incomplete, and therefore modeling the weather is a more appropriate approach to pricing. In this work we base our modeling on a widely accepted physical approach, a reduction of Navier-Stokes equations applied to a thin atmosphere to a set of three Ordinary Differential Equations. This modeling is considered by meteorologists a **"very-long-weather"** prediction and allows for an accurate and robust temperature forecasting. We show that under this setting we empirically outperform the standard approach to weather derivative pricing.*

Introduction

Weather derivatives are a fascinating type of securities, with payoffs derived from physical weather measurements, i.e. Cumulative Average Temperature (CAT) at a given day, measured in New York City's Central Park weather station. While these contracts have already been standardized and traded on the Chicago Mercantile Exchange (CME), a sufficiently accurate and robust pricing model hasn't been established yet.

The importance of weather derivatives to the industry is profound. It is estimated that 30 percent of the U.S economy is directly affected by weather, including traditional energy companies hedging inventory, storage of heating oil, and growing renewable energy producers relaying on energy harvesting from wind and solar radiation as their revenue. Therefore we estimate that market penetration and traded volume increase, using these financial instruments is only a question of time.

Weather forecasting is crucial to both the demand and the supply sides of the weather derivatives market. Consider first the demand side; any firm exposed to weather risk on either the output (revenue) such as ski resorts, agriculture and renewable energy production, And the supply side (cost) such as oil storage and real estate heating cost. Under this need to distribute and exchange risk, the weather derivatives market has grown rapidly. Since it's opening in 1998, it's estimated volume increased from $500 million to more than $5 billion, with better liquidity , small bid-ask spreads and a vivid secondary market activity. Weather derivative instruments include weather swaps, options, and option collars.

Weather derivatives are different from "standard" derivatives. Unlike many other enhanced markets, the underlying asset (i.e. temperature) is not traded in a spot market.

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Section 3:

Accounting, Regulations and Reporting Perspectives

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ENTERPRISE RISK MANAGEMENT EVOLVING IN A NEW BANK STRUCTURE „ASSOCIATION OF VOLKSBANKS (VOLKSBANKEN KREDITINSTITUTE-VERBUND)“: THE PATH TOWARDS A BANK-WIDE RISK MANAGEMENT BETWEEN REGULATORY COMPLIANCE AND CHALLENGES OF A NEWLY FORMED INSTITUTION.

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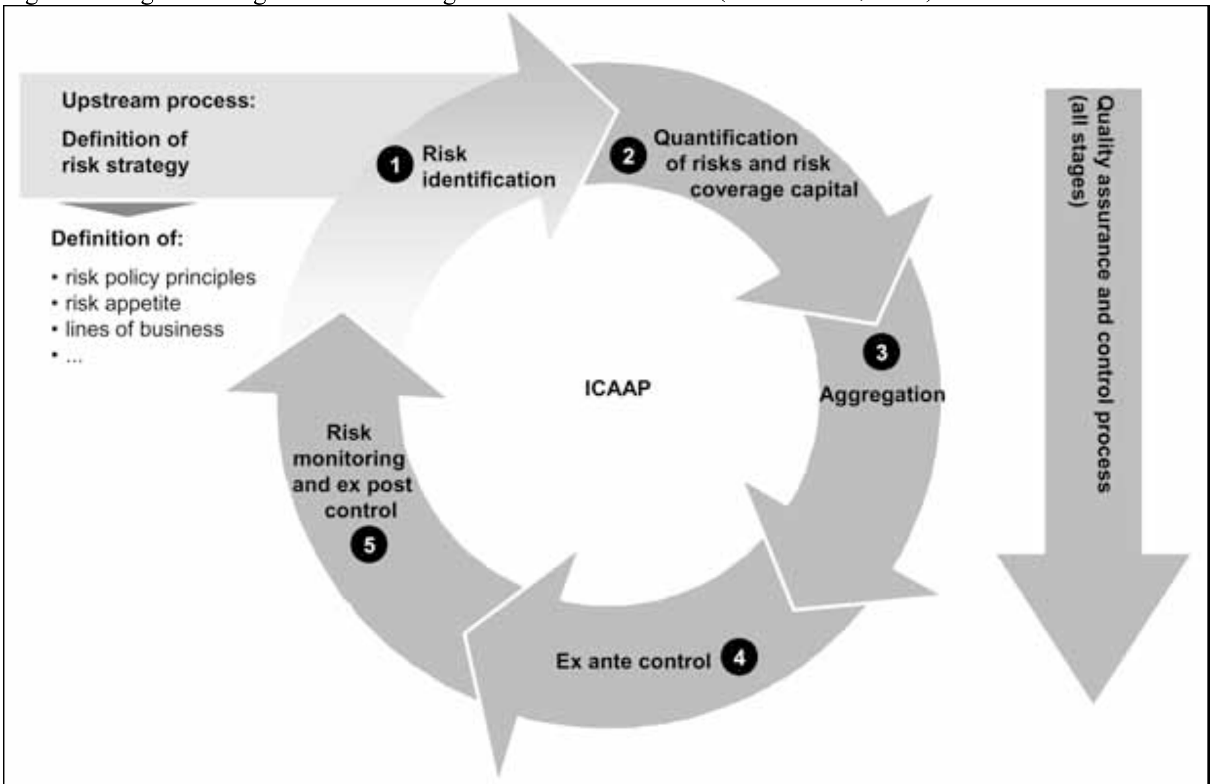
Abstract: *Enterprise risk management or bank-wide risk management has emerged as an indispensable approach for managing the portfolio of risks, which banks are facing today. Basically the development of a comprehensive bank-wide risk management is already associated with diverse challenges. For the newly formed Association of Volksbank, increasing regulatory pressure and the reorganisation of individual Austrian Volksbanks only magnifies it. Based on a case study and the use of existing literature, the author aims to identify the challenges towards a bank-wide risk management in the Association of Volksbanks arising from regulatory compliance and the newly formed structure. The author examines (1) the different perspectives of the new Association and (2) current regulatory requirements on a banks risk management. The author finds 12 distinct challenges for bank-wide risk management in the Association of Volksbanks. Challenge No. 1 „The development of a risk strategy applicable for the whole Association on a consolidated level and risk strategies for the individual Volksbanks“. Challenge No. 2 „The definition and communication of an institution-wide risk culture and risk policy principles“. Challenge No. 3 „The distribution of roles in risk management between the central organisation (CO) and individual primary banks, standardized systems and processes as well as the arrangement of robust governance structures“. Challenge No. 4 „The definition of a risk appetite statement, which is then broken down to a target risk profile on a consolidated and individual level using an integrated limit system (risk capital allocation)“. Challenge No. 5 „The consideration of risk-return aspects (risk adjusted performance measures, RAPM) in the risk appetite statement and risk capital allocation“. Challenge No. 6 „The risk identification on an individual and consolidated level as well as the development of a common understanding of risk definitions“. Challenge No. 7 „The standardization of methods for the quantification of risks and coverage capital“. Challenge No. 8 „The consideration of inter-risk concentration and diversification effects at risk aggregation“. Challenge No. 9 „The establishment of an integrated reporting structure and action plans“. Challenge No. 10 „The development of a stress testing programme composed of a multi-layered approach from simple sensitivity analysis on single portfolios or specific types of risks over complex macroeconomic scenarios on a firm-wide basis to reverse-stress testing“. Challenge No. 11 „The application of the proportionality principle in terms of risk identification, methods of risk quantification, reporting or stress testing due to widely varying sizes of associated Volksbanks.“ Challenge No. 12 „Consistent*

documentation of methods, systems and processes as well as an open communication to all associated institutions.“

Introduction

The risk management in Austrian banks is primarily founded in the Basel II capital accord (BCBS, 2004), the Austrian Banking Act (BWG) ("Austrian Federal Banking Act," 2013) and the Guidelines on Bank-Wide Risk Management in Internal Capital Adequacy Assessment Process (ICAAP), prepared by the Oesterreichische Nationalbank (OeNB) in cooperation with the Financial Market Authority (FMA) (OeNB/FMA, 2006).
Basel II, Pillar 2 Supervisory Review Process (SRP) requires banks to establish suitable risk management systems and to implement a process for assessing their capital adequacy in relation to their risk profiles as well as a strategy for maintaining their capital levels i.e. the Internal Capital Adequacy Assessment Process (ICAAP) (OeNB/FMA, 2006).
In this study the author refers to integrated bank-wide risk management as the components of the Internal Capital Adequacy Assessment Process (ICAAP) as shown in figure 1 (OeNB/FMA, 2006) .

Figure 1: Stages of Integrated Risk Management / ICAAP Process (OeNB/FMA, 2006)



The Volksbanks in Austria are traditional banks, well known and with a high penetration throughout Austria. The Volksbanks had been established as early as 1850 as commercial cooperative credit associations. The present Österreichische Volksbanken-AG (VBAG) was established in 1922 as the central institution of the Austrian Volksbanks in order to support them in fulfilling their service mandate. Its primary role was to offset fluctuations in liquidity among the regional Volksbanks. The Volksbanks were marked by growth in Austria and the expansion of the Österreichische Volksbanken-AG continued into Hungary, Slovenia, the

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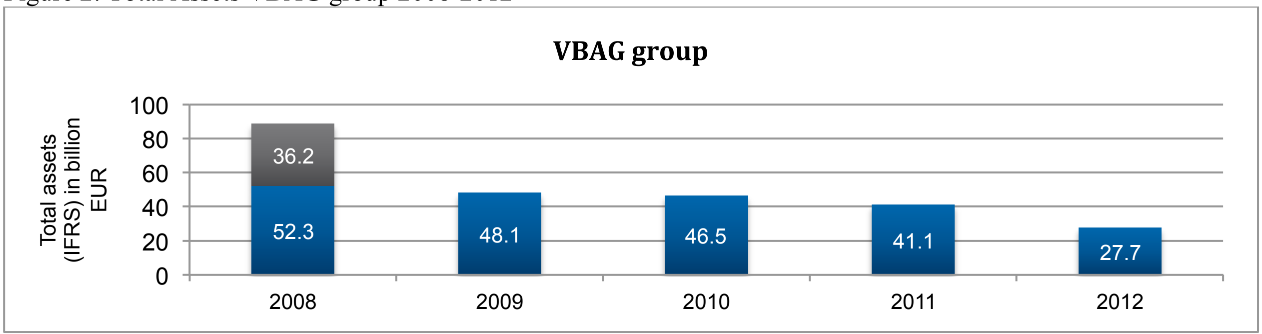
Czech Republic, Croatia, Romania, Bosnia and Herzegovina, Serbia-Montenegro and Ukraine, until the financial crisis hit the bank in 2008. The VBAG was never publicly listed on Austria's stock exchange.
In 2008, the VBAG had to dispose Kommunalkredit Austria AG (EUR 36,2 billion) to the Republic of Austria. In the following year the capital was strengthened by participating capital in the amount of 1 billion euro issued to the government of Austria. In the years 2010 to 2012 the bank sold foreign subsidiaries and started to reduce its real estate activities. In February 2012 the Republic of Austria and the Volksbanks have reached an agreement on a solution to stabilise a struggling VBAG. The capital of VBAG was reduced by 70%. At the same time, the Republic of Austria and the Volksbanks performed a capital increase of 480 million euro in total. Also in 2012, the VBAG and Investkredit have legally merged. The regional Volksbanks hold now a 50.1% and the Republic of Austria a 43.3% stake in VBAG. All assets, participations and subsidiaries, which are not part of VBAG´s core business, were pooled in the Non-core Business division and are sold. Large parts of the Corporates and Real Estate business fields and of the investment book have been classified as non-core business. Furthermore, the participations in VB Romania and in VB Leasing International as well as Volksbank Malta have been allocated to the non-core business area. VBAG´s core business therefore includes Group Treasury services, VB Investments products, syndicated finance, corporate subsidies management, export financing as well as factoring and leasing products. Figure 2 shows the decrease of total assets of VBAG group due to its restructuring strategy.

Figure 2: Total Assets VBAG group 2008-2012



On 18th September 2012 the regional Volksbanks and Österreichische Volksbanken-AG (VBAG) have established a „Kreditinstitute-Verbund" (Association of Volksbanks) pursuant to section 30a, Austrian Banking Act based on a joint liablity and joint liqudity scheme. It was modelled after the organisational structure of the Dutch Rabobank. The new structure of the Association of Volksbanks is illustrated in figure 3

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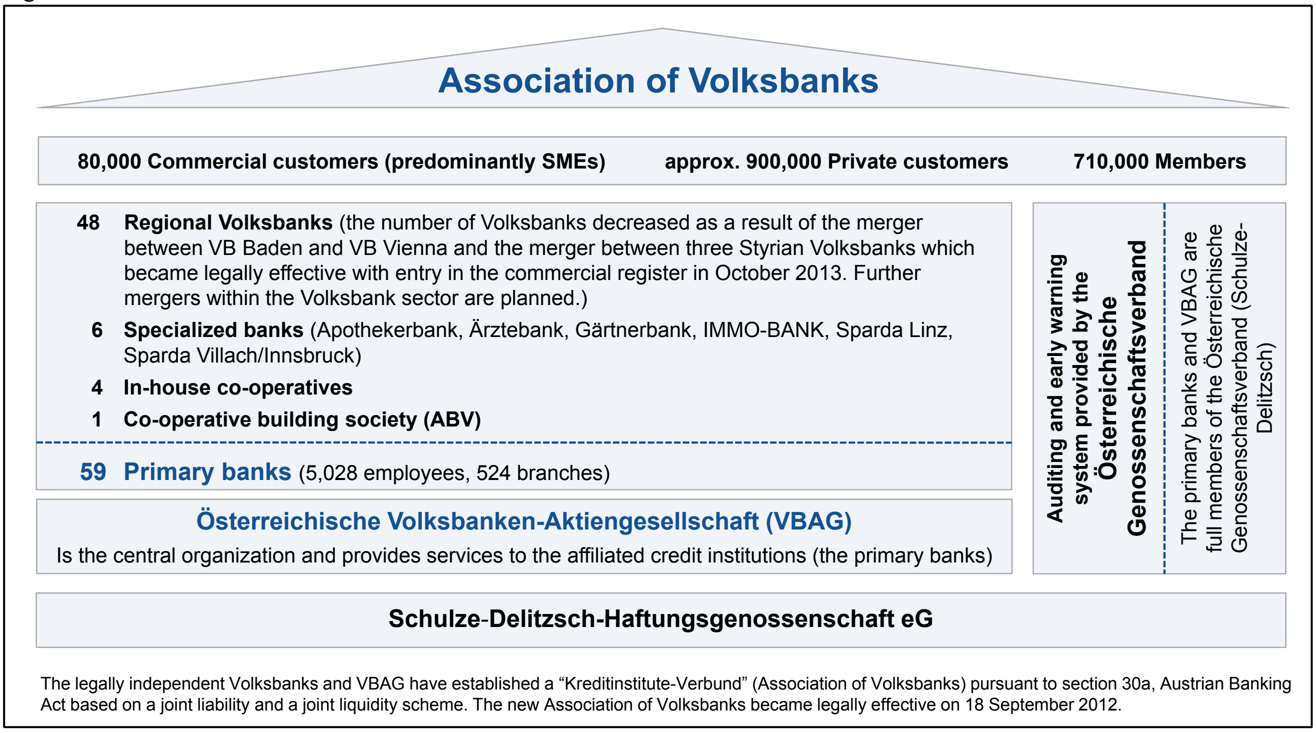
Figure 3: New structure of the Association of Volksbanks



The total asset of the Assocation is EUR 46.2 billion. VBAG is the central organisation (CO) of the Association of Volksbanks and accordingly, is responsible for a comprehensive and consistent risk management for the banks of the Association.

Research motivation and objectives

Expressive pressure and incentives to employ a bank-wide approach to risk management have emerged from various sources, including legislation, supervisory authority and shareholder. A continuously growing demand, both quantitative and qualitative, concerning a banks risk management, ultimately leaves the senior management with the challenge to find the proper balance between regulatory necessity and the requirement to pursue a bank-oriented risk management.

It is no longer sufficient for the risk management to simply focus on the development of advanced methods for measuring the bank's substantive risks, but rather to target a sustainable value creation through risk management. A bank has to allocate its limited amount of capital to business units, where the associated risks can create the appropriate return.

The path towards a bank-wide risk management is in general comprehensive and challenging, however the elaboration within the Association of Volksbanks is moreover characterized by the new bank structure implying discrepancies in culture, methods and systems as well as increasing pressure from regulations, guidelines and supervisory authority.

Based on the research motivation, the objective of this study is to examine the supplemental challenges for a bank-wide risk management within the Association of Volksbanks arising from regulatory compliance and a newly formed structure. The author therefore proposes the following structure (as seen in figure 4).

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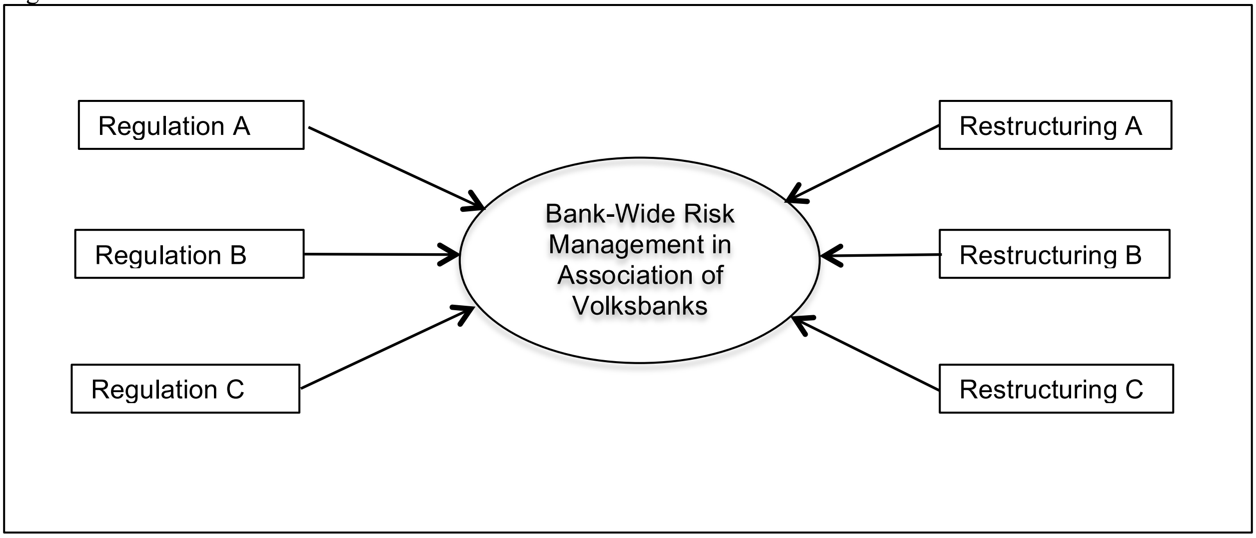
Figure 4: Research Framework



The study is structured as following. First, the author provides a brief summary of the different perspectives of the newly formed bank structure. Further, the existing literature of new regulations and guidelines concerning risk management is scanned. Third, the relevant components and holistic approaches of a bank-wide risk management are explored. Fourth, the author highlights specific obstacles to develop a bank-wide risk management between regulatory compliance and the new bank structure. Finally, the author concludes by summarizing the results.

Research design

This paper is based on a single holistic case study (Yin, 2003), which allows retaining comprehensive and meaningful characteristics of real-life events (Yin, 2003). The form used is an intrinsic case study according to Stake (1995). This approach is chosen, because the intent is to better understand the case. It is not undertaken primarily because the case represents other cases. The purpose is not to build theory, but the case itself is of interest.

The author is going to rely on existing literature in collecting information of new regulations and best practices for a well-developed bank-wide risk management. By using a cluster-based approach large compilation of internal documents and manuals are browsed. Further perceptions are drawn from direct observation and open discussions of the daily routine within the central institution.

Association of Volksbanks - A new bank structure

The structural reform of the Assocation of Volksbanks is based on five key elements of modification. First, the VBAG as central institution is authorized to issue directives to the affiliated credit institutions regarding regulatory requirements.

Moreover the VBAG and the regional Volksbanks have established a joint liability scheme. Prevention of illiquidity or insolvency is the main aspect of the joint liability of the credit institutions within the framework of the new liability scheme. The liability of VBAG within the framework of the joint liability scheme is unlimited. Liability of Volksbanks is limited by the amount of surplus equity, i.e. the liability of the regional Volksbanks is restricted by the amount of equity exceeding the legally required capitalization (which is 8% under Basel II).

Third, the VBAG and the Volksbanks form a joint liquidity and funding scheme, consequently the associated credit institutions (Volksbanks) are obliged to hold their liquidity at the central institution (VBAG).
Further, intensified local cooperation or centralization in certain areas like organisation or IT will result in increased efficiency and generation of synergies.
The final key element of the modified Association is the joint management of capital and common principles of risk management. Volksbanks are responsible for capital management within the framework of limits and guidelines.
The central institution provides services to the Austrian Volksbanks encompassing for example group treasury, capital market products, liquidity management and risk management. Whereby it is important to mention that those services regarding risk management are still evolving.
In previous years the methods and developments concerning risk management in the VBAG with its subsidiaries (VBAG Group) and the regional Volksbanks were performed separated from each other. At the moment there are two parallel risk management systems, processes and organisations in place. The first risk management system is integrated in the VBAG, thus so far used for the VBAG Group, but was in the meantime partially enhanced to the level of the new Association. The other risk management system performed by the Austrian Cooperative Association (ÖGV) was applied for all primary Volksbanks and was likewise expanded for the Association of Volksbanks.
Although both risk management systems roughly follow the guidelines on the ICAAP by the OeNB and FMA (OeNB/FMA, 2006), the two systems are not synchronized, which makes a holistic and top down management of the Association unattainable. So ultimately with the new Association originates the requirement to install one holistic and consistent risk management designed and provided by the central institution and applicable for the overall Association.
The author identified various factors challenging the way towards a bank-wide risk management due to the incorporation of VBAG and the regional Volksbanks. The factors are clustered in cultural, methodical, organisational and technical aspects.
A divergence in risk culture and risk awareness between the central institution and the primary banks was perceived. So far a common understanding of risks or consistent norms of behaviour do not exist within the Association. The primary banks tend to focus on low risk taking and prefer to remain well under any risk limits. Although neither the VBAG nor the primary banks have a risk-return analysis incorporated in the risk management.
In terms of methods and practices used in both risk management systems the author identified significant disparities. The types and number of risk quantified and reported differ among the risk management systems. Moreover the definition of certain types of risks as well as the methods used for their quantification is not matched. The methods for risk quantification in the VBAG are Value-at-Risk (VaR) oriented, adequate for the size and complexity of the VBAG and its subsidiaries. Whereas the methods provided by the Austrian Cooperative Association (ÖGV) are well adapted for the smaller and less complex regional Volksbanks. In fact, the principle of proportionality ("Austrian Federal Banking Act," 2013; OeNB/FMA, 2006) was thus far well performed through two distinct risk management systems. With the new Association also arises the question about the potential risks of linkage among Volksbanks and the VBAG e.g. investments or refinancing. In both risk management systems is a limit system implement, however with a different approach.
Organisational challenges might arise from the different sizes of primary banks and the central organisation. The total assets of the individual primary banks vary from EUR 80 million to EUR 2.8 billion. Whereby the total assets of the central organisation was in 2012 around EUR 27 billion. Difficulties also arise from the lack of a consistent risk management

structure or architecture. The responsibilities and roles of the risk management are shared between two central risk management departments in the CO and a risk management function in each individual Volksbank.
In general the Austrian Banking Act (BWG) has to be applied on three different levels within a banking group, an individual institution level, a consolidated level and sub-consolidated level (ICAAP). Effective procedures for determining, controlling, monitoring and reporting current and future risks as well as appropriate internal control mechanisms are required on every level. Furthermore the Austrian Banking Act demands adequate rules, procedures and mechanisms with regard to the nature, scale and complexity of the bank's business activities as well as comprehensive strategies and procedures for continuous evaluation and regular review of the amount, composition and distribution of internal capital which is considered adequate to cover current risks and any future risks in both quantitative and qualitative terms ("Austrian Federal Banking Act," 2013). The institutions affiliated to a central institution according to section 30a of the Austrian Banking Act ("Austrian Federal Banking Act," 2013), the primary banks, may waive the application of the Austrian Banking Act on an individual basis. The central institution is responsible for the application on a consolidated basis. Nevertheless the credit institutions, including the primary banks and VBAG, are accountable to inform about current and future risks as well as having the proper strategies and procedures to continuously evaluate those risks ("Austrian Federal Banking Act," 2013). The already complex structure is intensified by the connections between the primary banks and the central institution (investments or credits) as well as the numerous subsidiaries of the VBAG and the primary banks. A continuous changing structure by mergers of primary banks or the sale of subsidiaries increases the organisational challenges.
From a technical point of view a lack of a common database due to numerous isolated applications and parallel systems was found. A consistent technical linkage from the various feeder systems at the regional Volksbanks to a central data pool containing both risk and accounting data is yet to be fully conceptualized.

Regulatory compliance - Increasing regulatory requirements

Regulatory requirements for banks within the European Union and Austria are numerous and it is easy to loose focus on the relevant standards or guidelines for a bank´s risk management. Multiple organisations on a global, European and national level, like the Basel Committee of Banking Supervision, the European Banking Authority or the Financial Market Authority (FMA) and Oesterreichische Nationalbank (OeNB), constantly publish new regulations and guidelines.
The author browsed the relevant websites for current publications regarding risk management on a granular level.

Table 1: Guidelines on Bank-Wide Risk Management (OeNB/FMA, 2006)

Title of Guideline / Regulation	Published by	Published in	Risk Management relevant	Effective in
Guidelines on Bank-Wide Risk Management, Internal Capital Adequacy Process	Oesterreichische Nationalbank (OeNB), Financial Market Authority (FMA)	2006	Complete Paper	2006

The Guidelines on Bank-Wide Risk Management (ICAAP) are currently the most comprehensive and significant guidelines on Pillar 2 implementation of the Basel II accord in

Austria published in 2006 by Oesterreichische Nationalbank (OeNB) and Financial Market Authority (FMA).

According to Basel II Pillar 2, banks are faced with the challenge of developing internal procedures and systems in order to ensure that they possess adequate capital resources on the long term with due attention to all material risks, these procedures are referred to collectively as ICAAP (Internal Capital Adequacy Assessment Process). The guideline explains in detail the basic structure and components of the ICAAP.

The guideline describes the requirements of a bank-wide risk management, from the ICAAP components such as risk strategy, risk policy and risk appetite. The guideline also provides various definitions on risk categories, internal and regulatory capital as well as hedging objectives. The linkage of potential risks and risk coverage as well as risk limitation as economic capital budgeting are further requirements of a bank-wide risk management. Central point of the guideline is, however the ICAAP process, consisting of the stages identification, quantification of risks and coverage capital, aggregation (examination of the risk-bearing capacity), ex-ante control and monitoring.

The guideline covers every important cornerstones of a bank-wide risk management, and a more detailed description in this context would lead too far.

Table 2: Supplementary Guidelines on Internal Capital Adequacy Process (OeNB/FMA, 2012)

Title of Guideline / Regulation	Published by	Published in	Risk Management relevant	Effective in
Supplementary Guidelines on Internal Capital Adequacy Process	Oesterreichische Nationalbank (OeNB), Financial Market Authority (FMA)	2012	Complete Paper	2012

The primary guidelines on ICAAP are now subject to further developments and specifications of prudential expectations regarding a bank-wide risk management. The OeNB and FMA point out the developments in the Supplementary Guidelines on ICAAP.

The supplementary guideline mentions risk categories, which should now be considered under pillar 2, credit spread risk, intra- and inter-risk concentration, foreign currency risk from investments, risk form foreign currency credits, structural liquidity risk and macroeconomic risks.

The new guideline also points out the two hedging objectives of the ICAAP, the going concern and the liquidation perspective. While the going concern aims the company's continued existence, in the liquidation perspective, the protection of the rights of foreign investors have priority. By no means, the immediate divestiture of the bank is to be understood under the term liquidation.

The determination of risk coverage capital must be consistent with the identification of potential risks. This means, ensuring the consistency of the carrying amounts of assets, from which the elements of the risk coverage capital (e.g. equity) and the risk contribution of these assets are calculated. Moreover the consolidation scope of the assets included in risk quantification and the risk coverage capital should be equivalent, otherwise a comparative analysis to the consolidation scope according to the Austrian Banking Act is necessary.

In relation to stress testing, the supplementary guideline refers first to the CEBS Guidelines on Stress Testing, but also focus on the term reverse stress testing. Reverse stress testing should start with the "result" of an insolvency of the institution as a hypothetical assumption, and then analyse which scenarios would lead to this „result".

Furthermore the guideline suggests the product introduction process as an essential part of the risk identification, since it is helpful for the systematic identification of new risks.

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Table 3: Directive 2013/36/EU (CRD IV) ("European Parliament, Council," 2013a)

Title of Guideline / Regulation	Published by	Published in	Risk Management relevant	Effective in
DIRECTIVE 2013/36/EU (CRD IV)	European Parliament, Council	2013	Complete Paper	2014

The capital requirement directive (CRD IV) entails significant developments in the prudential supervision, encompassing supervisory powers and powers to impose penalties, internal capital adequacy assessment process, governance arrangements and capital puffer.
Authorities will have all information gathering and investigatory powers that are necessary for the exercise of their functions. Furthermore, authorities will be given all supervisory powers to intervene in the activity of institutions that are necessary for the exercise of their function, when the institution does not meet the requirements of CRD IV or CRR. Supervisory powers include different measures e.g. the right to withdraw an authorisation, the requirement to hold own funds in excess, the reinforcement of the arrangements, processes, mechanisms and strategies implemented, the restriction or limitation of business, operations or the request to divest activities that pose excessive risks.
Regarding the Internal Capital Adequacy Assessment Process (ICAAP) new risk categories were introduced under CRD IV, the risk of excessive leverage and the counterparty credit risk. On the basis of Basel III, the Austrian Banking Act extended the pillar two risks with systemic risks, the risk that results form the business model of a bank and results of stress tests for banks that use internal approaches.
The CRD IV also requests institutions to ensure that recovery plans for the restoration of an institution's financial situation following a significant deterioration, and resolution plans are put in place.
Furthermore, the CRD IV implicates a corporate governance reform encompassing defined responsibilities and effective monitoring of strategy, risk appetite, internal controls and management, increasing professional and personal requirements of the Supervisory Board and Executive Board as well as ensuring sufficiently strong and independent risk management functions.
Institutions have to maintain in addition to the common equity tier 1 required by Article 92 of Regulation (EU) No 575/2013 a capital conservation buffer of common equity tier 1 capital equal to 2.5% of their total risk exposure. Additionally, it is required to keep an institution-specific countercyclical capital buffer equivalent to their total risk exposure amount multiplied by the weighted average of the countercyclical puffer rates with ranging from 0% to 2.5%.
In order to prevent and mitigate long-term non-cyclical systemic or macro prudential risks, the Directive introduces the systemic risk buffer of common equity tier 1 capital for the financial sector, which can vary from 0% to 5%. For global systemically important institutions (G-SIIs) a capital buffer to 3.5% and other systemically important institutions (O-SIIs) a capital buffer to 2% may be assigned. Where an institution is subject to a systemic, O-SII or G-SII buffer, the highest of the three shall apply. For all of these buffers, periods for transitions were installed. A comprehensive assessment by the European Central Bank already set a benchmark for capital thresholds for the Association. The threshold is set at 8% Common Equity Tier 1, decomposed into a Common Equity Tier 1 ratio of 4.5%, additionally the 2.5% capital conservation buffer and an add-on of 1% buffer for systemic relevance of the bank's considered significant under the SSM Regulation. The VBAG with credit institutions affiliated are considered as significant under the SSM Regulation ("ECB," 2013).

Table 4: Regulation (EU) No 575/2013 (CRR I) ("European Parliament, Council ", 2013b)

Title of Guideline / Regulation	Published by	Published in	Risk Management relevant	Effective in
REGULATION (EU) No 575/2013 (CRR I)	European Parliament, Council	2013	Complete Paper	2014

The main contents of the CRR I focus on own funds, liquidity, leverage and counterparty credit risks. The capital ratios, common equity tier 1 ratio of 4.5%, additional tier 1 ratio of 1.5% and tier 2 ratio of 2%, have to be fulfilled for the Association of Volksbanks principally on a consolidated level. But the accountability of the Volksbank's co-operative shares and participation capital as common equity tier 1 is still to be discussed.
In line with Basel III, the Commission introduces a leverage ratio. The leverage ratio is defined as Tier 1 capital divided by a measure of non-risk weighted assets. The purpose of the leverage ratio is to have an instrument that offers a safeguard against the risks associated with the risk models underpinning risk weighted assets. A leverage ratio of 3% is seen as appropriate, and the public disclosure starts as of 2015. The decision on whether to introduce the leverage ratio as a binding measure will take place in 2018.
The CRR further imposes quantitative regulatory standards for liquidity, introducing two new ratios, Liquidity Coverage Requirement (LCR) and Net Stable Funding Requirement (NSFR).

Table 5: Banking Union ("European Parliament, Council," 2013c)

Title of Guideline / Regulation	Published by	Published in	Risk Management relevant	Effective in
Single Resolution Mechanism (SRM) / Single Supervisory Mechanism (SSM) - Banking Union	European Parliament, Council	2013	Complete Paper	SSM 2014 SRM 2015

A set of proposals is a first step towards an integrated “banking union” which includes components such as a single rulebook, common deposit protection, a single supervisory mechanism and a single bank resolution mechanisms. In 2012, the Commission proposed a single banking supervision mechanism in the euro area. It confers new supervision powers on the European Central Bank (ECB) for the banks of the euro area i.e. the creation of a single supervisory mechanism. As of July 1st 2013 all banks of major systemic importance are put under the supervision of the ECB. The phasing-in process will be completed within one year from the entry into force of this Regulation at the latest that is on January 1st 2014, when the new SSM will cover all banks. The degree of direct European supervision by the ECB on a daily basis and the role played by national supervisors may vary according to the size of banks. Certain key supervisory tasks necessary for the supervision of credit institutions are conferred on the ECB while all tasks not spelt out in the regulation would remain the competence of national supervisory authorities.
The Single Resolution Mechanism (SRM) was proposed to complement the SSM. It will basically apply the substantive rules of the single rulebook in a coherent and centralised way ensuring consistent decisions for the resolution of banks, and common resolution financing arrangements.
The Single Resolution Mechanism (SRM) will ensure that if a bank subject to the Single Supervisory Mechanism faces serious difficulties, its resolution can be managed efficiently. In case of cross-border failures, it is more efficient than a network of national resolution authorities. The SRM will take over when ECB, as the supervisor, would flag a bank, which needs to be resolved in the euro area or established in a Member State participating in the

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Banking Union. The SRM is planned to apply from January 2015 together with the Bank Recovery and Resolution Directive

Table 6: Bank Intervention and Restructuring Act (BIRG) ("Austrian Parliament," 2013)

Title of Guideline / Regulation	**Published by**	**Published in**	**Risk Management relevant**	**Effective in**
"Bankeninterventions- und Restrukturierungsgesetz (BIRG)" / Bank Intervention and Restructuring Act	Austrian Parliament	2013	Complete Paper	2014

In 2012 the European Commission proposed in addition to regulations on „banking testaments", the settlement of an institution, far-reaching restructuring and early intervention measures, which will be applied until January 1st 2015. The European Banking Authority (EBA) has now the task to develop a wide range of Binding Technical Standards.
In Austria the regulation will be implement by the Bank Intervention and Restructuring Act (BIRG). It's planned to become effective in January 2014, a year earlier than the European-wide regulation, and concentrates basically on the creation of a „banking testament". Institutions must provide recovery and resolution plans and it allows the Austrian Financial Market Authority early intervention measures.
The institutions are required to define specific qualitative and quantitative trigger events and the remedial measures which should be used in the stated events. For the creation of the resolution plan the same principles apply as for the recovery plan. In order to identify and describe those trigger events, the risk management function has to be involved.
If an institution fails to comply with the requirements for the recovery and resolution plan, the FMA has enhanced measures available like the limitation of risk positions, increased information obligations or restrictions on the development of new business areas or products.
First, appropriate reorganisation measures in certain trigger events have to be applied, which are supposed to prevent an escalation of problems, and the risk of a bank´s failure should be reduced. However, if there is a significant deterioration in the financial situation of the institution, early intervention measures need to be taken. If the prevention of the failure is not likely, the resolution has to start.
In its scope, the regulation is aimed to credit institutions within the meaning of the Austrian Banking Act and (mixed) financial holding companies. Within a group a recovery plan on a consolidated level has to be made, which shall include a plan for the group as a whole, for the parent institution, and for each "significant" subordinated institution. The term "essential" has still to be defined by the FMA.

Table 7: Guidelines on the Application of Supervisory Review Process under Pillar 2 (CEBS, 2006)

Title of Guideline / Regulation	Published by	Published in	Risk Management relevant	Effective in
Guidelines on the Application of Supervisory Review Process under Pillar 2	Committee of European Banking Supervision (CEBS)	2006	Complete Paper	2006

The paper provides guidance on what supervisory authorities expect of institutions under the Pillar 2 framework. It sets out guidelines on internal governance and on the ICAAP.
The management body should set the risk strategy, the risk policy, and accordingly the risk-bearing capacity of the institution. The management body (both supervisory and management functions) is also responsible for integrating capital planning and capital management into the institution's overall risk management culture and approach.

The ICAAP should form an integral part of the management process and decision making culture of the institution. This could range from setting internal capital targets that are consistent with its risk profile and operating environment, using the ICAAP to allocate capital to business units, to having it play a role in the individual credit decision process, to having it play a role in more general business decisions (e.g. expansion plans) and budgets.
Any changes in the institution's strategic focus, business plan, operating environment or other factors that materially affect assumptions or methodologies used in the ICAAP should initiate appropriate adjustments to the ICAAP. New risks that occur in the business of the institution should be identified and incorporated into the ICAAP.
The ICAAP should be comprehensive and forward-looking. To be comprehensive the ICAAP has to include pillar 1 risks, risks that are not fully captured under pillar 1, all material pillar 2 risks and risk factors external to the institution, which may arise from the regulatory, economic or business environment. Some of these risks are non quantifiable, but should be included if they are material, even if they can only be estimated.
The institution should have an explicit, approved capital plan, which states the institution's objectives and the time horizon for achieving those objectives, and in broad terms the capital planning process and the responsibilities for that process.
The results and findings of the ICAAP should feed into an institution's evaluation of its strategy and risk appetite.

Table 8: High Level Principles on Risk Management (CEBS, 2010b)

Title of Guideline / Regulation	**Published by**	**Published in**	**Risk Management relevant**	**Effective in**
High Level Principles on Risk Management	Committee of European Banking Supervision (CEBS)	2010	Complete Paper	2010

The guideline proposes high-level principles to strengthen banks' risk management practices, in particular in the areas of governance and risk culture, risk appetite and risk tolerance, the role of the Chief Risk Officer and risk management functions, risk models and integration of risk management areas and new product approval policy and process.
A strong institution-wide risk culture is one of the key elements for effective risk management.
The risk culture must extend across all of the organisation’s units and business lines and encompass all relevant risks, both financial and non-financial (e.g. reputational risk). Risk policies must be formulated based on a comprehensive view of all business units, and risks must be evaluated not only from the bottom up but also across business lines.
Institutions express their risk appetite and risk tolerance in a variety of forms, including setting a target credit rating or a target rate of return on equity (sometimes, but not always accompanied by a target limit on the variance of that return). It is important both that institutions set such targets, and that the targets be consistent with one another, as well as being consistent with the institution’s obligation to maintain the risk to depositors within the constraints implied by capital and liquidity regulation. The management body and senior management are responsible for setting the institution’s risk appetite and risk tolerance.
Because of the volatile nature of banking business and the economic environment, risk measurement should be regularly reviewed and scrutinized against the institution’s strategic goals and risk appetite and risk tolerance.
Regular and transparent communication mechanisms should be established within the organisation, so that the management body, senior management, business lines, the risk management function and other control functions can all share information about risk measurement, analysis and monitoring.

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Table 9: Guidelines on Internal Governance (EBA, 2011)

Title of Guideline / Regulation	**Published by**	**Published in**	**Risk Management relevant**	**Effective in**
Guidelines on Internal Governance	European Banking Authority (EBA)	2011	Complete Paper	2011

Internal governance for institutions in the European Community is covered by Directive 2013/36/EU, which requires that every credit institution has robust governance arrangements. The European Banking Authority has consolidated the majority of its guidelines regarding general internal governance issues in the present Guidelines on Internal Governance. The guideline as well contains requirements regarding internal governance on risk management.
The key responsibilities of the management body regarding risk management should include the coordination of the institution´s business and risk strategies, as well as setting and overseeing an institution´s overall current and future risk tolerance/appetite and its risk management framework and the amounts, types and distribution of both internal capital and own funds adequate to cover the risks of the institution.
An institution shall develop an integrated and institution-wide risk culture, based on a full understanding of the risks it faces and how they are managed, taking into account its risk tolerance/appetite. A sound and consistent risk culture throughout an institution is a key element of effective risk management. An institution should have a holistic risk management framework extending across all its business, support and control units and including policies, procedures, limits and controls providing adequate, timely and continuous identification, measurement or assessment, monitoring, mitigation and reporting of the risks posed by its activities at the business line and institution-wide levels.
An institution has to establish a comprehensive and independent Risk Control function (RCF). The RCF shall be actively involved at an early stage in elaborating an institution´s risk strategy and in all material risk management decisions. Furthermore, the RCF should be responsible for ensuring the risk limits are in line with the institution´s overall risk appetite/risk tolerance and monitoring on an on-going basis that the institution is not taking on excessive risk.
A risk committee (or equivalent) should be formed and responsible for advising the management body. To enhance the effectiveness of the risk committee, it should regularly communicate with the institution´s Risk Control function and Chief Risk Officer.
An institution should adopt appropriate internal alert procedures that staff can use to draw attention to significant and legitimate concerns regarding matters connected with internal governance.

Table 10: Guidelines on Stress Testing (CEBS, 2010a)

Title of Guideline / Regulation	**Published by**	**Published in**	**Risk Management relevant**	**Effective in**
Guidelines on Stress Testing	Committee of European Banking Supervision (CEBS)	2010	Complete Paper	2010

Capital Requirement Directive (CRD), and, in particular, supervisory review under Pillar 2 requires institutions to take a forward-looking view in their risk management, strategic planning and capital planning. Also, the Basel Committee on Banking Supervision (BCBS) published principles for sound stress testing practices and supervision.
Stress testing programmes in an institution should encompass all the material risks relevant for the banking group. To be effective, stress testing should consist of a multi-layered approach from simple sensitivity analysis on single portfolios or specific types of risks over

complex macroeconomic scenario on a firm-wide basis to reverse-stress testing. Stress tests should also be used to evaluate the reliability of the capital planning.
Institutions are expected to consider a broad range of mitigating techniques and contingency plans against a range of plausible stressed conditions with a focus on at least a severe but plausible negative scenario.
Large and complex institutions are expected to have an appropriate infrastructure in place to undertake a variety of the stress testing approaches, whilst small and simple institutions may focus more on the qualitative aspects.
In cases where the institution applies a centralised approach to risk management, and stress tests are being conducted predominantly at the consolidated level, the design of the stress testing programme should allow for articulation of the impact of the consolidated level stress tests to material entities and/or business lines.
The management body has ultimate responsibility for the overall stress testing programme. However, the management body should actively engage in the discussion, and is expected to question assumptions underlying the stress tests from a common/business sense perspective.

Table 11: Principles for effective risk data aggregation and risk reporting (BCBS, 2013)

Title of Guideline / Regulation	**Published by**	**Published in**	**Risk Management relevant**	**Effective in**
Principles for effective risk data aggregation and risk reporting	Basel Committee on Banking Supervision (BCBS)	2013	Complete Paper	Variable

This paper presents a set of principles to strengthen banks' risk data aggregation capabilities and internal risk reporting practices. These Principles apply at both the banking group and on a solo basis. The author only presents the most relevant principles of the 14 in total.
Data should be aggregated on a largely automated basis so as to minimise the probability of errors. Risk data should be reconciled with bank's sources, including accounting data where appropriate, to ensure that the risk data is accurate.
As a precondition, a bank should have a "dictionary" of the concepts used, such that data is defined consistently across an organisation.
Supervisors expect banks to document and explain all of their risk data aggregation processes whether automated or manual and to measure and monitor the accuracy of data and to develop appropriate escalation channels and action plans to be in place to rectify poor data quality.
A bank should be able to capture and aggregate all material risk data across the banking group. Data should be available by business line, legal entity, asset type, industry, region and other groupings, as relevant for the risk in question, that permit identifying and reporting risk exposures, concentrations and emerging risks.
A bank should be able to generate aggregate risk data to meet a broad range of on-demand, ad hoc risk management reporting requests, including requests during stress/crisis situations, requests due to changing internal needs and requests to meet supervisory queries.
Reports should identify emerging risk concentrations, provide information in the context of limits and risk appetite/tolerance and propose recommendations for action where appropriate. For example, an aggregated risk report should include, but not be limited to, the following information: capital adequacy, regulatory capital, capital and liquidity ratio projections, credit risk, market risk, operational risk, liquidity risk, stress testing results, inter- and intra-risk concentrations, and funding positions and plans.
It is suggested that national supervisors apply these principles to banks identified as domestically important banks (D-SIBs) three years after their designation as D-SIBs.

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Table 12: Guidelines on the management of concentration risk under the supervisory review process (BCBS, 2010)

Title of Guideline / Regulation	**Published by**	**Published in**	**Risk Management relevant**	**Effective in**
Guidelines on the management of concentration risk under the supervisory review process	Basel Committee on Banking Supervision (BCBS)	2010	Complete Paper	2010

Concentration risk is one of the specific risks required to be assessed as part of the Pillar 2 framework. In order to identify the concentration risk within an institution, it is not sufficient only to analyse within a risk type (intra-risk analysis), analysis of concentration risk across risk types (inter-risk analysis) is also necessary. Institutions are expected to adequately address concentration risk in their governance and risk management frameworks.
Intra-risk concentrations may be captured by the existing risk management models and practices. Whereby interactions between various risk factors and inter-risk concentrations, might not be sufficiently captured by the existing approaches to risk (and concentration risk) management.
Inter-risk concentrations stemming from interdependencies between risk types may not be fully considered when risks that are identified and measured on a stand-alone basis ("silo" approach) are combined (added up) in a simple way, e.g. by adding up Value-at-Risk figures. In this case, inter-risk concentrations via single factors driving the risks of different business lines may not be captured.
Institutions should have a framework for the identification of intra- and inter-risk concentrations.
Risk drivers, which could be a source of concentration risk, should be identified. Furthermore, the risk concentration identification framework should be comprehensive enough to ensure that all risk concentrations which are significant to the institution are covered, including on– and off- balance sheet positions and committed and uncommitted exposures, and extending across risk types, business lines and entities.
Stress testing in the form of both sensitivity analysis and more complex scenario stress testing is a key tool in the identification of concentration risk. Some specific sensitivity analyses targeted on behaviour of known concentrations in a portfolio or single risk type level may improve an institutions' knowledge about concentration risk.
Furthermore, institutions should have adequate arrangements in place for actively controlling, monitoring and mitigating concentration risk.
An institution should set top-down and group-wide concentration risk limit structures (including appropriate sub-limits across business units or entities and across risk types) for exposures to counterparties or groups of related counterparties, sectors or industries, as well as exposures to specific products or markets.

Table 13: IFRS 9, 13 (IASB, 2013)

Title of Guideline / Regulation	**Published by**	**Published in**	**Risk Management relevant**	**Effective in**
International Financial Reporting Standards	International Accounting Standards Board (IASB)	2009 - 2013	IFRS 9, 13	IFRS 9 2017, IFRS 13 2013

IFRS 9 Financial Instruments sets out the recognition and measurement requirements for financial instruments and some contracts to buy or sell non-financial items. The IASB is

adding to the standard as it completes the various phases of its comprehensive project on financial instruments, and so it will eventually form a complete replacement for IAS 39.
The project is divided into three phases, phase one classification and measurement, phase two impairment methodology and phase three hedge accounting.
IFRS 9 Financial Instruments was published in 2009 and contained requirements for financial assets. Requirements for financial liabilities were added to IFRS 9 in 2010. The International Accounting Standards Board (IASB) released a new exposure draft (ED) Financial Instruments: Expected Credit Losses on 7 March 2013 as part of phase two proposing the recognition and measurement of a credit loss allowance or provision based on expected rather than incurred credit losses. The new expected credit loss model would apply to loans, debt securities, trade receivables, lease receivables, irrevocable loan commitments and financial guarantee contracts. Credit losses will be measured as the 12-month expected credit losses or, if the credit risk has increased significantly since initial recognition (with some exceptions), the credit losses will be measured as the lifetime expected credit losses.
On 7 September 2012 the IASB proposed the general hedge accounting requirements that will be added to IFRS 9. IAS 39 does not provide an objective for hedge accounting, so the IASB has proposed a number of significant changes. The overall effect of IFRS 9 will be more opportunities to apply hedge accounting and consequently less profit or loss volatility arising from risk management activities. Highlights of the new changes include allowing more items to qualify as eligible hedged items, simplifying effectiveness testing, less profit or loss volatility for entities using options and/or forwards as hedging instruments and alternatives to hedge accounting available to manage the accounting mismatch for economic hedges of credit risk and 'own use' contracts.
IFRS 13 Fair Value Measurement applies to IFRSs that require or permit fair value measurements or disclosures and provides a single IFRS framework for measuring fair value and requires disclosures about fair value measurement. The Standard defines fair value on the basis of an 'exit price' notion and uses a 'fair value hierarchy', which results in a market-based, rather than entity-specific, measurement. The fair value measurement will influence risk quantification of certain assets.

Table 14: Technical Standards on Supervisory Reporting (EBA, 2013)

Title of Guideline / Regulation	**Published by**	**Published in**	**Risk Management relevant**	**Effective in**
Technical Standards on Supervisory Reporting	European Banking Authority (EBA)	2013	Complete Paper	2014

The CRR includes articles with specific mandates for the EBA to develop draft Implementing Technical Standards (henceforth 'ITS') relating to supervisory reporting requirements. These draft ITS specify uniform formats, frequencies, dates of reporting, definitions and IT solutions to be applied by credit institutions and investment firms in Europe. Originally there were different supervisory reporting frameworks in the various Member States.
The ITS set out reporting requirements relating to own funds and own funds requirements (common reporting, COREP), financial information (financial reporting, FINREP), losses stemming from lending collateralised by immovable property, large exposures, leverage ratio and liquidity ratios. As the ITS follow the scope and level of application set out in the CRR, in general they apply to credit institutions and investment firms on both an individual and a consolidated level on a semi-annual basis, with the exception of financial information by those institutions that apply International Financial Reporting Standards.
For Austrian credit institutions the Austrian Banking Act requests a quarterly report with different intervals for individual items. Furthermore an Association of Volksbanks according to the Austrian Banking Act is only required to report on a consolidated level.

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Table 15: MaRisk (BaFin, 2012)

Title of Guideline / Regulation	Published by	Published in	Risk Management relevant	Effective in
Minimum Requirements for Risk Management for Banks and Financial Services Institutions (MaRisk)	The Federal Financial Supervisory Authority (BaFin), Germany	2012	Complete Paper	2012 in Germany; not in Austria

Institutions have to set up appropriate 'Robust Governance Arrangements', as well as strategies and processes that ensure adequate internal capital to cover all material risks ("Internal Capital Adequacy Assessment Process"). The MaRisk is the German counterpart to the Guidelines on ICAAP of the Austrian authorities.
The requirements set forth in MaRisk relate to the management of material risks of the institution, as well as risk concentrations associated with these risks. In order to assess whether or not a risk is deemed material, the management has to obtain an overview of the overall risk profile of the institution. As a general rule, the types of risk to be taken into consideration include counterparty risks (including country risks), market price risks, liquidity risks and operational risks. Within the risk assessment it's evaluated, which risks can affect the profitability, liquidity or financial position (including capital). On the basis of the overall risk profile, the institution has to ensure that the material risks are covered by the risk taking potential at all times. For risks that are not classified as material, appropriate precautions must be taken.
MaRisk now requires every institution to have a procedure in place for planning its future capital requirements. In their internal process to ensure risk-bearing capacity, institutions must also analyse how planned modifications to their own business activities or strategic objectives as well as expected changes in the economic environment would impact future risk-bearing capacity. In order to identify future capital requirements as early as possible, a period extending beyond the risk analysis horizon of the risk bearing capacity concept (usually one year) must be reviewed. The capital planning procedure should thus comprise an appropriate period of several years.
The risk strategy has to contain the objectives of risk treatment with regard to the institution's material business activities. It may be divided into sub-strategies where appropriate (e.g. a strategy for counterparty risks). Appropriate consideration has to be given to the limitation of risk concentrations when determining the risk strategy. The management board has to review the strategies at least once per year and adjust them as appropriate.
The revised MaRisk now also contains requirements that aim first and foremost at an appropriate compliance organisation and culture at the institution.
Institutions with primarily smaller scale client business and stable refinancing can use a simple cost allocation system. Major institutions with complex business activities on the other hand must create a liquidity transfer price system that is characterised by costs, benefits and risks being internally transferred at centrally fixed prices.

Table 16: EMIR ("European Parliament, Council, " 2012)

Title of Guideline / Regulation	Published by	Published in	Risk Management relevant	Effective in
European Market Infrastructure Regulation (EMIR), Regulation (EU) No 648/2012 on OTC derivatives, central counterparties (CCPs) and trade repositories (TRs)	European Parliament, Council	2012	Art 11	2012

This Regulation lays down conditions for mitigating systemic risks and improving the transparency of derivative contracts.
In general all standardised OTC derivative contracts should be cleared through a central counterparty (CCP) and OTC derivatives should be reported to trade repositories.
Financial counterparties and non-financial counterparties that enter into an OTC derivative contract not cleared by a CCP, shall ensure, exercising due diligence, that appropriate procedures and arrangements are in place to measure, monitor and mitigate operational risk and counterparty credit risk. Formalized processes, which are robust, resilient and auditable in order to reconcile portfolios, to manage the associated risk and to identify disputes between parties early and resolve them, and to monitor the value of outstanding contracts, are required.
Financial counterparties shall hold an appropriate and proportionate amount of capital to manage the risk not covered by appropriate exchange of collateral.

Table 17: Liikanen-Report (Liikanen, 2012)

Title of Guideline / Regulation	**Published by**	**Published in**	**Risk Management relevant**	**Effective in**
High-level Expert Group on reforming the structure of the EU banking sector (Liikanen-Report)	Erkki Liikanen	2012	Complete Paper	-

The Report of the European Commission's High-level Expert Group on Bank Structural Reform (known as the "Liikanen Group") as a set of recommendations to remedy deficits in bank reforms published in 2012 by a group of experts led by Erkki Liikanen, proposes action in five areas. Additional separation of activities, conditional on the recovery and resolution plan, mandatory separation of proprietary trading and other high-risk trading, amendments to the use of bail-in instruments as a resolution tool, toughening of capital requirements on trading assets and real estate related loans (i.e. mortgages) and strengthening the governance and control of banks, including measures to rein in or bail-in bonuses.
There are various other guidelines and standards on specific risk categories. A listing of those would have been too excessive for the purpose of this paper.

Challenges for a Bank-Wide Risk Management in the Association of Volksbanks

In this chapter the author describes the respective components that are essential for a bank-wide risk management within the Association of Volksbanks. For each of these components the challenges arising from regulatory compliance or requirements due to the new structure will then be analysed.
Basis of the extensive contents and the process of a bank-wide risk management is the ICAAP guideline of the Austrian Supervisory Authority (OeNB/FMA, 2006). But also specifications from non-banking related frameworks or standards such as COSO´s Integrated Framework on Enterprise Risk Management (COSO, 2004) or the structured approach to Enterprise Risk Management under the requirements of ISO 31000 (AIRMIC/ALARM/IRM, 2010) provide indications for an improved implementation of a bank-wide risk management.
The fundamental principles of a bank´s risk management are manifested in the risk strategy. "A risk strategy is a compact, concise document focusing on strategic issues and describing a bank's fundamental risk policy" (OeNB/FMA, 2006).
Every bank is characterised by a fundamental attitude towards risks and risk management, based on that, the bank must define general strategic conditions for the organisation. The result of this process is the risk strategy. According to the ICAAP guideline (OeNB/FMA,

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2006) the risk strategy consists of the bank´s risk policy principles, its risk appetite, its current and planned risk structure as well as the structure and positioning of risk management within the institution. It is also mentioned that the scope and level of detail of a risk strategy depend on the size, complexity and risk levels of the specific institution, but a concise strategic outline should be preferred over an excessively long description. The risk strategy must be approved by the management and updated periodically (and at other times as necessary). In the ICAAP guideline the terms “risk strategy” and “risk policy” are used synonymously. Whereas ISO 31000 (AIRMIC/ALARM/IRM, 2010) states that risk strategy, appetite, attitudes and philosophy are defined in the Risk Management Policy. This standard further provides a list of contents included in a typical risk management policy. According to ISO 31000 (AIRMIC/ALARM/IRM, 2010) a risk management policy should include risk management and internal control objectives (governance), statement of the attitude of the organisation to risk (risk strategy), description of the risk aware culture or control environment, level and nature of risk that is acceptable (risk appetite), risk management organisation and arrangements (risk architecture), details of procedures for risk recognition and ranking (risk assessment), list of documentation for analysing and reporting risk (risk protocols), risk mitigation requirements and control mechanisms (risk response), allocation of risk management roles and responsibilities, criteria for monitoring and benchmarking of risks and risk activities and risk priorities for the coming year (AIRMIC/ALARM/IRM, 2010).
Burkett et al (2010) defines risk policy as a governance document that describes how the organisation views risk, the role risk assumption or risk avoidance plays in the management and oversight of company operations, and the processes the company has established to monitor and, when necessary, to intervene to keep the organisation’s operations aligned with the level of risk the company has established as being acceptable.

Challenge No 1

Challenges according to risk strategy within the Association of Volksbanks are arising especially from the new structure. As indicated the Austrian Banking Act still requires proper strategies and procedures to continuously evaluate risks on a consolidated and an individual basis. As a result the development of a risk strategy for the overall Association is required, which should then be transferred to risk strategies for the individual primary banks and the VBAG. Furthermore it becomes necessary to define the relationship between consolidated and single strategy in the context of the review process and the distribution of roles in the creation of the strategy.
BaFin (BaFin, 2012) even suggests, that the risk strategy has to contain the objectives of risk treatment with regard to the institution’s material business activities. It may be divided into sub-strategies where appropriate (e.g. a strategy for counterparty risks).
Brodeur et al (2010) suggests a risk strategy statement, which can be considered as a form of a mission statement. It should demonstrate the mission or purpose of the bank´s risk management, what is to be ensured with the risk strategy and how risks should generally be managed. Convincing examples are ´The objective of the bank‘s risk management is to ensure at all times sufficient capital adequacy´ or ´Our risk systems are not designed to eliminate risks that threaten the achievement of our business objectives but to manage them´ (Brodeur et al., 2010).
The basic attitude and awareness towards risks and risk management is specified in a bank´s risk policy principles or risk philosophy as part of the risk strategy (COSO, 2009).
Risk policy principles include all central rules of conduct for handling risks within the bank. These principles form the basis for a maximum of uniformity in the employees understanding of the bank’s risk management goals throughout the organisation. If the risk policy principles

are known throughout the bank, employees will be able to deduce which course of action complies with the principles in many specific cases. In addition to the overall bank perspective, it is often helpful to establish certain principles for specific risk types, for example in a credit risk policy, market risk policy or liquidity risk policy (OeNB/FMA, 2006). COSO (2009) uses the term risk philosophy, which reflects the ways risks are considered in the development of the entity's high-level strategy and objectives and how those risks are considered in day-to-day business. The dependence of the business strategy is clearly present in this context. Examples for principles are as follows ´Risk management is everyone´s responsibility, ´Risk Management will be integrated with major business processes such as strategic, business planning and operational management´ (Aabo & Simkins, 2005).
Furthermore, a risk culture ought to be determined within a risk strategy. Brodeur et al (2010) and Crickette et al (2012) define "risk culture" as the norms of behaviour for individuals and groups within a company that determine the collective willingness to accept or take risk, and the ability to identify, understand, discuss, and act on the organisation's risks. A communicated risk culture forms a common risk awareness and understanding.

Challenge No 2

A strong integrated and institution-wide risk culture is one of the key elements for an effective risk management according to the Guidelines on High Level Principles on Risk Management (CEBS, 2010b) and risk policy principles are important to create a uniformity in the employees understanding of the bank's risk management goals throughout the organisation (OeNB/FMA, 2006).
Risk culture is defined as the norms of behaviour for individuals and groups within a company that determine the collective willingness to accept or take risk, and the ability to identify, understand, discuss, and act on the organisation's risks (Brodeur et al., 2010). A risk culture should be central to a firm`s risk management and governance and should be grounded in shared values and common understanding ("Deloitte," 2013). Organisations get in trouble when individuals, knowingly or unknowingly, act outside of the expected risk culture, or when the expected risk culture either is not well understood or enforced (Crickette et al., 2012).
Risk policy principles include all central rules of conduct for handling risks within the bank (OeNB/FMA, 2006) and defines the role risk assumption or risk avoidance plays in the management and oversight of company operations (Burkett et al., 2010).
Differences in risk understanding, risk definition and sizes of individual banks in the Association of Volksbanks, make it difficult to find a common definition of risk culture and principles. Nevertheless, a common risk culture extending across all of the organisation's units and business lines and encompassing all relevant risks, both financial and non-financial (e.g. reputational risk) has to be defined. What´s more, risk policies must be formulated based on a comprehensive view and awareness of risks. The risk culture and policy principles only become effective if they are communicated to all employees across the organisation's units.

Challenge No 3

The structure of risk management has a key role in a bank´s risk strategy. A structure or architecture specifies the roles, responsibilities, communication and risk reporting structure (AIRMIC/ALARM/IRM, 2010). Not only the information on structural organisation should be part, but also process organisation, systems and internal control mechanism (OeNB/FMA, 2006).

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With a decentralised organisation, two central risk management departments at the CO and a risk management function at each Volksbank, the architecture of risk management within the Association of Volksbanks needs clear and consistent structures.
The challenge is to define roles and responsibilities distributed between the central risk management and isolated risk management functions in the primary banks. Parallel risk management departments, systems and processes need to be harmonised into a central architecture with distinct roles, uniform processes and systems as well as one direct line of communication.
As already cited, regulatory requirements for robust internal governance arrangement are covered by Directive 2013/36/EU ("European Parliament," 2013a), MaRisk (BaFin, 2012) and the EBA Guidelines on Internal Governance (EBA, 2011). So it's important for the Association to implement such governance structures. In terms of risk management, the institution has to establish a comprehensive and independent Risk Control function (RCF). The RCF shall be actively involved at an early stage in elaborating an institution´s risk strategy and in all material risk management decisions. It is further necessary to determine, if the governance only has to be established on a consolidated level at the central organisation or on a single level for each primary bank as well.

Challenge No 4

The bank´s risk appetite is another influencing factor in its fundamental risk strategy. Risk appetite is defined as the bank´s willingness to take on risks (OeNB/FMA, 2006).
In the literature the terms risk appetite, risk tolerance and risk limit are sometimes used synonymously. But below the author explicitly provides the different definitions from existing literature.
Risk appetite is not only defined as the willingness to take on risks, but also takes other factors, objectives or value, into account. Risk appetite is also defined as the amount of risk an organisation is willing to take on in pursuit of value. Or, in other words, the total impact of risk an organisation is prepared to accept in the pursuit of its strategic objectives (Cheng & Shang, 2012).
Burkett et al (2010) describes risk appetite as one or more statements that describe the levels of risk that company management deems to be acceptable in the pursuit of overall financial and solvency goals. Risk tolerance on the other side is one or more statements that establish boundaries on how much variation away from expected financial return the entity is willing to accept.
Risk tolerance reflects the acceptable variation in outcomes related to specific performance measures linked to objectives the entity seeks to achieve (COSO, 2009). Risk tolerance requires a company to consider in quantitative terms exactly how much of its capital it is prepared to put at risk ("Towers Perrin," 2010).
As the notion itself suggests, defining a firm's risk tolerance is more than just setting an upper risk limit. A 'healthy' risk tolerance is not just about helping the firm to avoid eating more than its capacity to digest, it's also about eating enough for the firm to live and thrive ("Deloitte," 2013).
Risk limits are the most granular level used for business operation. It translates enterprise risk tolerance and risk appetite for each risk category into risk-monitoring measures. Risk capacity is the quantum of risk that the firm is willing to accept within its overall capacity (Cheng & Shang, 2012).
An institution should define a risk appetite framework, including a risk appetite statement, a target risk profile, risk limits and responsibilities of those overseeing the implementation and monitoring of the framework (OeNB/FMA, 2006).

Risk appetite is not developed in isolation from other factors (COSO, 2004) and a suitable risk appetite is a basic operational prerequisite for the bank to set consistent risk limits (OeNB/FMA, 2006). The risk appetite has first to be defined on a firm-wide level. An institution should consider different correlating factors in the development. At high level, the firm's strategic plan and objectives, e.g. a market or product launch, and the nature of the risks to be assumed (market, credit, operational risk) in form of a risk strategy, are main influences on risk appetite. On the other hand the institution has to identify potential risks that may prevent the achievement of the institutions strategic objectives. Determining a company's risk appetite continues by assessing its current risk capacity, the maximum amount of risk the bank can take on before breaching its supervisory constraints (Solvency Ratio) and its future risk capacity based on capital management plan and business plan (Brodeur et al., 2010). The bank should also consider its existing risk profile and the current level of unexpected losses, not as a determinant of risk appetite but as an indication of the risks it currently addresses (COSO, 2004). Based on current risks profile, risk capacity and strategic plan, the bank needs to define how much risk it wants to take on and at what rate of return. This in turn effects a bank's capital planning and the question of how much capital is necessary to cover the specific risks involved (OeNB/FMA, 2006).

Banks should set basic goals for risk appetite and consider all types of risks when defining risk appetite. Two criteria for risk-appetite statements are emphasized, it should include all financial and nonfinancial risk, and they should contain both quantitative and qualitative elements. Brodeur et al (2010) says that a group-level risk appetite has to contain three key components, zero tolerance risks, quantitative and qualitative measures. The quantitative component includes hard measures of risk, the description of type and quantum of risk the business wants to and is willing to take, the direct relation to a bank's targeted financial performance indicators e.g. earnings ratios. Within the qualitative components, a bank has to state the risks that are not measurable but can affect a business performance. Lastly, the bank has to identify the categories of risk it wishes to avoid. The direct involvement of CRO and Board members in the development of a risk appetite is a necessary factor ("European Parliament, Council," 2013a).

It is important to check that the 'top down' risk appetite is consistent with the 'bottom up' perspective. The assessment of a bank's consolidate risk profile against its risk appetite should be an on-going iterative process (OeNB/FMA, 2012).

Risk appetite becomes tangible and actionable when directly calibrated to the company's targeted financial performance indicators. As the quantitative expression of risk appetite, corporate risk tolerance conveys the actual amount a company is prepared to put at risk by assigning quantitative targets to performance indicators in the form of ultimate risk limits ("Towers Perrin," 2010). Risk tolerance should not only determine the specific maximum but also minimum levels beyond which the institution is unwilling to lose (Crickette et al., 2012). Examples include 'The bank will not risk more than X% of its economic value' Earnings volatility limited to Y% per year', 'Z% probability of financial strength rating maintained above a minimum level' and 'Y% probability of remaining above minimum solvency requirements' ("Towers Perrin," 2010).

The risk appetite has then to be allocated to the firm's business lines, legal entities and down to all relevant levels, which need to align with the firm's strategic and business plan. In this way, the bank can define the risk preference for each risk category, which results in a target risk structure and at the same time enable decentralized risk responsibility and decision-making in individual lines of business or operational units (OeNB/FMA, 2006).

Risk limits are the most granular levels used for business operation. It translates the bank-wide risk tolerance and the risk appetite for each risk category into risk-monitoring measures (Cheng & Shang, 2012). The bank-wide risk tolerance (lower and upper risk limit) is often

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referred to as bank-wide risk limit (upper risk limit) or risk capital (upper risk capital limit). The risk capital is then allocated to business lines and risk categories by assigning limits, summarized under the expression capital allocation (OeNB/FMA, 2006). The bank has to set for each material and measurable risk the maximum level of risk that the bank is willing to operate within, based on not only on a bank's risk appetite and tolerance, but also on its risk capacity and current risk profile (OeNB/FMA, 2006). It is advisable not to allocate 100% of the banks risk coverage capital, but to retain a certain share of capital at the overall bank level. Structural limits or volume limits based on creditworthiness can limit concentration risks effectively in areas where a risk-based limit (VaR limit) cannot be calculated (OeNB/FMA, 2006).
At this stage there is no risk appetite or target risk profile on an overall level documented or developed for the Association of Volksbanks. The author identified especially the formulation of an association-wide risk appetite considering the interdependencies of the influencing factors, risk capacity, risk strategy, current and planned capital, current risk profile and risk-reward objectives as a main challenge. Further, it needs to be discussed if the risk appetite and target risk profile on a consolidated level has to be broken down for each individual Volksbank (top down) and how the consistency can be guaranteed.
At the moment there are two parallel risk limit systems in place, varying between the two risk management systems. Here, the challenge definitely arises from the requirement to harmonize the two limit systems. It is necessary to enhance the limit system from a risk limit on an Association level to an allocation of risk capital to risk categories and individual Volksbanks. Whereby the number of levels at which the limits are distributed, e.g. structural and nominal limits, has to be defined as well.

Challenge No 5

Risk-taking is not an end in itself, rather it should always be assessed in relation to its potential returns. Under a return-oriented risk policy, risks should only be taken in cases where the appropriate return can be generated, that is, where risks and opportunities are balanced in the transaction (OeNB/FMA, 2006).
In determining risk appetite, a bank should not only ask how much risk it wants to take on, but also on what rate of return (OeNB/FMA, 2006). The risk appetite statement should articulate the desired balance between the key risk objectives (e.g. target debt ratings, earnings volatility, capital adequacy) and profitability objectives (Return on Equity (ROE), Risk Adjusted Return on Capital (RAROC)) (Barfield, 2010).
Further the process of assigning capital to business units should be based on risk-return metrics. The capital allocation process is the mechanism by which management (and the board) gives its blessing to parts of the company to take on certain risks in the search for return (Barfield, 2010) .
At this point a risk-return or value-oriented view does not find any entrance in the Associations risk management. The consideration of risk-return aspects (risk adjusted performance measures RAPM) in the risk appetite statement and risk capital allocation outlines another challenge for the bank-wide risk management within the Association.

Challenge No 6

The risk identification is the initial stage of the risk management process, which purpose is to record (in a structured form) as many risks as possible, which might hinder the bank in attaining its goals. All of a bank´s material risks are assessed and then aggregated into the bank´s overall risk position. In addition, this process should be designed in such a way that

changes in existing risks as well as the emergence of new risks can also be taken into account (OeNB/FMA, 2006). Especially when launching activities in new types or lines of business, the bank may be confronted with risks, which previously bore little or no significance. The supplemental guidelines on ICAAP (OeNB/FMA, 2012) claim that a comprehensive product introduction process is a substantial component of risk identification, since it is inevitable for the systematic identification of new risks. According to the Austrian Banking Act ("Austrian Federal Banking Act," 2013), the individual banks affiliated to the Association are still required to conduct a risk inventory/assessment on a single level. Thus, consolidating the results at an individual level leads to a statement for the entire Association.
Due to variant definition of single risk categories and a lack of uniform understanding of risk between the central organisation and the primary banks, a comprehensive risk identification/assessments presents a challenge to the bank-wide risk management. The regular introduction of new risk categories by the European or national regulators such as the additional risk categories arising from the CRD IV, cause an even more complex risk assessment.

Challenge No 7

The second task in the risk management process is risk quantification. Likewise, the bank also has to quantify its risk coverage capital. Once they have been identified and quantified, all the individual risks have to be aggregated to determine the bank´s overall risk position in the ICAAP. Along with risks, the available risk coverage capital has to be aggregated. The bank´s coverage capital is then be compared with its risks (OeNB/FMA, 2006). The ICAAP should be based on the banks hedging objectives, represented as going concern or liquidation perspective. The hedging objective of the going concern perspective is to enable the bank to absorb negative events and to continue operation as a going concern. In this context, the minimum regulatory capital requirement must be regarded as the absolute bottom limit for the going concern objective. In addition, it is advisable to set up an early warning level in the assessment of an institutions risk-bearing capacity. Under the going concern approach the potential risk, which is likely not to be exceeded (e.g. 95% probability), is compared with the coverage capital defined (or available) for the going concern. The hedging objective in the liquidation scenario (worst-case scenario) in the ICAAP is to protect the interests of lenders (e.g. bond holders, savings investors). These parties provide debt capital, which, in contrast to equity, cannot be regarded as risk capital. The level of hedging must be higher in order to enable repayment of debts. In this context, the banks overall economic risk, which is likely not to be exceeded (e.g. 99.9% probability), is compared to all sustainable risk coverage capital, i.e. the net asset value (OeNB/FMA, 2006), (OeNB/FMA, 2012).
As mentioned, there are currently two parallel risk management systems in place with distinct types of risks included that are also not quantified with standard methods. Components of the risk coverage capital are different between the two systems as well. In addition, the hedging objectives and types of risk bearing capacity calculation between the two risk management systems vary in definition and methods. Derived thereof, the author recognized the demand for one clearly defined going concern and liquidation scenario with uniform and central predefined methods for quantification in each scenario.
Furthermore, the calculation of risk coverage capital will become constrained by the new CRR I standards for own funds. As above stated some form of tier 1 and tier 2 might also no longer be allowable for the risk coverage capital, which will put pressure on the risk bearing capacity. The capital ratios including capital buffers will further be incorporated into the risk bearing capacity calculation as a strict constraint.
Due to various national and international institutions as part of the Association, different consolidation scopes according to IFRS, Austrian Commercial Code or Austrian Banking Act

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exist. The regulator (OeNB/FMA, 2012) however requests that the consolidation scope of the assets included in risk quantification and the risk coverage capital should be equivalent.

Challenge No 8

The more complex a bank´s structure is, the more demanding and involved the risk aggregation process becomes. This is especially the case within the Association of Volksbanks.
According to the guidelines on risk data aggregation (BCBS, 2013) a bank should be able to capture and aggregate all material risk data across the banking group and the data should be available by business line, legal entity, asset type, industry, region and other groupings. A bank should moreover be able to generate aggregated risk data to meet a broad range of on-demand, ad hoc risk management reporting requests, including requests during stress situations, requests due to changing internal needs and requests to meet supervisory queries. Due to parallel and isolated databases is that another challenge to overcome for the newly formed Association.
In term of risk aggregation, the Guidelines on the management of concentration risk (BCBS, 2010) indicate that it is not sufficient only to analyse within a risk type (intra-risk analysis), but an analysis of concentration risk across risk types (inter-risk analysis) is also necessary.
Intra-risk concentrations are captured by the existing risk management models and practices, but the interactions between various risk factors and inter-risk concentrations, are not captured by the existing approaches to risk management in the Association.
The institution should also have a framework for the identification inter-risk concentrations and the framework should be comprehensive enough to ensure that all risk concentrations are covered, including on– and off- balance sheet positions and committed and uncommitted exposures, and extending across risk types, business lines and entities. The guideline also suggests to have adequate arrangements in place for actively controlling, monitoring and mitigating concentration risk like limit structures across business units or entities (BCBS, 2010).
But not only the increasing of a bank's overall risk arising from inter-risk concentrations should be accounted for but also positive interdependencies or correlations between risk types. Due to diversification effects, values, which deviate from a completely positive correlation, will reduce a bank's overall risk.
So the challenge for a consistent bank-wide risk management is also to consider inter-risk concentration and diversification effects at risk aggregation in the future.

Challenge No 9

The results of risk management activities require internal and external reporting on different levels.
Principles for effective risk data aggregation and reporting by BCBS (2013) claim that reports should identify emerging risk concentrations, provide information in the context of limits and risk appetite/tolerance and propose recommendations for action where appropriate.
For the Association detailed reporting hierarchies, recipients of reports, levels of detail, media and time intervals need to be determined. A clear definition of information reported to the board of the central organisation and/or reported to the individual Volksbanks has to be established.
Reporting is only useful if it is connected to a set of action plans guiding the whole Association and individual banks.

Challenge No 10

A stress testing programme shall be composed of a multi-layered approach from simple sensitivity analysis on single portfolios or specific types of risks over complex macroeconomic scenarios on a firm-wide basis to reverse-stress testing. According to the CEBS Guidelines on Stress Testing (CEBS, 2010a), in the cases where the institution applies a centralised approach to risk management, and stress tests are being conducted predominantly at the consolidated level, the design of the stress testing programme should allow for articulation of the impact of the consolidated level stress tests to material entities and/or business lines, in this case individual Volksbanks. The risk managers of the central organisation have to determine the form of stress tests they want to provide for the individual Volksbanks, from single sensitivity analysis on particular parameters or stress tests for special portfolios e.g. tourism industry for Volksbanks in a tourism area to break down the association-wide macroeconomic stress tests for the individual Volksbanks. One way of stress testing for the smaller and simpler Volksbanks may even focus on more qualitative aspects (CEBS, 2010a). So the challenge in terms of stress testing for the Association of Volksbanks is definitely the development of an association-wide and throughout infrastructure of a stress testing programme.

In the next step, a set of emergency measures or escalation mechanism needs to be evolved not only on a consolidated level but also on an individual level for primary banks and the central organisation.

Following the Bank Intervention and Restructuring Act ("Austrian Parliement," 2013), institutions will be required in the future to define specific qualitative and quantitative trigger events and the remedial measures which should be used in the stated events, which is directly related to the required firm-wide macroeconomic stress tests. According to the Act, recovery and resolution plans have to be established for the group as whole and for each “significant” subordinated institution, which leads to another challenge for the Association’s risk management.

Challenge No 11

The principle of proportionality accounts for the fact that different requirements will be appropriate for banks, which conduct business activities of low complexity and low risk levels compared to large, internationally active banks with complex business structures.

On the one side, in the case of the Association of Volksbanks, the affiliated banks vary greatly in size and complexity. The smaller and less complex Volksbanks need simpler methods, the CO with its subsidiaries in turn require more complex systems. On the other side, however, a unified risk management throughout the entire Association is required. The principle of proportionality has to be taken into account in terms of risk identification, risk quantification, reporting or even stress testing.

Challenge No 12

All the above discussed has to result in a consistent documentation of the methods, systems and processes as well as a communication line to all subordinate institutions.

It is important to distinguish clearly of what has to be centrally documented and what the individual Volksbank still needs to document locally. Whereby, the local documentation and manuals should be incorporated into the documentation of the central organisation.

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Conclusion

The Association of Volksbanks is still relatively young and with the cooperative organised design it represents a new type of bank structure in Austria. Even in the European Union are only a few role models established.
The risk management within the Association is still not calibrated to the new structure. There are parallels in systems, organisational structures and processes. A uniform and consistent risk management has not yet been conceptualized Therefore, a central risk control can't be guaranteed at this point.
Hence it becomes apparent that the main challenges are arising from the new structure. In a first step the focus of the risk management function should be on the harmonization of the various systems and processes. However the risk manager should not loose sight of new and additional regulatory requirements. During the literature search the author realized that the abundance of regulatory requirements, that affect a bank's risk management, have reached a critical level in scope and lack of transparency.
On the other side, after a sufficient screening particular standards and guidelines appeared to provide useful information on the basic conditions for the development of a bank-wide risk management.
The challenges of the new structure are already very extensive and the mass of regulatory demand forces a bank in a tight corset with little opportunities for designing and conceptualizing. As a result, it is not possible for a bank to focus on what bank-wide or enterprise risk management is supposed to aim towards, namely the value orientation. A risk-return perspective, using risk adjusted performances measures (RAPM), would allow a bank to use its capital more efficiently and generate value for the members of the cooperative.
The objective of a consistent risk-return management in the Association can only be pursued after the successful calibration and harmonization of the existing risk management.

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SOLVENCY-TESTS – AN ALTERNATIVE TO THE RULES FOR CAPITAL-MAINTENANCE WITHIN THE BALANCE SHEET IN THE EUROPEAN UNION

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Abstract. *Creditor protection in the European Union (EU) is based on the principle of capital maintenance within the balance sheet in accordance with the Second Company Law Directive issued in 1976. Developments in financial reporting, especially the trends towards internationalization in connection with the adoption of International Financial Reporting Standards (IFRS), have a major impact on the current principles of capital maintenance. Accounting law in the EU is based on the Fourth Council Directive which allows a wide range of accounting options leading to a different basis for distributions to shareholders. As a consequence creditor protection may be endangered. As a consequence the European Commission has initiated projects with the aim to modernize company law. Solvency tests are seen as a possible alternative to the existing principles of capital maintenance.*

This contribution provides an overview of the current rules within the EU to limit distributions to shareholders. On the other hand, a critical analysis of both systems, as well as an overview of current developments, shows a need for political action.

Keywords: Solvency-test, Capital-maintenance, Creditor Protection

Introduction

Planned reforms of company law in Europe initiated a discussion in connection with the elimination of creditor protection in the form of capital maintenance within the balance sheet based on the Second Council Directive (the " Capital Directive") (Council of the European Communities, 1976) dated from 1976 (Brandt, Jödicke, & Richard, 2007. p. 367-371).

Limitations of distributions to shareholders based on article 15 of the Capital Directive especially became the focus of considerations. US-based capital protection regulations are often mentioned as possible alternatives. This contribution should provide an overview over the current rules of the European Union to limit distributions to shareholders. On the other hand, existing alternatives in the United States of America are presented. In summary a critical analysis of both systems as well as an outlook on potential developments will be given (Pellens, Brandt, & Richard, 2006, p. 2021).

Capital-Maintenance Rules in the European Union

In the European Union, creditor protection is determined on the concept of capital-maintenance within the balance sheet, based on the Capital Directive dated from 1976. Member states have to enforce regulations that comply with this Directive (Council of the European Communities, 1976, Article 43).

The aforementioned Capital Directive provides regulations concerning capital-maintenance, among others. In the Articles 15 till 24 you can find rules concerning:

- Limitations for the payments of dividends,
- Claims for return of unlawfully received dividends,
- Call of a general meeting in the case of a serious loss,
- Limitations for the acquisition of own shares,
- Prohibition of financial support with a view to the acquisition of shares by a third party,
- Acceptance of own shares as security.

Article 15 of the Capital Directive provides rules in connection with distribution of dividends:

> *“1 (a) Except for cases of reductions of subscribed capital, no distribution to shareholders may be made when on the closing date of the last financial year the net assets as set out in the company’s annual accounts are, or following such a distribution would become, lower than the amount of the subscribed capital plus those reserves which may not be distributed under the law or the statutes.*
>
> *[...]*
>
> *(c) The amount of a distribution to shareholders may not exceed the amount of the profits at the end of the last financial year plus any profits brought forward and sums drawn from reserves available for this purpose, less any losses brought forward and sums placed to reserve in accordance with the law or the statutes.”*

The so called „balance-sheet test” according to Art. 15 (1) a) restricts the distribution to shareholders, provided that the nominal capital and restricted reserves – based on law or statute – would be diminished.

The so called „profit and loss account test” according to Art. 15 Sec. 1 (c) takes into consideration the financial situation of the company. Profits (gains and losses) of prior periods are taken into account for the measurement of the ceiling for distributions.

Limitations for Distributions according to US Company Law

US company law is not familiar with distribution rules of European style. In the US, so called “solvency tests” should ensure the future solvability of the company (Krapf & Schürmann, 2008, p. 119).

In this connection, it should be mentioned that US corporations are organized under state laws, so that there are fifty different corporation statutes. The formation of a US corporation is independent from the location where it does business. Management can choose the state of incorporation and therefore the governing law for the corporation. The most important State of incorporation is Delaware, where more than 50 per cent of the publicly listed companies are incorporated, followed by the State of California (KPMG, 2008, p. 155).

Efforts to harmonize the different corporation laws in the 1940s led to the development of the Model Business Corporation Act (MBCA)(Committee on Corporate Laws of the Section of Business Law of the American Bar Association, 2010). This model corporation statute is applied by the majority of the States (Krapf & Schürmann, 2008, p. 274).

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Hereinafter, the basis for distributions to shareholders based on the MBCA, the rules of the state of California (based on the California Corporation Code) (State of California, 2012) and Delaware (according the Delaware General Corporation Law) (State of Delaware, 2013), will be presented.

Rules for the measurement of dividends on the basis of the MBCA

The MBCA initially presented in the 1940s, was subject to a comprehensive revision in 1984, which led to a simplification and modernization of the rules in connection with distributions to shareholders (Committee on Corporate Laws of the Section of Business Law of the American Bar Association, 2010; Krapf & Schürmann, 2008, p. 274).

According to § 1.40 (6), dividends "are direct or indirect transfers of money or other property (except for the own shares of the company) or incurrence of indebtedness by a corporation to or for the benefit of its shareholders in respect to any of its shares. "Distributions to shareholders can – besides possible limitation in the articles of incorporation – only be authorized if the provisions of the equity insolvency test and the balance sheet test (§ 6.40(c) (1) and (2) MBCA) are fulfilled.

Main clauses in detail are:

No distribution may be made if, after giving it effect:

(1) the corporation would not be able to pay its debts as they become due in the usual course of business; or

(2) the corporation's total assets would be less than the sum of its total liabilities plus (unless the articles of incorporation permit otherwise) the amount that would be needed, if the corporation were to be dissolved at the time of the distribution, to satisfy the preferential rights upon dissolution of shareholders whose preferential rights are superior to those receiving the distribution.

Pursuant to these rules, a company will be able to meet its obligations from the ordinary business, considering the impact of a planned distribution (equity insolvency test). Furthermore, the corporation's total assets must not exceed the sum of its total liabilities plus the amount that would be needed, if the corporation were to be dissolved at the time of the distribution, to satisfy the preferential rights upon dissolution of shareholders (balance sheet test).

The equity solvency test takes into account the interests of creditors. The MBCO does not provide detailed guidance in connection with both tests. According to KPMG (KPMG, 2008, p. 158) there are strong indications that a significant shareholder's equity, operations under normal conditions, regularly audited financial statements without qualification in its most recent auditor's opinion concerning the corporation's status as a "going concern" would lead to a positive judgement. When there are any doubts concerning the solvency, detailed plans for the development of liquidity are necessary. This calculation should include the possibility for raising additional funds to fulfill obligations in the near future as well as contingent liabilities. The MBCO does not define a time horizon.

When considering the balance sheet test after distributions, there must be assets that, at a minimum are equal or exceed debts of the company plus any amount that would be needed to satisfy the shareholders' superior preferential rights upon liquidation if the corporation were to be dissolved at the time of the distribution.

In reference to accounting practices § 6.40 (d) MBCA financial statements are required to be compiled in accordance with current accounting principles or on the basis of fair value measurement or other methods that are reasonable for the circumstances. An obligation to prepare financial statements according to the US-GAAP does not exist (Krapf & Schürmann, 2008, p. 122).

Rules for the measurement of dividends on the basis of the California Corporations Code

As early as 1977, the concept of legal capital was removed by the California Corporation Code (Cal.Corp.Code) (Pellens et al., 2006, p. 2022). The foundation of a company does not require a minimum legal capital. According to § 409 (a)(1) Cal.Corp.Code considerations of shareholders may be in the form of money, services rendered, as well as tangible or intangible property. Equity will be divided into contributed capital (considerations by shareholders) and retained earnings.

Basis for contributions to shareholders are the financial statements prepared in accordance with US-GAAP of the current version (§ 114 Cal.Corp.Code). In the case of a corporation with subsidiaries, consolidated financial statements of the corporation are required as a basis for distributions.

Paragraph 500 et seq. of the Cal.Corp.Code provide guidance concerning limitations for distributions to shareholders, whereby distributions are defined as transfers of cash or property by a corporation to its shareholders without consideration (§ 166 Cal.Corp.Code). Distributions are principally prohibited, if the corporation in general or as a consequence of distribution is unable to meet its liabilities as they mature (§ 501 Cal. Corp.Code). This rule is referred to as the "*equity solvency test*".
Par. 501 Cal. Corp.Code states:

> *" Neither a corporation nor any of its subsidiaries shall make any distribution to the corporation's shareholders [...] if the corporation or the subsidiary making the distribution is, or as a result thereof would be, likely to be unable to meet its liabilities (except those whose payment is otherwise adequately provided for) as they mature."*

If these conditions are satisfied according to § 500 (a), distributions are only allowed, if the amount does not exceed the retained earnings. In the course of the liquidity test, it must be analyzed if the current assets exceed current liabilities, taking into consideration the planned distribution.

Rules for the measurement of dividends on the basis of the Delaware General Corporation Law (DGCL)

The State of Delaware does not stipulate minimum capital requirements for corporations. According to § 151 DGCL, the issuance of stock, with or without par value is permitted.

At the discretion of the board of directors, considerations received for the issuance of shares are split into capital and surplus. In addition, corporation law does not specify particular accounting methods. Corporations do not have to adhere to any specific accounting method (KPMG, 2008, p. 168). An appreciation of assets beyond cost is permitted, if directors act in good faith.

Distributions to shareholders are primarily based on regulations in the certificate of incorporation. According to § 170 DGCL, payment of dividends may not exceed the surplus (surplus test). If there is no surplus, dividends can be paid out of the net profits for the fiscal year in which the dividend is declared and/or from the preceding fiscal year (net profit test). Capital cannot be diminished by the way of distribution beyond the amount attributable to issued and outstanding shares with preferential rights. Distributions are allowed if this limit is exceeded.

A solvency test, comparable to the regulations of the MBCA and those of the State of California, has not been provided for. However, distributions in the case of imminent insol-

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vency lead to a breach of fiduciary duty towards creditors and as a consequence to the risk of personal liability of the board of directors (Krapf & Schürmann, 2008, p. 167).

Criticism of the limitations on distributions within the European Union and Reform Efforts

A limitation of distributions to owner and connections to creditor protection seems to be necessary if no personal liability exists for liabilities of a corporation falling due in the future. Distributions shall only be allowed up to the amount that future payments to creditors (principle and interest) can be made (Grottke, 2009, p. 262).The realistic objective of limitations of distributions cannot be to totally prevent insolvency; rather it is intended to avoid such forms of insolvency that are based on conscious excessive payments to shareholders to the detriment of creditors (Fuchs & Stibi, 2007, p. 20).

The European Union tries to achieve this objective by using the rules of Art. 15 of the Capital Directive. Distributions are only allowed if the minimum level of capital is observed and on the other hand, only retained earnings can be distributed. This limitation of the distribution is only effective, if accounting rules are also based on the principles of creditor protection. Recognition and measurement principles should support this rationale.

Insofar as accounting rules are not defined in the Capital Directive, the Fourth Council Directive (Council of the European Communities, 1978) should provide the basis. This directive provides many accounting choices, which lead to all kinds of possibilities abroad for national law makers (Lanfermann, 2008, p. 1925). Additionally creditor protection cannot be achieved by this Directive.

The so called IAS-Directive (European Parliament and the Council of the European Union, 2002) led to an extension of accounting rules insofar as the member states can prepare individual financial statements in accordance with International Financial Reporting Standards (IFRSs). Creditor protection is not the core principle within these accounting principles.

On 29 June 2013 this Directive was repealed by the Directive 2013/34/EU(European Parliament and the Council of the European Union, 2013). Member States of the European Union shall bring into force laws, regulations and administrative provisions necessary to comply with this Directive by 20 July 2015. The new rules have to be applied in financial statements for financial years beginning on 1 January 2016 or during the calendar year 2016. The new Directive reduces some accounting choices, nevertheless "true and fair view" is the dominant principle when preparing financial statements and not the prudence principle.

Par. 9 of the introduction of Directive 2013/34/EU states:

> *"Annual financial statements should be prepared on a prudent basis and should give a true and fair view of an undertaking's assets and liabilities, financial position and profit or loss. It is possible that, in exceptional cases, a financial statement does not give such a true and fair view where provisions of this Directive are applied. In such cases, the undertaking should depart from such provisions in order to give a true and fair view."*

Accounting in compliance with the prudence principle also provides protection only in years of profit. If hidden reserves are released unnoticed in years of losses, this procedure opposes the intention of creditor protection (Pellens, Jödicke, & Richard, 2005, p. 1394).

An essential point of criticism in connection with the current concept of capital maintenance within the balance sheet and the consequential restriction of distribution is seen in the retrospective view, instead of the orientation on forward looking cash-flows (Pellens et al., 2005, p. 263). In this respect future liquidity situations and investment decisions are mainly ignored (Pellens et al., 2006, p. 2027).

The fundamental reform of capital protection rules within the European Union was initiated by the report of the High Level Group in 2002 concerning a "modern regulatory framework for company law in Europe" (High Level Group of Company Law Experts, 2002).

In connection with rules for distributions to shareholders, the following recommendations were proposed (High Level Group of Company Law Experts, 2002, p. 92):

"In the alternative regime to be considered at a later stage, a proper solvency test should be required for any payment of dividend or other distribution. The solvency test should be based on at least two tests to be performed before making the distribution: a balance sheet test and a liquidity test.

Directors of the company should issue a solvency certificate, in which they explicitly confirm that the proposed distribution meets the solvency test. Directors are responsible for the correctness of the solvency certificate and Member States should impose proper sanctions, which could be extended to "shadow" directors (High Level Group of Company Law Experts, 2002, p. 100).

The report also provides indication towards the direction to solvency tests in accordance with US-rules (High Level Group of Company Law Experts, 2002, p. 84).

Criticism of the Limitations on Distributions according US Corporate Law

Chapter three describes the three forms of limitations for distributions according to the Model Business Corporation Act (MBCA) as well as those of the States of California and Delaware. They show different forms of limitations of distributions. In the MBCA and statutory regulations in the State of California, you can find the so called "equity solvency test" which allows distribution insofar as the company stays solvent after distribution. Both regulations do not define the time frame for the planning nor a concrete method of the calculation of solvency of the corporation. A wide field of discretion and corresponding uncertainties remains (Lienau, 2008, p. 90; Pellens et al., 2005, p. 1396).

In the state of Delaware, solvency tests preceding distributions are resulting de facto on the fiduciary duty of the board of managers. Provisions for liabilities for unlawful distributions support this principle.

A critical point, however, is that all mentioned statutory regulation do not issue precise guidance for the calculation of the solvency test. Insofar a lack of legal certainty exists, as in many cases, courts assess the admissibility of distributions ex post (Brandt et al., 2007, p. 358).

In addition to the solvency test, you can find in all mentioned state-laws as well as in the MBCA, further tests that allow or forbid distributions if certain ratios are reached or exceeded. Barring the legal rules in the State of California, which only allow accounting according to the current version of US-GAAP (§ 114 Cal.Corp.Code), accounting rules are not explicitly defined. Hence recognition and measurement of assets and liabilities can be different and lead to different results. As a consequence, this cannot assure reliable measures for the limitation of distributions with respect to creditor protection.

Summary and Outlook

Distributions to owners of corporations without personal liabilities for future obligations of the corporation may endanger creditor protection. Current limitations of distributions within the European Union to protect creditors are based on the Capital Directive of 1976 and the concept of capital maintenance within the balance sheet.

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The Fourth Council Directive provides many accounting options and the application of different accounting principles, which may pursue different objectives besides creditor protection. The application of IFRSs in the individual financial statements may especially lead to the recognition of - unrealized - profits that may be distributed to shareholders. Accounting Directive 2013/34/EU strengthens the "true and fair view" principle in comparison to "prudence principle". Insofar as accounting rules follow the prudence principle as a core standard, such rules should continue to apply. For accounting principles that primarily serve the information needs of the readers of financial statements, solvency tests should be obligatory as an alternative (Krapf & Schürmann, 2008, p. 211).

Reform efforts within the European Union urge a modernization of company law and adjusted rules for the limitations of distributions to shareholders.

In the course of the reform plans, rules concerning the limitations of distributions in the US are mentioned. These jurisdictions do not rely on the principle of capital maintenance. Solvency tests – sometimes supplemented by so called balance sheet tests – provide the basis for the payment of dividends. Such payments to shareholders in the aforementioned States are forbidden, if the company cannot settle its debts after distribution. Detailed guidance concerning the design of the solvency test as well as underlying accounting principles are predominantly lacking (Krapf & Schürmann, 2008, p. 140).

The implementation of the US-rules (solvency tests) as an instrument for the limitation for the distributions of corporations within the European Union without detailed guidance for the design of the test would not achieve the objectives. Discretionary decisions in the process of achieving the data basis prevent an effective creditor protection.

Along with the introduction of a solvency test, changes in liability provisions for the board members should be introduced to better assure satisfaction of claims of creditors (Lienau, 2008, p. 87).

Finally, the trend to Internationalization in the accounting is an ongoing process that cannot be stopped. There is a need for action for European lawmakers to prepare a modern framework for creditor protection. Insofar as different accounting principles – comprising different recognition and measurement principles – in individual financial statements are permitted, limitations for distributions cannot be based on items from financial statements.

Calculations based on future cash flows should provide a more secure and reasonable basis for payments of dividends to shareholders. Accompanying documentation and possible audit requirements for such calculations should be reconsidered. Liability provisions for board members should be revised in this context. Reform concepts should also consider distinctions based on the size of the corporation.

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THE EVOLUTION OF REGULATIONS IN BANKING: A CYCLE BASED APPROACH

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Abstract. *The question about the specialness of banks has been the center of debates amongst academicians and regulators over a long period of time as leading to extensive regulations for controlling and supervision of banks. The base regulations, though not legally compulsory, have been those developed and published by Basel Committee since mid-1970s. The main intention of these regulations is to assure globally sound and stable financial systems in individual countries that will eventually lead to a stable economy across the globe. However, the recent financial crisis has proved that the banking regulations have not served as intended and yet they are under major revisions again. In this paper it is intended to investigate the evolution of bank regulations with a particular attention to the scope of banking, capital adequacy and deposit insurance. It will be another focal point of this paper to draw attention to the existence of cycles in the processes of regulations that makes regulations to move between two extremities; tight and loose regulations. In this manuscript these issues are investigated with an analysis of related literature and with specific observation on the evolution of regulations in the USA.*

Keywords: *bank regulations, capital adequacy, deposit insurance, basel committee.*

Background

The academic discussion regarding the specialness of banks is closely linked to the developments and evolving of bank regulations. It is argued that as delegated monitors banks are special for the fact that they transform risk, maturity and liquidity for generating investment (liabilities) and funding (assets) instruments that meet the taste of a wide range of individuals and corporations. Due to information asymmetry it is in favor of individuals to delegate banks as their agencies dealing with risky operations that they are not capable of managing effectively. Corrigan (1982 and 2000) discusses that what make banks special are (1) they offer transaction accounts, (2) they are sources of liquidity for all other institutions and (3) they are transmission belt for monetary policy. He continues to justify the regulations imposed upon banks as a result of their unique roles in economies. Calomiris and Gorton (1990) also state that banks are unique due to the services that they provide on the each side of their balance sheets. Similarly Diamond and Dybvig (1986) states that banks are special due to the fact that they offer transformation services that enable them to convert illiquid assets into liquid assets i.e. creating liquidity.

The reliability of banks as the safeguards of households' deposits and/or savings is another issue that governments and regulators try to assure. The reaction towards this issue is twofold. Academics that have a complete trust in market economy are against regulating banks for the fact that banks are just like other profit seeking firms that are subject to market rules that will eventually make distinction between reliable and unreliable banks. For example; Fama (1980), as quoting from Tobin (1963), argues that specialness of banks derive from regulations rather than the business that they do or the functions that they perform. It is claimed that if banks are left to function in a market free of regulations, their equilibrium would be determined by the market rules, just like it is the case for other industries. Ferrera (1990) also discussed that the heavy regulation wall had to fall due to the fact that it was no longer possible to keep banks separated from other activities such as investment banking and even owning non-financial subsidiaries. Additionally, Barth, Caprio and Levine (2012) states that tightening capital requirements or increasing supervisory powers had no positive impact on the financial sector, and in fact increased supervision was found to be positively related to corruption in banking. They further argue that strengthening private monitoring was found to be associated with deeper, more efficient, and less corrupt financial systems, but not with greater financial stability.

The regulations imposed upon banks are justified for different reasons. Blinder (2009) specifies that government intervention to markets is justified for the following purposes; (1) to create and enforce rules of the game and keep the system honest, (2) to guard against undue concentration, thus keeping markets competitive, (3) to redistribute income, e.g., through the tax-and-transfer system,(4) to correct externalities or other market failures, e.g., those due to asymmetric information, (5) to protect the interests of taxpayers, e.g., in cases in which public money is being spent or put at risk. He further underlines that by implementing regulations, governments target to protect consumers and taxpayers and to ensure financial and economic stability both locally and internationally.

Another issue about bank regulations is the cost of preventing and/or combatting financial crises. Calomiris and Gorton (1990) states that while private bank coalitions were effective in monitoring banks and mitigating the effects of banking panics, governments eliminate banking panics through costs of deposit insurance and reserve requirements. They also underlined that private self-regulation system could be effective when combined with some government policies.

Currently banks are the most heavily regulated firms. The evolving of regulations, in line with the expanding businesses and functions of banks and experienced financial crises, causes regulations to become more and more complicated. However, regulations are intended to be designed in line with the market rules and whenever it is possible it is avoided to include direct controls, such as interest rate controls applied in the past, on banks' operations. Stevens (2000) after underlining that safety nets could produce suboptimal market by inflating banks' incentives to take risk, he suggests banking regulation and supervision to replace safety nets by the market discipline. The third pillar of Basel II named Market Discipline is aimed to increase the level of private monitoring in bank regulations that will reduce the level of government intervention in the future regulations. Thus it is observed that regulations are tried to be converged with market rules in order to minimize the involvements of governments.

Another issue regarding the regulations is about internationalization of them throughout the world. Regulations that are initially imposed upon banks were nationally-based and after the internationalization of banking businesses, the current regulations contained international dimensions and it is aimed to harmonize them throughout the world since the foundation of Basel Committee in 1975. Despite the fact that it is not compulsory to adapt to the regulations

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developed by the Basel Committee, it has been the duty of IMF and the Word Bank to spread these rules amongst almost all countries in the world.

Another dimension of regulations is related to product innovation and technology. As stated by Markham (2010) banks became financial supermarkets and this makes their balance sheets even more complicated for regulators to identify risks coherent to their balance sheets and take the necessary measures to control them. Similarly, DeYoung (2007) states that during the 1980s it became increasingly difficult to maintain a regulatory environment that could protect the banking industry from competition while, at the same time, ensuring a vibrant and healthy banking industry. He then suggests that changes in market conditions and financial and technological innovation necessitated changes in the regulatory regimes too.

Although there might be some other features of regulations, however, they are not discussed here. In the remaining parts of this paper the evolving of bank regulations will be analysed from different perspectives with specific focus to the relationship between financial crises and regulations. In the first part regulations regarding the scope of banking, in the second part regulations regarding capital requirements and finally regulations regarding deposit insurance will be investigated with a historical based literature review.

The Evolution of Regulations Regarding the Scope of Banking Activities

The scope of banking, as widely accepted, can be divided into two main pillars namely commercial banking and investment banking. Although there are other banking activities such as private banking, consumer banking, international banking that are parts of current banking businesses, from the regulatory point of view they are not considered as being completely different from either of the two main sections mentioned. These banking businesses can be parts of either investment banking or commercial banking.

The main distinction between a commercial bank and an investment bank is that a commercial bank accepts deposits from the households and transfers these funds mainly to traders in the form of self-liquidating loans. On the other hand investment banks do not have licences to accept deposits and thus they are free to get involved in risky businesses such as stock market operations, underwriting activities and etc.

In the United States (US) the regulation cycle regarding scope of banking started during the colonial time when banks were provided a charter to operate. Apart from providing commercial banking activities, charter banks provided services to the government as the underwriters of their bonds. However, after witnessing that charter banking system, due to creating a monopoly, caused corruption and instability in the US banking system, these regulations were repealed and it was followed by the era of free banking. McCarthy (March/April 1984) underlines that charter regulations were criticized as being odious to the free spirit of US civil institutions. Thus new regulations were designed to assure that anyone who could meet the minimum legal capital requirements was entitled a charter to own a bank. After the establishment of free banking system in the US, many banks were established to offer commercial banking services to their customers. They were also assisting the government to raise revenue by purchasing and depositing state bonds for guaranteeing the convertibility and circulation of their own banknotes.

As indicated by McCarthy (March/April 1984) due to the heterogeneous bank notes and due to the exploitation of the free banking system by the so-called “wildcat banks”1, many

1 For a definition of wildcat banks see for example Gianni and Vannini (2010) P. 413

bank failures were witnessed and that necessitated the reorganization of the banking system in the US that led to the national banking system.

The National Banking System was established after the enactment of the National Currency Act by the US congress, in 1863. McCarthy (March/April 1984) outlines that the act imposed a number of restrictions on bank activity in order to enhance bank soundness and stability. Alongside minimum capital requirements, these new regulations were: (1) reserve requirements, (2) restrictions on the scope of operations primarily to accepting deposits and making short-term, self-liquidating loans to businesses, and (3) a requirement to provide periodic reports of condition to the Comptroller.

After the establishment of national banking system commercial banks were not allowed to be a part of capital market operations and they were encouraged to serve trade activities and invest their funds mainly in the so-called self-liquidating loans. However, they were allowed to broker securities for their customers. As indicated by Markham (2010) the Office of Comptroller of Currency (OCC) prevented this in 1902. Nonetheless this did not last for a long period of time. As emphasized by McCarthy (March/April 1984) the entering of US to World War I accelerated the integration of commercial and investment banking activities and that enabled banks to finance the government’s war expenditures. Therefore the involvement of commercial banks in investment banking activities continued to grow and commercial lending of banks declined significantly.

By the time of the great depression of 1929, many commercial banks went bankrupt just because they were heavily involved in investment banking operations. Therefore the economic crisis of 1929 led to two new regulations from the past imposed upon banks by the enactment of Banking Act of 1933 or Glass-Steagall Act (GSA) in the US. The first regulation was related to the separation of investment banking from commercial banking and the second was the prohibition of paying interest on demand deposits and setting interest rate ceiling on various types of deposits. These two regulations were enacted because during the global crisis of 1929 banks were heavily involved in investment banking that swallowed almost all their deposit borrowings from the households. Thus the aim of these regulations were to push banks into the traditional banking activities i.e. borrowing deposits and lending self-liquidating short term commercial loans. On the other hand, interest rate related regulations were enacted to prevent banks from unjustified interest rate competition.

The GSA remained enacted until 1999 when the enactment of Gramm-Leach-Bliley Act (GLBA) in 1999 repealed it and enabled commercial banks convert themselves into financial holding companies that could provide not only commercial banking services but also investment banking services alongside many other modern financial services. However, as stated by Blinder (2009), it is believed that the repeal of GSA has seeded the causes of 2008 global financial crisis and it is suggested to re-enact GSA which has provided a half century financial crisis free banking system in the US. On the other hand, DeYoung (2007) states that from the early 1980s through the early 1990s, approximately 10% of U.S. commercial banks failed in contrast to the period 1940-1980 when only 237 banks failed. However, he discusses that the appearance of safety and soundness during those years of GSA is deceptive because the financial regulations and industry structure present at the time were themselves the root cause of the bank insolvencies of the 1980s and 1990s.

Despite the fact that GSA re-shaped banks in the US i.e. banks had to separate their commercial banking and investment banking activities, as indicated by Ferrera (1990) in mainland Europe, banks were formed under the name of universal banking that enabled commercial banks to provide not only investment banking services but also own industrial companies. This was the case in Japan and in Turkey as well. Gruson and Nikowitz (1988)

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indicate that The Second Banking Directive of the European Economic Community counts securities and derivatives trading as parts of European Banks' activities.

These different types of bank structure in Europe and in US were centre of debates for a long period of time. Before the repeal of the GSA, Shull and White (1998) suggested that both the holding company affiliate arrangement and the operating subsidiary structure appear to be safer than the universal banking for non-traditional activities that are not examinable and supervisable by bank regulators. They were suggesting US banks to be converted into bank holding companies rather than universal banks in order to effectively compete with banks outside of USA. Jeannot (May 2000) states that the dismantlement of GSA was inevitable due to the fact that the deregulation of banking industries in developed countries (mainly in Europe) had potentially placed US banks in a disadvantageous environment and left them uncompetitive. On the other hand as indicated by Macey (2000) the GSA was dead even before GLBA because federal regulators, particularly the Federal Reserve Board and the Comptroller, had already eviscerated the "Maginot Line" between commercial and investment banking through liberal regulatory interpretations of the statute long before the Act was passed. Thus Congress, in passing the Act, merely gave formal recognition to the changes that had been taking place in the marketplace over the past years. Markham (2010) also supports the statement of Macey (2000) regarding the legal disintegration of GSA being just a result of the developments in the markets that practically dismantled the GSA. In other words bankers were able to exploit and/or create loopholes in GSA in order to allow themselves providing investment banking services alongside the traditional banking activities. As they were doing this, the regulators were not preventing them due to the fact that not only the financial system but also banking system was getting more and more complicated following the invention of new financial instruments such as certificate of deposits in 1960s, securitisation in 1980s, credit default swaps in 1990s and other revolutionary and complex instruments. Indeed regulators needed time to understand and then to regulate these issues.

It is obvious that the cycle of regulations regarding the scope of banking has two extremities: the unity of commercial and investment banking on one extreme side and their separation on the other extreme side. The cycle started with the free banking era in the USA when these two banking services were unified and later the cycle continued with the separation of these two banking facilities during the national banking era. After that, regulators were forced by the market players to unify them despite the existence of the regulations preventing it. Nonetheless, banks were providing both types of banking services in the market after being encouraged by the federal government for its own financing purposes. Having continued until 1929, banks found themselves exposed to market risk empowered by the global depression. The cycle kept continuing with the enactment of GSA that banned again the unification of these two types of banking facilities at extreme sides. Nonetheless, the market forces gradually succeeded to dismantle the GSA over time especially with the help of the invention of new financial instruments and technology that resulted in intense competition in banking industry alongside creating complex balance sheet and risk structures that finally caused the legal repeal of GSA in 1999.

Having lived through the global financial crisis of 2008 some argued that GSA should be re-enacted in order to prevent future financial crises. Some also argue that the restoration of GSA is impossible. Kregel (2010) discusses that GSA provided the unregulated investment banks with a monopoly over securities market activities that were functionally equivalent to the deposit business and liquidity creation of regulated banks. He then adds that due to the complexity of financial markets in comparison to the time of the inauguration of GSA it will not be possible to re-enact GSA. Nonetheless he suggests that the banking definition to be widened so as to include investment banking activities under the regulatory umbrella of today's commercial banks. However, Carpenter and Murphy (June 2010) indicate that after the 2008 financial crisis, a new regulation, named "Volcker Rule" enacted in the US, already limits the ability of commercial banking institutions and their affiliated companies and subsidiaries to engage in trading unrelated to their customer needs and investing in and sponsoring hedge funds or private equity funds.

Stiglitz (2009) after stating four reason behind the global financial crisis of 2008; (1) firing the chairman of FED in 1987 who opposed deregulation processes, (2) tearing down the walls separating banks' investment banking activities from their commercial banking operations (3) application of leeches such as tax cuts in the USA, (4) faking the numbers that caused enactment of Sarbanes-Oxly to combat operational risk and (5) letting it bleed (veered from one course of action to another), he criticizes the belief that markets are self-adjusting and that the role of government should be minimal. On the other hand Calomiris and Gorton (1990) states that the history of US banking regulation can be written largely as a history of government and private responses to banking panics.

In which direction is the cycle going to continue? The separation or unification of the scope of banking? Building upon the latest core banking regulations of Basel Committee aka Basel III, it can be said that banks will continue to get involved in investment banking activities due to the fact that capital regulations are heavily related to the complex synthetic instruments and the calculation of their risk weights. Nonetheless the debates over the separation and unification of commercial banking and investment banking activities will remain unsolved. Within the borders of cycle defined the degree of separation and/or unification will change depending on market conditions, geography, tradition and bankers' lobby power.

Having gone through the brief history of regulations regarding the scope of banking it is easy to recognize that regulations are introduced following financial crises. Thus the structure of new regulations is extremely affected by the last crisis lived. Accordingly, new regulations are designed and implemented for combating financial crises similar to the latest crisis that crashed markets and influenced the content of new regulations. However, new regulations which are designed to prevent a specific crash usually do not have a complete perspective to cover and/or to combat new types of crises to be witnessed in the future. Also the regulations introduced after financial crises soon become the shooting target of the market players for the changes that will allow them to freely act in the markets in order to maximize their market value and/or profitability. And the cycle goes on indefinitely.

Nonetheless the Basel Committee's new and comprehensive regulations named Basel III seem to be designed with a broader and longer vision so as to ensure that banking systems around the globe will be sound and stable for overcoming potential crises in the markets.

The Evolution of Regulations Regarding Capital Adequacy

In present times the main regulatory body of capital regulations and also bank regulation is the set of regulation that has been developed by the Basel Committee since 1975 when the committee was established. Before moving into the details of present capital regulations, Basel III, looking at the historical developments of capital requirements will help to better understand capital adequacy issue and its evolving directions.

As outlined in FDIC (2003), prior to the Basel regulations regarding the capital requirements, the US regulators stressed factors such as managerial capability and loan portfolio quality, and largely downplayed capital ratios. Supervisors did try to make use of a variety of capital adequacy measures as early as 1864, when the National Banking Act set static minimum capital requirements based on the population of each bank's service area, but

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most early attempts at quantifying the notion of capital adequacy were controversial and unsuccessful. In the 1930s and 1940s, state and federal regulators began to look at the ratios of capital-to-total deposits and capital-to-total assets, but both were dismissed as ineffective tests of true capital adequacy. Tarullo (2011) states that it was after the recognition of the effects of losses occurred on banks' loans to foreign sovereigns that the US regulators started to re-impose minimum capital ratios upon banks.

As stated in FDIC (2003) various studies related to the ways to adjust assets for risk and create capital-to-risk-assets ratios were undertaken in the 1950s, but none were universally accepted at that time. Therefore a judgment-based, subjective, bank-by-bank approach to assessing capital adequacy remained effective in the USA until the failure of many banks during the 1981 recession. After that the federal banking agencies introduced explicit numerical regulatory capital requirements. The standards adapted employed a leverage ratio of primary capital (which consisted mainly of equity and loan loss reserves) to average total assets. It was this capital regulation that resulted in the first comprehensive capital regulations developed by Basel Committee in 1988 that combined a risk based capital approach named Basel I.

The analysis of banking crises in different countries showed that bank failures could be classified in many ways, including by risk type, the type of shock that precipitated the failures or crisis, the state of the banking system, what portion of the banking system was affected, how the crisis was resolved, and whether the failures resulted in regulatory changes (Basel Committee (April 2004) P.67). While each country's experience has unique characteristics the common figure in the crises that they lived is similar. Spain, Norway, Sweden and the U.S. had very similar experiences when they liberalized their financial systems. Credit risk, particularly real estate lending, led to widespread banking problems in Switzerland, Spain, the United Kingdom, Norway, Sweden, Japan and the U.S. Market risk was the principal cause of failure in the isolated failure of Herstatt (Germany) and also caused the first stage of the U.S. Savings and Loan failures. Financial liberalization (deregulation) was a common feature of major banking crises often combined with supervisory systems that were inadequately prepared for the change. It is also stated that banking problems were more severe and/or more difficult to resolve when they hit weakly capitalized institutions (Basel Committee (April 2004) P.68).

These crises affecting a variety of countries all around the world have helped the regulators of these countries to agree upon internationally accepted bank regulations around the world. Legislative and regulatory changes followed three main lines. First, supervisors tried to improve the risk adequacy of regulation. Second, legislators and supervisors tried to strengthen market and supervisory discipline. Finally, some countries revised legislation with a view to more efficient resolution. While considerable efforts to improve banking regulation and ongoing supervision were taken on a national level, national authorities have also pooled their experience within the revision of international capital standards under the guidance of the Basel Committee on Banking Supervision (Basel Committee (April 2004) P.69).

As a matter of fact following banking crises in different countries, regulators were encouraged to redefine the capital adequacy ratio and related body of regulations. The Basel Criteria that were initially introduced in the form of Cooke Ratio basically converted the previously used simple shareholders' funds over assets ratio into regulatory capital over risky assets. It was aimed that by recognizing the different risk structures of individual banks, it would help regulators better controlling of banks with proper recognition of each different bank's financial statements. However, the definition of risky assets was initially limited to credit risk only as missing other risks such as interest rate risk, liquidity risk, foreign exchange rate risk, operational risk and others. Nonetheless having witnessed bank failures due these above mentioned risks the remaining risks (in the form of market risk and operational risk) were included in the calculation of capital adequacy ratios in order to complete the risk based regulations regarding the capital requirements.

Soon after the capital adequacy formula has been finalized the bankers started to complain about the calculation process that it did not take into consideration the management skills of individual banks and that it was providing the same standard calculating procedure for all banks alike. The Basel Committee decided to allow banks to calculate their own risk weighted assets based on the internal models developed by them and approved by the local regulatory authorities. This initiative given to banks allowed them to measure their riskiness as using their internal models and provided them with an opportunity to reduce their risk weighted assets by improving their risk management skills. The better risks are managed the lower risk weighted assets are to be calculated by their own internal models. This tradeoff between risk management skills and risk weighted assets allowed banks while increasing the total sizes of their balance sheets to keep their risk weighted assets under control without violating the existing capital rules.

This helped banks to keep their risk based capital ratios well above the required ratios also by the help of asset sales through securitization and other structured facilities. As discussed by Eken (May 2006) these activities left banks with high leverage ratios but still well sufficient risk based capital adequacy ratios. Recognizing this, the Basel Committee amended a new condition to Basel III regarding the leverage level of banks free of their risk based capital adequacy ratios in order to assure the soundness of banks alongside the comprehensive capital adequacy ratios applied imposed upon them.

Similar to the cycle of regulations regarding banking scope capital adequacy regulations also move between two extremities; the basic “shareholders’ funds over assets” ratio and the complicated “regulatory capital over risk weighted assets” ratio. The global financial crisis of 2008 has caused regulators to restructure the capital related regulations as converting Basel II regulations into Basel III. Although the calculation of capital adequacy ratio was left very much similar, some new amendments were introduced for the strengthening of capital adequacy levels of banks. As specified in Basel Committee (June 2011) aka Basel III, alongside additional increases in the minimum capital ratios specified in Basel II, banks will be forced to maintain an additional 2.5% Tier 1 capital to risk weighted assets. Besides a maximum leverage multiplier is introduced. A 3% Tier 1 capital to on balance sheet assets plus the off-balance sheet items multiplied with the suitable credit conversion factors is going to be tested during the period January 1st 2013-January 1st, 2017.

These new regulations bound banks with tighter restrictions that will eventually be shooting target of professional bankers soon. It is also mentioned in the Basel III that especially the leverage ratio will be tested in the future leaves both regulators and supervisors with an option to abolish it after a certain period is passed free of shocks. And the cycle will probably continue with the easing of regulations and then continue again by tighter regulations after banks are hit by a new crisis.

Within the extremities of this cycle it is apparent that for the safety and soundness of banking systems and for the protection of depositors initially tight capital requirement ratios are implemented. Following that the modification in line with the demands of bankers and developments in the markets that loose the initial regulations over time take place in the future. Finally, after a strike by a financial crisis, the regulations are restructured or reshaped in order to combat problems occurred.

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The Evolution of Regulations Regarding Deposit Insurance

The main idea behind the establishment of deposit insurance is to protect households' savings that will keep public confidence restored and eventually ensuring a stable banking industry. A Safety Fund was in place during the free banking era in US that was criticized for two reason: The first was the cost of participating in the fund and the second was that the cost was calculated with a flat rate for all banks that meant that low risk banks subsidized bankers with high risk preferences. McCarthy (1984) stated that similar to the establishment of safety fund system in 1820s the Federal Deposit Insurance Corporation (FDIC) was established to restore the public confidence in banking industry following the great depression of 1929. Calomiris and White (1994) indicated that unless the great depression of 1929, it would be very unlikely to adopt deposit insurance in the USA. That was because prior to 1933 when, by the enactment of the GSA, FDIC was established, eight state-level deposit insurance systems had been created since 1908 and in the 1920s, all collapsed under the weight of excessive risk taking and fraud, encouraged by the protection of deposit insurance.

Following the establishment of FDIC deposit insurance has been widely included in banking regulations around the world. For example it was after the collapse of Herstatt in 1974, that German authorities decided to set up a deposit protection system in 1976 (Basel Committee (April 2004) P.6). Following the bankers crisis; a crisis occurred after the liberalization of the financial markets that alongside traditional banks allowed so called bankers; individuals authorized to accept deposits, to compete for deposits by offering higher interest rates in early 1980s. This competition ended with the collapse of many bankers that forced Turkish authorities to set up deposit insurance system in 1983 in order to restore the public confidence.

As stated by Santos (2000) government backed deposit insurance has proven very successful in protecting banks from runs, but at a cost that it leads to moral hazard which has been underlined by many other academics. Diamond and Dybvig (1986) states that banks are subject to runs mainly due to the transformation services they offer. However, they indicate that any regulation to prevent bank runs must not simultaneously prevent banks from producing liquidity which will eventually prevent banks from doing their businesses. Nonetheless, Diamond and Dybvig (1986) suggest regulators as having introduced deposit insurance it is crucial to keep banks out of risky businesses that may eventually cause their failures.

Mishkin (2006) states that policymakers' pledge not to engage in a bailout of large banks is not time consistent: when a large bank is about to fail, policymakers will want to renege on their pledge because they want to avoid the systemic risk that the failure of the bank would entail. At the beginning of the 1994 banking crisis, in Turkey, the deposit insurance coverage increased to 100% of deposits and it was widened to include all banks' borrowings after the crisis of 2000 and 2001 when almost all failed banks were overtaken by the government. However, after the restoration of the public confidence the coverage range was limited to savings deposits and its level was dropped to only 50,000 of Turkish lira. Similar examples are seen almost in every country.

Basically when there is a tension in the markets deposit insurance becomes an important tool for the restoration of the public confidence almost in every country. However, after the tension is over the coverage of deposit insurance is narrowed for the sake of not causing moral hazard. Nonetheless when markets are hit by another shock the coverage range and limit of deposit insurance is widened again. And this movement between two extremities keeps repeating itself similar to cycles of other regulations.

Conclusion

As indicated by academics there is a strong connection between regulations imposed upon banks and financial crises lived. On the one hand in order not to intervene the free market rules it is avoided by the regulators to impose heavy or tight regulations upon banks. On the other hand, in order to prevent any costs occurred during financial crises to be imposed upon taxpayers, for the protection of savers and for a sustainable public confidence they target to have some minimum regulations in place. Nonetheless during financial crises, the cost is almost all the time imposed upon taxpayers by the governments. Alongside imposing costs upon taxpayers some heavy regulations are introduced in order to restore the public confidence in the system. After it is achieved the new regulations undergo severe criticisms directed by the market professionals and free market advocates that generally ends up with major corrections of these regulations imposed, if they are not abolished completely. It is argued that it is probably this process that plants the seeds of new crises to follow.

The process of imposing and abolition of regulations that continued to go this way has not preserved banks and/financial systems from the market shocks so far. In other words, the indecisive character of regulations i.e. differentiating regulations in line with the market expectations and in line with market shocks introduce the regulations themselves with a variation or volatility that eventually could cause in the ineffectiveness of regulations at all. Always changing regulations make it difficult to adapt to for banks and make it difficult for the regulators to pursue. Of course it is evident that as time passes market conditions change, technology and product range evolve and that requires to be converged with the regulations. This can be done either way that regulations could be loosened to allow markets to develop new products or products that are to be developed could be formed as taking into consideration the existing rules and regulations. Whichever way is preferred it is better to be decisive. No matter regulations are tight or loose but it is a matter to have regulations to be stable at a certain level and at least for a certain period of time that will help banks and regulators with a clearer vision into the future.

However, as mentioned earlier regulations are not stable and they change over time for different reasons such as covering new instruments, including contemporary developments and similar issues. On the one hand it is justified that by doing this regulations are structured to cover any developments that might possibly cause disturbances. On the other hand it is justified that this ensures that the regulations are not in conflict with the market rules. This seems to be a strong part of regulatory structure so as to keep regulations vivid and elastic. However, this also causes regulations to have a volatile feature that makes it difficult to adapt to easily and on a timely basis.

There are always inventions in the financial markets regarding new instruments, products and structures. It takes time for regulators to recognize, understand and finally include them within the coverage of the existed regulations. In other words there is always a time lag between innovations in the market and their inclusion within the coverage of regulations. After allowing the market players a time for adaptation to the changes in regulations, the time lag between innovations and the implementation of the regulations becomes even wider. By the time this gap is narrowed some new innovations appear to take place in the markets and the gap becomes wider again.

Apart from this time lag between regulations and innovations regulators target to ease regulations in order to be in harmonization with the free market rules. To do that amendments to the existed set of regulations are introduced together with an adaptation period for the harmonization of the new rules. Sometimes even before adapting to the changes some new rules are introduced that are also followed by newer changes and it goes on this way until

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there is a shock in the market. Following the new crisis the existed and loosened regulations are tightened again in order to restore the confidence in the system.

This cycle can be witnessed almost in every country and regarding any type of regulation. The movements between two extremities of the cycle diminish the targeted effects of regulations. The initial tight regulations basically prevent banks from getting involved in risky and/or complex activities so as to keep their balance sheets sound and stable that would eventually result in sound and stable financial markets. Nonetheless the loosening of regulations in line with the market professionals' demand and in line with the idea of converging regulations with the market rules, results in ineffective regulations by the time of financial crises. In other words it makes no difference between having regulations and having no regulations. Then tight regulations are put in place in order to restore the public confidence. Therefore, instead of having regulations that move between two extremities it would be better to have regulations that are stable at a predetermined level for a certain period of time. This sustainability in the level of regulations will help the market to find its equilibrium in line with the stable level of regulations. Otherwise the market equilibrium will also change in line with the changing regulations.

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PSEUDO MARKET TIMING OF PREMIUM AND STANDARD LISTING IPOS

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Abstract. *Recently, the IPOs are classified into premium listings and standard listings under the new FSA (Financial Services Authority) issuance regime at the time of flotation. The pseudo market timing of 231 IPOs is examined over a window of April 2010 to September 2012 from a panel of UK Initial Public Offerings (IPOs). The study shows contrasting results for both the categories. The premium listing IPOs register on an average -12.03% return over 1-24 post calendar months, while the standard listings yield an average 0.04% excess return. The premium listing IPOs indicate underperformance of between -0.43% to -5.89% over one calendar year. Whereas, the standard listing registers marginal excess positive return over the same post calendar month period. The supplementary analysis suggests that underpricing is a significant character of the premium listing but does not feature in the standard listing offers. Therefore, the results support to some extent that the timing effects are observable and can be explained by the pseudo market hypothesis.*

Key Words: *Pseudo Market timing, Standard and Premium listing, IPO aftermarket performance*

Introduction

Going public by IPO issuance is an equity market phenomenon. In addition to inherently endogenous factors, firms tend to go public because of exogenous market influence; for example, anticipated excess market returns. Market timing typically indicates a proclivity of firms to issue IPOs before low market returns or at the peak of high market returns. Also firms prefer IPOs when comparable firms have high market-to-book ratios, in expectation that an upward looking market may yield better returns for their issuance. Mostly market timing is perceived as an exogenous cause. IPOs exhibit poor performance relative to matched stock indices, particularly while abnormal returns are estimated in event time. Schulz (2003) identifies this as a bias and refers as pseudo market timing. His simulation finds that with a 50% chance, there is a -18% CARs yield over five years following IPO issuance. However, Butler et al. (2005) find that aggregate pseudo market timing is an alternate understanding of the small-sample bias studied by Amihud and Hurvich (2004), Lewellen (2004), Polk, Thompson, and Vuolteenaho (2006) and Campbell and Yogo (2006). Nevertheless, Schulz (2003) emphasises that the pseudo market time is not a small sample bias, even if it uses only two sample periods. Typically, underperformance emerges when the investors perceive the true value of firms. Schulz (2003) rationalises the phenomenon on the basis that IPO activities peak with market price when the potential proceeds of IPO increase irrespective of unpredictable future market returns. Thus, IPO activities exhibit a directly proportional behaviour in line with the market movement.

In 2009, London Stock Exchange (LSE) under the FSA (Financial Services Authority) issuance regime has introduced amended categories of IPO flotation, i.e. premium listing and standard listing. This study evaluates the pseudo-market timing of UK IPOs issued under this new issuance regime. A simulation of post-2009 IPOs are conducted to reappraise the pseudo market timing documented by Schultz (2003). The study is supplement with a cross-sectional explanatory analysis examining the performance of IPOs.

The amended regime of two-tier segments under the premium listing stipulates more stringent standards than the prior listing and exceeds the EU directives (see Appendix I). For example, all listings under premium categories must adhere to the UK Corporate Governance code inclusive of overseas one. This arrangement is designed to facilitate investors' confidence and generate market liquidity. The standard listing follows minimum prescribed standards set out in the EU directives. Each of the listings is characterised by specific investment portfolios. Premium listing includes equity shares of commercial firms, investment funds for both the open-end and closed-end portfolios. The standard listing comprises of both equity and non-equity, debt, matched debt securities, securitised derivatives and miscellaneous securities. Prior to this regime change, overseas firms are only allowed to have secondary listing and UK firms require to satisfy premium listing criteria, if they cannot satisfy the conditions; they should consider flotation in the AIM (Alternate Investment Market). In addition, equity shares are only permitted under the premium listing. This equity shares include securities convertible. The changes further stipulate that all preferential shares and warrants are not admissible to standard listing. The premium listing IPOs mandatorily require last three years audited historical financial statements, whereas; the standard listing may with exception submit less than three years statements if they are not available. The focus of this amendment emphasises towards a deregulatory approach for the UK firms. In particular, to provide an attractive and robust alternative to the AIM; where UK issuers can well inform their investors for rational pricing choices. At the same time, investors will be vigilant regarding the status of their shares depending on the listing categories.

IPO Long-run Performance and Pseudo Market Timing

Managers attempt to identify a buoyant market for issuing IPOs. However, IPO clustering and market returns do not necessarily conclude that managers have identified a peak and deliberately time the market conditions. Ritter (1991) supposes managers do time the market issue in anticipation of higher return. The prospect of predicting future market returns of IPOs is inconsistent (For example, see Loughran, Ritter and Rydqvist, 1994). The market performance and evidence of returns could be a reflection of investors' behaviour, irrational choice and over optimism. The stock prices do vary fundamentally, and firms sell their equity in a higher price to the optimist investors during the period of issuance. However, the market does not maintain the price buoyancy and the issuing shares consequently underperform. This explanation is largely consistent with the behavioural timing of the market. Although Loughran et al. (1994) document a positive correlation between the numbers of IPO issuance with prospective market return. The investors' choice could be independent of market sentiment; therefore managers are not always in privy of timing. Schulz (2003) argues that,

> *"Pseudo market timing is completely different from these other explanations for the poor performance of equity issuing firms. Unlike explanations based on mis-measurement of risk or statistical significance, the pseudo market timing hypothesis says that, ex-post, the poor performance of equity issuers is real and significant. That is, IPOs have underperformed relative to their ex-ante expected return. Nevertheless, this is consistent with an efficient market. Even if the ex-ante expected abnormal return is zero following equity offerings, a positive covariance between abnormal returns and the number of future offerings*

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> *means that the probability of observing negative abnormal returns in event-time following offerings may far exceed 50 percent."*

Prior to pseudo-market timing, several other competing explanations such as, behavioural issue, econometric bias, insufficient risk adjustment are proposed by Ritter (1991), Baker and Wurgler (2000); Gompers and Lerner (2003); and Eckbo, Masulis, Norli (2000). Pastor and Veronesi (2005) find that underperformance occurs in IPOs cluster due to optimal exercise of real option to go for the public issuance. Viswanathan and Wei (2008) provide a fixed sample and asymptotic theory for event studies with endogenous events, i.e. with event-generating processes that depend on the past history of event returns. However, many variations to those explanations are also examined, for example; IPOs raising more cash have a poorer long-run performance (Zheng, 2008). Ljungqvist (2007) presents a comprehensive discussion surround the phenomenon of IPO underpricing.

Dahlquist et al. (2008) find that under stationarity, pseudo market timing is only a problem in small samples. Their study too finds that even in a moderate sample such biases apparently dissipate. In essence, their study disagrees with Schulz (2003). Gregory et al. (2010) examining a set of 2,499 UK IPOs launched between mid-1975 to the end of 2004, find that their results supports Loughran and Ritter (2000) behavioural timing hypothesis rather than the Schulz (2003) pseudo timing explanation. Two interesting findings of their study are, under-performance is concentrated in AIM/USM stocks and IPO underperformance is concentrated in smaller firms. Certain exogenous market effect such as, litigation in market could potentially affect underpricing, However, a study of IPOs by Hao (2011) over 1996-2005 suggest that there exists no dependable relationship between underpricing and litigation risk for U.S IPOs.

Typically the pseudo market timing is associated with peaked offering period, since such issuance during high period (peaked) most frequently results in underperformance (Schulz, 2003). The changes in IPO issuance regime duly influence the offering seasonality and do as well influence the pattern of offering. Another feature of pseudo market timing is the IPO clustering; therefore due to the regime change, IPO issuance under different classifications may generate clustering. Further, the investors expectation are supposed be influenced by the choice of categories. The rational pricing choice may be affected by the behavioural biases such as 'conservatism' or 'over-confidence'. Shleifer (2000) finds that various asset pricing decisions are hard to reconcile, since investors do benchmark their choices against several priory available to them. In particular, if firms signal that higher issuance price indicates more investment opportunity and less earning dilution, then investors assume excess positive returns. However, the decision to go public is not dependent on the fact that the future returns are predictable, rather it is an exogenous response to the current price levels.

The study primarily attempts to answer a simple question. Do the pseudo market timing and related underperformance appear in the new regime change of IPO issuance categories? In addition, a supplementary analysis is undertaken to examine the explanatory characteristics of both the new regimes. The paper is organised into 5 sections. Section 2 reviews the literature underpinning the key aspects of the pseudo market timing and underperformance. Section 3 includes data and methodology adopted. Section 4 reports the results obtained from the market simulation and supplementary analysis. Section 5 concludes the paper.

Data and Methodology

Data

The initial dataset contains 892 IPOs offered in LSE (London Stock Exchange) main market during January 1998 to December 2011.The panel of data is collected from London Stock Database Price (LSPD) based on LSPD G8 code excluding AIM (alternate Investment Market), PSM (Professional Securities Market) and SMF (SEDOL Masterfile). PSM and SMF markets are not included since very few listings are registered during the sample period. The financial companies, investments trusts, banks and other investment entities were excluded resulting in a final data set of 431 IPOs. In addition, the dataset is matched with a comparable listings from Zephyr, *Bureau Van Dijk (BvD)* so that the financial measures required for supplementary analysis can be extracted from Zephyr or from the portfolio of BvD databases. Further, two sub-sets of data comprising of premium and standard listings are extracted from the final panel of data. The sub-set data for premium listings includes 57 issuances from April 2010 to September 2012. The second sub-set of standard listings includes 174 issues from April 2010 to September 2012. The FTSE All Share index is used to simulate the market timing from April 2010 to September 2012.

A change in listing procedure was introduced on 6th of October 2009 by the FSA listing regime. The previous primary listings became premium listings and secondary listings relabelled as standard listings. Prior to this change, only overseas companies are allowed for secondary listings. The UK companies are not considered eligible for secondary listings. If they cannot satisfy the eligibility for the primary listings, they seek admission to AIM. However, now these changes have allowed UK companies to get admission to secondary or standard market. Also only equity shares are eligible for the primary or premium listings. A summary of the key differences between the premium and standard listings is presented in Appendix I.

A cross-sectional supplementary analysis is used in addition to the market return simulation. For the supplementary analysis, a set of explanatory variables are utilised. The daily stock returns are extracted from the DataStream, while other measures are collectively obtained from DataStream, FAME as well as ORBIS and computed subsequently. The variable definition is presented in Table 1. Both FAME and ORBIS belong to *Bureau Van Dijk (BvD).* Since DataStream appeared to have limited availability of MARKET-TO-BOOK value, FAME and ORBIS are used to supplement the dataset. One additional measure, i.e. RISK is estimated from the standard market model under the GJR-GARCH specification. Explanatory variables such as, VOLUME RETURN, UNDER PRICING, AGE and OFFER PRICE are obtained from LSE New Issues and IPO summary statistics. Other variables; EBIT, ASSET GROWTH, CASH HOLDING and SIZE are collected and computed, where appropriate from ORBIS and FAME.

Table 1: Variable Definitions used in Supplementary analysis and Control samples

EBIT	a. The natural logarithm of the earnings before taxes divided by operating revenue. b. The same measure is used for the matched control sample.
VOLUME RETURN	a. Ratio of total number of share traded in during the issuance of IPO over the total number of shares issued. b. For the control sample VOLUME RETURN denotes the Ratio of total number of share traded in during the same year of IPO issuance over the total number of shares in the market.
MARKET-TO-BOOK	a. Ratio of the market value of shares plus book value of debt over the sum of book value of IPOs plus book value of debt prior to the IPO issuance.

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	b. For the control sample MARKET-TO-BOOK denotes Ratio of the market value of shares plus book value of debt over the sum of book value of shares during the same year of IPOs plus book value of debt prior to the same year of IPO issuance.
ASSET GROWTH	a. Percentage change of total assets in the year preceding IPO b. For the control sample ASSET GROWTH denotes Percentage change of total assets in the year preceding the same year of IPO issue.
CASH HOLDINGS	a. Percentage of cash plus tradable securities divided by the total assets. b. The same measure is used for the matched control sample.
RISK	a. Represents the systematic Risk (β) estimated using the market model under the GJR-GARCH specification. b. The same measure is used for the matched control sample.
SIZE	a. Size of firm is measured as the natural logarithm of total assets. b. The same measure is used for the matched control sample.
AGE	a. The natural logarithm of one plus age of the firm at the time of its IPO b. For the control sample AGE denotes the Natural logarithm of one plus age of the firm at the same of the IPO.
LEVERAGE	a. The total debt to total assets. b. The same measure is used for the matched control sample.
UNDERPRICING	a. First day return of IPO issuance. b. For the control sample UNDERPRICING denotes the First day return of the same year of IPO issue.
OFFER PRICE	a. The IPO price offered to public b. For the control sample OFFER PRICE denotes the share price of the firm matching with the date of the IPO issue.

a: IPO sample variable definitions
b: Control sample variable definitions

In addition, a matched comparison control sample is constructed based on three measures, i.e. industry classification benchmark (ICB), Market Value (MV) and MARKET-TO-BOOK value (MTBV). First, all IPO firms are categorised into 9 industry groups according to the FTSE/DJ Industry Classification Benchmark (ICB) and matched that with London Stock Database Price (LSPD) and LSE New Issues and IPO summary statistics. Second, an average is taken for MV and MTBV for all the firms within IPO firm's industry, which is within one year of the date of flotation. Next, the firms are combined into one group with average MV is in ±30% of issuance firm's average MV. When a match is not available, this range is expanded to ±35%, ±40% etc. Finally, within the group of companies, a matched firm is identified that has the closest MTBV with IPO firm. Again, any matched firms that are on the FTALLSH list one year of the date before the IPO firm's announcement was excluded. All the delisted firms are also excluded.

Methodology

Simulation of Aftermarket Performance

The methodology adopted to simulate the marketing timing is identical to the one used by Schultz (2003). To capture the underperformance, the IPO index is compared with FTSE all share index over the time period of April 2010 to September 2012. An IPO index is created using two sub-sets data, i.e. 57 issuance of premium listing IPOs and 174 issuance of standard listing IPOs. At the same time, a matched comparable index of FTSE All Share index is generated. Next, to simulate the number of offerings and abnormal return; the market returns are assumed to be normally distributed and ex-ante expected abnormal return is approximated to zero. The expected value of abnormal returns is calculated as follows:

The average long-run cumulative abnormal returns

$$\overline{CAR} = \sum_{e=1}^{E} \frac{\left\lfloor \sum_{j=1}^{N} \left(r_{j,e} - r_{m,e}\right) \right\rfloor}{N} \text{.......} Eq.\ (1)$$

where number of offerings are exogenous and correlated with the excess returns

$$E(\overline{CAR}) = \left(\frac{1}{N}\right) E\left[\sum_{e=1}^{E}\sum_{j=1}^{N}\left(r_{j,e} - r_{m,e}\right)\right] + Cov\left(\left(\frac{1}{N}\right), \left[\sum_{e=1}^{E}\sum_{j=1}^{N}\left(r_{j,e} - r_{m,e}\right)\right]\right) \text{.......} Eq.\ (2)$$

The expected value of the average cumulative abnormal returns needs to negative, thus IPOs underperforming as in line with pseudo market timing.

Supplementary Analysis

A binary logistic model is constructed to examine the performance of IPOs for both the premium and standard listings. A set of unique explanatory variables are used to capture the performance indices of IPOs. The model is specified for all the variables in one run of the estimation. The logistic model is written as follows:

$$Y_{i,t}^{*}(\pi) = a_0 + a_1 \ln(EBIT_{i,t}) + a_2 VOLUMERETURN_{i,t} + a_3 MARKET-TO-BOOK_{i,t} + a_4 ASSETGROWTH_{i,t} + a_5 CASHHOLDING_{i,t} + a_6 RISK_{i,t} + a_7 \ln(SIZE_{i,t}) + a_8 \ln(AGE_{i,t}) + a_9 LEVERAGE_{i,t} + a_{10} UNDERPRICING_{i,t} + a_{11} OFFERPRICE_{i,t} + \varepsilon_{i,t} \text{.......} Eq.3$$

where $Y_{i,t}^{*}$ is a binary choice latent variable for firm *i* at year *t*. Here *t* represents the event year for firm *i*. However, what is observed is a 0-1 (firms that restructure/firms that did not restructure) dummy variable defined as $y_{i,t} = \begin{cases} 1\ if\ Y_{i,t}^{*} \geq 0 \\ 0\ if\ Y_{i,t}^{*} < 0 \end{cases}$. The logit transformation gives the log-odds $Ln(\frac{\pi}{1-\pi})$. A positive and significant value of any coefficient indicates sizable influence of that particular variable on likelihood of significant performance of IPO. Therefore, the particular variable is not affected by underperformance, and not in line with the pseudo market timing.

The beta, i.e. systematic risk is estimated under the GJR-GARCH specification. Since the OLS estimate suffers from the *ARCH* effects, especially when high frequency data is use, the GJR-GARCH specification is used to generate risk parameter.

Under the GJR-GARCH estimation the conditional variance of Eq. 4 can be written as:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 + \gamma \varepsilon_{t-1}^2 I_{t-1}^{-1} \text{.......} Eq.4$$

where I_{t-1}^{-}= 1 if ε_{t-1}< 0 and 0 otherwise. In Eq. 4, last period's good news, ε_{t-i}> 0, and bad news ε_{t-i}< 0, have differential effects on the conditional variance, as well as good news have an impact of α_i, while bad news have an impact of $\alpha_i + \gamma_i$. If, γ_i> 0, bad news increases volatility, and this condition is referred as leverage effect for *i-th* order. If $\gamma_i \neq 0$, the news impact is asymmetric. I^{-}_{t-1} is a zero/one dummy variable which is set to zero if ε_{t-i} is positive, otherwise 1. Typically, this specification assists to examine the asymmetry with respect to ε_{t-i}. The FTSE All Share stock index is employed as a benchmark while computing conditional variance (β) and asymmetry (γ).

Empirical Results

Simulation of Aftermarket Performance

The simulation process follows an identical approach adopted by Schulz (2003). The distribution of monthly return on the FTSE All Share index is estimated over April 2010 to September 2012. During this estimation period, the mean monthly return is 1.212 and the standard deviation was 5.873 percent. The slope coefficient for the premium listing IPO index is 1.455 and the residual standard deviation was 5.093 percent. The slope coefficient for the standard listing IPO index is 1.876 and the residual standard deviation was 6.235 percent. Unlike Schulz, a series of 500 simulations are run.

A series of return is generated from the normal distribution using the mean and standard deviation of the monthly return on the FTSE All Share index over April 2010 to September 2012. The return on the portfolio of premium IPOs is generated by multiplying the market return by the slope coefficient of 1.455 and adding a residual return that is generated from a normal distribution with a mean of zero and a standard deviation of 5.093 percent. In addition, the expected return is adjusted for the IPO portfolio and market return. The procedure of calculation for both the premium and standard listing is identical. The level of IPO index and market index are set to 100 counting from the beginning of the first month of simulated sample. The simulated level of the market and IPO portfolio is calculated by multiplying the previous month's level by one plus the previous month's simulated return.

Table 2 reports the simulation results. Panel A presents the simulation results for the premium listing IPOs and Panel B reports for the standard listing IPOs. Diagram 1 presents the mean calendar moth returns of both the premium and standard listing IPOs. For all 500 simulations, the CARs are estimated for 8 sub-periods over 2 years. Median value for -24, -1 months is 10.32% for the premium listing and for the standard listing IPOs, it is 14.41%. The standard listing IPOs seems to have better market return as compared to the premium listing in archival sense. Whereas, in calendar month 1, premium listing IPOs indicate underperformance than the standard listing IPOs, i.e. median and mean -0.43% and -0.48% respectively contrary to 0.18% and 0.15%. The excess return during 1-3 months is -1.31% and 0.10% for both the listing categories respectively with reported t-statistics -58.91 and 56.73. Most of the returns are positive for -1 to -24 months. The most interesting result Panel B reports is the continuation of positive return for the standard listing IPOs, whereas the premium listing IPOs underperforming over calendar months. The excess return for the premium listing have a -12.03% mean value for the post 24 months, while there is a 0.04% excess return for the standard listing. The findings suggest that the premium listing IPOs underperform and captures the pseudo-market timing, while the standard listing IPOs do not register any underperformance.

Table 2: Simulation of IPO excess returns

Panel A: Premium Listing IPOs

	Cumulative Abnormal Returns (CARs)							
Months	-24,-1	-12,-1	-3,-1	-1	1	1-3	1-12	1-24
Median	10.32%	6.71%	0.87%	0.22%	-0.43%	-1.23%	-5.89%	-11.28%
Mean	10.36%	6.08%	0.79%	0.26%	-0.48%	-1.31%	-6.75%	-12.03%
t-statistics	56.65	41.22	30.14	29.07	-55.61	-58.91	50.21	48.98
Percentage<0	13.9	19.2	21.5	22.3	79.8	81.6	77.8	69.8

Panel B: Standard Listing IPOs

	Cumulative Abnormal Returns (CARs)							
Months	-24,-1	-12,-1	-3,-1	-1	1	1-3	1-12	1-24
Median	14.41%	7.80%	0.91%	0.32%	0.18%	0.11%	0.09%	0.06%
Mean	13.83%	8.07%	0.89%	0.28%	0.15%	0.10%	0.07%	0.04%
t-statistics	56.29	39.81	27.66	26.79	53.41	56.73	48.21	38.97
Percentage<0	14.6	20.1	22.5	24.3	80.1	84.2	69.8	59.7

Around 500 simulations of IPO returns are calculated over 2 years. The entire estimation procedure is identical to Schultz (2003). The mean event excess return for each IPO in each simulation for periods before and after the IPO is calculated. Estimates are based on actual data for April 2010 to September 2012.

Diagram 1: Mean calendar month returns of Premium and Standard listing IPO simulation

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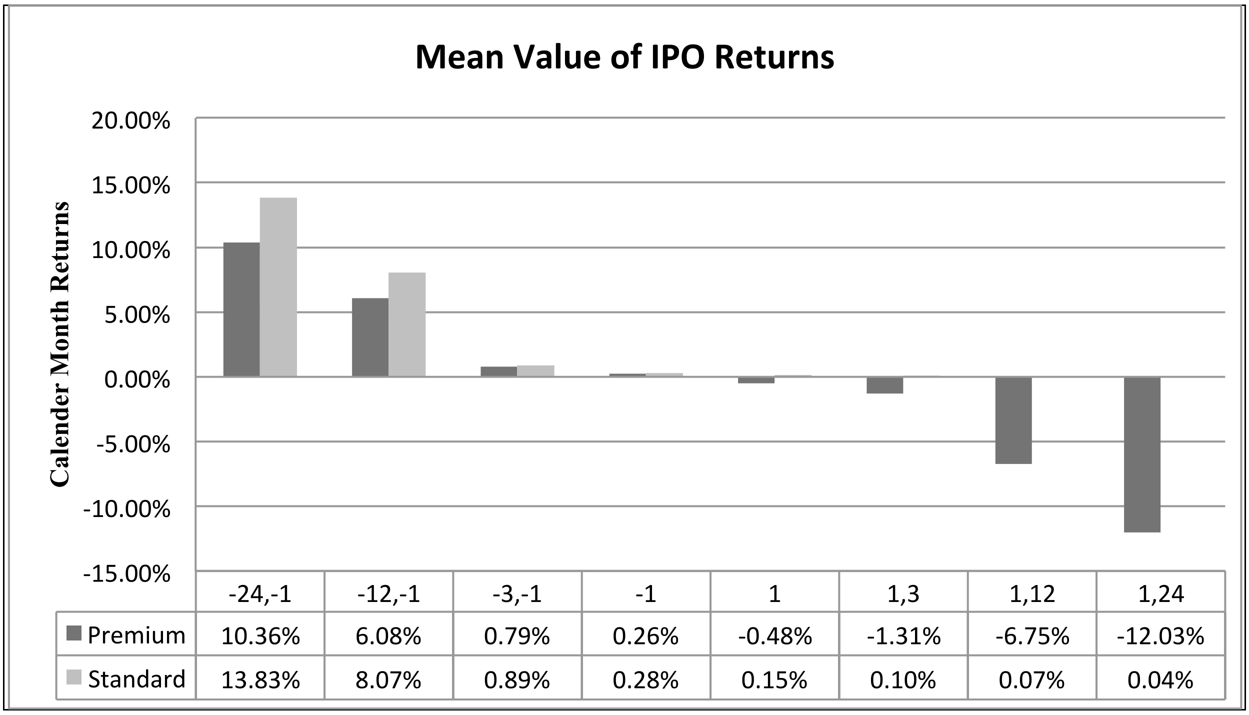

Summary Statistics of variables for Supplementary analysis

Table 3 reports the summary statistics for all the variables used in the logistic model. The difference in mean value of standard and premium listing IPOs is tested under a conventional t-test. The statistics indicate that the mean values of all the variables are significantly different. The variables, VOLUME RETURN, CASH HOLDING, and AGE denote a negative coefficient value. These variables are likely to be different as standard listing IPOs trade less volume, and have less tradable securities compared to the premium listing. A sizable mean value difference is observed amongst EBIT, VOLUME RETURN, ASSET GROWTH, CASH HOLDING, SIZE and AGE variables for standard and premium listings indicating the regime change has strongly influenced the issuance pattern of the offerings. The statistics for underpricing suggest that premium listing offers do suffer from under performance, i.e. -0.480, while standard listings do not register any underpricing effect, i.e. the mean score is 0.045.

Table 3: Supplementary Analysis Variable Summary Statistics

Variables	Mean		Std. Dev.		t-statistics for difference in mean premium & standard
	Standard (N=174)	Premium (N=57)	Standard (N=174)	Premium (N=57)	
EBIT	0.217	0.897	7.647	7.267	4.536[a]
VOLUME RETURN	8.357	0.873	-12.452	16.984	-3.166[a]
MARKET-TO-BOOK	2.230	3.919	4.403	2.746	2.187[a]
ASSET GROWTH	1.549	3.428	10.960	12.863	4.801[a]
CASH HOLDINGS	1.272	3.195	28.084	33.528	-2.879[a]
RISK	12.299	13.716	10.426	4.525	3.8716[b]
SIZE	8.351	11.620	9.857	7.456	7.647[a]
AGE	1.634	3.501	10.788	22.869	-5.452[a]
LEVERAGE	0.610	0.705	18.477	23.110	4.403[a]
UNDERPRICING	-0.874	-0.480	-10.465	-9.080	1.960[b]
OFFER PRICE	1.412	1.709	19.287	21.695	8.084[a]

N: Number of IPO issued.

a, b, c: Indicate that the appropriate test statistics are significant at 1%, 5% and 10% levels respectively.

Supplementary Analysis Results

Table 4 and 5 report the supplementary analysis results respectively. Both the premium and standard listing IPO portfolios are examined under a binary choice logistic specification. A set of unique variables are employed to capture the explanatory characteristics of IPOs performance over 2010-2012. Two matched comparison control samples are generated for both the listings as described in the methodology section.

Table 4 presents the results for the premium listings IPOs. Overall the model is parsimonious and robust. The Omnibus model test statistic is 238.765 and significant at 1% level. The Hosmer & Lemeshow test statistic suggests a goodness-of-fit for the model. Both the Cox and Snell, and Nagelkerke R^2 statistics explain variance around 28% and 36% respectively. In addition, the Ljubg-Box test up to lag 6 suggests independent distribution of variables that is free from auto-correlation biases. Most of the variables are significant at at least 10% with exception to OFFER PRICE. It appears the nominal IPOs price is below average market price. EBIT, VOLUME RETURN, MARKET-TO-BOOK, CASH HOLDING and UNDERPRICING denote significant negative coefficients. The results indicate that the IPO firms over moderate to long-run do underperform. The RISK is significant and positive with a reported odd ratio value of 1. 134, therefore the risk increases in ex-post market for the firms. In addition, the SIZE is significant and the reported odd ratio is 13.743, suggests that the asset growth is achieved, most likely due to issuance of offers.

Table 5 reports the results for the standard listing. Overall the model is robust and significant. Most of the variables are significant at at least 10% level excluding CASH HOLDING, LEVERAGE and UNDERPRICING. The variables EBIT, VOLUME RETURN, MARKET-TO-BOOK, ASSET GROWTH, SIZE and OFFER PRICE denote significant positive coefficient value. The Risk is significant and denotes a negative coefficient value. The findings indicate standard listing offers do perform comparable to the market and the effect of underpricing is not documented for this category. The finding is consistent with the market simulation results.

Table 4: Premium listing IPOs and Control Sample Logistic Results

Predictors	β	*Std. Err*	*Wald's* χ^2	e^{β} *(odds ratio)*
Constant	-1.438^a	0.171	70.791	0.237
ln(EBIT)	-0.154^a	0.053	8.464	0.857
VOLUME RETURN	-0.259^a	0.038	47.785	0.771
MARKET-TO-BOOK	-3.121^a	1.091	8.176	0.044
ASSET GROWTH	0.095	0.105	0.821	0.909
CASH HOLDINGS	-0.074	0.048	2.394	0.929
RISK	0.126^a	0.046	7.447	1.134
ln(SIZE)	2.621^a	1.080	5.886	13.743
ln(AGE)	1.071^a	0.147	52.788	2.918
LEVERAGE	0.001^a	0.001	4.871	1.001
UNDERPRICING	-0.516^a	0.167	9.568	1.675
OFFER PRICE	-0.168	0.118	2.035	0.846
Goodness-of-fit test			χ^2	
Omnibus model Test			238.765^a	
Hosmer &Lemeshow Test			37.811^d	
Diagnostic tests				

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Percentage correctly classified	81.4[a]
Cox and Snell R^2	0.276
Nagelkerke R^2 (Max rescaled R^2)	0.362
-2 Log likelihood	990.520
Kolgomorov-Smirnov	
Logit residuals	3.765[a]
Studentized residuals	3.651[a]
Standardised residuals	3.463[a]
Ljung-Box Q statistics	
$Q^2(2)$	0.367
$Q^2(6)$	0.531

a, b, c. indicate that the appropriate test statistics are significant at 1%, 5% and 10% levels , respectively

d. sig. = 0.403

$$Y^*_{i,t}(\pi) = a_0 + a_1 \ln(EBIT_{i,t}) + a_2 VOLUMERETURN_{i,t} + a_3 MARKET-TO-BOOK_{i,t} + a_4 ASSETGROWTH_{i,t} + a_5 CASHHOLDING_{i,t} + a_6 RISK_{i,t} + a_7 \ln(SIZE_{i,t}) + a_8 \ln(AGE_{i,t}) + a_9 LEVERAGE_{i,t} + a_{10} UNDERPRICING_{i,t} + a_{11} OFFERPRICE_{i,t} + \varepsilon_{i,t}$$

Table 5: Standard listing IPOs and Control Sample Logistic Results

Predictors	β	*Std. Err*	*Wald's* χ^2	e^{β} *(odds ratio)*
Constant	0.089[a]	0.073	1.488	0.915
ln(EBIT)	0.051[b]	0.027	3.522	1.052
VOLUME RETURN	0.162[a]	0.049	11.132	0.851
MARKET-TO-BOOK	0.110[b]	0.061	3.273	.896
ASSET GROWTH	0.682 [b]	0.169	2.407	1.299
CASH HOLDINGS	-0.001	0.003	0.182	0.999
RISK	-0.215[a]	0.081	7.024	0.807
ln(SIZE)	0.028[c]	0.016	2.988	1.029
ln(AGE)	0.149[a]	0.043	11.819	1.161
LEVERAGE	0.119	0.170	0.488	1.126
UNDERPRICING	0.002	0.000	0.294	1.000
OFFER PRICE	0.300[a]	0.115	6.836	0.741

Goodness-of-fit test	χ^2
Omnibus model Test	321.665[a]
Hosmer &Lemeshow Test	67.880[d]

Diagnostic tests	
Percentage correctly classified	79.3[a]
Cox and Snell R^2	0.321
Nagelkerke R^2 (Max rescaled R^2)	0.346
-2 Log likelihood	789.992
Kolgomorov-Smirnov	
Logit residuals	4.009[a]
Studentized residuals	4.211[a]
Standardised residuals	3.877[a]
Ljung-Box Q statistics	
$Q^2(2)$	0.502
$Q^2(6)$	0.661

a, b, c. indicate that the appropriate test statistics are significant at 1%, 5% and 10% levels , respectively

d. sig. = 0.521

$$Y^*_{i,t}(\pi) = a_0 + a_1 \ln(EBIT_{i,t}) + a_2 VOLUMERETURN_{i,t} + a_3 MARKET-TO-BOOK_{i,t} + a_4 ASSETGROWTH_{i,t} + a_5 CASHHOLDING_{i,t} + a_6 RISK_{i,t} + a_7 \ln(SIZE_{i,t}) + a_8 \ln(AGE_{i,t}) + a_9 LEVERAGE_{i,t} + a_{10} UNDERPRICING_{i,t} + a_{11} OFFERPRICE_{i,t} + \varepsilon_{i,t}$$

Conclusion

The pseudo-market timing of the premium and standard listing IPOs is examined following Schulz. This new tow-tier regime of IPO issuance has recently been introduced in the London Stock Exchange by the FSA. Although pseudo market timing explanation of IPO underperformance is not a new development, but the regime change may have bearings. The study shows contrasting results for both the categories. The premium listing offers register an average -12.03% return over 1-24 post calendar months, while the standard listings yield an average 0.04% excess return. The premium listings indicate underperformance of between -0.43% to -5.89% over one calendar year. Whereas, the standard listing suggests marginal excess positive return over the same post calendar month period. The supplementary analysis suggests that underpricing is significant in the premium listing but is not registered in standard listing offers. However, the results support to some extent that the timing effects are observable and can be explained by the pseudo market timing hypothesis.

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Appendix I

A summary of the key differences between premium and standard listings

Key Eligibility criteria	Premium-Equity shares	Standard-shares	Standard-Depository receipts
Free float	25%	25%	25%
Audited historic financial information	Three years	Three years or such shorter period	Three years or such shorter period
75 per cent of applicant's business supported by revenue earning record for the three-year period	Required	n/a	n/a
Control over majority of the assets for the three-year period	Required	n/a	n/a
Requirement for clean working capital statement	Required	n/a	n/a
Sponsor	Required	n/a	n/a
Key continuing obligations			
Free float	25%	25%	25%
Annual financial report	Required	Required	Required
Half-yearly financial report	Required	Required	n/a
Interim management statements	Required	Required	n/a
EU-IFRS or equivalent	Required	Required	Required
UK Corporate Governance Code	Comply or explain	n/a	n/a
Model Code	Applied	n/a	n/a
Pre-emption rights	Required	As required by relevant company law	n/a
Significant transaction ('Class tests')	Rules apply	n/a	n/a
Related-party transactions	Rules apply	n/a	n/a
Cancellation	75 % shareholder approval required	No shareholder approval required	No shareholder approval required

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This list is not exhaustive and should be read in conjunction with the FSA Handbook (Listing Rules, Prospectus Rules and Disclosure & Transparency Rules).
This guide is written as a general guide only. It should not be relied upon as a substitute for specific legal or financial advice. Professional advice should always be sought before taking any action based on the information provided.

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DISTRIBUTED COGNITION & COLLECTIVE COMMITMENT FOR FAIR VALUATION OF FINANCIAL INSTRUMENTS

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Abstract. *The expansion of subjective fair value accounting has been a central concern in recent accounting regulation. Moreover, the method to evaluate complicated esoteric financial instruments has been debated since the recent financial crisis. This study aims to offer a unique understanding of the increasingly complicated and specialized fair value accounting process. This study consists of three tasks. First, it points out the background of a broad issue of complex as well as professionalized valuation of financial instruments and identifies why fair value accounting matters in terms of the concept of financial innovation. Second, this study applies a distributed cognition perspective (Hutchins, 1995a and 1995b) to the valuation of financial instruments that is now complicated and distributed to multiple actors. Furthermore, this study relies on the theory of collective commitment (Tuomela, 2007) and knowledge sharing in professions (Styhre, 2011), and highlights the importance of interactions among human actors. Third, this study investigates actual practices by using several information sources to demonstrate that investment companies' actual valuation process is widely distributed beyond a single entity. It also analyzes a case at the beginning of recent financial crisis, when important information for the valuation was unevenly distributed among small number of organizations and individuals. This interdisciplinary study contributes to future research by drawing attention to the importance of and shedding new light on the collective commitment and knowledge sharing among market participants in a highly professionalized fair value accounting.*

Keywords: *Valuation of Financial Instruments, Fair Value Accounting, Distributed Cognition, Collective Commitment, Knowledge Sharing*

Financial Innovation and Fair Value Accounting

Financial Innovation and Complicated Financial Valuation

Among the many kinds of corporate assets and liabilities, fair value accounting (namely, FVA) is particularly controversial in the evaluation of complicated financial instruments. The development of FVA parallels the development of the regulatory regime for innovative financial instruments such as derivatives.[1]

1 The popularization of derivative instruments from the late 1980s constituted the incentive for standard setters to develop International Accounting Standard (IAS) 39 Financial Instruments: Recognition and Measurement. A Joint Working Group (JWG) comprising the IASC and accounting standard setters from major countries around the world provided the methodology by which enterprises should account for financial instruments and similar items: valuing the present value of its expected cash flows discounted at the current market rate of return (Georgiou & Jack, 2011, p. 319). This standard could be one of the causes of diffusion of FVA.

Generally speaking, we tend to have a positive impression of the word "innovation" and it holds true for financial innovations. So, the financial product innovation is believed to open up new economic options and improves the allocation of risks and productive resources within the economy (Nightingale & Spears, 2010). According to Lerner and Tufano (2011, p. 6), "financial innovations are the act of creating and then popularizing new financial instruments as well as new financial technologies, institutions and markets". For instance, "derivatives (e.g., options and swaps) are typical examples of financial innovation, and they can be innovative since previously existed assets were unbundled to form a finer partition over the status-of-nature (Nightingale & Spears, 2010).

However, according to a study on the diffusion of financial innovation (Redmond, 2013), negative aspects of financial innovation are characterized by three elements: lack of intermediaries, deterioration of quality, and proneness of externalities. First, most financial innovations are developed by investment banks playing an intermediary role in a financial market. For example, Peter Hancock is considered as the "intellectual godfather" of J.P. Morgan's derivative team, among the first investment bankers to offer modern credit derivatives (Tett, 2009).[2] During the development of credit derivatives, while investment banks have acted primarily as protection buyers to hedge their own exposure,[3] market developments have also allowed them to sell protection according to their estimation of the credit risk entailed by various reference entities (Huault & Montagner, 2009, p. 556). When the innovator is also the intermediary, an important independent control check is lost. Although the innovator/intermediary has financial innovation expertise, this type of knowledge may not be shared with customers (Redmond, 2013, p. 527). In addition, the incentive plans offered by investment banks tend to be skewed to the near term rather than the long term (Redmond, 2013, p. 527). The professional financial experts, who design and market financial innovations are handsomely rewarded on an annual basis, but usually not for having a long-term vision of the business or for protecting their customers' welfare (Redmond, 2013, p. 527).

Second, since the quality of financial innovation depends, in part, on the quality of the existing instruments (which can degrade over time), many financial innovations are based on a reconfiguration of existing instruments (e.g., securities). Although innovative technologies (especially those that are easily copied, such as pharmaceuticals) are often protected from imitation by intellectual property laws, particularly patent laws, innovative financial products (such as derivatives pricing models) have had little legal protection, at least until very recently (MacKenzie, 2009, p. 72). Thus, innovative financial instruments tend to be complex and poorly understood by most customers who have limited insight into the risks of the innovation (Redmond, 2013, p. 528).

Third, when a financial innovation fails, the resulting harm often spreads to non-transacting parties, since the financial system is intricately interconnected among financial firms and is related to many other businesses (Redmond, 2013, p. 529).

To sum up, the risks of financial instruments newly innovated by profit-seeking financial intermediaries tend to be unknown to some market participants and customers despite those intermediaries' shot-term prospect. Such innovative instruments are also likely to be complex as well as opaque and risk damaging the financial system due to the uncertainty of their fair value generation. In other words, those intermediaries' "marketization of new risks" (Huault

[2] While the appearance of the first true credit derivative is difficult to trace back, 1997 can be chosen as the starting point for the development of the market, at least in Europe. That year, J.P. Morgan proposed a reference model to price and handle credit derivatives, the CreditMetrics model (Huault & Rainelli-Weiss, 2012, p. 242).

[3] In a credit derivative contract, the creditor (purchaser of the protection) can transfer the associated credit risk to another party (the vendor of the protection) while still retaining the debt on his/her balance sheet (Huault & Montagner, 2009, p. 556).

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& Rainelli-Weiss, 2012, p. 247) has flourished through complicated financial innovations. To tackle these aspects of innovative financial instruments, principles (or judgments)-based accounting standards were demanded and expected to flexibly cope with the unpredictability of the tangled reconfigurations of risks and intricate valuation of financial instruments for the sake of a wide range of stakeholders.

Some may think external auditors rather than accounting rules could handle the unpredictability. They may object to the reporting company's FVA figures during an audit, but most auditors have little training in valuation (Martin et al., 2006, p. 289). The FVA makes it increasingly difficult for auditors to feel and actually be in control of their own expertise (Smith-Lacroix et al., 2012). Furthermore, "no amount of auditing can remove the underlying estimation uncertainty of reported values determined by management-derived estimation models that are hypersensitive to small changes in inputs—inputs that are subjectively chosen by management from within a reasonable range (Christensen et al., 2013)." Therefore, auditors prefer to follow the standards concerning FVA auditing (Fitzsimons et al., 2010) even though they provide little directional guidance (Bratten et al., 2013).

Currently, formal accounting standards stipulate how to coordinately calculate the fair value of corporate assets and liabilities. The background and content of the standards are indicated in the next subsection.

The Pursuit of Acceptable Calculation: Controversial Fair Value Accounting

Fair value accounting (FVA) has been a central issue in financial accounting for several decades. This subsection discusses why FVA matters and then how the concept is so controversial.

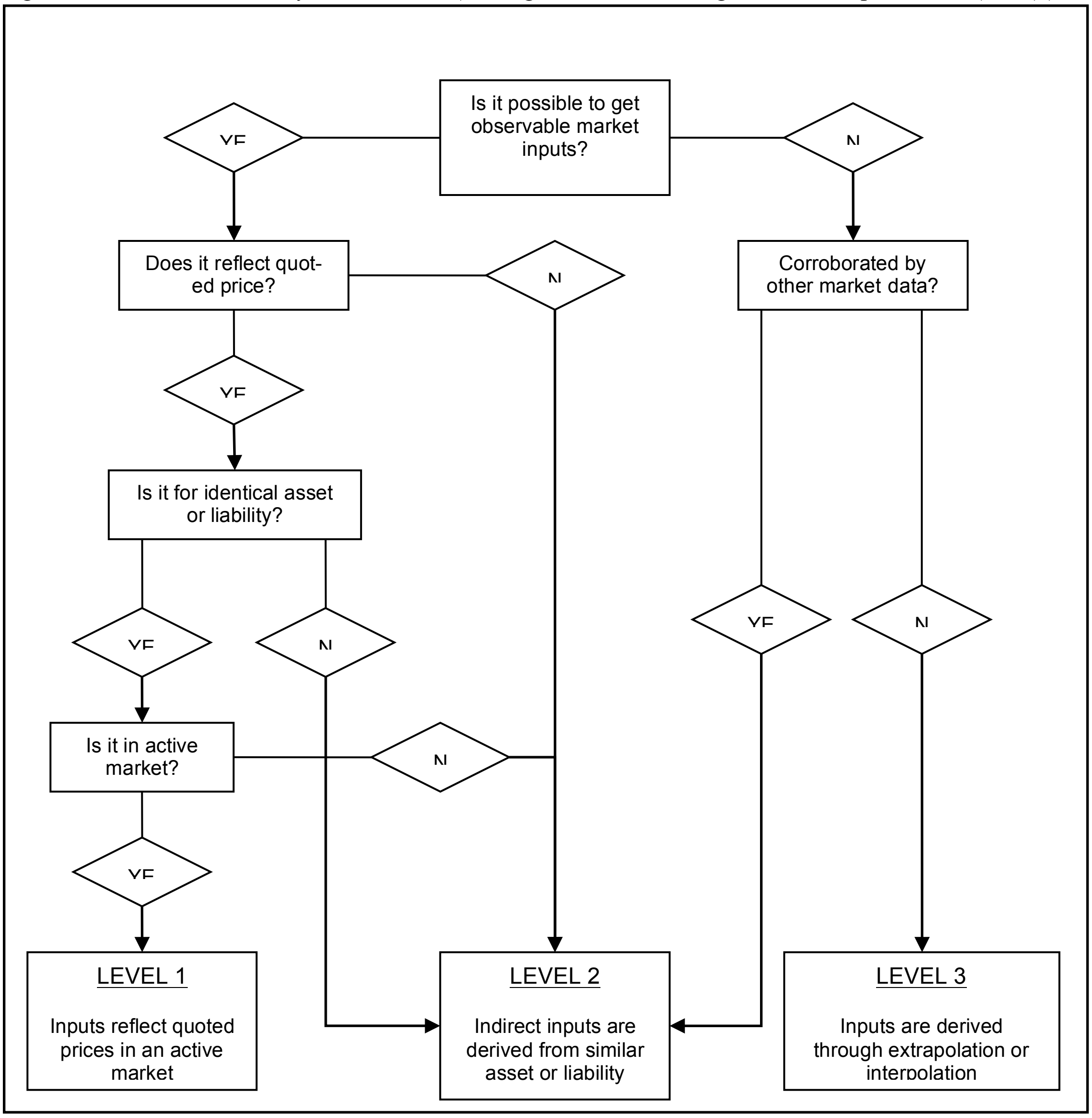
The issue of FVA became particularly controversial after the 2008 financial meltdown, culminating in the collapse of Bear Stearns and the bankruptcy of Lehman Brothers. Since then, FVA has been an issue not only in accounting but in society at large. Boyer (2007) warns that FVA, often called "mark-to-market accounting," may cause the excessive volatility of financial markets to permeate the entire economic system, which could trigger erroneous capital allocation decisions (p. 782). Some other critics argue that FVA contributed significantly to the financial crisis and exacerbated its severity for financial institutions in the US and around the world (Laux & Leuz, 2009, p. 826). For example, the impact of FVA on the recent financial crisis has been discussed in terms of pro-cyclicality. An International Monetary Fund (IMF)'s report has explicitly warned that it can be difficult to determine the fair values of assets not only in downturns and illiquid markets but also during boom times in active markets, when prices can overshoot and incorporate a risk premium that inflates profits (IMF, 2008, p. 110).

To date, the application of FVA has greatly expanded as the role of corporate financial activities in the economy has gained momentum. Although the development of FVA has not been straightforward,[4] it has finally resulted in the establishment of the Statement of Financial Accounting Standards (SFAS) "157: *Fair Value Measurement"* (also known as "ASC 820" in the US FASB's updated codification). The independent comprehensive standard of FVA has been effective for corporate financial statements issued in the US since November 2007, and it was welcomed first because a single standard would increase the efficiency and consistency of measuring fair value across the many standards that require fair value reporting and disclosure (AAA Financial Accounting Standards Committee, 2005, p. 188). Figure 1 below depicts the process of calculating fair value of corporate assets and liabilities under SFAS 157 which

[4] The historical development of fair value accounting is studied in Georgiou & Jack (2011).

defines "fair value" as "the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date" (FASB, 2008, para. 5).

Figure 1 Fair Value Hierarchy in SFAS 157 (The figure is based on Figure 1 in Campbell et al. (2008).)



The standard distinguishes between cases where market prices for identical assets or liabilities are readily available from active markets (in "Level 1 measurements") and cases that require the estimation of hypothetical market prices (in "Level 2 and 3 measurements", differentiated according to their degree of subjectivity). The IASB recently issued the "IFRS 13: *Fair Value Measurement*," and the requirements of both standards are quite similar.

For both standards (SFAS 157 and IFRS 13), the major concern is usually not Level 1 but the more subjective Level 2 and 3 measurements in the FVA hierarchy (see Figure 1). In the context of FVA, the long-standing dilemma of pursuing "relevance" or "reliability" in accounting remains controversial. "Proponents of fair values in accounting argue for their greater relevance to users of financial information, but the deeper point is that they also redefine the reliability of fair values supported by financial economics, both in terms of specific assumptions and in terms of its general cultural authority (Power, 2010, p. 205)." For example, empirical research has documented correlations between fair value measurements and

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stock prices that are useful for understanding whether fair values are relevant to investors (Penman, 2010). However, since FVA "finds its justification in efficient market theory (Penman, 2010, p. 170)"[5] and "can only be supported for securities traded on highly liquid markets" (Hitz, 2007, p. 325), Level 2 inputs (other than the observable quoted prices) and 3 inputs (which are not based on observable market data) for the valuation of financial instruments in an illiquid or unusual market may produce subjective unreliable accounting numbers.

Although disclosing the categorization of financial instruments based on the three levels is required,[6] an article by a leading independent audit and advisory firm states that "one of the principal challenges which will be faced by some companies will be that of distinguishing Level 2 and Level 3 investments" (Grant Thornton, 2009).[7] Therefore, in addition to managerial manipulation of estimation and model inputs (Landsman, 2007), the manipulation of categorization[8] may be possible under the current FVA standard because the information relevant for category determination tends to be subjective.

In addition to the disclosure requirements, the International Standard on Auditing 500: Audit Evidence (ISA500), published by the International Federation of Accountants, states that auditors may accept as appropriate audit evidence the findings of a specialist hired by management. However, such a collaborative work "is not a natural process arising through the division of multiple-disciplinary labor; it may signify specific and often competing hierarchical relations between different bodies of expertise (Power, 1997, p. 140)". Then, "the specialization of tasks reinforces the auditor's role as conductor of an orchestra, and the need to acquire the necessary competence in valuation methods to be able to ensure there is good coordination between the specialists concerned" (Jacquemard, 2007, p. 279).

Needless to say, under the current FVA standards, it is difficult for a single entity itself to cope with the complex valuation of highly innovative financial instruments. Professional financial people with multiple knowledge types must perform complex calculations cooperatively, during which process cognitive tasks tend to be distributed to many actors. This aspect can be analyzed within the distributed cognition framework in the next section.

Applying the Distributed Cognition Perspective to FVA

A Perspective of Distributed Cognition

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[5] This typically means that all the relevant information is incorporated into the quoted prices (Boyer, 2007, p. 781).

[6] The FASB's codification standards (*Fair Value Measurement and Disclosures*, Topic 820, updated-2010-06) require corporations to disclose the level of the fair value hierarchy within which their fair value measurements are categorized in their entirety (i.e., Level 1, 2, or 3).

[7] According to the article (Grant Thornton, 2009), "In practice, investments for which there is an exchange listed price will often fall into Level 1 and for some investment companies this may be the end of the deliberations. Unquoted private equity or venture capital holdings might however be generally expected to fall into Level 3. Depending on the circumstances, certain derivatives such as interest rate swaps or forward currency contracts where inputs are mostly observable might conceivably fall into Level 2. For some investment companies, it is possible that Level 2 might turn out to be the smallest of the three categories, but equally it may be the category that generates most discussion."

[8] This supposes the intentional selection of a favorable FAV hierarchy category in a borderline case.

One of the most prominent studies on distributed cognition is by Hutchins (1995a and 1995b), which is based on extensive studies of naval navigation and the cockpit of commercial airlines. It focuses on the fact that "human cognition is always situated in a sociocultural world and cannot be unaffected by it" (1995a, p. 8). The concept of distributed cognition has attracted attention in several disciplines, ranging from law (e.g., jury decision making) and sociology (e.g., information processing in organizations) to computer science (e.g., GRID computing and medical informatics) and the philosophy of science (e.g., expert panels) (List, 2008, p. 285). Its unique analytical viewpoint is also applicable to the study of FVA.

Distributed cognition occurs during the cognitive division of labor. According to Hutchins (1995a, p. 176), "all division of labor, whether the labor is physical or cognitive in nature, requires distributed cognition to coordinate the activities of the participants." Callon & Muniesa (2005, p. 1245) also state that "economic calculation is not an anthropological fiction, precisely because it is not a purely human mechanical and mental competence; it is distributed among human actors and material devices." Thus, "rather than simply assuming that all cognition is restricted to a specific individual, we are invited to think of some actual cognition as being distributed among several individuals" (Giere, 2007, p. 314). This mode of thinking fills the gap between models of a general-purpose cognitive architecture and explanations of human performance in complex, real-word situations (Hazlehurst et al., 2008, p. 230); it can also serve as an alternative to an individual-centered model of cognition (Hazlehurst et al., 2008). According to Hazlehurst et al. (2008, p. 228), distributed cognition treats the activity system, rather than the individual, as the unit of cognitive analysis.

Distributed Cognition in the FVA Process

Investment companies are known to use external professional services to valuate some complex financial instruments. Nowadays multiple financial (or market) data vendors occasionally provide data to investment companies and financial traders. Based on a survey conducted by Streambase (2010) on more than over 215 people, of whom more than 200 were active market participants,[9] almost half of all respondents (46%) supported two to three market data providers. Some 18% dealt with only one provider, while 17% used six or more. Unsurprisingly, Bloomberg and Thomson Reuters were the most commonly used market data providers. According to an another survey, conducted by one of the Big 4 accounting firms to industry professionals representing 67 asset managers[10] (Deloitte, 2010), "73% of survey participants indicated that they feel the pricing services provide a more reliable valuation than brokers" and "when performing due diligence on pricing sources, 81% of survey respondents are asking their pricing services and brokers whether prices reflect the most recent transactions, an increase of 22% from the previous year's survey. "

This information suggests that some FVA is being partly conducted by distributed actors in various organizations such as pricing vendors. Moreover, it is assumed that those tasks can be cognitively distributed not only to human beings but also to tools and artifacts. Berdone & Secchi (2009, p. 190) note that external resources, such as artifacts, tools, and objects, shape human cognition. MacKenzie (2009) also assumes that cognition and calculation can be distributed not only to human beings but also to artifacts, such as technical systems (e.g., models and databases). In addition to human actors, thus, the configuration of information-bearing tools, such as databases or pricing software, can play functional roles in this framework. In

[9] Some 59% of respondents were from buy-side firms, 20% were from the sell side, and the rest hailed from exchanges, infrastructure companies and other industry firms.

[10] Those asset managers advised more than 3,000 mutual funds with assets under management exceeding $2.2 trillion. The survey results show that disagreements were routine among the asset managers.

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the distributed cognition framework, knowledge can be seen as a set of embodied material structures, which has important implications for how the identities of players in interactions are conceived (Herrmann-Pillath, 2012, p. 23).

However, it can be predicted that the more the cognition is distributed to material artefacts, the less human interactions. Then, the distributed cognition perspective implies not only the importance of distributed cognition to each actor in a specific task or activity, but also the ambiguity of the boundary demarcating a unit or a group of distributed actors. How do we synthesize those independent distributed actors and artifacts? This issue is elaborated from a different social perspective in the next section.

Collective Commitment of Professional Actors in Financial Market

We-mode Concept and Collective Commitment

As tasks and activities are conducted by distributed actors and devices, various boundaries demarcate the groups and units (e.g., the organizations or groups of professional individuals) conducting the tasks or activities; such boundaries can be drawn between individuals, organizations, industries, and markets. A social point of view on a group action provides a useful framework for grasping it. According to Tuomela (2007), "An action is an action as a group member if and only if it is collectively accepted by (or is collectively acceptable to) the group members as an action promotes, or is at least weakly conducive to, the satisfaction and maintenance of the ethos of the group, and where the ethos is at least a partial reason for the action in question" (pp. 22-23). For example, a business (corporation) is regarded as an example of an organization of group members: "An organization has a certain ethos, basic goals, values, standards, and so on" (Tuomela, 2007, p. 43). A group can be viewed as in "we-mode," if its members (or a substantial number of them) collectively construct (or interpret) the group in we-mode terms (as in the phrase "this is our organization and we are working together as a unit").

However, as this perspective of we-mode group action is all-inclusive, this study especially focuses on the concept of collective commitment in Tuomela's theory. He argues that "the notion of collective commitment that is part and parcel of the we-mode can be regarded as central 'glue' in social life" (Tuomela, 2007). This notion concerns the group members' collective binding of themselves to, for example, an idea, action, or the group itself. In its weakest form, collective commitment is "group-socially" normative rather than properly (substantively) normative: normative in a moral, legal, or broadly prudential sense. Tuomela (2007) repeatedly emphasizes the necessity of collective commitment in group action as follows: (1) group membership in a group functioning as a group requires collective commitment; (2) group identity in a group functioning as a unit requires collective commitment; (3) a group functioning as a group requires collective commitment; and (4) group responsibility requires collective commitment.

This conceptual reasoning seems somewhat circular, and the content of collective commitment depends on the type of a task, the group members and their real-world characteristics. Nevertheless, Tuomela's argument implies that collective commitment must be at least shared by the distributed actors in a unit or a group. And the point can be further considered through the views in Styhre (2011) on knowledge sharing among professional actors. For instance, those involved in a complex FVA tend to have at least some professional identity as well as technical knowledge of finance and accounting.

Here, it is also important to note that only human actors can share collective commitment; it is a mental process, and, although some embodied artifacts and devices can evoke a collective commitment among distributed group members, these material things by themselves are not agencies with the capacity to share the collective commitment.

Collective Commitment of Professional Actors in the Context of FVA

Styhre (2011) observes that the professions are increasingly being oriented towards market-based activities. In a sense, professional knowledge is now evaluated by its market value, as happens in financial markets. For example, as valuation tasks in investment banks and consulting (or accounting) firms are highly sophisticated, the annual salaries (and bonuses) in those industries have been significantly higher than those in others. However, the excessive marketization of professional knowledge causes fierce competition, leading to the specification and distribution of the application of complex financial knowledge such as for the valuation of innovative financial instruments.

Professionalism operates primarily on the basis of daily norms and values, which guide activity and regulate the boundaries of what is professionally legitimate (Styhre, 2007, p. 29). Although some professionals have no formal professional association or organization, they use many techniques, technologies, means of inscription, regimes of representations (both numeric and symbolic), narratives and embodied communication modes (Styhre, 2011, p. 79). In the face of complicated financial instruments, finance professionals, given the limited memory and computational capacity of the human brain, must develop and acquire systematic ways of making sense of markets that reduce this complication (MacKenzie, 2009).

In addition, professionals commonly acquire professional identities and legitimacy which derive from the capacity to participate in thoughtful and purposeful knowledge sharing. This also applies to the professionalism of financiers (Styhre, 2007, p. 165) since they often deal with cutting-edge innovative financial instruments. They need to establish routines and mechanisms for knowledge sharing that both construct meaningful professional identities and circulate know-how among professionals. The core of the professional identity is both consisted by and constitutive of "relational identity" that is produced on the basis of interaction between social groups (Styhre, 2011, p. 114). For example, such a relationship is salient when professional traders and accountants measure the risk of a transaction. "The choice of models by a bank's front-office traders and quants is constrained by the models employed by the bank's accounting and risk control divisions (MacKenzie & Spears, 2013).[11]

In the collaborative knowledge sharing within the FVA process, the moral obligation which is derivative of the intersubjective relationships characterizing the members of a given community (Shearer, 2002) is necessary. Thus, the professional actors in the FVA process need to consider ways of making their economic institutions more responsive to the other, by recognizing the obligation to "the other" (Sharer, 2002). Sharer's argument and its emphasis on the concept of "the other" imply that finance professionals should acknowledge an obligation derived from "the other" (Okamoto, 2011). Finance professionals should have a kind of feeling for "the other" who wants to, at the very least, sustain a stable market and prevent a tragic crash.

Based on this conceptual analysis, the next section focuses on the actual financial valuation process in investment companies. As Kaplan (2012) implies, it is now more important than ever to pay attention to the peculiarities of FVA practices for complex financial instruments. Though the main purpose of this paper is a conceptual analysis, it is also useful to link

[11] Employing a model that is too different from that used by the accountants imperils 'Day 1 P&L', in which the present value of the anticipated future income stream of a trade is credited to the trader at the time at which the trade is entered into ('P&L' is the acronym of profit and loss), while use of a model that differs too radically from that used by a bank's risk controllers threatens the capacity to do the trade at all. (MacKenzie & Spears, 2013)

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that conceptual analysis with actual practice. The next section draws on several information sources to capture the reality of accounting valuation. A legal case concerning valuation in the midst of recent financial crisis is analyzed, as FVA (or its ambiguous inputs) can be at its most important in an unusual condition, and the available legal documents offer detailed glimpses of the reality.

The Cases of Actual Valuation Practice

Knowledge Sharing among Professionals in FVA

The FVA of financial instruments offers many knowledge sharing opportunities among professional financial market actors. Some funds have explicitly stated that they marked bonds at mid-market prices (i.e., the average of the bid and ask prices; Cici et al., 2011, p. 215). One survey found the following:

> *One sign of the industry's focus has been its use of the price challenge process. Approximately 97% indicated that they have challenged the valuations by the primary pricing vendor. Almost 34% have been issuing price challenges daily. The rise of the price challenge process is not unusual given the volatility and uncertainty in the investment marketplace and the general strengthening of fund policies and procedures. Fund groups are more successfully teaming within their organizations, sometimes on a daily basis, to assess valuations provided by others using traditional and newly developed internal tools. The challenge process and questions asked have become routine (Deloitte, 2010, p. 2).*

The term "price challenging" refers to a disagreement between an asset manager and his or her external pricing vendor. As mentioned, requesting external vendors to offer pricing services in the FVA process is now quite common. Occasionally, the marks used for pricing some complex and thinly-traded financial instruments are markedly different among valuers, which could create conflicts among them. Consequently, many financial institutions and funds are using valuations by external professionals, and price challenges occasionally erupt in some funds.

As another example, a consulting company's 60-page white paper (Rothstein Kass, 2013) includes a section, "Management Responsibility for Valuation Inputs Developed by Third Parties," in which it is proposed that the management should fulfill responsibilities concerning the use of third party information in FVA, such as learning the third parties' overall and security–specific methodology and ensuring their conformity with the governing documents and the current US GAAP. Comparing the prices of alternative service providers, evaluating the specialists' credentials, and reviewing the valuation report are necessary for the management to determine whether the appropriate valuation inputs were used and the proper valuation technique(s) were applied.

In summary, both the price challenge and the due diligence in calculating fair values represent the ways of knowledge-sharing among professional valuators, which contributes to sustaining the collective commitment among professional actors in financial markets. However, it is assumed to happen in a usual market condition. In other words, it may not be the case in unusual market turmoil.

Lack of Collective Commitment in an Unusual Market Condition

In an unusual market condition, professionals in investment banks (and funds) do not appear to share collective commitments easily. This section analyzes the valuation of the collateralized debt obligation (CDO) and credit default swap (CDS). These financial instruments have drawn much attention since the financial crisis began. The quotation below indicates how traders in a hedge fund valued CDOs and CDSs whose fair market value was not easily available.

A CDO is an investment in a bundle of fixed income securities. The investor in a CDO is betting that the underlying securities will generate revenue. Most CDOs are structured as multiple "tranches" with various levels of risk. The riskier tranches incur the initial losses and have a higher rate of return, while the less risky tranches have a lower rate of return because they incur losses only after the liability of the riskier tranches has been exhausted. A CDS is a security that provides insurance on the default of asset-backed securities.

The SFAS 157 states that it is possible to obtain an instrument's fair value as the average of others' estimates of similar assets (FASB, 2008, C91). However, the following has also been argued in a nonfiction book:

> *The way hedge funds-such as those run by Cioffi and Tannin[12] —are required by the Securities and Exchange Commission to value the securities they own is pretty arcane. But it is based on the idea of taking an average of the prices other Wall Street firms and other traders are finding in the market for similar securities, most of which are thinly traded from one firm to another and are rarely traded by retail investors or on exchanges, as with stocks. With these illiquid securities, hedge-fund managers had to wait until the end of each month to get the marks from other brokers and dealers, and then average them, and then report the "net asset value," or NAV as it is known on Wall Street, to investors (Cohan, 2011, p. 548).*

The author then reveals how FVA was being performed at the beginning of the financial crisis.

> *A week later, "knowing full well we've published our NAV," according to this executive, Goldman Sachs sent, by e-mail, its April marks on the securities to Cioffi. "**Now** there's a funny little procedure that the SEC imposes on you, which is that even if you get a late mark, you have to consider it," he said. "Suddenly we get these marks. Except these marks are not marks from ninety-eight to ninety-seven. They go from ninety-eight to fifty and sixty. Okay? You get it? They give us these fifty and sixty prices. What we got from the other counterparties is ninety-eight. The SEC rules say that when you do this, you either have to average them—but they're meant to be averaging ninety-sevens and ninety-eights, not fifties and ninety-eights—or you can go and ask if those are the correct marks (Cohan, 2011, p. 549).*

In the situation described above, Goldman likely expected that the related illiquid mortgage market would continue to decline, and thus was selling or shorting those securities (The Financial Crisis Inquiry Commission, 2011, p. 236). Actually, unlike most other banks, Goldman hedged or liquidated its ABS (asset backed securities) and ABS CDO positions several months before the crisis (MacKenzie, 2011, p. 1832). Thus, "Goldman has been criticized—and sued—for selling its subprime mortgage securities to clients while simultaneously betting against those securities." A structured finance expert…reportedly called Goldman's practice "the most cynical use of credit information that I have ever seen" and compared it to "buying fire insurance on someone else's house then committing arson" (The Financial Crisis Inquiry Commission, 2011, p. 236). Here, the purpose of this study is not to debate if Goldman was acting ethically and legally but rather to understand that Goldman recognized the impairment of financial instruments before others had shared that information. How was that possible? A recent legal action (complaint) of Basis Yield Alpha Fund against Goldman Sachs & Co and affiliated companies can provide useful clues.

In October, 2012, New York Supreme Court Judge Shirley Werner Kornreich partly denied Goldman's motion to dismiss the suit, dropping the breach of contract and breach of the implied covenant of good faith and fair dealing claims made by plaintiff Basis Yield Alpha

[12] These individuals (Matthew Tannin and Ralph R. Cioffi) are former Bear Stearns hedge fund managers who managed sub-prime-laden hedge funds (the Bear Stearns High Grade Structured Credit Strategies Master Funds Ltd and the Bear Stearns High Grade Structured Credit Strategies Enhanced Master Funds Ltd). They were arrested on June 19th in 2008 but later found not guilty of misleading investors about the risks involved in the sub-prime market.

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Fund (BYAFM), but retaining other claims including those for fraud, fraudulent inducement, and fraudulent concealment.

Basis Yield Alpha Fund brought an action against Goldman Sachs & Co. and affiliated companies ("Goldman") for knowingly making materially false and misleading statements and omissions in connection with the sale of a security issued by a CDO based upon subprime residential home mortgages, known as Point Pleasant 2007-1 Ltd ("Point Pleasant"), and the entry into two CDSs that referenced AAA and AA rated securities from a similar CDO known as Timberwolf 2007-1, Ltd ("Timberwolf"). Goldman began to market and sell the Point Pleasant and Timberwolf securities in the first quarter of 2007. Within weeks of BYAFM buying these securities, they rapidly declined in value, as the defendants knew and intended they would. Why Goldman could promptly recognize the decline of value in those complex financial instruments backed by mortgages (of Point Pleasant and Timberwolf) and how it obtained the inside mark are described below (following the order of paragraphs in the documents[13]):

The market for securities based on subprime residential mortgages as it existed during the timeframe relevant to this dispute was highly complex, opaque, and concentrated. Only a few investment banks were significant issuers or traders in this market, which was characterized by illiquidity and a paucity of publicly available information. Goldman was a central participant in this market and was intimately involved in all phases of it, including working closely with banks and other lenders who made high-risk mortgage loans in the first instance, working with syndicators in bundling mortgages into RMBS (residential mortgage backed securities), creating and marketing both cash and synthetic CDOs, providing information to rating agencies to secure ratings on the securities it was offering and monitoring the performance of the securities and their constituent underlying securities post-issuance. As a consequence, Goldman was one of a very small group of market participants to have and acquire information about the current value and outlook for RMBS and CDO offerings (para. 21).

Goldman and the other investment banks exercised substantial control over the flow of information, including pricing information, about these RMBS and CDO securities. As a result, the investors in the RMBS and CDO securities relied heavily on and reasonably expected the investment banks, such as Goldman, to provide truthful and complete information about the RMBS and CDO securities and the pricing and market for these securities (para. 22).

Thus, the buyers of those esoteric securities (customers) had to trust highly sophisticated investment banks. Actually,

As the underwriter and sponsor of these securities, Goldman had far superior knowledge to BYAFM about the quality, value, pricing and likely performance over time of Point Pleasant and Timberwolf, as well as the criteria by which the underlying and reference securities on which these offerings were based were selected, information that was largely unavailable to BYAFM (para. 23).

Moreover,

On March 8, 2007, Daniel Sparks, the head of the Mortgage Department at Goldman, gave, in an internal Goldman e-mail, a lengthy statement of his views on RMBS. He referred to the Timberwolf deal, which at that point had not yet been issued, as one of Goldman's "most risky" CDOs. He reconfirmed Goldman's anticipation of a "dramatic credit environment downturn" and reiterated that Goldman is "still net short" (para. 34).

Goldman knew that the resulting Point Pleasant and Timberwolf securities were of much lower quality and value than represented. Goldman knew this because of its own due diligence investigations and the due diligence investigations, performed for Goldman's benefit but not for disclosure to customers Goldman was soliciting, by outside firms like Clayton Holdings, Inc. ("Clayton"). In addition to arranging CDOs, Goldman was also directly involved in acquiring or originating mortgage loans and then assem-

[13] It can be downloaded at: http://www.pf2se.com/pdfs/LitigationCases/basis%20v%20goldman.pdf (accessed 11 September 2013).

bling, creating, and marketing RMBS that were backed by pools of these loans. As a direct result of this role, Goldman acquired a great deal of non-public detailed information about the quality or lack thereof of the mortgages that backed the RMBS. This information was highly material to assessing whether the RMBS would either perform as expected, or instead would fail to meet expectations and even go into default. Equally, this information was highly material as to the expected performance and risk of CDOs constructed out of these RMBS (paras. 131-133).

Goldman, either directly or through a third-party due diligence firm, routinely conducted due diligence review of the mortgage loan pools it bought from lenders or third party brokers for use in its RMBS securitizations. Thus, Goldman, including Sparks, had access to detailed non-public information concerning the true quality of the loans collateralizing the RMBS securitizations it sponsored. Goldman retained third-party due diligence providers such as Clayton to analyze the loans it was considering placing in its securitizations. Throughout 2006, Goldman was Clayton's largest client. For each quarter of 2006, and for the full year, Clayton reviewed more loans for Goldman than for any other investment bank. Clayton told the New York Attorney General "that starting in 2005, it saw a significant deterioration of lending standards and a parallel jump in lending expectations." As a key client of Clayton, Goldman had access to non-public reports and data by Clayton showing this significant deterioration. Clayton's reports to Goldman were confidential, and were not shared with purchasers of RMBS or CDOs underwritten and sold by Goldman. Nor were the reports shared with BYAFM. Documents released by Clayton confirm that Goldman was aware of the weakness in the loan pool and in the underwriting standards of the originators it used in its RMBS transactions (paras. 138-142).

According to MacKenzie & Spears (2013, p. 32), Goldman (or perhaps Clayton)'s modelling of CDOs used estimates of default probabilities and correlations based on patterns of market prices, not, e.g., the historical records of mortgage defaults used by other banks and by the rating agencies. They say it partly accounts for Goldman's decision to exit the subprime market (and indeed to 'short' it) as market conditions began to deteriorate late in 2006, a decision that made it possible for Goldman to survive the crisis financially almost unscathed.

Although this situation might have been an exceptional circumstance at the beginning of the financial crisis, it indicates that information and the due diligence useful for estimating the price of hard-to-value securities was not shared but was limited to a small number of market actors or was distributed unevenly. The information that Sparks (and Goldman) and Clayton had at the beginning might have been close to the fair value of those securities. It is nevertheless difficult to accept that relevant information remained confidential within only a couple of organizations rather than being widely distributed among market professionals, indicating insufficient collective commitment and knowledge sharing among professionals. Since Goldman and the other investment banks exercised substantial control over the flow of information in the market (para. 21), the knowledge of the securities should have been shared with other market participants. Did they actually care "the other" market participants? This case indicates an unexpected consequence of distributed FVA in an unusual market condition. Relevant and critical information was not shared by most professional market participants.

Concluding Remark

Subjective FVA is still controversial despite its significant impact on economy and society. However, as financial innovation progresses, financial intermediaries such as investment banks have become a driving force for the development of the financial market, and their innovative financial instruments often entail complexities and opaqueness. To cope with these aspects, flexible FVA standards were developed and the valuation process is now distributed

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among many professional actors. Even though the FVA process is distributed among multiple organizations and individuals, those with professional financial knowledge of financial markets at least share some degree of collective commitment as professionals. This study has attempted to identify the essence of the collective commitment. As Styhre (2011) and Shearer (2002) suggest, collective commitment among professional actors can consist of knowledge sharing among professionals with a feeling for "the other." Furthermore, an analysis of a case occurring at the beginning of the financial crisis showed that knowledge sharing was not enough, suggesting that, even in an unusual market condition, the FVA of financial instruments should be done by professionals who share a collective commitment to sustaining the market for the sake of other.

This argument is mainly based on a conceptual analysis and secondary information sources from fragmentary practical evidence. Although this study may have only weakly connected its significant concepts, its introduction of unique cognitive and social perspective should be beneficial to future interdisciplinary studies of finance and accounting.

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REPORTING DESIGN – A SYSTEMATIC LITERATURE REVIEW

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Abstract. *Due to the fact, that the quality of decisions is directly linked to the availability and the perception of information, its selection and representation are of major importance in business communication. The purpose of this paper is to identify the current status quo of existing research in the field of information design in business reports (reporting design) in order to cluster empirical contributions and to generate new findings. A systematic literature review consisting of 48 international studies published between 2003 and 2013 was conducted. The extended cognitive fit model from Shaft and Vessey (2006) serves as a research framework. The analysis of its four main perspectives: "External Problem Representation", "Internal Problem Representation", "Problem-Solving Task" and "Mental Representation" revealed the following eight literature streams: (1) Tables versus Graphs, (2) Analyses of annual reports, (3) Reporting Guidelines, (4) Knowledge and Skills, (5) Task Type, (6) Task Complexity, (7) Working Memory and Memory Affection, and (8) Information Overload. Based on this literature review a research agenda was developed.*

Key words: *Reporting Design, Information Design, Information Perception, Visualization, Tables and Graphs, Information Overload*

Introduction

The rate at which big data is generated in business is increasing exponentially (Gantz et al 2008 in Agrawala et al 2011; Mukherjee/Hahn 2007) whilst the techniques and methods for sorting and representing remain largely the same, resulting in a gap between presented and perceived information. The optimal selection and visualization of information has been proposed as one especially important perspective of representation in business reports conveying information targeted at managers and shareholders alike (Wong 2011).

When selecting the data, the amount of the information presented seems to be crucial when it comes to the ability of the human brain to fully perceive and process relevant information (Chandler/Sweller 1991). Too much data tends to have a negative effect on the ability to capture information and information overload can occur (Edmunds/Morris 2000). Sending signals to the reader by highlighting the message that should be transmitted by choosing to use graphs or tables, for example, rather than text for specific information, attracts the attention of the reader and therefore helps the processing of the presented material. This way of dealing with Information Overload is called Signaling and is used in business communications (Mayer/Moreno 2003).

Techniques of visualization then can support the human brain to deal with complex data (Heisters/Leu 2004). In total, 70% of our sensory receptors are used for visual perception. Therefore, our individual visual perception has a great influence on our business mindset and decision-making (Few 2006). An appropriate information design improves and accelerates the process of information perception and relieves its recipients cognitively (Beattie/John-Jones 1993). In view of the scope and the sustainability of decisions based on data, the economic leverage of an improved visualization, resulting in an improved perception of this information is fundamental (Hellbrück 2011; Peterson 1983; Beattie/John-Jones 1993; Schaubroeck/Muralidhar 1991).

As the conference call states, information as a prerequisite for rational decisions has become almost overly affluent - in terms of timeliness, scope and delivery. The quality of managers' and investors' decisions is directly linked to the representation of information: Information controls reaction (Weber et al 2008; Laux 2005). The following figure shows the causal link between information, perception and decision-making:

Figure 1: Information and Perception as a basis for decision-making (Source: Eisl et al 2012)

Information design in general means the focus on the fusion of content, structure, and appearance of documents. Data, statistics and images as its resources have to be organized and presented in an optimal way, so an efficient and effective understanding of the presented information can be achieved (McLaughlin 2009). Information design is applicable in a broad variety of scientific disciplines and therefore various definitions can be found (Carliner 2002). However, the specific application of information design in the field of business reporting lacks a definition. In this paper this specific field of research will be referred to as Reporting Design which focuses on the visualization of information in business reports (e.g. management and annual reports). Reporting Design aims at a recipient-oriented preparation of primarily quantitative information of reports for business owners, managers, shareholders, and other stakeholders. Tables, graphs and texts should be designed so that the perception of information can be as effective and efficient as possible. This effectiveness and efficiency of Reporting Design can be measured by the accuracy and speed at which information is perceived. (Eisl et al 2013)

Current studies provide evidence that management reporting strongly influences management decisions, but at the same time many recipients of management reports are only partly satisfied with the representation of the included information (Gleich et al 2007; Weber et al 2008; Eisl et al 2013). Yet this dissatisfaction of the recipients is in contrast to the intense effort dedicated to the preparation of management reports (Eisl/Mayr 2007; Schäffer et al 2012). Additionally, the contributors to these management reports face increasing uncertainty regarding the appropriate design of their reports. Esthetic and personal preferences, CI-specifications, utilization of software technology and temporal limitations in preparing the reports impact the idiosyncratic reporting design. As a consequence in current corporate practice, tables and graphs representing crucial information are prepared individually and inconsistently, preventing decision makers from focusing on the relevant data and potentially leading to wrong decisions. Ultimately this failure in information perception may even damage the companies' performance (Lurie/Mason 2007; Hummel 2007).

Empirical guidelines provided for a perceptually optimized reporting design could make a considerable contribution to increasing the effectiveness and efficiency in information processing of managers and external stakeholders.

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Purpose

In order to provide a solid foundation for subsequent empirical studies, the paper analyses and clusters extant literature on information design in the context of business reports. The paper therefore addresses the following research questions:

1. Which relevant topics within the subject of "reporting design" can be identified?
2. Which empirical approaches have been applied in empirical contributions in order to generate new findings?
3. What are the research opportunities and controversies identified by the authors?

A critical review of theoretical foundations as well as empirical research is employed to determine the current status of reporting design and reveal further research relevance. As the literature covering information design is substantial yet fragmented (Kelton et al 2010), applying a systematic literature review was chosen by the authors above other alternatives to answer the stated research questions.

Methodology

Systematic Literature Review

The guideline of Okoli and Schabram (2010) for conducting a systematic literature review provides the foundations of the research process. The review includes 48 studies published in journals listed in the Academic Journal Quality Guide or in the VHB-JOURQUAL list, derived from the databases "EBSCO Business Source Premier", "Sage Premier" and "Science Direct" from 2003 to 2013. This broad selection of databases and journals was necessary, given the broad scope of the topic and various contributing disciplines. The databases used, allowed a keyword search in the title or abstract of an article with the following keyword-strings: "information & presentation & format", "information & display", "table & graph", "reporting & design". This keyword search resulted in a total number of 26 peer-reviewed articles with a dominant focus on the addressed subject. According to Levy and Ellis (2006), doing only a keyword search is not enough to get a comprehensive list of studies. By applying keyword search as well as backward search, theoretical saturation should be achieved. Our backward search resulted in a further 22 articles included in this paper. Table 1 shows the derived 48 articles clustered by scientific discipline and applied research approach.

Table 1: Included articles by discipline and empirical approach

Discipline / Approach	Empirical Study	Empirical study & Experiment	Experiment	Literature Review	Total
Information Management	1		12	4	17
Accounting & Finance	1	1	8	3	13
Psychology			7		7
Other			8	3	11
Total	**2**	**1**	**35**	**10**	**48**

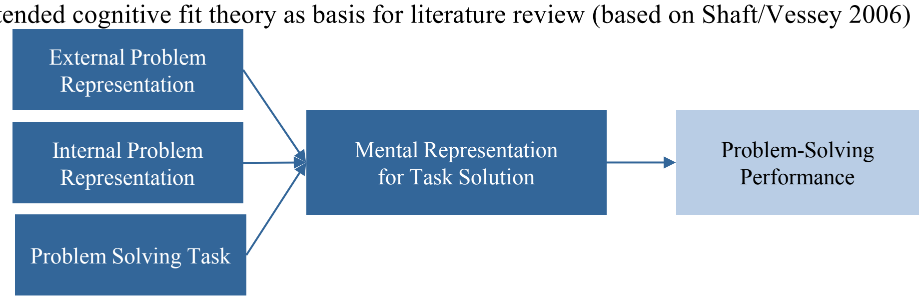
Analyses of the found literature show that the theoretical foundation for research was established in the 90s. By analyzing the references of the 48 chosen articles, it could be found that more than 80 % of the cited references are older than 10 years and that about 40 % is even older than 20 years. It could also be found, that the work of Iris Vessey in 1991, who developed the theory of cognitive fit in the context of choosing the right display format, was incorporated into the majority of the 48 identified studies. For that reason the theory of cognitive fit was also used in this study as the theoretical background and is explained in the next paragraph.

Research Framework

Similar to Dilla et al (2010) and Kelton et al (2010), the author applied the cognitive fit theory (Vessey 1991; Vessey/Galletta 1991; Shaft/Vessey 2006) as an underlying framework for the systematic literature review.

Vessey (1991) based the model of cognitive fit on the general model of problem-solving. The general problem-solving model understands the performance of problem-solving as a result of the interaction between the problem representation and the problem-solving task. The mental representation as the product of the combination of the problem representation and the solving task is the way the problem is represented in human working memory.

Figure 2: Extended cognitive fit theory as basis for literature review (based on Shaft/Vessey 2006)



The model of cognitive fit analyses information presentation modes (Vessey 1991). This theory extends this general problem-solving model by splitting the problem representation into the internal and external problem representation (Shaft and Vessey 2006). The interaction between the internal and external problem representation contributes to the mental representation for task solution. The external problem representation stands for the information presentation format and the internal problem representation stands for the individual's task knowledge (Kelton et al 2010). If the problem representation and the problem-solving task match each other, cognitive fit exists and neither problem representation nor solving task have to be transformed. Cognitive fit leads to consistent mental representation and therefore to an effective and efficient problem-solving performance. If there is a mismatch, the recipient has to transform either the data derived from the problem representation or the solution task. This causes increased cognitive effort and task time and decreased decision outcome (Vessey, 1991).

Limitations

To ensure theoretical saturation, the authors applied the backward search method in addition to the keyword search. Despite this fact, the authors cannot guarantee that all the relevant studies for answering the research questions have been identified. By failing to identify all relevant studies, important theories or models might not be incorporated into this review. By only including studies published in journals listed in the Academic Journal Quality Guide or in the VHB-JOURQUAL List, studies relevant to the subject not published in listed journals have not have been incorporated (Bryman/Bell 2011).

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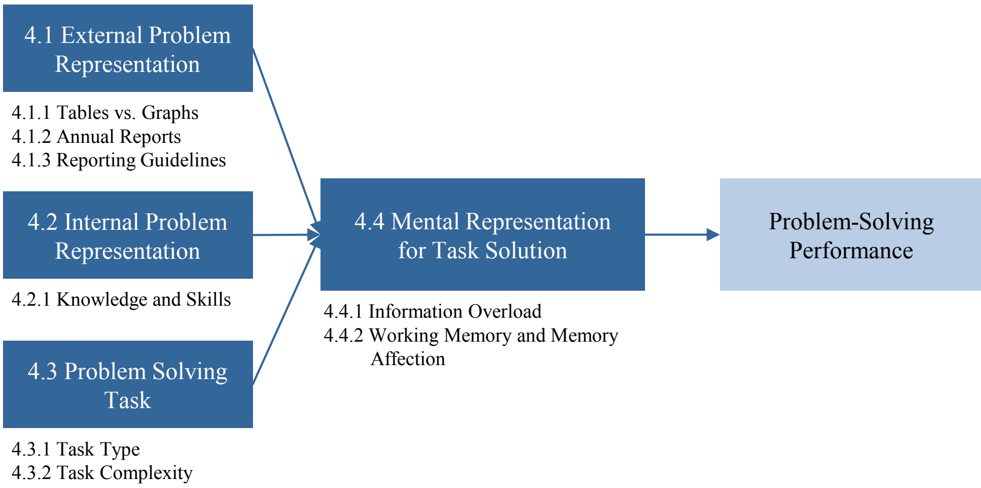
Findings

As previously stated, the extended cognitive fit model serves, on the one hand, as a research framework. On the other hand, it serves as a structure for the presentation of the findings of the research, clustering them in the four main perspectives “External Problem Representation”, “Internal Representation”, “Problem-Solving Task” and “Mental Representation”. Figure 3 shows the four major perspectives including eight identified research streams.

Figure 3: Structure of the literature review.



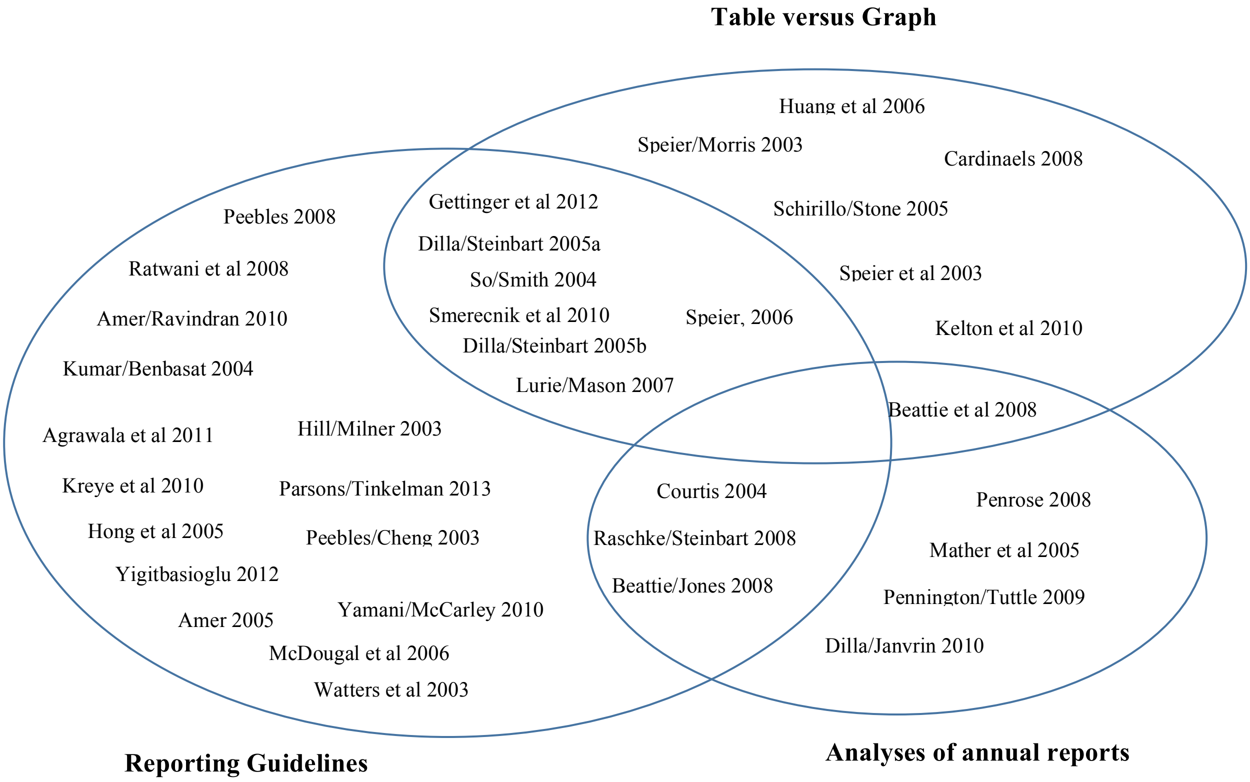
Perspective “External Problem Representation”

The external problem representation refers to the information display, i.e. which format best suits a given task (Kelton et al 2010). The literature review resulted in three main research streams, namely: (1) Tables versus graphs, (2) Analysis of annual reports and (3) Development of reporting design guidelines, which will be discussed separately in the following chapters.

Out of the 48 included studies, 36 studies deal with topics regarding external problem representation. The Venn diagram presented in

Figure 4 gives an overview of the incorporated studies and the distribution among the three streams. It shows a majority of studies in the cluster “Reporting Guidelines” and a major intersection with the cluster “Table versus Graph”.

Figure 4: Overview of incorporated studies (External Problem Representation) Tables versus Graphs



The most frequently used formats for displaying numerical information are tables and graphs (Smerecnik et al 2010). Choosing the right format, table or graph, is discussed extensively in the literature and each format tends to be better under certain circumstances. The pros and cons of these display formats are discussed in the following paragraphs.

By analysing various studies, Gettinger et al (2012) find that tables are qualified information displays when decision makers search for specific amounts, accurate values or compare data. Also Speier and Morris (2003) indicate that tables are effective for searching for specific details or to directly compare specific data attributes. On the other hand, tables do not display integrative information and the decision makers have to link the single data values by themselves to detect patterns or trends (Shah/Hoeffiner 2002, in Gettinger et al 2012;

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So/Smith 2004). This process of creating associations between data is time consuming and can lead to wrong decisions (So/Smith 2004).

Graphical displays provide an overview of the displayed information (Gettinger et al 2012) and lead to more intuitive and holistic processing (Holbrok/Moore 1981, Sloman 1996, in Lurie/Mason 2007). Research show that graphical information displays can reduce the cognitive burden and information overload (Miller 1956, Tegarde 1999, in Lurie/Mason, 2007; Moriarity 1979, Stock/Watson 1984, Wright 1995, in Cardinaels 2008). Graphs support the comprehension of large amounts of quantitative information and are more effective for detecting trends, patterns or time sequence data (Beattie et al 2008; Dickson et al 1986, Meyer et al 1997, Shah/Hoeffner 2002, Smelcer/Carmel 1997, Umanath/Scamell 1988, in Gettinger et al 2012). In addition, people are more likely to remember visual patterns than data presented in tabular form (Beattie et al 2008). Speier and Morris (2003) state that graphical displays may enhance the processing of large, complex data sets. Similarly, So and Smith (2004) find that the information presentation format has a significant impact on decision accuracy when complex information is displayed. Despite their positive features, graphs can lead to biased interpretations (Cleveland/McGill 1984, Krider et al 2001, Raghuber/Krishna 1996, Raghuber/Krishna 1999, in Lurie/Mason 2007).

By analysing various experiments following these rules for choosing the right display formats, it could be found that the studies tend to show inconsistent results. Beattie et al (2008) tested table-graphical-display combinations and they detect a tendency to pick graphs rather than tables but results show also a decline in accuracy. This is because the graphical display receives more attention which is even heightened when the graphical display uses colours (Beattie et al 2008; Lurie/Mason 2007). The experiment of Speier (2006), on the other hand, show a better result for simple-spatial as well as for complex-spatial tasks by using the graphical format, although participants receiving the tabular display had greater confidence in their solutions. In the field of risk management, graphical risk information attracts more attention than tabular and textual information displays (Smerecnik et al 2010). Gettinger et al (2012) find that the information presentation format does affect the negotiation processes.

11 out of 14 included studies about “tables versus graphs” refer to Vessey’s (1991) and Vessey’s and Galleta`s (1991) studies. This reveals that Vessey’s cognitive fit theory is widely applied and may be seen as an appropriate underling theory in this field. This suitability of cognitive fit theory, however, is not entirely undisputed. A few studies contradict this theory. Speier (2006) examines whether cognitive fit theory can be applied to more complex tasks, indicating that a match between task type and information presentation format may not always lead to the most effective and efficient problem-solving performance. So and Smith (2004) also found that on low information complexity, the information presentation format has no significant effects.

Analyses of Annual Reports

An important issue regarding annual reports is the presentation of important information and in this context the perception of the recipient (investor, bank, state etc.). Although accounting standards ensure that accounting numbers are unbiased and correctly displayed, the narrative section and especially financial graphs and other presentational formats are subject to little regulation and no official guidelines (Beattie et al 2008; Penrose 2008). The perception of graphical displays in annual reports can be manipulated through the selection of different graph types, colours, scales, emphasis, size or other modifications (Penrose 2008). Various research studies in the area of impression management state that graphs in annual reports are manipulated worldwide to display better results than the underlying data would permit (Beattie/Jones 2008; Pennington/Tuttle 2009).

Possible distortions affecting graphs are classified into three categories (Beattie et al 2008; Beattie and Jones 2008):

1. **Selectivity** meaning that companies choose whether they use graphs to present their financial information or not and what information should be presented.
2. **Measurement distortion** exists when the underlying data is not displayed in the same proportion in the graphical display.
3. **Presentational enhancement** exists when the design is used to enhance or disguise certain features.

According to Arunachalam et al (2002, in Pennington/Tuttle 2009), graphical distortions with the greatest impact are distortions involving the X- and Y-scales.

Beattie et al (2008) detect in their study of annual reports in the U.K. various ways of impression management. A selective displaying of graphed Key Financial Variables (KFVs) was used to conceal negative effects, like avoiding the display of the normal 5-year time series. Comparable evidence of selectivity of KFVs was revealed by Dilla and Janvrin (2010).

Pennington and Tuttle (2009) find that distorted graphs, despite the fact that all necessary information for detecting the distortions were provided, influence decisions, lead to incorrect conclusions and that these wrong interpretations persist in the reader's memory.

To measure graphical distortions, the two aspects of the magnitude and the nature (i.e. favourable or unfavourable) of the distortion have to be considered. The Graph Discrepancy Index (GDI) (Mather et al 2005) is a common measure that originates from Tufte's "lie factor" (1983, in Mather et al 2005) and compares the change in the displayed graph with the percentage change in the underlying data. The result quantifies the magnitude of the graph's distortion. According to Mather et al (2005) a measure for identifying and quantifying distortions must be robust. The GDI does not fulfil this criterion as a high or low GDI value is not always linked with a high or low visual distortion. This inconsistency is overcome by the Relative Graph Discrepancy Index (RGD) as a possible alternative (Mather et al 2005).

The use of different colours is an integral part of annual reports and internationally used as a component of visual rhetoric. Analyses of annual reports indicate that the use of different colours causes different judgements. Courtis (2004), however, states that there are no guidelines regarding how to use colours in annual reports.

A number of studies also argue for the need for guidelines regarding graphical display formats in business communication. Graphs are used as a tool for impression management, preparers as well as users would benefit from graphical guidelines (Beattie et al 2008; Dilla/Janvrin 2010; Raschke/Steinbart 2008). Guidelines could be published by standard-setting or regulatory bodies (Beattie et al 2008). Beside the question which format (table or graph) to choose, apparently there is also the question of how to use each format correctly.

Reporting Guidelines

The question is not whether the chosen format is eye-catching or not, but rather if the information display format and style have positive effects on decision making (Speier 2006). Guidelines which include appropriate standards for the design and which help to understand what graphical formats are best suited for certain strategies would help to increase competency in graphical design and would improve interpretive skills (Hill/Milner 2003).

As already stated above (in

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Figure 4), the subject "Reporting Guidelines" is also mainly addressed by the reviewed studies in the field of external problem representation (25 of 36 studies), reflecting the importance of this issue. There are guidelines dealing with the correct display of graphs, however, there is a lack of guidelines for tables.

Regarding guidelines for graphical displays, Hill and Milner (2003), suggest a three step approach for determining the best fitting graphical display:

1. **Aims and objectives of graphical display:** The purpose of graphical design influences, for example, the type of data displayed, the level of aggregation or the format. Data, displayed for internal receptors may be more detailed than data displayed for external ones. The different characteristics and level of knowledge has to be considered as well as the question if other display formats, for example tables, are more suitable (Hill/Milner 2003).
2. **Graphs Choice:** After determining the aims and objectives of the data display, the suitable graphical display has to be identified (Hill/Milner, 2003). In order to determine which graph is best suited, the task at hand has to be considered (Visschers et al 2009, in Smerecnik et al 2010), the nature of the phenomenon and the measurement scales or components (Hill/Milner 2003). Graphical systems are able to display these measurement scales by using different visual variables. According to Kumar and Benbasat (2004) by referring to Bertin (1981), there are eight visual variables: the two dimensions of the plane graph, the size, value, texture, colour, orientation and the shape of the graph.
   There is still no clarity as to which graphic type supports which scope of application best. According to Peebles (2008), data is displayed in bar charts or line graphs in different ways. Bar charts are most appropriate when displaying nominal data (Hill/Milner 2003). Bar charts are usually interpreted by their height, direct the attention to their separate values and are useful for comparing and evaluating specific quantities (Culbertson/Powers 1959, Zacks/Tversky 1999, in Peebles 2008). According to Visschers et al (2009, in Smerecnik et al 2010), bar graphs are best suited for depicting trends. Contrary to this belief, Peebles (2008) argues that line graphs are more suitable for identifying trends and according to Hollands and Spence (1992, in Hill/Milner 2003), both bar and line graphs, are adequate for displaying trends and changes in the data.
   Further graphical display possibilities which have been discussed in the included studies are the history and the negotiation dance graph (Gettinger et al 2012), pie charts (Penrose 2008), schematic faces (So/Smith 2004), kiviat (also spider, radar or star) graphs (Peebles 2008), small multiples (Parsons/Tinkelman 2013), 3D line graphs (Kumar/Benbasat 2004) and three point trend and fan diagrams (Kreye et al 2010).
3. **Graphical Design:** Arunachalam et al (2002, in Amer 2005) found that improperly designed graphs may affect recipients' choices. Therefore, authors (e.g., Bertin 1983, Kosslyn 1994, Tufte 1983, in Amer/Ravindran 2010) developed graphical display guidelines which should ensure that the information taken from the graphical display is consistent with the information which would be taken when analysing the data instead of the graphical display (Amer/Ravindran 2010).

The most important characteristics a graphical display should have are: clarity, simplicity, fidelity, accuracy, information impact and good design (Hill/Milner 2003). Understandability is generated by clear graphs, which show the essence of the results and include clear titles and labels for the axes (Cleveland 1985, in Hill/Milner 2003). Raschke and Steinbart (2008) argue that one of the most important guidelines for graphical displays is that the underlying data has to be represented correctly by the visual display. A clear, understandable title should be located at the top of each graphical display (Schmid 1983, Kosslyn 1989, in Beattie/Jones 2008).

Redundant visual variables like decorated frames or unnecessarily added 3D objects may also distort the attention paid to the displayed information (Tufte 2006, in Yigitbasioglu 2012).

Recommendations regarding colour use should enable users to easily distinguish visual clusters (use of spectral colour (e.g., rainbow colours) and avoidance of too many different colour codes) (Ratwani et al 2008). According to Curran (1999, in Hill/Milner 2003), no more than four colour codes should be used (Hill/Milner 2003). Too much colour use may distract the user and therefore can have negative effects on the decision making process.

Similar to graphs, different tabular display styles affect the decision making process (Dilla/Steinbart 2005b). Compared to graphical displays the optimal design of tables is barely reflected in the literature. The cognitive effort needed to evaluate and compare the same information displayed in separate lists is significantly higher than by displaying the information in tables with a matrix format (Dilla/Steinbart 2005b). By using the competition-for-attention theory, Hong et al (2005) describe these differences and impacts of matrix and listed formats in online shopping (Hong et al 2005).

Perspective "Internal Problem Representation"

The second research stream of the cognitive fit model "Internal Problem Representation" is represented by the discussion about knowledge and skills. The internal problem representation reflects the existing knowledge of the percipients, which can be used for the problem-solving process (Shaft/Vessey 2006). Seven studies (Cardinales 2008; Kumar/Benbasat 2004; Peebles/Cheng 2003; Raschke/Steinbart 2008; So/Smith 2003; Speier 2006; Yigitbasioglu/Velcu 2012) address the topic of knowledge and skills.

Carinales (2008) found in various studies that the level of knowledge and skills possessed influences how percipients process displayed information. Percipients with a higher level of knowledge are better in retrieving and searching for important data and may also derive better solutions. So and Smith (2003) found in their literature review that the different cognitive styles, abilities and personalities affect information processing and decision making. Furthermore, the level of knowledge influences the memory of the percipients (Cardinaels 2008).

Cardinales (2008) also shows in his review that percipients that exhibit more knowledge in a specific area tend to apply analytical processing to the displayed data. A more focused search enables them to distinguish the more important from the less important information. In addition to this, Benbasat and Schroeder (1977, in Cardinaels 2008) state that knowledgeable decision makers look for specific data and details. Contrary to this, less knowledgeable percipients access information through an overview of the displayed data. As a result, the different skills of decision makers result in different needs regarding the aggregation of the displayed data (Lederer/Smith 1988, in Yigitbasioglu/Velcu 2012).

Further research indicates that decision makers with little task-specific knowledge are greatly influenced by how the information is presented (Bonner/Pennington 1991, Chi et al

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1981, in Raschke/Steinbart 2008). When a graphical display format is familiar to the percipient, the user will be able to resort to previous learned strategies and retrieval processes. The way the information is obtained will therefore be more effective than for users unfamiliar with the display (Peebles/Cheng 2003).

Percipients processing knowledge about graphical design are able to use this knowledge to detect misleading graphs. They are also able to mentally change the misleading graphical display and thus obtain unbiased information (Kosslyn 1989, Shah/Shellhammer 1999, in Raschke/Steinbart 2008).

Perspective "Problem-Solving Task"

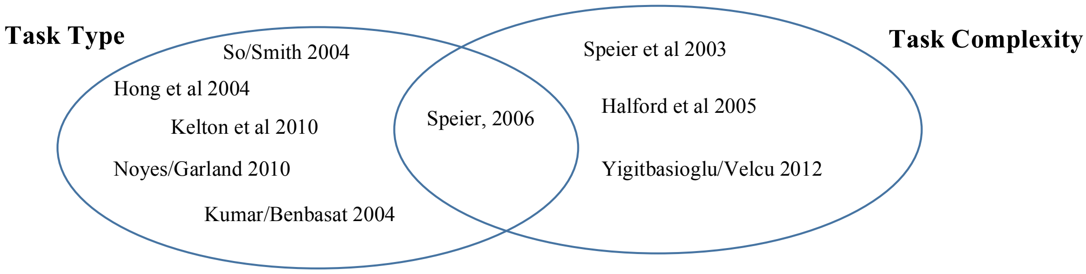
So and Smith (2004) state in their literature review that both task type and task complexity are seen as important factors in evaluating the suitability of certain display formats. The display format and the task characteristics therefore have to be taken into account. Vessey (1991) also states that an effective and efficient decision-making process can only occur when a match between the problem representation and the task exists (Vessey 1991). By citing De Sanctis (1984) and Libby and Lewis (1982), So and Smith (2004, p. 284) argue that:

> "The issue of task characteristics is, however, quite complex, given the variety of definition, interpretation and measurement, and the absence of a ready taxonomy of classification. Task characteristics have many dimensions, among them, those more commonly reported in the literature: task type and task complexity."

These two streams of discussion – task type and task complexity – are also represented in the analysed literature. In total, nine studies addressed the topics regarding problem-solving tasks. The Venn diagram (

) shows the incorporated studies and the distribution among these two literature streams.

Figure 5: Overview of incorporated studies (Problem-Solving Task)



Task Type

Speier (2006) analysed various studies and found that there might be a great consensus that the suitability of a certain information display format depends on the type of task at hand (for further evidence see also Kelton et al 2010; So/Smith 2004). There is not "one" definition or classification of task types. The authors of this paper therefore outline the different classification of task types identified in the analysed studies in an overview of all these classifications (2).

Table 2: Overview of Task Type Classifications

Author	Task Classification	Description	Suitable Display Format
Liberatore et al (1988,	Simple	n/a	n/a

in Kelton et al 2010)	Range	n/a	Tables
	Integration	n/a	Graphs
Amer (1991, in Kelton et al 2010; So/Smith 2004)	Integrative	Integration of multiple cues	n/a
	Selective	Examination of one single cue	Tables
Hard/Vanecek (1991, in Kelton et al 2010; So/Smith 2004)	Accumulation	Acquiring a single cue	Tables
	Recognition	Patterns or relationships between 2 or 3 cues	Tables & Graphs
	Estimation	Trends between numerous cues	Tables & Graphs
	Projection	Future values	Tables
Coll (1992, in Kelton et al 2010)	Relational information	Retrieval of relational information	Graphs
	Specific values	Retrieval of specific values	Tables
Greeno (1987, in So/Smith 2004)	Induction	n/a	n/a
	Transformation	n/a	n/a
	Arrangement	n/a	n/a
Tan/Benbasat (1991, in Kumar/Benbasat 2004)	Elementary	Extraction of single data point	n/a
	Advanced	Integration is needed, also trend or pattern identification	n/a
Vessey (1991); Vessey/Galletta (1991)	Spatial	Assessing the problem as a whole	Graphs
	Symbolic	Precise data values	Tables
Hong et al (2005)	Searching	Looking for specific product	Listed Format
	Browsing	Looking for potential products	Matrix Format
Larking/Simon (1987, in Speier 2006)	Information acquisition	n/a	Graphs

Although the analysed studies use different terms for task classification, similarities between the recommendations of the most suitable information display format can be identified. A widely used distinction is the identification of single cues versus the evaluation of multiple cues (e.g., pattern or trend identification). There seems to be consensus that for single cue evaluations, tables are the most appropriate display format, whereas for the processing of multiple data cues, graphs or both graphs and tables are recommended (Coll 1992, in Kelton et al 2010; Amer 1991, Hard/Vanecek 1991, in Kelton et al 2010; So/Smith 2004; Vessey 1991; Vessey/Galletta 1991).

Task Complexity

The complexity of a task can be classified into objective task complexity and experienced task complexity (Bonner 1994, Campbell 1988, Wood 1986, in Speier 2006, p. 1117):

> *"Objective task complexity has been conceptualized and operationalized in a number of ways, however, there is a consistent belief that task complexity is: (1) a function of the number of distinct information cues that must be processed; (2) the number of distinct processes that must be executed; and (3) the relationship (i.e., interdependence and change of time) between the cues and processes."*

Experienced task complexity is a product of the interplay between the task and the characteristics or the cognitive skills of the percipient (Campbell 1988, in Speier 2006). As the complexity of a task increases, the cognitive load and the required mental attention become higher (Baecker et al 1995, in Speier 2003). Speier (2006) presents a model including four task types used for different levels of complexity:

1. **Simple tasks** which require very low cognitive processing (Speier 2006).
2. **Feasibly solvable tasks** with relatively low objective complexity. A decision maker possessing the right knowledge and given the time needed would be able to reach an optimal decision outcome (Paquette/Kida 1988, in Speier 2006).

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3. **Trade-off tasks** reach a level of complexity where decision-makers try to reduce the cognitive burden (Ho/Weigelt 1996, Hohnson/Payne 1985, in Speier 2006). Such strategies for reducing the cognitive workload can reduce accuracy and may negatively affect the decision outcome. Decision makers reducing cognitive burden, may however, be satisfied with non-optimal solutions (Paquette/Kida 1988, Payne et al 1988, in Speier 2006).
4. **Limiting tasks** possess a very high task complexity and the necessary cognitive processing is likely to exceed the abilities of the percipients. Such tasks will therefore either not be completed or a solution is derived by guessing (Johnson/Paynes 1985, Te'eni 1989, Vessey 1994, in Speier, 2006).

Halford et al (2005) examined the concept of complexity by adjusting the variables depicted in a graphical display. In order to assess the given task, all variables had to be integrated. In their study they found that the accuracy and speed were heavily affected when the variables were increased from three to four, the increase to five variables could only be evaluated by guessing (Halford et al 2005).

The way information is displayed can mitigate the problems caused by complex tasks. Furthermore, information should be visualised in a way that helps to focus on the relevant information (Yigitbasioglu/Velcu 2012).

Perspective "Mental Representation"

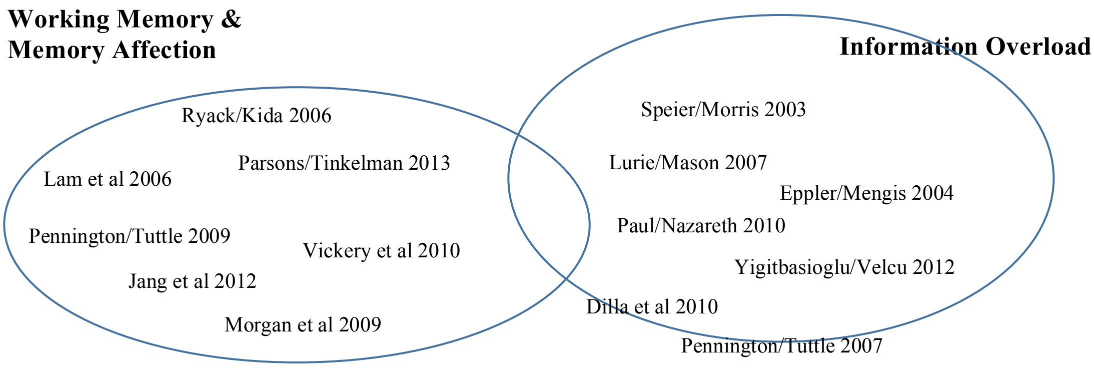
> "The mental representation is the way the problem is represented in human working memory." *(Vessey 1991, p. 221)*

It is affected and formulated by the characteristics of the three remaining factors of the cognitive fit model and thereby influencing the problem-solving performance, namely the external problem representation, the internal problem representation and the problem-solving task (Shaft/Vessey 2006).

Again two streams of discussion – "Working memory & memory affection" and "information overload"– are represented in the analysed literature. 14 studies were incorporated into this section of the literature review, displayed by a Venn diagram in

.

Figure 6: Overview of incorporated studies (Mental Representation)



Working Memory & Memory Affection

Users often need to recall financial information for making decisions. This is the case when information is no longer available. But even if information is at hand in one display format, percipients have to recall and transfer it to another format. Percipients may be more familiar with another display format or they currently work with another format (Ryack/Kida 2006).

Ryack and Kida (2006) found that memory improves when the conditions of information retrieval are similar to those for encoding. Recall of information may be enhanced by applying standardised presentation formats.

For decision makers the comparison between different information variables is easier when they are displayed in close proximity. This is the case because of the limitations of the short-term memory (Parsons/Tinkelman 2013). Zach et al (1988) cited in Pennington and Tuttle (2009) found, for example, that short delays in viewing information are already enough to affect decision making and outcomes. Similar, Jang et al (2012) found that a stacked display of information leads to slower processing, as it becomes harder to integrate data.

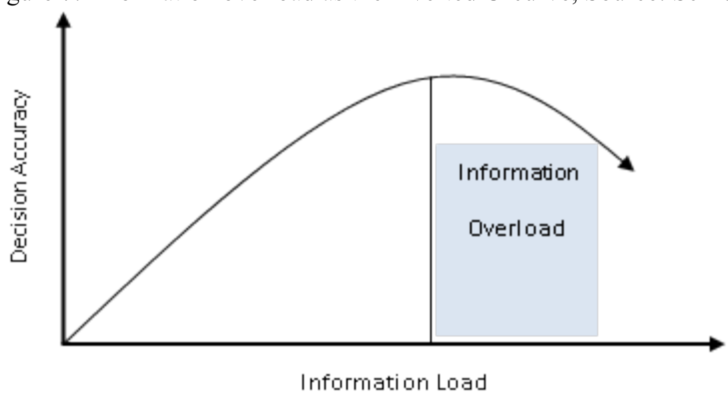
Percipients remember the basics of a displayed graph more easily while specific details of a graphical display tend to decay over time (Pennington/Tuttle 2009). Pennington and Tuttle (2009) find evidence that distorted graphs lead to biased decisions and that these errors persist in memory. The effects of distorted graphs were further increased when the percipients had to rely on their own memories. The findings also indicate that the effect of distortions on memory is dependent on the type of distortions employed (Pennington/Tuttle 2009).

Information Overload

In today's business environments, companies generate and deal with extensive amounts of data. This is caused by advances in information and communication technology (Dillon 2000, in Speier/Morris 2003; Yigitbasioglu/Velcu 2012). As a result of this vast amount of data, decision makers are often unable to comprehend all of the information provided and do not realize their beneficial impact on decisions (Farhoomand/Drury 2002, Lurie 2004, Schwartz 2004, in Lurie/Mason 2007). Additionally, this large amount of information might lead to inaccuracy (Paul/Nazareth 2010) and is further heightened by poorly designed management reports (Yigitbasioglu/Velcu 2012). This problem, which arises when the mental capacity for processing the displayed information is exceeded by information-processing demands (Schick et al 1990, in Pennington/Tuttle 2007) is generally referred to as information overload.

Performance is usually positively affected by the amount of information provided. If a certain point is crossed, however, performance will be affected negatively (Chewning/Harrell 1990, in Eppler/Mengis 2004). This effect is illustrated by the inverted U-curve (Figure 7), developed by Schroder et al (1967, in Eppler/Mengis 2004).

Figure 7: Information overload as the inverted U-curve, Source: Schroder et al (1967, in Eppler/Mengis 2004)



Paul and Nazareth (2010) summarise review the factors leading to information overload in their literature which are: the number of information cues, the diversity of information, the task, task interruptions and non-routine tasks and time pressure. Eppler and Mengis (2004)

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also provide an overview of the main reasons for information overload. The overarching factors are information, the percipients, the task, the working structures and the way information technology is used or not used. They also state that information overload is mostly a result of the interaction of all of these factors.

Eppler and Mengis (2004) also summarise a list of effects occurring because of information overload: Percipients may have problems in assessing the most important information, only take a certain amount of information into account and the process of decision-making is affected regarding both time and decision outcome. They also divide possible countermeasures into categories regarding the information (e.g., visualization, display format or aggregation), the individual level (e.g., the percipient), organizational design (e.g., collaborative work), processes (e.g., standardization) and information technology (e.g., information management systems).

Interactive visualisation tools help to deal with large and complex data sets (Dilla et al 2010). According to Dilla et al (2010), more and more companies are using interactive visualisation tools both for internal and external information display.

Summarizing the perspectives

Based on the relevance, range and depth of the analysed literature our findings can be distilled into the following propositions:

1. Reporting Design is an important area of research.
   This can be seen by the fact that
   - information presentation has an impact on decision accuracy when complex information is displayed (Yigitbasioglu/Velcu 2012).
   - display format and display style affect the decision making process (Speier 2006).
   - information presentation affects the negotiation process (Gettinger et al 2012).
   - distorted graphs lead to incorrect decisions and these conclusions persist in memory (Pennington/Tuttle 2009).
2. The suitability of a design depends on the task and the knowledge and abilities of the decision maker.
   a) The problem-solving task, meaning task type and task complexity, impacts information processing and its task classification distinguishes in literature
   Task types are categorized in different ways and are divided into broad categories (e.g. Vessey 1991: spatial tasks – use graphs, symbolic tasks – use tables). Related to the practical application these broad categories are highly questionable.
   The complexity of design leads to difficulties for the decision makers. Graphs should not include too many variables. As the number of displayed variables rise, information processing gets harder. When processing four variables in one display, the limit of human processing capacity is reached therefore, relevant information should be highlighted for the recipients.
   b) Knowledge and personal abilities influence the processing of information.
   Cognitive styles and personalities have an impact on the process of information perception. Individuals with higher levels of knowledge show improved information processing abilities. They tend to look for specific data and details, detect distortions and therefore make better decisions. Decision makers with less know-how are more strongly affected by the way information is processed. Although this affect can be reduced by training, it cannot be completely avoided.

3. Impression management is widely used for presenting key financial data and can lead to wrong decisions.
   Worldwide, graphs in annual reports are manipulated to display better results than the underlying data would permit. Distorted graphs influence decisions, lead to incorrect conclusions, and these wrong interpretations persist in memory. A number of studies argue for the need for guidelines regarding graphical display formats in business communication.
4. Information overload literature focuses on theoretical concepts and the identification of countermeasures. However, these theoretical concepts are not entirely empirically tested.
   It is a well-known fact that the decision making ability is initially enhanced by increasing information, but from a certain point onwards performance decreases with a further increase of information (concept of the u-curve). But no empirical method for an exact determination of this turning point was detected within the analysed studies.
5. Reporting guidelines can increase the effectiveness and efficiency of information perception and reduce information overload as well as perception illusions.
   a) Guidelines for graphical display: The most important characteristics a graphical display should have are: clarity, simplicity, fidelity, accuracy, information impact and good design (Hill/Milner 2003). Related to the specific design of these design elements, a number of questions remain unanswered and statements of authors often diverge.
   b) Guidelines for tabular display: The literature focuses more on the design of graphs than on the design of tables resulting in few guidelines for tables being available.
   c) Standardization and Condensation: The standardization and condensation of information help recipients of business reports to recall information within the decision making process. As widespread information causes a slower processing of information, different information variables should be displayed in close proximity.

Conclusion and further research

The aim of this article was the identification of relevant topics and research opportunities regarding the subject of Reporting Design. Therefore a definition of reporting design was established. Based on this definition and related key words 48 peer-reviewed articles could be identified and incorporated in the literature review. These papers were clustered by scientific discipline and empirical approach. The selected literature was structured according to the four main perspectives of cognitive fit theory which seems to be firmly established in the subject of information design. Due to the relevance, range and depth of the literature, five main propositions were deducted.

Although there has been a lot of research in the past, there are still questions left unanswered regarding the field of Reporting Design. Based on the propositions of this paper the authors suggest the following further research activities:

Development of an empirically validated design concept

The literature review shows that – as already stated by Meyer and Speier in 2006 – no generally accepted reporting design guidelines exist. Recent research activities focused solely on the discussion of table versus graph and on questions related to the best type of graph (primarily line-versus bar graph) and the design of certain elements (e.g. use of colours, reference lines in diagrams, etc.). However, there is a lack of an empirically validated and generally accepted design concept. As authors recommend various distinct design elements, further validation is necessary. Additionally, a need for further research activities in the fields of information perception and commenting can be deduced. Another field of interest is the

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combined use of graphical and textual information displays for percipients (Lurie/Mason 2007). According to Speier (2006), research should not only focus on "graphs versus tables". Research should also evaluate the effectiveness of other visualizations (Speier 2006). In this context we recommend a qualitative study, addressing the identification of relevant test objects by experts.

To determine if the dominant reading direction affects which part is first addressed, the results should be verified with participants applying a right-to-left reading pattern (Lam et al, 2007).

Further verification and expansion of findings of the cognitive fit theory

Although the underlying cognitive fit theory is well established and recognised, additional findings suggest further research activities, especially in the fields of task type and task complexity. Speier (2006) indicates that cognitive fit theory and the match between task type and information presentation does not always lead to the most effective decision processes. As complexity of symbolic tasks increases, a certain point will be reached at which symbolic complex tasks are no longer best supported by symbolic display formats. In addition to this, studies have shown that not only the display format (i.e., table or graph) but also the display style and the reporting design have to be considered and further examined.

Further development of objective assessment methods and performance indicators

For Agrawala et al (2011) methods for analysing the effectiveness of graphical displays and design principles should be improved. Measures should also be identified for preventing the creation of misleading graphs (Raschke/Steinbart 2008). As the Graph Discrepancy Index (GDI) is inconsistent, future research is needed to find a generally accepted measure for graphical distortion. The Relative Graph Discrepancy Index (RGD) introduced in 2005 may overcome the problems associated with the GDI (Mather et al 2005). Future research using process tracking methodology to assess mental representation differences between various information presentation formats is needed and has the greatest potential to contribute to information presentation format research. In this context the development of a test concept can give companies the opportunity to test their reports regarding efficiency and effectiveness.

Information Overload

Information overload, its effects and countermeasures, should be examined more deeply in the field of group or team work (Paul/Nazareth 2010). The variables and the function of the u-curve are still undiscovered and should be examined in further detail.

Working Memory and Memory Affection

Within the interrelated subjects memory, abilities, and knowledge the authors suggest analyzing:

a) the effect of information access costs on the memory by using different tasks and methods for interruptions (Morgan et al 2009)
b) if different levels of accounting knowledge affect memory, and the variation of time delay between encoding and retrieval (Ryack/Kida 2006)
c) the effects on long-term memory caused by improperly designed graphs
d) the possibilities for percipients to mitigate the effects caused by misleading graphs on memory (Pennington/Tuttle 2009)

e) the usage of subjective mental workload, as employed by Speier and Morris (2003). Subjective workload could also be validated by comparing it with objective workload measures like the heart rate (Speier/Morris 2003).

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HOW DOES THE ELIMINATION OF THE PROPORTIONATE CONSOLIDATION METHOD FOR JOINT VENTURE INVESTMENTS INFLUENCE EUROPEAN COMPANIES?

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Abstract. *Following the adoption of IFRS 11 "Joint Arrangements" on 1 January 2014, IFRS-reporting entities are facing new challenges regarding the classification and accounting of joint ventures. As a consequence of the short-term convergence project between the IASB and the FASB, the accounting option for joint ventures has been eliminated in the new standard in order to reduce the differences between these two major accounting principles. However, the abolition of the accounting option for joint ventures will affect financial statement figures and key financial ratios, as some European companies have to change from the proportionate consolidation method to the equity method. This paper examines how the transition from the proportionate consolidation method to the equity method will affect European companies. It describes the relevance and preferred accounting methods for joint venture investments and explores whether the effects on several financial statement figures and key financial ratios are material for European companies. Thus, this paper provides European companies as well as the users of financial statements – auditors, financial analysts, banks and investors – first evidence of these expected effects.*

JEL: *M40, M41, M42, M48*

Keywords: *IFRS 11, joint arrangements, joint ventures, proportionate consolidation method, equity method, materiality, effect analysis*

Introduction

To achieve economic goals, joint ventures have gained international importance in recent years (for the development of joint ventures in recent years see IASB, 2011a and KPMG & IESE, 2009). Therefore, the International Accounting Standards Board (IASB) published International Financial Reporting Standard (IFRS) 11 – a new standard for accounting on joint arrangements – to replace IAS 31, which was endorsed by the EU in 2012 and will be mandatory for European companies for annual periods beginning on or after 1 January 2014 (earlier application is permitted). With the goal of improving the quality of financial reporting, the revision of IAS 31 concentrated on two major aspects. First, the identification, classification and accounting requirements now focus on the rights and obligations of the parties as central criteria for demarcation. Second, the accounting option for joint ventures has been eliminated to reduce differences between IFRS and United States-Generally Accepted Accounting Principles (US-GAAP) and to improve the comparability of IFRS reports. Therefore, the proportionate consolidation (PC) method for joint ventures is prohibited, which means that all joint ventures have to be included in the consolidated financial statements using the equity method (see IFRS 11.24 as well as Küting & Seel, 2011).

Through this harmonisation between IFRS and US-GAAP, as well as the new requirements of IFRS 11, European companies are facing new challenges in accounting for joint arrangements. On one hand, they have to apply the new classification rules and therefore have to re-evaluate all existing joint arrangements. Especially for companies in industries where the use of know-how and financial resources is an important factor (e.g. in the construction and food industries), re-evaluation causes a significant workload. On the other hand, the abolition of the accounting option affects financial statement figures and key financial ratios. These effects can be justified by a change from the PC method to the equity method.

The structure of the paper is organised as follows to cover the aforementioned topics. In a first step, this paper shows the readjustments of IFRS 11 compared with the previously prevailing legal norm IAS 31, followed by a critical analysis of the abolition of the accounting option based on the general opinion in the literature and in practice. The empirical part of this paper analyses the practical relevance of joint ventures and consolidation methods. It then provides information about how many of the sampled European companies account for joint ventures using the PC method and consequently are concerned with the effects of the transition. In the main part, the effects of the abolition of the accounting option on selected financial statement figures and key financial ratios for European companies are analysed and compared with the formulated hypotheses using a deductive empirical study.

Background

In May 2011, the IASB published IFRS 11 “Joint Arrangements” to replace the former standard IAS 31 “Interests in Joint Ventures”. This led not only to fundamental changes in terminology, but also to conceptual changes. Thus, the title IFRS 11 “Joint Arrangements” reflects not only the subject matter, but also the content more clearly than that of IAS 31. While under IAS 31, joint ventures were described by the scope of the standard in terms of a preamble, under IFRS 11 joint ventures are referred to as an exclusive type of joint arrangement (Küting & Seel, 2011 and Lüdenbach, 2011).

With the aim of improving the quality of financial reporting, IFRS 11 focuses on two main aspects. Contrary to IAS 31, in which the legal form of the arrangement was the primary determinant for the classification, IFRS 11 defines the rights and obligations of the involved parties as the central criteria for classification. According to that, IFRS 11 now identifies two instead of three forms of joint arrangements (i.e. joint operations or joint ventures). As a material conceptual change, the accounting option for joint ventures has also been eliminated. Accordingly, the PC method is no longer allowed with the result that joint ventures have to be accounted for using the equity method. For a summary of the material terminological and conceptual changes, see Figure 1.

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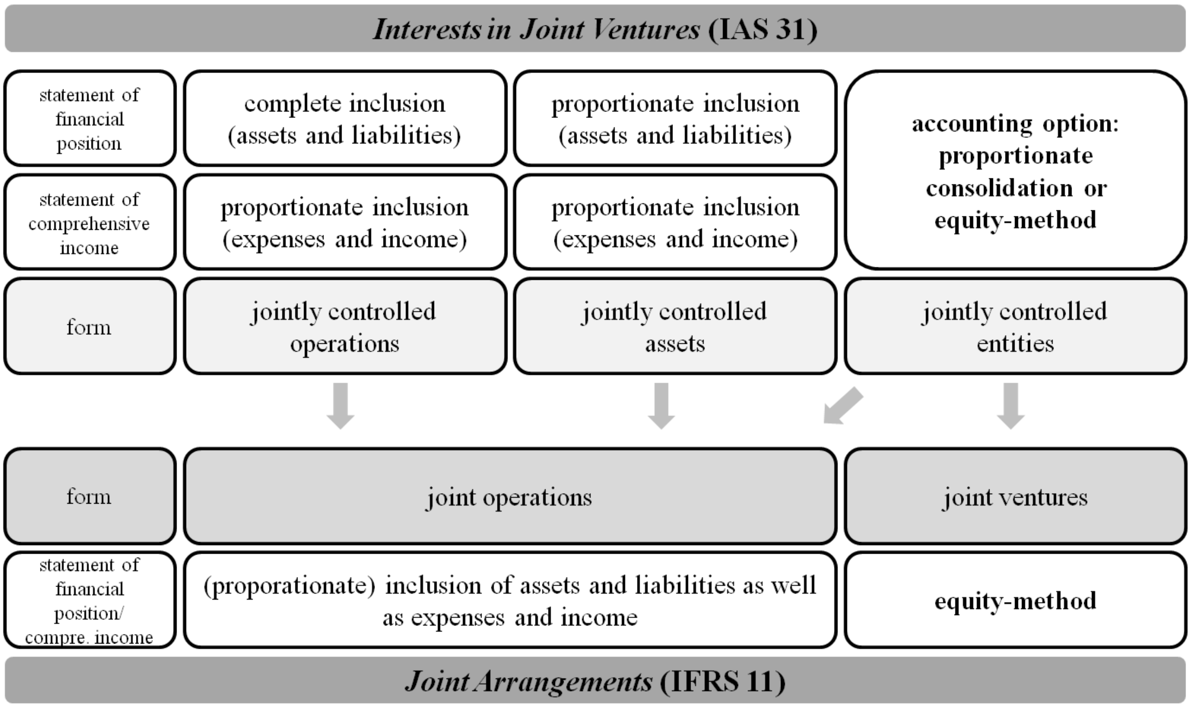
Figure 1: Terminological and conceptual changes between IAS 31 and IFRS 11 (Source: Küting & Seel, 2011)



Accounting for jointly controlled entities under IAS 31

Joint ventures appear in different forms and structures. Depending on the stage of legal integration and organisational structure, IAS 31 distinguished three forms of joint ventures: jointly controlled operations, jointly controlled assets and jointly controlled entities. Under IAS 31, the demarcation of jointly controlled operations/assets and jointly controlled entities was based on the existence of a legal entity separated from the parties and therefore on the legal form of cooperation (IAS 31.13, IAS 31.19, IAS 31.24). As its classification was consistent with the subsequent accounting treatment, this step was paid special attention in practice. In the following part of this paper, the accounting for jointly controlled entities and joint ventures is considered, as the effects on financial statement figures and key financial ratios can be justified by the change from the PC method to the equity method only for that form.

PC method

For the inclusion of jointly controlled entities, IAS 31 provided an accounting option between the PC method and the equity method. IAS 31 (revised 2000) stated that the PC method was the benchmark treatment. In the current version, there is no highlighting. However, the PC method was recommended by the IASB, as it reflects the substance and economic reality of a venturer's interest in a jointly controlled entity better (IAS 31.40).

According to the PC method, the assets and liabilities from the balance sheet and the income and expenses from the income statement of jointly controlled entities are recorded in the consolidated financial statements of the venturer at the level of the group's share (percentage rate). This percentage rate is calculated using the capital share rather than the voting share (an alternative calculation of the capital share could be the profit share, however, the most common method is consolidation using share capital; Pellens et al., 2011). IAS 31 allowed two reporting formats when using the PC method. The first format combined the proportionate interests in the assets, liabilities, income and expenses of the joint venture with the corresponding items in the venturer's financial statements (line-by-line reporting). The second format showed those proportionate interests in the venturer's financial statements as separate line items.

Under the PC method, the principles of full consolidation according to IAS 27 are applied. The main difference between PC and full consolidation is that minority interests are not reported in the consolidated financial statements (Fröhlich, 2011). Furthermore, all transactions between partner companies and the jointly controlled entity have to be eliminated proportionally through liabilities, expenses and income consolidation as well as the elimination of inter-company profit and loss. From this, upstream and downstream transactions can be distinguished (Pellens et al., 2011).

Equity method

Under the equity method, the investment is initially recognised at cost and has to be adjusted for the post-acquisition change in the venturer's share of net assets of the investee. In contrast to the PC method, the venturer presents its proportion of the inferred value of the investment in a single line on the balance sheet and its proportion of the net income as a single line in the statement of comprehensive income (see IAS 28 for further details). Similar to the PC method, profit and losses through upstream and downstream transactions have to be eliminated proportionally within the equity valuation. In the literature, there is a discussion as to whether the equity method is a consolidation or a valuation method (see, for example, Busse v. Colbe et al., 2010). Even if consolidation activities (e.g. the elimination of inter-company profit and loss) are necessary, it is not necessary to summarise the accounts.

Accounting for joint ventures under IFRS 11

Similar to IAS 31, accounting for joint arrangements under IFRS 11 is determined by the classification. IFRS 11.24 states that for joint ventures, it is mandatory to use the equity method in accordance with IAS 28. As classification results in a joint venture under IFRS 11, which was previously accounted using PC under IAS 31, transition to the equity method is mandatory (for a detailed analysis of the transition from the PC method to the equity method see IFRS 11.C2-6 in association with IFRS 11.BC60-69 as well as Böckem & Ismar, 2011; Ernst & Young, 2011a; Fuchs & Stibi, 2011; Galbiati & Baur, 2011; KPMG, 2011; Küting & Wirth, 2012 and PWC, 2011a).

PC method versus the equity method

The main aim of the elimination of the PC method is to achieve convergence with US-GAAP, which allows for only the use of the equity method for joint venture investments. Even with the elimination of the PC method, full convergence with US-GAAP will not be achieved, however, since AIN-APB 18 and EITF Issue No. 00-1 allow for some industries to use PC within US-GAAP (e.g. the oil and gas exploring and construction industries). For this reason, the new standard of accounting for joint ventures does not comply with US-GAAP. Owing to the events of recent years, convergence with US-GAAP is becoming more and more irrelevant for companies using IFRS. As at the end of 2007, the Securities and Exchange Commission (SEC) abolished reconciliation requirements to US-GAAP for foreign companies using IFRS (SEC, 2007a). In addition, the decision to allow US registrants to prepare financial statements in accordance with IFRS questions the importance of adapting the new IFRS to US-GAAP (SEC, 2007b). Thus, it should be more important to identify a method that supports the decision usefulness of the consolidated financial statements.

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In Europe, the public's reaction to the elimination of the PC method was mainly negative (for negative responses, see, for example, the Comment Letters to ED 9 of the Accounting Standards Committee of Germany (DRSC), the European Financial Reporting Advisory Group (EFRAG) and the Federation of European Accountants (FEE)). Three main arguments against the abolition were propagated: (i) the PC method provides more useful information and leads to the better validity of the consolidated financial statements, (ii) the elimination of the PC method means that joint ventures are accounted for in the same way as associated companies and (iii) ED 9 contained no compelling arguments for the elimination (DRSC, 2008, EFRAG, 2008 and FEE, 2008). However, the elimination of the PC method was a step towards a more consistent framework, which can be justified by the economic unity concept (IASB, 2008).

Critics also argue that the PC method leads to divergent conceptual results compared with the equity method, that comparability between IFRS reports is more difficult and that it contravenes the economic unity concept of the framework. Supporters, however, argue that the PC method provides higher information value and the better validity of IFRS reports (see the next chapter for a detailed analysis).

Furthermore, the costs of financial reporting are expected to rise following the abolition of the PC method; when the internal reporting of joint ventures was based on PC, external reporting had to be carried out based on the equity method. This led to inconsistencies, as the management approach is mandatory in reporting operating segments in accordance with IFRS 8.

In summary, the accounting option for joint ventures is divisive and this has led to a dispute over the actual methods used. Nevertheless, each method has its advantages and disadvantages. However, the elimination of the PC method was not a decision in favour of the equity method, but rather a consequence of the underlying principle of IFRS 11 that the accounting treatment of joint arrangements depends on rights and obligations. The question of whether the equity method is a suitable form for accounting for joint venture investments remains open (IFRS 11.BC41-45).

Previous research

Since the beginning of the 21st century, standard setters worldwide have called for research to investigate the impact of different joint venture accounting methods. Nevertheless, there is little extant literature on accounting for joint venture investments.

According to the categorisation of Biddle et al. (1995), the following studies explain the relative information content based on a multiple regression model. Therefore, the conformation content of an accounting method is measured by the predictive value of an elected earnings ratio. The study of Kothavala (2003) provided market-based evidence that financial statements based on the equity method are more relevant for bond ratings. Even based on the same regression model as Kothavala (2003), the results of Bauman (2007) showed that financial statements prepared under the PC method are more relevant for explaining bond ratings. However, the samples differ due to differences in reporting methods used in the financial statements (US-GAAP, Canadian GAAP), bond rating methodologies and sample composition (Bauman, 2007).

The findings of the study by Stoltzfus & Epps (2005) pointed out that the PC method for accounting for joint ventures should be used if there is evidence of guarantees and/or other agreements. These results indicated that financial data prepared under the PC method have a stronger association with bond risk premiums than financial data prepared under the equity method.

For a set of Canadian firms, Graham et al. (2003) found evidence that financial statements prepared under the PC method have more relative information content for predicting future returns on shareholder equity than financial statements prepared under the equity method. Based on the same regression model, the study of Leitner-Hanetseder (2010) indicated that the PC method provides greater predictive power of future profitability than the equity method for German listed companies. The findings showed that the intended elimination of the PC method would not improve the relative information content for users of financial statements prepared under IFRS. However, the findings also proved that additional disclosures to calculate PC data would improve the relative information content of future profitability under the equity method.

Richardson et al. (2012) found that the elimination of the choice of joint venture accounting method does have value relevance implications. Similarly, the findings of the study by Soonawalla (2006) proved that the separate recognition of the disclosure of joint ventures and associate companies provides value relevance.

According to previous research, the elimination of the choice between the PC method and equity method decreases value relevance. Furthermore, the use of the PC method provides stronger information content than the use of the equity method. However, few studies investigate the relevance of the equity method or PC method for accounting for joint venture investments within single industries. The study of Keitz (2005) indicated, for example, that the equity method is preferred in the automobile and transport industry and that the PC method is preferred in the construction industry. Nölte et al. (2007) and Leitner (2009) investigated the impact of the change from the PC method to the equity method on financial figures and/or ratios. However, the studies mentioned were carried out only for German and/or Austrian listed companies. Similar results for listed companies in the EU are missing.

With the present empirical study, the authors of this paper aim to contribute to the research by investigating the relevance of the choice of joint venture accounting methods and the impact on financial figures and ratios of a change from the PC method to the equity method in the financial statements of European companies. In the next section, the methodology, hypotheses and sample of the empirical study are described.

Methodology of the empirical study

As shown above, the transition from the PC method to the equity method affects financial statement figures and key financial ratios. However, the extent of these impacts has been analysed to a limited degree for European companies. As potential effects are still known theoretically (see IASB, 2011b and KPMG, 2011), this study provides a detailed descriptive overview and quantifies these impacts in practice using data of 350 European companies from different indices, industries and countries in the EU.

The following cross-sectional study is characterised as a deductive analysis, which means that the hypotheses introduced will be confirmed or rejected. Descriptive deviation analysis was elected as the methodology, whereby selected financial statement figures and key financial ratios are calculated twice, using the PC method and a fictitious equity method. For the fictitious calculation of the equity method, the impacts on assets, liabilities, income and expenses can be directly seen in the Notes.

As the study examines the effects on total assets and liabilities as well as income and EBIT, these financial data were converted. To convert liabilities and sales under the equity method, the liabilities and sales of joint ventures had to be subtracted. To ascertain the fictitious equity in joint ventures, the share of liabilities decreases the amount of total assets. The fictitious total assets under the equity method are increased by the amount of the net book

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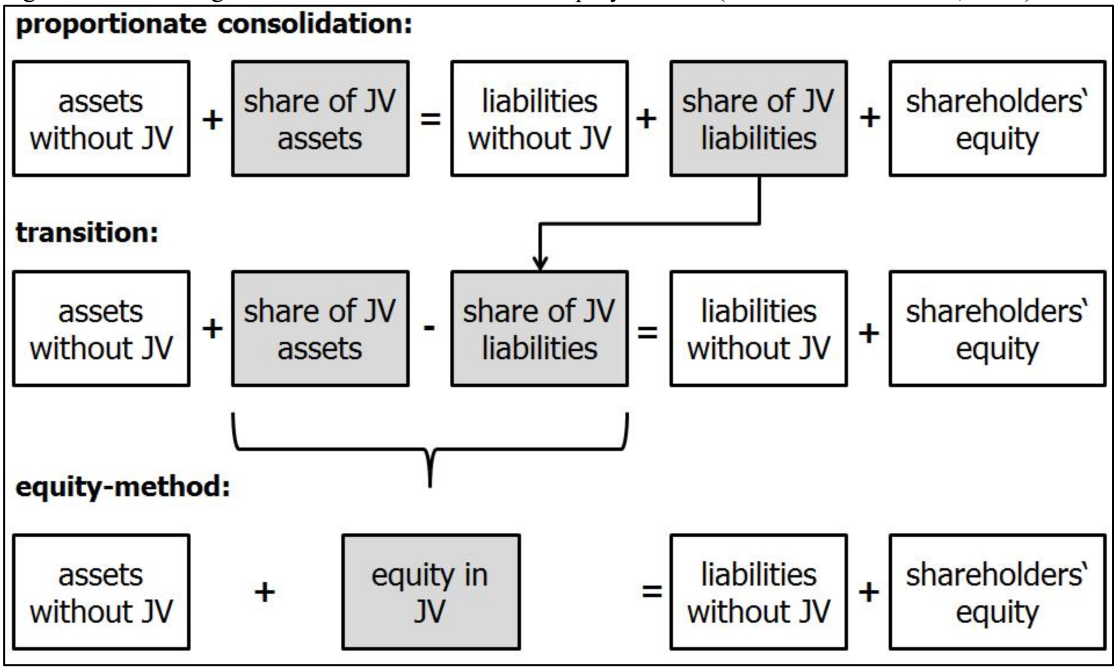
value of the joint venture. Figure 2 illustrates the procedure for converting the financial data under the PC method to the financial data under the fictitious equity method.

Figure 2: Converting PC financial statements to the equity method (Source: Graham et al., 2003)



A calculation is only possible if European companies provide information about their jointly controlled entities in the Notes as required by IAS 31.56. Furthermore, the results are based on the assumption that jointly controlled entities under IAS 31 will be joint ventures under IFRS 11 otherwise an evaluation of the results is impossible. However, this will be expected in most cases (IASB, 2011b and KPMG, 2011).

The aim of this study is to answer the following questions:

1. What practical relevance do joint ventures have for European companies, i.e. how many European companies account for joint ventures in their consolidated financial statements?
2. Which accounting method do European companies use for joint ventures, i.e. what accounting method is relevant in practice and how many European companies account for their joint ventures using the PC method and therefore will be affected by the transition to the equity method?
3. How does the transition affect the selected statement figures according to the concerned European companies in point two, i.e. to what extent do financial statement figures change?
4. What quantitative impacts do the change in financial statement figures have on key financial ratios, i.e. to what extent do key financial ratios change due to the transition?

Development of hypotheses

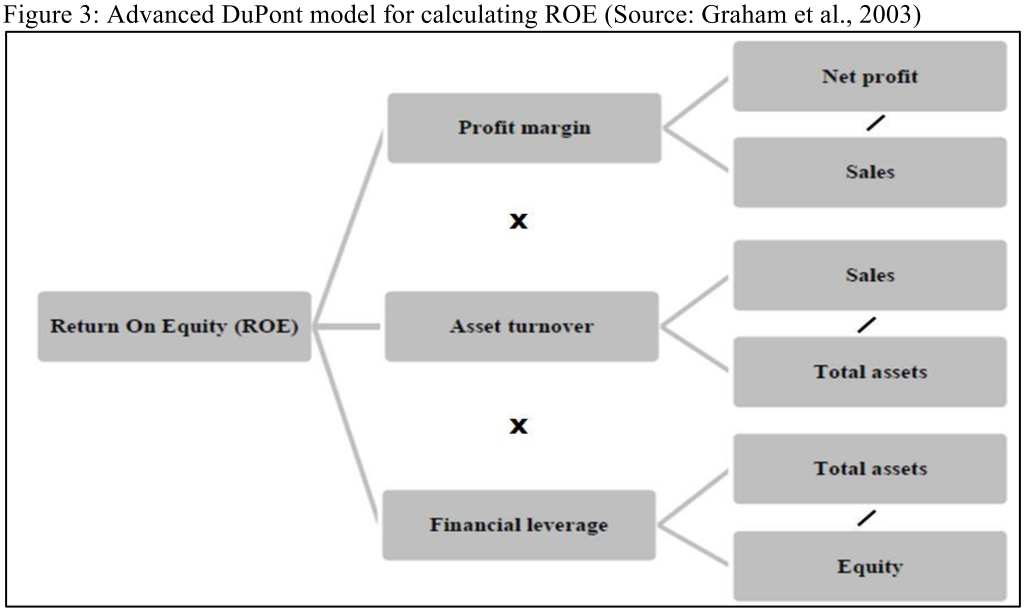
IAS 1.9 states that "…the objective of financial statements is to provide information about the financial position, financial performance and cash flows of an entity that is useful to a wide range of users in making economic decisions". The change from the PC method to the equity method will affect financial positions and financial performance and, consequently, key financial ratios. As, theoretically, these effects are already known, we analyse whether they are below or above a materiality margin of 5% for financial positions respectively 5 percentage points for key financial ratios and confirm or reject the following hypotheses using a deductive approach.

For financial positions, we check the following hypotheses:
H_1: When changing from the PC method to the equity method, total assets of European companies decrease by more than 5%.
H_2: When changing from the PC method to the equity method, liabilities of European companies decrease by more than 5%.
H_3: When changing from the PC method to the equity method, income of European companies decrease by more than 5%.
H_4: When changing from the PC method to the equity method, EBIT of European companies decrease by more than 5%.

Under the equity method, the joint venturer's assets and liabilities will no longer be proportionately consolidated. Instead, the adjusted share of net assets will be shown in a single line on the balance sheet. Therefore, total assets and liabilities will decrease and H_1 and H_2 can be justified due to that fact. Equally, income will decrease to the extent of the entity's previously recognised share income of the joint venture and H_3 will also be justified. The decline in EBIT and therefore H_4 can be justified because the share of EBIT is also not included in the income statement. However, it must be noted that the effects on EBIT depend on whether the entity or joint venture ever achieves a positive EBIT. If the joint ventures have a negative EBIT in total, the group companies' EBIT will rise, as a negative EBIT of the joint ventures will not be included. As no rules within IFRS exist as to whether the earnings of joint venture investments under the equity method must be shown as financial earnings or operating earnings, companies can show such earnings in either manner. The following results imply that companies using the equity method would show their earnings of joint venture investments as financial earnings, because this is the most common way in practice. Therefore, EBIT would decrease in comparison with the use of the PC method.

For business analysis and valuation, the impacts on key financial ratios can be derived from changes to financial statement figures. According to Burns et al. (2008) and Graham et al. (2003) we use an advanced DuPont model that divides Return On Equity (ROE) into three distinct parts and their determinants (see Figure 3). Hence, the cause and effects of the impacts can be shown with this model.

Figure 3: Advanced DuPont model for calculating ROE (Source: Graham et al., 2003)



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ROE is computed as follows:

ROE = Profit margin x Asset turnover x Financial leverage	
Profit margin I =	Earnings after tax/Sales
Profit margin II =	EBIT/Sales
Asset turnover =	Sales/Total assets
Financial leverage =	Total assets/Equity

For the key financial ratios of the advanced DuPont model, we check the following hypotheses:

H_5: When changing from the PC method to the equity method, Profit Margin I (Profit Margin II) of European companies rises (decreases) by more than 5 percentage points.
H_6: When changing from the PC method to the equity method, Asset turnover of European companies decreases by more than 5 percentage points.
H_7: When changing from the PC method to the equity method, financial leverage of European companies decreases by more than 5 percentage points.
H_8: When changing from the PC method to the equity method, ROE II of European companies decreases by more than 5 percentage points.

As there is no effect on net profit in the numerator and sales in the denominator are not included using the equity method, Profit Margin I will rise inevitably. Unlike Profit Margin I, calculating Profit Margin II means that EBIT is used in the numerator, which usually decreases under the equity method. Primarily for companies whose joint ventures contribute significantly to EBIT, this leads to a decline in Profit Margin II, and thus H_5 can be justified due to this fact. H_6 and the decline in asset turnover can be justified because the numerator (sales) as well as the denominator (total assets) decline under the equity method. H_7 means that equity in the denominator is subject to no change and that there is a decline in total assets in the numerator; therefore, financial leverage also decreases.

In summary, ROE is calculated as the multiplication of profit margin, asset turnover and financial leverage. If ROE is calculated using Profit Margin I, there is no impact on ROE I, as neither net profit nor equity are subject to change. If ROE is calculated using Profit Margin II, the decrease in ROE II can be justified because EBIT already decreases. Nevertheless, the level of the impact depends on the ratio of the joint ventures' EBIT and the groups' equity.

Sample selection and descriptive statistics

As research into the extent of the impacts on financial statement figures and key financial ratios has been analysed to a limited degree for European companies thus far in the literature, we used 350 annual reports of different indices, industries and countries in Europe. Thus, we analysed annual reports from companies listed on the indices of the Prime Market of the Vienna Stock Exchange of Austria, the DAX, MDAX and TecDAX of the German Stock Exchange, the Financial Times Stock Exchange (FTSE) of the United Kingdom and the New York Stock Exchange (NYSE) of France. Depending on the index, 40 companies of the Austrian Traded Index (ATX) Prime, 110 companies of the HDAX (DAX, MDAX and TecDAX), 100 companies of the FTSE 100 and 100 companies of the Euronext 100 were analysed (see Table 1). In order to draw conclusions about the population of all European listed companies with a representative sample, the sample was chosen so that companies from continental Europe (Austria, Germany and France) and from Anglo-Saxon countries (United Kingdom) are represented. In addition, the Euronext 100 index provides a broad spread of European companies, including companies from the Netherlands, Belgium, Portugal and Luxembourg.[1]

1 36 companies (72%) of the EURO STOXX 50 index are included in the sample. This index contains the most important 50 listed companies from 12 countries in the EU and it has developed into a leading barometer of

Table 1: Sample selection by index

Index	Stock Exchange	Country	*n*	in %
ATX Prime	Austrian Stock Exchange	Austria	40	11.43
DAX	German Stock Exchange	Germany	30	8.57
MDAX	German Stock Exchange	Germany	50	14.29
TecDAX	German Stock Exchange	Germany	30	8.57
FTSE 100	London Stock Exchange	United Kingdom	100	28.57
Euronext 100	NYSE Euronext	France	100	28.57
Total			350	100.00

Furthermore, Table 2 shows the sample selection by industry according to the Industry Classification Benchmark (ICB).[2] The largest proportion of the sample is allocated to industrials (78 companies, 22.30%), followed by finance (45 companies, 12.90%), consumer goods (42 companies, 12%) and basic materials (36 companies, 10.30%). The samples of the technology industry (21 companies, 6%), oil & gas as well as healthcare (20 companies each, 5.70%), utilities (15 companies, 4.30%) and telecommunications (12 companies, 3.40%) are comparatively small.

Table 2: Sample selection by industry

ICB code	Industry	*n*	in %
0001	Oil & Gas	20	5.70
1000	Basic Materials	36	10.30
2000	Industrials	78	22.30
3000	Consumer Goods	42	12.00
4000	Health Care	20	5.70
5000	Consumer Services	45	12.90
6000	Telecommunications	12	3.40
7000	Utilities	15	4.30
8000	Finance	61	17.40
9000	Technology	21	6.00
	Total	350	100.00

Of these 350 annual reports, one company did not provide an annual report (Consolidated Airlines Group S.A. listed on the FTSE 100) and six companies (Century Casino Inc., Fresenius Medical Care AG, Fresenius SE & Co KgaA, Carnival Plc. and ASML Holding N.V.) did not prepare their consolidated financial statements using IFRS. Thus, the total sample comprised 343 annual reports.

Sample Selection:

ATX, HDAX, FTSE 100, Euronext 100	350
-no annual report	-1
available annual reports	349
-not applying IFRS	-6
Sample	343

Europe. Hence, the sample represents a smaller part of the whole population and, therefore, it can be considered to be representative.

[2] The ICB structure enables the classification of companies into 10 industries, 19 super sectors, 41 sectors and 114 subsectors. The ICB system is maintained by FTSE International Ltd.

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Empirical results

Relevance of joint ventures and related accounting methods

Based on the data for 2010, of the 343 companies in the sample, 246 had a joint venture (71.70%). The results in Table 3 indicate that joint ventures are highly relevant in most industries. Indeed, in the basic materials, consumer goods, consumer services, utilities and finance industries, more than 75% of companies had one or more joint ventures.

Table 3: Relevance of joint ventures by industry

Industry according to ICB	***Joint Ventures***					
	No		**Yes**		**Total**	
	n	**in %**	***n***	**in %**	***n***	**in %**
Oil & Gas	6	30.00	14	70.00	20	100.00
Basic Materials	6	16.70	30	83.30	36	100.00
Industrials	26	33.80	51	66.20	77	100.00
Consumer Goods	8	19.00	34	81.00	42	100.00
Health Care	10	58.80	7	41.20	17	100.00
Consumer Services	8	18.60	35	81.40	43	100.00
Telecommunications	5	41.70	7	58.30	12	100.00
Utilities	1	6.70	14	93.30	15	100.00
Finance	13	21.30	48	78.70	61	100.00
Technology	14	70.00	6	30.00	20	100.00
Total	97		246		343	

Of these 246 companies, only 229 disclosed information about the accounting method used for joint ventures: 127 of these 229 companies used the equity method and 100 used the PC method for accounting for joint ventures in their consolidated financial statements. To provide consistency across financial statements, companies are not allowed to mix accounting methods. In line with IAS 31.1 and IAS 39, two companies valued their joint ventures under the fair value approach (see Table 4).

Table 4: Relevance of accounting methods

Accounting method	***n***	**in %**
Equity method	127	51.63
PC method	100	40.65
Fair value	2	0.81
No information on accounting method	17	6.91
Total	246	100.00

These results show that within single indices the equity method is preferred for accounting for joint venture investments. Further, companies listed on the ATX Prime Market, DAX, MDAX, TecDAX and FTSE 100 prefer the equity method to the PC method. Only in the Euronext 100 Index is the PC method preferred (see Table 5).

Table 5: Relevance of accounting methods by index

Indices	**Accounting method**							
	Equity method		**PC**		**Fair value**		**Total**	
	n	**in %**	***n***	**in %**	***n***	**in %**	***n***	**in %**
ATX Prime	11	52.38	10	47.62	0	0.00	21	100.00
DAX	18	81.82	4	18.18	0	0.00	22	100.00
MDAX	18	56.25	14	43.75	0	0.00	32	100.00
TecDAX	6	75.00	2	25.00	0	0.00	8	100.00
FTSE 100	46	69.70	18	27.27	2	3.03	66	100.00
Euronext 100	28	35.00	52	65.00	0	0.00	80	100.00

Total	127	100	2	229

Furthermore, the results indicate that more than half of the sampled companies in the basic materials, industrials, utilities and finance industries prefer the PC method for accounting for joint ventures (see Table 6), implying that half of these companies will be affected by the change from the PC method to the equity method.

Table 6: Relevance of accounting method by industry

Industries according to ICB	**Accounting method**						**Total**	
	Equity method		**PC**		**Fair value**			
	n	**in %**	***n***	**in %**	***n***	**in %**	***n***	**in %**
Oil & Gas	11	78.57	3	21.43		0.00	14	100.00
Basic Materials	12	42.86	16	57.14		0.00	28	100.00
Industrials	23	48.94	24	51.06		0.00	47	100.00
Consumer Goods	17	58.62	12	41.38		0.00	29	100.00
Health Care	5	71.43	2	28.57		0.00	7	100.00
Consumer Services	24	75.00	8	25.00		0.00	32	100.00
Telecommunications	5	71.43	2	28.57		0.00	7	100.00
Utilities	7	50.00	7	50.00		0.00	14	100.00
Finance	19	42.22	24	53.33	2	4.45	45	100.00
Technology	4	66.67	2	33.33		0.00	6	100.00
Total	127		100		2		229	

At least 40% of the European companies sampled would have had to change accounting method for joint ventures from the PC method to the equity method. In particular, companies in the Euronext 100 index and/or single industries will be affected by this change. These companies consequently are concerned with the following impacts on selected financial statement figures and key financial ratios.

Impacts on selected financial statement figures

This section evaluates the impacts on the consolidated financial statement figures caused by a change from the PC method to the equity method for the financial year 2010 (see Table 7).

Table 7: Descriptive statistics of the effects of conversion on selected financial statement figures

	Impact on total assets in %	**Impact on liabilities in %**	**Impact on sales in %**	**Impact on EBIT in %**
n*	82	80	54	64
Mean	-3.17	-5.75	-7.87	-16.51
Median	-1.70	-3.13	-4.43	-2.75
Std. Deviation	5.24	9.20	9.38	83.70
Maximum	-39.70	-58.21	-43.40	-662.50/+85.75
Hypothesis	rejected	confirmed	confirmed	confirmed
Impact according to industry				
Oil & Gas	immaterial	material**	immaterial	material
Basic Materials	immaterial	material	material	immaterial
Industrials	immaterial	immaterial	material	material
Consumer Goods	immaterial	immaterial	immaterial	material
Health Care	immaterial	immaterial	immaterial	immaterial
Consumer Services	immaterial	material	immaterial	material
Telecommunications	immaterial	immaterial	material	material
Utilities	immaterial	material	material	material
Finance	immaterial	material	material	material
Technology	immaterial	immaterial	no information***	material

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Based on financial data for 2010, Table 7 points out the relative differences between financial data under the equity method and under the PC method.
*n means the number of companies using the PC method and disclosing the data required for the financial year 2010
**material means that the impact was more than 5% on average
***no information means that none of the companies in the industry selected disclosed the information required

Therefore, a calculation of the impact on total assets of the change from the PC method was possible for only 82 companies. For half of these companies, the change to the equity method implied a decrease in total assets by a maximum of 1.70%. By analysing total assets, we find an average impact of -3.17% (*SD* = 5.24). Excluding outliers[3], the mean is -2.38% (*SD* = 2.52). Therefore, H_1 is rejected. The results also show that in none of the industries regarded an impact of more than 5% on average was given. Therefore, the impact is immaterial.

By using the equity method, selected companies would have on average 5.75% (*SD* = 9.20) lower total liabilities. This means that H_2 is confirmed. However, without outliers the decrease in total assets is on average -4.28% (*SD* = 4.73). Regarding single industries, the results show a material impact in the oil & gas, basic materials, consumer services, utilities and finance sectors.

Half of companies would see a decrease in sales of at most 4.43%. The impact on total sales would be on average -7.87% (*SD* = 9.38) (without outliers Mean = -6.11% [*SD* = 5.95]). Therefore, H_3 is confirmed. The results indicate that the impact is material only in five industries. However, in utilities and telecommunications, the average impact is considerable (telecommunications = -17.75%, utilities = -18.48%).

From the sample, only 64 companies could be identified to calculate the impacts on EBIT. By transition to the equity method, the selected companies would have on average 16.51% (*SD* = 83.70) lower EBIT. Excluding outliers, EBIT would decrease by on average 6.99% (*SD* = 10.56). Therefore, H_4 is confirmed. The high SD without excluding outliers can be justified because impacts depend on whether the joint ventures have positive EBIT. In cases where the EBIT of the joint ventures is negative, a change to the equity method could cause a rise in EBIT, as negative EBIT would no longer be proportionally consolidated. For example, the EBIT of Salzgitter AG would rise by 15.38% due to the change to a fictitious equity method.

Based on financial data for 2010, those companies whose joint ventures contribute significantly to EBIT should expect a material decline, such as EVN AG (-33.21%), Warimpex Finanz- und Beteiligungs AG (-39.86), Randgold Resources Ltd. (-33.13%) and Veolia Environment S.A. (-33.52%). Furthermore, five companies in the sample should expect a material decline in EBIT of more than 20%. Further, in eight of the 10 industries selected, the impact is material.

Impacts on key financial ratios

Based on the changes in financial statement figures, the impacts on key financial ratios can be derived. In this regard, each financial ratio was calculated twice, first using the PC data and second using the data from the conversion to the equity method. Thus, the analysis of the impact of conversion was possible. As stated in before, we concentrate on financial ratios according to the advanced DuPont model, as the cause and effects of the impacts can be

[3] Outliers are calculated using the statistical software SPSS. In SPSS, outliers are marked through boxplots, when their interval at the 25th percentile or 75th percentile is more than three times the height of the box, leaving the range of values with the middle 50%.

shown with this model. Table 8 presents the differences in financial ratios based on the financial data for 2010.

Table 8: Descriptive statistics of the effects of conversion on key financial ratios

	Impact on ROE II	**Impact on profit margin I**	**Impact on profit margin II**	**Impact on asset turnover**	**Impact on financial leverage**
n*	39	54	39	54	82
Mean	-1.90	2.84	1.16	-2.05	-13.62
Median	-0.88	0.39	-0.01	-0.85	-4.47
Std. Deviation	2.63	12.86	9.75	3.07	33.02
Maximum	-11.00/+0.05	-0.21/+94.61	-4.34/+59.70	-13.76/+0.20	-272.72
Hypothesis	rejected		rejected	rejected	confirmed
Impact according to industry					
Oil & Gas	immaterial	immaterial	immaterial	immaterial	material
Basic Materials	immaterial	immaterial	immaterial	immaterial	immaterial
Industrials	immaterial	immaterial	immaterial	immaterial	material
Consumer Goods	immaterial	immaterial	immaterial	immaterial	immaterial
Health Care	immaterial	immaterial	immaterial	immaterial	immaterial
Consumer Services	immaterial	immaterial	immaterial	immaterial	material
Telecommunications	immaterial	immaterial	immaterial	immaterial	immaterial
Utilities	immaterial	immaterial	immaterial	immaterial	material
Finance	not material	material**	material	immaterial	material
Technology	no information***	no information	no information	no information	material

Based on financial data for 2010, Table 8 points out the relative differences between financial data under the equity method and under the PC method.
*n means the number of companies using the PC method and disclosing the data required for the financial year 2010
**material means that the impact was more than 5 percentage points on average
***no information means that none of the companies in the industry selected disclosed the information required

In the statement of comprehensive income, there are four levels of profit or loss (i.e. gross profit or loss, operating profit or loss, pre-tax profit and net income). As mentioned above, in the present study, profit margin was calculated by using two numerators. Under profit margin I, net income after tax was used, while under profit margin II, operating profit or loss was used. Profit margin I was used to calculate ROE I. Profit margin II is an important ratio to investors, as management has much control over operating expenses. In most cases, positive and negative trends in this ratio can be directly attributed to management decisions. Although sales decrease under the equity method, the impact on profit margin I is positive, as the numerator is lowered by the amount of sales from the joint venture investments. A lower numerator increases profit margin I.

For the calculation of profit margin I, 54 companies of the sample could be identified, which provided the necessary information. Following a change from the PC method to the equity method, profit margin I would increase by an average of 2.84 percentage points (*SD* = 12.86). Without outliers, the average increase in profit margin I would be 0.85 percentage points (*SD* = 1.32). In the cases of Wienerberger AG (-0.21 percentage points) and Thales S.A. (-0.10 percentage points), a decrease in profit margin I could be identified due to their negative net profits. In 50% of cases, however, the impact would be no more than 0.39 percentage points. These results also indicate that only in the finance industry the impact would be material.

In the next step, the results indicate few differences between profit margin II under the equity method and the PC method. Even though a maximum difference of -4.34/+59.70 percentage points was calculated, the difference in profit margin II was no higher than -0.01

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percentage points in half of the cases. As the average impact was only 1.16 percentage points (without outliers M = 0.04 percentage points [*SD* = 0.93]), H_5 is rejected. As with profit margin I, the impact would only be material in the finance industry.

The numerator and denominator of asset turnover are influenced by the conversion from the PC method to the equity method. Asset turnover decreases if the total sales of joint venture investments are higher than the decrease in total assets caused by the conversion and vice versa. The decrease in total assets equates to the total liabilities of the joint venture. Based on a sample of 54 companies, asset turnover would decrease by an average of 2.05 percentage points (*SD* = 3.07). Without outliers, a decrease of M = 1.61 percentage points (*SD* = 2.08) could be analysed for asset turnover. Thus, H_6 is rejected. The results also indicate that in none of the sampled industries would the impact be material.

From the sample, 82 companies could be identified to calculate the impact on financial leverage. In half of cases, the leverage ratio would decrease by -4.47 percentage points (without outliers, mean = -7.62 percentage points [*SD* = 9.41]). The mean difference in the leverage ratio includes a decrease of -13.62 percentage points (*SD* = -272.72). Thus, H_7 is confirmed. Based on the comparative descriptive statistics of the components of ROE, the highest impact of the change from the PC method to the equity method can be determined for the leverage ratio. Based on the data for 2010, there would be a material impact on the leverage ratio in six (oil & gas, industrials, consumer services, utilities, finance, technology) of the 10 industries selected following a change from the PC method to the equity method.

As mentioned above, net income after tax and equity are the same under both accounting methods; therefore, ROE I is also the same. ROE II was calculated as the product of profit margin II, asset turnover and financial leverage. From the sample, only 39 companies could be considered where all three ratios could be computed. The results show that the difference between ROE II under the PC method and that under the equity method is very low. Compared with ROE II under PC method, ROE II decreases (increases) under the equity method if the joint venture shows an operating profit (loss). Further, the difference between ROE II under PC and the equity method would be negative (positive) if the joint venture shows an operating profit (loss) in the financial statements under PC. In 50% of cases, ROE II decreases by at least 0.88 percentage points. On average, ROE II would decrease by 1.90 percentage points (*SD* = 2.63). Excluding outliers, the mean is -1.66 percentage points (*SD* = 2.19). On average, therefore, the impact on ROE II is immaterial and H_8 is rejected.

However, there are material impacts in single cases. For example, Warimpex Finanz- und Beteiligungs AG should expect a material decline in ROE II of -11.00 percentage points. The cause/effect analysis of this model shows that profit margin I would rise (+1.16 percentage points), while asset turnover (-1.04 percentage points) and financial leverage (-272.72 percentage points) would decrease, and therefore ROE II would also decrease. However, in none of the industries selected would the impact of a change from the PC method to the equity method be material for ROE II.

Conclusion

As shown herein, the application of IFRS 11 influences European companies. First, they have to re-evaluate all their joint arrangements due to the new classification rules on rights and obligations. Second, European companies using the PC method are affected by the change in accounting method. Hence, financial statement figures and key financial ratios will change following the transition from the PC method to the equity method.

The presented empirical results indicate that joint ventures are highly relevant in practice because approximately 70% of the European companies sampled account for at least one joint venture. In particular, in the materials, consumer goods, consumer services, utilities and finance industries, more than 75% of the European companies sampled account for joint ventures in their consolidated financial statements. The results also show that the equity method is preferred for accounting for joint ventures. Nevertheless, approximately 40% of sampled firms use the PC method, and therefore they are concerned with the impact of the change to the equity method. In particular, more than half of the companies listed on the Euronext 100 index and those from the basic materials, industrials, utilities and finance industries have to change their accounting methods and are facing impacts due to that fact.

By analysing the impacts on selected financial statement figures, H_2, H_3 and H_4 were confirmed, which means that liabilities, sales and EBIT are all influenced materially by the discussed change. H_1 was rejected, however, meaning that there is no material impact on total assets. These results also indicate that in several industries changing from the PC method to the equity method causes material impacts on selected financial statement figures. However, not all industries are affected in the same way. For a detailed analysis of the impacts on specific industries, we recommend Ernst & Young (2011b, c, d), PWC (2011b, c, d) and EFRAG (2012).

Owing to these changes in financial statement figures, the impacts on key financial ratios using an advanced DuPont model were then derived. The results show that these impacts are in the single-digit range on average, except for financial leverage. As a consequence, H_5, H_6 and H_8 were rejected, which implies no material impact on profit margin I and II, asset turnover and ROE II. However, H_7 was confirmed, suggesting that financial leverage changes materially due to an accounting change.

It must be noted here that in single cases impacts were material on both financial statement figures and key financial ratios; therefore, these cases are relevant for the companies and stakeholders involved. Although the results of the present study provide the first evidence of the expected effects, the extent of the impact still depends on the year of transition. As this study was designed as a cross-sectional investigation, further research is thus necessary. For example, the methodology of this study could be changed to a longitudinal study design to measure, for example, the correlations between accounting methods and their predictive power, as shown in previous studies, or to analyse the impacts of economic development on the accounting change.

In summary, the results of this paper are highly relevant for practice and for scientific discourse. On one hand, they provide a first reference point on the impacts that can be expected when applying IFRS 11 for the first time. On the other hand, they open up further scientific discussion on the impacts of changing from the PC method to the equity method.

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Moreover since replicating derivatives with other derivatives is not cost efficient we can consider this market as an incomplete market Flood (1991), therefore risk neutral probability cannot be constructed and arbitrage pricing cannot be efficiently executed. Consequently pricing the derivatives is based on modeling the probabilistic dynamics of the underlying asset and using the martingale pricing framework proposed by Samuelson (1965).

In this research we will address the problem of pricing and modeling of temperature derivatives. The temperature process on which we build our analysis on is the mean-reverting process with seasonality. It has been proposed by Brody et al. (2002). The temperature dynamics can be modeled as an Ornstein Uhlenbeck (OR) process with constant volatility. In earlier works the seasonality decomposition was a single trigonometric function (Alaton 2002) that later was expanded into a full linear model using Fourier decomposition (Campbell and Diebold 2005) or alternatively Wavelet decomposition. Except for Brody all the analysis mentioned had an additional assumption that the residual volatility also exhibits seasonality and was modeled accordingly.

While all previous work treats the temperature from signal processing point of view, we take the physical approach to the modeling of the temperature. We consider the temperature time series that reflects the solution of Navier-Stokes equations applied to a thin atmosphere. This modeling which was introduced by Lorentz in his seminal work (Lorentz 1962), lays the foundation for **"very-long-weather"** prediction and allows for a temperature forecasting based on a set of three first orders Ordinary Differential Equations (ODE).

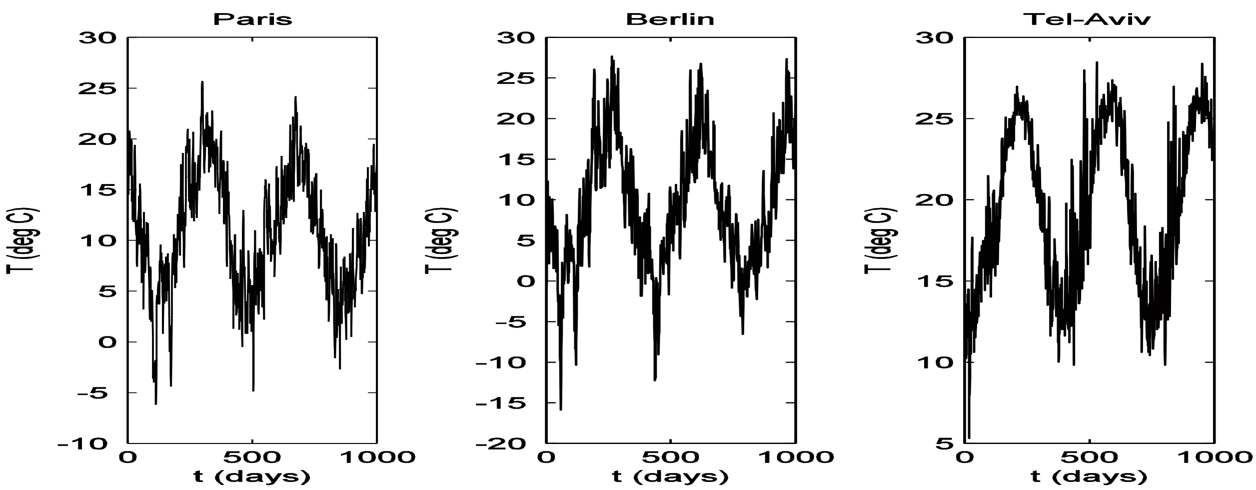
The rest of this paper is arranged in the following manner. In chapter 2, we discuss the Ornstein Uhlenbeck framework with respect to temperature modeling. In chapter 3, we present the numerical procedure of embedding the time series and reconstructing a dynamical system from it. Finally in chapter 4, we conclude the results of the temperature analysis with respect to benchmark methods.

Stochastic Temperature Modeling.

As we stressed in the introduction, the main task in evaluation of weather derivatives is the mathematical modeling of temperature time series.

Figure 1 represents the daily average temperature in Paris, Berlin and Tel Aviv weather stations, over the course of 3 years. As the figure reveals the daily temperature, incorporates strong seasonality, and suffers from extremely large deviations around the mean.

Figure 1: Time Series Plots, Daily Average Temperature. Each panel displays a time series plot of daily average temperature



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Seasonality and Trend Modeling

We follow Alaton (2002), Dornier and Querel (2000) and propose an Ornstein-Uhlenbeck framework for the dynamic process:

$$dT_t = [(dT_t^m / dt) + \alpha(T_t^m - T_t)]\,dt + \sigma_t\, dW_t$$

Here T_t represents the mean daily temperature dynamical variable, σ denotes the variance which is assumed to be constant. Mean reversion speed is parameterized by α. The first right hand side term involving the time derivative of the temperature dT_t^m / dT is inserted in the SDE in order to force mean-reversion to T_t^m since the process itself is governed by a center manifold set of equations and is not a decaying process.

Presented in Alaton (2002), we model the temperature as an Ornstein Uhlenbek process reverting to a time dependent mean. We assume that the temperature performs a mean reverting process. The temperature reverts towards a seasonality function $T_t^a(t)$.

The temperature time series can be represented as an Ornstein-Uhlenbeck stochastic differential equation:

Here T(t) represents the average cumulative temperature, $\sigma(t,T)$ represents the residual volatility and $a(t,T)$ represents the speed of reversion towards the mean. In our work we wish to optimally calibrate the seasonality trajectory $f_T(t)$ to the historical temperature, thriving for the smallest volatility of the residual distribution.

Seasonality Modeling

In this work a method is proposed to model the local temperature time series of a given station. Time series analysis is carried out using the standard methods of non-linear dynamical systems obtained from phase space reconstruction of the signal.

There have been previous attempts to model temperature time series. Most notable ones include Campbell and Diebold (2005) of decomposing time series into seasonal, trend and GARCH components.

As is shown in our results our method out performs Campbell's work and offers an advantage in long range forecasting (90 days ahead) in which the GARCH model completely fails.

Phase space reconstruction (also known as 'embedology', Sauer, Casdagli and Yorke 1991)) is the method used to obtain the phase space of the dynamical system. Based on Takens embedding theorem (1981) the method ensures, that given a dynamical system of dimension *d* producing the time series *x(t)*, one can find a 'lag' τ and embedding dimension *m* and using the embedding mapping:

$$\{x(t), x(t+\tau), x(t+2\tau), \cdots, x(t+(m-1)\tau)\} \text{ provided } m > 2d\,.$$

We thus obtain an embedding of the original dynamical system in *m* dimensional manifold.

Our method is comprised of the following steps:

1. Time series is non-linearly filtered using Sauer (1991) non-linear filter. In this method noise is projected onto a high dimensional manifold. Singular value decomposition is used to obtain principal directions of the attractor, thus obtaining clean signal.
2. System autocorrelation function is used to obtain the correct 'lag'.

3. False nearest neighbor analysis is performed to obtain the correct dimension of the manifold.
4. System is then 'delayed' (projected) to m dimensional space.
5. Using the projected m dimensional system we fit a nonlinear system of first order ODEs, based on Lorenz system.

(1.) $\frac{dx_i}{dt} = f_i(x_j, t), i \in \{1,..,m\}$

Where:

$$f_i(x_j, t) = \alpha_{ik0} x_k + \alpha_{ikl} x_k x_l + \alpha_{i00} \cos\left(\frac{2\pi t}{365}\right) + \alpha_{i11} t$$

α_{ijk} Is the tensor of parameters, to be determined by the fitting.

6. We use Gauss-Newton method to obtain α_{ijk}.
7. We solve equation (1.) using initial conditions from the data to obtain forecasting.

Results

We conclude our results by comparing the non linear Modeling to the GARCH model introduced by Campbell and Diebold (2005). We calibrate the two models to the temperature time series in Paris, Berlin and Tel Aviv.

In Figure 2 we show the seasonality trajectory calibrated to the temperature raw data. It is apparent that a regular Fourier decomposition of the temperature signal will not converge in the number of frequencies due to the "*Gibbs effect*" that is sensitive to jumps and edges in the signal. Physical modeling using nonlinear dynamics does compensate for the temperature extreme fluctuations while maintaining an overall smooth trajectory.

Figure 2, represents the fitted trajectory after the seasonality reconstruction process.

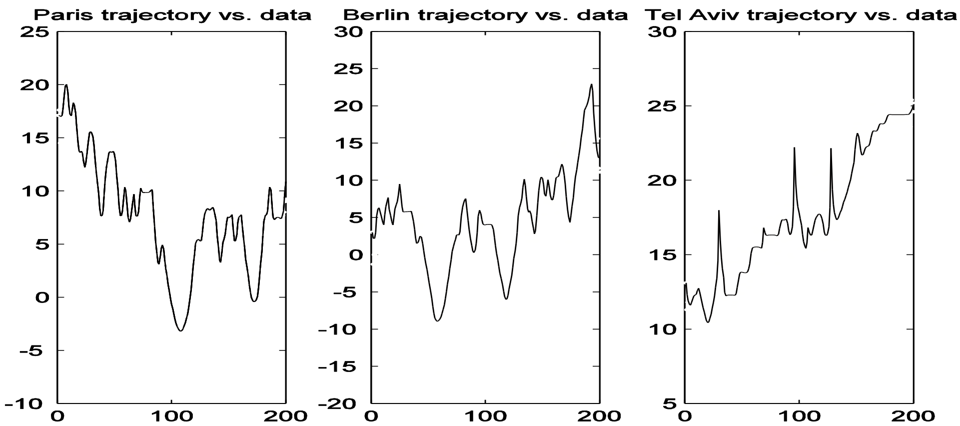

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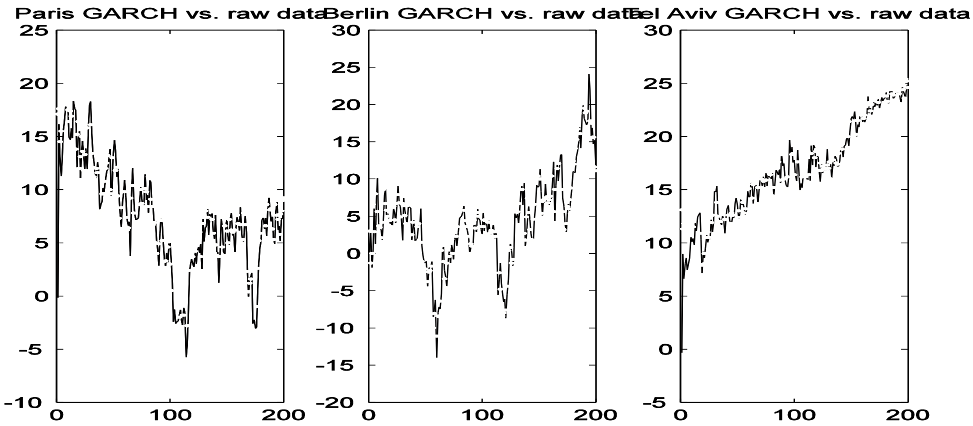
Figure 3, represents the GARCH fitted trajectory after the seasonality reconstruction process.



In figure 4 and 5 we compare the residual of the fitted seasonality to the raw data. As predicted, the volatility of the nonlinear fitting is approximately half the GARCH model seasonality fitting. The financial implication of the less accurate fitting is that the derivatives are overpriced using the GARCH model under the martingale pricing.

Figure 4, represents the residual distribution from nonlinear modeling.

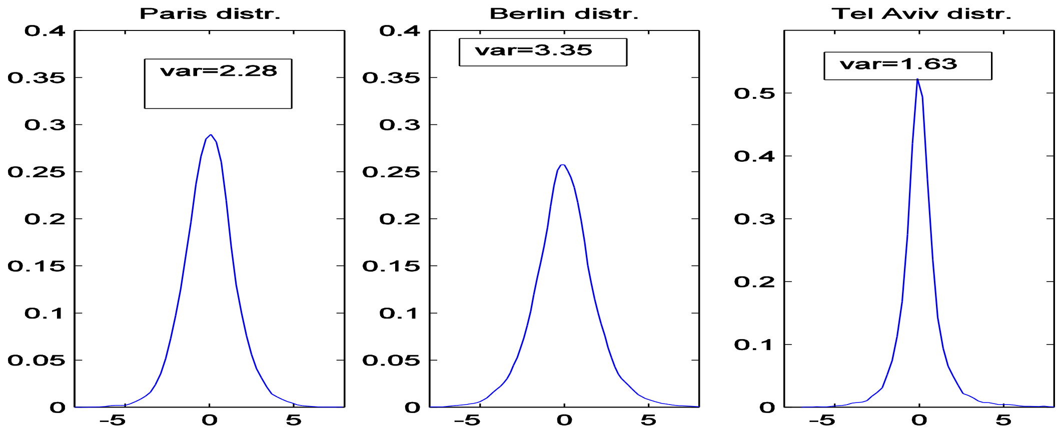
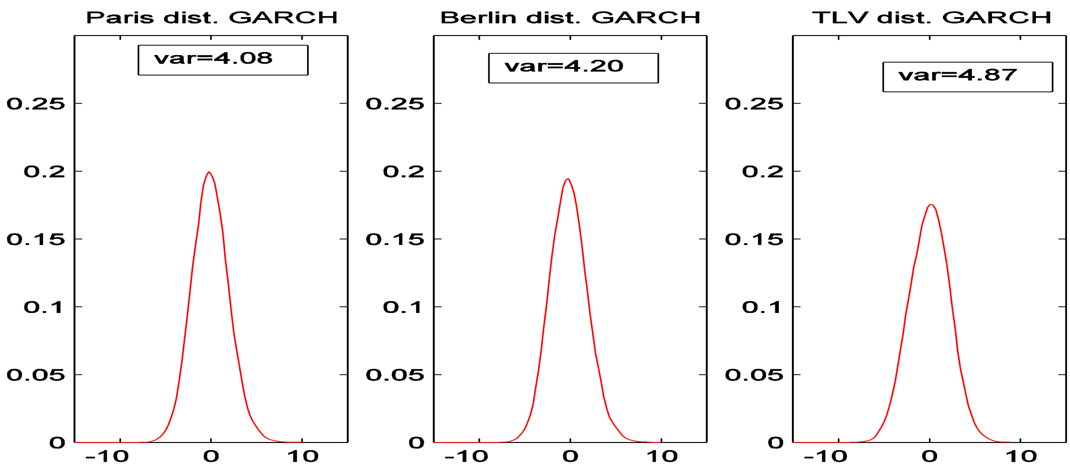


Figure 5, represents the residual distribution from GARCH modeling.



Finally, in Table 1 we compare the predicted forecasting of the two models. The table reflects the Root Mean Square Error (RMSE) of the real temperature versus the Seasonality trajectory. These predictions play a major roll in the acceptance of the modeling. Weather derivatives have maturities ranging from months to years, therefore a model predicting only 11 days ahead as suggested by Campbell and Diebold (2005), is simply not feasible to use for real traded options. As we can see our model performance is approximately an order of magnitude more accurate then the GARCH model. This affect is mainly due to the robustness of the system and the nature of atmosphere physics that could be better captured and modeled with nonlinear dynamics as Lorentz has predicted.

Table 1: Comparison of RMSE prediction error with Campbell (2005), short range predictions.

	1 Day ahead	***3 Days ahead***	***5 Days ahead***	***7 Days ahead***	***9 Days ahead***	***11 Days ahead***
Tel-Aviv						
Campbell (2005)	1.15	2.36	3.40	4.22	4.94	5.56
This work	0.13	0.62	1.19	1.46	1.53	1.44
Berlin						
Campbell (2005)	1.33	0.73	3.43	5.53	9.37	13.44
This work	0.98	2.51	1.90	0.69	3.24	4.12
Paris						
Campbell (2005)	2.34	5.75	7.13	9.03	8.88	13.44
This work	0.44	2.66	4.20	5.01	5.44	4.12

Table 2: Comparison of RMSE prediction error with Campbell (2005), long range predictions.

	30 Days ahead	***60 Days ahead***	***90 Days ahead***
Tel-Aviv			
Campbell (2005)	9.74	36.65	61.25
This work	2.74	3.51	8.51
Berlin			
Campbell (2005)	11.81	48.71	68.3
This work	1.87	19.14	15.41

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Section 4:

Entrepreneurship and Management Perspectives

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A MANAGEMENT CONTROL PERSPECTIVE OF SUSTAINABILITY REPORTING IN HIGHER EDUCATION: IN SEARCH OF A HOLISTIC VIEW

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Abstract. *Higher education institutions have been actively attempting to integrate sustainability in their curricula, research, operations, and outreach activities over the last decades. Despite the efforts undertaken, it is currently still challenging for their stakeholders to assess an institution's sustainability-related activities and the extent of their implementation within the different activities of higher education. Since sustainability reporting in higher education is currently still in its early stages, and because a systemic approach to sustainability integration in higher education is often lacking, this paper researches possible contributions of management control to sustainability reporting and the sustainability integration process in higher education. The paper adheres to a management control approach by applying Simons' (1995) Levers of Control framework to the field of sustainability in higher education, in search for a framework for integrating sustainability on a strategic level into higher education. The research stresses the need for a holistic approach, including the four types of controls, and for further in-depth study into how sustainability reporting is used in higher education in relation to strategy, in order to assess its potential for organisational learning.*

Keywords: *Management control, levers of control framework, sustainability in higher education, sustainability reporting, social responsibility, performance management, management control systems.*

Introduction

Over the last decades, the concept of sustainable development (SD) has received more attention, due to global problems of, amongst others, population growth, climate change, and financial crises the world has been confronted with. This aspiration of achieving a society that creates value on an economic, social, and environmental level has inspired many actors in society to take action. Higher education institutions (HEIs) are among these actors, and they hold a unique position in society, because of their potential to facilitate, promote, and encourage societal response to a diverse array of sustainability challenges facing communities around the world (Stephens, Hernandez, Román, Graham, & Scholz, 2008).

HEIs have engaged in promoting SD by educating future leaders, decision makers, academics, and politicians, sharing thoughts and ideas via conferences (e.g., the Halifax Conference on University Action for Sustainable Development in 1991, the Johannesburg Summit in 2002, and the UNESCO World Conference on Education for Sustainable Development in 2009), and the subsequent development and signing of declarations (e.g., Stockholm Declaration, Talloires Declaration, or Ubuntu Declaration) (Lozano, Lukman, Lozano, Huisingh, & Lambrechts, 2013; Wright, 2002). Despite the array of SD initiatives undertaken by HEIs—e.g., the development of SD courses, teacher trainings on SD, or "campus greening" initiatives)—it is still challenging for their internal and external stakeholders to assess an institution's sustainability related activities and the extent of their implementation within its different functions [i.e., education, research, operations, and community outreach (Cortese, 2003; Lidgren, Rodhe, & Huisingh, 2006; Velazquez, Munguia, Platt, & Taddei, 2006)]. Some HEIs have been voluntarily reporting their efforts of SD integration via SD reporting, following the upsurge of this type of reporting in the corporate world (Daub, 2007). Nevertheless, SD reporting in HEIs is currently still in its early stages, both in terms of the number of institutions reporting, as well as the level of detail in which they are reporting (Lozano, 2011).

Transparent and standardised reporting on sustainability performance should provide a clear view of HEIs' current state of progress towards sustainability for internal and external stakeholders (Lozano, 2006a), clearly increase cross-institutional comparability, in addition to providing managers with tools for strategic management of SD integration in the organisation (Burritt & Schaltegger, 2010). In their research on the integration of SD reporting in management practices, Adams & Frost (2008: 288) indicate that, *"there has been surprisingly little research into sustainability reporting processes and the extent to which data collected is used in decision-making in organisations."* This paper offers a conceptual study on SD integration and reporting in higher education, viewed from a management control perspective. The research aims at providing answers to the following research question: *"How can management control contribute to the process of sustainability reporting in HEIs when integrating sustainability on a strategic level within the organisation?"* The innovative character of the paper is its connectivity with two different fields of study, i.e., the field of higher education for sustainable development (HESD), and the field of management control (MC).

On the one hand, the emerging field of HESD has been criticised for not always providing solid theoretical frameworks and offering various case studies of strongly differing quality (Barth & Thomas, 2012; Karatzoglou, 2013). On the other hand, within the field of MC, there is an increased interest in studies on control models, on new forms of organisation, and on the concept of sustainability (Berry, Coad, Harris, Otley, & Stringer, 2009). Moreover, Berry et al. (2009) stress the essential need to combine theory and practice in management control research, and to place more emphasis on the study of real control systems. Because until today, MC topics have not been analysed in depth specifically for HEIs, focus will be set on the possible contributions of MC to SD reporting and the SD integration process in HEIs. Simons' Levers of Control framework (Simons, 1995), a seminal and still frequently used theory from the MC literature (Berry et al., 2009), will be applied to the HESD context. This seminal framework has been used particularly in business environments, and has currently not been applied to the field of HESD. Nevertheless, the following sections will show that there is a potential for synergies between these topics. Although this paper presents a conceptual study, it offers a set of managerial implications, and can provide a basis for further empirical research on SD reporting in higher education, grounded in organisational reality.

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The structure of the paper is as follows: in the next sections, a critical analysis of the relevant literature on MC and SD reporting in HESD will be provided. Afterwards, by finding the interconnections between these different topics, a theoretical framework will be sought on the contributions of MC to SD reporting when integrating SD on a strategic level into HEIs. Finally, some paths for further research will be presented.

Management Control Systems for Strategic Control

Research within the field of MC has evolved strongly since the application of the classical, accounting-based management control theories from the 1960s (Hewege, 2012). In this period, Anthony (1965, in Langfield-Smith, 1997) defined MC as, *"the process by which managers assure that resources are obtained and used effectively in the accomplishment of the organisation's objectives."* Nevertheless, an important shift has occurred throughout the years, i.e., *"the change from a focus on business planning to a wider focus on business strategy and strategic control processes"* (Otley et al., 1995 in Berry et al., 2009), making this one of the most important and often discussed emerging themes in the current MC literature (Berry et al., 2009). A more recent definition of MC reflects this shift; Merchant & Van der Stede (2012) state that MC is, *"the third of management functions along a process involving objective setting, strategy formulation, and management control", or in other words, "the back end of the management process."* The latter also clearly distinguish between "strategic control" and "management control", because the authors view strategic control as a management process in relation to the external environment of the organisation, while according to them MC is focused on execution and has an internal focus (Merchant & Van der Stede, 2012).

Management control systems (MCS) should be understood in this context, and can be more specifically placed within the field of performance management for strategic control. Analogously with the concept of MC, many different definitions exist of the concept of MCS. Simons (1995) defines MCS as*, "the formal, information-based routines and procedures managers use to maintain or alter patterns in organisational activities."* Contrarily, Merchant & Van der Stede (2012) define MCS broadly, *"to include everything managers do to help ensure that their organisation's strategies and plans are carried out or, if conditions warrant, that they are modified."* Often discussed in the literature is what is called the "integrated approach" towards studying performance in MCS. Otley (1999, in Berry et al., 2009) states that, *"examining objectives, strategy, measures, incentives, and information flows, as well as contextual issues, e.g., external environment, organizational culture, social controls and history,"* are all part of studying this topic in an integrated manner.

There are different models present in literature that bring together these components, or in other words, that study performance management in MCS in an integrated or holistic way (Berry et al., 2009):

- strategic performance measurement systems (SPMS), e.g., Kaplan and Norton's balanced scorecard (Kaplan & Norton,1996);
- Simons' Levers of Control (LOC) framework (Simons, 1995); and
- Ferreira and Otley's performance management and control (PMC) framework (Ferreira & Otley, 2009).

Of these different control models for performance management, Simons' LOC framework has been very influential and has been often applied, but is also still under discussion and in the process of being further developed. Although the development of the framework stems from the beginning of the 90s, its applications are still part of the emerging literature on MC (Berry et al., 2009). Because of its influential status and applicability to the field of HESD and SD reporting, the framework will be used for this conceptual study.

Simons' Levers of Control Framework

Simons' LOC framework was constructed in the early 1990s as a reaction against traditional philosophies of management and control, where strategy was imposed top-down, standardisation and efficiency were rule, and results had to be according to plan (Simons, 1995). Simons' (1995) framework, contrarily, allowed more space for flexibility than traditional management control systems, in times where new types of organisations were forming, strategies became more driven by the external environment, and continuous improvement and empowerment became key.

Simons' LOC framework starts from the idea that every organisation distinctively uses four types of MCS to control its business strategy (Simons, 1994), and that the mix of these MCS applied in the organisation should be studied in an integrated way, looking at the whole system rather than solely focusing on certain (accounting) controls (Tuomela, 2005). Central to the LOC framework are the opposing forces that occur within MCS between the following concepts (Simons, 1995: 4): freedom vs. constraint, empowerment vs. accountability, top-down direction vs. bottom-up creativity, and experimentation vs. efficiency. An organisation's business strategy can be controlled by finding a suitable balance between the tensions induced by these opposing forces, represented in the four levers of control (Mundy, 2010; Tessier & Otley, 2012). Since the LOC framework balances the need for innovation and constraints within an organisation (Tuomela, 2005), it contributes to managing organisational performance (Mundy, 2010).

Elements of the Framework

According to Simons (1994), MCS used in organisations can be clustered into four different types, according to their relationship to strategy and their use by top managers. Together, these four controls form the LOC framework:

- beliefs systems;
- boundary systems;
- diagnostic control systems; and
- interactive control systems.

The first two levers of control, i.e., belief and boundary systems, are about framing the strategic domain of the organisation. On the one hand, Simons' (1995) belief systems are *"used to inspire and direct the search for new opportunities"*. They are about giving employees a certain direction, by offering them a mission and vision to adhere to when working for the organisation. On the other hand, his boundary systems are *"used to set limits on opportunity-seeking behaviour"*. They clarify where the boundaries of this strategy are for the organisation, and they provide direction on the risks and activities to be avoided within the organisation.

Simons' (1995) diagnostic control systems are *"used to motivate, monitor, and reward achievement of specified goals"*. They are formal negative feedback systems designed to ensure predictable goal achievement, by allowing measurement, comparison to standards or goals, and corrective action. This implies that via these systems, and after setting up relevant critical performance variables, managers can relatively easily, or without constant oversight, verify whether the decisions made and actions undertaken within the organisation are in line with the organisational goals and intended strategies set out in the beliefs and boundary

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systems. Simons (1995) stresses the importance of the selection and training of workers in an organisation that have the capacity to adequately deal with diagnostic control systems.

The interactive control systems of Simons' framework are *"used to stimulate organisational learning and the emergence of new ideas and strategies"*. They stimulate dialogue and organisational learning, and allow new strategies to emerge from different parts of the organisation. They are a response to the strategic uncertainties that arise in an organisation, and that demand strategy adaptation and managerial attention. Interactive controls also provide feedback, but focus on the emergent, instead of on the intended, organisational strategies. Simons (1995) stresses that by focusing attention on these strategic uncertainties, interactive control systems can guide and shape emerging, bottom-up processes.

Further Developments

Since the development of Simons' (1995) LOC framework, different authors have been presenting further developments or applications of the framework. Among those authors are: Gond, Grubnic, Herzig, & Moon, 2012; Mundy, 2010; Tessier & Otley, 2012; Widener, 2007. In 2007, Widener presented an empirical study of the relation between MCS and firm performance, and used Simons' framework to support its theoretical model. Some of the main results of the research are that (1) two levers of control—i.e. diagnostic and belief systems—facilitate the efficient use of management attention, while interactive control systems consume management attention (or can be seen as costs of control) and (2) organisational learning is enhanced by emphasis on the beliefs system and by use of the diagnostic system.

Mundy's (2010) research aimed at understanding how organisations balance the dynamic tensions between the controlling and enabling uses of MCS, as represented in Simons' framework. The author used a single case to study MCS in an organisation in depth, and identified and explained a number of factors that influence an organisation's ability to balance the different uses of MCS. The study showed, amongst others, that interactions between different uses of MCS are potentially impacted as much by "absence of use" as by "inappropriate use" (e.g., by suppression). Moreover, the research found that certain levers of control can persistently determine the use of other levers, regardless of specific contingent factors influencing the organisation.

Tessier and Otley's (2012) conceptual paper covered a thorough examination of Simons' LOC framework. The authors offered a revised LOC framework, with a set of 14 differences or clarifications to the original framework. One of the most important elements of the revised framework was the division between management intentions and employee perceptions, indicating that there is a distinction between the choices managers make regarding the use of certain control systems on the one hand, and on the other hand, the way employees, after presentation of the controls, react to these controls. The paper concludes that in-depth research should be performed on the topic of the distinction between the two, and that further studies should also study MCS from a holistic point of view.

Also in 2012, Gond et al. presented a conceptual study theorising the integration of strategy and SD. The authors approached SD from an organisational point of view and relate it to organisational strategic renewal. Moreover, they claimed that although many organisations have embedded sustainability in their mission statements and external reporting, there is a lack of examples of organisations implementing sustainability in their management systems, and of research on the potential impacts of doing so. Therefore, Gond et al.'s (2012) aim was to clarify the relationship between MCS and sustainability control systems, and to research how, on a strategic level and from a management control perspective, the integration of SD in organisations can be either facilitated or prevented. The authors extended Simons' LOC framework to the domain of SD, and approach management control from a strategic perspective when trying to integrate management control systems with sustainability control systems. A possible path for further research on this topic was, according to Gond et al. (2012), the identification of more contingency factors affecting an organisation's capacity to use and integrate management control systems.

Sustainability Reporting and Management Control

Sustainability reporting, according to the GRI (2011: 3), can be described as: "the practice of measuring, disclosing, and being accountable to internal and external stakeholders for organizational performance towards the goal of sustainable development". Daub (2007: 76) clarified that a sustainability report—an outcome of sustainability reporting—must, "contain qualitative and quantitative information on the extent to which the company has managed to improve its economic, environmental and social effectiveness and efficiency in the reporting period and integrate these aspects in a sustainability management system". These definitions clearly refer to two elements of SD reporting: (1) reporting of SD initiatives for external communication purposes, and (2) reporting with the aim of improving management practices towards SD integration. It is mainly the second element, i.e., reporting with the aim of improving management practices, which is a central issue in the research of this paper.

A specific link of Simons' (1995) LOC framework to the different uses of SD reporting by managers was made by Gond & Herrbach (2006). According to the authors, SD reporting can be either used as a diagnostic tool, or as an interactive tool, leading respectively to SD adaptation or SD learning processes. In the first case, top management's commitment to SD reporting is weak, and only employees involved in the process as part of their regular jobs will be affected by the procedure of reporting. In the second case, there is a high commitment to SD reporting on all levels of the organisation, leading to an emergent perspective on strategy, with room for bottom-up processes and innovation.

Gond & Herrebach (2006) indicated that certain aspects of SD reporting—as compared to SD reporting as a whole—might be used interactively or diagnostically, depending on their strategic importance as viewed by management. The authors suggested the need for further empirical research addressing these topics, in addition to looking at specific external elements (e.g., market turbulence, industry norms, or legislation) or organisational characteristics (e.g., size, culture, or the strategic importance of SD), that could affect this relationship.

Sustainability Integration and Reporting in Higher Education

HEIs hold an important exemplary function in society, since they are educating future citizens, policy makers, and world leaders (Ceulemans & De Prins, 2010; Lozano, 2011). Although HEIs have been called upon to integrate SD into these different functions, actual implementation remains difficult (Thomas, 2004; Velazquez, Munguia, & Sanchez, 2005); there are a number of barriers and challenges to SD integration in HEIs that are apparently hard to overcome (Lozano, 2006b).

Table 1 presents an overview of the most important barriers found in the higher education for sustainable development (HESD) literature. Within Table 1, the barriers and challenges of SD integration in HEIs have been divided into different categories, and the main articles mentioning these issues are added. Among the barriers found in the literature, a distinction can be made between barriers on the level of the individual, of different groups within the organisation, and of the whole organisation (i.e., the HEI).

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Table 1: Major Barriers to SD Integration in HEIs found in the HESD Literature

Major Barriers to SD Integration in HEIs	Authors from HESD Literature
On the individual HEI stakeholder level:	
- a fundamental lack of **awareness**, **interest**, and **involvement** in the SD topic among management, staff, and students;	*Fenner, Ainger, Cruickshank, & Guthrie, 2005; Jabbour, 2010; Lidgren et al., 2006; Thomas, 2004; Velazquez et al., 2005*
- a lack of **understanding** of the SD concept and a **perceived difficulty** of implementation;	*Jabbour, 2010; Lidgren et al., 2006; Sibbel, 2009; Thomas, 2004; Velazquez et al., 2005*
- a feeling of **not being supported** by management for SD integration;	*Thomas, 2004; Velazquez et al., 2005*
- a lack of **time** due to other primary responsibilities within the HEI; and	*Fenner et al., 2005; Velazquez et al., 2005*
- a general **resistance to change**.	*Ferrer-Balas et al., 2008; Lidgren et al., 2006; Lozano, 2006b; Velazquez et al., 2005*
On the HEI group level:	
- the **divide** between the education, research, and service functions of HEIs, leading to sometimes varying or competing orientations and priorities in terms of SD, differing modes of engagement towards SD, and an often diffuse focus; and	*Bero, Doerry, Middleton, & Meinhardt, 2012; Krizek, Newport, White, & Townsend, 2012*
- the **discipline oriented divisions** within the educational and research departments, with little intra-departmental interaction and an academic culture of specialisation and individual academic freedom.	*Fenner et al., 2005; Ferrer-Balas et al., 2008; Lidgren et al., 2006; Sibbel, 2009; Thomas, 2004; Velazquez et al., 2005*
On the HEI organisational level:	
- a lack of **integration** due to decentralised management and power concentrations at different levels, bureaucracy, students and faculty turnover, non-standardised processes;	*Krizek, Newport, White, & Townsend, 2012; Velazquez et al., 2005*
- a general lack of **policies** to promote SD in HEIs, e.g.:	*Velazquez et al., 2005*
* the **incentive structure** within HEIs (salaries, promotions, and granting of tenure), which does not take SD efforts into account;	*Ferrer-Balas et al., 2008; Lidgren et al., 2006; Thomas, 2004*
- regarding the presence of **resources** and information, i.e.:	
* a lack of **financial resources** to invest in sustainability issues;	*Bero, Doerry, Middleton, & Meinhardt, 2012; Jabbour, 2010; Krizek et al., 2012; Velazquez et al., 2005*
* a lack of availability of trained and skilled **staff** and **experts** to deal with SD issues;	*Jabbour, 2010; Lidgren et al., 2006; Thomas, 2004; Velazquez et al., 2005*
* the lack of, the inaccuracy of, and the inaccessibility of **data** on SD issues within HEIs;	*Sibbel, 2009; Velazquez et al., 2005*
* the lack of **performance indicators** for monitoring progress towards SD;	*Velazquez et al., 2005*
* the lack of **communication** on SD initiatives and progress;	*Velazquez et al., 2005*
- a lack of **pressure** from society to change institutional behaviour.	*Ferrer-Balas et al., 2008; Lidgren et al., 2006*

On the level of the individual internal HEI stakeholder, the typical barriers prevailing are, amongst others: a lack of awareness or involvement for SD, a perceived difficulty of implementation of SD initiatives within the individual job context, and a general resistance to any type of change within the institution. On the group level, the barriers occurring can be related to the typical organisational structure of HEIs. On the one hand, there is a divide between the different functions of HEIs, which implies that mainly communication between the educational and research departments and their counterparts of the service departments is often difficult or non-existing. Because these groups within the organisation are often managed separately, this divide leads to varying interests and priorities between the different groups, also in terms of engagement for SD. On the other hand, there is also a large divide within the educational and research departments in terms of the different disciplines, resulting in a lack of management interaction, interdisciplinary cooperation, and communication. Moreover, this is reinforced by the tendency towards specialisation and individual academic freedom prevailing in higher education.

These group level barriers, along with other issues like frequent student and faculty turnover or bureaucracy, result in a lack of integration on the organisational level of HEIs. Other barriers on the organisational level are a general lack of policies promoting SD in HEIs, and the lack of certain resources and information, like financial means to invest in SD initiatives, skilled staff and SD experts, and data to inform SD management within the institution. Besides the lack of data, their inaccuracy, or their inaccessibility within HEIs, there is also a lack of performance indicators for monitoring the progress towards SD integration in higher education.

Since many of the above mentioned problems, barriers, and challenges—especially the ones on the group level—are specifically inherent to HEIs, they require an adapted approach (Lidgren et al., 2006). In 1976, Weick already pointed out this specific situation of HEIs and their challenges on the group level, by calling them "loosely coupled systems", that consist of different, separately operating departments and faculties with their own identity and functioning, and that are therefore difficult to manage as a whole and require the development of a contextual methodology (Weick, 1976).

Approaches to Strategic SD Management and Management Control in HEIs

Within the field of HESD, many papers report on the critical need of management support for SD integration in HEIs (Lidgren et al., 2006; Lozano, 2006b), but the actual topic of how to put this into practice is not often discussed. Nonetheless, some management approaches to SD integration are presented in the HESD literature. Velazquez et al. (2006) and Lukman & Glavič (2006) respectively presented their own "sustainable university model" and "process and elements of a sustainable university", both clearly top-down models based on a quality management approach. Lidgren et al. (2006) indicated that a systemic approach to SD integration in HEIs is required, but also stated that the traditional "results control" approach—as usually applied when implementing an ISO 14001 environmental management system—does not seem to be effective for use in HEIs, mainly because of HEIs' specific organisational structure. The authors claimed that "intra-university learning" is recommended to intervene in the system, but do not specify how this can be achieved.

While in the HESD literature, only a few examples can be found of the use of MC or MCS for SD integration, more papers are found discussing environmental management systems (EMS) in HEIs. Clarke's (2006) research on the EMS cycle in practice at Dalhousie University discussed the necessity of the distinction between deliberate and unrealised strategies, and the inclusion of emergent strategies in EMS cycles within HEIs, and stated that there is often no clear distinction between planning and implementation phases of the EMS. In this article, strategic management theories were linked with an EMS model, and a more realistic model for environmental management at HEIs was offered, based on the author's own campus experiences (see Figure 1) (Clarke, 2006).

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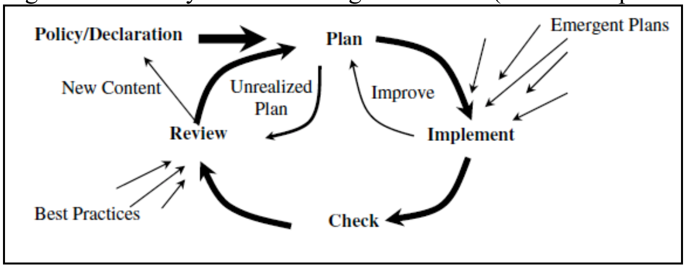
Figure 1: EMS Cycle with Emergent Content (Source: Reprinted from Clarke, 2006: 386)



Clarke & Kouri (2009) further theorised on Clarke's (2006) findings and discussed the decisions HEIs have to make when implementing an EMS. The authors presented some unique key features of EMS for HEIs, derived from the literature and from a comparison of the presented frameworks. According to Clarke & Kouri (2009), an EMS for HEIs:

- involves a continual improvement cycle with emergent plans, unrealised plans, best practices feeding into the review, and interactions between planning and implementation (see also Figure 1);
- can be used for both internal and external purposes (going from compliance, cost savings, and quality management to stakeholder engagement and partnerships);
- requires a structure that matches the decision-making structures of the HEI (e.g., an environmental officer aligned with the operations side of the HEI or with the academic side);
- requires policies that match the decision-making structures (e.g., overarching policies or separate ones for the different HEI dimensions);
- needs specific roles and responsibilities (e.g., an environmental officer, departmental contacts, an auditing team, a multi-stakeholder committee); and
- prefers less EMS documentation, and a sector-specific environmental assessment.

The key features of EMS specified by Clarke and Kouri (2009) offer insights that can also be applied to general sustainability management (e.g., the fact that an EMS requires structures and policies matching the decision-making structures also counts for sustainability management). What is important about these features, is that they offer a contextual approach, adapted to the HEI situation, and that they provide advice that can facilitate practical implementation of management systems in HEIs.

Top-down versus Bottom-up Approaches to SD Integration

Traditional approaches to MC are mostly top-down oriented, and investigate ways for the management to control the behaviour of their employees in order to achieve certain organisational goals (in this case SD integration in HEIs). Nevertheless, certain authors within the HESD literature also critically comment on this managerial approach. For example, Thomas (2004) and Fenner, Ainger, Cruickshank, & Guthrie (2005) stressed the importance of bottom-up initiatives by individuals within the university to promote curricular change (e.g., staff members or students), besides the necessary top guidance to sustain this change. Lozano (2006b) addressed ways of tackling the SD integration barriers in an incremental way, including the engagement and empowerment of convinced individuals. Ceulemans, De Prins, Cappuyns, & De Coninck (2011) also referred to the top-down/bottom-up debate, and concluded that a good balance between top-down and bottom-up initiatives seems to be the most beneficial for sustained SD integration efforts.

Since Brinkhurst, Rose, Maurice, & Ackerman (2011) saw bottom-up change as change initiated by student movements only, they stressed the necessity of the "institutional middle" (in this case faculty and staff, as opposed to top/management and bottom/students), as a way to enable “middle out change.” But as in most of the HESD literature, actual strategies to implement SD initiatives initiated by the institutional middle are not further specified. In their research on EMS, Disterheft et al. (2012) made a distinction between the implementation of such a system via a top-down approach, versus participatory approach, or a mix of both. According to the authors, the use of a participatory approach or a mix of top-down and participation is more effective when aiming for more than just the implementation of EMS, but also creating the necessary settings for a paradigm shift to sustainable practices in all the dimensions of a HEI’s system (Disterheft et al., 2012).

Research on SD Reporting in HEIs

Due to the importance of sustainability reporting in the corporate world, and because of the need for transparency on SD integration efforts, some HEIs have begun sustainability reporting in the last decade. Nonetheless, only a few relevant articles can be found in the HESD literature discussing SD reporting in HEIs, and among them, none of the articles discussing SD reporting as the core topic of the research currently make a connection with the field of MC.

Within both Velazquez et al. (2006) and Lukman & Glavič’s (2006) top-down models for SD integration, SD reporting is shortly addressed. Velazquez et al.’s (2006) model stressed the need for sustainability audits, assessment and reporting as a way to monitor, analyse, and control the performance of sustainability initiatives. Lukman & Glavič (2006) specifically stressed that the improvements achieved in the entire process of SD integration should be included in a sustainability report, thereby facilitating both effective monitoring and communication for SD integration, as well as comparison and benchmarking of HEIs. In both of the articles control and monitoring are addressed, but the SD reporting process is used in a diagnostic rather than an interactive way.

Lozano (2006a), Madeira, Carravilla, Oliveira, & Costa (2011) and White & Koester (2012) addressed SD reporting as a core topic of their research, and discuss the use of (diagnostic) SD reporting methodologies that are specifically adapted to the context of HEIs. In 2011, both Lozano and Fonseca et al. addressed the state of SD reporting for HEIs, respectively throughout the world and within Canada. Lozano (2011) reported a low level of the SD reports found, when compared to corporate SD reporting. Fonseca, Macdonald, Dandy, & Valenti (2011) found that in Canadian HEIs SD reporting is an uncommon and diverse practice. The research also points out that the potential value of the SD reports currently studied is very limited as a tool to inform SD oriented decisions.

Albrecht, Burandt, & Schaltegger's (2007) research is the only article addressing SD reporting in relation to organisational learning—but not MC nor the interactive use of the reporting process are discussed. The article discussed the potential of SD projects for organisational learning, and used the SD reporting process in Lüneburg University as one of the cases studied. The research concluded that SD reporting can be a driver for organisational learning in HEI, because of its potential to mobilise HEI actors and to allow for incremental and fundamental learning. Nevertheless, more research is necessary on this theme to draw further conclusions, since the case of SD reporting was not addressed in a very detailed matter, and since SD reporting was not the central theoretical concept researched within the study. White & Koester (2012) also shortly referred to the potential for organisational learning through the implementation of SD reporting tools in conjunction with SD assessment tools, but do not offer any further insights into the matter.

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Discussion: In Search for a Management Control Framework for Sustainability Integration and Reporting in Higher Education

Within the HESD literature, some attempts have been made to relate the topic of SD integration in general to (aspects of) MC (Lidgren et al., 2006; Lukman & Glavič, 2006; Velazquez et al., 2006). Nevertheless, most of the discussed articles do not manage to offer a systemic view on the topic, provide concrete strategies to improve management practices in HEIs, or offer space for bottom-up approaches to SD integration. Applying Simons' LOC framework to SD reporting and integration in HEIs offers a potential for the HESD literature and practice, because of its holistic approach, its aims of improving management practices while focusing on employee empowerment and flexibility, its potential for a practical approach through the use of sustainability reporting, and because of the possibility to provide links with a large number of the SD integration barriers. These elements will be further discussed in this section.

Since Simons' framework was developed for business environments, it focuses on combining creative innovation with predictable goal achievement for achieving profitable growth. The framework can be adapted and used in non-profit environments, and can be focused specifically on strategy development for SD in HEIs. This provides an analysis of Simons' (1995) framework for the contingency factor "type of organisation" (i.e., HEIs), as suggested by Gond et al. (2012). The adaptation implies that, although important for any type of organisation, less focus will be on the achievement of profitable growth, and on the notion of competition, since there is a common goal for HEIs to direct their organisations towards SD, rather than strong competition to do so, or than the need to relate this to profit making. Nevertheless, this still leaves the necessary space for HEI managers to develop unique and distinctive SD strategies when striving towards SD integration in their institutions.

Beliefs and Boundary Systems for SD Integration in HEIs

When striving towards SD integration, a clear SD vision and mission statement should be present in the organisation, which can be provided by the belief and boundary systems of an MCS. Important is that these statements are defined broad enough to make sure that all types of personnel members can identify with them and understand their meaning (Simons, 1995). When looking at the SD integration barriers, belief systems—when actively used in the organisation—could tackle some of the barriers on the individual level (see Table 1), e.g., the problem of the feeling of absence of management support for SD (Thomas, 2004; Velazquez et al., 2005). Moreover, they can create awareness, interest, and involvement in SD topics among all university stakeholders, which can also be an important barrier to SD integration (Fenner et al., 2005; Jabbour, 2010). Also, a clear definition of what the SD concept signifies for the organisation (Lidgren et al., 2006; Sibbel, 2009) could help tackling the lack of understanding of SD, and therefore links to the boundaries of the SD integration strategy. Or in other words, implementing SD initiatives could be simplified when the limits to what can be done or which activities one can invest in are made clear in the organisation.

As Lee, Barker, & Mouasher (2013) and Lozano et al. (2013) stressed, top-level commitments, such as mission and vision statements or the signing of declarations, should translate into concrete actions on all levels of the HEI. Moreover, within a modern MC approach, an SD strategy is formed through engagement with internal and external stakeholders, via the concept of materiality, where both the significant impacts for the organisation, as well as for their stakeholders count and develop mutually into strategic SD goals. As some research has been performed on the importance of mission statements and declarations, the main challenge here is to integrate and use this research within a holistic MC approach to SD integration in HEIs.

SD Reporting as Diagnostic and Interactive Tool for SD Integration in HEIs

SD reporting—in any type of organisation—is fundamentally about communicating the SD message to a wide range of stakeholders. Nevertheless, by linking the reporting process to Simons' (1995) LOC framework, SD performance can also be facilitated, and a potential arises for organisational learning (Gond & Herrbach, 2006).

Regarding diagnostic controls, SD reporting offers an entire range of indicators to measure and monitor SD integration in an organisation, especially when using the Global Reporting Initiative (GRI) Guidelines[1]. Nevertheless, when applied to HEIs, only the operational functions of HEIs are covered by the GRI indicators (Lozano, 2006a). In order for the diagnostic indicators to judge SD integration in HEIs, some specific indicators for SD integration into the education, research, and outreach functions should be integrated into SD reporting standards such as the GRI (Lozano, 2006a; White & Koester, 2012). Some of the most relevant tools for SD integration covering the core activities of HEIs are: AISHE (Roorda, 2001), GASU (Lozano, 2006a), STAUNCH (Lozano, 2010), and STARS (AASHE, 2012).

Using SD reporting as a diagnostic tool also has the potential to address other integration barriers to SD integration in HEIs. Diagnostic controls can help tackle some of the barriers on the organisational level (see Table 1), e.g., the presence of resources and information in the organisation (Bero, Doerry, Middleton, & Meinhardt, 2012; Krizek, Newport, White, & Townsend, 2012). More specifically, they link to the need for performance indicators, and for accuracy and accessibility of data on SD issues (Sibbel, 2009; Velazquez et al., 2005). As one of the barriers to SD integration is the lack of trained and skilled staff on SD issues, staff development is also crucial for being able to tackle SD integration within HEIs, and for internal stakeholders to know what to teach and how to monitor SD performance. This need has also been stressed in the recent HESD literature (Barth & Rieckmann, 2012; Ceulemans & De Prins, 2010), as well as by Simons (1995) as one of the requirements for the functionality of the LOC framework.

Although the use of a particular set of diagnostic indicators is necessary within a MCS, the potential for organisational learning of SD reporting only arises through interactive use of the reporting process (Gond & Herrbach, 2006). Therefore, SD reporting should be used as an interactive tool on all levels of the HEI. For example, regarding internal stakeholders, SD reporting offers them the chance to get to know what others do in relation to SD, and learn from each other. Addressing the group level barriers of SD—i.e., the divide between the core business and service functions of HEIs, and the discipline-oriented divisions between the educational and research departments (Bero et al., 2012; Fenner et al., 2005; Krizek et al., 2012)—through SD reporting has the potential to facilitate better communication between the different departments within an HEI, which is important considering the loosely coupled organisational structure of HEIs (Weick, 1976). This is, amongst others, because all of these staff members have to be involved in the process of data collection and engagement, and because the results are visible for everyone in a concrete report. Nevertheless, as Clarke & Kouri (2009) stressed, in order to be functional in HEIs, the structure of the platform for SD reporting processes should match the decision-making structures in HEIs, implying that all

[1] The GRI Guidelines are considered to provide the most detailed, competent, and prescriptive set of indicators for SD reporting (Daub, 2007; Fonseca et al., 2011; Lozano, 2006a; Velazquez et al., 2006).

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the departments and faculties should be in some way included. An SD report can be used interactively within the different departments, allowing for bottom-up processes to arise, which are considered an important part of the SD integration process (Brinkhurst et al., 2011; Ceulemans et al., 2011).

The report can also guide the stakeholder dialogue included in the SD reporting process with internal and external stakeholders. Setting up an interactive dialogue with stakeholders, especially when following the GRI guidelines, enables an organisation to respond to the reasonable expectations, interests, and important challenges present inside or outside the organisation (GRI, 2011), in addition to the formal requirements or demands set up by direct stakeholders such as accreditation bodies. Consequently, it can provide space for emergent strategies (as stressed by Clarke, 2006) to develop into realised strategies within HEIs.

The SD reporting process also offers synergies with the beliefs and boundary systems of the LOC framework, because the reporting process can help clarify and communicate the beliefs and boundaries throughout the organisation and to external stakeholders. Simons (1995) also refers to the importance of involving employees when setting up belief statements in the organisation. SD reporting could provide assistance for this type of exercise, since it provides a process of internal and external stakeholder engagement and strongly emphasises the materiality of certain SD topics to an organisation.

Importance of Holistic Approach and Continuous Management Cycles

This paper offers a MC framework for SD integration in HEIs, amongst others through presenting the use of SD reporting as a diagnostic and interactive tool within the organisation. This results in an approach to SD integration that gives clear top-down directions towards SD strategy development while providing the necessary space for bottom-up initiatives to be developed within higher education, and importantly, turns SD reporting into more than solely a communication tool for SD initiatives implemented in the organisation. In order for the approach to be holistic, the LOC framework should be approached holistically, which means that the four different controls should be used and researched in conjunction with each other.

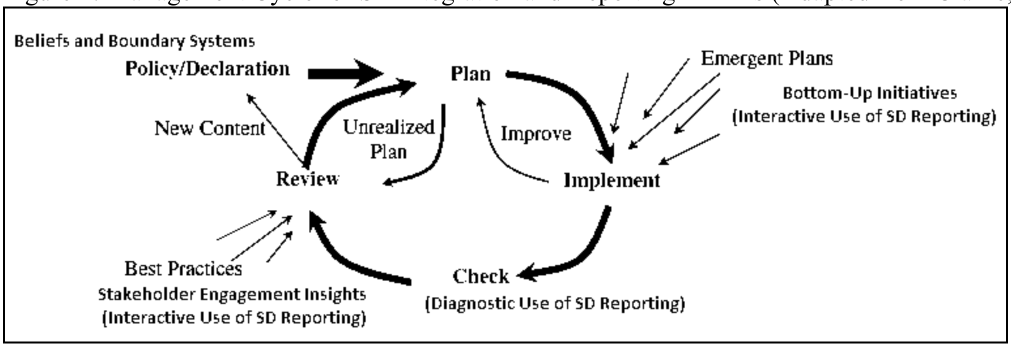
Therefore, empirical research should address this framework holistically (Tessier & Otley, 2012), with specific attention to the different aspects addressed within the framework. Some of these aspects are: the translation of SD mission and vision statements or declarations to operational levels, the concept of materiality in relation to the beliefs and barriers, the development of training initiatives for HEI staff, the adaptation of the diagnostic control indicators for HEIs core activities, and organising interactive stakeholder engagement processes included within the SD reporting process. These issues are represented in Table 2, in conjunction with the LOC framework. Although all the elements included in the framework are important, it is the combination of the different elements, or the holistic approach, that might determine whether SD integration progresses move in the desired direction. And since all HEIs are different, tailoring SD integration and the controls to the specific situation of the HEI might be necessary (Lidgren et al., 2006).

Table 2: Linking Simons' (1995) LOC Framework with SD Integration and Reporting in HEI

Belief and Boundary Systems
- Importance of Materiality to Form Beliefs and Set Boundaries - Implementation of SD Mission and Vision Statements through Operational Activities
Diagnostic Control Systems
- Adaptation of SD Reporting Indicators to HEI Core Activities and Practical Use in HEIs - Training in SD Knowledge and Skills for HEI Staff
Interactive Control Systems
- Importance of SD Stakeholder Dialogue, with Communication between HEI Departments and Input from External Stakeholders - Room for Emerging Strategies through Use of Bottom-up Approach in SD Reporting Process

In order to allow for continual improvement, the framework can be linked with repeating management cycles. Clarke (2006) and Clarke & Kouri (2009) clearly stressed the need for subsequent management cycles and for continual improvement and adaptation of SD strategies, and therefore offered a clear representation of these cycles in higher education. Clarke's (2006) management cycle can be easily adapted to general SD integration instead of EMS, and added to the SD integration framework, but nevertheless, some new elements should be added, in order to move away from the traditional results control (Lidgren et al., 2006), and allow for organisational learning through the use of sustainability reporting.

Figure 2: Management Cycle for SD Integration and Reporting in HEIs (Adapted from Clarke, 2006)



The cycle starts from the "policies and declarations", representing Simons' (1995) beliefs and boundary systems, and then moves to the implementation of intended and emergent strategies, as was also referred to by Simons (1995). Reporting, used as a diagnostic tool, should be added to the cycle in the "check" phase. The "emergent plans" Clarke (2006) refers to in Figure 1 can be seen as the bottom-up initiatives coming from faculty staff and students, while insights from the stakeholder engagement process can be added to the phase where "best practices" join the reviewing process. Both of these elements can be seen as interactive uses of the SD reporting process. Adding these new elements to the management cycle generates an adapted SD management cycle as represented in Figure 2.

Paths for Further Research

Although in-depth research on SD integration and reporting based on solid theoretical frameworks is currently scarce in the HESD literature, future research can build on this framework to further develop it and to test its applicability in practice. Since only a limited number of HEIs are currently reporting on their SD activities and addressing SD integration strategically, future empirical research should be focused on some of these institutions and

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use their experiences as pilot studies. When carefully selected, single case studies—such as Mundy's (2010)—and preferably longitudinal ones, can be undertaken within HEIs.

Such case studies could cover an in-depth study of the implementation of SD reporting and integration within certain HEIs, and test whether the four controls are put in practice and how they are used in conjunction with each other. This can point out how certain combinations of the different controls are used and what their benefits, challenges, and potential for improvements are. An important issue to study within this process is how SD reporting is used in HEIs in relation to strategy, or in other words whether SD reporting is used interactively, in order to test its potential for organisational learning towards SD. These suggestions for further research can provide interesting insights to the topic, both for theory development, as well as for providing managers with practical advice for SD integration in higher education.

Conclusion

Within our society, the general interest in SD is increasing, due to a number of challenges on the global level, such as climate change, poverty, or financial crises. As HEIs are an important actor in our society, they should be addressing these issues as a priority within their educational, research, and outreach activities, as well as in their physical operations. Whether HEIs actually practice what they preach regarding the implementation of SD issues, can be assessed by their internal and external stakeholders through the process of SD reporting. Nevertheless, as this paper emphasises, SD reporting has the potential to be more than solely a tool for communicating efforts towards SD integration: it can set in action a larger process of real engagement and change towards SD within the internal management of the HEI.

This paper offers theoretical insights on the contributions of MC to improving SD integration in HEIs. It applies Simons' (1995) LOC framework and stresses that it is the combination of its different elements, or the holistic approach, that determines whether the SD integration process moves in the desired direction. By using SD reporting as an interactive tool within the organisation, opportunities are created for organisational learning towards SD. And as HEIs are essentially institutions for learning, this is a fundamental issue they should be pioneering in, instead of their current situation of, in many aspects of SD integration, lagging behind the corporate sector. Therefore, besides aiming at facilitating further research on the topic of SD reporting in HEIs, the paper also intends to motivate HEI managers to engage in SD reporting within their institutions, and to offer their staff members the necessary space and tools to put this into practice.

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THE INFLUENCE OF FINANCIAL ANALYSTS ON THE UNDERINVESTMENT PROBLEM

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Abstract. *In this paper, we investigate whether more analyst coverage alleviates firm's financing and investment distortions. Using a sample of 44 countries, we find that analyst coverage is positively related to firm's financing constraints, in accord with the view that financial analysts' do not reduce information asymmetries between market participants and contribute to efficient capital allocation. Furthermore, our results also indicate that analysts' activities do not produce different effects depending on the country's home environment.*

Keywords: analyst coverage, firm's financing constraints, information asymmetry, market efficiency, investment-cash flow sensitivity, financial hierarchy

Introduction

Given that small investors lack both time and resources to perform detailed firms evaluations, there is keen interest in how security analysts' activities benefit the typical investor. Allegedly, analyst coverage is meant to reduce information asymmetries between market participants, thereby contributing to keep stock prices in line with firm fundamentals. However, widely heard, the rhetoric about security analysts is being questioned in the sense that it fails to clarify the true nature of their role in capital markets. In fact, subsequent to 2008 financial crisis, security analysts have come under considerable criticism. Allegations against financial institutions engaging in massive conflicts of interest, betting against their own clients, and assigning AAA ratings to high risk securities have severely shaken investors' confidence in the useful role of security analysts. Therefore, the purpose of this study is to examine whether financial analysts act as providers of firm-specific information or focus on serving their own interests (e.g., generate trading commissions) at the expense of other market participants.

Regarding the questionable amount of firm-specific information conveyed by financial analysts, recent empirical evidence suggests that it is not significant. With respect to the US market, Piotroski and Roulstone (2004) support the contention that analysts' activities decrease the amount of private information impounded in stock prices and increase stock return synchronicity (the extent to which market and industry factors explain variations in stock returns). Chan and Hameed (2006) provide similar evidence for emerging markets. These findings suggest that analysts are outsiders who have less access to firm-specific information. As for us, we propose an intuitive approach that investigates whether firms can profit from analysts activities. The traditional approach, in the literature, is to examine whether investors can profit or not from analysts recommendations. On the other hand, the consequences of analyst following on corporate investment and external financing have received less attention. We try to address this deficiency by providing a valuable setting that directly examines the connection between analysts' activities and firm's financial constraints. The papers that are close in spirit to our research are Doukas et al. (2008) and Chang et al. (2006). Doukas et al. (2008) investigate whether excessive analyst coverage, motivated by investment-banking transactions and trading commissions, impacts companies external funding. Their evidence indicates that firms with excessive analyst following overinvest and realise lower future returns, in comparison to firms with low analyst coverage. While Doukas et al. (2008) tests yield a number of interesting findings, their study does not address whether analysts' activities allow firms, with good projects, to invest according to their growth opportunities and investors to distinguish between high quality firms and lemons, which is the focus of our study. Chang et al. (2006) examine the potential associations between firm's financing choices (debt versus equity issuance) and analysts' activities, using the number of analysts as a proxy for information asymmetry. In our approach, we consider the number of analysts' who issued one-year ahead forecasts as a proxy for the resources spent on gathering firm-specific information (Bhushan, 1989), but we do not necessarily view firms with high analyst coverage as facing less information asymmetry problems. In fact, contrary to Chang et al. (2006), we do not assume that high analyst coverage is associated with low asymmetric information because our research is motivated by the mounting evidence raising concerns about the informational role of analysts. Instead, we propose a different approach that investigates whether security analysts help disseminate firm-specific information into stock prices.

In this study, we develop and test the hypothesis that financial analysts can mitigate the Myers and Majluf underinvestment problem if they are able to assess firm value through their research activities. In 1984, Myers and Majluf show that asymmetric information between corporate managers and investors has adverse impacts on firm's ability to raise external capital. Under asymmetric information, outside investors are unable to distinguish between high quality firms and lemons. This, in turn, push investors to value all firms at the population average and impose a premium on high quality firms that offset losses related to funding lemons. As a consequence, firms with profitable investment opportunities are undervalued and managers of high quality firms will choose to forgo firm's investment opportunities. We argue that the underinvestment problem should «disappear» if security analysts generate and provide firm-specific information to outside investors. For instance, if analysts provide investors with valuable information, they might reduce the acquisition costs for investors, and in turn, lower the expected returns of securities. In the same vein, the potential increased transparency and exposure, linked to more analyst following, should attract more investors and broaden firm's investors' base (investor recognition hypothesis, Merton (1987)). As a result, risk should be more widely shared and investors should be more willing to commit capital to companies. In the same line of reasoning, if analysts can collect and disseminate private information, stocks that are covered by a high number of analysts should exhibit price convergence to firm's fundamentals. Hence, as stock prices reflect firm's fundamentals, we should expect them to serve as signals for efficient resource allocation and investment decision (Tobin, 1982; and Durnev et al. 2003).

We base our empirical analysis on one of the most influential theories of firm's financing decisions (Pecking Order Theory). We estimate the association between investment and cash flow to test for the presence and importance of firm's financing and investment distortions. Many

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authors (e.g., Fazzari et al. 1988) interpret high investment-cash flow sensitivity as evidence that firms are financially constrained. According to them, internal capital may impact corporate investment because of a financial hierarchy in which internal funds have a cost advantage over external funds. In fact, when the cost differential between internal and external capital is high, firms are considered as facing binding financial constraints and a value maximizing firm should issue new debt or shares only after it exhausts internal funding (Fazzari et al. 1988). These facts suggest that financially constrained firms should invest more when they have enough cash flow to do so, which will increase the sensitivity of investment to the availability of internal capital. In contrast, unconstrained firms have the possibility to increase their investment expenditures even when they do not have enough cash flow, because the cost differential between internal and external capital is small. Hence, unconstrained firms should exhibit low investment-cash flow sensitivity. To our knowledge, our paper is the first research that applies a traditional measure of firm's financing constraints (investment-cash flow sensitivity) in analyst coverage literature. In addition to our intuitive approach, we also contribute to the literature by using a large sample of firms and countries (44 countries) over the period 1995-2007. It is worth mentioning that most studies in the literature provide either US evidence or limited international evidence. Furthermore, we extend our tests to examine any cross-sectional differences in the role played by analysts in different economic and institutional environments. To test such hypothesis, we propose to classify firms according to financial markets development, the level of investors' protection and accounting standards; before estimating the association between analyst following and firm's financing constraints. Finally, we supplement our primary analysis with more robust specifications that control for potential endogeneity problems.

We find a positive and significant relation between our proxy of firm's financing constraints and analyst coverage, which indicates that analysts' activities are associated with less efficient capital allocation and investment decisions. Our evidence suggests that security analysts' seem to engage more in profitable investment-banking business rather than providing the market with valuable firm-specific information that could decrease the financing and investment distortions of the firm. Finally, we do not document any cross-sectional differences in the role played by security analysts around the world. In fact, our main findings prevail for countries with strong or weak institutions.

The remainder of the paper is organized as follows. Section 2 discusses the existing literature and the conceptual framework. In section 3, we present our methodology and our adopted proxy for firm's financing constraints. Section 4 describes the data and univariate results. In section 5, we discuss our main findings including robustness' tests results. Section 6 offers conclusions.

Literature Review and Hypotheses Development

Our paper relates to an ongoing debate about the useful role of security analysts in shaping efficient capital markets. One stream of research suggests that analysts' activities help mitigate information asymmetries between market participants and improve capital allocation (e.g., Gleason and Lee, 2003). Another strand of research assumes a different role for financial analysts, arguing that analyst coverage is motivated mainly by investment-banking business and trading commissions (e.g., Lin and McNichols, 1998 and Doukas et al. 2008).

A. Evidence of the useful role of analysts

An important empirical literature supports the beneficial and informative role of analysts. For instance, Barber et al. (2001, 2010) document that purchasing (short selling) stocks with the most (least) favorable consensus analysts' recommendations allows investors to earn positive abnormal returns. Knyazeva (2007) and Yu (2008) show that higher analyst coverage is associated with less earnings management. In the same line of reasoning, Barth and Hutton (2000) find that companies with high levels of analyst following incorporate more quickly information on accruals and cash flows, in comparison to companies with low analyst coverage. Moreover, Chung and Jo (1996) document a positive relation between analysts' activities and firm value, and attribute such association to the governance role of analyst coverage. The literature also shows that additional analyst coverage helps facilitate price discovery (e.g., Gleason and Lee, 2003).

B. Conflicting view

There is mounting evidence in the literature that points to a different role for security analysts. In 2001, Lim shows that analysts have incentive to issue earnings forecasts that tend to be upward biased, because optimistic forecasts can improve access to management and increase trading commissions. In the same line of reasoning, Hong and Kubik (2003) study suggests that brokerage houses reward optimistic analysts who promote stocks. As for Doukas et al. (2008), they show that excessive analyst coverage is associated with equity overvaluation, lower future returns and overinvestment. Other contributions (e.g., Jensen 2004, 2005) consider that analysts' optimistic bias puts pressure on firms' managers who, in some cases, will engage in managerial misconduct (e.g., Enron, Nortel and WorldCom) in order to meet analysts' unrealistic forecasts.

C. Analyst coverage and firm's financing constraints

The conceptual framework of this research relates analysts' activities to traditional models of investment with financial constraints. We emphasize asymmetric information between firm's managers and outside investors to explain financing and investment distortions. Myers and Majluf (1984) show that asymmetric information problems represent an important reason why internal funding have a cost advantage over external funding. Asymmetric information can generate a significant cost differential between internal and external capital, which results in underinvestment and less efficient capital allocation. This cost differential exists because investors are unable to distinguish between good and bad projects, under asymmetric information. Theoretically, every issue is priced based on the average projects outcomes (Oliner and Rudebush, 1992). As a result, securities issued to back good projects should be undervalued. Such undervaluation implies that the cost of financing good projects with external capital exceeds the cost of funding the same projects with internal capital (lemon premium). We argue that when the cost differential between internal and external funds is high (binding financing constraints and severe asymmetric information problems), a value maximizing firm will issue new debt or shares only after it exhausts internal capital. Hence, we should expect that investment spending responds positively to an increase in internal capital for constrained firms. The investment-cash flow sensitivity is also linked to the collateral represented by the net worth of the firm. Gilchrist

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and Himmelberg (1995) argue that a decrease in cash flow signals a reduction in firm's net worth and an increase in firm's financial risk. Hence, in periods when cash flow is low, financially constrained firms invest less because the cost of capital is high. On the other hand, when net worth rises (high cash flow), the cost of external capital should decrease and investment should respond more to cash flow innovation.

Theoretically, by collecting and reporting a wide range of firm-specific information to investors, financial analysts can reduce the information risk borne by investors and allow them to distinguish the quality of firms. Therefore, outside investors should not value all firms at the population average and demand a premium that offset losses related to funding lemons. As a result, new shareholders should commit more capital to firms with good projects and the cost of new equity issuance faced by managers of high quality firms should not differ from the cost of internal funding. Under these circumstances, investment opportunities for quality firms should not depend on the availability of internal capital (low investment-cash flow sensitivity) and managers will not choose to forgo such opportunities, because they will simply use external capital to smooth investment expenditures when internal cash flow fluctuates (Fazzari et al. 1988). Furthermore, in the presence of security analysts who mitigate asymmetric information problems, the cost of capital for lemons should be much higher than the cost of capital for quality firms, but the differential cost between internal and external capital should also be small for lemons. Following these arguments, when analysts can mitigate the adverse investment selection problem of Myers-Majluf, financial factors such as the availability of internal cash flow should be irrelevant to investment for both lemons and high quality firms given that external capital can be considered as a "perfect" substitute for internal capital. Instead, investment spending may simply depend on how much risk investors are willing to take for an expected return. As a consequence, we should expect low investment-cash flow sensitivity.

On the other hand, when analysts cannot discriminate between news related to firm's fundamentals and noise, it is possible that investors evaluate investments in stocks based on second-hand information rather than looking at quantitative and qualitative factors. Hence, a positive relation between analyst coverage and noise should affect adversely investors choices, contribute to worsen information asymmetries between market participants, add uncertainty to expected projects outcomes, and ultimately increase firm's financing constraints (investment-cash flow sensitivity). In fact, by increasing noise, financial analysts could, in the short term, issue unrealistic earnings forecasts (e.g., higher growth targets) and make investors feel like if they have valuable information. However, in the long term, analysts' unrealistic forecasts (which are considered by the market as relevant quantitative information) could exacerbate financing and investment distortions when firms could not be able to meet these forecasts. Under these circumstances, we should expect a positive relation between analyst coverage and firm's financing constraints when analysts cause stock prices to deviate from firm's fundamentals.

Empirical Methodology

Our proxy of firm's financing distortions is based on Fazzari et al. (1988). It is meant to measure the relation between firm's investment outlays and firm's internal capital. Therefore, in this paper, we regress corporate investment on cash flow to estimate firm's financing constraints:

$$(I/K)_{i,t} = \beta_0 + \beta_1 (CF/K)_{i,t} + \beta_2 (M/B)_{i,t-1} + \beta_3 Size_{i,t-1} + \varepsilon_{i,t} \qquad (1)$$

Where $I_{i,t}$ represents investment in plant and equipment for firm *i* during period *t*; K denotes the beginning-of-period value of total assets; CF is the sum of income before extraordinary items and depreciation net of cash dividends (for robustness, we also measure CF as : net income + depreciation and/or amortization + changes in deferred taxes); M/B denotes the market to book ratio, and Size denotes the natural logarithm of firm size. The market to book ratio is a proxy for investment opportunities and growth, while size variable controls for potential market imperfections related to firm size. Our main interest in equation (1) centers on β_1. This coefficient represents the investment-cash flow sensitivity (cash flow coefficient (CFC)). According to Fazzari et al. (1988), constrained firms exhibit high CFC.

To study how analyst coverage can influence the investment-cash flow sensitivity, we estimate the following regression:

$$\begin{aligned}(I/K)_{i,t} &= \beta_0 + \beta_1 (CF/K)_{i,t} + \beta_2 (M/B)_{i,t-1} + \beta_3 Size_{i,t-1} + \beta_4 \log(1 + NA_{i,t}) \\ &+ \beta_5 CF/K_{i,t} * \log(1 + NA_{i,t}) + \varepsilon_{i,t}\end{aligned} \qquad (2)$$

Where $NA_{i,t}$ is the number of analysts who issued one year-ahead earnings forecasts for firm i during year t. In equation (2), we augment our primary regression (equation (1)) with analyst coverage and interaction of analyst coverage with firm's cash flow. The interaction term (CF/K*log(1+NA)) proxies for the impact of analyst coverage on the relation between investment spending and cash flow. For instance, a negative β_5 means that high analyst coverage decreases the investment-cash flow sensitivity (firm's financing constraints). A neutral coefficient suggests that analysts' activities have no impact on firm's financing constraints. Finally, if analyst coverage increases noise, we should expect positive coefficients because an increase in the number of analysts may add credibility to rumors and push investors to trade on second-hand news as if they were quantitative factors. Hence, stock prices movements should not reflect changes in firm's fundamentals.

We estimate equation (2) using country, industry, and year fixed effects. To choose between fixed or random effects estimation, we use the Hausman specification test. The latter rejects the null hypothesis (H_0: group effects are uncorrelated with the regressors) in favour of the fixed effects estimation. In addition, standard errors in equation (2) are adjusted for heteroskedasticity and clustering at the firm level.

Data and Univariate Tests

In this paper, we use international data from 44 countries over the 1995-2007 period. Our data source on analyst coverage is the Institutional Brokers' Estimate System (I/B/E/S). Firm-level information is drawn from Datastream and Worldscope and country-level data from Djankov et al. (2008) and Doidge et al. (2004). We start by considering all firms included in the country list provided by Datastream from 1995-2007. The second step consists of matching firms from I/B/E/S and Datastream. Note our exclusion of financial and banking firms because the financial nature of their assets hinders accounting data comparisons with other firms. Furthermore, if I/B/E/S does not report an analyst forecast for firm i in year t, we assume that the number of analysts following the firm is zero as suggested by Piotroski and Roulstone (2004). Therefore, our main analysis includes firms with no earnings forecasts. In our robustness checks, we care to exclude such firms. Finally, to avoid drawing spurious inferences from extreme values, regression results are robust to outliers (observations are winsorised at 1%).

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Given that our proxy of firm's financing constraints is measured by the association between investment and internal capital, we propose, in our univariate tests, to compute first the investment-cash flow sensitivity (CFC in Table 1) according to equation (1) before estimating the potential univariate relation between analyst coverage and firm's financing constraints. Table 1 presents descriptive statistics for our main variables. The mean of firm-level variables is calculated as the average across all industries and years. We do not measure the mean (median) across all firms because pooling years of data to calculate CFC for each firm may problematic. In fact, the result could be unreliable measures of CFC given that we should use few observations for our estimation purpose (maximum 13 observations for each firm: from 1995 to 2007). To avoid this limitation, we use a cross-section of similar firms.

Table 1: Descriptive statistics
This table presents descriptive statistics for the sample between years 1995 and 2007. Firm-level variables are constructed using two-digit SIC cross-industry approach. The latter is conducted by polling firms in a two-digit SIC industry to calculate the corresponding measures. The mean of firm-level variables are calculated as the average across all industries and years. The sample size is 24 two-digit code industries constructed using 14294 firms. The mean of country-level variables (anti-director rights index and accounting standards index) are calculated as the average across all countries and years.

Variables	Mean	median	5th Pctl.	95th Pctl.	Std dev	N
CFC	0.651	0.568	-0.020	1.603	0.611	300
NA	2.059	1.900	0.973	3.635	0.841	300
Log(1+NA)	0.551	0.533	0.317	0.829	0.161	300
NAbis	5.451	5.157	3.353	8.350	1.588	300
Log(1+NAbis)	1.696	1.685	1.269	2.094	0.244	300
Dividend-payout (Divp)	0.232	0.166	0.032	0.733	0.426	294
Leverage (Lev)	0.305	0.259	0.181	0.435	0.360	300
Size	11.843	11.840	10.592	13.314	0.991	300
Market-to-Book (M/B)	2.578	2.073	1.083	5.404	2.041	289
Anti-director rights index	0.516	0.46	0.21	0.95	0.238	572
Accounting standards index	66.770	65	54	78	9.346	468

In term of investment-cash flow sensitivity, our estimation shows large CFC (average CFC of 0.651 and median of 0.568) which suggests that corporate investment is highly sensitive to the availability of internal capital. This is consistent with the existence of a financial hierarchy. Furthermore, given the large proportion of firms with zero analyst coverage, we perform our tests both with and without these firms. A potential concern is that our findings can be influenced by these observations. In fact, as suggested by Chan and Hameed (2006), the presence of zero analyst coverage could mean that there is no analyst coverage or that the data for the firm were not captured by I/B/E/S. The average number of analysts covering our sample firms is 2.059 (median of 1.90). On the other hand, when we drop observations with zero analyst activity, the average number of financial analysts (NAbis) becomes 5.451 (median of 5.157). To test any cross-sectional differences in the role played by analysts based on institutional factors, we also propose to classify firms according to a variety of country-level variables related to legal environment and accounting standards; before estimating the relation between analyst coverage and firm's financing constraints. Our proxy of legal environment is the anti-director rights index from Djankov et al. (2008) that measures the level of minority investors' protection. This index ranges from zero to one and high scores indicate strong protection of investors. As suggested by Morck et al. (2000), the weak property rights in some countries may discourage arbitrage based on private information, so that there will be fewer benefits for analysts to gather firm-specific information. In these countries, it’s also possible that security analysts have less informational advantage over insiders. Hence, analysts’ activities should not reduce information asymmetries between market participants in countries where investors are less protected. We also consider an index that rates countries accounting standards. The scores of such index range from zero to ninety with ninety as the highest standard. The average estimates of the anti-director rights index and the accounting standards index are 0.516 and 66.77 respectively.

Table 2: Pearson Correlations (p-values):
This table presents the correlations between variables. The sample period is from 1995 to 2007.

	CFC	**NA**	**Log(1+NA)**	**NAbis**	**Log (1+NAbis)**	**Divp**	**Lev**	**Size**
CFC	1.0000	-0.0366	-0.0587	0.0468	0.0424	-0.0043	0.0180	0.1384
		(0.4248)	(0.2009)	(0.3077)	(0.3554)	(0.9272)	(0.7008)	(0.0029)
NA	-0.0366	1.0000	0.9275	0.7892	0.7404	-0.0438	0.0625	0.4384
	(0.4248)		(0.0001)	(0.0001)	(0.0001)	(0.3513)	(0.1796)	(0.0001)
Log(1+NA)	-0.0587	0.9275	1.0000	0.5876	0.6162	-0.0249	0.0608	0.4446
	(0.2009)	(0.0001)		(0.0001)	(0.0001)	(0.5965)	(0.1919)	(0.0001)
NAbis	0.0468	0.7892	0.5876	1.0000	0.9310	-0.0434	0.0206	0.3366
	(0.3077)	(0.0001)	(0.0001)		(0.0001)	(0.3551)	(0.6591)	(0.0001)
Log (1+NAbis)	0.0424	0.7404	0.6162	0.9310	1.0000	-0.0415	0.0316	0.3388
	(0.3554)	(0.0001)	(0.0001)	(0.0001)		(0.3769)	(0.4985)	(0.0001)
Divp	-0.0043	-0.0438	-0.0249	-0.0434	-0.0415	1.0000	-0.0698	0.0452
	(0.9272)	(0.3513)	(0.5965)	(0.3551)	(0.3769)		(0.1382)	(0.3350)
Lev	0.0180	0.0625	0.0608	0.0206	0.0316	-0.0698	1.0000	-0.0911
	(0.7008)	(0.1796)	(0.1919)	(0.6591)	(0.4985)	(0.1382)		(0.0503)
Size	0.1384	0.4384	0.4446	0.3366	0.3388	0.0452	-0.0911	1.0000
	(0.0029)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.3350)	(0.0503)	

In table 2, we present the matrix of correlations between our key variables. If analysts’ forecasting activities reduce information asymmetries, we should expect a negative and significant correlation between analyst coverage and firm’s financing constraints (CFC). Several key relations are apparent in Table 2. First, CFC and analyst coverage display an insignificant negative correlation. Second, when we remove firms with zero analyst coverage, CFC and analyst following continue to have an insignificant correlation. Third, as expected, we find a positive correlation between CFC and leverage, and a negative correlation between the dividend payout ratio and CFC. Leverage is the ratio of long term debt to total assets and dividend payout is the ratio of dividends to EBIT. We include dividend payout because many authors (Fazzari et al. 1988, and Kaplan and Zingales, 1997) consider firms with high dividend payout ratios (dividends/EBIT) as unconstrained and firms with low dividend payout ratios as financially constrained. According to Fazzari et al. (1988), one reason why firms might retain an important portion of their internal cash flow is that they have investment spending that exceeds their cash flow. This is a value maximizing behaviour when the cost disadvantage of external finance is large (binding financial constraints). Finally, the positive and significant correlation between analyst coverage and firm size indicates that large companies tend to attract more analysts. According to our univariate findings, the relation between analyst coverage and CFC is not significant, which is consistent with the fact that analysts’ activities do not alleviate firm’s financing constraints. However, it's worth mentioning that these preliminary results only

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represent a univariate data analysis. Our tests are best performed using multivariate regression analysis, because the above conclusions do not account for the potential interrelationships among our main variables.

Multivariate Regression Results

Table 3 reports the coefficient estimates of equation (2). Model 1 in Table 3 serves as our starting point in that we use the logarithm of the number of analysts (log (1+NA)) as a proxy of analyst coverage. In model 2, we use the number of analysts instead of the logarithm of the realisation of that proxy. Furthermore, in models 1 and 2, all observations including those with zero analyst following are used in the estimation. For robustness, we propose to drop observations with zero analyst coverage in model 3 and model 4. In Table 3, the interaction variable (CF/K*log (1+NA)) coefficients are positive and significant (at 1% level) for all models (e.g., coefficient of 0.123 with a p-value of 0.001 in the case of model 1 estimation); suggesting that enhanced analyst coverage positively impacts the association between investment and cash flow. Such evidence indicates that firms with more analyst coverage exhibit high investment-cash flow sensitivity and binding financing constraints. In other words, our findings suggest that analysts do not mitigate the underinvestment problem.

Table 3**:** Firm's financing constraints and analyst coverage: Primary results
This table presents the results of the following regression:

$$(I/K)_{i,t} = \beta_0 + \beta_1 (CF/K)_{i,t} + \beta_2 (M/B)_{i,t-1} + \beta_3 (Size)_{i,t-1} + \beta_4 NA_{i,t} + \beta_5 (CF/K)_{i,t} * NA_{i,t} + \varepsilon_{i,t}$$

Investment spending divided by total assets (I/K) is the dependent variable. Cash flow/total assets (CF/K), firm's market-to-book ratio (M/B), firm's size, analyst coverage and interaction of analyst coverage with firm's cash flow are the independent variables. In model (1), we use the logarithm of the number of analysts (log (1+NA)) as a proxy of analyst coverage. In model (2), we use the number of analysts as a proxy of analyst coverage instead of the logarithm of the realisation of that proxy. Models (1) and (2) include observations with zero analyst coverage. For robustness, we propose to drop these observations in models (3) and (4). We use log(1+NAbis) and NAbis as proxies for analyst coverage in models (3) and (4) respectively. Standard errors are adjusted for heteroskedasticity and clustering at the firm level. P-values for two-tailed tests are in parentheses. One, two or three asterisks denote significance at the 10%, 5% and 1% levels, respectively. Country, industry and year dummy variables are included but not reported

Independent Variables	Regressions including observations with zero analyst coverage		Regressions without zero analyst coverage observations	
	Model 1	***Model 2***	***Model 3***	***Model 4***
Intercept	-0.401	-0.481	-0.635	-0.811
	(0.001) ***	(0.001) ***	(0.001) ***	(0.001) ***
Cash Flow	0.271	0.351	0.379	0.448
	(0.001) ***	(0.001) ***	(0.001) ***	(0.001) ***
Market-to-Book	-0.000	-0.000	-0.000	-0.000
	(0.684)	(0.672)	(0.530)	(0.426)
Size	0.044	0.053	0.061	0.076
	(0.001) ***	(0.001) ***	(0.001) ***	(0.001) ***
NA	-0.035	-0.009	-0.037	-0.010
	(0.001) ***	(0.001) ***	(0.001) ***	(0.001) ***
Cash Flow*NA	**0.123**	**0.015**	**0.057**	**0.006**
	(0.001) ***	**0.001)** ***	**(0.001)** ***	**0.001)** ***

Country dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Adjusted R^2	0.5521	0.5397	0.5795	0.5798
N	81 939	81 939	43 673	43 673

In our primary analysis, a remaining concern is endogeneity because not all firms in our sample have analyst coverage. In fact, security analysts could self-select the firms they cover based on their financial status which will introduce a selection bias. The econometric concern here is that the residual errors in our regressions may correlate with the independent variable log(1+NA) and the interaction variable (CF/K*log(1+NA)). To mitigate this potential endogeneity problem, a Heckman model can identify the existence of this bias and address it.

Table 4: Firm's financing constraints and analyst coverage: Self-selection bias estimation
This table reports the results of the Heckman (1979) two-stage procedure. In the first stage, we specify a model of the choice of covering a firm (probit model). In the second stage we estimate equation (2). In our analysis, we use the logarithm of the number of analysts (log (1+NA)) and observations with zero analyst coverage. Regressions include country, industry, and year fixed effects. P-values for two-tailed tests are in parentheses. One, two or three asterisks denote significance at the 10%, 5% and 1% levels, respectively.

Probit model Dependent variable (Coverage)	coefficients (p-values)
Intercept	0.491
	(0.001) ***
Size	0.542
	(0.001)***
RV	-0.000
	(0.807)
EV	-0.003
	(0.498)
TV	-0.017
	(0.031)**
O	-0.005
	(0.001)***
N	27 918
Dependent variable (Investment)	
Intercept	-0.085
	(0.632)
Cash Flow	0.085
	(0.006) ***
Market-to-Book	-0.018
	(0.073)
Size	0.177
	(0.001) ***
NA	-0.099
	(0.003) ***
Cash Flow * NA	-0.004
	(0.632)
λ	0.252
	(0.352)
N	27 918

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For the Heckman's (1979) two-step estimation, we need, in the first stage, to model the choice of covering a firm through a probit model. We assume that analyst coverage is affected by the following variables: firm size, return volatility, earnings volatility, trading volume and ownership (Bhushan, 1989; Barth et al. 2001; and Chan and Hameed, 2006).

$$U_i = W_i \gamma + \upsilon_i \quad \text{(coverage decision equation)} \qquad (3)$$
$$Coverage_i = 1 \text{ if } U_i > 0 \text{ ; 0 otherwise}$$

Where U_i is an unobserved latent variable (utility of analyst i to cover a firm) and W_i is a set of variables that affect the decision of analysts to cover a firm. We don't observe U_i. All we observe is a dichotomous variable *Coverage*$_i$ with the value of one if the firm has analysts that follow its activities ($U_i > 0$) and 0 otherwise. Table 4 reports the results of the Heckman (1979) model. In the second stage estimation, the coefficient of the interaction variable (CF/K*log (1+NA)) is negative and non significant (-0.004 with a p-value of 0.632) suggesting that our primary conclusions are robust to self-selection.

Another source of endogeneity is omitted variables bias. Therefore, we propose to examine the robustness of the findings presented so far with respect to changes in model specification. We add lagged values of investment in equation (2) because prior year investment (I_{t-1}) may have explanatory power for current investment (I_t) when investment spending is not completed in one year (multi-year project). Further, as suggested by Cleary and Booth (2008), we also include lagged values of cash. The latter may have explanatory power for investment when firms build up financial slack in order to use it as a buffer against binding financing constraints. In all models (results not tabulated), the interaction variable (CF/K*log (1+NA)) coefficients are positive indicating that our conclusions are robust to endogeneity.

Further, we re-estimate our equation (2) using fixed firm and year effects. Fixed firm effects models account for time-invariant firm characteristics that are unobservable or at least difficult to measure and fixed time effects are included to capture aggregate business-cycle influences. Table 5 reports estimates of this alternative methodology. The reported firm-fixed effects estimates are obtained by demeaning the observations with respect to the firm average for each variable. Year dummies are included but not reported. Again, our primary findings remain unchanged when we re-estimate our main equation using fixed firm and year effects models instead of country and industry fixed effects models.

The following table presents the results of the following regression:

$$(I/K)_{i,t} = \beta_0 + \beta_1 (CF/K)_{i,t} + \beta_2 (M/B)_{i,t-1} + \beta_3 (Size)_{i,t-1} + \beta_4 NA_{i,t} + \beta_5 (CF/K)_{i,t} * NA_{i,t} + \varepsilon_{i,t}$$

Investment spending divided by total assets (I/K) is the dependent variable. Cash flow/total assets (CF/K), firm's market-to-book ratio (M/B), firm's size, analyst coverage and interaction of analyst coverage with firm's cash flow are the independent variables.
In model (1), we use the logarithm of the number of analysts (log (1+NA)) as a proxy of analyst coverage. In model (2), we use the number of analysts as a proxy of analyst coverage instead of the logarithm of the realisation of that proxy. Models (1) and (2) include observations with zero analyst coverage. For robustness, we propose to drop these observations in models (3) and (4). All regressions include firm fixed effects and year fixed effects. Fixed firm effects account for unobserved time-invariant relations between our explanatory variables and investment spending. Year dummies are include but not reported. P-values for two-tailed tests are in parentheses. One, two or three asterisks denote significance at the 10%, 5% and 1% levels, respectively.

Table 5: Firm's financing constraints and analyst coverage: fixed firm and year effects estimation

Independent Variables	Regressions including observations with zero analyst coverage		Regressions without zero analyst coverage observations	
	Model 1	***Model 2***	***Model 3***	***Model 4***
Intercept	-0.378	-0.386	-0.600	-0.589
	(0.001) ***	(0.001) ***	(0.001) ***	(0.001) ***
Cash Flow	0.057	0.065	0.065	0.058
	(0.001) ***	(0.001) ***	(0.001) ***	(0.001) ***
Market-to-Book	-0.000	-0.000	0.000	0.000
	(0.785)	(0.795)	(0.982)	(0.951)
Size	0.049	0.051	0.073	0.072
	(0.001) ***	(0.001) ***	(0.001) ***	(0.001) ***
NA	0.007	0.000	-0.006	-0.000
	(0.015) **	(0.434)	(0.207)	(0.269)
Cash Flow*NA	**0.031**	**0.006**	**0.016**	**0.005**
	(0.001) ***	**(0.001)** ***	**(0.001)** ***	**(0.001)** ***
Year dummies	Yes	Yes	Yes	Yes
Adjusted R^2	0.3522	0.3324	0.3477	0.3295
N	81 939	81 939	43 673	43 673

Next, we argue that it is important to ensure that our results prevail for all countries. As suggested earlier, in countries with weak governance structures and enforcement laws, it is easier for controlling shareholders and firm managers to extract private benefits from outside investors. However, in these countries, it is not clear whether security analysts stand at a disadvantage or not over insiders in accessing firm-specific information. Hence, it is plausible that our primary results may be driven by countries with weaker financial markets and governance rules. To test this argument, we partition our sample according to the level of financial markets development before estimating equation (2). The findings (not tabulated) do not support the hypothesis of a differential effect across these two markets. For instance, in the case of developed markets, the coefficients of the interaction between analyst coverage and firm's cash flow become negative and non significant while the same coefficients remain positive and significant for emerging markets. Based on these findings, it seems that financial analysts have a neutral impact on financing and investment distortions for firms originating from developed markets. On the other hand, analyst coverage seems to increase firm's financing constraints in emerging countries. In sum, these additional results indicate that analysts do not alleviate firm's financing constraints in both developed and emerging markets. We also classify firms according to their country legal status and accounting standards. As suggested earlier, our measures of legal status and accounting standards are, respectively, the anti-director rights index from Djankov et al. (2008) and an accounting index that rates companies annual reports for their inclusion or exclusion of 90 items (see Doidge et al. 2004 for a discussion). Countries with scores above the median for both indexes fall into the category with strong protection of minority investors and strong disclosure rules.

Again, analyst activities do not produce different effects between countries with strong legal institutions and countries with weak legal institutions (results not tabulated). The same conclusion holds when we partition our sample into subsamples arranged by accounting standards.

Conclusion

This paper examines how analysts' activities impact firm's financing constraints. If security analysts primarily facilitate the incorporation of firm-level information into stock prices, we should expect a reduction in informational asymmetries between market participants, which will contributes to relax firm's financial constraints. Our analysis is based on models of capital market imperfections that show that information asymmetry increases the sensitivity of investment to fluctuations in internal cash flow. In particular, we use the relation between investment and cash flow to test the presence and extent of firm's financing constraints. According to Fazzari et al. (1988), when the wedge between internal and external cost of capital is large, firms are considered as financially constrained because they are effectively rationed in their access to external funding. As a result, internal capital will impact investment and we can interpret greater investment-cash flow sensitivity as evidence that firms are facing binding financial constraints.

We document two main findings. First, the relation between our proxy of firm's financing constraints and analyst coverage is positive and significant in most cases (in some cases, the association is non significant), suggesting that analysts' activities do not allow outside investors to better assess firm's investment opportunities. This result is robust to many aspects of our methodology. Second, additional analysis provides evidence indicating that analysts' activities do not produce different impacts depending on the country's institutional environment. In fact, the positive or neutral associations between analyst coverage and firm's financing constraints prevail for countries with strong or weak institutions. Our results support the findings of Piotroski and Roulstone (2004), Chan and Hameed (2006), and Doukas et al. (2008). In summary, the main conclusion of this paper is consistent with the view that companies do not profit from analysts' activities.

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INCREMENTAL VALUE OF EMOTIONAL INTELLIGENCE ON BANK PERFORMANCE IN NIGERIA

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Abstract. *The study was designed to determine the incremental value of emotional intelligence (EI) on bank performance and propose strategies for enhancing emotional literacy of Nigerian bank managers. Emotional intelligence is a dispositional variable that is critical to performance outcomes. The study was carried out by using the survey research design. The design for advanced data analysis was employed in analyzing the data of the study. It was found that for a 1% change in "emotional intelligence" "bank performance" changes by 1.42%. The researcher made ten recommendations based on the findings of this study.*

Keywords: *emotional literacy, emotional intelligence, value, bank performance, profitability, magomago, milestone, psychological wellbeing*

Background

Banking enterprise is unique to the extent that it depends on managerial competence and public confidence. To this degree, bank managers should be composed of pro-active men and women of proven track records in banking who have distinguished themselves as good managers of human and materials resources in banks. A person's emotional state has a lot to do with perception. A strong emotion such as total distaste for an organizational policy can make a person perceive negative characteristics in most organizational policies and rules. Determining a person's emotional state is difficult. Because strong emotions often distort perceptions, managers need to discover which issues or practices that trigger strong emotions within subordinates and customers. Attribution theory provides insight into the process by which we assign causes or motives to people's behaviour. Observing behaviours and drawing conclusions which is known as making an attribution is crucial to managerial practice, but dispositional attributions emphasize some aspects of the individual, such as ability, skill or internal motivation. There is a substantial and growing body of research that emotional intelligence is an index of multiple skills that are critical to performance outcomes. For example, Goleman (1995), suggests that there are four components of emotional intelligence : (i) self-awareness, the ability to control anxiety, impulsiveness and react appropriately to anger,(ii) motivation, a passion to work for reasons that go beyond money or status, (iii)empathy, the ability to respond to unspoken feelings of others, and (iv) social skills, the proficiency to manage relationships and build networks. However, there are still many unanswered questions about emotional intelligence such as how it impacts performance, in what situations it is most important, how it can be measured reliably and validly and whether training can improve a person's emotional intelligence. Despite such gaps in research results organizations are paying attention to emotional intelligence because of its perceived role in increasing the productivity of firms and entire nations. (Salovey & Mayer, 1990, Bar-On, 1997, Cherniss, and· Goleman, 2001).

In hiring, Organizations around the world are now placing more emphasis on hiring people with high emotional intelligence than on traditional technical attributes. For example Gibson, et al, (2003) report that a large American firm found that sales agents with higher emotional intelligence scores sold approximately $91,000 more than what colleagues with lower emotional intelligence scores sold. They went further to state that efficiency denotes the degree of effectiveness with which a task - like managerial task-is performed. Given the interactions between organizations and their environment, it follows, that efficiency is ultimately related to how well managers understand, and react to the environment. Unfortunately there is no consensus about how to measure effectiveness or efficiency. For example, a bank can make itself to look extremely efficient by over stating its profits in the short run by ignoring provision for toxic assets and skimping on wages. But over time such a bank will no doubt falter. This is exactly what happened in Nigeria where 25 "perceived efficient" banks were liquidated by the Central Bank of Nigeria (Philip, 2007). On the other hand efficiency should indicate increase in geometric progression as the competencies, skills, of the managers that work in the organization increase in arithmetic progression (Richards & Greenlaw, 1966) Organizational performance is a measure of how effectively and efficiently managers use resources to satisfy customers and achieve organizational goals, which should increase in direct proportion to increase in efficiency and effectiveness. But this is not the case in the Nigerian banking industry where the incidence of bank failures have been frequently traced to acute managerial inefficiency (Nwankwo, 1991, Nwaze, 2006, N'zotta, 2004, McNaughton, 1997, Ugoani, 2013 Goleman, 1998 Cherniss & Adler, 2000). Being efficient means doing something at the lowest possible cost. But related to efficiency and effectiveness is the concept of value, or quality over price. If you can provide the customer a better banking service without changing price, value has gone up. If banking services that are of a high quality are provided at a lower price, value goes way up.

Statement of the problem:

The serious economic down turn which faced the nation since 1992 has continued till today without any signs of immediate recovery. This situation has been compounded by inept bank management in Nigeria. The quality of management can no doubt make a critical difference between sound and unsound banks. Poor bank management in Nigeria has resulted in excessive risk taking by many banks that have failed. Such banks were frequently at fault through high and fraudulent operating expenses, in adequate loan management and an overly aggressive growth policy to win public sector deposits, interest rate speculation and sharing of commission on turnover (COT) with "finders" coupled with other unethical practices as well as sense of poor judgment that culminated in the distress syndrome in the banking system. (Alarape, 2012, Ademu, 1997). In 2011, the Central Bank of Nigeria injected about ₦700bn into the banking system to bail out the distressed banks(The Guardian, 2011, Itua,2013)

Delimitation of the Study:

The study was delimited to 100 bank managers in Aba, Owerri and Umuahia, South East Nigeria. Nigeria is a vast country and due to poor road network the study was also delimited to the South East Zone, a situation that was further compounded by lack of research grant.

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Hypotheses:

To guide the study, these hypotheses were formulated and tested at 10% level of significance:

- Emotional Intelligence has no significant incremental value on bank performance.
- Emotional Intelligence has significant incremental value on bank performance.

Literature Review:

According to Ademu (1997), capital provides a cushion for banks to withstand abnormal losses not covered by current earnings, thus enabling the bank to regain equilibrium and re-establish a normal earning pattern. Unfortunately a good number of the country's banks are still grossly undercapitalized. This situation could partly be attributed to the fact that many banks were established with very little capital. The problems of inadequate capital has been worsened by the huge amount of non-performing loans which has eroded the banks' capital base. Available data on the financial condition of the banking system as a whole and particularly on the category of institutions classified by the authorities as distressed point to a serious deterioration of the problem of distress in banks in Nigeria. For example, Wabara (2012) that the Nigerian Deposit Insurance Corporation (NDIC's) (2011) Annual Report and Statements of Accounts prove that there are still unsound and marginal banks in Nigeria. It revealed that nine of all the banks in Nigeria did not show any significant improvement in their financial condition in the preceding year, just as equity capital in the industry in the year under review decreased approximately by 12% from ₦249.71bn in December, 2010 to -₦220.21bn in 2011.Also 2012 NDIC report shows that there are ten unsound banks in Nigeria. What is curious about the marginal banks is that from outside everything appears good with so much window dressing. The decadent system is such that most managers are unlikely to know about the rot until the bubble bursts! How much less for the outsider or depositor who does not have any access to cooked and dressed accounting books usually certified by big external auditors, which when subjected to superior forensic audit analysis gives the true picture of the fiscal decay and managerial *magomago*? It is a well known fact that managers can make the difference between a healthy and a distressed institution, where a bank is approaching a state of loss or distress an emotionally intelligent manager should be in a position to find ways to avert the situation and lead the bank back to the path of profitability. (Folasade-Koyi, 2012, Shadare, 2012, Ugoani, 2006, 1998). Emotional Intelligence is noted as the index of such competencies as integrity, discipline, loyalty, creativity, trustworthiness, among others, and if applied in the banks will possibly make positive contribution to performance. Emotional intelligence is the composite of many other qualities such as effective oral communication and the ability to respond well to setbacks, which distinguishes the competent from the truly successful bank Manager. Relationship management is where theories of emotional intelligence are put into practice. There are three major workplace situations that demand the use of EI skills: (1) change, (2) conflict and (3) teamwork. Successful management of these issues requires good relationships with colleagues, and building and maintaining these relationships require using EI skills. In fact Emotional Intelligence is crucial in all attempts to manage or lead. (Akers, Miller, Franze and Haygood, 2002, Feldman and Mulle, 2011). And Landy (2005), has claimed that the few incremental validity studies conducted on EI that found little or nothing to the explanation or prediction of some common outcomes must be due to methodological fallacy.(Anumihe, 2013)

Methodology:

The survey research method was employed. The 100 respondents were drawn from top, middle, and lower management levels of the administrative hierarchy of ten selected banks. All respondents were selected by simple random sampling technique to ensure that only those who were knowledgeable about the issues under investigation were involved. Two methods of data collection were used: a self-administered questionnaire and informal in-depth interviews, these methods were used to complement, supplement, and validate the data collected through each other. After collection, data were organized and filtered for the purposes of detecting errors and omissions and correcting them to ensure accuracy, consistency, and completeness, after which they were coded, and classified. Using the Statistical Package for Social Sciences version 15, Computer Software, to analyze data, frequency analysis, factor analysis and correlation analysis were used preliminarily. In order to achieve the specific objective of this study therefore, linear regression analysis was used, after which this researcher formed opinions, recommendations and conclusion based on the findings of the study.

Presentation of Results and Interpretation

In order to achieve the specific objective of the study use was made of linear regression given by:
$Y=a + bX$ ….. (1)

Where:

Y = Bank performance measured as "efficiency" of the coded data.
X = Emotional Intelligence measured as 'EI factor' of the coded data.
a = The value of bank performance when there is no emotional intelligence.
b = The value of bank performance per $1^{\%}$ change in emotional intelligence.

'b' is used to test the hypothesis of no significant contribution of emotional intelligence to bank performance.
The results were presented below in five regression tables designed **as tables 1-6**

Table 1: Regression Analysis, Variable Entered/Removed[b]

Model	Variable	Variable Removed	Method
1	EI factor score for analysis 2[a]		Enter

All requested variables entered.
Dependent Variable: efficiency

Table 2: Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	-610[a]	.372	.294	1.95023

Predictors: (Constant), EI factor score for analysis 2
Dependent Variable: efficiency

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Table 3 : ANOVA[b]

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression Residual Total	18.041 30.427 48.468	1 8 9	18.041 3.803	4.743	.061[a]

Predictors: (Constant), EI factor score for analysis 2
Dependent Variable: efficiency

Table 4: Coefficients[a]

Model	Unstandadized Coeficients		Standadized Coeficients	t	Sig
1. (Constant)	4.055	0.617		6.575	.000
EI factor score for analysis 2	1.416	0.650	.610	2.178	.061

a. Dependent Variable: efficiency

Table 5: Residual Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	2.2081	5.7738	4.0550	1.41581	10
Residual	-3.41926	2.41611	.00000	1.83869	10
Std. Predicted Value	-1.304	1.214	.000	1.000	10
Std. Residual	-1.753	1.239	.000	.943	10

Dependable Variable: efficiency

Table. 6 EI Factors scores with bank performance variable-Efficiency

s/no	Banks	EI Factor score(X)	Bank performance variable(Y)
1	Bank a	7.42	0.69419
2	‘’ ‘’ b	1.72	0.76582
3	‘’ ‘’ c	2.48	-1.30446
4	‘’ ‘’ d	8.05	1.11519
5	‘’ ‘’ e	5.66	1.21403
6	‘’ ‘’ f	2.15	-0.86322
7	‘’ ‘’ g	4.02	-0.7931
8	‘’ ‘’ h	4.27	0.7003
9	‘’ ‘’ i	1.66	-0.27479
10	‘’ ‘’ j	2.94	-1.25395

Interpretation of results

The ANOVA table showed that at 10% level of significance, bank performance (Y) can be predicted using a linear regression with emotional intelligence (X).

The Coefficients table showed that:

$$Y = 4.06 + 1.42X \ldots (2)$$

Here, ‘b’ = 1.42 and is significant at 10% level. What this means is that for a 1% change in ‘emotional intelligence’, bank performance changes by 1.42%. it was therefore concluded that emotional intelligence contributes significantly to bank performance. This is the specific objective of this research.

From the model summary, R^2 value is 37.2%. R^2 measures the goodness-of-fit of a regression model. For dichotomous response models such as this, R^2 value could range between 0.2 to 0.6. Therefore, in this research, the value of R^2 of .372 is adequate. Again, one of the assumptions of regression is that the errors be normally distributed. To check whether or not this assumption is met, we plot the residuals on a special 'probability paper' scale. This can also be done by the computer. When plotted on a probability-paper scale, the residuals should form a straight diagonal line. Serious deviations from the line indicate that the residuals are not approximately normally distributed. Also the histogram of the standardized residuals should look like a normal curve. But looking at the histogram of the standardized residuals, represented here as figure 1 and the plot of the standardized residuals presented here as figure 2, it is clear that the arrows are approximately normally distributed. Therefore, this model is adequate. (Gujarati, 2003, Aczel, 1989 Koutsoyiannis, 2003).

Figure 1: Histogram, Dependent Variable: Efficiency

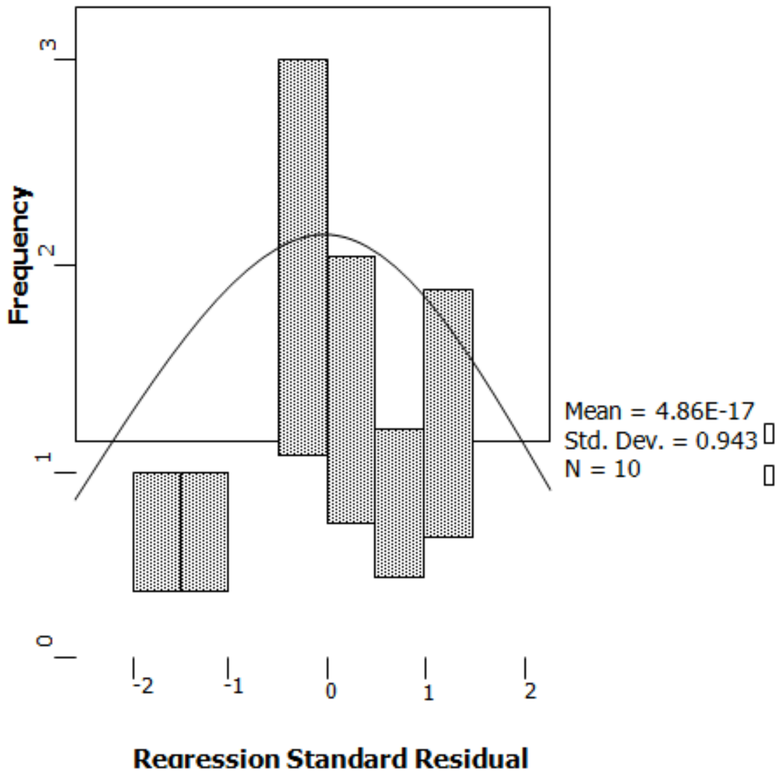
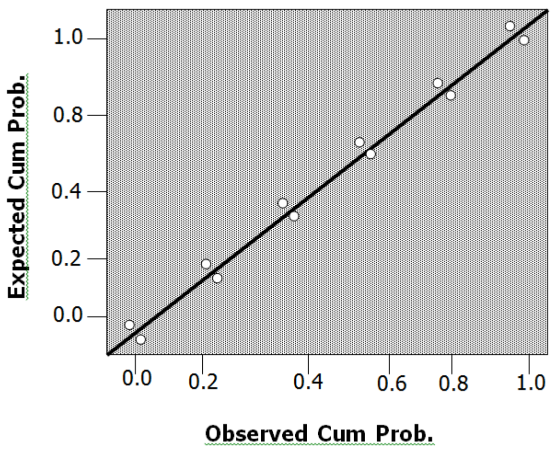


Figure 2: Normal P – P Plot of Regression Standard Residual, Dependent variable efficiency



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Discussions

Figures are powerful tools for analyzing trends and structures. They facilitate comparison of performance and structures over time and show trend lines and changes in significant aspects of bank operations and performance. (Greuning and Bratanovic, 2003). This empirical result is a milestone in EI research as it agrees with the findings of classic EI researchers. For example, Cherniss and Goleman (2001) opine that emotionally intelligent responses to stimuli contribute to the attainment of positive results in given situations, and that creating an upward self-reinforcing spiral of trust group identity, and group efficacy requires more than a few group members who exhibit emotionally intelligent behavior. And Cherniss (2000) believes that emotional intelligence can be used to improve both productivity and psychological wellbeing in the workplace of tomorrow. Other researchers like Akers, et al (2002) found evidence that emotional intelligence is vital for entry and success in today's workplace. Ugoani (2013) in a unique contribution to EI research postulated a mixed model of EI within the context of managerial theory emphasizing the combination of EI competencies and managerial skills and found that EI contributes significantly to bank success.

Scope for Further Research

Further research should be conducted to determine if emotional intelligence has any effect on bank stability.

Recommendations

Educational Institutions should restructure their programmes to include emotional intelligence studies. This will help to improve the level of emotional literacy among executives.

Deposit Insurance Corporation should restructure the system of ownership in banks. This will help to remove the problem of one family dominating a bank's board, and build public confidence in the banking system.

The case of banks owning multiple subsidiaries should be revoked. This is necessary as most of the subsidiaries serve merely as conduit pipes for stealing public funds by bank promoters.

Entry level employees should be exposed to emotional literacy training for at least one month. This will help them to learn the competencies and skills necessary for handling customers and the general public as a whole.

The Central Bank of Nigeria (CBN) should ensure that banks have adequate capital. This will help them in cushioning the effect of unexpected loses.

The Central Bank of Nigeria (CBN) should stipulated stringent sanctions against banks that engage in COT sharing just to win cheap deposits. This will help in purging the society of pyramidal corruption.

The Federal Government of Nigeria (FGN) should establish special courts to try bank looters. This will serve as deterrent to others. Treating such thieves with kid gloves leaves much to be desired.

The Nigerian Deposit Insurance Corporation should be prompt in publishing the status of banks to guide the public. The present postmortem approach is almost scandalous.

The big audit firms who preside over cooked and dressed bank books should be disgraced. They are as guilty as the bank thiefs.

The Federal Ministry of Finance (FMF) should evolve a policy that no external auditor be retained by one bank for more than 24 months. This may help in reducing the connivance between them and their respective clients.

Conclusions

It was found that Emotional intelligence has significant incremental value on bank performance. For a change of 1% in "Emotional Intelligence" bank performance changes by 1.42%. Based on this specific finding it was concluded that emotional intelligence contributes significantly to bank performance. Therefore, in furtherance of literature in the emotional intelligence community, this original study has brought a new perspective of the concept of emotional intelligence in bank management. Despite the breakthrough achieved, the doors have further been widened for more intellectual and academic work in this area. This baseline research supports the findings of Landy (2005).

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LEAD KINDLY LIGHT? A BLENDED NEO-CLASSICAL AND BEHAVIOURAL CONTEXT OF MERGER WAVES IN EMERGING MARKETS

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Abstract. *The preferred mode of payment in M&A deals in the emerging markets is cash, primarily due to high ownership concentration. Such markets are characterized by institutional voids, such as lack of investor protection, under-developed debt markets and lack of access to bank funding for M&A deals. These features close-out equity and debt mis-valuation routes for merger waves to occur in these markets. However, conscious policy decisions (often deregulatory) at the aggregate and the industry level give impetus to firms in some industries to restructure, and such restructuring at the industry level generally clusters in time, causing merger waves. Moreover, there are certain behavioural causes like herding, envy and hubris, which can also drive merger waves. We observe that industry-shock thesis embedded in the neo-classical explanations and the 'anchor acquirer' hypothesis embedded in the behavioural theory explain merger waves at the industry level. Additionally, we lead an inquiry in to the ethnic background of promoter-managers in the context of merger waves, and study its impact on bidder returns, and also analyse the herd behaviour of bidders at the aggregate level.*

Keywords: *Merger waves, mergers and acquisitions, emerging markets, mis-valuation hypothesis, behavioural corporate finance, promoter ethnicity, regulatory changes.*

Introduction

Merger waves – periods of intense M&A activity- are intriguing and one of the greatest unsolved puzzles of financial economics (Brealey & Myers, 2007). This area has received renewed attention from the researchers in the last decade, who have investigated reasons beyond the neo-classical theories of M&A clustering. Market mis-valuation, i.e. equity and debt market mis-valuation theories (Shleifer & Vishny, 2003, Rhodes-Kropf & Vishwanathan, 2004, Martos-Vila et al., 2012), and behavioural theories (Goel & Thakor, 2010; Gugler et al., 2012), are more contemporary theories that explain the clustering of M&A deals in time, and in industries, as well.

The theory of equity mis-valuation implies that managers time the deals to capture the benefits of general market mis-valuations and use their overvalued stock as the method of payment (Shleifer & Vishny, 2003, Rhodes-Kropf & Vishwanathan, 2004), thus causing a wave.

However, the sixth merger wave that was observed in the US from 2003 to 2007 saw more use of cash instead of stock as the method of payment. This contradictory fact motivates Alexandridis et al. (2012) to posit that overvaluation is less likely to have caused this wave, because the acquirers were less over-valued than targets. In fact, they suggest that the presence of liquidity and industrial shocks had led to this wave. An alternate explanation, the debt-misvaluation theory, implies that financial buyers, as compared to strategic buyers, would lead the surge in M&A activity when debt is overvalued (Martos-Vila et al., 2012).

We have considered India as a case in point, since the country's economy is rife with institutional voids. Since, Indian banks are prohibited from funding domestic M&A deals, and debt-capital markets are yet to be developed, Indian business houses cannot rely on them for their funding requirements for external capital investments. This feature unique to an emerging market closes the route of debt-market mis-valuation (Martos-Vila et al., 2012), and thus weakens the overvaluation theory in explaining merger waves. This theory is further weakened in the presence of high-insider ownership, a classic feature of emerging market firms. Indian companies are largely organized as business groups or family firms, with promoters holding majority stake. This factor drives more cash offers in M&A deals, and stock is very rarely offered. Therefore, equity misevaluation is also unlikely to cause surge in M&A activity.

In this paper, we contrast the sixth merger wave of the US with the coinciding merger wave in India. Using the standard de-trended PE and PB methodology, and also the approach suggested by McNamara et al. (2008), we find that at the aggregate level there was only one merger wave in India, and it started in 2004, peaked in 2007, and ended in 2011. Therefore, unlike the US wave, Indian merger wave didn't end in 2007, although the value of deals decreased substantially in 2008 and 2009. Moreover, the number of deals carried out suggests that the wave in India continued even when the world was going through an economic downturn.

When we examine the occurrence of M&A wave at the industry-level, we observe that eight industries had nine merger waves. On analysing the causes, we observe that neo-classical factors triggered asset-reallocation at the industry level; but along with the industry level economic shocks, there are certain behavioural factors at play, too, which add to the momentum in M&A activity.

In this paper, we proffer a behavioural hypothesis, where we argue that there is a tendency on the part of industry players to imitate the behaviour of the leaders. In the context of external capital investments, significant deals – '*anchor deals*' in an industry inspire the rest of the industry to carry out M&A activity, leading to a merger wave at the industry level. We hypothesize that deals by the anchor acquirers, if significant in size compared to the industry, would have ripple effects across the industry and lead other players to follow suit and carry out M&A deals.

We also assess if behavioural factors have any role to play in the wave at the aggregate level. The herding hypothesis (Harford, 2003, 2005) implies that first successful deals would induce herding. We observe that the deals done earlier gained more than the deals carried out later in the wave. Additionally, the ethnic diversity of India motivated us to lead an inquiry into the ethnic background of promoters, and test if ethnic identity (Akerlof and Kranton, 2000) has any role to play in the aggregate merger wave.

The paper is organized as follows: in the second section we present the theoretical background and develop the main hypotheses. In the third section, we present data and the methods adopted. In the fourth section, we discuss results, and present our conclusions in the fifth section.

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Theoretical Background and the Research Questions

Literature that deals with the causes of merger waves can be broadly classified into neo-classical theories and behavioural theories. M&A Clustering, as per neo-classical theorists, is due to dramatic economic changes in the business environment (Gort, 1969), which lead to asset re-allocations, culminating into a wave. Empirical research based on the neo-classical theories (Steiner, 1975; McGowan, 1971; Mitchell and Mulherin, 1996; Andrade et al., 2001; Andrade and Stafford, 2004) has provided evidence of industry shocks and economic growth as drivers of merger waves. Technological shocks (Jovanovic and Rousseau, 2002), and regulatory shocks are also shown to be the drivers of merger waves. The economic shock thesis (Nelson, 1959) implies that macro-economic factors would lead to the ebb and flow of M&A activity. The capital liquidity argument that deals with the availability of cash reserves (Harford, 1999) with potential acquirers and access to external finance (Maksimovic and Phillips, 2001), also explains the increased likelihood of companies to engage in M&A activity. Neo-classical explanations, like the economic, regulatory and technological shocks, have received renewed attention in the last decade. Harford (2005), has shown that these shocks drive merger waves but with a qualifying condition of the presence of the overall capital liquidity. These theories assume that managers are rational and the markets are efficient.

There are sociological explanations (Haunschild, 1993) that originate from the contagion models (Strang & Soule, 1998) which show how information dissemination of a strategy can lead to a wave-like-behavior. Other explanations that dominate the current wave literature are behavioral theories. These theories are based on the premise that managers are not always completely rational. Managers of the companies that are performing badly are under pressure to steer the firm in a profit making direction. Such managers are desperate to try new and risky investments, which often mean entering into mergers and acquisitions (Iyer & Miller, 2008). This hypothesis assumes that managers are 'boundedly' rational. However, this theory doesn't explain the clustering of mergers in time.

Goel and Thakor (2010) have proposed the hypothesis of CEO envy to explain merger waves. Since CEOs of larger firms get paid higher compensation, some envious CEOs would undertake M&A deals simply to increase the size of their firm. Thus, their theory implies that earlier mergers in a wave would be driven by economic reasons, and would acquire smaller and more profitable targets; whereas, the latter deals would be driven by envy and would involve bigger targets. Bouman, Fuller & Nain (2009), propose the managerial herding hypothesis, which has predictions similar to the CEO envy hypothesis. Managers follow a herd behaviour when a wave kicks off, thus the deals that happen later in a wave tend to be value destroying compared to the ones happening in the earlier phase.

Gorton, Kahl and Rosen (2009) club the behavioural and neo-classical theories to explain M&A clustering. They suggest that a shock may cause reallocation of assets in the initial phases, but as the momentum of M&A activity develops, some managers make acquisitions to avoid being acquired.

Gugler et al. (2012) have proposed the managerial theory to explain merger waves. Their basic premise is that during the buoyant markets, investors are over-optimistic about the market prospects, and tend to accept new news as good news. Opportunistic managers take advantage of this over-optimism of investors and enter M&A deals to obtain private benefits.

Garfinkel & Hankins (2011) hypothesize that uncertainty of cash flows could also start-off a wave. Managers in such volatile situations would resort to operational hedging by entering in vertical mergers. Hence, increased volatility of cash flows could also cause merger waves.

Shleifer and Vishny (2003) and Rhodes-Kropf and Viswanathan (2004), have proposed over-valuation theory which implies merger waves are caused due to market overvaluation. Acquirers use their overvalued stock to acquire an undervalued or a relatively less overvalued target. Shleifer & Vishny (2003) argued that target firm managers accept a stock offer due to her relatively short investment horizon, whereas, Rhodes-Kropf & Viswanathan (2004) argue that high market valuations lead a manager to overvalue the deal synergies and accept an offer made with an overvalued stock.

Dong et al. (2006) observe that mis-valuation theory holds only for the period 1990 to 2000, but for the pre-1990 period, Q-theory explanations hold. This is intuitively logical, since the profitable re-allocation of assets did happen in hostile mergers of the 1980s. But, in 1990s the markets were shown to be inefficient and hence mispricing-led mergers occurred.

Anchor Acquirer Hypothesis

This hypothesis is motivated by the behavioural theories that explain why merger waves occur. There is a theoretical basis, and sufficient empirical evidence (Harford, 2003, 2005; Iyer & Miller, 2008; Goel & Thakor, 2010; Gugler et al., 2012) to argue that managers do not always act in wealth maximizing manner. There is a tendency on the part of managers to act out of envy (Goel & Thakor, 2010), hubris (Roll, 1986) and over-optimism (Rhodes-Kropf & Vishwanathan, 2004). Additionally, merger waves have been attributed as the periods of high optimism in the market. Managers sometimes tend to commit valuation mistakes (Rhodes-Kropf & Vishwanathan, 2004), and sometimes, they tend to follow herd behaviour by mimicking the actions of initial few successful mergers (Harford, 2003, 2005). We believe that such behaviour of mimicking could be observed through-out the wave period, that is, the leaders, whose actions are mimicked by followers, are present through the wave, and not just at the beginning of it.

The general theory of ‘Big Player’ (Koppl & Yeager, 1996), elucidates how the actions of big players lead to herding in asset markets. Since, the smaller players are reluctant to disregard the actions of big players; small players often follow the footsteps of the latter. The literature on herd behaviour in asset pricing upholds that big investors are the ones with substantial private information, and the small investors are often mis-informed (Lee et al., 1999), yet the latter trade based on the positive feed-back received from the actions of the former (De Long et al., 1990). Moreover, since a manager is ‘boundedly rational’ (Iyer & Miller, 2008), in addition to fundamental analysis, he might frequently look for signals from the bigger players. Drawing from this theoretical basis, we hypothesize that a merger wave in an industry could be anchored around some prominent deals. It is likely that there is surge in M&A activity in an industry because smaller players are reacting to positive feedback signals from the deals by the significant players in the industries (as can be seen in the Table 3). Therefore, there could be anchor acquirers whose actions are being imitated by the other players in the industry. Hence, some mergers in a wave could be based on a sound economic basis, but other mergers could be purely behavioural reactions to the on-going significant deal activity in the industry.

Promoter Ethnicity

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Akerlof and Kranton (2000) consider identity – 'a person's sense of self' to explain economic behaviour. They uphold that identity can have economic implications like altering payoffs from one's and other's actions, and thereby significantly affect economic outcomes and behaviour. There are motivations other than purely economic (Akerlof & Kranton, 2005) and related to identity, which supplement economic incentives. In the similar vein Efferin and Hopper (2007) note that: "Ethnicity is a source of group identity: it not only attributes characteristics (whether founded or imaginary) to members' focal group but also to other ethnic groups. Ethnicity defines the self in relation to others and can be a source of action and meaning."

If 'a person's sense of self' in the form of his ethnicity can explain his economic behaviour, then an inquiry into the ethnic background of promoters of Indian bidders can shed some light on their external capital investment choices in the periods of heightened M&A activity. Traditionally, business in India is associated with certain communities like the Gujaratis, Marwaris, Parsis, Chettiars, and a few others, but post-independence there is an influx of other communities like the Jats, Marathas, Reddys, and others (Damodaran, 2008). Therefore, we expect to observe substantial diversity in the background of Indian promoters. Hence, we consider promoter ethnicity of Indian bidders who participated in the industry waves and test if the same affects their M&A decisions as reflected in the investor reactions around such deal announcements.

Thus, in this paper, we attempt to address the following research questions:

- What are the factors that lead to merger waves in India where probable routes (like equity and debt-market mis-valuations) that trigger merger waves are absent?
- Are there any regulatory, technological or other shocks that explain the merger waves?
- Is the wave caused by behavioural explanations like herding?
    - Are there Anchor Acquirers in Industry Waves? Do these Anchor Acquirers have any impact on the industry merger wave?
    - Are the shareholder wealth effects different for early adopters, followers and the late comers?
- Does Promoter Ethnicity play a role in merger waves?

Data and Methodology[1]

Our data set comprises mergers and acquisition deals by Indian acquirers from 1995 to 2012. The data on mergers and acquisition deals in India are taken from Thomson Reuters' Thomson One database. The data on the acquirer's financial information and stock prices is taken from the CMIE's Prowess database.

For our study, we have considered only the completed deals by the Indian acquirers with deal value more than $0.25mn. These deals are domestic and cross border as well, hence, the target firms in our data set are either Indian companies or foreign entities. We exclude the following types of deals: buybacks, bankruptcy acquisitions, and divestiture. We also exclude

[1] Part of this section is from the authors' paper on a similar topic. Ladkani, Radha and Banerjee, Ashok, Emerging Market Bidder Returns and the Choice of Payment Method in M&A: Evidence from India (August 31, 2012). Midwest Finance Association 2013 Annual Meeting Paper.

those deals where acquirer is an investor group, deals where value of the transaction is undisclosed or unavailable, deals by private firms and government owned enterprises.

There are deals that are announced in parts, i.e., the deals where the acquirer and the target is the same, but the deal value and other deal characteristics differ. We club such deals if their dates of announcement and completion are the same; otherwise we include the deal with the highest percentage acquired. However, if such deals are apart by at least a month, then they are treated as different events. The date considered for event study, the return and the risk calculation, is the first date of a deal announcement.

We consider only those deals where the percentage acquired is 10 or more. However, for a deal to be included in our data set must have all the required data with respect to closing stock prices and other financial variables used in the study. The absence of data on any relevant variable disqualifies the deal from being included in the dataset.

We have accessed the Bombay Stock Exchange (BSE) data, the Securities and Exchange Board of India (SEBI) data, and data from Bloomberg for verification of deal dates and information on other corporate events around the merger/acquisition deal announcements. For the event study we have excluded the deals with confounding corporate events, i.e., other corporate events or announcements (viz. dividend announcements, results announcements, or other deal announcement) made seven days before or after the first deal announcement.

Identification of Merger Waves

As per the approach followed in Goel and Thakor (2010), we have used de-trended PE and PB of Sensex, India's leading stock index. As per this approach, the periods where the actual PE (or PB) is above the de-trended PE (or PB), would be the time when there is a high likelihood of a merger wave. Another approach is suggested by Carow et al. (2004) and McNamara et al. (2008), where to identity a wave, it is required that M&A activity must increase by 100 per cent or more in the peak year compared to the start year, and decreased by 50 per cent or more in the end year compared to the peak year.

Based on these two methods combined, we find that at the aggregate level there was only one merger wave in India, which started in 2004, peaked in 2007, and ended in 2011 (Table 1, Figure 1,2,3 and 4). We use the second method to identify industry-level merger waves. We find that there were 9 waves in 8 industries, and the number of deals carried out in each of these waves was significantly different from the number carried out in non-wave periods (Table 2).

Logistic Regression on Panel Data

We use logistic regression on panel data to estimate the likelihood of a merger wave in a given year in an industry. We test if the economic shocks to the industry, regulatory changes and behavioural factors explain M&A clustering at industry level. To capture the economic changes at industry level, we have used the principal component analysis on certain industry level variables. We have estimated the following model using random effects on the panel data of eight industries for 18 years:

$$Y_{it} = Anchor\ Acquirer_{it} + M/B_{it-1} + 3\ Yr.Avg.Stock\ Ret_{it-1} + Stdev\ 3Yr.Stock\ Ret_{it-1} + Econ\ Shock\ Index_{it-1} + MSCI\ Index_{t-1} + Regulatory\ Changes_{it-n} + Industry\ Size_{it-1} \quad (1)$$

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In the above equation, Y_{it} is an industry year, which takes value one if an industry *i* has a wave in a given year, otherwise it takes the value 0. $Anchor\ Acquirer_{it}$ is the highest value deal in an industry *i* and year *t*, scaled by industry size in the previous year. M/B_{it-1} is the log of the market-to-book ratio of industry *i* in year *t-1*; $3\ Yr.Avg.Stock\ Ret_{it-1}$ is the past three years average-stock-return of industry *i* in year *t-1,* and $Stdev\ 3Yr.Stock\ Ret_{it-1}$ is the standard deviation of such return. $Econ\ Shock\ Index_{it-1}$ is obtained using the principal component analysis as described in the next section (section 3.2.1). $MSCI\ Index_{t-1}$ is the return on stock market index (we have used MSCI World and MSCI ACWI). $Regulatory\ Changes_{it-n}$ is a dummy variable, which takes value 1 if there is a significant regulatory change, at the industry or the aggregate level, in the previous two years. $Industry\ Size_{it-1}$ is the log value of the industry size in the previous year. In a slight variation of the above model, we have used 'uncertainty of operating income' in place of the economic shock index to capture economic shocks to an industry.

Principal component analysis

There are several industry-level economic variables that could be used to capture economic shocks to an industry. However, the industry level economic variables are often highly correlated with each other. Hence, we have extracted the first principal component from the select six variables using the principal component analysis (PCA). Harford (2005) have used the following seven variables to capture economic shocks to an industry's operating environment: Cash-flow margin, asset turnover, research and development, capital expenditure, employee growth and return on assets (ROA)[2]. We have excluded employee growth from our calculations, since the same was not significantly correlated with any of the variables. Similar to Harford (2005) and Garfinkel & Hankins (2011), we term this industry-level annual measure as the economic shock index.

Event Study and the Cross Sectional Regression[3]

We have used the event study approach (Brown & Warner, 1985; Kothari & Warner, 2007) to capture the announcement effects of M&A deals in a merger wave. We have considered the standard market model (model 2), and have calculated cumulative abnormal returns (model 4) as an aggregate of abnormal returns (model 3) over different event windows.

$$E(R_{it}) = \alpha + \beta R_{mt} \tag{2}$$

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[2] Harford (2005) has used these variables based on their relevance for capturing industry shocks as shown in Healy et al. (1992) and Mitchell and Mulherin (1996). The variables used here are calculated as follows: Cash flow margin is the cash flow variable by sales, asset turnover is net sales scaled by beginning-of-period assets, R&D is R&D scaled by sales, Capital expenditure is capital expenditure (including CWIP) scaled by beginning-of-period assets.

[3] Part of this section is from the authors' paper on a similar topic. Ladkani, Radha and Banerjee, Ashok, Emerging Market Bidder Returns and the Choice of Payment Method in M&A: Evidence from India (August 31, 2012). Midwest Finance Association 2013 Annual Meeting Paper.

$$AR_{it} = R_{it} - E(R_{it}) \tag{3}$$

$$CAR_i^T = \sum_{t=t_1}^{t_2} AR_{it} \tag{4}$$

$E(R_{it})$ in model 1 is the expected return of on acquirer's shares for an event i, R_{mt} is the return on market portfolio and R_{it} is the actual return of the bidder for the event i. AR_{it} is the abnormal return for the event i on the day t; it is the difference between the actual returns and the estimated returns from our market model. The above abnormal returns are calculated assuming that investors frequently rebalance their portfolios.

The length of the estimation period for the model 1 is 200 days, prior to the t-7 day (t – is the event day), that is, the estimation period is t-207 to t-8 day. This period of 200 days is a sufficiently long period for the estimation of model coefficients as suggested in the event study methodology papers (Brown & Warner, 1985, Kothari & Warner, 2007).

The variable CAR_i^T is the cumulative return for an event window T. We have calculated the cumulative abnormal returns for different event windows, that is, different combinations of days before and after a deal announcement. For example, CAR(-1,+1) is a cumulative abnormal return over three days, from one day prior to one day post the deal announcement. The objective of this part of our analysis is to capture the differences in early movers, late entrants in an aggregate wave, and also the differences in the CARs of different ethnic groups.

We use cross sectional OLS regression to examine if the ethnic background of promoters has any significant impact on announcement returns during industry waves. We estimate the following model:

$$\begin{aligned} &CAR_i^T \\ &= \alpha + \gamma_i \, Promoter\ Ethnicity\ Dummy_i \\ &+ \beta_i \, Other\ Explnatory\ Variables\ and\ Controls\ (Fin_i, Prom\ Hold_i, Rel_i, Percent\ Acq_i, \\ &Percent\ Acq26_i,\ \ Rel\ Size_i, Sqrt\ DE_i, Debt\ Cost\ Dummy_i, Industry\ Controls_i\ Yr.Dummy_i) \end{aligned} \tag{5}$$

$\boldsymbol{CAR_i^T}$ is the cumulative abnormal return for observation i calculated over the event window T;

$\boldsymbol{CAR_i^T}$ is the same as CAR($\boldsymbol{t_1}, \boldsymbol{t_2}$), where period $\boldsymbol{t_1}$ to $\boldsymbol{t_2}$ are represented by an event window T. We have controlled for promoter ethnicity by using dummy variables. Other explanatory variables in the equation are the standard variables used to study the abnormal returns. These variables are defined in the appendix B.

Results and Discussion

Logistic Regression on the Panel data –What causes the industry level waves?

In section 3.1 we have identified the aggregate wave and the industry level waves in India. As noted, we observe that there has been one aggregate wave in India, which lasted from 2004 to 2011, and was at its peak in 2007. This aggregate wave in India coincides with the sixth merger

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wave in the US, but unlike the latter, it does not end in 2008. Although the total value of deals witnessed a dip, the fall in M&A activity levels (as represented by the number of deals) is not as much. Moreover, this was the period of low valuations internationally, which corroborates the low values of deals carried out in 2009.

We also observe that there are nine merger waves in eight industries in India (section 3.1). These eight industries are: Pharmaceuticals, chemicals, textiles, automobiles, mining, oil, information technology & information technology enabled services (IT & ITES), and telecommunications. There are two merger waves in IT & ITES. Interestingly there is no difference in the average value of deals carried out in the wave and non-wave periods in these industries (Table 2), but there certainly is a difference in the number of deals.

We have a panel data with a cross section of 8 industries for 18 years, 1995 to 2012, and we run a logistic regression to identify the causes of industry level merger waves. The neo-classical framework used to study merger waves, suggests that an economic rationale emerging out of industry, regulatory or technological shocks would drive a merger wave. To capture this, we use the principal component analysis to extract industry specific economic index from six underlying variables (section 3.2.1). Alternatively, we also look at the industry level shocks to operating income.

We observe that the economic shock index, used to capture industry shocks, explains the presence of a wave when we control for industry size (Models IV and V in Table 6). The variable that captures volatility in operating income (Models III and VI in Table 6) fails to capture this effect. This result suggests that there are shocks to an industry's environment that lead to capital re-allocation through mergers and acquisitions. However, the industry-shock thesis cannot solely explain the persistence of these waves for longer periods.

Harford (2005) has shown support in favour of the neo-classical explanations of merger waves. They note that, economic shocks to the industry explain merger waves, but this observation holds only when there is high capital liquidity. As we have mentioned in our opening remarks in the introductory section, Indian acquirers find it very difficult to access debt capital to fund their M&A deals due to regulatory prohibition on the banks for financing their domestic deals and also due to the under-development of the debt market. Therefore, capital liquidity does not have a weighty role to play in fuelling M&A activity in India.

The above discussion draws our attention to other factors, besides economic shocks, at play in industry merger waves. The table 6 presents an interesting result on the behavioural factor used to examine industry-level merger waves. It is a challenging task to instrumentalize the anchor acquirer variable. We refer to the literature on the 'big player' influence (Koppl & Yeager, 1996), and consider the anchor acquirer to be the one with the highest deal value in a given year. We scale this variable with the industry size in the previous year, and thereby numerically define anchor acquirer to be the deal that was sizeable enough compared to the industry size to be able to have a ripple effect across the industry. The anchor acquirer variable, as defined above, captures the big player influence in the form of herding by other industry players.

We observe that 'anchor acquirer' variable holds critical significance in explaining the industry-level merger waves. The significant coefficient of this variable in all the models presented in table 6 suggests that when there is a deal big enough compared to the industry size, it attracts attention from other industry players, who take a note of the same and possibly follow suit. We believe a big deal is capable of creating a lot of enthusiasm in the industry in which it is undertaken, and consequently leading to more M&A deals.

Some of the M&A activity could be caused by changes in the economy in the target companies' countries. Although it is not possible to capture changes in all the countries and industries of the target companies beyond the borders of India, we have tried to control for changes in a composite index of the world stocks. Therefore, we have used the MSCI World (Models II, III, V and VI) and the MSCI ACWI[4] (Models I and IV) indices to control for such changes.

We have attempted to capture significant regulatory changes at the industry-level (Table 4) and at the aggregate-level (Table 5) in the two years preceding an industry year. The coefficient of this variable is not significant. The tables 4 and 5 suggest that there were significant regulatory changes in some of the industries (not all), but certainly there were significant deregulatory changes at the aggregate level impacting all the wave industries. However, this variable lacks explanatory power, possibly because the economic shock index captures favourable changes to an industry due to such deregulatory initiatives.

We also control for other variables which are some of the noted characteristics of merger waves, like valuations and high stock returns. The market-to-book variable is a control used in merger wave literature to account for high industry level valuations. Similarly, high stock returns, and the dispersion in such returns, are captured through the three year average stock returns and the standard deviation of such returns, respectively. The market-to-book ratio is highly significant, and so is the dispersion of returns.

Herding at the Aggregate Level

If behavioural factors like herding (Harford, 2003) or the bandwagon effect (McNamara et al., 2008) cause a wave then that implies that there are early movers who capture most of the gains from merging. The subsequent deals are due to herding and the bandwagon effect, and therefore, such deals would not be able to capture as much gains, and could be value destroying as well.

An interesting result on the shareholder wealth effects on M&A deal announcements in India is that such deals on an average display positive abnormal returns for bidders, i.e., they create value for the acquirer's shareholders. We observe that on an average the M&A deals announced during the aggregate wave were received positively. On comparing the early movers versus followers, we observe that the deals done earlier gained more than the deals carried out later in the wave (Table 7). The difference in the gains of the early movers versus the followers is the highest when we compare the deals announced in the first and the last years. This difference reduces, although it remains significant, as we augment the number of years for the aforementioned comparison. Therefore, this part of the analysis indicates that there is a high possibility that the late entrants in the aggregate wave are succumbing to the bandwagon pressures (McNamara et al., 2008) or the herd behaviour. This is in line with our behavioural analysis on the Anchor acquirer effect at the industry level.

Ethnic Back-ground of the Promoter

In this part of the analysis we study if the ethnic back-ground of a promoter leads him to behave in favourable manner (or otherwise) in a merger wave. Ethnicity is associated with the 'sense of

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[4] MSCI ACWI is the All Country World Index, whereas the MSCI World is a collective index only for the developed countries' stocks.

self', and can affect economic choices (Akerlof and Kranton, 2000, 2005; Efferin and Hopper, 2007).

The business houses, and also the family firms in India, often find their roots in trading business communities like Gujaratis, Marwaris, Parsis, Chettiars, although there is more recent influx of other communities too (Damodaran, 2008). Since our data is limited to the merger waves in Indian industries, we have been able to divide the ethnic background in broader categories like Gujaratis and Marwaris, North Indians (includes Jats, Yadavs), South Indians (includes Chettiars and others), Maharashtrian, Parsis, Punjabi and Sindhi, and other minorities.

On comparing the promoters from traditional business communities with the newer communities, we observe some interesting results in Table 8[5]. We observe that M&A deals by traditional business communities, i.e., Gujaratis and Marwaris are not received as positively as the deals by North Indians, or South Indians (Panel I and II in Table 8). However, when compared with the group comprising minority communities, we observe that all the groups perform better (Panel III to VI).

We conduct a multivariate analysis to determine if promoter's ethnic background affects abnormal returns (CARs) after controlling for other explanatory variables. We report the results of the multivariate analysis in table 9. The coefficients on the ethnicity dummies suggest that market does not react significantly when the promoters from traditional business communities announce M&A deals. In other words, when promoters from Gujarati, Marwari, North Indian and South Indian communities, announce M&A deals, the market reacts based on the deal and firm characteristics, the promoter ethnicity doesn't play any role in signalling deal prospects. But when deals are announced by the promoters who belong to the 'other' category, the market reacts negatively. In such cases, promoter ethnicity signals negative information.

Conclusion

India, an emerging economy rife with institutional voids like lack of debt capital through markets or bank route, and also with its unique feature of high ownership concentration with promoters, has given us an opportunity to study the intriguing phenomenon of merger waves in a new context. The void of debt capital, either through the capital market or through the banking route, closes out the debt mis-valuation route which could lead financial buyers to propel M&A activity (Martos-Vila et al., 2012). High promoter ownership of Indian firms closes out the possibility of stock offers, and thereby weakens the equity mis-valuation theory of merger waves.

We observe that in the presence of above factors, the industry-shock thesis, i.e., neo-classical explanations for merger waves, explain the industry level merger waves in India. There have been conscious policy changes at the industry and aggregate level, which have also boosted M&A activity, although the effect of the same is not captured in the variable used to identify such regulatory changes.

In addition to the neo-classical explanation, we have proposed a behavioural explanation in the form of the 'anchor acquirer' hypothesis. This hypothesis is motivated by different behavioural theories that attempt to explain merger waves, and the 'big player' theory used to explain asset pricing. We argue that a manager could be acting out of sheer optimism as created

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[5] This table reports only those group comparisons for which the difference in abnormal returns was significant.

by a big deal in the industry. In the attempt of mimicking the anchor acquirer, the other players of the industry contribute to the momentum in M&A activity and thus lead to a wave. This hypothesis holds alongside the neo-classical hypothesis in explaining industry M&A waves.

On further analysis of behavioural factors we observe herding at the aggregate level, as well. When we lead an inquiry in to the ethnic background of the promoter-manager in the context of merger waves, we observe that deals by traditional business communities do not draw significant reaction from the market, but the deals from the minority communities are received negatively. Additionally, we do observe, interesting significant differences in the market reaction to the deals by different ethnic groups.

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Figure 1: Summary of M&A Activity in India (deals by Non-financial firms)

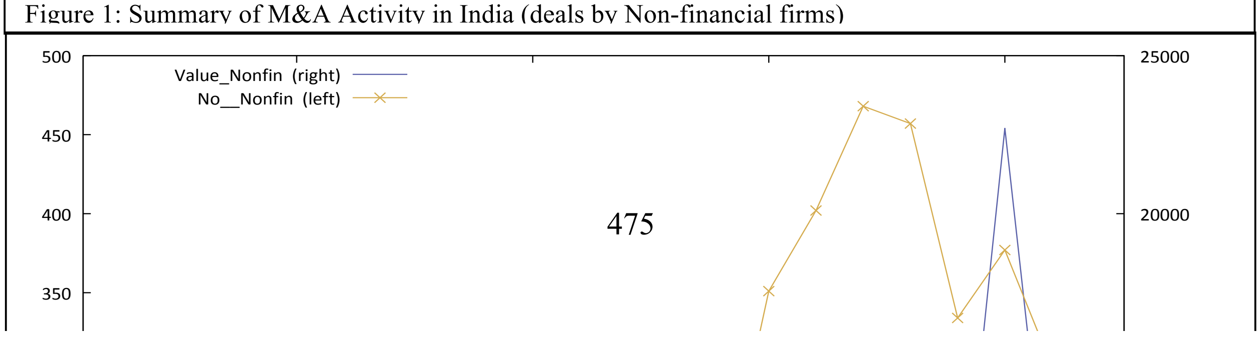

Figure 2: Summary of M&A Activity (Deals of value more than USD 0.25 million)

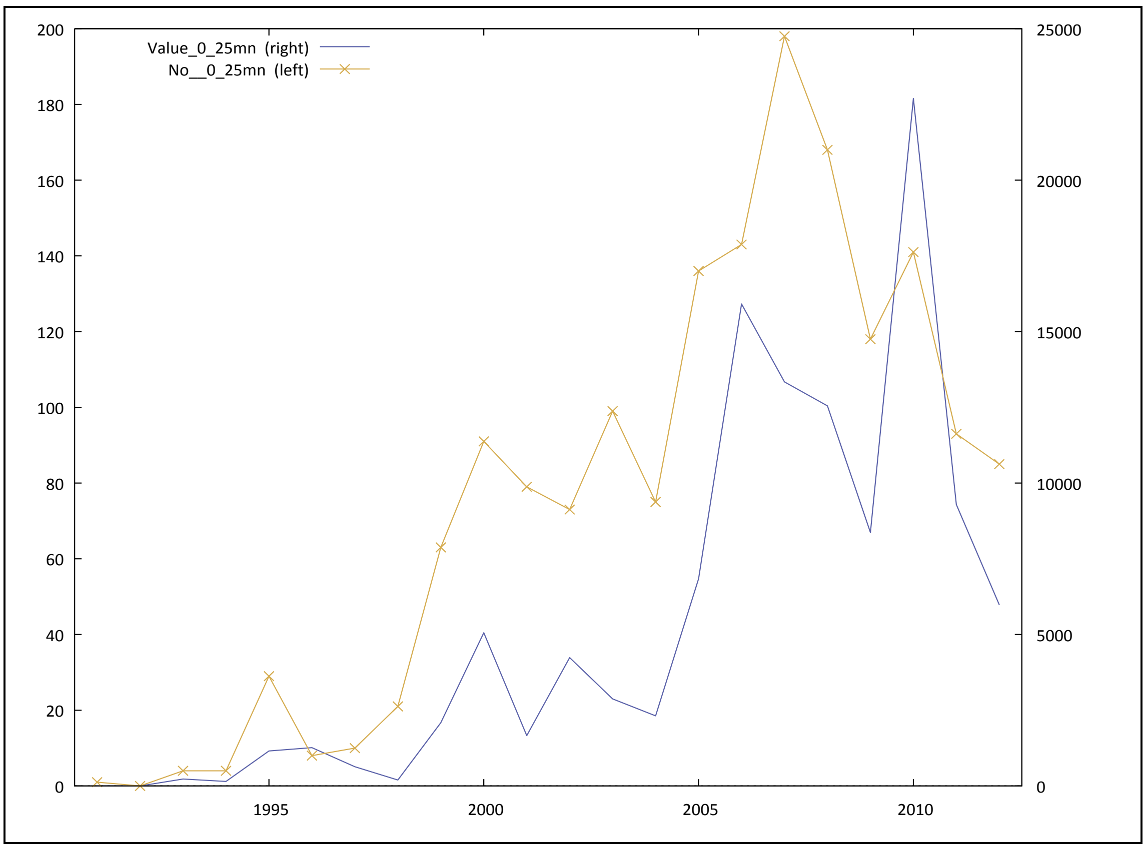

Figure 3: Identifying Merger Waves – De-trended PE versus the Sensex PE

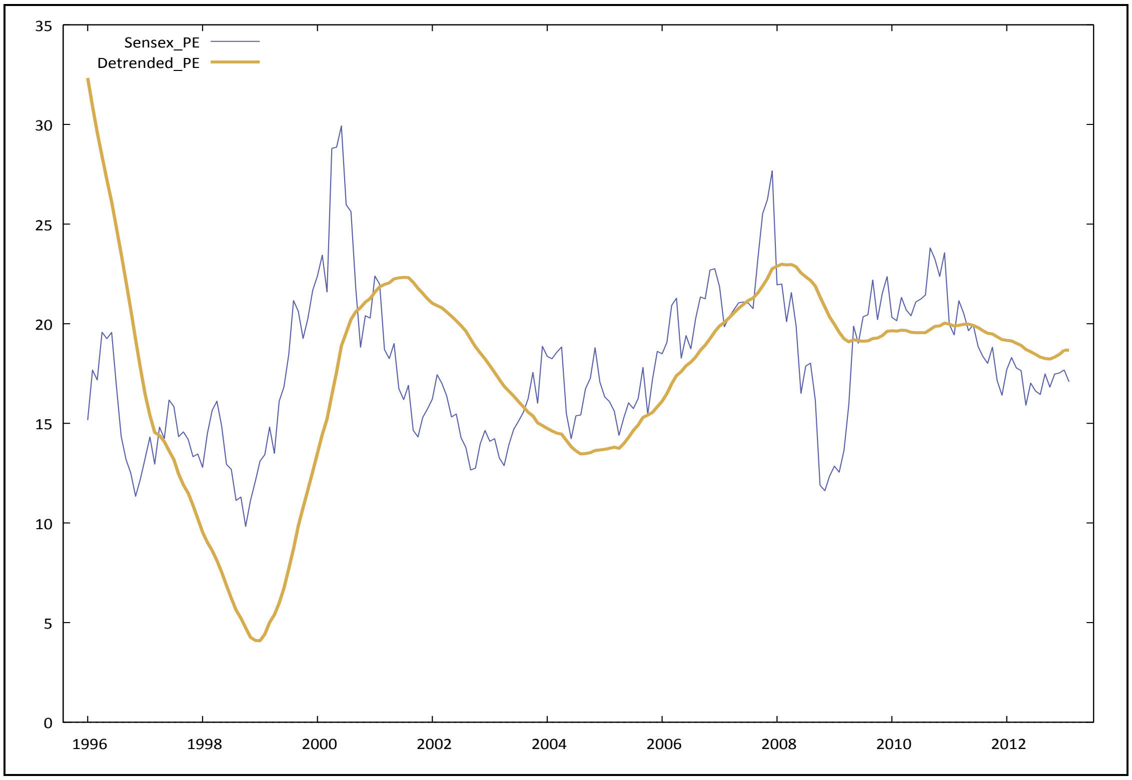

Figure 4: Identifying Merger Waves – De-trended PB versus Sensex PB

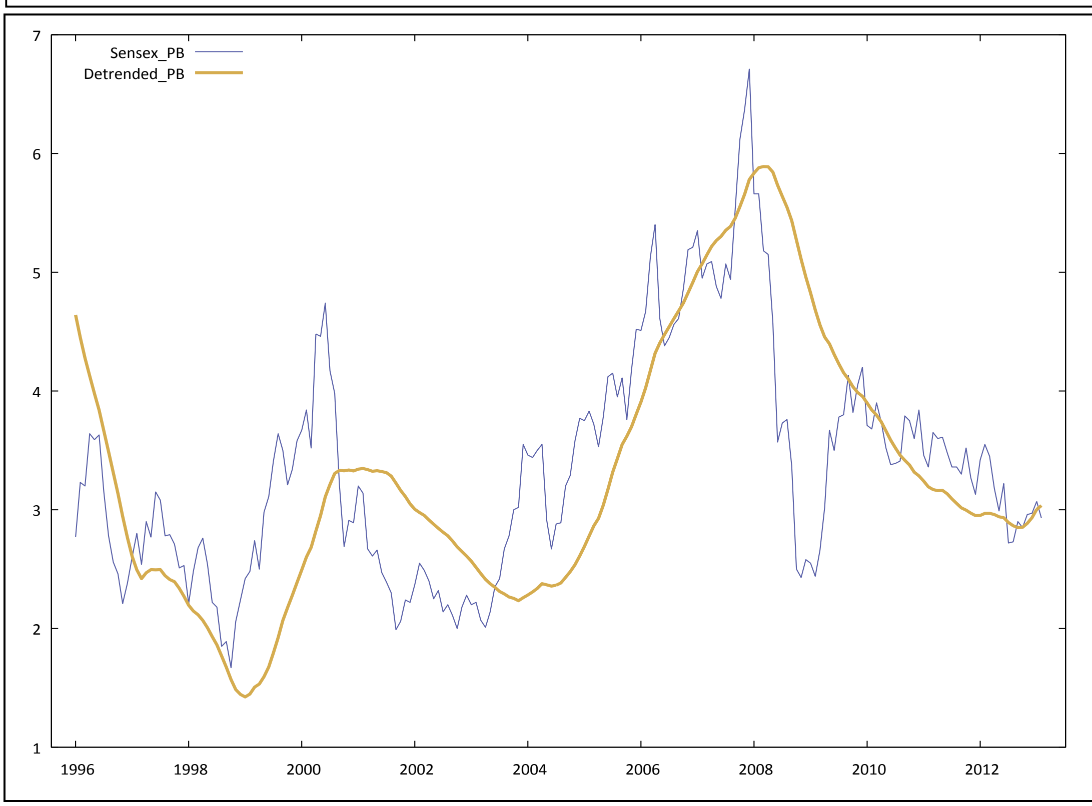

Table 1: M&A Activity in India from 1991 -2012

This table presents M&A activity in India from 1991 to 2012. We have considered only the completed deals by Indian acquirers. We have also reported the price-to-earnings and the price-to-book ratio for the BSE Sensex (our proxy for market Index).

	No filter		All Non-fin		Non-fin>= $0.25mn		BSE Sensex	
Year	Sum of Value of Deals	No of Deals	Sum of Value of Deals	No of Deals	Sum of Value of Deals	No of Deals	PE	PB
1991	30.642	7	0.65	4	0.65	1	24.46	4.37
1992	12.399	13	0	10	0	0	31.72	5.44
1993	972.495	12	229.56	9	229.56	4	40.02	5.16
1994	1040.324	31	148.234	10	148.234	4	34.5	4.88
1995	1393.298	90	1154.87	70	1154.427	29	15.99	2.92
1996	1291.358	32	1264.099	22	1263.939	8	12.2	2.38
1997	642.735	38	633.714	31	633.714	10	13.46	2.53
1998	252.497	55	195.769	43	195.649	21	12.08	2.24
1999	2296.235	180	2088.058	123	2087.707	63	21.67	3.58
2000	5474.729	397	5059.244	239	5057.666	91	20.28	2.89
2001	2586.376	256	1662.417	184	1661.838	79	15.73	2.22
2002	5775.1	242	4238.507	164	4238.032	73	14.64	2.28
2003	3160.42	325	2873.709	195	2873.192	99	18.86	3.55
2004	2843.381	360	2314.734	214	2314.01	75	17.07	3.77
2005	23071.72	591	6839.829	351	6839.079	136	18.61	4.52
2006	21048.35	647	15912.88	402	15912.33	143	22.76	5.21
2007	20933.29	738	13339.68	468	13338.55	198	27.67	6.71
2008	20402.59	718	12548.14	457	12547.11	168	12.36	2.58
2009	11813.88	629	8368.249	334	8367.685	118	22.36	4.2
2010	33695.68	619	22698.99	377	22697.24	141	23.56	3.84
2011	12994.26	498	9290.498	303	9290.203	93	16.41	3.13
2012	9954.258	443	5978.475	259	5977.866	85	17.53	2.97

Table 2: Industry Level Waves in India

This table presents the industries which underwent merger waves and the periods for which such heighted M&A activity was observed. The difference in transaction values and the number of deals is determined based on the T-Test, Wilcoxon Rank-sum test and Medians test.

Industry	Wave Period	Character	Difference in Transaction Values	Difference in Number of Deals
Drugs / Pharmaceuticals	2004-2009		Not significant	Significant
Chemicals	2004-2010		Not significant	Significant
Textiles	2004-2007		Not significant	Significant

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Automobiles	2005-2010	Two peaks (2008 & 2010)	Not significant	Significant
Mining	2008-2011		Not significant	Significant
Oil	2002-2010		Not significant	Significant
IT&ITES	1999-2001 and 2004-2009	Two waves	Not significant	Significant
Telecom	2004-2010	Two peaks (2006 & 2010)	Not significant	Significant

Table 3: Anchor Acquirers in Industry Waves in India

This table presents data on M&A activity of the significant players in an industry. The deal value presented here is the total of all the deals carried out by each acquirer in an industry wave.

Acquirer	No. of deals	Total Value of Deals ($ mn)
Panel I: Pharmaceuticals		
Acquirer	No. of deals	Total Value of Deals ($ mn)
Dr Reddy's Laboratories Ltd	4	659.39
Wockhardt Ltd	4	464.00
Ranbaxy Laboratories Ltd	4	400.32
Sun Pharmaceutical Industries Ltd	3	397.53
Jubilant Organosys Ltd	5	321.70
Matrix Laboratories Ltd	2	208.17
Others	26	637.048
Panel II: Automobiles		
Acquirer	No. of deals	Total Value of Deals ($ mn)
Tata Motors Ltd	3	2318.37
Mahindra & Mahindra Ltd	4	805.4
Others	16	712.50
Panel III: Mining		
Acquirer	No. of deals	Total Value of Deals ($ mn)
Hindustan Zinc Ltd	3	1575.86
Sesa Goa Ltd	3	839.64
Others	2	36.94
Panel IV: IT & ITES		
Acquirer	No. of deals	Total Value of Deals ($ mn)
SSI Ltd	1	717.34
Tata Consultancy Services Ltd	5	642.352
Wipro Ltd	5	461.915
Firstsource Solutions Ltd	1	330.00
MphasiS BFL Ltd	4	323.628
Subex Systems Ltd	3	307.5
HCL Technologies Ltd	2	184.502
Teledata Informatics Ltd	5	165.028
3i Infotech Ltd	2	103.6

Patni Computer Systems Ltd	2	95.2
Others	61	1,395.83

Table 3 contd.: Anchor Acquirers in Industry Waves in India		
Panel V: Chemicals		
Acquirer	No. of deals	Total Value of Deals ($ mn)
Tata Chemicals Ltd	4	1255.03
Uniphos Enterprises Ltd	6	230.56
GHCL Ltd	4	166.95
Others	31	494.82
Panel VI: Textiles		
Acquirer	No. of deals	Total Value of Deals ($ mn)
Indian Rayon & Industries Ltd	3	480.13
Spentex Industries Ltd	5	143.58
Himatsingka Seide Ltd	2	83
Welspun India Ltd	3	48.86
Others	15	87.58
Panel VII: Oil		
Acquirer	No. of deals	Total Value of Deals ($ mn)
Oil & Natural Gas Corp Ltd {ONGC}	4	3472.58
Reliance Industries Ltd	4	1800.03
Indian Oil Corp Ltd{IOC}	4	826.49
Others	7	619.84
Panel VIII: Telecom		
Acquirer	No. of deals	Total Value of Deals ($ mn)
Bharti Airtel Ltd	2	11000
Sun TV Ltd	2	1013.623
Videsh Sanchar Nigam Ltd	5	438.135
Others	13	1,957.16

Table 4: Major Regulatory Changes at the Industry Level			
This table presents significant regulatory changes at the industry level. The data on regulatory changes like the acts and policies is obtained from the ministry websites as referred below.			
Industry	Year	Regulation	Source
Pharmaceuticals	1995	Drugs (Prices Control) Order 1995	Dept. of Pharmaceuticals, Min. of Chemicals & Fertilizers (pharmaceuticals.gov.in)
	2002	Pharmaceutical Policy 2002	
	2005	The introduction of Product Patents in India in 2005 has boosted the discovery of new drugs	
	2011	National Pharma Pricing Policy	
Chemicals	2007	Policies for setting Petroleum, Chemicals and Petrochemicals Investment Regions (PCPIR)	Department of Chemicals & Fertilizers (chemicals.nic.in)

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Textiles	1995	Textiles Undertakings (Nationalization) Act, 1995	Ref. Ministry of Textiles (texmin.nic.in)
	1995	Sick Textile Undertakings (Nationalization) Act, 1995	
	2000	National Textile Policy	
	2005	Multi-Fibre Arrangement expired in Jan, 2005	
	2006	The National Institute of Fashion Technology (NIFT) Act, 2006	
	2008	National Jute Board Act, 2008	
Automobiles	1993	1993: Sector de-licensed	Ref. Department of Heavy Industry (dhi.nic.in)
	2001	2001: Auto Policy 2001	
	2006	2006: Automotive Mission Plan (AMP, 2006-2016)	
Mining	1993	National Mineral Policy, 1993	Ref. Ministry of Mines (mines.nic.in)
	2003	Mineral Conservation & Development Rules, 2003 (Amendment)	

Table 4 contd.: Major Regulatory Changes at the Industry Level			
Oil	1997	CBM Policy 1997 (Coal Bed Methane)	Ref. Ministry of Petroleum & Natural Gas (petroleum.nic.in)
	1999	New Exploration Licensing Policy (NELP), 1999	
	2002	The Petroleum Rules, 2002	
	2003	Auto Fuel Policy, 2003	
	2006	Petroleum & Natural Gas Regulatory Board (PNGRB) Act, 2006	
	2009	Petroleum & Natural Gas (Amendment) Rules, 2009	
IT&ITES	1991	Software Technology Parks in India in 39 locations across India	Ref. Department of Electronics & Information Technology, Ministry of Communications & Information Technology (deity.gov.in)
	2000	The Information Technology Act, 2000	
	2002	Liberalization of the international long distance	
Telecom	1994	National Telecom Policy, 1994	Ref. Department of Telecommunications, Ministry of Communications & Information Technology (dot.gov.in)
	1997	Telecom Regulatory Authority of India (TRAI) Act, 1997	
	1999	New Telecom Policy, 1999	
	2001	Communication Convergence Bill, 2001	
	2004	Broadband Policy, 2004	

Table 5: Major Regulatory Changes at the Aggregate Level	
This table presents regulatory changes carried out the aggregate level in the economy. Only the regulatory changes which could have had implications with respect to M&A are reported here.	
Year	Regulation

1991	FDI Opened up, upto 51% in 35 high priority industries under the Automatic Route
1994	SEBI Takeover code, the Substantial Acquisition of Shares and Takeovers, 1994
1996	FDI Automatic Approval Route extended to 111 industries (under four categories, Part A -up to 50%, Part B- up to 51%, Part -up to 74%, & Part D -up to 100%)
1997	SEBI Takeover code, the Substantial Acquisition of Shares and Takeovers, revamped in 1997
2000	FDI - Except for a negative list, all the remaining activities were placed under the automatic route
2002	Competition Act – Law to ensure free and fair competition in market
2002	Annual limit of overseas investment raised to US$ 100 MN (up from US$50 mn)
2002	Indian companies in SEZs can make overseas investment without the restriction of US$ 100 mn
2003	Indian companies allowed to invest up to 100% of net worth in a foreign entity (up to US$ 100 mn) in a foreign entity through the automatic route
2004	Indian companies can invest up to 100% of their net worth even if the investment exceeds the previous US$ 100 mn ceiling
2004	Indian companies can invest or acquire abroad in areas unrelated to their business at home, can be overseas joint ventures or wholly owned subsidiaries
2005	Indian companies are allowed to fund foreign direct investment using external commercial borrowing
2011	The Takeover Regulations 1997 were repealed and the new code, the SAST 2011, came into force.

Table 6: Logistic Regression on Panel Data

This table presents results of the logistic regression on panel data (random effects model) of industries that had merger waves in India. In Model I and IV- the MSCI Index considered is MSCI-ACWI, whereas, for all other models - MSCI World Index is considered. In Model III & VI we have considered operating income volatility, whereas, in all other models we have considered the Economic shock Index derived using principal component analysis on industry level financial variables. The p-values are in parentheses. * p<0.1, **p<0.05, ***p<0.01.

Variables	Model I	Model II	Model III	Model IV	Model V	Model VI
Anchor Acq	49.34**	48.83**	47.92**	48.32*	47.60*	44.04*
	[0.026]	[0.028]	[0.030]	[0.067]	[0.071]	[0.074]
MB Log	2.080***	2.106***	2.399***	1.823***	1.841***	1.899***
	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]	[0.000]
Stock Ret	-89.95	-110.4	-63.9	155.2	142.3	289.5
	[0.910]	[0.890]	[0.934]	[0.851]	[0.864]	[0.708]
Stdev_InvSqrt	0.640***	0.644***	0.556**	0.237	0.241	0.182
	[0.007]	[0.006]	[0.018]	[0.195]	[0.190]	[0.323]
Econ Shock	0.342	0.346	-22.75	0.587**	0.588**	-7.375
	[0.192]	[0.187]	[0.316]	[0.029]	[0.029]	[0.670]
MSCI Index	-1.502	-1.748	-1.73	-0.729	-0.884	-0.861
	[0.168]	[0.125]	[0.128]	[0.499]	[0.435]	[0.430]
Regulatory	-0.793	-0.757	-0.652	0.032	0.0542	0.215
	[0.168]	[0.190]	[0.248]	[0.957]	[0.927]	[0.713]

Industry Size				1.124***	1.121***	1.002***
				[0.000]	[0.000]	[0.000]
Constant	-7.045***	-7.120***	-6.366***	-20.15***	-20.16***	-18.03***
	[0.001]	[0.001]	[0.004]	[0.000]	[0.000]	[0.000]
N	144	144	144	144	144	144
chi2	22.48	22.66	22.37	31.99	32.04	32.95
p	0.0021	0.0020	0.0022	0.0001	0.0001	0.0001
LL	-68.85	-68.62	-68.91	-59.67	-59.6	-62.03
rho	0.1950	0.1960	0.2180	0.0000	0.0000	0.0000
sigma_u	0.8920	0.8970	0.9580	0.0005	0.0005	0.0012

Table 7: Early Movers versus Late Entrants in a Merger Wave -The Difference of Means test

This table displays cumulative abnormal returns (CAR) of the acquirers in the aggregate merger wave over different event windows. This table also reports the difference of means test for the early entrants and the late entrants in the aggregate merger wave. We have used the event study methodology for this part of our study (Brown and Warner, 1985 and Kothari and Warner, 2007). We have estimated the expected returns based on the standard market model, and have calculated the abnormal returns as the difference between the actual returns and the expected returns. The estimation period for our market model is 200 days ending 7 days before the first day of announcement (i.e., the day 0). In this table, we have reported results only for those event windows where the difference of means test on cumulative abnormal returns is significant.

Event windows	Day 0	Day -1 to 0	Day 0 to 1	Day 0 to 3	Day 0 to 5	Day 0 to 7	Day -1 to 1	Day -5 to 5	Day -7 to 7	Day -2 to 0	Day -2 to +1
Panel I: Year 2004 vs. 2011											
Diff. of Mean (N: 19,20)	0.0097	0.0280	0.0278	0.0307	0.0460	0.0514	0.0461	0.0647	0.0773	0.0169	0.0349
T-stat	0.8844	1.9741	1.8067	1.3074	1.9181	1.8675	2.5142	1.7756	1.9358	1.1078	1.6915
p-value	0.3822	0.0559	0.0789	0.1991	0.0628	0.0698	0.0164	0.0840	0.0606	0.2751	0.0991
Panel II: Year 2004-5 vs. 2010-11											
Diff. of Mean (N: 43, 56)	0.0125	0.0203	0.0183	0.0267	0.0353	0.0442	0.0262	0.0424	0.0490	0.0142	0.0200
T-stat	1.8599	2.4931	2.0756	2.3170	2.9031	3.0671	2.5903	2.4103	2.4422	1.4895	1.7529
p-value	0.0659	0.0144	0.0406	0.0226	0.0046	0.0028	0.0111	0.0178	0.0164	0.1396	0.0828
Panel III: Year 2004-5-6 vs. 2009-10-11											
Diff. of Mean (N: 74, 90)	0.0055	0.0161	0.0094	0.0124	0.0192	0.0203	0.0200	0.0141	0.0119	0.0100	0.0139
T-stat	1.0065	2.2057	1.2217	1.3635	1.9537	1.7489	2.1948	0.9777	0.7187	1.2172	1.3964
p-value	0.3157	0.0288	0.2236	0.1746	0.0525	0.0822	0.0296	0.3297	0.4734	0.2253	0.1645
Panel IV: Year 2004-5-6-7 vs. 2008-9-10-11											
Diff. of Mean (N: 118, 129)	0.0089	0.0174	0.0100	0.0133	0.0208	0.0184	0.0186	0.0182	0.0160	0.0116	0.0128
T-stat	1.9885	2.9485	1.5877	1.7972	2.5388	1.9203	2.4825	1.5185	1.1721	1.7482	1.5957
p-value	0.0479	0.0035	0.1136	0.0735	0.0117	0.0560	0.0137	0.1302	0.2423	0.0817	0.1118

Table 8: Difference in Cumulative Abnormal Returns based on the Ethnic Background of Promoter

This table displays cumulative abnormal returns (CAR) of the acquirers in the aggregate merger wave over different event windows. This table also reports the significance in difference between two samples based on the difference of means test, the Wilcoxon Rank-sum test and the Medians test, for the early entrants and the late entrants in the aggregate merger wave. We have used the event study methodology for this part of our study (Brown and Warner, 1985 and Kothari and Warner, 2007). We have estimated the expected returns based on the standard market model, and have calculated the abnormal returns as the difference between the actual returns and the expected returns. The estimation period for our market model is 200 days ending 7 days before the first day of announcement (i.e., the day 0). In this table, we have reported results only for those event windows where the difference on cumulative abnormal returns is significant. Y denotes that the difference is significant, and stars denote: * p<0.1, **p<0.05, ***p<0.01.													
Panel I: Guj+Marwari vs. North Indian													
Row Labels	N	Day 0	Day -1 to 0	Day -3 to 0	Day -7 to 0	Day 0 to 1	Day 0 to 3	Day 0 to 7	Day -1 to 1	Day -3 to 3	Day -2 to 0	Day -2 to +1	Day -3 to +1
Guj+Marwari	62	0.0082	0.0184	0.0157	0.0111	0.0053	0.0020	-0.0045	0.0156	0.0095	0.0141	0.0112	0.0128
North Indian	14	0.0199	0.0376	0.0356	0.0512	0.0307	0.0287	0.0067	0.0484	0.0444	0.0339	0.0448	0.0464
Diff. Significant	T-Test					Y*			Y*				
	Ranksum				Y*								
	Medians				Y**	Y*						Y*	Y*
Panel II: Guj+Marwari vs. South Indian													
Guj+Marwari	62	0.0082	0.0184	0.0157	0.0111	0.0053	0.0020	-0.0045	0.0156	0.0095	0.0141	0.0112	0.0128
South Indian	34	0.0188	0.0292	0.0266	0.0362	0.0270	0.0243	0.0091	0.0374	0.0321	0.0301	0.0383	0.0348
Diff. Significant	T-Test					Y*	Y*					Y*	
	Ranksum					Y*			Y*				
	Medians					Y*						Y*	
Panel III: Guj+Marwari vs. Others													
Guj+Marwari	62	0.0082	0.0184	0.0157	0.0111	0.0053	0.0020	-0.0045	0.0156	0.0095	0.0141	0.0112	0.0128
Others	11	0.0077	-0.0006	0.0057	0.0272	-0.0161	-0.0286	-0.0312	-0.0243	-0.0306	-0.0041	-0.0279	-0.0181
Diff. Significant	T-Test						Y**		Y**	Y**		Y**	
	Ranksum						Y*		Y**	Y*		Y**	
	Medians									Y*			

Table 8 contd.: Difference in Cumulative Abnormal Returns based on the Ethnic Background of Promoter (contd.)													
Panel IV: Maharashtrian vs. Others													
Row Labels	N	Day 0	Day -1 to 0	Day -3 to 0	Day -7 to 0	Day 0 to 1	Day 0 to 3	Day 0 to 7	Day -1 to 1	Day -3 to 3	Day -2 to 0	Day -2 to +1	Day -3 to +1
Maharastrian	14	0.0196	0.0197	0.0346	0.0211	0.0222	0.0081	0.0161	0.0223	0.0230	0.0286	0.0312	0.0372
Others	11	0.0077	-0.0006	0.0057	0.0272	-0.0161	-0.0286	-0.0312	-0.0243	-0.0306	-0.0041	-0.0279	-0.0181
Diff. Significant	T-Test					Y*		Y*				Y*	
	Ranksum							Y*				Y*	
	Medians	Y*		Y*		Y*		Y*	Y*	Y*	Y*	Y*	Y*
Panel V: North Indian vs. Others													
North Indian	14	0.0199	0.0376	0.0356	0.0512	0.0307	0.0287	0.0067	0.0484	0.0444	0.0339	0.0448	0.0464
Others	11	0.0077	-0.0006	0.0057	0.0272	-0.0161	-0.0286	-0.0312	-0.0243	-0.0306	-0.0041	-0.0279	-0.0181
Diff. Significant	T-Test					Y*			Y**			Y*	
	Ranksum					Y*			Y**	Y*		Y*	Y*
	Medians			Y*		Y*			Y*	Y*			Y*

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Panel VI: Parsi vs. Others													
Parsi	27	0.0071	0.0151	0.0184	0.0048	0.0116	0.0122	0.0061	0.0196	0.0236	0.0117	0.0162	0.0229
Others	11	0.0077	-0.0006	0.0057	0.0272	-0.0161	-0.0286	-0.0312	-0.0243	-0.0306	-0.0041	-0.0279	-0.0181
Diff. Significant	T-Test					Y*	Y**	Y*	Y**	Y**		Y***	Y*
	Ranksum						Y*	Y*	Y**	Y**		Y**	Y**
	Medians			Y*		Y*		Y*	Y*	Y**	Y*		Y**
Panel VII: South Indian vs. Others													
South Indian	34	0.0188	0.0292	0.0266	0.0362	0.0270	0.0243	0.0091	0.0374	0.0321	0.0301	0.0383	0.0348
Others	11	0.0077	-0.0006	0.0057	0.0272	-0.0161	-0.0286	-0.0312	-0.0243	-0.0306	-0.0041	-0.0279	-0.0181
Diff. Significant	T-Test					Y**	Y**		Y**	Y*		Y**	Y*
	Ranksum		Y**			Y**	Y**	Y*	Y***	Y*	Y*	Y**	Y*
	Medians	Y*	Y**	Y*		Y*	Y*	Y*	Y*	Y*	Y*	Y*	Y*

Table 9: Promoter Ethnicity -Multivariate Analysis

This table presents the results of the cross sectional OLS regression used to determine if Promoter ethnicity significantly affects the abnormal returns around M&A deal announcements. We have used robust standard errors method while estimating our regression model. The dependent Variable is CAR15 (Day -2 to +1) for all the models. The p-values are in parentheses. * p<0.1, **p<0.05, ***p<0.01.

Variables	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII
Guj-Marwari			-0.0054		-0.0068	-0.0082	-0.0049
			[0.655]		[0.715]	[0.659]	[0.702]
North Indian	0.0508	0.0302	0.0274		0.0247	0.0231	0.0265
	[0.114]	[0.360]	[0.414]		[0.493]	[0.509]	[0.448]
South Indian	0.0220	0.0148	0.0172		0.0153	0.0082	0.0139
	[0.192]	[0.451]	[0.354]		[0.503]	[0.719]	[0.503]
Others	-0.0326**	-0.0327**	-0.0350**	-0.0332**			-0.0324*
	[0.011]	[0.016]	[0.024]	[0.021]			[0.063]
Others Parsi					-0.0108	-0.0111	
					[0.565]	[0.557]	
Fin	-0.0004	-0.0037	-0.0010	-0.0151	-0.0147	-0.0202	-0.0146
	[0.990]	[0.900]	[0.973]	[0.607]	[0.623]	[0.508]	[0.633]
Rel Size	-0.0002	0.00226***	0.00215***	0.00264***	0.00227***	0.00231***	0.00236***
	[0.335]	[0.001]	[0.002]	[0.000]	[0.003]	[0.002]	[0.002]
Rel	-0.0124	-0.0079	-0.0075	-0.0062			
	[0.257]	[0.474]	[0.498]	[0.567]			
Percent Acq 26	0.0081	0.0066	0.0059				
	[0.662]	[0.712]	[0.748]				
Promoter Hold	0.0341	0.0214	0.0282	0.0212	0.0245	0.0242	0.0258
	[0.273]	[0.533]	[0.377]	[0.479]	[0.428]	[0.429]	[0.451]
Sqrt DE		-0.0147					-0.0111

		[0.381]					[0.533]
Debt-Cost Dummy		-0.0032	-0.0038	-0.0073	-0.0054	-0.0063	-0.0046
		[0.768]	[0.722]	[0.521]	[0.616]	[0.569]	[0.676]
Per cent Acq				0.0364	0.0378*	0.0352	0.0353
				[0.101]	[0.078]	[0.101]	[0.110]
Form				-0.0229	-0.0248*	-0.0257*	-0.0211
				[0.102]	[0.075]	[0.066]	[0.150]
Year Dummy					-0.00574	-0.00707	-0.0028
					[0.618]	[0.541]	[0.810]
IT&ITES						0.0167	
						[0.286]	
N	147	143	143	143	143	143	143
R-sq	0.082	0.122	0.115	0.111	0.122	0.131	0.136
Adj. R-sq	0.028	0.055	0.048	0.058	0.048	0.051	0.056
F	2.1120	4.4640	4.9990	4.7580	3.9350	3.6810	3.8590
P-value	0.0385	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000

Appendix A: Logistic Regression on Panel Data (Odds Ratios)

This table presents the odds-ratios of the logistic regression (results reported in Table 6) on panel data (random effects model) of industries that had merger waves in India. In Model I and IV- the MSCI Index considered is MSCI-ACWI, whereas, for all other models - MSCI World Index is considered. In Model III & VI we have considered operating income volatility, whereas, in all other models we have considered the Economic shock Index derived using principal component analysis on industry level financial variables.

Variables	Model I	Model II	Model III	Model IV	Model V	Model VI
Anchor Acq	2.67E+21	1.60E+21	6.50E+20	9.65E+20	4.69E+20	1.34E+19
MB Log	8.003098	8.218185	11.01447	6.188014	6.305043	6.680806
Stock Ret	8.61E-40	1.16E-48	1.78E-28	2.60E+67	6.32E+61	5.40E+125
Stdev_InvSqrt	1.896044	1.904701	1.743664	1.267973	1.272075	1.199883
Econ Shock Index	1.407835	1.412724	1.32E-10	1.798086	1.800292	0.0006268
MSCI Index	0.2227721	0.1741726	0.1772558	0.4825039	0.4133101	0.4225423
Regulatory	0.4525632	0.4690177	0.5212472	1.03255	1.055691	1.239827
Industry Size				3.076269	3.067125	2.72328

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Appendix B: Variable Definitions	
CAR	Cumulative Abnormal Return. Calculated as total of daily abnormal returns for a given event window T (i.e., t_1 to t_2)
Debt Cost	The cost of debt is measured as the ratio of interest expense and the average borrowings in the quarter before deal announcement.
Debt Cost Dummy	A dummy variable, which assumes value 1 if the acquirer's cost of debt before the deal announcement is more than the median cost of debt, 0 otherwise. The cost of debt is measured as the ratio of interest expense and the average borrowings in the quarter before deal announcement.
FIN	The method of financing for a deal, defined as a binary variable, assuming the value 1 if it is a stock offer, 0 if it is a cash offer
Log Deal Size	The log of the transaction value
Percent Acq	The percentage of stake acquired in a deal
Percent Acq26	A dummy variable based on the percentage of stake acquired in a deal. It assumes value 1 if the per cent acquired exceeds 26 per cent, otherwise it takes value zero
Promoter Hold	Promoter holdings of an acquirer before deal announcement, expressed as a percentage of total outstanding shares.
Year Dummy	A dummy variable to identify recession years -2007, 2008 and 2009
Rel	The industry relatedness dummy variable for a deal, assuming value 0 if the acquirer and the target are in the same industry, 1 otherwise. For determining whether a merger is happening in the same industry we have looked at the SIC codes (up to the third digit), i.e., if the acquirer and the target have same SIC up to 3 digits then we identify that deal as the one happening in a related industry.
Rel Size	The relative size of a transaction, measured as the ratio of the value of transaction over the market value of its acquirer.
Sqrt DE	The square root of the acquirer's debt-equity ratio before deal announcement
Guj-Marwari	A Dummy variable used to identify Gujarati and Marwari Promoters
North Indian	A Dummy variable used to identify North Indian Promoters
South Indian	A Dummy variable used to identify South Indian Promoters
Others	A Dummy variable used to identify Promoters belonging to a miscellaneous minority communities
Others Parsi	A Dummy variable used to identify Promoters belonging to a miscellaneous minority and Parsi communities
Form	A dummy variable used to identify asset acquisitions
IT&ITES	Industry dummy to identify IT & ITES industry

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SUSTAINABLE DEVELOPMENT OF ENERGY SECTOR AND THE ENVIRONMENT – THE CASE OF MACEDONIA

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***Abstract**. One of the topics that were mostly discussed in an international level in past decade is the sustainability of energy and environment, this mainly because of the rise of the industry and modernization of the countries which seeks for use of more energy. The debate was oriented on what will happen if we don't change the way how we use energy and how we produce energy. One of the things that is well known in the economy is that the growth of the supply of the energy has had always environmental consequences such as damage to the forests, reduce of the number of fish, influence on the climate changes etc.*

In the theoretical part of the research paper we will try to analyze what sustainability of the energy sectors means and what is relationship between the use of energy and environment, what is the right balance between the use of natural resources and the use of energy, how can we use energy now and still have it in the future. Further we will try to identify sustainable energy systems, identification of energy indicators for sustainable development and energy policies for 2050.

Our main concern in Republic of Macedonia is, are we using our resources in production of energy rationally, are we sure that with this tempo of use of environment in production of energy we will still have resources to produce energy in a future. That's why our research will be oriented toward Macedonian energy sector in terms of the balance of use of natural resources in production of energy and the relationship between the production of energy and environment. In the beginning we will describe the Macedonian actual situation relating to energy, its production, the sustainability of the energy sector, the effect of energy production into environment etc. We will analyze the strategy of development of energy sector in Macedonia till 2030, and the elements relating to the sustainability of energy sector and the balance of use of natural resources. The main research will be oriented to analyze and show how long Macedonia can produce energy with this way of use of natural resources and its impact to the environment. What it should be done in order to change the actual situation toward use of natural resources. Also we will make a comparative analysis on the actual situation towards Kyoto Protocol of Macedonian energy sectors and the countries in region.

***Key Words:** Sustainable development; Environment, balance of use of natural resources and environment, sustainable sources of energy, energy efficiency.*

Introduction

Today's generation live in completely different circumstances than in past, in a everyday life we have lots of with innovation which became a necessity of the humanity. This generation won't be able to survive without the use of innovation, the time will simply stop. Most of these innovations were related with the use of different technique and technology which appear in almost every aspect of our living. The increase in the use of technology by itself requires tremendous increase in the use of energy like electricity, oil, gas, coal, water, uranium etc. Unfortunately in the process of using the energy we didn't pay lots of attention to the future, mankind didn't bother itself on that how long can we use these natural resources. The problem is that we are using them in a much faster tempo than the earth created them or it is creating, this means that we have to think toward our future and have in mind that energy usage will increase in the future for about 40% in 2030, by this the use of natural resources will increase approximately the same. This statistics influenced us to raise two very important issues:

1) What is the influence in the environment on how we produce and use energy today in order to secure our future needs of energy?

2) Do we know how many years can we use the natural resources now and still have them in a accepted amount in the future (do we care about the balance)?

The two mention issues raised in this paper actually try to find out, will the quantity of the resources we use and the way (effect on the environment) will secure us that in the year 2700 human kind will still be able to use these resources in order to produce energy as much as they will need. It is true that in the future the technology might change and new sources of energy supply might be secure but we can't make our decision based on the hope, we have to secure that the way how we use energy will secure that mankind has it in the needed level in the future.

In order to understand what we mean with energy security lets firstly define it. Specifically, it refers to the ability of the energy supply system – suppliers, transporters, distributors and regulatory, financial and R&D institutions – to deliver the amount of competitively-priced energy that customers demand, within accepted standards of reliability, timeliness, quality, safety and environmental impacts, under a wide range of geopolitical, economic, social, technological and weather circumstances. 1

In order to achieve this energy security it is needed to be taken some measures manly from the government of each state, because if governments do not implement policies beyond those already planned between now and 2030 it will be very hard for the governments to have energy security, especially if we know that it is projected: 2

- energy consumption will increase by over half (53%);
- the energy mix will remain fairly stable and dominated by fossil fuels (80% share);
- energy-related CO2 emissions will increase by over half (55%); and
- large populations of the world's poor will continue to lack access to electricity (about 1.5 billion) and modern cooking and heating services (about 2.5 billion).

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1 OECD Contribution to the United Nations Commission on Sustainable Development 15, energy for sustainable development, organization for economic co-operation and development, 2007 p.9.

2 OECD Contribution to the United Nations Commission on Sustainable Development 15, energy for sustainable development, organization for economic co-operation and development, 2007.p.7

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We have to mention that over 70% of this growth of energy use is expected to come from developing countries, which will need more energy than OECD countries around the end of 2014.3 The world especially the developing countries use fossil fuels as the largest source of energy satisfying about 80% of global demand in 2004 and is expected that it will stay approximately the same with 81% in 2030. It is expected that the use of oil will slightly fall from 35% to 33% in 2030; the use of coal will rise from 25% to 26%; similarly the use of gas will rise from 21% to 23%. We know that we can't produce these natural resources and we also know that these natural resources are limited in the nature. An increase in the production of energy means an increase in the pollutants in the environment which is also related with the future of a mankind who will have to use only those resources that will be left as a heritage to them. Government's should pay huge attention to the energy sector and for the reason that this sectors offers many types of jobs, such as engineers, technicians, sales or client support. 4

Production of energy and the environment

In the introduction part the first issues that we raised was the impact on the environment which will be as a result of the increased need of energy in the future. If we see the result of projection of the level of CO2 emissions we will see an increase from 26.1 Gt CO2 today to 40.4 Gt CO2 in the year 2030. By sector most CO2 emissions growth are forecast as coal based power generation (32%), oil use in transport (13%), coal use in non-power sectors (9%), gas-based power generation (8%) and oil used in non-power sectors (7%).5

Even though there have been achieved great results relating air pollutants there have been achieved satisfactory result in the last 30 years, between 1980 and 2009 emissions of SO2 and N Ox in the EU-27 were reduced by around 80% and 57% respectively still there is a lot to be done.6

The European Union in its energy and climate change policy has decided to set up binding target known as 20/20/20 where it will be required 20% renewables in gross final energy demand, to reduce greenhouse gases emissions by 20% and to increase the energy efficiency by 20% by 2020, so that they achieve to decrease greenhouse gas emissions by 80–95% by 2050.7 In order to achieve this goal it will be needed almost complete technology shift, fortunately this technology is already available, mainly in the area of renewable electricity and heat generation, biofuels and electricity for transport, energy efficiency in buildings and transportation etc. 8 One thing is for sure that increased demand on the energy

3 OECD Contribution to the United Nations Commission on Sustainable Development 15, energy for sustainable development, organization for economic co-operation and development, 2007.p.7

4 Environment and Sustainable Development Report, 2012 EDITION, Trends in Environmental & Sustainability Performance of the Electricity Industry,p.23

5 OECD Contribution to the United Nations Commission on Sustainable Development 15, energy for sustainable development, organization for economic co-operation and development, 2007.p.9-10

6 Environment and Sustainable Development Report, 2012 EDITION, Trends in Environmental & Sustainability Performance of the Electricity Industry,p.7.

7 Neven Duic, Zvonimir Guzovic, Vyatcheslav Kafarov , Jirˇi Jaromir Klemeš, Brian vad Mathiessen, Jinyue Yan ,“ Sustainable development of energy, water and environment systems” 2013

8 Neven Duic, Zvonimir Guzovic, Vyatcheslav Kafarov , Jirˇi Jaromir Klemeš, Brian vad Mathiessen, Jinyue Yan ,“ Sustainable development of energy, water and environment systems” 2013

sector by itself will require tremendous investments in order to produce, convert, transport and distribute energy and not influence the environment.

Statistics show us that there is going to be an increase on electricity use, thus about 1.6 billion people – mostly in the rural areas lack access to electricity, and 2.5 billion people use traditional biomass for cooking and heating which effected that 1.3 million people – mostly women and children – die prematurely every year because of exposure to indoor air pollution from cooking and heating with traditional, inefficient biomass stoves. 9

Sustainable Development of energy (electricity) sector

The second issue that we raised in this research paper is the sustainability of energy sector; we have to make sure that the future generation will have the opportunity to use natural resources as we do. Sustainable development as a concept was mainly popularized by the International Union for the Conservation of Nature in its "World Conservation Strategy". Sustainable development means development that meets the needs of the present, without compromising the ability of future generations to meet their own needs. 10 This definition and others contain three important elements:

1. Sustainable economic development,
2. Social development/equity and environmental,
3. Environmental protection/conservation/preservation.

In the continuance we will try to analyze the three main strategies that can be used to solve the raised issues:

1. Nuclear energy,
2. Energy efficiency,
3. Renewable energy.

Is nuclear technology the solution

Nuclear energy is a nearly carbon-free technology that has progressed through several generations of development and that can compete favorably with alternatives for base-load electricity generation and enhance the security of energy supply. Today the nuclear energy sector is using the "Generation III" which was developed in the 1990s which differ from the second generation mainly on safety. Today most developed countries in the world are working on developing "Generation IV" of nuclear power plants which will offer more advantages in the areas of sustainability with a better use of natural resources and less waste production, economics, safety and reliability, and proliferation resistance and physical protection. Assuming current concerns are met, increased use of nuclear power could provide substantial CO2 emission reductions in a cost-effective manner.11

The main problem in using nuclear energy is it safety. The world started to see nuclear energy differently after 11 March 2011, when a powerful earthquake occurred on the east

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9 OECD Contribution to the United Nations Commission on Sustainable Development 15, energy for sustainable development, organization for economic co-operation and development, 2007.p.15

10 Sustainable Development: The Case of Energy in South Africa, International Institute for Sustainable Development, 2003, p 1-2

11 OECD Contribution to the United Nations Commission on Sustainable Development 15, energy for sustainable development, organization for economic co-operation and development, 2007.p.31

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coast of Japan, which was followed by a tsunami that seriously damaged the nuclear power plant Fukushima Daiichi. The reactor cooling systems were disabled, leading to nuclear radiation leaks. This was the second nuclear disaster after the Chernobyl in 1987. This accident influenced enormously the nuclear energy sector right after that Germany decided on a complete phase-out by 2022, a referendum halted the planned nuclear program in Italy, EU Energy Commissioner Günther Oettinger proposed nuclear “stress tests” to harmonies safety standards in Europe etc. 12

Expect safety as a very important aspect we can number three key issues that present obstacles to an increased use of nuclear energy:13

1. The lack of political stability and regulatory framework stability which increases the business risks of investing in a technology with a capital intensive cost structure;
2. Public opposition due to the perceived threats of mainly radioactive waste management and to a lesser extent nuclear accidents; and
3. The possible proliferation of nuclear weapons.

We have to bear in mind that in order to produce nuclear energy we know that we need another very important natural resources uranium. Based on some statistics this natural resource in a lower price will be sufficient after about 85 years from today. By 2025, world nuclear energy capacity is expected to grow to between 80 000 tones and 100 000 tones, which also raise the question will we be able to satisfy the need for uranium. 14

Increasing energy efficiency in production and use

One of the best and cheapest ways to deal with already mention problems related with the energy sector is energy efficiency in its production and use, which can influence in reduction of energy usage and production enormously. Most of the government around the world has invested huge amounts of money in energy efficiency especially in teaching of their citizens on the way how they can reduce their energy use efficiently. There are different ways how governments can influence energy efficiency use, we will number some:15

1) New buildings could be made 70% more efficient than existing buildings through use of insulated windows, modern gas and oil furnaces, and more efficient air conditioners. District heating, heat pumps and solar energy can all save energy. Improved lighting could yield cost-effective savings of 30 to 60%.
2) For households, major improvements have been made in refrigerators, water heaters, washing machines and dishwashers. New technologies such as "smart" metering, micro combined-heat-and power generation, fuel cells, solar photovoltaic and more efficient lighting can save energy.
3) In industry, energy demand and CO_2 emissions can be cut through improved efficiency of motors, pumps, boilers and heating systems; energy recovery in

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12 Environment and Sustainable Development Report, 2012 EDITION, Trends in Environmental & Sustainability Performance of the Electricity Industry, p.8

13 OECD Contribution to the United Nations Commission on Sustainable Development 15, energy for sustainable development, organization for economic co-operation and development, 2007.p.30

14 Uranium 2005 – Resources, Production and Demand (NEA/IAEA, 2006). p.31.

15 OECD Contribution to the United Nations Commission on Sustainable Development 15, energy for sustainable development, organization for economic co-operation and development, 2007.p.34

materials-production processes; recycling of used materials; and higher efficiency of materials use. Other approaches are advanced membranes that can replace distillation in some petrochemical processes; "direct casting" in iron and steel; and the use of bio-feed stocks in the petrochemical industry to replace oil and natural gas.

4) In transport, the efficiency of conventional gasoline and diesel vehicles can be improved through turbochargers, fuel injection and advanced electronic methods of engine control; new materials and more compact engines; efficiency gains in vehicle air conditioning; and hybrid vehicles and advanced diesel engines.

Saving a kilowatt of energy is 1000 to 1000 times more cost effective than generating a new kilowatt of energy.16

Renewable energy

Statistics showed that there have been some positive movements since 1980 where the percentage of , renewable energy sources other than **hydro** represented 0.4% of the total capacity for the EU-27 but in the year 2000, the same source represented 3.2%, and in 2010 it reached to acceptable 15.4%. This percentage it is expected that in a near future reach about 40%. There are some natural resources that can be used as renewable resources in producing electric energy, like: 17

Hydropower is already widely deployed and is, in many areas, the cheapest source of power. However, there is considerable potential for expansion, particularly for small hydro plants. What is needed is better technology.

Geothermal resources have started to be considering as a great alternative especially after the cost of high temperature for power generation had been decreased very much since the 1970s. The main issue here is that geothermal is available only in some countries.

Solar photovoltaic (PV) technology is playing a rapidly growing role in niche applications. Costs have dropped with increased deployment and continuing R&D.

***Biomass* for power** this resource is commercially attractive where quality fuel is available and affordable. Co-firing a coal-fired power plant with a small proportion of biomass requires no major plant modifications, can be highly economic and can also contribute to CO2 emission reductions.

Liquid *biofuels* currently meet around 1-2% of the global road transport energy demand.

Wind energy and Ocean energy (wave, ocean currents, thermal and saline currents) is approaching the near commercial stage with many devices being tested as prototypes or on a pilot scale. Significant R&D investment is necessary to develop this promising renewable energy resource.18

In order to increase the use of renewable resources in production of energy, governments need to take lots of measures soon as possible, because they can play a huge role in this process which is very successful. The government’s policy priorities should be oriented toward:19

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16 SEA Change, Fairer, Cleaner, Safer – Toward a more sustainable, people centered approach to energy development in South East Europe, 2012, p.10

17 Environment and Sustainable Development Report, 2012 EDITION, Trends in Environmental & Sustainability Performance of the Electricity Industry,p.19

18 OECD Contribution to the United Nations Commission on Sustainable Development 15, energy for sustainable development, organization for economic co-operation and development, 2007.p.35-37

19 Renewable Energy: RD&D Priorities: Insights from IEA Technology Programs (IEA, 2006).

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1) Connection and integration of variable renewable energy sources into electricity grids.
2) Interconnection safety, codes and standards to help manage the variability of renewable energy sources.
3) Flexible, reliable and low-cost energy storage to help manage the variability of renewable energy sources.
4) Improving the reliability and efficiency of wind turbines, solar PV panels, solar water heaters, ground heat pumps and other emerging technologies.
5) Demonstrating the compatibility and safety of renewable electricity technology.
6) Renewable energy heating and cooling technology deployment.
7) Public acceptability, access to public lands, siting of projects, permitting and royalties, and other socio-economic and environmental concerns, especially for geothermal, wind, hydropower, ocean energy and concentrating solar power.
8) Distributed energy systems as an adjunct or partial replacement of traditional electricity and heating grids.

Analysis of Macedonian energy sector

Each country in South East Europe, except Bulgaria and Bosnia, are net electricity importers. Macedonia, Serbia and Kosovo are winter peak countries when most of the importers occur in this time of the year, Greece is a summer peak country and Albania has a rather stable consumption throughout the year. Production mix in the whole SEE is very poor and dominant primary energy resources are lignite and hydro, except Bulgaria and Greece, where there are some resources with natural gas as well as nuclear, in the former one is available. This is one of the reasons, beside the socio-economic, that in many countries wholesale power prices are low compared to other Western European countries. Regulated wholesale power prices do not match with the production costs and that's why the import prices are extremely higher compared to the domestic ones. In other hand the countries of South East Europe are extremely energy inefficient. Between 1,7-3,9 times more energy is used to produce a unit of GDP in the SEE compare to the EU average. 20

The main function of electrical and power system (EPS) of Macedonia is production, transmission and distribution of electricity. The structure of the EPS of Macedonia comprises:21

- Hydropower plants with total installed power of 580 MW,
- Lignite and heavy fuel oil fired thermal power plants with total installed power of 1010 MW and
- Electricity transmission and distribution system.

The EPS of Macedonia is operated by four entities, namely: AD **ELEM** – Skopje (Power Plants of Macedonia), state owned, shareholding company for production and supply of electricity, AD **MEPSO – Skopje,** (Macedonia Electricity Transmission System Operator), state owned, Macedonian's transmission system operator – shareholding company for transmission of electricity and management with the electricity and power system of

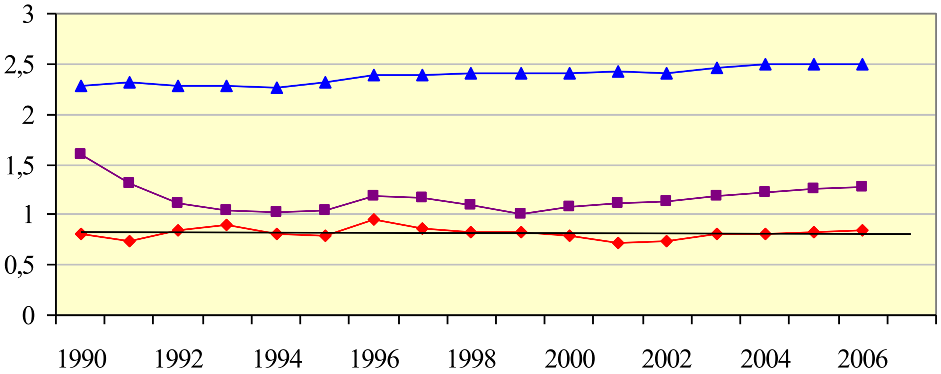
20 Toward a more sustainable, people centered approach to energy development in SEE,-SEA Change, August 2011

21 Statement on Security of supply, Republic of Macedonia, Government of Republic of Macedonia and Ministry of Economy, 2011

Macedonia, the distribution company **EVN Macedonia** AD and AD **TPP Negotino**, state owned, shareholding company for production of electricity.22

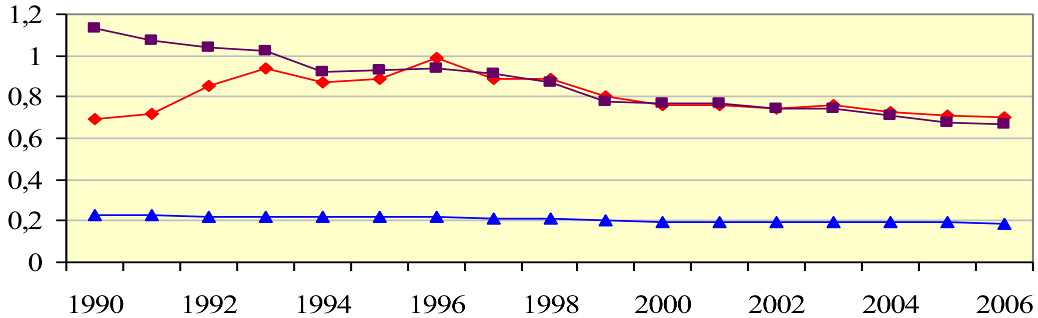
Macedonia is characterized with very low level of consumption of electricity per citizen.23 As we can see from the figure 1 in 2006 in Macedonia the level of consumption of energy per citizen was three times lower compared with the consumption of EU member's countries. These statistics don't let us to do any prediction toward reduction of consumption of energy from Macedonian citizens, but it will be very real to expect an increase in the energy consumption.

Figure 1. Consumption of energy in Republic of Macedonia per citizen



Having in mind that it is not expected to have any important increase in the GDP it is expected that this trend will continue till the year 2020 even though that the consumption of final energy will increase by 3% annually(this trend will be followed also from EU members. But even though that the percentage of consumption of energy per citizen is very low, Macedonia is one of the countries with very high consumption of energy per GDP unit. This is mainly because of the very low level of GDP per capita in Macedonia. The use of energy per GDP in 2006 has been 3,7 from the average in the European countries' (Figure 2).

Figure 2. Percentage of energy consumption per unit GDP



According to statistics the annual growth of the total energy consumption in the past period was around 4,5%, the average growth of electricity was 3,5% and natural gas was around 10% (Table 1).

22 Statement on Security of supply, Republic of Macedonia, Government of Republic of Macedonia and Ministry of Economy, July 2011

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Table 1. Energy consumption in the period 2000-2010

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Coal	104	95	69	138	90	109	136	182	146	68
Petroleum Products	670	587	686	689	707	726	715	776	751	741
Natural gas	7	26	32	30	32	33	34	34	31	29
Geothermal	15	21	12	12	11	9	9	9	8	9
Biomass	204	143	141	165	166	151	163	138	169	191
Electricity	448	432	428	490	496	536	554	580	593	550
Heat	153	132	136	128	122	127	118	107		

* According the methodology of IEA and EUROSTAT
Source: Statement on Security of supply, Republic of Macedonia, Government of Republic of Macedonia and Ministry of Economy, July 2011,

According to the projections until 2020 the total final energy consumption will grow with an average annual rate of 2.64% annually. The average growth of electricity is expected to be 2,5% annually and for natural gas the average growth is expected to be 7,8% annually.

Table 2. Prediction of energy consumption till 2020 ***ktoe***

	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Electricity	675	696	718	738	760	781	802	822	843	864
Heat	121	123	125	127	129	131	134	136	138	140
Petroleum Products	749	784	822	858	896	936	975	1014	1055	1093
Natural gas	42	45	50	54	59	65	73	81	89	98
Coal	102	119	123	126	130	133	137	140	144	147
Biomas for combustion	222	223	225	227	228	230	231	233	234	236
Geothermal	11	11	12	14	15	18	20	24	28	34
Solar	1,4	1,6	1,9	2,2	2,6	3,1	3,5	4	4,6	5,2

The total energy needs growth from 2012 to 2020 is in total about 25%, more electricity consumption in 2020 than in 2012, or Macedonia will use about 168 GWh more electricity than in 2012. If we analyze separately from the table 2, we can see that greater increase is expected at solar energy for about 14, 5%, followed by natural gas 7, 8%, geothermal energy 9, 7% and oil and biomass 3, 1% annually.

Energy production and the environment in Macedonia

The electricity production in the Republic of Macedonia is mostly based on the use of non-renewable energy sources (coal in the thermal power plants, and recently natural gas in the thermal power plant - heat supplier (combine cycle power plant) in Skopje). There are 800 MW of coal (lignite) power plants capacities in total and 550 MW of hydro potential. There is an independent oil fired power planed served as cold reserves, however due to high operating costs it runs only few hours during cold winters when the region is short. Electricity plays a major role in polluting the environment because almost 90% of primary energy is produced mainly from coal, lignite and oil. This sector is responsible for 70% of the total pollution on the environment. All projection related with production of electricity using coal and lignite show an increase of 3,6% in pollution for the period 2012-2020 even though that the projections of total pollution are to be increased by 1,4% annually. The most common components of pollution from the combustion of lignite and coal include: CO_2 (carbon dioxide), SO_2 (sulfur dioxide), NO_x (nitrogen oxides), CO (carbon monoxide), NMVOC (non-methane volatile organic compounds) dust, heavy metals and other. In the table 3 we will show the current (2012) level of emission of pollutants in Macedonia.

Table 3: Emissions of pollutants in present condition

No.	Energy Carrier	Dust	SO_2	NOx	CO	NMVOC	CO_2	Energy Consumption
		t/year						MWh/year
A.	**Present condition**							
1.	Electricity	7.76	147.08	124.96	11.77	9.27	89,982	83,471
2.	District heat	2.92	3.69	24.37	15.44	1.89	23,594	85,796
3.	Heating oil	3.85	82.79	62.09	12.35	3.21	42,359	160,451
4.	Heavy fuel oil	3.57	101.07	20.32	4.03	1.04	16,001	57,558
5.	Firewood	3.87	37.68	26.24	1310.00	157.24	1,321	88,038
	Total:	**21.97**	**372.31**	**257.98**	**1353.59**	**172.65**	**173,257**	**475,314**

Source: National program for energy efficiency in public buildings in the Republic of Macedonia until 2019, (phase i), Government of Republic of Macedonia and Ministry of Economy, 2012.

It is obviously that the current condition relating the pollutants isn’t I a satisfying level and that’s why Macedonia plan to take some measures that will reduce the level of emissions of pollutants mainly in public buildings in R. Macedonia, and upon these measures it is expected to have satisfying result in reduction of these pollutants till 2020, table 4.

Table 4: Emissions of pollutants after improvements in public buildings in R. Macedonia in 2020

No.	Energy Carrier	Dust	SO_2	NOx	CO	NMVOC	CO_2	Energy Consumption
		t/year						MWh/year
B.	**After exploitation of saving potential under the NPEEPB**							
1.	Electricity	7.55	143.13	121.60	11.45	9.02	87,566	81,230
2.	District heat	1.32	1.67	11.03	6.99	0.85	10,677	38,827
3.	Heating oil	2.24	48.22	36.16	7.20	1.87	24,670	93,447
4.	Heavy fuel oil	2.24	63.49	12.76	2.53	0.65	10,050	36,154
5.	Firewood	2.98	28.99	20.18	1007.94	120.98	1,016	67,738
	Total:	**16.33**	**285.50**	**201.73**	**1036.11**	**133.37**	**133,973**	**317,396**
	Total emissions reduction:	**5.64**	**86.81**	**56.25**	**317.48**	**39.28**	**39,278**	**-**

Source: National program for energy efficiency in public buildings in the Republic of Macedonia until 2019, (phase i), Government of Republic of Macedonia and Ministry of Economy, 2012.

It is obvious that lots of savings in the pollution will be achieved, we can notice that the emission of carbon dioxide (CO_2) will decline with 23% or 39,278 t/year, relative to the actual emissions. Expect the benefits that we will have relating to pollution there will be lots of Social benefits of Program implementation by improving the energy efficiency of the Macedonian public buildings like: reduce of greenhouse gas emissions, improvement of energy security, social welfare, reduction of fuel poverty, new business opportunities, improved quality of public services, as well as improved air and life quality and health.24 Another very important aspect relating to the global economic condition in Macedonia is that

24 National program for energy efficiency in public buildings in the Republic of Macedonia until 2019, (phase i), Government of Republic of Macedonia and Ministry of Economy, 2012.

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all measures relating energy efficiency include activities which are labour intensive, a recent study of the Central European University makes an overview of such studies and presents the range of the employment impacts from 10 to 30 jobs per million Euros invested, however in Macedonia it will create about 3000 new jobs. 25

Strategy for Sustainable development of energy (electricity) sector in Macedonia

In the energy strategy till 2020 in Macedonia exist three scenarios, in the first one it is predicted an increase of 2 % annually till 2020, in second scenario 2, 5 % and in the third 3%. This of course requires additional need of resources in order to produce this energy, mainly coal. The actual level of coal is insufficient to satisfy the increased growth of need for energy, especially that some of the mines are in the last year of their exploitation. And therefore additional mines will need to be activated. In the table 5 we represent the mines that will need to be activated depending on which scenario will be realized in order to secure the needed level of energy.

Table 5: Period of building the new production capacity

	SCENARIO 1	**SCENARIO 2**	**SCENARIO 3**
Increase of the consumption	2 %	2,5%	3,0%
2021	**XE VELES**	**XE VELES, TE MARIOVO**	**XE VELES**
2022	**TE MAVROVO**		
2024	**TE NEGOTINO**	**TE NEGOTINO**	
2026			**HE_1000**

Source: National program for energy efficiency in public buildings in the Republic of Macedonia until 2019, (phase i), Government of Republic of Macedonia and Ministry of Economy, 2012.

Macedonia has Electricity Production 6.273 billion KWH and energy consumption of Electricity 7.216 billion KWH which means that's it imports electricity for 943 million KWH every year. The national Energy Strategy until 2030 points to Macedonia's strong dependence on increasing energy imports as a contributor to the growth of the trade deficit of the Republic of Macedonia. In the long run, unless the situation improves, energy fuel imports can also have adverse impacts on the inflation, foreign currency reserves and the macroeconomic stability of the country in general.26 Government of Republic of Macedonia in April 2010 adopted Strategy for Energy Development till 2030, which pointed some priorities that will need to be taken into consideration, those are:27

- ✓ Maintenance, revitalization and modernization of the existing and construction of new, modern infrastructures for the purposes of energy production and utilization,
- ✓ Improvement of the energy efficiency in the production, transmission, and utilization of energy,
- ✓ Utilization of domestic resources (reserves of lignite, hydropower potential, wind and solar energy) for electricity production,
- ✓ Increase of natural gas utilization,

25 Employment Impacts of a Large-scale Deep Building Energy Retrofit Program in Hungary, June 8, 2010, Centre for Climate Change and Sustainable Energy Policy, Central European University

26 Strategy for Energy Development in the Republic of Macedonia until 2030, Ministry of Economy, Skopje, 2010, p.19

27 Statement on Security of supply, Republic of Macedonia, Government of Republic of Macedonia and Ministry of Economy, 2011

- ✓ Increase of the utilization of renewable energy sources,
- ✓ Establishment of economic prices on energy,
- ✓ Integrating the energy sector of the Republic of Macedonia in the regional and European market of electricity and natural gas by constructing new interconnections and by harmonizing its legislation.

Macedonia has to do this investment in order to better its efficiency in production of energy. Experts suggest that if we made this investment than we will increase the production of energy per 7.2 % per unit. This investment is necessary especially because the life time of existed power plants in Macedonia is almost at the end of its usage.28

Increasing energy efficiency (EE) in production and use

Macedonia till today had made important progress especially during the last couple of years in developing the strategic and legal framework for energy efficiency in production and use. Peter Johansson, high expert of WB for Energy efficiency in his calculation came to the findings that for one Euro investment in EE save 2,2 euros. The countries of South East Europe are extremely energy inefficient. Between 1.7 and 3.9 times more energy is used to produce a unit GDP in the SEE compared to the EU average.29 To achieve energy efficiency improvements in the buildings sector and to meet its strategic targets as outlined in the Energy Development Strategy of the Republic of Macedonia until 2030, the Government of Macedonia plans to launch a National Program for Energy Efficiency till 2020 in Public Buildings (NPEEPB) where 2,441 public buildings with total heated area of 2,265,944 m^2 included.30 The main objective of this program is to provide input to reach the established indicative target of at least 9% reduction of energy consumption in Macedonia until 2018 compared to 2012. These programs include thermal energy savings and electricity savings.

*EE measures aimed at **thermal energy** savings include*: thermal insulation on the outside wall, replacement of the existing windows and outside doors with new, energy efficient one, thermal insulation of the roof (attic), thermal insulation on the floor, installation of Automatic Control (AC) systems in existing heating substations in the public buildings that are connected to the district heating system, reconstruction of boiler stations in existing hot water radiator heating systems, installation of AC systems in boiler stations in existing hot water radiator heating systems, replacement of existing room stoves operating on firewood with new, highly efficient ones, replacement of existing radiator masks in kindergartens with new ones, to enable better emission of the heat produced from the radiator units.

*EE measures aimed at **electricity savings** include:* improvement of lighting arrangement, replacement of existing pumps in hot water supply systems with new EE pumps.

The expected energy savings of Program implementation amount to 33.2% from the current actual consumption, the required investments for its realization amount to 95.26 million Euros and it will bring monetary annual savings of nearly 14 million Euro/year, and with ROI of only 6.8 years. The audit costs amount to 3.22 million Euros. Capacity building activities and Program administration will require additional funding of about 9.5% over

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28 Vlatko Cingoski, PhD. EE. Jasna Ivanova Davidovic, Daniela Mladenovska “Investment incentives for rehabilitation and performance improvement of tpp bitola”, 2012

29 *SEA Change, Fairer, Cleaner, Safer – Toward a more sustainable, people centered approach to energy development in South East Europe, 2012, p.10*

30 *National program for energy efficiency in public buildings in the Republic of Macedonia until 2019, (phase i), Government of Republic of Macedonia and Ministry of Economy, 2012.*

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investment costs, or about 9 million Euros. This program which deals with public buildings represent 18.24% of the annual energy consumption of the Commercial and Services sector, so with the reduction of the energy it will be achieved reducing of GHG emissions with about 39,000 t CO_2/year. Despite the mention benefits there will be additional important social, political and economic policy agendas, including the improvement of energy security, social welfare, reduction of fuel poverty, improved quality of public services, as well as improved air and life quality and health and new jobs (3000 jobs will be created).31 In the part of strategy for sustainable energy sector we mention the measures that need to be take in order to increase the energy efficiency in production.

Renewable energy

Actually in Macedonia 80% of the electricity is produced from thermo plants using coal, and 20% on hydro plants. Renewable energies in 2030 are planned to achieve 4600 GWh (396 ktoe) or about 30% from todays 11%. In Macedonia we use the mainly the following natural resources in producing the energy: 32

- Biomas – Total consumption of biomes till the year 2020 will increase to 249 ktoe (2900 GWh).
- Hydro power – it is planed on the level of 2920 GWh (251 ktoe).
- Geothermic energy – the consumpation of geothermal energy together with the loss in the distribution achieve 10% of the primary energy.
- Solar energy – solar energy will be used mainly for heating and till 2020 it is expected to achieve 9,5-18,1 ktoe.
- Wind energy - it is expected that wind energy till 2020 to achieve 15,5 - 31 ktoe (180 - 360 GWh) yearly.

In the year 2020 as most used resource in macedonia is coal, folowed by oil and bio fuel, natural gass, biomas, solar energy, wind energy and geothermal energy. It is predicted that the percentage of use of coal from the actual 81% to decrease at 70,8% in 2020 година, percentage of gas from actual about 3 % to increase at 16% in 2020, the percentage of renewable energy in 2020 should increase at about 21% of the total final energy production.

Power Balance

The generation of energy in the Macedonian power system is shared between thermal and hydro power plants. The Thermal power plants, with an installed capacity of 1260 MW, represent 70% of total installed capacity, and the Hydro power plants, with an installed capacity of 528,4 MW, represent approximately 30% of total. The largest generation facility and the foundation in the whole system is TPP Bitola with 675 MW installed. TPP Bitola is located in the south-west of the country. It uses lignite for energy production from nearby located open pit mine. TPP Bitola, together with TPP Oslomej covers 80% of electricity consumption. The rest of the consumption is covered by TPP Negotino (heavy fuel fired), hydro power plants and import. The major hydro power plants are located in the west of Macedonia.

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31 National program for energy efficiency in public buildings in the Republic of Macedonia until 2019, (phase i), Government of Republic of Macedonia and Ministry of Economy, 2012.

In addition to major power generating plants, various small generating units operate in the EPS. The total installed capacity of small thermal generation units owned by industrial consumers is about 50 MW. There is also dispersed generation on distribution level of ten (10) small hydro power plants with total capacity of 38 MW. Total electricity consumption in 2010 was 8102 GWh, with power peak load of 1491 MW. Energy balance shows that TPP-s produced 4332 GWh, HPP-s produced 2184GWh and the rest of 1568 GWh was covered by import.

Conclusion

From the overall determined 664 million tons geological coal reserves in Republic of Macedonia, it is estimated that 38% could be exploited with surface excavation, and the rest with cavity - underground technology. Cavity coal excavations are still not applied on our territory.33 This means that Macedonia can exploit with surface excavation which is much cheapest alternative, maximum 252 millions of tons of coal. According to actual statistics Macedonia is using about seven million tons of coal per year (TPP Bitola uses 6 000 000 tons of coal in a year) so with this tempo of using the coal reserves, Macedonia can use its coal with surface excavation for maximum around next 35 year from toady. Let us include the total amount of reserves assuming that Macedonia will achieve to use its entire coal reserve using cavity, with as we mention maximum 664 millions of tons, Macedonia will have coal for the next about 90 years, of course hopping that the level of coal usage will stay at this level. Unfortunately all statistics showed that the use of coal in Macedonia will increase or at least stay in this level, having in consideration the previously showed figures on the increase of the level of energy use in Macedonia.

The new hydropower station and all renewable energy resources according to all previous showed data's in this research paper, we came to a conclusion that they will be enough to satisfy only the increased amount of new needs for energy but they won't be able to reduce substantially the percentage of use of coal in production of energy. This statistics are scary because Macedonia very soon will have to face with most difficult problem of the today's society the ability to satisfy the costumers need for electricity from its own resources. Macedonia has to follow also the world wide forum for nature (WWF), "energy report" where their vision is that by mid-century we need to have 100% renewable energy sources, and this is not the best way, but this is the only way.34 This will be extremely hard especially for Macedonia because it will require billions of euros which Macedonia don't have and it will be very difficult do find especially if we know that Macedonia has the lower price for 100 mwh(only 5 euros). One of the ways is to start private partnership as it alredy started but much more need to be done and promote the benefits of investing.

In the analyses of EBERD on sustainability of energy sector in the transition economies we can notice that all countries of SEE are below 40% of sustainable energy sector where Croatia and Albania are being the best with 40%, Macedonia around 35% and Montenegro

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33 (www.elem.mk)

34 *SEA Change, Fairer, Cleaner, Safer – Toward a more sustainable, people centered approach to energy development in South East Europe, 2012, p.15*

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the worst at only 10%.35 If we compare this statistics to some developed countries like Spain, UK, Netherland and Germany this percentage is 70% to 80%, even the worst economy related to this indicator Bulgaria has almost 55%, we will understand that Macedonia need to invest in this sector as much as possible and as fast as possible.

These facts brought Macedonia to a very hard situation relating the energy, the first problem is related with the insufficient amount of coal and lack of resource like oil or gas and the second problem is very high level of air pollutants that are produced compared with European countries. Macedonia import its oil form Greece through a daughter company of Hellenic Petroleum OKTA and all Macedonian projection in oil supply are depending from this company (Greece). OKTA is supplied with crude oil through pipeline jointly owned by Hellenic Petroleum (80%) and government of Macedonia (20%). The maximum capacity of OKTA is 2.5 million tons of oil per year. The main problem of this dependence is the political situation regarding these two countries which mainly because the name issues the past twenty years had led to a very cold relations. The next resource that we lack is natural gas, there are only very small amount of gas in a northern part of Macedonia. The only way to have gas is to import it, but Macedonia also lack the needed infrastructure in order to increase the use of gas. In the moment there are signed some contracts with Russia in order to improve the gas infrastructure which will result in more use of gas from the household, but much more need to be done in order to improve gas infrastructure and bring gas usage in a satisfying level.

The main positive side in the increase of the use of this natural resource is its influence in the environment, since gas is much more acceptable when it comes to air pollution because compared to coal which produce dust, NOx and Sox gas produces only small amounts of NOx. In power generation, fuel switching from coal to gas can reduce CO2 emissions by 50% to 75%.36 This is also important because Macedonia very soon (after 2015) it will have to meet the EU requirement relating the environment where the level of NOx and Sox has to lower in an acceptable level and they have to build dust collector. All of this will require tremendous amount of money for Macedonian government or in total 135 million euros. 37 Another positive side of using gas is that we can stop the extreme exploitation of coal reserves in Macedonia. Macedonia has to pay serious attention to the environment protection follow the European communication from 2011. "A roadmap to mowing to a competitive low carbon economy in 2050" and reduce the overall greenhouse gases emission by 80to 95%.38 We have to take care for children born in 2013 or they that will be born in 2040, how Macedonia will look like if we don't change the way how we use natural resources and the environment how much will the air pollutants how much natural resources will they have? Definitely the will almost have no resources and almost all electricity will be produced from the resources imported. But will we still have from whom to by resources in 2100? We have to think on that and be sure that 100% we don't depend from other countries when it comes to energy as

35 SEA Change, Fairer, Cleaner, Safer – Toward a more sustainable, people centered approach to energy development in South East Europe, 2012, p.18

36 Sustainable Development: The Case of Energy in South Africa, International Institute for Sustainable Development, 2003, p 35

37 Vlatko Cingoski, PhD. EE. Jasna Ivanova Davidovic,Daniela Mladenovska "Investment inscenitives for rehabilitation and performance improvement of tpp bitola", 2012

38SEA Change, Fairer, Cleaner, Safer – Toward a more sustainable, people centered approach to energy development in South East Europe, 2012, p.15

maybe the most important element for normal operation of the human kind in twenty firs century.

Macedonian government has to invest enormously mostly in a renewable energy and use its enormous potential in hydro plants in order to increase the level of these resources in production of energy and reduce the use of coal. Macedonia imports about 2,5 TWh/year in total for the needs of both tariff and direct customers. In order to cover the distribution needs, ELEM imports around 500 GWh from average prices of 80-120 EUR/MWh. If we take into account that electricity prices for yearly contracts in most of Western and Central Eastern European market are 50-55 EUR/MWh, clearly can be seen that there is huge difference each has to be manage in these investments opportunities!

Having in mind that Macedonia most of its energy produce using coal this means that the percentage of air pollutants is much higher compared to EU countries that use only 29% coal. That's why the Macedonia produces twice as much as EU countries CO2.39 This is approximately the same as the result of the use of coal because Macedonia uses more than twice coal in production of energy that EU country. Annual emission of SO2 in Macedonia in 2006 and 2007 were at level of 140 kt, followed by drop to 110 kt in 2008.40 Macedonia should import as much as possible coal that we can buy, and use its reserve, at as much as possible. By this Macedonian resources of coal can be used as longer as possible, in the opposite case just after maximum 90 years Macedonia won't have any coal to exploit.

Unfortunately even through Macedonia has a strategy for its energy sector till 2030 we can say that that strategy is directed in solving the energy problems of Macedonia till 2030 but it will impact negatively on the years after 2030. The aim of strategy of energy sector should be to secure energy for Macedonia till 2030 but also after that. Energy strategy till 2030 should be much more oriented toward increase of renewable energy sector of at least 70%, and decrease of the percentage of air pollutants for 80% to 90%, and increase energy efficiency. It doesn't matter if it is hard, this is necessary.

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39 SEA Change, Fairer, Cleaner, Safer – Toward a more sustainable, people centered approach to energy development in South East Europe, 2012, p.29

40 SEA Change, Fairer, Cleaner, Safer – Toward a more sustainable, people centered approach to energy development in South East Europe, 2012, p. 38

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HOW TO GROW YOUR BUSINISESS?

EVIDENCE FROM MACEDONIA

Gadaf Rexhepi

Abstract. Selecting the right strategy in the right moment usually can become the best competitive advantage that an enterprise can gain. The purpose of the paper is to achieve this competitive advantage, through understanding the strategy and selecting the right growth strategies typical for different phase of life cycle in which their enterprise is at the moment. In the paper, are presented the growth strategies that small and medium enterprises can gain when it is in the growth stage by using theoretical and practical research. Empirical data which came as a result of 95 enterprises which operate in the growth phase in Macedonia showed that hybrid strategy tends to be the better strategy that enterprises can select when they operate in the growth phase.

Introduction

One of questions that is still unanswered is why some businesses fail to exist and why do some succeed. The research conducted by Stapford and Baden-Fuller (1990) showed that almost all enterprises that have been part of the research invested in new equipment and organizational change. But, after some months, only some of them managed to survive. The reasons for failure varied for different situations, but most of all, tit was as a result of failure to adapt and continuously innovate the enterprise strategy.

Depending on the phase of the life cycle where they currently operate, enterprises use different strategies in order to compete successfully in the market (Rexhepi,2013). Another question that still remained unanswered is why some enterprises are more profitable than others. Porter (2004) considered that industry profitability results from the interaction of five competitive forces that he proposed, and that industry profitability depends from the impact of these five forces. But why then enterprises in the same industry differ in their profitability? Some research had pointed out that profitability inside the industry differs three to five times more than profitability between industries (Roos, 2005). We propose that choosing the right strategy for the right moments has huge impact on enterprise profitability. This research is oriented toward enterprises that are in the growth phase of their life cycle. There are several alternative types of strategies that are available to businesses, but we will try to identify the growth strategies that will enable growth to enterprises.

Characteristics of the growth phase

Growth implies continuous growth of sales, purchases, number of employees, profit and thus the normal growth of the enterprise. The growth of the enterprise from an internal point of view at the same time means increased management-type problems in all spheres, but also facing greater competition from an external point of view. The competition which the enterprise starts facing with is not as simple as it was in the past and therefore requires special attention and analysis.

Furthermore, the enterprise should continue its confrontation with a number of specific requirements of customers and finding quality suppliers. This means almost complete change of the usual management operation and undertaking of new management activities. The manager at this phase will hardly be able to perform all tasks related to his work. In this section, the use of the technique ***empowerment*** as a way that will make it easier for enterprises to overcome these problems is recommended.

We will try to give some of the characteristics of the enterprise growth phase such as:

- More frequent undertaking of new competitive moves,
- Increase of productivity and efficiency as a result of the accumulated knowledge and skills,
- Problems with volume production as well as production efficiency and quality,
- Establishment of formal organizational structure,
- Reduced variation of the strategy,
- Continuous growth in sales and profits,
- Sophisticated consumer demand,
- Increasing entry barriers,
- Consumers are gradually familiar with the products/services of the enterprise,
- Increasing demand.

It is important to emphasis that not every enterprise will be able to pass the first phase of the life cycle. Most of the enterprises usually fail to pass the first phase in the first year. Statistics showed that only one of three enterprises will be able to move into the next phase of the enterprise life cycle. Entry of the enterprise in growth phase implies the need for a larger space, so that enterprises can breathe freely. In order to achieve this, it is necessary to manage the enterprise effectively and efficiently throughout its development. Usually enterprises are not aware of the fact that they have progressed to the next phase of their development. In order for enterprises to be able to correctly determine when the enterprise has stepped into the growth phase, it is necessary to define what growth phase is. It is assumed that an enterprise enters the growth phase after it achieves a positive growth of the profit of more than 1% per month (Rink and Fox, 2004).We should also take into consideration that the duration of one phase of the life cycle of enterprises is different and depends on many factors.

Factors that affect the duration of enterprise life cycle are: (Balanko-Dickson, 2007)

- *Capacity* - refers to whether enterprises have adequate financial capabilities.
- *Premises* - refers to whether enterprises have the necessary office/warehouse space, necessary to achieve their objectives.
- *Attitudes* - ways you can elevate your emotional and intellectual capacity.
- *Opportunities* – analysis of the capabilities of enterprise to accept opportunities in the last 6 months, as well as the necessity to increase the ability to leverage the opportunities offered.

Most of the enterprises, as we noticed earlier, have problems in identifying the **phase of the enterprise life cycle**. They do not notice that their enterprise is in another phase ahead and that the enterprise cannot perform in the old way. The ability of the enterprise to adapt to the new demands is related to the enterprise future success or existence. Transition from one phase to another is a difficult, but necessary process.

The Management of enterprises should realize that each phase of the enterprise life cycle is special, because the needs and benefits at each phase are different. Each phase is characterized by different ways of decision-making, it has a different organizational structure and therefore normally requires different strategies (Kazanjian&Drazin, 1990).

It is important to bear in mind that the factors that made an enterprise successful in the first phase (low cost, good quality, etc.) must remain present in growth phase. This means, the enterprise should continue offering products or services with the same quality in the second phase, as well as do its best in improving the quality of a given product or service. Despite the changes in the management approach, a very strong accounting unit which will provide a clearer financial picture of the overall situation of the enterprise is also required. These data should be valid and timely.

At this phase, it is necessary to increase the number of employees as well as explore new sources of funding that will allow funding of growth and utilization of the new alternatives. This phase is followed by an increase in revenue, number of employees, etc., which represent a huge management challenge and as a result – increasing difficulties in controlling and managing the enterprise.

Growth strategies

The point of strategy is to offer an enterprise a sustainable competitive advantage and this can be done only if the enterprise has a strategy which is original compared to other enterprises and a strategy which is coordinated with all enterprise activities and emerges through time (Rexhepi, 2013)

Growth strategies are classified into two basic categories, concentration on existing business or industry and diversification into other businesses or industries. Concentration strategy is used primarily in cases where the enterprise operates in an attractive industry with good growth potential. Diversification strategy is used in opposite situation where the enterprises operate in unattractive industries. Concentration strategy further can appear in the following two types:

- *Vertical integration* - is used in cases when the enterprise has a strong competitive position in a growing industry.
- *Horizontal integration* - involves expansion of the current product into other market segments or increasing of the volume of products in the existing market, or a combination of both.

Also there are several *diversified growth strategies*, including:

- Related diversified strategies (concentrated) - involves the expansion of the activity of enterprises in related industries that are in synergy with existing lines of businesses.
- Unrelated diversified strategies (conglomerate) - includes entry into new businesses that are not related to existing business lines.

Furthermore, enterprises can exploit the benefits of generic strategies (cost leadership, differentiation and focus on cost leadership and differentiation) in the growth phase. These are the main strategies that usually enterprises in the growth phase can use. Once more, enterprises also need to understand that *choosing the right strategies for given situations in the right moment* is the best competitive advantage that an enterprise can invent. Most enterprises, when shaping their strategy, are usually oriented towards strategies of other successful enterprises. But, it is unlikely that a strategy which is successful in one enterprise will be successful in another enterprise, if we take into the consideration the uniqueness of each enterprise.

Deciding on the strategy

One of the dilemmas that enterprises have in the growth phase is whether to grow or remain small. In the literature, there is a dilemma about what will happen if the enterprise decides to remain in the current position and does not want to grow, will it continue to exist and perform successfully or will it disappear? Some authors believe that those enterprises that choose to act in niche markets do not need to grow in order to survive (Agarawal and Audredsch, 2001).This means that enterprises can ***use niche strategy*** to remain small and to achieve excellent profitability by occupying parts of the market that are not attractive to bigger companies. According to Churchill and Lewis (1983), the choice of such strategy (niche strategy) will not be significantly influenced by external circumstances. With the growth of the enterprise, there will be a need of engaging functional managers who do not have to be from the highest caliber (because their goals can be higher than those that enterprise owners want to reach). The strategy for performing in **niche market** can be used **if the industry is in the maturity phase;** if the industry is in introduction or growth phase, then this strategy is not recommended (Agarawal and Audredsch, 2001, p. 26). This for the reason that strategies should be selected depending on the enterprise life cycle and industry life cycle. Selection of strategy is related depends on the phase of the life cycle at which the enterprise is and the phase of the life cycle the industry is. Thus if an enterprise is in the growth stage in an industry that is in maturity stage should select different strategy from the enterprise which is in the maturity stage operating in the same industry (Rexhepi, 2013).

Another strategy that enterprises can choose is to **continue the growth** of the enterprise. The growth of the enterprise will be financed from the generated profits and financial assets that are available. Engaged managers need to address the future as well as to install a system that will be oriented to future needs (Churchill and Lewis, 1983).

The growth of the enterprise in growth phase can be achieved in two ways:

- Growth through direction,
- Growth through delegation.

Another view is related to with the research conducted by Wu, Wang, Chen and Pan (2008),it was found that in 166 enterprises in Taiwan the competitiveness of enterprises increases as resources increase. Under resources, the authors take into account both touchable and untouchable resources and capabilities of the firm during the growth phase. Resources fall into five categories (Wu et al., 2008, p. 537):

- A specialized know-know,
- Financial capital,
- The ability of managers,
- Reputation,
- Past experience with alliances.

Hwang and Park (1999) consider that enterprises at this phase are mainly internally oriented. They worry about the way how to produce and sell product that will increase its financial performance. It is recommended for the enterprises at this phase to use incremental innovation. There are eight factors that are suggested as important for the growth of the enterprise at different phases of the life cycle and that act differently in each phase(Mitra and Pingali, 1999, p. 66):

- Management orientation,
- Management objectives,

- The current business strategy,
- Human Resources Policy,
- Orientation towards customers,
- Consumer base,
- The current management style,
- The managers' capacity.

Extremely important aspects related to the growth of the enterprise are management orientation and objectives. They are more important for the growth of the enterprise rather than consumer satisfaction and current business strategy. Taking into consideration the characteristics of the growth phase, there are several strategic options that enterprises can undertake at this phase:

- try to grow faster than the industry itself (if the industry is on the growth phase),
- use the low cost strategy in order to attract new customers (if the industry is in the growth phase and maturity phase),
- use innovation as a strategy to offer innovative products and increasing the value of the existing products (in all phases of development of the industry),
- establish access to additional distribution channels and retail outlets,
- expand the market in which they act in order to access new customers,
- expand production lines in order to offer them to a wider range of consumers,
- use empowerment and
- make alliances and network strategies.

Besides enterprise life cycle, Hofer (1975) considers that the product life cycle is also very important when we want to establish enterprise strategy, in whatever phase the enterprise may be. Thus, we also need to define what the growth phase of the products. We can define it as time period from commercial birth and maximum monthly income (Cox, 1967). It is assumed that this period most frequently lasts for seven months, depending on the nature of the product.

According to Rink and Fox (2004), when both enterprises and their products are in the growth phase, enterprises should *follow the below listed strategies* related to their purchases and sales:

- Strictly maintaining the quality standards,
- Monitoring reports for sale,
- Extensive list of suppliers, switching to large suppliers,
- Using the internal changes in product modification,
- Creation of large amount of stocks
- Instant payment of the invoices to local suppliers.

These strategies can be of great help to the enterprises in making decisions about their purchases that are larger and rising at this phase. When being in this phase, *strategic alliances and cooperation* with other enterprises are highly recommended. Hwang and

Park (2007) in their research related to the formation of strategic alliances across the life cycle of the organization, propose the following:"During the growth phase, the decision to enter into alliances should be aimed at finding partners that suit their specific requirements and match their strategies. Furthermore, these enterprises together should be able to achieve better efficiency in production and marketing activities"(p. 431).

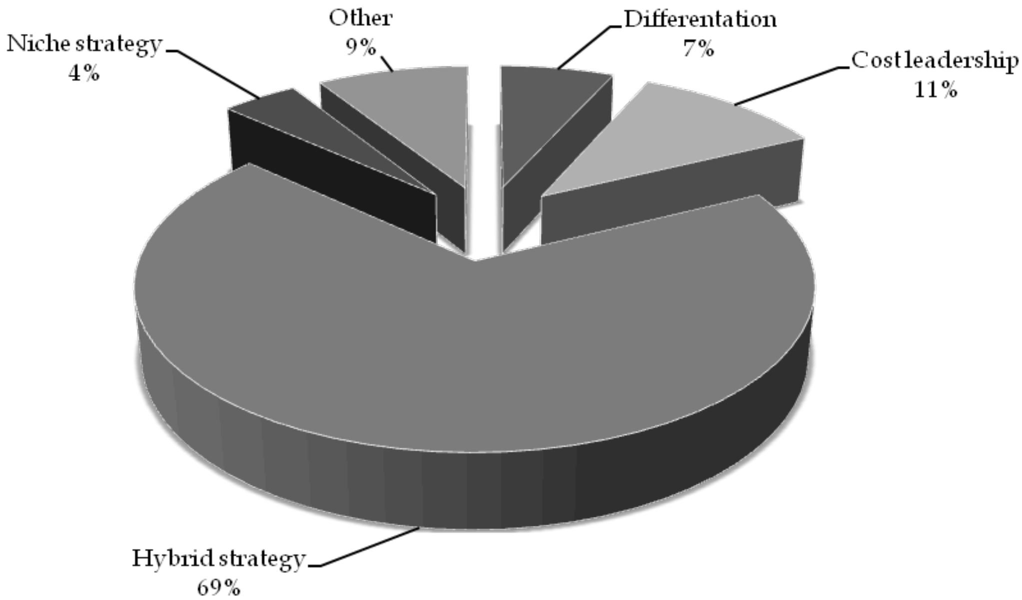
Research Mothodology

Beside the theoretical analysis presented within this research, we have also conducted an empirical research which was carried out in several ways, starting with a personal interview with the general managers of several enterprises, further questionnaire sent by mail and finally using the e-mail. Direct interview was conducted in total 40 enterprises, by post are sent 25 questionnaires, 18 were returned. Via e-mail, 200 questionnaires were sent, out of which only 37 were returned, resulting in a total of 95 enterprises surveyed. This showed that the direct interview and the use of the mail is still the best way of communicating with the enterprises in the Republic of Macedonia, and the use of electronic mail proved to be quite inefficient. The survey was conducted in the period from 15 May to 25 August 2012 and during march in 2013. Data from the questionnaire were processed using the statistical program Statistical Package for the Social Sciences (SPSS).

Research Results

Research showed that the most frequent strategy used by enterprises in growth phase is hybrid strategy, where 69% of the analyzed enterprises said that they use this strategy which incorporates both strategies on cost leadership and differentiation (**Figure 1**). The pure strategy on cost leadership has been used in 11 % of the cases, differentiation strategy has been used in 7% of analyzed enterprises and focus strategy in only 4% of cases. More than 90% of analyzed enterprises which used hybrid strategy were successful in the past five years (2006-2011) compared to only 10% of enterprises that use pure strategy. This leads us to the conclusion that hybrid strategy is the most successful strategy for enterprises in the growth phase in Macedonia and in countries similar to Macedonia.

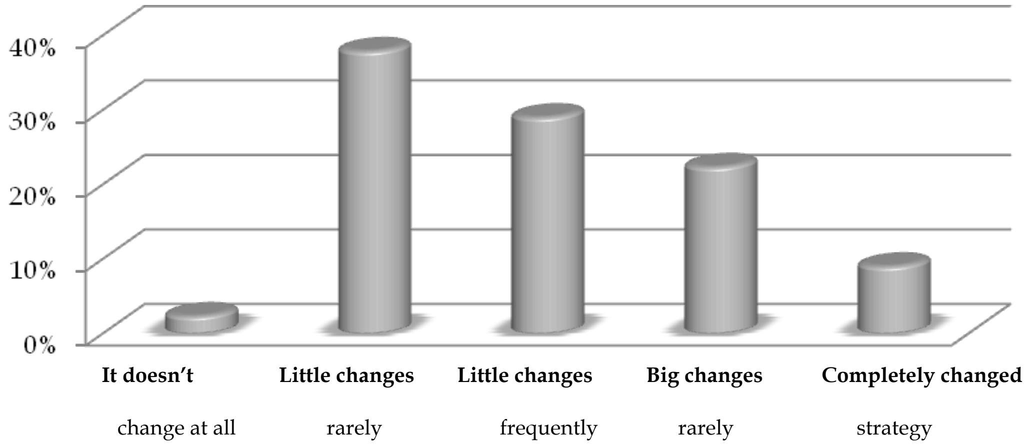
Figure 1. Strategy selection



Source: Own research

A part of this research has also included the question if the strategy of the enterprises in the growth phase emerges or it is deliberate and does not change over time. Empirical research has shown that only 9% of enterprises had committed a complete change of the strategy, 22% of enterprises had made major changes rarely, the other 29% of the enterprises had made small changes frequently, while 39% of enterprises had made minor changes rarely, and only one enterprise had never made any change in their strategy (**Figure 2**). Similar to theoretical conclusion strategies in the growth stage emerge in time but these changes are minimal and the original strategies stays unchanged.

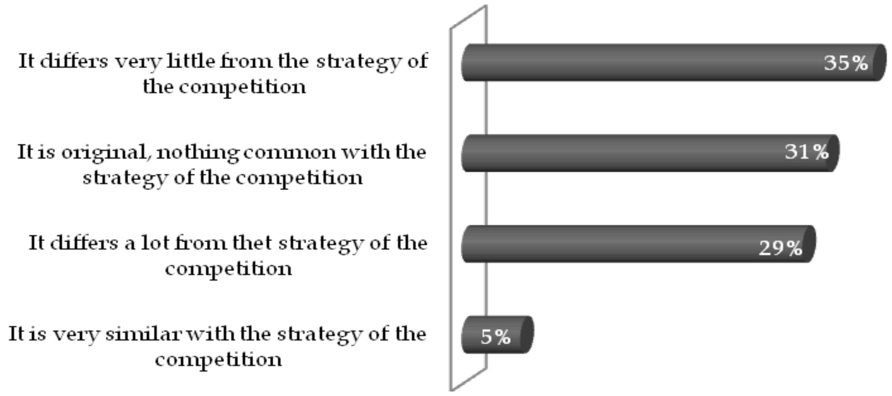
Figure 2. Degree of change of the strategy



Source: Own research

As we mention in the theoretical part in order for their strategies to offer to enterprises competitive advantage then strategies need to fulfill some requirement which we were part of this research. The research results presented in **Figure 3**, showed that only 31% of surveyed enterprises have original strategy that is very different from that of the competition, 29% of them said that their strategy differs in many aspects from the strategy of other enterprises-competitors. About 40% of the enterprises said that their strategy has just some minor differences or it is completely equivalent to that of the competition, where only 22% of them had increase in their profitability in the past five years (2006-2011), compared with about 60 % of the enterprises who had original strategy or almost complete different strategy that had 78% increase of profitability in the past five years (2006-2011).

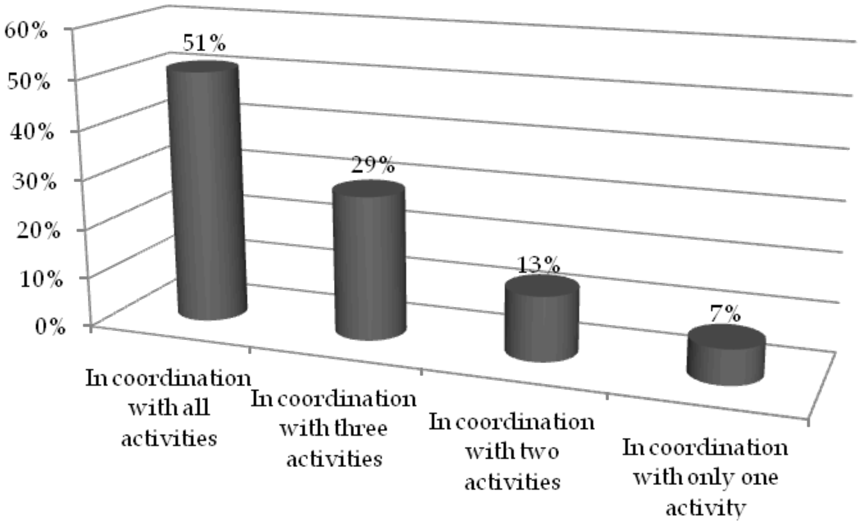
Figure 3. Degree of strategy differentiation



Source: Own research

Studies presented in **Figure 4** show that only 51% of the enterprises which are in the growth phase coordinate their strategy with all of their activities, in 29% of the cases the strategy is coordinated with more than three activities, while in the remaining 20% of the cases the strategy is coordinated with one or two activities which is as an indicator of the strength of the strategy. Thus enterprises whose strategies had coordinated their strategies with one or two activities had only 5% profitability in the past five years (2006-2011), compared to 95% of enterprises who coordinated their strategies with more than three or enterprise activities.

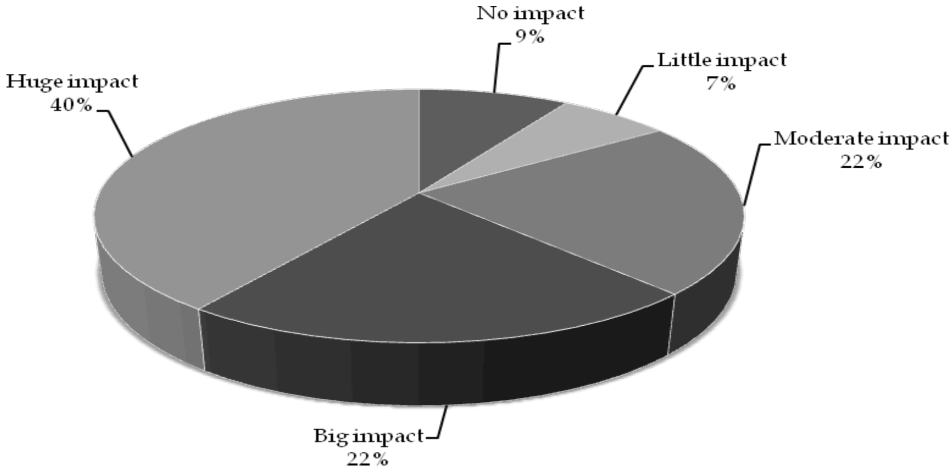
Figure 4. Degree of coordination of the strategy



Source: Own research

The research also included the question - what is more important in establishing strategy in the growth phase, industry life cycle or enterprise life cycle? The survey showed that 62% of enterprises responded that the phase of development in which the enterprise is located has a great and profound impact on the choice of strategy, while only 16% of enterprises believe that it has no or little effect (**Figure 5**).

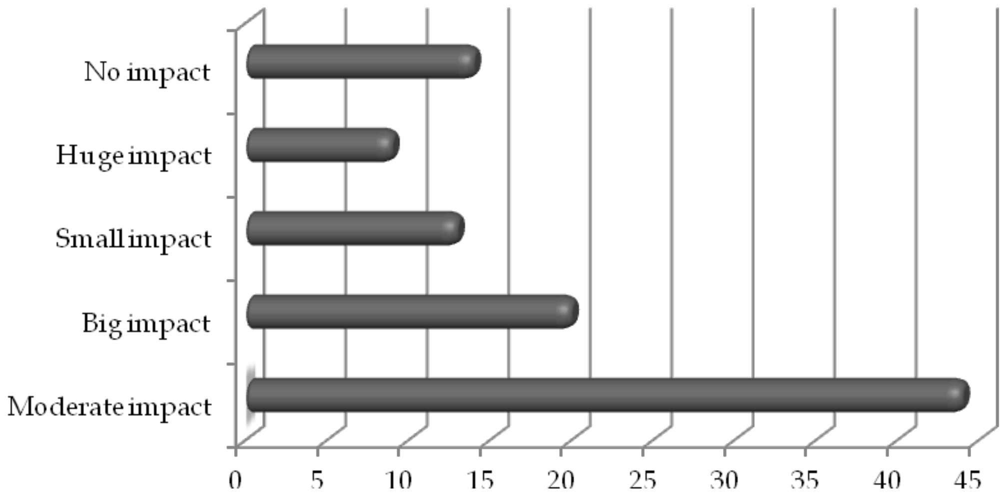
Figure 5. Influence of enterprises life cycle



Source: Own research

On the other hand, only 29% of enterprises believe that the phase of development of their industry has big or huge influence in formulating strategies, while 27% of the enterprises responded that the phase of industry development has little or no impact in their strategies, as presented in **Figure 6**.

Figure 6. Impact of industry life cycle



Source: Own research

The results showed that the impact of both life cycles is very important, but the enterprise life cycle is more important than the industry life cycle in selecting enterprise strategy in the growth phase.

Conclusion

For the enterprises that are in the growth phase, the use of incremental innovation is recommended. It is very important that these enterprises ensure that products or services that are offered in the first phase and continue to be offered in the second phase, retain the same quality, and if possible, improve. At this phase, the formulation of strategic directions toward which the enterprise will be moving in the future in order to become recognized by their customers takes place. In this regard, this is the phase when the enterprise should decide whether it will expand or stay at the current market position.

Strategies in the growth phase of the enterprises should definitely be planned, but it is necessary to allow these strategies to change, upgrade or evolve over time. Empirical research has shown interesting results and that only 9% of enterprises committed changes in their original strategy. Most frequently or in 68% of cases enterprises, have committed minor changes to their original strategies, while only 23% of the enterprises made major changes in their strategies, although this does not mean that they have completely changed their original deliberated strategies. This leads us to the conclusion that growth strategies emerge but in their own shape.

When selecting the enterprise strategy, the impact of the enterprise life cycle and industry life cycle of the industry is quite significant, but the enterprise life cycle is more important than the industry life cycle. The results showed that 62% of surveyed enterprises believe that the enterprise life cycle has more impact in the formulation of strategy, while only 27% of surveyed enterprises believe that the impact of industry life cycle has a great influence in the formulation of strategy.

According to the survey conducted among 95 enterprises which are in a growth phase, it can be concluded that the most common strategy that these enterprises use or 69% of them is the hybrid strategy. This means that these enterprises use a combination of the two strategies, strategy of differentiation and cost leadership strategy. The consecutive strategy is the strategy of cost reduction which is used in 11% of enterprises in the growth phase and only 7% use differentiation strategy, while the strategy of focus is hardly used. The high percentage of using hybrid strategy confirmed that the enterprise which is at this phase very rarely uses the option of pure strategy despite the opinion of many authors who believe that the use of the hybrid strategy is very dangerous. Other strategies which can be proposed to enterprises in the growth phase are: vertical integration strategy, innovative strategy, increasing sales to existing customers, building new flexible competitive capabilities, strategy of continuous quality improvement and blue ocean strategy.

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GLOBAL ISSUES IN TEXTILE INDUSTRY OF PAKISTAN

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***Abstract**: This research investigates the global issues in Textile Industry in Pakistan. Data were collected 100 textile mills, in the form of unstructured questionnaire from the textile industry of Pakistan. The main respondents of the questionnaire were senior to middle level management located in Karachi, Hyderabad, Kotri, Nooriabad, Faisalabad and Lahore. Findings of this research indicates that 77% correlation between CC and LR, therefore by controlling contaminated cotton we can control the lower returns as well as the quality of yarn can also be improved. There is a 57% correlation between HM and CA, therefore by improving the handling methods we can take benefit of competitive advantage to some extent. Furthermore, we have take some measures so that textile industry of Pakistan can take desired benefit of competitive advantage.*

***Key Words:** Global, Issues, Textile Industry.*

Introduction:

Some of the constraints for the Pakistani textile industry during the post quota era are:

- Fragmented structure with the dominance of the small scale sector
- Unfriendly labor laws
- Logistical disadvantages in terms of shipping costs
- Time pose serious threats to the growth
- Lack of Foreign investments due to unfriendly overall factors for the foreign investors
- Marketing skills must be improved
- Low standard of hand loom and power loom sectors
- Lack of Budget
- Low exports of value added products
- Low production of mixed products prepared from cotton and man-made fibres, which has high demand globally for being cheap and durable
- Less diversification

High Cost of doing Business

There is a high cost of doing business in India. It should also be lowered to compete internationally for the sake of attracting foreign direct investment FDI in this sector. Furthermore, there is a high power costs, rising interest rates, high transaction costs etc.

Subsidies and preferential treatments

Subsidies that were not WTO-compatible have phased out. Benefits of special treatments like Generalized System of Preference (GSP) are no more available

GSP Generalized System of Preferences

India is the second recipient of the EU. It accounts for about 11 per cent of imports to the 25-nation bloc. In this connection it was expecting that it would continue to get tariff preferences in textiles under the EU Generalized system of preferences (GSP) under the post-quota era but it was only a dream because the benefits of special treatments like Generalized System of Preference (GSP) are no more available1.

Textile Industry of Sri Lanka

The textile industry of Sri Lanka is one of the oldest industries since 257 years BC. The "Wellawatta Spinning and Weaving Mill" was established in the late 19th Century2.

- Total (22 Issues): 3603
- Suggested : 2882.4 (80%)
- Taken (16 Issues): 2888 (80.16%)

1 “EU will extend GSP benefits for Indian textiles”, The Financial Express, Posted: Saturday, Jan 15, 2005, © 2010: The Indian Express Limited.

2 www.wikepedia.com

ISBN: 978-3-9503518-1-1

Correlation of Global issues

GLOBAL

			ROQ	LOA	WIP	EUR	ETP	FE	DD	LD	ILO	DPI	QI	LIP	FBC	ADD	MPT	SC	WTO	RR	EOI	BO	TES	POI
Spearman's rho	ROQ	Correlation Coefficient	1.000	.230	-.179	-.105	-.060	-.158	-.153	-.338*	-.056	-.449**	-.009	-.179	-.036	-.357*	-.250	-.140	-.220	.165	.030	.007	-.203	-.033
		Sig. (2-tailed)	.	.128	.239	.492	.695	.301	.317	.023	.715	.002	.955	.239	.812	.016	.097	.359	.147	.278	.847	.966	.180	.829
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	LOA	Correlation Coefficient	.230	1.000	.159	-.270	-.256	-.115	.374*	-.069	.139	.097	.246	.222	.126	.008	.111	.279	.071	.211	.098	-.342*	-.026	-.106
		Sig. (2-tailed)	.128	.	.298	.073	.090	.451	.011	.650	.362	.526	.103	.142	.408	.957	.468	.063	.644	.163	.524	.021	.867	.490
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	WIP	Correlation Coefficient	-.179	.159	1.000	-.242	.183	.011	.271	.192	.311*	.180	.081	.106	.406**	.239	.198	.265	.263	.081	-.103	-.177	.178	-.474**
		Sig. (2-tailed)	.239	.298	.	.109	.229	.943	.072	.206	.037	.237	.599	.488	.006	.113	.192	.079	.081	.598	.499	.244	.242	.001
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	EUR	Correlation Coefficient	-.105	-.270	-.242	1.000	.062	.078	-.158	-.108	-.269	-.030	-.374*	-.152	-.042	.206	.080	-.138	-.295*	-.508**	-.109	.100	-.051	.366*
		Sig. (2-tailed)	.492	.073	.109	.	.686	.611	.301	.480	.074	.847	.011	.320	.785	.175	.601	.367	.049	.000	.476	.515	.739	.013
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	ETP	Correlation Coefficient	-.060	-.256	.183	.062	1.000	.242	-.326*	.220	.010	-.067	-.022	-.052	.152	.184	.152	-.175	.012	.031	.038	.255	.114	.089
		Sig. (2-tailed)	.695	.090	.229	.686	.	.109	.029	.147	.950	.660	.884	.734	.317	.225	.320	.251	.940	.838	.806	.091	.456	.559
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	FE	Correlation Coefficient	-.158	-.115	.011	.078	.242	1.000	.087	.155	.138	.010	.082	-.115	.051	.067	-.168	-.154	.002	-.045	.228	.053	.183	-.053
		Sig. (2-tailed)	.301	.451	.943	.611	.109	.	.571	.309	.366	.950	.593	.453	.738	.664	.269	.314	.988	.769	.132	.728	.230	.730
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	DD	Correlation Coefficient	-.153	.374*	.271	-.158	-.326*	.087	1.000	.489**	.485**	.295*	.377*	.441**	.352*	.361*	.215	.685**	.624**	.289	.034	-.262	.288	-.351*
		Sig. (2-tailed)	.317	.011	.072	.301	.029	.571	.	.001	.001	.049	.011	.002	.018	.015	.155	.000	.000	.054	.822	.082	.055	.018
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	LD	Correlation Coefficient	-.338*	-.069	.192	-.108	.220	.155	.489**	1.000	.580**	.118	.219	.185	.299*	.508**	.367*	.424**	.624**	.310*	-.108	-.313*	.382**	-.243
		Sig. (2-tailed)	.023	.650	.206	.480	.147	.309	.001	.	.000	.442	.148	.224	.046	.000	.013	.004	.000	.038	.480	.036	.010	.107
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	ILO	Correlation Coefficient	-.056	.139	.311*	-.269	.010	.138	.485**	.580**	1.000	.130	.397**	.212	.263	.432**	.358*	.297*	.532**	.557**	-.052	-.183	.303*	-.493**
		Sig. (2-tailed)	.715	.362	.037	.074	.950	.366	.001	.000	.	.395	.007	.161	.081	.003	.016	.047	.000	.000	.736	.229	.043	.001
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	DPI	Correlation Coefficient	-.449**	.097	.180	-.030	-.067	.010	.295*	.118	.130	1.000	-.008	.147	.114	.253	.231	.206	.148	-.127	-.117	.200	.058	-.178
		Sig. (2-tailed)	.002	.526	.237	.847	.660	.950	.049	.442	.395	.	.956	.336	.457	.094	.127	.175	.332	.405	.443	.189	.704	.242
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	QI	Correlation Coefficient	-.009	.246	.081	-.374*	-.022	.082	.377*	.219	.397**	-.008	1.000	.456**	.424**	-.046	.132	.283	.423**	.297*	.234	-.015	-.002	-.242
		Sig. (2-tailed)	.955	.103	.599	.011	.884	.593	.011	.148	.007	.956	.	.002	.004	.763	.388	.059	.004	.047	.122	.921	.989	.110
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	LIP	Correlation Coefficient	-.179	.222	.106	-.152	-.052	-.115	.441**	.185	.212	.147	.456**	1.000	.262	.173	.396**	.626**	.540**	.128	.027	-.147	.034	-.102
		Sig. (2-tailed)	.239	.142	.488	.320	.734	.453	.002	.224	.161	.336	.002	.	.082	.256	.007	.000	.000	.400	.861	.335	.826	.504
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	FBC	Correlation Coefficient	-.036	.126	.406**	-.042	.152	.051	.352*	.299*	.263	.114	.424**	.262	1.000	.370*	.249	.420**	.482**	.047	-.133	-.032	-.249	-.147
		Sig. (2-tailed)	.812	.408	.006	.785	.317	.738	.018	.046	.081	.457	.004	.082	.	.012	.099	.004	.001	.757	.382	.837	.098	.336
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	ADD	Correlation Coefficient	-.357*	.008	.239	.206	.184	.067	.361*	.508**	.432**	.253	-.046	.173	.370*	1.000	.505**	.483**	.396**	.050	-.065	-.043	.141	-.131
		Sig. (2-tailed)	.016	.957	.113	.175	.225	.664	.015	.000	.003	.094	.763	.256	.012	.	.000	.001	.007	.744	.671	.778	.355	.390
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	MPT	Correlation Coefficient	-.250	.111	.198	.080	.152	-.168	.215	.367*	.358*	.231	.132	.396**	.249	.505**	1.000	.533**	.402**	.140	-.200	.016	.183	-.182
		Sig. (2-tailed)	.097	.468	.192	.601	.320	.269	.155	.013	.016	.127	.388	.007	.099	.000	.	.000	.006	.360	.187	.915	.230	.231
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	SC	Correlation Coefficient	-.140	.279	.265	-.138	-.175	-.154	.685**	.424**	.297*	.206	.283	.626**	.420**	.483**	.533**	1.000	.730**	.244	-.066	-.305*	.208	-.425**
		Sig. (2-tailed)	.359	.063	.079	.367	.251	.314	.000	.004	.047	.175	.059	.000	.004	.001	.000	.	.000	.106	.667	.042	.171	.004
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	WTO	Correlation Coefficient	-.220	.071	.263	-.295*	.012	.002	.624**	.624**	.532**	.148	.423**	.540**	.482**	.396**	.402**	.730**	1.000	.492**	.038	-.298*	.225	-.392**
		Sig. (2-tailed)	.147	.644	.081	.049	.940	.988	.000	.000	.000	.332	.004	.000	.001	.007	.006	.000	.	.001	.803	.046	.137	.008
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	RR	Correlation Coefficient	.165	.211	.081	-.508**	.031	-.045	.289	.310*	.557**	-.127	.297*	.128	.047	.050	.140	.244	.492**	1.000	-.032	-.093	.291	-.350*
		Sig. (2-tailed)	.278	.163	.598	.000	.838	.769	.054	.038	.000	.405	.047	.400	.757	.744	.360	.106	.001	.	.832	.543	.053	.018
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	EOI	Correlation Coefficient	.030	.098	-.103	-.109	.038	.228	.034	-.108	-.052	-.117	.234	.027	-.133	-.065	-.200	-.066	.038	-.032	1.000	.052	.025	.059
		Sig. (2-tailed)	.847	.524	.499	.476	.806	.132	.822	.480	.736	.443	.122	.861	.382	.671	.187	.667	.803	.832	.	.733	.870	.700
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	BO	Correlation Coefficient	.007	-.342*	-.177	.100	.255	.053	-.262	-.313*	-.183	.200	-.015	-.147	-.032	-.043	.016	-.305*	-.298*	-.093	.052	1.000	-.108	.239
		Sig. (2-tailed)	.966	.021	.244	.515	.091	.728	.082	.036	.229	.189	.921	.335	.837	.778	.915	.042	.046	.543	.733	.	.479	.113
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	TES	Correlation Coefficient	-.203	-.026	.178	-.051	.114	.183	.288	.382**	.303*	.058	-.002	.034	-.249	.141	.183	.208	.225	.291	.025	-.108	1.000	-.331*
		Sig. (2-tailed)	.180	.867	.242	.739	.456	.230	.055	.010	.043	.704	.989	.826	.098	.355	.230	.171	.137	.053	.870	.479	.	.026
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	POI	Correlation Coefficient	-.033	-.106	-.474**	.366*	.089	-.053	-.351*	-.243	-.493**	-.178	-.242	-.102	-.147	-.131	-.182	-.425**	-.392**	-.350*	.059	.239	-.331*	1.000
		Sig. (2-tailed)	.829	.490	.001	.013	.559	.730	.018	.107	.001	.242	.110	.504	.336	.390	.231	.004	.008	.018	.700	.113	.026	.
		N	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Result of Correlation on GLOBAL ISSUES

1. ETP (217): -----
2. TES (213): CM=.001
3. FE (208): GCP=.001
4. LIP (200): LF=.003
5. WIP (198): RD=.003
   LS=.002
6. MPT (193): IIA=.003
7. EOI (188): -----

QI (182): LIP =.002
FBC=.004
WTO=.004

9. LOA (179): -----
10. ILO (176): DD=.001
    ADD=.003

POI=.001
11. FBC (173): OI=.004
SC=.004
WTO=.001
12. ADD (170): ILO=.003
SC=.001
13. LD (159): DD=.001
14. EUR (152): -----
15. WTO (151): QI=.004
FBC=.001
EOI=.001
16. DD (132): LD=.001
ILO=.001
LIP=.002

Conclusion.

There is a 77% correlation between CC and LR, therefore by controlling contaminated cotton we can control the lower returns as well as the quality of yarn can also be improved. There is a 57% correlation between HM and CA, therefore by improving the handling methods we can take benefit of competitive advantage to some extent. Furthermore, we have take some measures so that textile industry of Pakistan can take desired benefit of competitive advantage

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INCREASE IN ECONOMIC EFFICIENCY OF ENTERPRISE DUE TO FIXED ASSETS UPGRADING

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Abstract. *This paper suggests using "value-oriented approach" or maximization of market value of an operating enterprise (MVOE). This calls for theoretic reconsideration of a number of fundamental statements of the economic science, solution to methodological problems, related with development of principles for economic efficiency formation, parameters, defining its value, assessment criteria and influencing factors, creation of economic efficiency management mechanism. The latter should become an efficient system of management of production, material, human and intellectual assets, which generate income, and ensure management decisions aimed at value maximization of an enterprise in the conditions of present resource limitations, high uncertainty of modernization process, investment in new technology and probabilistic nature of the forecast parameters.*

Keywords: *economic efficiency, market value, innovation, investments, economic added value, profitability, risk.*

Introduction

The problem of enterprise economic efficiency aggravates, when fixed assets are being modernized and production assets are being restructured, considering the system innovation implementation and introduction of modern management methods, and it has the following specific features:

presence of a big number of alternative options for development and technical and technological facilities of industrial production, which ensure increase in its social and economic efficiency;

existence of a complex system of economic assessment, which is used for taking management decisions when modernizing the production and investing into the system innovation plus necessity for accounting future achievements in different fields of knowledge, science and technology, prospects of innovation and scientific-technical progress;

long-term plans for production development in order to boost competitiveness of Russian industry require considerable capital cost (investment, venture capital, address and targeted investment programs of production modernization and development). Such plans feature risks and uncertainty of achievement (non-achievement) of the expected technical and technological plus socio-economic results when complying with the planned terms of its achievement;

evaluation of costs and results of the production modernization process has, to an extent, a probabilistic character. Moreover, the system innovation has a quality of multiplication, idempotent character.

commercialization of R&D and intangible assets can result in emergent effects due to the high performance of investment strategy of enterprise development, which is aimed at long-term growth in production competitiveness in Russia.

The present paper suggests using "value-oriented" approach or maximization of the market value of an operating enterprise (MVOE).

Currently, the concept of risk only as a negative factor in asset management is not quite correct. Since risk is seen as a possible additional competitive advantage it is directly linked to the development of the concept of real option in practice. Shift to evaluation, and management of value added become of greater importance.

Optimization of the company's asset management during investment involves creating conditions to increase the value of the enterprise, and includes the following activities:

1. Improved operating activities due to the production factors, intangible assets, new technologies, innovation as a whole.
2. Choosing investments with ROI higher than the costs to attract the capital required for their implementation.
3. Improved asset management, e.g., due to sale or liquidation of non-core, secondary, unprofitable assets, decreased periods of accounts receivable turnover, stocks (so-called "disinvestment); the management of institutional factors of development
4. Improved governance structure of the capital.

Literature review is used to define an evaluation system for value chain management and to apply the evaluation system to the company. The article research served both the interest of the organization performance, which was to measure how profitable the company's supply chain was, and the interest of science, namely to produce knowledge about new ways of looking into supply chain performance measurement (Gummesson, 2000, Coughlan and Coghlan, 2009, Yin, 2003). EVA® is a modified version of residual income or economic profit where the modifications consist of accounting adjustments designed to convert accounting income and accounting capital to economic income and economic capital. Many authors (e.g., Stewart (1991); Young and O'Bryne, 2001; O'Bryne, 1996; Biddle, Bowen, and Wallace, 1997 and 1999; Martin and Petty, 2000; Feltham et al., 2004; D.J.Obrycki, R. Resendes 2000, Holler, 2009) have described the EVA® for explaining the value of a enterprises. EVA® estimates by major firms, e.g., Goldman Sachs, First Boston, and Stern Stewart (Weaver, 2003), Delloitte.

Fundamentals for Efficiency Assessment according to the Value Approach

Value approach transforms conventional concepts of efficiency, value, efficiency indicators of business activities of an enterprise: from relative indices of performance (productivity, profitability) towards market value assessment. The economic mechanism of efficiency of an industrial enterprise should be understood to mean the process of target-oriented formation of production and economic activities' results which satisfy, to the fullest extent, both public needs and goals of the enterprise during modernization.

When **defining EE (economic efficiency) of EIA (enterprise innovation activity)** as economic category, it is worth bearing in mind that, in its general meaning, efficiency

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characterizes developed systems, processes and phenomena. Efficiency becomes an indicator of development of an enterprise and the most important stimulus for its modernization, growth and development. Striving for boosting efficiency of a certain type of activity or project results in designing some measures which encourage development process and cutting off the activities which result in regression.

Today **the current capital value of an enterprise** (current value of an enterprise PV) is used **as the complex index of operating efficiency**. According to I. Fisher, "cost of a capital asset is equal to the sum of the current (present) costs of all future incoming cash flows, generated by this asset". Normally, the market value of an enterprise is the market value of the company's capital. Internal value of an enterprise, according to I. Fisher is calculated by formula:

$$PV = \sum_{t=1}^{t=T} \frac{CF_t}{(1+r)^t} \quad (1),$$

where CF_t – is an expected value of the free cash flow in t period; r – the rate of the required return of the invested capital or discount rate; T – economic life span of an enterprise.

A complex method of efficiency assessment of investment into new technology or modernization of enterprise funds is closely related to the methods of SWOT analysis of development strategy options and resource facilities for their implementation in the enterprise. According to the classical approach to assessment, the value of the enterprise (V) can be defined as the total of the balance sheet value of the enterprise (BV_0) and the value of growth prospects:

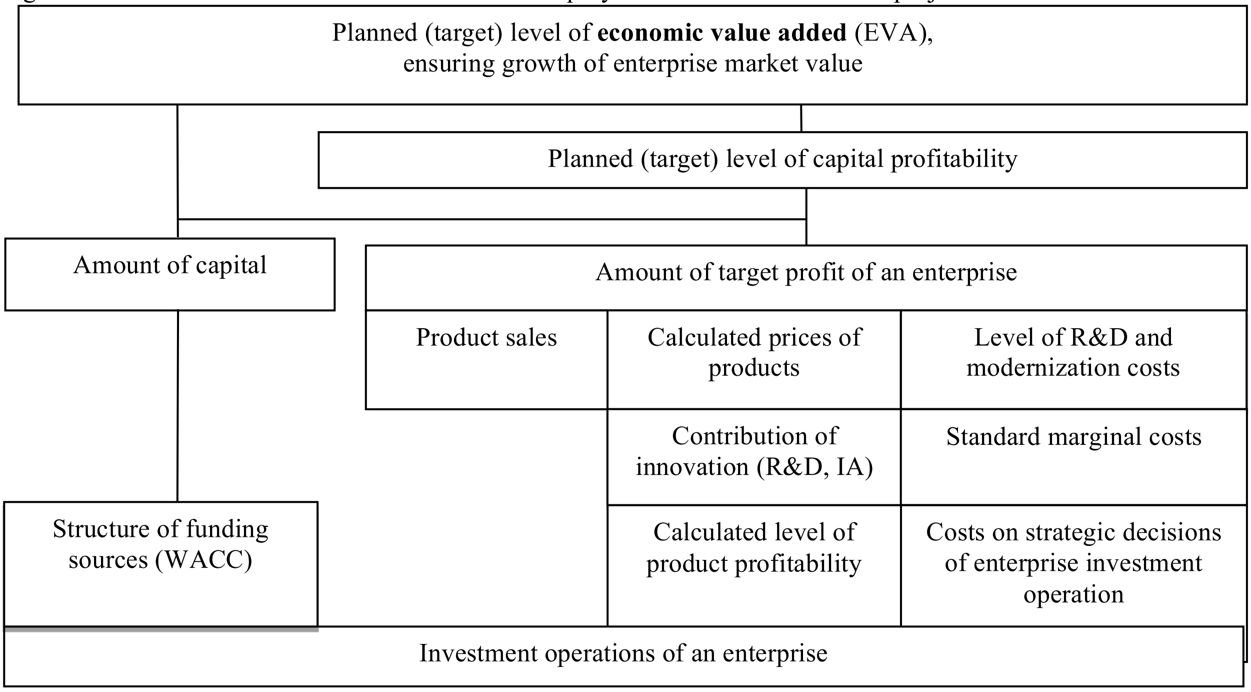
$$V = BV_0 + K * NOPAT \frac{ROCE - WACC}{WACC(WACC - g)} \quad (2),$$

where K – is reinvestment coefficient; $NOPAT$ – operating profit after tax; $ROCE$ – return on capital invested; $WACC$ – weighted-average cost of capital; g – growth rate of an industrial enterprise.

As may be inferred from the formula, the major factors of enterprise value are profitability of the invested capital; price of the invested capital; growth rate of the enterprise. They are defined by supply and demand factors. The principal model of interrelations between target values of EIA performance and new product costs can be represented in a simplified form (Fig. 1). At the same time, MVIA (Market Value based on Income Approach) is characterized with low operational mobility in relation to the tactic decisions of an enterprise, which is determined by high volatility of the free cash flow index.

So, in the methodology it is common to use the concept of economic profit (*EP*) or economic value added (*EVA*). Apart from important factors, influencing MVIA, which implements modernization and innovation (such as life cycle of an enterprise, technology or product) the major role is played by costs of new products and R&D. The contents and structure of costs affect direction and choice of definite methods of cost management.

Fig.1. Scheme of main relations between return on equity and return on investment projects



According to the theory, the economic profit *EVA* is net operational profit of an enterprise after deduction of interest on all used capital at the rate, defined by weighted-average cost of capital (WACC) :

$$EVA = NOPAT - WACC\ x\ CE \qquad (3),$$

where *CE* – is capital employed; WACC – weighted-average cost of capital; NOPAT – net operational profit after corporate tax (profit tax), but before financial expenses on bank credit/loan: $\mathrm{NOPAT} = \mathrm{EBIT}^{\mathrm{adj}}(1\text{-}\mathrm{T}^{\text{эфф}})\mathrm{NOPAT} = \mathrm{EBIT}(1 - T)$, where EBIT – earnings before interest and tax, including corrections on capitalized costs for R&D, leasing, writing-off methods, T – corporate tax rate.

Value added of an enterprise is created when there is increment or when *EVA>0* index is positive. The same as the book-keeping index, *EVA* index gives an idea about economic efficiency for a certain time period and, contrary to the traditional profit, *EVA* does not only cover explicit costs on investment attracted, but cover alternative costs on capital.

Let us define the amount of *EVA* by the following formula through direct capitalization (capitalization rate is also equal to WACC):

$$PEVA = \frac{EVA}{WACC} = CE * (\frac{ROCE}{WACC} - 1) \qquad (4)$$

The given amount of future EVA can be both a positive and negative figure, which means either creation or destruction of value as a whole and in each line of activities or discount /premium on the used capital and efficiency/inefficiency of its use.

According to the *EVA* model, market value of an enterprise is defined as the amount of capital invested for the beginning of the period and discounted value of the projected *EVA* (normally for the economic life span of an industrial enterprise):

$$V = CE + PEVA \qquad (5)$$

As long as there is no growth (change) of *EVA,* market value of an enterprise can be calculated by formula 4 and 5:

$$V = CE + \frac{EVA}{WACC} = CE + CE * (\frac{ROCE}{WACC} - 1) = \frac{CE * ROCE}{WACC} = \frac{NOPAT}{WACC} \tag{6}$$

In order to choose directions for development of an enterprise when it is being modernized, to assess efficiency of alternative capital investment in case of different options for modernization or development of an enterprise, it is worth defining, on the bases of *EVA,* threshold amount of return on the enterprise own equity (both for the forecast and accounting period), which represents a criterion for decision-making:

$$ROE_{EVA} = \frac{EAT}{k_e} + \frac{EAT * (r_e - k_e)}{r_e * k_e} * \frac{g}{k_e - g}, \tag{7}$$

Where: EAT - earnings after tax ($\mathrm{EAT = NOPAT - Int - T}$), Int- financial expenses on borrowed capital; (r_e - k_e) –efficiency spread, r_e – return on own equity for new investment; g – growth rate; k_e – required return on own capital.

In this way, current operating indices transform into the analytical index *EVA*, and further on into the index of an enterprise's value, which accounts for "cost of previous investment". In other words, the value of an enterprise is defined with the help of operating indices of corrected profit (but not generated projected cash flows), which reflect efficiency of management of investment activities of an enterprise and make it possible to assess it on the basis of operating activities of an industrial enterprise: change of return on all equity invested into the enterprise; change of profitability of new investment in R&D and intangible assets; change of increment rate of new investment (primarily due to increase of reinvested profit share, cost reduction, cost redistribution); attraction of additional financing sources of investment (disinvestment) etc.

So, assessment of value on the basis of factor decomposition of economic value added index makes it possible to consider the greatest number of key factors for creation (destruction) of an enterprise's value and investment activities. Such an approach assesses strategic and current tactic management decisions complexly.

Efficiency Assessment of Enterprise Innovation Activities (EIA) according to the Cost Reduction Principle

As practice shows, cost reduction principle plays an important role in EIA justifying (Fig. 2 in IDEFO form). When analyzing EE of EIA the following major stages may be highlighted:

Confirmation of innovation character of a project in accordance with the data available – "innovation bank" of projects, referring to products and technology.

Confirmation of "commercial efficiency" of EIA. EIA can include a significant number of projects whose EE can be proved as being commercial one. It can refer, in particular, to EIA with a relatively short economic life span.

The use of cost reduction principle and relevant technology for implementation of this principle. When individual principles and methods of economic feasibility for EIA and confirmation of their EE are absent, programs of cost reduction measures for project implementation may be used provided that the principle of "invariability (equivalency) of the obtained final result" from the project is strictly complied with.

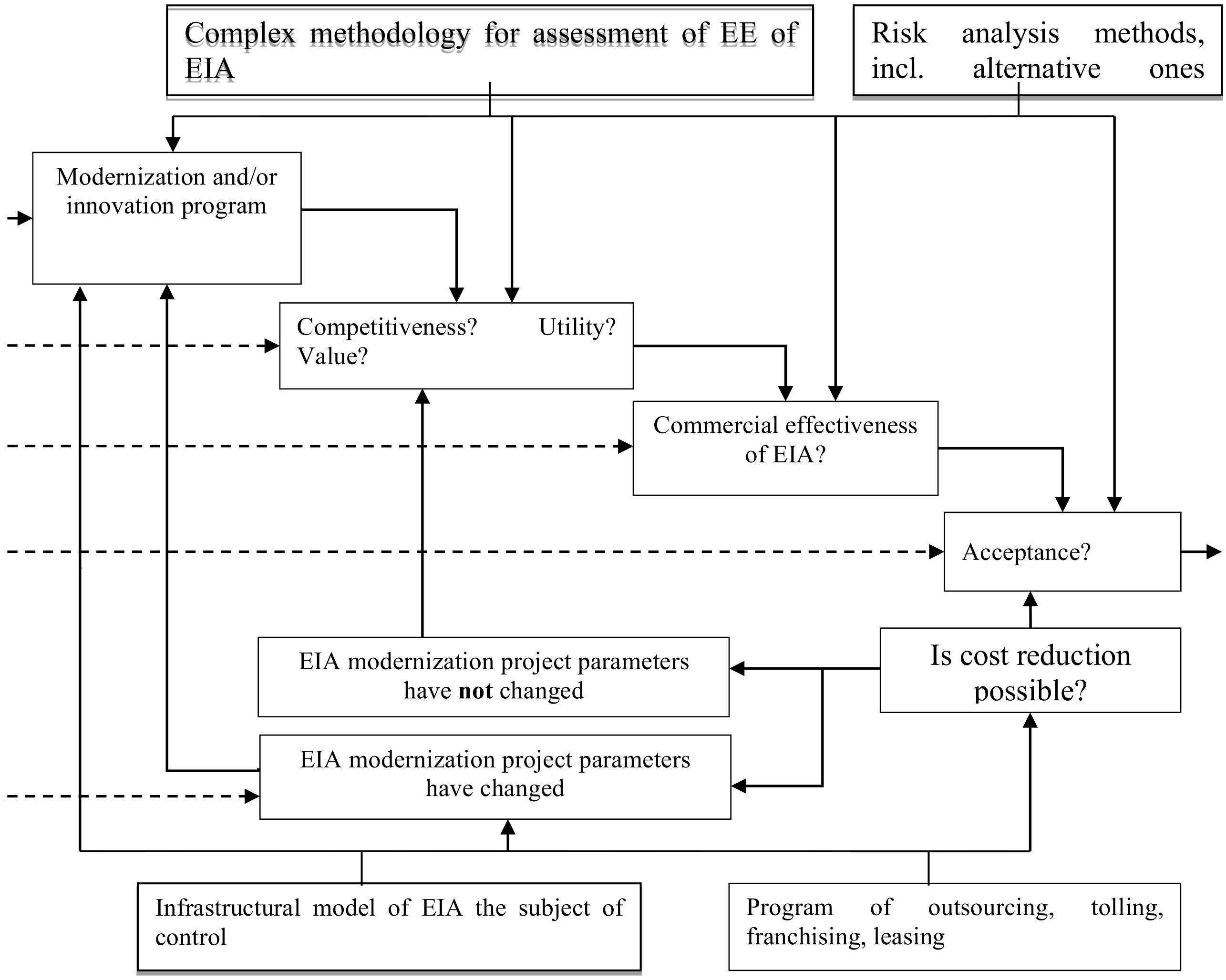
After costs are reduced, new calculations, confirming EE of the project, are necessary, since the obtained level of cost reduction may be insufficient to overcome the project EE threshold. In such a case an additional cost-reduction program for the project may be developed and implemented.

However, at the same time the requirement of the enterprise for equivalency of the final result may be violated. This means that cost reduction measures when being implemented may change the internal return index of EIA. Then additional confirmation of innovation nature of the project is necessary and the analysis procedure has to be repeated.

For EIA, due to the specifics of innovation projects, work and services outsourcing may play a discrete role and help reduce the cycle of the project implementation and approximate the time of the expected result. However, use of this technology results in considerable cost increase of the project, which is why outsourcing programs can become an object for cost-reduction. In this case additional aspects of EE analysis of EIA emerge and they have to be reflected in the economic feasibility technique.

This refers, primarily, to institutional aspects: if an enterprise, involved in EIA, does not use outsourcing and, correspondingly, does not bear related costs it automatically results in additional cost for these services being provided by the enterprise itself. Quite often these internal costs are lower than those for outsourcing. Validation and confirmation of EE of EIA does not automatically mean its acceptance, since existing risks have considerable significance. Risk analysis should become an integral part of decision-making when EIA is being accepted. Issues related with risk analysis and management of EIA should be dealt with separately.

Fig. 2. Cost reduction model (CR) during EIA



Efficiency assessment of EIA with savings on semi-fixed costs and increase in production. The prime postulate of this method is calculation of the net present value of an investment project (NPV):

$$NPV = -\sum_{t=1}^{T} \frac{I_t}{(1+r)^t}{}_0 + \sum_{t=1}^{T} \frac{CF_t}{(1+r)^t} \qquad (8),$$

where CF_t– is a cash flow, generated by the project per year *t*; I_t –initial investment per year *t; r* – discount coefficient. The criterion for project acceptance is non-negative value of $NPV \geq 0$. Innovation in production technology of an enterprise should result in production growth of improved (new) goods or in labor productivity increase. In case production grows, relative decrease in production costs is possible due to reduction of semi-fixed costs per unit of output. Let us formulate the following basic principle, which makes it possible to use statements of marginal theory: utility of some parameter (index) can be accepted as equal to the value of the parameter (index) itself. So, let us present the method for **operating risk calculation of EIA in case the industrial enterprise is modernized in accordance with an alternative approach to risk analysis**.

Let us put down the expression for operating effect in respect to one type of products,

$$EOL(\bar{X}):\ EOL(\bar{X}) = \frac{m\bar{X}}{m\bar{X} - F}, as\ p - v = m \Rightarrow E(EOL(\overline{X})) = EOL(E(\overline{X}) - PR) \qquad (9)$$

Let us apply this principle to measure the value of operating risk of EIA, related with a decision about definite volume of new products output.

We assume that actual volume of output will be different from the planned one, i.e. it will be a random quantity which adopts the value ($X_{1,},\ldots X_s$ with probabilities $q_1,\ldots q_s$). The volume of operating risk is the volume of risk premium (*PR*), which is defined from the following balance condition (formula 11).

This condition means that the expected value of operating effect of EIA has to be exactly equal to the operating effect of the expected volume of output minus risk premium.

So, the real weight of the operating effect for EIA is the difference between the expected value of the operating effect and risk premium. The expression in the right part is sometimes called risk-free equivalent whereas the risk premium represents the difference between expected final result and risk-free equivalent. Such a criterion was proposed by H. Markowitz, in which case risk premium PR can be considered as numerical quantity indicator of operating risk. In order to illustrate the method of operating risk calculation with the use of equivalency principle, we are going to follow the methodology of L. Kruschwitz so as to define the types of risk relations. Let us present the left part of the equation in the form of:

$$EOL(\overline{X}) = EOL(\overline{X}) + E(\overline{X}) - E(\overline{X})) \tag{10}$$

After which the left and right part of the equation will be presented in the form of Taylor series. For this purpose the right part of the equation will be expanded to the first-order derivative and the left one – to the second-order derivative.

Right part: $EOL(E(\overline{X}) - PR) = EOL(E(\overline{X})) + EOL^{'}(E(\overline{X})) * (-PR)$, hereinafter we accept the designations: $f'(X) = \dfrac{df(X)}{dX}$, $f''(X) = \dfrac{d^2 f(X)}{dX^2}$.

Left part:

$$E(EOL(\overline{X})) = EOL(E(\overline{X})) + EOL'(E(\overline{X})) * E(\overline{X} - E(\overline{X})) + \frac{1}{2} EOL''(E(\overline{X})) * E((\overline{X} - E(\overline{X}))^2)$$

Let us remark the following obvious postulates:

1. $E(\overline{X} - E(\overline{X})) = 0$.

2. $E((\overline{X} - E(\overline{X}))^2) = VAR(\overline{X})$ - dispersion.

Let us define from this condition, the amount of risk premium *PR:*

$$PR = \frac{1}{2} * VAR \qquad (\overline{X}) * (-\frac{EOL''(\overline{X})}{EOL'(\overline{X})}) \tag{11}$$

This is approximate formula for risk premium calculation for small amount of risk.

The expression in brackets in the economic theory is called “the coefficient of absolute risk aversion” or Arrow-Pratt coefficient. On its basis it is possible to acknowledge that risk premium PR of EIA is equal to half of the product of the existing operating risk, which is expressed by uncertainty with regard to the actually obtained volume of output (sales), which is measured by dispersion of this value and subjective degree of risk aversion, defined by the absolute risk aversion coefficient. This coefficient may be taken as an index to define operating risk of EIA:

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If $EOL'(\overline{X}) = -\frac{m*F}{(m*\overline{X}-F)^2}$, $EOL''(\overline{X}) = -\frac{2*m^2*F}{(m*\overline{X}-F)^3}$, the risk aversion coefficient, as the ratio of these values is equal to: $\frac{2*m}{m*\overline{X}-F}$.

The coefficient shows that volumes of output in proximity to the breakeven point (*BEP*) are related with the highest operating risk of EIA and, consequently, "work" around the breakeven point entails high risk aptitude or, which is identical, low degree of risk aversion. This formula also implies that at the breakeven point, this coefficient has an infinitely large value and its value decreases as the volume of output of EIA increases.

In order to carry out an analysis by the methodology proposed (Fig. 3), it is essential to provide monitoring of the dynamics change of the resulting indices of EE, considering their interrelation, i.e. on the basis of evaluation of new technology impact on economy of an enterprise. As mentioned before, this can entail labor productivity growth and lower wages expenses. If labor productivity grows faster than cost rates on technology operation and maintenance, the prime cost will go down and vice versa. Consequently, in order to take economically competent decisions when choosing certain technology to implement, it is not enough to be limited to the analysis of investment EE. So, the complex method of EE assessment of EIA, presented in Fig. 3, is aimed at the analysis of internal economic results of modernization and innovation implementation at an enterprise.

Fig. 3. Complex model of EE assessment of EIA and calculation algorithm

<table>
<tr><td colspan="7">Complex assessment of EE of EIA</td></tr>
<tr><td colspan="7">Control mechanism of EE of EIA</td></tr>
<tr><td rowspan="3">external resources</td><td>Personnel policy and motivation</td><td>Financing of investment, modernization</td><td>Development of technology, R&D, IA and OIP</td><td>External and internal logistics</td><td>Marketing policy</td><td rowspan="3">value for consumer of the product</td></tr>
<tr><td colspan="5">Strategic planning → Current planning → Control, correction of plans</td></tr>
<tr><td>Supply and purchase</td><td>Production</td><td>Sales and distribution</td><td>After-sales service</td><td></td></tr>
<tr><td colspan="7">1. Assessment of return growth and labor productivity increase during modernization and innovation;
2. Assessment of net income of an enterprise, its market prospects according to SWOT;
3. Analysis of return on investment and increment of intellectual capital during implementation of innovation ;
4. EE Assessment of investment into new product and operating risk assessmentриска;
5. Assessment of innovation impact on economy of an enterprise;
6. Analysis of innovation impact on EVA formation;
7. Assessment of commercial efficiency of new products and choice of most attractive options of EIA during modernization;
8. Development of implementation plan of EIA and its financial provision through the method of synchronous planning</td></tr>
<tr><td colspan="7">Maximization of MVIA</td></tr>
</table>

Key indices of investment return of new product or modernization program: increment of intellectual capital, return on investment and increase of sales revenue from new product, net income, labor productivity increase, increment of economic value added and competitive recovery of the enterprise. Efficiency assessment of EIA, choice and formation of investment plan during modernization of an enterprise have to be within the context of the following condition: $\mathbf{EVA} > \mathbf{0}$, value increment (V) is maximal.

When analyzing impact of new technology on economy of an enterprise, the basis for comparison can become economic data before implementation of EIA in the business entity as a whole. In order to assess the impact of improving technology it is reasonable to carry out a comparison study and compare indices directly for the innovation company area. Results, obtained on the basis of these indices, can be both optimistic and pessimistic. So as to choose the optimum direction for innovation development and take a final decision about attractiveness of new products, it is worth to consider the dynamic analysis of these indices and do calculations of synchronous investment and financial planning by the Albach model.

In order to increase EE of management of an industrial enterprise it is possible to apply the model of synchronous investment and financial planning or one-stage multi-period Albach model, according to the developed methodology. This model considers the goal of “maximization of the total value of the capital of investment and financial program”. With the help of liquidity conditions, financial balance is guaranteed for all accounted projects for the planned period. The enterprise’s own funds for modernization of the investment objects (hereinafter – objects) are limited. For each program of production, a certain quantity of manufacture (new) products of each type is set in such a way so that the total quantity of products does not exceed the quantity of sales (marketing plan).

The goal function of an industrial enterprise’s value maximization accounts for weighted average value of the cost of capital, which ensures reality of conditions. At the same time, in order to elaborate the financing plan of investment measures for modernization of production, the following conditions have to be complied with:

“Realistic” or “similar” alternative options of development and modernization pan are suggested, which can be implemented by the beginning of the planned period in the course of modernization program implementation. Future investment projects and planned financial sources are included totally only provided that there are future investment and financial possibilities, which comply with the predetermined interest rate. I.e. efficiency spread is (r_e - WACC)>0, where r_e – enterprise's own capital return on new investment.

The quantity of product types, manufactured by a certain investment object, and maximum volume of their sales can definitely be referred to a certain period or point of time.

Let us characterize variable parameters. Herewith, an important condition has to be mentioned: «payment row of investment objects and object to be financed is represented as *negative* balance of payment", according to the traditional representation of the Albach model:

Variables: x_j = number of units of investment object j (j=1,…,J); y_i = volume of use of the financed object i .

Parameters: $a_{j\tau}$ = negative balance of payments per unit of an investment object j at the point of time τ (τ =0,1,…,T); $d_{i\tau}$ = negative balance of payments per unit of the financed object at the point of time τ ; c_j = cost of capital per unit j of the investment object; v_i = cost of capital per unit i of the financed objet; E_τ = enterprise's own funds available at the moment τ ; X_j = maximally implemented j units of the investment object; Y_i = maximally implemented volume i of the financed object.

Objective function:
$$\sum_{j=1}^{J} c_j x_j + \sum_{i=1}^{I} v_i y_i \Rightarrow \max \qquad (12)$$

Where $\sum_{j=1}^{J} c_j x_j$ - value of the cost of investment capital; $\sum_{i=1}^{I} v_i y_i$ - value of the cost of the capital of financial measures.

Total cost of capital on investment and financial programs have to be maximized.

Liquidity conditions:
$$\sum_{j=1}^{J}\sum_{\tau=0}^{t} a_{j\tau} \cdot x_j + \sum_{i=1}^{I}\sum_{\tau=0}^{t} d_{i\tau} \cdot y_i \leq \sum_{\tau=0}^{t} E_\tau \qquad (13)$$

Where $\sum_{j=1}^{J}\sum_{\tau=0}^{t} a_{j\tau} x_j$ - at the point of time t negative balance of payments of investment objects; $\sum_{i=1}^{I}\sum_{\tau=0}^{t} d_{i\tau} \cdot y_i$ - at the point of time t negative balance of payments of financed objects; $\sum_{\tau=0}^{t} E_\tau$ - at the point of time t enterprise's own funds.

For every term t (t=0,1, ..,T) it is necessary to ensure that total value of the negative balance of payments from investment and financial activities does not exceed the value of enterprise's own funds. If the latter ones are interpreted as incomings, a rule comes into force, which says that the total amount of incomings at a certain point of time should exceed or be equal to payments.

Conditions of the project: $x_j \leq X_j$, for j = 1,...,J; $y_i \leq Y_i$, for i = 1,…,I;

$x_j \le 0$, *for j = 1,…,J;* $y_i \le 0$, *for i = 1,…,I.*

Total number of all investment objects j, as well as the use of all financed objects i should not be negative or exceed the upper limit.

So, internal complication of the problem of economic efficiency management of an enterprise in the process of its development and modernization, introduction of new information technology and intellectual property objects is conditioned by the lack of analogues for definite industrial conditions. In order to solve the problem of economic efficiency boosting, it is essential to consider various combinations of conditions and factors, as well as presence of feedbacks in the mechanism of economic efficiency management, including the need for collection and timely assessment, processing, correction of a large amount of information, which results in problematic situations that require detailed analysis in order to take the most efficient management decisions. However, methodology of EE management requires solving the problems that correspond to the aforementioned characteristics and features. This conditions development of relevant tools for complex assessment of economic efficiency of capital investment into modernization of production, makes it necessary to use an economic mechanism for justification of system innovation efficiency. At the same time, application of "common practice for assessment of commercial projects efficiency" negatively affects the efficiency parameters of management mechanism of an enterprise with implementation of new technologies, introduction of R&D, technology modernization.

The article provides a control mechanism for EIA on the basis of the value maximization mechanism, which provides EE of EIA from the standpoint of creation of long-term value for owners (increment of economic value added), assessment of new product utility for end-users plus internal operating efficiency, motivation and training of personnel, development of production activities. This, eventually, helps to increase competiveness of an industrial enterprise, i.e. capacity of the enterprise for adaptation of new ideas, provision of its management flexibility in constantly changing economic conditions, orientation on constant improvements. There have been developed and elaborated models of system innovation control with practical relevance: model of production cycle decrease due to technological innovation, model of investment distribution into production innovation.

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RISK, AMBIGUITY AND UNCERTAINTY IN INVESTMENT AND INSURANCE MARKETS: A HUMAN CAPITAL PERSPECTIVE

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Abstract:*Understanding risks faced by firms and their reactions in response to those risks requires analysis of the ambiguities inherent in human behaviour. Yet, evidence from two case studies on investment and insurance professionals in the finance industry suggest that more focus on human capital may be prudent in reducing epistemic uncertainty particularly considering recent events in which the investing public has had a crisis of confidence in corporate leaders. It is particularly appropriate for regulators to provide a context in which market participants exercise due diligence by ensuring human capital is enhanced by as much knowledge as possible where more human capital knowledge could reduce both risk in investments and insurance, ultimately challenging the sustainability of organisations during periods of epistemic uncertainty. This paper suggests that investment analysts, fund managers and insurance professionals lack the appropriate competencies, skills, knowledge and abilities required to meet the demands of the analysis of human capital in relation to understanding risk. Such competencies include disciplinary knowledge of sustainable human resource management and organisational change systems and their links to corporate performance and risk mitigation. An alignment with human resource management (HRM/ HR) that is equally focused on internal and external risk is of strategic importance for such professionals and their organisations in human capital risk mitigation.*

Key words: *regulation; risk management; financial services.*

Introduction

After recent corporate collapses, corporate stakeholders and investors have focused more on the human element as a key indicator of risk and of potential future value in firmsi. This requires financial market professionals to interpret the ambiguity inherent in early warning signs of risk and uncertainty, implying a move away from "lag" to "lead" indicators of a firm's financial performance. Some human capital analytical models used in this regard have been adapted from the discipline of accounting. These have included attempts to value people as assets; creating an index of 'good' management practices and relating these to business results; statistics about the composition of the workforce and measures of the productivity and output of peopleii. However, these models do not interpret the more complex process of managing the uncertainty and ambiguity of human capital in ways that can be readily understood by investors or the corporate leaders. As such, investors and indeed the corporate stakeholders today lack a coherent way to assess whether the configuration of human capital within a firm is internally consistent and provides a context for a firm to deliver its stated strategy.

Initiatives such as the United Nations Principles for Responsible Investment (PRI)iii provide a context for investment markets to broaden equities research to incorporate more ambiguous themes including analysis of good governance principles and strong environmental management. However, while attempting to capitalise on this emerging mandate most fund managers and corporate leaders fall into the trap of measuring what they *can* measure, such as data on health and occupational safety incidents, staff turnover and headcount, rather than analysing what they *should* measureiv. While the Environmental, Social and Governance (ESG) principles of UN PRI incorporate the role of boards and directors' duties, corporate accountability and disclosure, risk management, corporate responsibility and 'doing the right thing' as well as major trends in financial accountingv; there is insufficient detail in these themes to sufficiently interpret key elements of ambiguity and uncertainty in relation to human capital related risks within organisations.

Traditionally, risk management within financial institutions such as insurers has evolved around risk identification, quantification, management, monitoring, and review. This process has then led to a situation where managers identifying and quantifying risks themselves. However, this process fails to readily identify the dynamism of human capital risks, most of which can exist simultaneously in the "known", "unknown" and "unknowable" states. A more robust process is to identify the drivers of risk in an institution, and then to develop an appreciation of how these drivers influence the various risks that may arise.

The overly simplistic models that accompanied did not incorporate human capital realities and failed to incorporate underlying systemic uncertainties and ambiguities. As noted by Ganegoda and Evansvi, investing in knowledge cannot reduce system level ambiguity. Financial markets include human interactions, which are characterised by ambiguity and can be subjected to misinterpretations as seen in the fallible system of credit rating of asset-backed securities (ABS). Ganegoda and Evans observed that the ratings were based on a set of assumptions based on the probability of default, similar to a bond rating scale, even though the loss distribution of the two are significantly different and the notation systems failed to distinguish the much higher level of ambiguity inherent in the ABS ratings. Similarly, Li's Gaussian cupola formula for minimising financial risk of mortgage default was criticised by Nassim Nicholas Taleb: "People

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got very excited about the Gaussian Copula because of its mathematical elegance, but the thing never worked…co-association between securities is not measurable using correlation.” vii. David Li, the author of the model, had no pretensions regarding its infallibility: "The most dangerous part is when people believe everything coming out of it” viii. Additionally, the widely used Black-Sholes-Merton (BSM) pricing model, while successful for a relatively stable environment, had not factored in the potential for crises in human behaviour under conditions of unpredictability. The model was helpful for markets to interpret elements of risk and uncertainty but not ambiguity. Nonetheless, when a critical mass of financial market players use specific models, it is possible that this high level of social commitment can “elevate a model to a paradigm without appropriate acknowledgement of underlying theoretical justifications…. If such ambiguities are not explicitly treated, consequences can be disastrous”ix.

In investment markets where “quant analysts” use normal distribution models to minimise uncertainty and risk, but not ambiguity, it is not surprising that some institutional investors can become disconnected from the complex reality which the figures are supposed to represent, needing regulatory remediation. However, the risk matrix described by Ganegoda and Evansx distinguishes between risk and uncertainty. Risk applies to situations where one possesses knowledge about the possible set of future outcomes and their underlying probability distributions. Uncertainty applies to situations where knowledge exists about the possible set of future outcomes, but knowledge does not exist about their precise underlying probability distribution. This is consistent with Oberkampf et al xi who distinguish between aleatory uncertainty and inherent variation in a system, where outcomes follow a known probability distribution and more knowledge does not change the distribution; as distinct from epistemic uncertainty derived from a level of ignorance of the system, which can be reduced with more knowledge.

Ganegoda and Evansxii observe that one approach to modelling this kind of episodic uncertainty is to invest in knowledge. However, there are barriers to acquiring knowledge on these aspects of corporate performance: time horizon concerns, significant expense of obtaining and interpreting data, conflicts of interest, and competitive interests preventing collaboration within a sector. Even so, there is also a cost to not investing in this knowledge.

The importance of knowledge and human capital

Conception of value is immensely different in a knowledge economy in comparison to traditional economies. In the knowledge economy, employees are no longer regarded as labour but as capital (Drucker, 2002). Knowledge-based companies originate profits from the commercialization of the knowledge created by their employees. Bassi et. al. (2001) defines knowledge as “the accumulated insights and understanding, both explicit and implicit, that the employees of a firm use to accomplish their assignments every day”. He sees knowledge as the thoughtfulness and attention people bring to doing their job in pursuit of the firm’s goals. Often, these new workers are labelled ‘knowledge workers’ and they are highly skilled, qualified, trained, and experienced. In essence, they are workers who deal with a high degree of complexity and uncertainty that requires a high degree of judgement (Dunphy, 2000).

The stock of competencies, knowledge, social and personality attributes, including creativity, embodied in the ability to perform work to produce economic value is generally termed as human capital. Royal and O'Donnell (2002a) define Human Capital as human resource management systems (HRMS) which consider overtime, the complexity of internal and external interdependencies of the organization. Human Resource Management (HRM, or simply HR) is the management of an organization's workforce. It is responsible for the attraction, selection, training, assessment, and rewarding of employees, while also overseeing organizational leadership and culture, and ensuring compliance with employment and labour laws. Human capital analysis links human resource management systems to the future performance of the firm (Royal & O'Donnell, 2003). However, efficient and effective management of "human capital" and analysis have progressed to an increasingly imperative and complex process. However, for sustainable competitive advantage, all HR functions need to be in synchronisation with each other as well as with the firm’s broader strategic infrastructure.

Knowledge and human capital link to investment and insurance risk?

Knowledge is key to mitigating and reacting to risk in “known”, “unknown” and “unknowable” states. Both investment professionals and financial organisations such as Insurers face common external human capital risks with regards to their products and their core offerings to clients. Additionally, both groups from an organisational operational perspective face internal human capital risks. Although regulators defined the minimum standards on mitigation of such risks through prudential standards and mandatory compliance regulations to ensure the wellbeing of Australia’s financial markets supported by confident and informed investors and consumers, it is clear that these guidelines are widely misunderstood by industry. Industry neither focused on specifically nor espoused to analyse human capital data. To make matters worse industry accepted that inconsistency existed across industry between the rhetoric espoused at the top levels of the organisation opposed to the reality of what was practiced within organisations, in regards to human capital risk and risks in general. Although some blame the regulator for lacking definitive guidance and creating confusion, others acknowledge that industry is unaware of or is unprepared to tackle human capital risk despite industries and organisations’ genuine efforts to reduce risks and human capital risk exposures. Industry furthermore believed that intangible people management aspect of risk was the main cause of scandals, and that human capital is a lead indicator or predictor of these kinds of situations. As such, the following mini-case studies focus on organisations and key stakeholders from a human capital risk management lens.

Fund managers - investment decisions and modelling epistemic uncertainty

In general, Environmental Social and Governance aspects of the United Nations Principles for Responsible Investment represent a coordinated effort to analyse and interpret aspects of both aleatory and episodic uncertainty. Environmental, Social and Governance (ESG) focus has grown through such initiatives as UNPRI. By June 2013, UNPRI had over 1195 signatories with a total of $34 trillion in assets under management, including over 128 signatories from Australia, comprising around 11% of the total number of signatories. It was estimated that funds under management or advice of the Australian signatories in 2010, as a total was approximately $591 billion[xiii]. Additionally, US focus on ESG can be seen with 360 shareowner resolutions were submitted in 2010 alone; 29% of those addressing environmental or social issues received more than 30% of shares voted[xiv]. Additionally, with MSCI Sustainability Indices that represent the performance of the investment opportunity set (‘ESG beta’) of companies with high ESG ratings

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relative to their sector peers has indicated that companies with less financial exposures to environmental and social factors, provide a clear case for seeing ESG as a long-term risk mitigation factor[xv]. Furthermore, in the current volatile economies, "Socially responsible" firms have shown to trade at a price premium relative to lagging CSP firms [xvi] implying that regulators may need to focus on this aspect of uncertainty.

ESG can force market participants to move towards a deeper understanding of the ways in which firms generate lasting value, through articulation of the "generative mechanisms"[xvii], or the underpinning patterns of behaviour of key actors. ESG also help illuminate a firm's relative level of ambidexterity that is the ability to both explore new horizons and exploit existing strengths[xviii] in order to make the investment recommendation process more transparent to stakeholders. In recent times, both governance and environmental themes have received considerable attention from researchers[xix], including from both investor and corporate perspectives[xx], with optimistic as well as pessimistic scenarios. Cross cultural issues have also been debated[xxi]. Climate change in some parts of the world, for instance, can mean investment opportunities for public health[xxii].

Governance aspects of ESG investing are becoming somewhat standardised [xxiii]. In the UK, since mid 2010, the Financial Reporting Council has required firms to make clear statements of a board's responsibilities relating to risk, including governance risk, with a greater emphasis on the importance of skills and experience on boards and a recommendation that all board members be put up for re-election every year[xxiv]. This kind of data is relatively comparable across firms, allowing for clearer analysis by markets. The Australian Stock Exchange has guidelines for good practice in governance, incorporating formal committees to create and execute corporate policies on strategic issues including remuneration for senior executives and to prepare for regular audits. These relatively simple policy changes appear to have had a positive impact in the Australian corporate governance context[xxv]. Overall, corporate governance ratings have a positive effect on firm performance[xxvi], implying that companies can improve performance by adhering to strong corporate governance practices.

The Social ESG themes are more ambiguous and more likely to include epistemic as well as aleatory uncertainty. In some cases, social aspects of ESG investing are defined in terms of labour law compliance, health and injury statistics, community engagement (such as in the London Group Benchmarking Model), social business investment to philanthropy. Some research has focused on the inevitable trade-offs between ecological and social themes[xxvii]. Other streams of research have focused on the kind of data, which is disclosed by firms and its level of materiality and assurance[xxviii]. Other research has found that it is not the precise nature of the data on social or human capital issues, which is of relevance to analysts rather it is the forward-looking analysis of how human capital investment is likely to generate business opportunities[xxix]. Given the array of definitions of S and confusion around units of analysis (e.g. at firm or business unit or individual or board level) and on the type of data under analysis, it is not surprising that securities analysts find it difficult to standardize their analyses of human capital and related social themes within ESG investing protocols. Of each of the three ESG principles, it is the Social aspects, which are most ambiguous. However, epistemic uncertainty cannot be modelled through an aleatory lens, although some fund managers analyse singular factors, such as employee engagement scores, as a proxy for all human capital and change management performance, even though these are more likely to provide an illusion of rigour rather than an illumination of the underlying complexity.

While regulators have not yet mandated that market participants need to analyse and interpret aleatory and epistemic uncertainty, recent initiatives from the Responsible Investment Association of Australasia (RIAA) have included awarding certification in responsible investingxxx. This is an important symbolic and practical qualification to address the regulatory reform required to enhance analyst licensing and skill development to incorporate all aspects of ESG investing. Understanding the financial performance of firms requires analysis of the ambiguities inherent in human behaviourxxxi. The same day that Lehman filed for bankruptcy on September 15, 2008, three credit ratings agencies had rated the investment bank as above average in its ability to meet its financial commitments. Those who tried to articulate the flaws in the underlying management systems were criticisedxxxii. However, while specific financial results cannot be predicted precisely, the human capital patterns shaping them can be understoodxxxiii and can provide insight into future value creation and destruction within listed firms. Regulators can provide a context for market participants to analyse and interpret human capital at the level of patterns and systems.

Quantitative techniques are valuable with regards to appreciating outcomes within multiple uncertain inputs, but users need to understand the imperfections of their assumptions. There are also non-readily quantifiable issues to take into account. Quantitative valuation methods, such as the BSM and Gaussian Cupola models, are necessary but not sufficient for predicting future value in complex, knowledge based markets. They need to be supplemented by rigorous qualitative research that incorporates interpreting the ambiguity inherent in human capital experienced by firms in changing economic conditions. Human capital professionals are trained in the disciplines of organisational psychology, strategic human resource management, and interpreting ambiguity. This is distinctly different to the overly simplistic use of accounting principles in human capital metrics, especially when those metrics were designed for internal corporate use, not market use. They do not allow an investor to assess whether a listed company has reduced ambiguity through appropriate configurations of human capital.

Emerging evidence for the role of human capital analysis in the investment process

An investigation of information flows in capital markets was conducted during 2000-2010, as a component of a larger study, undertaken during 1996-2010 in investment banks in Australia, Asia and the UKxxxiv. Investors can assess generative mechanisms of value creation, in part, through the analysis of qualitative aspects of human capital within listed firms. An illustrative model of human capital analysis within investment markets can be seen in Figure 1, Table 1 and Table 2. Such a system can be described using semantic concepts: ‘actor’, ‘role’ ‘task’ and ‘task artefacts’, within an ‘awareness net’. According to Figure 1, there are 9 task artefacts that connect 9 pairs of tasks with same labels. These are T1T1, T2T2, …, T8T8 and represent collaborations among the actors, and role artefacts are represented by lines connecting a Role to a Task. These lines can be referred to as R1T1, R1T2, …. and R8T6.

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Figure 1: An awareness net representation of the investment decision process (Daneshgar, Royal and O'Donnell, 2005)

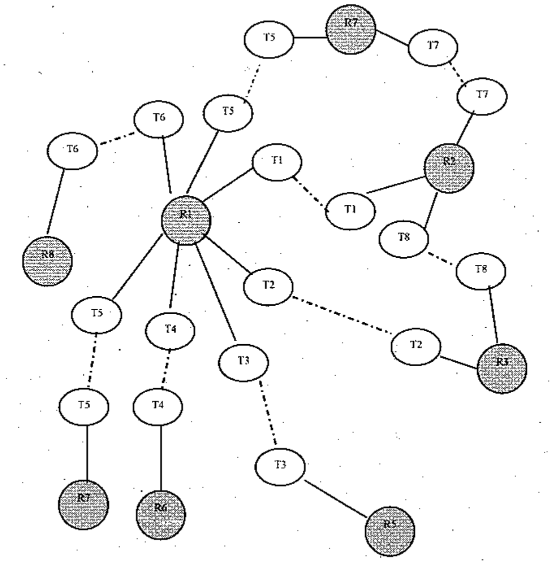

Table 1: Roles and steps in the investment analysis process: incorporating current role of regulators and fund managers (adapted from: Daneshgar, Royal and O'Donnell, 2005)

Roles	R1: Securities analyst
	R2: Client (investment manager or broker)
	R3: Sales People
	R5: Company
	R6: Security and Investment Commission
	R7: Stock Exchange
	R8: Human Capital Expert
Tasks	T1R1: R1 provides advice to the Client, R2
	T1R2: R2 requests for advice from R1
	T2R1: R1 prepares and sends the Research Product to Sales, R3
	T2R3: R3 receives Research Product from R1
	T3R1: R1 requests Company Profile from the Company, R5
	T3R5: Provides R1 with the Company Profile
	T4R1: R1 consult SIC, R6, for their Rules and Regulations
	T4R6: R6 provides R1 with Rules and Regulations
	T5R1: R1 consult SX, R7, for Financial Data
	T5R7: R7 provides R1 with the Financial Data
	T6R1: R1 Seeks expertise on human capital from R8
	T6R8: R8 provides Expert Advice to the R1
	T7R2: R2 seeks market and price data from R4
	T7R7: R4 provides market and price data to R2
	T8R2: R2 requests to buy shares from R3
	T8R3: R3 provides shares to R2

Table 2: Knowledge gaps in the current investment system (adapted from: Daneshgar, Royal and O'Donnell, 2005)

1.	Securities analyst, R1, needs expert advice (R8) in the area of human capital. Such is currently not systematically included in investment recommendations.
2.	Currently this collaboration is sub-optimised by non-systemic data on human capital to underpin advice by R1 to R2.
3.	Currently, such interaction is based on quantifiable elements, without systematic use of qualitative data.

4.	A knowledge gap exists in this collaboration as a result of a lack of skill base in both R1 and R5 in terms of gathering and analysing the human capital data.
5.	R6 does not currently license capability in analysing qualitative, system-level human capital data, as part of licensing certification for R1.
6.	Regulatory standards on human capital data from R7 to R1 emphasise readily quantifiable themes including senior executive remuneration and corporate governance implications.

By analysing various components of the awareness net, several knowledge gaps have been identified (see Table 2) within the current investment recommendation process. Points 5 and 6, in particular, highlight the role of regulators in improving these knowledge gaps.

Mini case study I – The experience of fund managers when inputting human capital analysis in to the investment process

It is useful to consider systemic ways to bridge the knowledge gaps identified in Table 2. It appears that investment markets professionals do not systematically acquire the skills, which underpin human capital analysis, including strategic human resource management, and organisational change management systems. Most finance professionals are trained in a very different set of underlying disciplinary fields, and these do not typically account for high levels of environmental ambiguity and episodic uncertainty. The nominal function of financial markets analysis is to conduct thorough research investigations into all aspects of the current and prospective financial condition of publicly listed companies and to provide an analysis of the findings in the form of a research report, which serves as a basis for making an investment recommendationxxxv. However, in spite of significant regulation on all aspects of recruitment, training, development, remuneration and promotion of financial analysts, regulators do not currently focus on the acquisition of skills in the inherently ambiguous nature of human capital within listed firms.

As part of an on-going research project in the use of human capital analysis by fund managers, selected fund managers were presented with detailed human capital analyses of listed stocks, incorporating publicly available information on the human capital systems used within selected firmsxxxvi. The following “thick descriptions”xxxvii were noted: one fund manager observed that a history of the CEOs and the chairs of the boards and the new executives provided perspective, context and an understanding of action versus words. He believed his role is to find and financially back management teams and he needed information to do that in a reasonably factual way. He expressed interest in understanding which stocks which have the potential to move from three to four or five stars, based on a five star human capital score, or the reverse, as well as those which are on a five star rating and which may be trending down to less. Another fund manager expressed interest in a range of human capital analysis services, including bespoke reports, “teach ins” or seminars for his team. In terms of engagement with this deeper form of company research, his preference was for a contract to provide a wide range of services. He voted on brokerage commissions, which generate specific payment per vote. He noted that within the context of an increasing number of third party and specialist research providers he had a preference for separation of execution and research - both had to be excellent and may be provided by different parties. He noted that some execution contracts require guarantees. A third fund manager regularly commissioned research on ESG issues, which was paid by internal profit centre groups who fund the research via brokerage commissions. They keep the research within their own organisation for approximately one month, to analyse and interpret for internal use and

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for external clients, and then allow it to be released for use by other finance industry organisations. Even with ESG research, this fund manager has chosen not to use negative filters. After significant time in the funds management industry, he believes that investing is more of an art than a science. He and his colleagues have sought to create a version of a human capital dashboard to incorporate specific metrics which have the most impact for analysts, particularly human capital metrics that link data qualitative to quantitative. This fund manager and his colleagues found some ESG reports to be patronising if the writers assume that analysts do not already look at management as their colleagues cover specific companies for many years.

These observations are consistent with earlier researchxxxviii on traders' views of human capital analysis: "The traders indicated they benefited from: timeliness of human capital information, which they saw as essential, providing a better balance of real time and "right time" financial and non-financial information, providing opportunities for sensing and responding to human capital events before their implications are widely known and understood….."

However, these fund manager observations also highlight a lack of systematic interpretation of human capital systems as a key component in investment research as one approach to identify and model episodic uncertainty. This knowledge gap is explored later in this paper, and specific potential solutions to bridging this knowledge gap are proposed.

Modelling ambiguity and episodic uncertainty

Based on field research in the finance industry, researchers derived a suite of analytical approaches to model human capital within listed firms, based on an analysis of human capital through management systems, allowing for comparisons across industry sectors and across firms. Unlike the Gaussian and normal distribution based quantitative models, these human capital models incorporate aspects of change managementxxxix. One extension of this human capital based approach to modelling types of uncertainty is seen in Figure 2, which illustrates it is possible to plot a firm's leadership style and change management themesxl and then to make inferences on the appropriate configuration of these relative to a firm's life cycle. In different stages of the life cycle of a firm, specific change management themes of systematic trial and error are replaced by more sophisticated change management themes. These themes can be characterised by steady growth, divisionalisation, realignment and systems for sustained success and associated human capital management systems. Each of these themes is associated with configurations of management systems, which are ideally both internally consistent and consistent with strategy for a firm to optimise its ability to execute on its stated mission xli. These change management themes can be analysed and interpreted at two levels: firstly at the level of the regulatory process itself, and secondly, at the level of the entities which are being regulated. It is worth noting that as these kinds of knowledge gaps become evident in regulatory processes, regulatory bodies, as with individual companies, can also progress through a process of change management. However, in this paper, we focus on the second process for market participants to use in their own internal processes to improve the outcomes.

Figure 2: Human capital analysis leadership matrix

Environmental context	Leadership style	Change management theme	Management systems
Episodic uncertainty	Primary leadership style: Entrepreneurial leadership	Systematic trial and error	Innovation of products, services and processes of all management systems
Aleatory uncertainty	Transactional leadership	Steady growth	Stability of management systems
Aleatory uncertainty	Systems based leadership	Divisionalisation – accelerated complex growth, organically or mergers and acquisitions	Reproduction of systems, rapid execution, clarity of core and non core systems
Episodic uncertainty	Change agent basis for leadership	Realignment of overall business to new conditions	Openness to change of management systems, awareness of flexibility and transformational change
Episodic uncertainty	Visionary and system based leadership	Organisational sustained success or organisational decline	Embedded systems to sustain success – alternatively, no embedded systems implies fragmentation, stagnation and failure

Regulators currently do not insist that analysts are trained in systemic human capital analysis, however, in an environment in which the investing public has had a crisis of confidence in investment professionals, during periods of epistemic uncertainty where more knowledge can help to reduce risk and uncertainty, it is appropriate for regulators to ensure market participants exercise due diligence by ensuring that as much knowledge is available as possible to investors. Just as securities analysts and fund managers require the appropriate competencies, skills, expertise, knowledge and abilities in order to form earnings estimates and investment recommendations [xlii] different competencies, skills and knowledge and abilities are required to meet the demands of the analysis of human capital, especially at the level of human capital systems. These include disciplinary knowledge of sustainable human resource management, organisational change and/or organizational behaviour and their links to corporate performance.

Currently, investment recommendations are made on a relative basis comparing a company's performance within a sector or industry and analyses cover all relevant publicly available information about the company and its business and the sector in which it operates. "It is not limited to financial statements, [and includes] research on the company, industry, product or sector, and public statements by and interviews with executives of the company, its customers and suppliers" [xliii]. These underpinning disciplines of econometrics, engineering and finance are effective in training graduates to model risk and even uncertainty, but they typically do not train graduates to model ambiguity.

The near collapse of the US financial sector in 2008 illustrated that market participants, including investors and regulators, were routinely mistaking measures and symbols for reality [xliv], creating conditions where hyper-reality appeared real. This paper calls for institutional investors, equity traders and analysts to analyse ambiguity as well as risk, especially in conditions of episodic uncertainty, and for regulators to ensure that this is embedded in the regulatory system.

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It is a flawed argument that a good regulatory regime has to protect participants only under predictable conditions xlv. A future research agenda into capacity building within regulators as the global financial crisis has revealed, using only traditional risk analysis models, few regulators could have predicted the extent of discontinuous change, as most regulators had a regulatory model to manage markets for "smooth sailing", or aleatory rather episodic uncertainty. To this end, a human capital systems perspective, which incorporates human as well as financial capital, is increasingly important for market participants and regulators within a complex, highly interdependent economic system.

The uncertainty can be minimized if institutional investors move beyond analysis and interpretation of traditional data sets, as seen in the UNPRI initiatives. However, even these principles are not adequate to ensure widespread adoption of appropriate levels of modelling episodic uncertainty. While the first and second generation interpretations of corporate social responsibility (CSR) and socially responsible investing (SRI) serve to challenge traditional quantitative risk models, they can be misinterpreted and have been used as an over simplistic proxy for human capital analysis and risk management xlvi. These approaches to investment analysis attempt to minimise ambiguity for investors by providing relatively simple industry based screens, such as tobacco, arms dealing and related industries. However, more comprehensive third and fourth generations of CSR and SRI are based on positive filters, such as examples of sustainable business practices, blended with substantial cost savings and efficiency improvements. While these filters are more sophisticated than the previous generation of investment filters, they are still limited in their scope and their benefit. Investors will increasingly rely on their ability to invest in the context of fifth generation CSR and SRI, involving a sophisticated approach to modelling to avoid (or minimise) risk and uncertainty in investment decisions making by fund managers.

Mini case study II – human capital knowledge in the insurance industry

Study overview

This mini case study is the first stage of a larger research project, and is exploratory by nature. It seeks to develop an understanding of human capital risk of insurance institutions (the roles and responsibilities, organizational structure and organizational functioning), and how the regulator assesses human capital risk in those institutions. Taking an external (elaborated as risk associated with products and clients) and internal perspective, the project first explored how human capital risk can be incorporated as part of regulator's prudential oversight of insurance institutions. It then sought to understand how insurance institutions incorporate their own human capital risk systems to their core business with a view to establishing best practice guidelines for management and continuous improvement, in order to reduce this risk.

The Institute of Actuaries of Australia has provided the funding for the first part of this research. The Actuarial profession has a significant influence in the management of financial institutions such as insurers and its involvement in the evolution of prudential management of the market. As such, it is of paramount importance and relevance to achieve the balance between an acceptable rate of failure and economic efficiency through competition, for organisations such as Institute of Actuaries of Australia. Whilst actuaries have tended to concentrate on quantitative data analysis for prudential management of the market, the profession is also intricately involved in non-quantitative data analysis and interpretation, as many members are involved in senior management of both financial institutions and the regulator. Although change management and human capital risks are not issues in which actuaries have traditionally been involved in, given the increasing community concern with the management of human capital in financial institutions (life and general insurers), this project will both educate actuaries in the techniques for analysis and catapult the profession into a position of being a valued participant in the debate. The project as with the investment analysts and fund managers in the previous project discussed earlier this will be a basis for extending the interest of the actuarial profession into an area, where there is little expertise, and where logical thinking and an understanding of the nature of extreme risks are required. The research is aimed at closing the knowledge gap of the profession and in establishing the profession as a leader in the public policy debate, with a view to establishing best practice guidelines and continuous improvements in order to reduce this kind of risk.

The research methodology utilised discussions, structured and semi-structured interviews with the regulator, nine major Australian insurers, and the Risk Management Research Committee of the Institute of Actuaries of Australia. The discussions first centred with the regulator on aspects of human capital risk systems in the industry and then with the selected sample of Australian insurance institutions, on their current knowledge on human capital.

Insurers

The frequency of natural catastrophes has drastically increased since the turn of the century, causing economic losses and gross human suffering. The impacts of man-made disasters have also increased, leading to greater numbers of victims and greater economic losses. Mitigation against losses and protecting populations has become one of society's greatest challenges. The magnitude and scope of these events require the involvement of insurance co-operations to strengthen societal resilience.

Insurance is the equitable transfer of the risk of a loss, from one entity to another in exchange for payment. It is a form of risk management primarily used to hedge against the risk of a contingent uncertain loss. Insurers' business model is to simply collect more premiums and investment income than what is paid out in losses, and to offer a competitive price that consumers will accept compared to its competitors. The most complicated aspect of the insurance business is the actuarial science of ratemaking (price-setting) of policies, which uses statistics and probability to approximate the rate of future claims based on a given risk. Although it is a straightforward concept, insurance affects society in various ways. On one hand, some argue that it can encourage fraud and great internal external risks, while on the other hand, it helps society, and individuals mitigate the effects of catastrophes. However, according to recent scandals in the financial markets the threat to insurers have materialised mostly from within, where focus is on the robustness practice of appraising and controlling risks within insurer to safeguard against collapse.

Insurers can influence the probability of losses through mitigating, against moral hazard, insurance fraud, and preventive steps taken within the insurance companies' systems. Insurance scholars have typically used morale hazard to refer to the increased losses due to unintentional carelessness and ever increasing risk due to intentional carelessness or indifference of staff. Insurers have typically attempted to address morale hazard primarily through system centric measures, and then through inspections and policy provisions requiring certain behaviour from

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their staff. However, reliance on technology and process may lead to overestimation of technological progress, forgetting that technology may create new risks and obscure the real focus area that is human capital. For example, human capital encompasses intellectual property, which could be used to by pass technology and processes that is intended to protect the organization. As Murphy's Law suggests, 'anything that can go wrong, will go wrong'. In simple terms safeguarding against epistemic uncertainty require an approach that protect against the unexpected, and the unthinkable.

The knowledge gap - human capital risk

A regulatory perspective

Life Insurer Risk Management Prudential Standards LPS 220, General Insurer Risk Management Prudential Standards GPS 220, and Audit and Actuarial Reporting and Valuation Prudential Standards GPS 310 are published by Australian Prudential Regulation Authority (APRA) aimed at ensuring that companies maintain a risk management framework and strategy that is suitable and adequate for the nature and scale of their operations. These guidelines involve identifying risks relevant, ensuring organization's ability to meet its objectives, assessing the likelihood and severity of those risks, determining an appropriate response, and the on-going monitoring of risks and the management actions taken to address them.

APRA defines a company's risk management framework in section 9 of LPS 220 as: "The risk management framework is the totality of systems, structures, policies, and processes and people within the life company that identify, assess, mitigate and monitor all internal and external sources of risk that could have a material impact on the life company's operations". As per the definition, APRA therefore sees Enterprise Risk Management (ERM) from a holistic point of view, which focuses on minimising epistemic uncertainty from an internal and external perspective by incorporating human capital risk as well.

The regulator primarily saw its role was to "assist companies balance making money and prevent perishing in the process". As such, APRA focus was on issuing robust and reorganised prudential standards aimed at firstly setting boundaries for financial organisations, secondly to guide ethical behaviour to ensure organisational sustainability. industry, and thirdly to bring out outliers back into the fold within the norm to ensure minimum standards and to finally protect industry from out side threats. In short, the regulator acknowledges that their response was shaped by risks at company, industry, and country levels (ex. China, India etc.).

It was stated that institution's board and senior management might exhibit too much arrogance and confidence on occasions, which may end up badly and APRA had to act as a counter balance to that. To this extent, the regulator made the insurers' boards ultimately accountable. The regulator requested boards of large lenders to certify that they are happy with their internal risk mitigation practices. The regulator added in the course of the interview that, "APRA does not do inspections or audits as in USA. APRA does visits with focus on getting boards, CEO, CFO attention, i.e. we get them to focus on the mantra, "we follow rules, we will not lie and we will not fail". It was noted that, "APRA wants companies to understand and be happy with the controls they have. The question is 'are our policies sound and sensible'… this question itself changed the practices of lenders through internally focused and questioning and probing of their practices by boards". Guiding advice to business from the regulator is "do your best to be sensible'".

Prudential Standards in regards to risk management have a technical and behavioural focus. The technical standards were associated with financial measures periodically reported by companies to the regulator. The aims of these were not risk management, but about being safe within margins of error as per prudential guides. Behavioural standards were primarily concerned with the minimum requirements for good practice regulator expected and introduced in consultation with industry. The regulator noted "If something was not sound, APRA would change it via Prudential Standards. After initial resistance, they (the insurance institutions) get on-board and that standard becomes the norm".

The regulator also focused on learning through mistakes in a transparent manner. APRA undertook an internal review after the HIH collapse in Australia, conducted by John Palmer (former superintendent of Financial Institutions Canada), which was made available to Royal Commission in Australia in full. The regulator advised that changes were made from those lessons learnt. One of the main lessons that were implemented was to make the board primarily accountable for risk and to engage with the boards directly for substantial concerns.

Nonetheless, the regulator saw supervision and highlighting deficiencies were more important than regulation itself. In that regards, regulatory supervisors were required to be knowledgeable of statutes, which are aimed at cutting through corporate opinions, arguments, and red tape. The regulator empowers and entrusts its supervisors to make decisions within the guidelines of APRA noting, "if a case is complex, APRA directives are based on more technical grounds. Most decisions are collective in nature. Supervisors' directions are not arbitrary. They also need to act within frameworks". It was noted that APRA has also increased the experience level of their supervisors, since the HIH collapse. It was noted, "Lot of experience and knowledge comes with age. In Canada supervisors are in their 50's. Average age of APRA supervisors were ~28 years of age. This went up to ~33 years within five to six years from corrective action being taken. They have on average 13 years industry and APRA experience". As such, APRA focused substantially on training that is relevant and required for staff development with four to six days per year and include modules on systems etc. to ensure, "they know what they are empowered and entrusted to do".

It was also tacitly acknowledged that the regulator's action was shaped by how comfortable APRA was with people leading the company. It was also noted that largely most companies measured average against the regulator's prudential measures. However, it was stressed that from the regulators point of view it is the captain of the ship, i.e. the boards that had to be accountable and have reasonable mitigations for risks at all times regardless of the nature of those risks. The regulator's view was also largely aligned with the industry view. APRA's view was that organisations should take steps to address their own responsibilities in human capital risk and HRM within the regulator's framework. The role of regulator was seen as to encourage industry to develop standards and address issues without having too many outliers to ensure that all companies work within the standards prescribed. However, the regulator acknowledged that they often get resistance when standards are proposed/ introduced in the first instance as the industry does not always feel comfortable with change. However, the regulator added "to be fair, most organisations perform and measure kind of average against our measures in regards to their conduct and risk mitigation".

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Internal and external reporting on the financial condition of the insurance organisations with respect to risk management, especially human capital.

The data highlighted that there are dozens of documents need to be kept and given for inspection as required by the industry. Most reports produced for regulator or external counterparts did not encompass human capital data. These included statutory structured and non-structured reports. Most are windows into organisations for the regulator. APRA looks in via these to the status of affairs. Also, APRA actuarial staff analyse these reports. Some of the general documents mentioned by the regulator included Internal Capital Adequacy Assessment Process (ICAAP), Risk Management Policy, and Financial Condition Reports. However, no human capital based reports were specifically highlighted. The regulator noted, that they have not seen companies knowingly falsifying reports, only unimpressive ones. In which case, APRA will ask to revisit these companies. The regulator saw reporting as a means of keeping focus on organisations inadequacies and in 2008-2009 there were about 600 institutions and about 150 were not adequately performing. APRA addressed these inadequacies. Companies reacted through mergers. Nevertheless, insurance organisations show these inadequacies in a positive light to the public as a way to manage the change process. However, the common theme visible in the data was that the regulator saw human capital systems to be associated with recruitment, performance management, remuneration management, training, and development functions and therefore internally focused.

A human capital perspective and the potential for inconsistency between the rhetoric and the reality provided by the financial institutions in the sector.

The regulator readily saw inconsistency between the rhetoric espoused at the top of the participating organisations (Insurers). It was noted that the cause of this was due to the disconnect between the top management and boards and the bottom of organisation. The regulator explained that 'good management' needs to know what is happening within the organisation in terms of people, processes, systems and practices against what is being preached at the top of the organisation. The boards and the regulator indicated that boards have ultimate responsibility. As such, the regulator focussed more on the board and not on the bottom levels of organisations leading to the admission that APRA does not see the direct disconnect of human capital in organisations but the symptoms visible from the outside. The regulator believes that the rhetoric vs. reality debate is inextricably linked to the broad concept of 'good management practices', which needs to focus on staff responsibilities, HRM practices within organisations and an organisations desire to act within regulations. The regulator was also quick to point out there is general resistance by the industry for regulatory conformity and mandated consistency adding that often there is resistance to change. However, once the regulator has successfully driven a change process through and it was embedded in the system and become the norm. In such instances, participants did not think twice about the validity of such requirements. Nonetheless, neither the disconnect between the rhetoric at the top of the organisation and the reality of what is practised below internally at lower levels of the organisation nor the reasons for managing new requirements were explained in terms of aspects of human capital risk.

Causes of financial services scandals and the role of human capital risk

The regulator when presented with a financial services scandal associated this with behavioural inadequacies. It was meant that there are behavioural standards that are primarily concerned with the minimum requirements for good practice by boards or senior management of the insurance organisations. Management and/or board members may well exhibit too much arrogance and confidence on occasions, which ultimately leads to APRA acting as a counter balance to that. However, it was stressed that the boards had to be accountable and have reasonable mitigations for risks at all times regardless of the nature of those risks. There was no direct mention of human capital risk more specifically.

The regulator does stipulate that the insurers' boards are accountable as is senior management. There was no evidence of management systems thinking in terms of inputs, process and systems that drove the event/scandals being discussed but more a view that human capital risk and its detection is part and parcel of a sound organisational ERM framework of which the boards and senior management are responsible for. To that end, the regulator has requested boards of large lenders to certify that they are happy with their internal risk mitigation practices.

The knowledge gap in the insurance industry in human capital risk - life and general insurers an insurance industry perspective

Understanding human capital risk: knowledge skill and expertise across the insurance industry

The insurance industry professionals highlighted that there was no specific knowledge, expertise or understanding of the definition of human capital risk or its components and hence no real understanding of the LPS 220 and GPS 220 definition as it pertains to "people, processes or systems and structure" by participants in the project. Human capital risk was more often than not confused by the participants with organisational human resource activities such as recruitment, performance management, and remuneration management and some understanding of culture as it pertains to culture and engagement surveys. Participants adopted an internal company lens and therefore indicated that all these human resource activities appeared to operate within insurance organisations from an organisational functioning perspective and in a parallel internal world. There was no link made by the participants between human resources activities and the stated ERM framework. There appeared from the data to be limited relationship outside of the traditional human resources activities and the department to which they pertain i.e. the Human Resource Department and their HR professionals in that department with those professionals whose key role in these insurance companies is centred on risk management.

When asked about the knowledge base/ qualifications and skill base of the board, CEO, CFO, Compliance Officer's and any other staff whose roles are focused on compliance and ERM in their insurance organisations there was no evidence in the data of any of the participating insurer organisations and their board members having the appropriate skill sets in human capital/ risk. Nor was there any indication of human capital risk knowledge skills or expertise at the more internal senior levels below the boards. To that end there was a limited amount of such expertise being found in any Risk Management and Senior Leadership committees within this insurance organisations and there was limited evidence of drawing on the human resource staff and their people management expertise for risk management purposes.

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The participants indicated that training and development in human capital risk management was patchy amongst the participating organisations if at all. Training and development mainly concerned on-going development with regards to the traditional organisational HR activities pertaining to leadership, communication, transparency and governance/ethics which took for the most part the form of workshops for senior staff. Some of these themes such as risk/risk culture, communication and ethics/whistle blowing participants highlighted were captured in training sessions for all staff as well. Human capital risk was seen by the organisations to be more generally related to behaviour and its link to compliance within their organisations. However, there was no evidence of bringing in external human capital professional expertise (independent consultants, advisory staff etc.) to assist with human capital risk management in their ERM framework or to provide external expertise directly to their boards, Risk Management Committees or other internal department/ committees concerned with ERM of the insurance organisations that participated in the study.

Similarly, the data highlighted that there was no specific knowledge, expertise or understanding of the definition of APRA risk management as it pertains to human capital risk or its components. Hence, no real understanding of the LPS 220 and GPS 220 definitions as it pertains to "people, processes or systems and structure" by staff at lower levels in their organisations. Some insurance organisations use culture and staff engagement surveys to ascertain the level of risk management culture and appetite for risk as well as staff engagement surveys. These human resource surveys are used for motivating and retaining staff for the most part and for providing a platform by which staff can raise issues that concern them. Some of these human resource surveys used by the insurance companies cover a couple of questions on risk management. More pointedly, others used focus groups to understand staff concerns more thoroughly and try to glean whether there is anything troubling in those surveys that relates to the behavioural aspects or culture of their organisations that could lead to a risk situation. However, most organisations said that they accepted that staff are internally focused about their thinking and knowledge of risk including human capital risk noting,' staff do not have enough knowledge or internal triggers to think of risk laterally. They look from inside outwards'.

Internal and external reporting on the financial condition of the insurance organisations with respect to risk management, especially human capital.

Most of the participants indicated that the reports produced by their insurance organisation for the regulator (APRA) or external counterparts did not encompass human capital data. One participant noted, "Most reports are financial. We don't spend a lot of time on human capital stuff". Examples of such reports included a) financial condition report - FCR b) Risk management strategy and risk management declarations, c) ICAAP, d) loss and Incident reporting to APRA and e) FS70 report provided to Australian Securities and Investments Commission (ASIC). However, some participants noted that they held discussions with the regulator on the ERM framework, prudential and remuneration reviews, which included human capital risk aspects. Most companies produced internal reports for audit and governance committees such as risk review, sustainability, and short term incentive targets report. Some of these key internal reports were reviewed and signed by the boards, similarly to reports provided to the regulator. This practice was explained stating, it is the regulator that has asked for internal reports retrospectively on occasions. Most companies declared that they undertook "deep dive assessment of risk frameworks before their board sign the declarations and annual reports given that the regulator held the board responsible with regard to risk focus and mitigation. However, it was noted that most reporting was driven by regulatory requirements and only few reports such as the 'Annual Report' and 'Annual Results presentation' did encompass a human capital side within their agendas. The human capital risk focus within reports produced for the regulator were therefore limited to specific issues such as 'fit and proper' test on key staff or availability of adequate human resources for the proper functioning of the organisation.

Most internal reports to the board were on general risk to the insurance organisation and covered elements on organisational human capital aspects. Most reports were summaries. One participant noted that the last report to the board had items on staff engagement from their survey, superannuation changes, and the remuneration review process etc. Those reports generally covered issues such as organisational transformations, key staff retention, remuneration/ performance reviews, organisational engagement, culture etc. Some organisations produced reports for some specialist internal committees such as the remuneration committee who receive a human resources performance analysis reports to review. Other committees such as Audit, Risk Management & Compliance Committee received a number of HR reports that focused on human resources from an outside risk perspective such as organisational culture and loss of key staff to competitors. It was noted that based on comments from the board and specialist committees senior management spend around 20 hours calibrating HR aspects, although it was not elaborated which HR aspects were calibrated. The HR aspects reported were generally the superficial aspects one could measure quickly at a high-level. However, no human capital based reports were specifically highlighted.

A human capital perspective and the potential for inconsistency between the rhetoric and the reality provided by the financial institutions in the sector.

Most participants were quick to agree that inconsistency existed across the industry between the rhetoric espoused at the top levels of the organisation as opposed to the reality of what is practiced within organisations, concerning human capital risk and risk in general. Although, the majority of the participants thought that insurance organisations made genuine efforts and took action to reduce risk and human capital risk exposures. However, most insurers pointed to potential misinterpretation of theories and strategies affecting company culture as the source of such disconnect. Some noted that the regulator and boards have discussed risk topics including human capital risk for a number of years without landing on definitive guidance. It was argued that risk behaviours were a subset of company culture and hence carving out a set of separate rules relating to human capital risk culture was flawed. They mostly believed that industry wide regulation would lead to little achievement and would thwart those insurance organisations that saw human capital as having a commercially competitive advantage as well.

To a large extent, human capital risk (a definition which to a large extent is being misinterpreted by the insurers across the industry) is being managed as a risk by itself and not as a risk that drives other risks. The data showed that there was confusion by the participants with regard to external and internal systems process and practises. This stems from their limited understanding of general management systems thinking, which looks at systems risk in terms of inputs, processes and outputs. In that sense the participants with limited knowledge and understanding that they have with regard to human capital risk confuse external client insurance services and products (and the pricing of risk) with internal HR activities that centre on managing the internal human resources for the insurance organisation. The latter external approach with regard to human capital risk and risk pricing lead to challenges in the traditional risk management

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quantitative applications sense as qualitative risks such as human capital are not easily quantifiable. People related risks are seen to be the responsibility of the HR function because they were seen as being broadly defined as management. Most insurance organisation participants could identify with this concept of 'Management' and it's importance to the organisation as a whole but tended to classify management then under the black box of "good" and "bad" management. They could drill down to a small extent to the aspects that make up 'good' or 'bad management'. However, they could not ascertain the systems upon which good management practices operate within. Furthermore, there was no other people related human capital filter used in their assessments of human capital risk or that constitute an ERM framework. Hence, the participants could only grapple with the identification of human capital as a risk itself let alone as a risk that potentially might drive all other risks.

Causes of financial services scandals and the role of human capital risk

The participants highlighted that systems thinking in management and the concept of managing risks through an analysis of the key drivers of human capital risk is not practiced. The concept of a management system i.e. systems thinking became very obvious to participants when an output was described to the participants in the form of an "event" such as a financial scandal and they were asked to explain what the causes of the event were. The data showed that the participants worked backwards methodically trying to grapple with the causes of the event (i.e. the output of dysfunctional processes that caused the event). They recognised that in a number of the financial scandals events that had occurred both locally and internationally that they were by and large 'bad management events' i.e. management related, remuneration and short term incentive based, human behaviour related, and organisational risk culture based. However, they did not try to ascertain the processes and the inputs that lead to these events in any systematic way nor did they suggest in their explanations as to what was the key human capital drivers of the overall risk management system that originally lead to the output i.e. (event) occurring at all. They furthermore did indicate that overall, across the industry it was the intangible people management aspect of risk that was the main cause of scandals and that human capital is a lead indicator or predictor of these kinds of situations. It only became clear to the participants after the financial scandal had been presented to them and having answered the preceding questions on the various aspects of human capital that they arrived at an important lens for risk analysis, human capital risk.

Conclusion - implications for financial market participants

In conditions of episodic uncertainty, more knowledge of human capital systems within listed firms is likely to be more useful to investors than less knowledge. While specific outcomes of human capital risk cannot be fully known, and markets are continually subject to "black swan" events, it is feasible for financial market regulators to consider embedding a more systematic analysis of human capital through the regulatory system. This goes beyond recognition of behavioural economics, and the role of cognitive biases such as overconfidence[xlvii]. Systemic analysis of human capital risks can also potentially prepare investors for the financial market equivalent of tsunamis, through clearer analysis of previously underestimated qualitative and quantitative data. Human capital risk analysis can provide a complementary approach to financial models, such as the Gaussian Cupola formula, which are based on efficient market hypotheses xlviii and normal distributions. It is acknowledged that human element creates more variables and complexities; which add to ambiguity, uncertainty and risk. However, regulators in the future may need to consider the significance of systematically incorporating human capital risk assessment into all aspects of the financial services industry, as one approach to reduce ambiguity especially in conditions of episodic uncertainty due to the underline HRM drivers that act as lead indicators in highlighting risk.

In terms of the insurance professionals, their organisations in reality practiced a segmented approach to human capital risk somewhat aligned with an internal HR framework. For these professionals human capital risk was internally focused with minimal attention paid to external risk associated with human capital risk exposures of a product or a client who subscribed to their products particularly in general insurance. The data indicated that there was no specific knowledge, expertise or understanding of the definition of human capital risk or its components within the risk committees or boards and hence no real understanding of the LPS 220 and GPS 220 definitions as it pertains to "people, processes or systems and structure". Human capital risk was confused with organizational human resource activities such as recruitment, performance management and remuneration management which was undertaken in an ad-hoc manner driven by process or systems and some understanding of culture as it pertains to surveys on culture and engagement. All these human resource activities operated in parallel world, and in an internally focused manner within these insurance organisations examined. Furthermore, there was no link made between HR activities, HR professionals, and the ERM framework of the organisations by the participants. It was evident that senior management and the board did not focus on what lower level staff did on a day-to-day basis or the HRM system that supported them and the organisation on going. As such, they did not see human capital as an intangible related to their primary core risks. They saw human capital risk as fraudulent activity that was event based and did not consider, human capital, HRM activities as aspects that may pose a threat to organisational reputation, leadership, change management etc.

There was no evidence in the data of any of the participating insurer organisations and their board members having the appropriate skill sets in human capital risk at an internal level on their Risk Management and Senior Leadership committees. Nor was there any evidence of drawing on the human resource staff and their people management expertise for risk management purposes. Similarly, no evidence of engaging external human capital experts to provide input into their ERM framework or to incorporate into their Boards and Risk Committees was uncovered. It was further ascertained that internal and external human capital reporting included minimal information on risks pertaining to human capital. Although it was seen that regulator demanded much more on human capital reporting as per the LPS 220 and GPS 220 definition, the reports prepared for APRA sees to cement the notion that the rhetoric across the industry was far stronger than the reality of what was being practiced.

The data indicated confusion with participants themselves in regards to external and internal systems process and practises stemming from their limited understanding of general management systems thinking i.e. inputs, processes, and outputs of systems. In that sense, the participants with their limited knowledge and understanding confused external client insurance services and products and the pricing of risk sometimes including people related risks to quantitative financial models with internal human resource activities that centre on managing human resources for the insurance organisation. Therefore, people related risks were to a small extent to be the responsibility of the HR function. However, people related risks were seen as being broadly defined as management which they all could identify as important to the organisation as a whole but were couched under the black box of "good" and "bad" management. There were no other people related human capital filters used, hence they could not identify the human capital as a risk driver of even other risks let alone as a risk itself.

The management concept of managing risks through an analysis of the drivers is not practiced. The management concept requires systems thinking which then allows one to understand what drives a system altogether. When an output was described by participants in the form of an "event" which was risk based, the data showed that the participants worked backwards trying to grapple with the causes. They did not work backwards even to ascertain the processes and the inputs that lead to these events in any systematic way nor did they suggest in their explanations, the drivers of the overall system that originally lead to the output (event) occurring at all. They furthermore did indicate overall across the industry that management was the main cause of these key risky events.

Ganegoda and Evans (2012) argued that Knightian risk, Knightian uncertainty, Ambiguity, and Ignorance exist contemporaneously, in such a manner that each realm of uncertainty is overlaid on upon the other with fuzzy boundaries subject to change expressing the commitment towards knowledge. Noting that knowledge itself is ambiguous, they stated that completely escaping from ignorance is almost impossible. However, they pointed out that the boundaries of each realm of uncertainty will depend on the individual's own knowledge, as well as their commitment towards the knowledge. In other words, they rejected the notion that uncertainty existed in an objective scale from small (Knightian risk) to large (Ignorance). They further suggested that the models and tools organisations used in the realm of Knightian risk are subject to ambiguity. Considering ignorance will always lurk in any sort of analysis and cannot be completely removed, special emphasis should be given to crisis management in addition to risk management to manage unavoidable black swan events. These case studies have indicated that there is an important knowledge gap of strategic importance to both groups and professionals in the finance sector. Human capital knowledge forms part of different realms of uncertainty and it has a strategic competitive advantage which may motivate organisations to assess their capabilities as well as limitations, in terms of measuring and managing human capital risk. Furthermore, human capital risk management knowledge would allow financial industry sector participants to make better decisions in terms of choosing the appropriate risk management tools, understanding their limitations, and in developing new strategic tools that incorporate human capital knowledge for both investment decision making and insurance risk assessment purposes.

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ENTREPRENEURIAL LEGITIMACY IN REWARD-BASED CROWDFUNDING

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Abstract. *Research on non-traditional social-network driven venture capital streams, such as crowdfunding is gradually acquiring scholarly attention. However, our understanding about entrepreneurial actions and processes that facilitate ventures legitimacy creation and financial capital assembly through reward-based crowdfunding is relatively limited. Entrepreneurial legitimacy creation in crowdfunding has not yet been clearly described or explained. Therefore, the purpose of this paper is to advance our understanding of entrepreneurial legitimacy creation processes in reward-based crowdfunding. We employ a novel dataset collected from Kickstarter projects to identify current entrepreneurial activities in crowdfunding and draw preliminary conclusions about entrepreneurial legitimacy creation through reward-based crowdfunding. By doing so, we aim to contribute to theories of entrepreneurial legitimacy creation processes by studying entrepreneurial practices and its outcomes in the innovative context of online crowdfunding.*

Keywords: *crowdfunding, entrepreneurial legitimacy, resource assembly*

INTRODUCTION

The online environment provides a new setting and mechanisms for entrepreneurial activity. Although online social networking emerged as a consumer-driven service, entrepreneurs have begun to exploit online-networks for financial capital assembly. The challenge of seed- or early-stage venture funding combined with accelerating rates of innovation and market adoption increase the apparent attractiveness of distributed online financing for new ventures.

Non-traditional web-enabled mechanism offer dynamic and market oriented approaches for entrepreneurs to monetise business opportunities by exploiting innovative online ecosystems (Benkler, 2002; Belleflamme et al., 2011; Ordanini et al., 2011). One specific entrepreneurial online ecosystem which experienced vast growth in recent years is crowdfunding. Crowdfunding establishes a novel vehicle for individuals or organisations to discover and exploit business opportunities through capital assembly from an online distributed social network (Lambert and Schwienbacher, 2010; Mollick, 2012). The crowdfunding mechanism introduces new possibilities for entrepreneurs to more embrace (prospective) consumer or investors to participate in the funding, (pre-) launch or growth of the entrepreneurial firm (Burtch et al., 2011; Mollick, 2012). Accordingly, crowdfunding enables entrepreneurs a capital management mechanism that might help to bypass the early capital gap young firm's face by pre-funding production and sales. Crowdfunding appears to provide entrepreneurs not only a unique approach to assemble financial resources but also to legitimate nascent ventures through their activities in such networks, and consequently might support organic business growth of nascent ventures. The reward-based crowdfunding mechanism provides unique features and dynamics that are likely to influence traditional investment metrics which are generally applied by the (venture) capital market (Eccles and Crane, 1988). In contrast to traditional venture capital streams, the financial capital assembly process through crowdfunding provides a dissimilar setting which is built around altered fundamental investment features. It appears, for example, that financial capital injections are less motivated by monetary or prospective financial rewards, but rather more driven by social-psychological incentives (Lehner, 2013). Particular feature that are implemented in the reward-based crowdfunding model, such as financial capital assembly in exchange of future (non-)monetary rewards (e.g. intangible or tangible products, gifts, mementos, etc.) emphasise that (Mollick, 2012; Lawton and Marom, 2013). Moreover, crowdfunding provides a possible mechanism for both entrepreneurs and investors to de-risk one of the most crucial aspects of venture capital finance, underfunding a venture, since there is no committing in investment unless the minimum funding size is met (e.g. all-or-nothing crowdfunding model).

Eckhardt et al. (2006) argue that it is important to understand why specific young firms have greater prospects than other ventures to be awarded external capital. The investigation of the causal criteria that drives investment selection establishes an important research area in the entrepreneurship literature (Eckhardt et al., 2006; Knockaert et al., 2010). While research frequently aims to explore, describe and examine early-stage venture funding causalities in the context of traditional venture capital sources (Denis, 2004; Chen et al., 2009; Maxwell et al., 2011), research on non-traditional venture capital mechanism is limited. Innovative online mechanism and increased use of online social networking advanced the internet into an important vehicle for entrepreneurial business activities. Entrepreneurial ventures amplify their online activities and more frequently start exploiting non-traditional methods to promote their ventures, acquire customers and assemble venture capital (Lee et al., 2008). Scholars such as Reuber and Fischer (2011:661) state that '[…] advances in information and communication technologies have been identified as enablers of international entrepreneurship'. The internet makes available an infrastructure that facilitates entrepreneurial business processes and as a result allows entrepreneurs to exploit business opportunities in a relatively instant and inexpensive way (Reuber and Fischer, 2011; Agrawal et al., 2011). Entrepreneurs and nascent ventures increasingly pursue online strategies to create, develop and internationalise their businesses on the side of the traditional (venture) capital market (Witt and Brachtendorf, 2006; Eckhardt et al., 2006). Specialised online-ecosystems offer entrepreneurs "tailor-made" solutions and tools to monetise their business opportunities through more dynamic and potentially greater market oriented approaches (Belleflamme et al., 2011; Ordanini et al., 2011). However, despite the increase of innovative online facilitated mechanisms which aim to support entrepreneurs towards their business opportunity exploitation and formation processes, the venture capital literature has paid partial attention to that development. We still have incomplete understanding about how crowdfunding supports entrepreneurs and what impact it has on entrepreneurial venture creation processes. But the different underlying mechanisms of crowdfunding seem to induce specific modifications of traditional entrepreneurial processes.

This paper aims to explore and investigate specific processes of entrepreneurial ventures related to legitimacy creation and capital assembly in reward-based crowdfunding. In contrast to traditional venture capital mechanisms, where institutional investors judge the credibility of entrepreneurial ventures and assess the provision of capital inflows based on metrics deriving from the (venture) capital market (Mason and Stark, 2004), the crowdfunding mechanism offers a different group of investors. Crowdfunding changes the target funder group from professional investors to "amateurs" or even just interested people who are not actually

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investing, but rather pre-finance a service or product. Hence, it is likely that financial resource assembly is facilitated through different legitimacy creation processes (Mollick, 2012).

By focusing on the entrepreneurial legitimacy creation through crowdfunding, this paper addresses a research gap in current crowdfunding literature. Crowdfunding creates a stimulating research area to study entrepreneurial legitimacy creation and capital assembly processes as it provides transparent and altered features and moves resource assembly into an online context. Crowdfunding not only creates an online-based social-network facilitated venture capital supply ecosystem, but further provides additional interesting features related to seed- and early-stage capital management techniques and risk distribution opportunities for entrepreneurs and investors. Therefore, this study aims (1) to extend our knowledge about the crowdfunding mechanism by particularly focusing on its role for entrepreneurs as a venture capital stream, and (2) to understand business pitch strategies to influence online network dynamics in order to nurture and facilitate business legitimacy for entrepreneurial ventures. We aim to investigate the strategies and processes that entrepreneurs deploy to nurture legitimacy for their entrepreneurial projects in reward-based crowdfunding. The research question that guide our study is *how do entrepreneurs create project legitimacy and how does the process impact the financial outcome in reward-based crowdfunding?*

RESEARCH MOTIVATION

Crowdfunding describes an interesting non-traditional venture capital mechanism for entrepreneurs. The concept of crowdfunding has been around for hundreds of years and has strong links to concepts such as the (family) partnership system in the late middle age (Lane, 1944), charitable fundraising (Bremner, 1996; Ingenhoff and Koelling, 2009) and microfinance (Morduch, 1999). But with technological progress in recent years the development of an online crowdfunding infrastructure was enabled which facilitated the emergence of new structures and institutions within the crowdfunding phenomenon.

A recent crowdfunding industry report identified 813 online crowdfunding platforms in 2012, representing an annual grow of 180% listing over 1.1 million crowdfunding projects globally (Massolution, 2013). Accordingly, it is no surprise that the phenomenon of crowdfunding is usually associated and characterised as an online fundraising mechanism. However, the process of raising socially-embedded capital can also take place in an offline setting (Belleflamme et al., 2011). Yet, the introduction of innovative online crowdfunding platforms such as Indiegogo (Indiegogo, 2013) or Kickstarter (Kickstarter, 2013) led the crowdfunding mechanism into the development of a standardised and professionalised capital ecosystem for entrepreneurial businesses. Ingram et al. (2013:1) argue that those specialised platforms are at ‘the heart of crowdfunding [and] drive the implementation of the crowdfunding model’. Crowdfunding platforms developed into critical capital intermediates (Lehner, 2013) and take the role of institutional actors within the venture capital industry as they ‘initiate changes that contribute to transforming existing, or creating new, institutions’ (Ingram et al., 2013:1). While the number of online crowdfunding platforms increased, the number of crowdfunding projects stayed relatively steady. The global investment volume for 2012 recorded a 81% annual growth resulting in a total of US$2.7bn. The increase seems to originate from a higher average project funding size. The average crowdfunding project size in 2012 was US$1,400 (donation-based crowdfunding), US$2,300 (donation-reward mix), US$2,300 (rewards), US$4,700 (lending), and US$190,000 (equity-based crowdfunding) (Massolution, 2013).

With increasing attention from policy-maker, practitioners, media and society the crowdfunding market is expected to continue to grow in a fast pace. Among entrepreneurial ventures the crowdfunding mechanism gain increasing legitimacy and acceptance because it enables entrepreneurs the opportunity to seek for higher funding goals than the initial "average" crowdfunding project. With its increasing role and influence on the traditional venture capital industry, it is important to integrate the crowdfunding phenomenon into a scholarly discussion in the entrepreneurship field. The potential prospects for entrepreneurs to discover and exploit business opportunities create interesting questions relating to the examination and interpretation of specific entrepreneurial actions and processes that aim to facilitate the legitimacy and resource assembly process through crowdfunding. Scholars such as Mollick (2012) highlight the important role of crowdfunding for entrepreneurial resource assembly and state that 'further work is needed to test the ways in which crowdfunding supports or undermines traditional views of how ventures succeed and raise capital' (Mollick, 2012:21). Further, Ley and Weaven (2011:103) point out that 'crowdfunding may provide access to socially embedded capital that is typically not available to entrepreneurs' and 'the success and longevity of crowdfunding in start-up finance may depend on ensuring the model is appropriately engaged'. The academic field recognises crowdfunding as an innovative entrepreneurial tool to acquire capital; however, crowdfunding research is still embryonic and in continues state of flux as it develops. The concept itself is still limited understood by researcher, policymaker and practitioners; therefore there is a need to provide a better understanding about crowdfunding through more research activity in this direction (Lehner, 2013).

THEORETICAL BACKGROUND

A large body of entrepreneurship literature revolves around central research questions such as why, when and how do entrepreneurs discover and exploit business opportunities and what is the short- and long-term outcome of their activities (Shane and Venkataraman, 2000). Key issues in this context are how nascent entrepreneurs manage and finance initial activities to facilitate early-stage development and firm creation (Shane and Cable, 2002). We know that nascent and small firms have specific difficulties such as the absence of non-financial resources or capital to access important venture capital sources in order to advance firm development (frequently characterised as 'liability of newness', see Stinchombe, 1965). Accordingly, scholars are interested in understanding how entrepreneurs and their ventures are able to overcome specific issues associated with nascent ventures through studying business techniques and actions of entrepreneurs to facilitate capital and resource access (Hitt et al., 2011; Ciabuschi et al., 2012). Understanding capital assembly and resource mobilisation processes of seed- and early-stage firms establish fundamental research subjects (Cumming, 2012). While the internet provides novel possibilities for entrepreneurs to manage and develop entrepreneurial activities, current research remain to focus on traditional venture capital streams as they continue to create important ecosystems for entrepreneurs. In this context, a large amount of literature focuses on traditional entrepreneurial finance instruments such as equity financing through Venture Capital firms (Bengtsson and Wang, 2010, Smolarski and Kut, 2011) or business angel investors (Harrison et al., 2010, Ramadani, 2009), and traditional debt finance models such as bank loans (Huyghebaert et al., 2007). Those studies investigate the role of specific mechanism and institutions to advance our understanding about their impact on entrepreneurial venture formation processes and development.

However, due to increased web-enabled business activities it is important to investigate the unique characteristics of internet-enabled venture capital mechanism such as crowdfunding and study the influence of innovative instruments for entrepreneurial processes. Crowdfunding takes traditional business processes that were carried out "offline" into an

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online environment, where entrepreneurs engage in specific online activities to nurture and facilitate business development. Stakeholder groups involved in crowdfunding are confronted with novel settings and different investment dynamics. Therefore, it is of interest to study how crowdfunding influences specific processes and activities associated with firm's legitimacy creation and resource assembly processes.

LITERATURE REVIEW

Crowdfunding as transaction mechanism

Most crowdfunding can be categorized into the four distinctive crowdfunding models: donation-, reward-, lending- and equity-based crowdfunding. Each model reveals unique differences to traditional financing mechanism, but the fundamental features that are associated with crowdfunding activities are valid in each model: enabling entrepreneurs to immerse into a social-network that is formed by a highly distributed group of individuals (the crowd) in order to actively engage with them to provide capital infusions for a specific entrepreneurial project or venture in exchange of in/tangible return on investment.

The donation- and reward-based crowdfunding model appear to be close related to social entrepreneurship activities, and the lending- and equity-based model more connected to traditional finance and capital issues. While the donation-based crowdfunding model establishes an interesting research area for the social entrepreneurship field (Lehner, 2013), the remaining three models create interesting research areas that can be linked with traditional venture capital literature as they enable and facilitate innovative entrepreneurial activities directed towards capital assembly (Mollick, 2013). In the reward-, lending-, and equity-crowdfunding model a tangible or monetary exchange takes place, creating a comparable contractual relationship between the entrepreneur and stakeholders as in traditional venture capital instruments (Ley and Weaven, 2011; Agrawal et al., 2011). Lambert and Schwienbacher (2010) explain that crowdfunding is not primarily enabling nascent ventures to raise financial capital, but in addition provides an ecosystem that might facilitate broader resource exchange between stakeholders than solely the exchange of financial capital. Their findings imply that the possibility to use the community to increase market awareness and receive customers feedback were motivations for entrepreneurs to opt up for crowdfunding as well (Lambert and Schwienbacher, 2010).

Belleflamme et al. (2011) study crowdfunding from a price discrimination theoretical perspective and associate crowdfunding with a pre-ordering model. Their results illustrate the rational of entrepreneurs to select crowdfunding rather than traditional investor- or creditor-based funding due to the possibility to implement price-discrimination and increase profitability of the capital assembly process. Especially crowdfunding campaigns through reward-based crowdfunding platforms increasingly have pre-order mechanism integrated in their reward-structure (e.g. invest US$10 and receive the music album). This method offers an interesting capital management technique as it provides a cash flow channel that fuels organic business growth in early business stages (Vanacker and Manigart, 2010; McKelvie and Wiklund, 2010).

Moreover, crowdfunding is often categorized as a particular alternative funding method for creative and social ventures. Lehner (2013) addresses crowdfunding in this context and highlights that the crowdfunding mechanism provides a venture capital model that includes social oriented investment criteria rather than financially driven principles. Crowdfunding provides a financial stream which adapt to the requirements of social or nascent ventures because '[…] crowd investors do not look much at collaterals or business plans, but at the ideas and core values of the firm […] and thus at its legitimacy' (Lehner, 2013:2). He characterises crowdfunding as a ‘specialised financial market’ for social entrepreneurs, where traditional financial performance metrics are inapplicable and social-psychological factors are more important. As a result, investment activities are influenced by different forms of rewards and entrepreneurial narrative sense-making. The possibility to leverage the social network and embrace consumer-entrepreneur interaction facilitates the social features of crowdfunding.

However, reward- and equity-crowdfunding investment motivations might not be as different as previous literature demonstrates (Mollick, 2013). Investors in equity-crowdfunding also seem to follow emotional and social-psychological investment motivations more than financial ones. Investors want to be part of an entrepreneurial endeavor and do not focus their investment decisions on future exit options. This is evident by looking at current equity-crowdfunding contracts, which are generally long-term and non-voting equity investment contracts (e.g. 10 year investment) that do not pay out dividends. Therefore, it seems that the rewards in equity-crowdfunding are similar to the rewards in reward-crowdfunding: supporting and being part of an entrepreneurial firm. In general, crowdfunding creates a reliable mechanism to nurture or improve venture legitimacy and assemble resources by active and dynamic engagement with the community. Therefore, entrepreneurial activities likely need to be adapted to new interaction methods provided by online crowdfunding platforms.

In a study that includes approximately 47,000 crowdfunding projects that were listed on Kickstarter (2013), Mollick (2012) provides additional understanding on specific characteristics of crowdfunding platforms. His research analyses the project pitches to provide descriptive insights into the dynamics of crowdfunding projects to determine success drivers of crowdfunding. Mollick’s (2012) work highlights that unsuccessful projects fail to raise their funding goal by large amount while successful projects exceed their funding goals by relatively small amounts. On the one hand, this crowdfunding outcome might be explained by the “wisdom of the crowd” phenomenon (Surowiecki, 2004), where individual investment decision making processes are indirectly influenced by believes and behaviors of the collective group (Burtch et al., 2011; Zhang and Liu, 2012). On the other hand, it can be argued that the specific “all-or-nothing” crowdfunding model (investment is only paid-off when the funding goal is achieved) may influence the investment decision process by directing individuals’ investment into projects that are more likely to succeed (Mollick, 2012). Independently of one another, the business pitch quality establishes the critical investment decision factor, similar to traditional investors (Mollick, 2013). Mollick (2012) adopts Chen et al.’s (2009) approach of preparedness as a signal of project quality (Pollack et al., 2012) and highlights the positive impact of visual communication (Clarke, 2011) in crowdfunding pitches for capital acquisition success.

Crowdfunding as social exchange

While issues related to the financial transaction processes in crowdfunding establish interesting research subjects, the social dynamics in the crowdfunding ecosystem create fundamental influencing variables for capital exchange through crowdfunding. Crowdfunding is constructed around the relationships of social networks. ‘Entrepreneurs who cannot identify or create a community around their product so that this community enjoys additional benefits, will hardly ever opt for crowdfunding’ (Belleflamme et al., 2011:23). In this context, peer-effects play an important factor. Social processes such as specific beliefs, actions and communications are publicly observable and are likely to influence future individual outcomes in the community (Ward and Ramachandran, 2010). Therefore, the crowdfunding process offers a dynamic approach to acquire financial capital, where specific interactions with the community influence financial resource allocation (Burtch et al., 2011).

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Entrepreneurial ventures and projects that are not able to achieve an active engagement with the crowd are less likely to succeed in their financial capital assembly process.

The role of geography and geographical proximity in venture capital investment establish important research issues in the venture capital literature (Lerner, 1995, 1998; Chen et al., 2009). For traditional venture capital mechanism the geographical location of the entrepreneurial business plays an important role to be more likely to access specific and critical resources. Harrison et al. (2010) argue that resource owner characteristically invest in close geographic proximity to mitigate investment risk. Long distance resource infusion is scarce in nascent ventures, resulting in the creation of geographical investment clusters (Rocha, 2004). However, further development of information technology allows the progression of internet markets that have the potential to dilute specific traditional social and business related barriers (Anderson, 2004). Accordingly, crowdfunding might have the potential to shift traditional entrepreneurial venture capital distribution to a more evenly capital distribution throughout the entrepreneurial venture population by diluting specific clusters. While the adaptation of the long tail phenomenon of the internet to crowdfunding (Anderson, 2004) would suggest that traditional investment criteria associated with geography, industry and business clusters are diminished, literature suggests that those clusters are still existing and valid in crowdfunding (Mollick, 2012). It is evident that geography continues to play an important role in crowdfunding and can be correlated to crowdfunding success (Agrawal et al., 2011; Mollick, 2012). Entrepreneurs' offline relationships influence the available online network and therefore limit the potential of crowdfunding to overcome long-distance investment barriers. Moreover, we might assume that online crowdfunding dilutes typical high-growth business investment approaches and enables entrepreneurial businesses a resource stream that otherwise would not be able to assemble capital through a traditional investment vehicle. However, the presence of traditional business clusters in crowdfunding is reflected through the uneven geographical distribution of projects from specific categories. Moreover, crowdfunding success seems to be correlated to geographical areas that are associated with higher entrepreneurial activity (Mollick, 2012). Higher crowdfunding activities from urban areas, and specific project category domination connected to the dominant industries in each geographical area can be reported (e.g. technology oriented projects in San Francisco). Therefore, geographic proximity in investment activities is not diminished and still valid in online mediated capital assembly processes.

Legitimacy and new ventures

In order to understand why some nascent entrepreneurial activities develop into firm entity and others not, literature frequently highlights the influential role of firm legitimacy. Forming ventures legitimacy is critical and establishes an important resource for key entrepreneurial processes and activities that subsequently lead to firm formation (Ahlstrom and Bruton, 2002). Lack of legitimacy restricts access to prospective strategic resource sources and consequently negatively affects early-stage development (Alvarez and Busenitz, 2001; Tornikoski and Newbert, 2007). In this context, scholars demonstrate that initial entrepreneurial actions are primarily directed towards legitimacy creation, with the aim to subsequently facilitate further, faster and more efficient external capital acquisition (Lounsbury and Glynn, 2001; Tornikoski and Newbert, 2007).

The possession of legitimacy can be understood as a firm related asset that firms either have due to their resources or which they need to acquire through specific actions (Zimmerman and Zeitz, 2002). Legitimacy establishes a critical role for entrepreneurs to engage in business activities and processes with stakeholders. Entrepreneurs must actively form legitimacy to access external stakeholders and secure external resource inflow (Mason and Harrison, 2000; Chen et al., 2009). Different influential factors have been identified that affect the entrepreneurial ventures legitimacy creation, such as the level of education, experience and heterogeneity of the entrepreneurial team (Cohen and Dean, 2005; Packalen, 2007; Balboa and Marti, 2007; Zimmerman, 2008; Dalziel et al., 2011), the institutionalisation of the entrepreneurial story in a business plan (Aldrich and Fiol, 1994; Delmar and Shane, 2004) and the utilisation of existing certificates and authorisations to build reputation (Rao, 1994; Sorescu et al., 2007). Entrepreneurs must be capable to exploit those influential factors effectively to promote their ventures legitimacy through their interactions (Baron and Markman, 2003; Anderson, 2005).

Delmar and Shane (2004) argue that firm legitimacy is the most important factor for early-stage ventures. All other activities such as developing social ties or assembling and recombining resources depend on the legitimacy of the nascent firm. Lounsbury and Glynn (2001) illustrate that initial entrepreneurial strategies in new venture formation processes are primarily directed towards legitimacy creation. Legitimacy is important as the nascent ventures activities depend more on stakeholder perception rather than on financial performance in early stages. The legitimacy which is transmitted through entrepreneurs' communication and stories are the vehicles by which resource acquisition is facilitated - '[…] stories can provide needed accounts that explain, rationalize, and promote a new venture to reduce the uncertainty typically associated with entrepreneurship' (Lounsbury and Glynn, 2001:546).

The relatively large amount of publications on entrepreneurial narrative implies that the process of storytelling in early-stage ventures is an essential ingredient to establish firm legitimacy (Martens et al., 2007). By packaging the firms intangible and tangible resources into a meaningful bundle, entrepreneurial narrative strategies mitigate the uncertainty of external stakeholders and mobilise potential resource streams to provide resource inflows (Shane and Cable, 2002; Smith and Anderson, 2004). Research on entrepreneurial narrative ascertains that effectively created stories can leverage existing entrepreneurial resources and play an intermediate role between external stakeholders and entrepreneurs (Martens et al., 2007). Further, entrepreneurial narrative strategies are critical to access external institutions and their resources (O'Connor, 2004; Martens et al., 2007).

Legitimacy-building and crowdfunding

In accordance with research that analyses the influential role of entrepreneurial narrative by looking at initial public offering prospectuses (Martens et al., 2007), or by following an entrepreneurial business through its early-stage development to understand the changes and shapes of creating a firm story to increase the investment opportunities (O'Connor, 2004), we likewise expect that the entrepreneurial narrative and particular actions play an important role in crowdfunding to facilitate legitimacy creation within the online-network and to fuel capital assembly. However, within the crowdfunding mechanism, entrepreneurs are able to facilitate legitimacy not only by communicating a story but moreover by establishing a narrative which is interactive and emotionally attached to the community through specific online related features such as visual updates, interactive responses and other communication methods which are uniquely associated with crowdfunding. Moreover, active engagement with the community allows nascent ventures to establish legitimacy through their customers (Reuber and Fischer, 2005).

Crowdfunding creates a legitimacy and capital assembly method which is built around interactive group dynamics. It establishes a different setting compared to traditional legitimacy and capital assembly approaches. Therefore, it is necessary to explore the process

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of legitimacy creation to understand why some ventures are successful and others fail in their resource assembly process through crowdfunding.

Tornikoski and Newbert (2007) illustrate that the actions entrepreneurial ventures take may be more critical than the firm related characteristics to understand the development and formation of organisations. They distinguish between conforming legitimacy and strategic legitimacy. Conforming legitimacy is formed by the unique resources the nascent firm holds and therefore is closely related to a resource-based perspective of the firm (Penrose, 1959). Resources are critical for the firm's development (Barney, 1991, Conner, 1991) and it is 'the firm's unique bundle of resources that is different from competitor firm that are potentially valuable and contribute to a firm's competitive advantage' (Alvarez and Busenitz, 2001:756). In this context, the resource bundle builds the strategic firm legitimacy that enables nascent ventures to overcome the liability of newness (Stichcombe, 1965) and facilitates firm's growth, performance and survival. Resources act as legitimacy drivers for the new venture, where resources support the firm to overcome its lack of reputation and bypass barriers to access capital by supporting the development of an external network through their business processes (Ebben and Johnson, 2006). Hence, resources can be considered as a legitimacy source, representing a measurable unit for the firms' value creation process or act as a moderating role for new business development stages (Wiklund and Shepherd, 2003).

Strategic legitimacy, on the other side, is created by specific actions which are aimed to manipulate the external audience's perception (Tornikoski and Newbert, 2007). The idea of strategic legitimacy can be associated to the cultural entrepreneurship concept (Lounsbury and Glynn, 2001) and postulates that legitimacy is created by entrepreneurial activities and processes rather than through venture related resources. To increase legitimacy it is important not to narrow the perspective on internal resources, but also study particular actions in nascent ventures as they influence the perception of the external audience and hence impact the legitimacy of the firm – '[…] what nascent entrepreneurs do may be more important than whom they are and what product-markets they intend to serve in their quest of legitimacy' (Tornikoski and Newbert, 2007:313).

Taking those two concepts of legitimacy creation into consideration, we can argue that both concepts are applied by the venture capital industry. However, the traditional venture capital industry seems to judge firms' legitimacy based on the set of resources a nascent firm holds. This might explain why institutional investment activities are more likely to take place in later stages of the venture development rather than in the seed- or early-stages, as ventures legitimacy can be measured more accurate through resources. Institutional capital sources judge the credibility of entrepreneurial ventures based on metrics deriving from the capital market, which are mainly focused on firm related tangible resources. Through crowdfunding entrepreneurs are able to create legitimacy not primarily by their resources, but moreover by strategic activities. In contrast to institutional sources crowdfunding provides a mechanism that actively facilitates legitimacy creation through interactive community features and therefore creates a much more dynamic environment to nurture and build legitimacy. Moreover, entrepreneurs are able to control and adjust their legitimacy through their crowdfunding activities by proactive strategies.

Accordingly, it can be expected that the crowdfunding mechanism offers an altered approach for entrepreneurs to actively create strategic legitimacy through the online-network setting. While entrepreneurs were seeking legitimacy to advance their business activities from few specific and sophisticated institutional gatekeepers, the internet provides a different legitimacy perspective where resource assembly seems to be triggered by altered legitimacy factors. Tornikoski and Newbert (2007:330) demonstrate in their study that 'legitimacy may be more effectually obtained via active efforts than by relying on the passive characteristics of the individual, organization, and environment'. This supports the idea of crowdfunding as a more dynamic and interactive approach for entrepreneurs to establish legitimacy for their ventures and hence supports capital assembly and entrepreneurship. However, our understanding about entrepreneurial actions and processes that facilitate the legitimacy creation and financial capital acquisition through crowdfunding is limited. This paper aims to contribute to the body of entrepreneurial legitimacy literature by broadening our understanding of legitimacy creation to non-traditional venture capital mechanism, an important research issue with growing interest in the entrepreneurship field.

METHODOLOGY

Current crowdfunding literature analyses the non-traditional venture capital mechanism in the context of online crowdfunding activities. Research frequently utilises data gathered from specific online crowdfunding platforms. Those specialised social networks and communities provide a large amount of publicly available data that can be used to measure the market size, specific developments and dynamics in the crowdfunding market. In general it is difficult to identify and capture seed- and early-stage investment activities as the venture capital industry is relatively opaque. The market usually realise specific investment activities once they are officially communicated by large institutional investment firms. We can report the same opaque characteristic for offline crowdfunding activities. Consequently, current data about the crowdfunding industry is primarily collected through online crowdfunding platforms.

The foundation of several web-enabled crowdfunding platforms since 2007 provided entrepreneurs specific online social-network platforms, where individuals with similar interest and motivations create an affinity group network. Those platforms increase the networking and venture capital assembly experience for both entrepreneurs and the community of investors. Crowdfunding platforms bundle entrepreneurial ventures and create an entrepreneurial ecosystem that aims to simplify entrepreneurial resource-seeking activities and customers or investors resource-provision processes by employing standardised features to search and facilitate financial capital exchange. Further, those platforms professionalised the crowdfunding infrastructure by establishing relative structured approaches to list ventures and investment offerings, but also to deal with financial transaction processes. Altogether, those specialised platforms address specific requirements of entrepreneurial ventures that seek for financial capital through crowdfunding. Therefore, crowdfunding platforms provide an accurate market insight as they bundle crowdfunding projects and provide a relative comprehensive approach to follow entrepreneurial processes and track the final outcomes. However, as a consequence, our current knowledge about crowdfunding is primarily based on activities that take place through online crowdfunding platforms.

Little is known about entrepreneurial legitimacy in crowdfunding and to explore entrepreneurial legitimacy creation in crowdfunding this study applies an empirical research method. This paper aims to identify specific patterns and causalities in the crowdfunding mechanism to facilitate current knowledge about entrepreneurial legitimacy creation in innovative online venture capital settings. An explorative analysis based on a novel dataset that was collected from Kickstarter (2013) is applied. Explorative research supports the identification of specific patterns and causalities and subsequently facilitates further research in new or less investigated research areas (Blaikie, 2011). Kickstarter establishes a leading reward-based crowdfunding platform in terms of registered members and listed entrepreneurial projects. According to Kickstarter's official statistics, a total of approximately 110,000 projects were launched through Kickstarter since its inception in 2008, reporting an investment volume of US$753 million that was provided by circa 4.6 million individual backers (Kickstarter Statistics, 2013). In terms of crowdfunding success rate, Kickstarter reports that around 47,154 projects were successful (43%) in their financial capital assembly,

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capturing an investment volume of US$643 million (85% of the total investment volume). Around 60,009 projects (55%) were unsuccessfully funded with a total investment volume of US$84 million, representing 11% of the total investment volume on Kickstarter (Kickstarter Statistics, 2013).[1]

Data collection

While Kickstarter provides a snapshot of the raw data behind its platform, this study applies a web data extraction method to capture more specific data from the crowdfunding platform (Kosala and Blockeel, 2000; Chang et al., 2006). The adapted data collection method is in accordance with previous studies on crowdfunding (Mollick, 2012). Web data extraction programs can be utilised to capture predetermined data from websites in an automatic approach (Thelwall, 2001). Such data collection techniques are increasingly accredited by academics with the purpose to analyse phenomena taking place in an online environment (Berger and Milkman, 2012; Mollick 2012).

We were able to capture the entrepreneurial activities of all projects that were listed on Kickstarter under the geographical area of New York between June and July 2012. By collecting variables such as the project funding target, number of backers, reward-level structure, and other project related data we are able to study entrepreneurial practices in the development of legitimacy creation and capital assembly in reward-based crowdfunding. The data, which represents 421 projects and captures an investment volume of US$3,517,500 provided by a total of 44,610 backers, enables a more specific snapshot of the current underlying entrepreneurial legitimacy formation practices and link them to the financial outcome in reward-based crowdfunding.

Empirical results

Descriptive statistics

Descriptive statistics of the main variables are provided in Table 1. The main variables are presented in a cross tabulation in order to illustrate the results of the entire sample but also for the subgroups of successful, unsuccessful and cancelled projects. This allows examining relationships within the data that are otherwise not apparent when analysing only the total sample size. The classification offers a better perspective to explore and investigate the key success driver in crowdfunding. Those variables can then be associated and discussed in connection with specific legitimacy creation activities.

From the total sample of 421 projects, 229 projects (54.4%) successfully achieved their funding target, 176 projects (41.8%) were unsuccessful in their crowdfunding and 16 projects (3.8%) were identified that cancelled their crowdfunding campaign (Table 1). The success rate in the sample is about 10% higher than the official Kickstarter statistics (Kickstarter Statistics, 2013). The sample exhibits a strong deviation in terms of project's funding target in reward-based crowdfunding. The minimum funding target in the sample is US$57, and the maximum funding target is US$1,000,000. The average funding target for our sample size is US$19,651. However, the average final funding is US$8,347. The largest project achieved a final funding of US$287,342. The average number of backers for projects is 106 individual backers. The largest backer number for one crowdfunding project is 4,242. The average funding per backer is US$81.27.

[1] The provided percentages do not equal 100% as numbers were rounded.

Funding target and final outcome

Comparing successful with unsuccessful projects provide understanding of key success drivers in crowdfunding (Table 1). Successful projects tend to have a much lower funding target (US$9,415) in comparison to unsuccessful (US$32,002) and cancelled (US$30,281) projects. Accordingly, it seems that it is important for project initiators to be transparent and honest with the required funding goal. Further, a financial breakdown of associated costs in the business pitch might support to create a legitimate request of the funding goal (Achleitner et al., 2013; Sievers, 2013). A relatively high funding goal might be perceived as negative legitimacy for the firm. The final funding average of successful projects is US$12,807. That means that on average successful projects tend to be over-funded by 32.6%. In terms of unsuccessful and cancelled projects the funding ratio illustrates that projects fail to achieve their funding goal by large margin, and on average only achieve 11.56% and 6.08% of the funding goal respectively. Those results may imply that there are strong dynamics on platforms that amplify a centralised distribution of capital towards projects that tend to be more likely to succeed (Mollick, 2012). Whether this can be explained through projects legitimacy features or through specific platform related mechanism (e.g. short-listing on the main page) is unclear and requires further investigation.

Funding period and reward-levels

In terms of the crowdfunding campaign duration and reward-level structure minor differences between successful and unsuccessful projects can be identified (Table 1). Average campaign days for unsuccessful crowdfunding projects are 37 and for successful projects 33 days. In general, project initiators tend to apply Kickstarter's suggested campaign duration default of 30 days (Kickstarter, 2013). In terms of the reward-level structures it is not possible to make a clear implication about the specific effect on success or failure. While we observe that the average number of reward-levels seem to be relatively similar for successful and unsuccessful projects, it can be deduced that creative oriented projects (e.g. art, design and publishing) implement a higher number of reward-levels (Table 2). The result for that might be that creative projects not only offer tangible rewards, but tend to integrate mixed intangible/tangible rewards. This allows project initiators to incorporate additional reward-levels in order to incorporate supplementary social-psychological investment incentives.

Visual pitch

Crowdfunding platforms allow project initiators additionally to a textual 'business plan', to include context through visual presentation. 365 projects, representing 86.7% of the sample incorporated a visual pitch in their crowdfunding campaign (Table 1 and 2). Out of all projects that have implemented a video pitch, 208 projects were successfully funded (57%). Kickstarter encourages project initiator to utilise videos in their funding pitches and state that '[…] a video is by far the best way to get a feel for the emotions, motivations, and character of a project. It's a demonstration of effort and a good predictor of success' (Kickstarter, 2013). As communicated by crowdfunding platforms, a key characteristic of crowdfunding is that fundraising activities are facilitated by new social media communication techniques over the internet (Lehner, 2013). Literature highlights the importance of visual communication and the use of visual symbols by entrepreneurs to increase legitimacy and develop support for nascent venture (Clarke, 2011). The findings reveal the importance of visual pitches to attain support and funding for the entrepreneurial project. Visual interaction allows entrepreneurs to actively create and manage emotions of stakeholders (Clarke, 2011). This result emphasises the more social-psychological rather than rational business oriented legitimacy creation process in reward-based crowdfunding.

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Team structure

Based on prior venture capital literature we know that structure and characteristics of entrepreneurial teams play an important role in terms of acquiring financial resources (Kotha and George, 2012; Zhao et al., 2013). Table 3 exhibits the different entrepreneurial team structures that are available in the sample. 320 fundraising projects (76%) were created by individual entrepreneurs and only 36 crowdfunding campaigns (8.40%) were formed by an entrepreneurial team. Organisations created 65 funding projects (15.40%). Crowdfunding might establish a funding channel for ventures formed by individual entrepreneurs, which are otherwise less able to access traditional capital sources due to investor's preferences to invest in entrepreneurial teams rather than in individual entrepreneurs (Maschke and Knyphausen-Aufseß, 2012).

DISCUSSION AND CONCLUSION

Recently the phenomenon of crowdfunding has experienced increasing attention from practitioners such as entrepreneurs, policy-makers and economists due to the non-traditional approach it offers to access and assemble venture capital for seed- and early-stage businesses. At the same time, research on crowdfunding is growing and we experience increasing interest. It is important to provide academic and rigorous research to identify the distinctive features and dynamics of online-driven business activities such as crowdfunding to be able to support practitioners and policy-makers to utilise internet-related entrepreneurial mechanism in a supportive way.

Crowdfunding provides an innovative investment experience for investors and an entrepreneurial involvement for individuals who are just interested in a project or business. For entrepreneurs, crowdfunding provides the opportunity to immerse in a community that can be exploited as a financial capital vehicle. On the other side, crowdfunding can also be characterised as a marketplace where resources can be shared in order to support a specific project or business by providing a one-off experience for the community. Whereas crowdfunding emerged as an alternative capital management approach for entrepreneurs to pre-fund sales and to overcome the young firm's "funding gap", more recently crowdfunding starts to detach itself from the traditional venture capital industry and offers a disintermediated alternative to traditional venture finance by moving resource assembly into a new context.

This paper identified particular entrepreneurial activities and revealed that specific features of the crowdfunding mechanism have an impact on the general mind-set of project initiators and the community in terms of entrepreneurial legitimacy creation and resource assembly. The utilised dataset provides interesting insights into characteristics that can be associated with success or failure in crowdfunding, and consequently are associated with legitimacy creation processes. Successful crowdfunding projects have more efficiently exploited specific mechanism on crowdfunding platforms than unsuccessful projects.

Crowdfunding seems to keep a predominantly concentration of creative oriented projects. Such projects are able to offer additional social-psychological reward-levels that motivate the community to be involved. Additionally, visual elements in the project pitch tend to improve crowdfunding success. In terms of the team structure, it appears that crowdfunding facilitates individual entrepreneurs to initiate and develop a business project. Prior literature highlights that the entrepreneurial team represents a critical factor of traditional venture capital investment-decision making processes. In crowdfunding this factor does not seem to create a valid investment-decision factor for the community as most projects were created by individual entrepreneurs.

While this study offers further understanding of some dynamics that take place in crowdfunding, research on crowdfunding is still limited. And while the crowdfunding industry continue to grow in a fast pace the competition for financial capital on crowdfunding platforms will intensify. The density of competition is likely to influence entrepreneurial activities and processes and the quality of future fundraising campaigns. It is possible to experience alterations in terms of business pitch features and legitimacy factors as crowdfunding is continuously evolving and the dynamic characteristics of the community strongly influence the market.

This paper aimed to advance our knowledge about the implications of the reward-based crowdfunding mechanism on the entrepreneurial legitimacy creation process and to facilitate our understanding of how entrepreneurs achieve success in crowdfunding. While our findings contribute to theories of entrepreneurial legitimacy creation processes by studying entrepreneurial practices and its outcomes in reward-based crowdfunding, further research is required as current studies are outcome oriented and utilise quantitative methods to explore and explain specific patterns in crowdfunding. Existing knowledge lacks understanding of the business processes that are associated with crowdfunding outcome. It is therefore necessary to move crowdfunding research into more qualitative research methods in order to provide deeper understanding of specific entrepreneurial activities and processes. Moreover, qualitative research would enable to capture a broader picture of the crowdfunding industry and allow to link offline activities with online processes. It is important to disclose offline activities to understand online crowdfunding processes and outcomes as our current understanding is built on knowledge that originates from activities on online crowdfunding platforms. While this paper focuses on specific variables that are captured for crowdfunding projects, further work is required to analyse more qualitative features of crowdfunding project pitches such as textual and visual pitches. Such future studies will allow us to gain deeper understanding about the legitimacy creation of projects in terms of entrepreneurial narrative.

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Appendices

Table 1 Descriptive statistics

Final Outcome

Variables	successful								unsuccessful							
	Count	Min	Mean	Median	Max	SD	Row N %	Sum	Count	Min	Mean	Median	Max	SD	Row N %	Sum
Funding Target	229	100.00	9415.10	5000.00	100000.00	14078.55			176	57.00	32001.89	10000.00	1000000.00	83012.24		
Final Funding	229	100.00	12806.87	5850.00	287342.00	26134.07			176	0.00	3242.66	285.00	53422.00	8106.44		
Funding ratio	229	15.00	132.57	110.33	953.50	79.95			176	0.00	11.56	4.07	67.40	16.22		
Backer number	229	5.00	168.92	78.00	4242.00	372.63			176	0.00	32.69	6.00	515.00	72.15		
Funding per backer	229	7.08	87.64	69.44	728.75	73.07			176	0.00	74.60	50.25	1006.62	104.00		
Days	229	8.00	33.11	30.00	60.00	11.27			176	10.00	36.82	30.00	60.00	12.86		
Pitch Video	229						54.4%	208	176						41.8%	143
Reward Levels	229	2.00	9.03	8.00	33.00	4.13			176	1.00	8.59	7.50	31.00	4.71		

Final Outcome

Variables	cancelled								Total							
	Count	Min	Mean	Median	Max	SD	Row N %	Sum	Count	Min	Mean	Median	Max	SD	Row N %	Sum
Funding Target	16	1500.00	30281.25	10000.00	124000.00	37602.29			421	57.00	19650.57	6500.00	1000000.00	56166.83		
Final Funding	16	0.00	665.25	250.00	4550.00	1110.43			421	0.00	8347.09	3101.00	287342.00	20547.55		
Funding ratio	16	0.00	6.08	1.58	56.88	13.91			421	0.00	77.18	100.80	953.50	85.19		
Backer number	16	0.00	8.94	6.00	37.00	9.71			421	0.00	105.89	40.00	4242.00	286.91		
Funding per backer	16	0.00	63.54	43.83	227.50	60.85			421	0.00	81.27	63.78	1006.62	87.12		
Days	16	21.00	37.19	32.50	60.00	11.62			421	8.00	34.81	30.00	60.00	12.09		
Pitch Video	16						3.8%	14	421						100.0%	365
Reward Levels	16	1.00	8.81	9.00	16.00	3.56			421	1.00	8.84	8.00	33.00	4.36		

Table 2 Cross tabulation project categories

		Final Outcome																											
		unsuccessful							successful							cancelled							Total						
Main Category	Variables	Count	Row N %	Sum	Max	Mean	Median	Min	Count	Row N %	Sum	Max	Mean	Median	Min	Count	Row N %	Sum	Max	Mean	Median	Min	Count	Row N %	Sum	Max	Mean	Median	Min
Art	Funding Target	18	48.6%	1389357	1000000	77187	9500	57	18	48.6%	116730	25000	6485	5500	500	1	2.7%	3500	3500	3500	3500	3500	37	100.0%	1509587	1000000	40800	6500	57
	Final Funding	18	48.6%	119916	53422	6662	915	0	18	48.6%	140082	26561	7782	6956	830	1	2.7%	270	270	270	270	270	37	100.0%	260268	53422	7034	2456	0
	Funding ratio	18	48.6%	295.60	63.75	16.42	6.47	0.00	18	48.6%	2206.40	171.70	122.58	110.75	100.75	1	2.7%	7.71	7.71	7.71	7.71	7.71	37	100.0%	2509.71	171.70	67.83	63.75	0.00
	Backer number	18	48.6%	725	264	40	12	0	18	48.6%	1838	317	102	71	17	1	2.7%	2	2	2	2	2	37	100.0%	2565	317	69	36	0
	Funding per backer	18	48.6%	1753.92	250.00	97.44	98.93	0.00	18	48.6%	1420.00	141.81	78.89	72.93	31.48	1	2.7%	135.00	135.00	135.00	135.00	135.00	37	100.0%	3308.92	250.00	89.43	81.87	0.00
	Pitch Video	18	48.6%	13	1	1	1	0	18	48.6%	17	1	1	1	0	1	2.7%	1	1	1	1	1	37	100.0%	31	1	1	1	0
	Days	18	48.6%	616	60	34	30	10	18	48.6%	528	46	29	30	17	1	2.7%	30	30	30	30	30	37	100.0%	1174	60	32	30	10
	Reward Levels	18	48.6%	173	30	10	7	2	18	48.6%	165	17	9	9	6	1	2.7%	10	10	10	10	10	37	100.0%	348	30	9	9	2
Comics	Funding Target	3	42.9%	46500	27000	15500	12500	7000	4	57.1%	24500	10000	6125	5750	3000	0	0.0%						7	100.0%	71000	27000	10143	7000	3000
	Final Funding	3	42.9%	3703	3603	1234	100	0	4	57.1%	38638	21372	9660	7108	3051	0	0.0%						7	100.0%	42341	21372	6049	3603	0
	Funding ratio	3	42.9%	14.77	13.34	4.92	1.43	0.00	4	57.1%	573.67	213.72	143.42	129.13	101.70	0	0.0%						7	100.0%	588.44	213.72	84.06	101.70	0.00
	Backer number	3	42.9%	43	40	14	3	0	4	57.1%	1407	962	352	184	78	0	0.0%						7	100.0%	1450	962	207	78	0
	Funding per backer	3	42.9%	123.41	90.08	41.14	33.33	0.00	4	57.1%	138.83	39.12	34.71	38.75	22.22	0	0.0%						7	100.0%	262.24	90.08	37.46	38.43	0.00
	Pitch Video	3	42.9%	2	1	1	1	0	4	57.1%	4	1	1	1	1	0	0.0%						7	100.0%	6	1	1	1	0
	Days	3	42.9%	95	45	32	30	20	4	57.1%	142	45	36	35	28	0	0.0%						7	100.0%	237	45	34	32	20
	Reward Levels	3	42.9%	32	17	11	8	7	4	57.1%	65	32	16	14	6	0	0.0%						7	100.0%	97	32	14	13	6
Dance	Funding Target	1	10.0%	3000	3000	3000	3000	3000	9	90.0%	64500	16700	7167	5000	2000	0	0.0%						10	100.0%	67500	16700	6750	4150	2000
	Final Funding	1	10.0%	511	511	511	511	511	9	90.0%	85346	31028	9483	5200	2075	0	0.0%						10	100.0%	85857	31028	8586	4372	511
	Funding ratio	1	10.0%	17.03	17.03	17.03	17.03	17.03	9	90.0%	1094.34	258.57	121.59	103.75	101.96	0	0.0%						10	100.0%	1111.37	258.57	111.14	103.56	17.03
	Backer number	1	10.0%	9	9	9	9	9	9	90.0%	628	153	70	57	26	0	0.0%						10	100.0%	637	153	64	54	9
	Funding per backer	1	10.0%	56.78	56.78	56.78	56.78	56.78	9	90.0%	1161.63	294.12	129.07	88.58	40.69	0	0.0%						10	100.0%	1218.41	294.12	121.84	78.50	40.69
	Pitch Video	1	10.0%	1	1	1	1	1	9	90.0%	8	1	1	1	0	0	0.0%						10	100.0%	9	1	1	1	0
	Days	1	10.0%	55	55	55	55	55	9	90.0%	255	35	28	30	13	0	0.0%						10	100.0%	310	55	31	30	13
	Reward Levels	1	10.0%	6	6	6	6	6	9	90.0%	63	9	7	8	5	0	0.0%						10	100.0%	69	9	7	7	5
Design	Funding Target	12	66.7%	753220	275000	62768	34685	1850	5	27.8%	131800	100000	26360	11500	300	1	5.6%	50000	50000	50000	50000	50000	18	100.0%	935020	275000	51946	17185	300
	Final Funding	12	66.7%	154123	47181	12844	6115	428	5	27.8%	176732	135002	35346	16295	375	1	5.6%	935	935	935	935	935	18	100.0%	331790	135002	18433	8001	375
	Funding ratio	12	66.7%	289.92	67.40	24.16	21.55	4.07	5	27.8%	674.27	158.26	134.85	135.00	114.31	1	5.6%	1.87	1.87	1.87	1.87	1.87	18	100.0%	966.06	158.26	53.67	25.55	1.87
	Backer number	12	66.7%	1916	515	160	68	8	5	27.8%	3227	2279	645	293	7	1	5.6%	16	16	16	16	16	18	100.0%	5159	2279	287	79	7
	Funding per backer	12	66.7%	1145.54	200.69	95.46	92.66	30.57	5	27.8%	246.51	59.24	49.30	53.57	36.95	1	5.6%	58.44	58.44	58.44	58.44	58.44	18	100.0%	1450.49	200.69	80.58	58.48	30.57
	Pitch Video	12	66.7%	10	1	1	1	0	5	27.8%	4	1	1	1	0	1	5.6%	1	1	1	1	1	18	100.0%	15	1	1	1	0
	Days	12	66.7%	434	60	36	32	30	5	27.8%	197	54	39	38	30	1	5.6%	35	35	35	35	35	18	100.0%	666	60	37	35	30
	Reward Levels	12	66.7%	139	28	12	9	5	5	27.8%	38	10	8	9	4	1	5.6%	9	9	9	9	9	18	100.0%	186	28	10	9	4

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Table 2 Cross tabulation project categories (continues)

		Final Outcome																											
		unsuccessful							successful							cancelled							Total						
Main Category	Variables	Count	Row N %	Sum	Max	Mean	Median	Min	Count	Row N %	Sum	Max	Mean	Median	Min	Count	Row N %	Sum	Max	Mean	Median	Min	Count	Row N %	Sum	Max	Mean	Median	Min
Fashion	Funding Target	19	73.1%	221500	100000	11658	6000	1000	6	23.1%	38000	13500	6333	5000	1000	1	3.8%	10000	10000	10000	10000	10000	26	100.0%	269500	100000	10365	5500	1000
	Final Funding	19	73.1%	20492	11189	1079	175	0	6	23.1%	160414	128722	26736	8218	750	1	3.8%	100	100	100	100	100	26	100.0%	181006	128722	6962	228	0
	Funding ratio	19	73.1%	126.79	21.50	6.67	4.35	0.00	6	23.1%	1675.62	953.50	279.27	109.75	15.00	1	3.8%	1.00	1.00	1.00	1.00	1.00	26	100.0%	1803.41	953.50	69.36	5.20	0.00
	Backer number	19	73.1%	227	115	12	3	0	6	23.1%	2202	1181	367	184	24	1	3.8%	1	1	1	1	1	26	100.0%	2430	1181	93	4	0
	Funding per backer	19	73.1%	1555.57	500.00	81.87	44.27	0.00	6	23.1%	324.77	108.99	54.13	43.76	7.08	1	3.8%	100.00	100.00	100.00	100.00	100.00	26	100.0%	1980.34	500.00	76.17	44.43	0.00
	Pitch Video	19	73.1%	12	1	1	1	0	6	23.1%	5	1	1	1	0	1	3.8%	1	1	1	1	1	26	100.0%	18	1	1	1	0
	Days	19	73.1%	608	50	32	30	15	6	23.1%	187	35	31	30	30	1	3.8%	30	30	30	30	30	26	100.0%	825	50	32	30	15
	Reward Levels	19	73.1%	151	16	8	7	3	6	23.1%	84	33	14	11	8	1	3.8%	4	4	4	4	4	26	100.0%	239	33	9	8	3
Film	Funding Target	55	47.0%	2109423	200000	38353	27000	500	60	51.3%	1064506	100000	17742	9875	100	2	1.7%	129000	124000	64500	64500	5000	117	100.0%	3302929	200000	28230	15000	100
	Final Funding	55	47.0%	190368	27147	3461	763	0	60	51.3%	1234622	124114	20577	10637	100	2	1.7%	490	307	245	245	183	117	100.0%	1425480	124114	12184	4325	0
	Funding ratio	55	47.0%	656.59	59.10	11.94	2.68	0.00	60	51.3%	7246.11	350.00	120.77	106.63	100.00	2	1.7%	3.91	3.66	1.96	1.96	.25	117	100.0%	7906.61	350.00	67.58	100.00	0.00
	Backer number	55	47.0%	1728	179	31	13	0	60	51.3%	12971	1976	216	111	5	2	1.7%	21	15	11	11	6	117	100.0%	14720	1976	126	46	0
	Funding per backer	55	47.0%	4837.39	1006.62	87.95	57.19	0.00	60	51.3%	6780.36	728.75	113.01	83.83	20.00	2	1.7%	50.97	30.50	25.49	25.49	20.47	117	100.0%	11668.72	1006.62	99.73	75.74	0.00
	Pitch Video	55	47.0%	53	1	1	1	0	60	51.3%	58	1	1	1	0	2	1.7%	2	1	1	1	1	117	100.0%	113	1	1	1	0
	Days	55	47.0%	2214	60	40	35	15	60	51.3%	2076	60	35	30	10	2	1.7%	81	56	41	41	25	117	100.0%	4371	60	37	30	10
	Reward Levels	55	47.0%	503	31	9	8	3	60	51.3%	613	24	10	9	4	2	1.7%	24	16	12	12	8	117	100.0%	1140	31	10	9	3
Food	Funding Target	0	0.0%						3	100.0%	32000	20000	10667	7000	5000	0	0.0%						3	100.0%	32000	20000	10667	7000	5000
	Final Funding	0	0.0%						3	100.0%	40139	21777	13380	10150	8212	0	0.0%						3	100.0%	40139	21777	13380	10150	8212
	Funding ratio	0	0.0%						3	100.0%	418.13	164.24	139.38	145.00	108.89	0	0.0%						3	100.0%	418.13	164.24	139.38	145.00	108.89
	Backer number	0	0.0%						3	100.0%	581	272	194	234	75	0	0.0%						3	100.0%	581	272	194	234	75
	Funding per backer	0	0.0%						3	100.0%	258.58	135.33	86.19	93.06	30.19	0	0.0%						3	100.0%	258.58	135.33	86.19	93.06	30.19
	Pitch Video	0	0.0%						3	100.0%	3	1	1	1	1	0	0.0%						3	100.0%	3	1	1	1	1
	Days	0	0.0%						3	100.0%	90	30	30	30	30	0	0.0%						3	100.0%	90	30	30	30	30
	Reward Levels	0	0.0%						3	100.0%	36	19	12	9	8	0	0.0%						3	100.0%	36	19	12	9	8
Games	Funding Target	5	62.5%	207612	100000	41522	5000	600	2	25.0%	29500	15000	14750	14750	14500	1	12.5%	10000	10000	10000	10000	10000	8	100.0%	247112	100000	30889	12250	600
	Final Funding	5	62.5%	10774	10419	2155	101	1	2	25.0%	29652	15081	14826	14826	14571	1	12.5%	1195	1195	1195	1195	1195	8	100.0%	41621	15081	5203	676	1
	Funding ratio	5	62.5%	17.71	10.42	3.54	1.94	.16	2	25.0%	201.03	100.54	100.52	100.52	100.49	1	12.5%	11.95	11.95	11.95	11.95	11.95	8	100.0%	230.69	100.54	28.84	7.72	.16
	Backer number	5	62.5%	214	197	43	4	1	2	25.0%	572	435	286	286	137	1	12.5%	37	37	37	37	37	8	100.0%	823	435	103	24	1
	Funding per backer	5	62.5%	144.24	52.89	28.85	24.25	1.00	2	25.0%	141.03	106.36	70.52	70.52	34.67	1	12.5%	32.30	32.30	32.30	32.30	32.30	8	100.0%	317.57	106.36	39.70	33.49	1.00
	Pitch Video	5	62.5%	5	1	1	1	1	2	25.0%	2	1	1	1	1	1	12.5%	1	1	1	1	1	8	100.0%	8	1	1	1	1
	Days	5	62.5%	164	40	33	31	30	2	25.0%	64	34	32	32	30	1	12.5%	41	41	41	41	41	8	100.0%	269	41	34	32	30
	Reward Levels	5	62.5%	56	15	11	12	7	2	25.0%	20	12	10	10	8	1	12.5%	7	7	7	7	7	8	100.0%	83	15	10	11	7

Table 2 Cross tabulation project categories (continues)

		Final Outcome																											
		unsuccessful							successful							cancelled							Total						
Main Category	Variables	Count	Row N %	Sum	Max	Mean	Median	Min	Count	Row N %	Sum	Max	Mean	Median	Min	Count	Row N %	Sum	Max	Mean	Median	Min	Count	Row N %	Sum	Max	Mean	Median	Min
Music	Funding Target	20	30.3%	262951	100000	13148	6000	500	43	65.2%	200044	12000	4652	4000	500	3	4.5%	35500	26000	11833	5000	4500	66	100.0%	498495	100000	7553	5000	500
	Final Funding	20	30.3%	14789	5398	739	25	0	43	65.2%	229604	13327	5340	4999	530	3	4.5%	516	230	172	186	100	66	100.0%	244909	13327	3711	2393	0
	Funding ratio	20	30.3%	201.15	67.10	10.06	.86	0.00	43	65.2%	5315.30	342.00	123.61	108.62	100.00	3	4.5%	7.01	4.13	2.34	2.00	.88	66	100.0%	5523.46	342.00	83.69	104.53	0.00
	Backer number	20	30.3%	174	54	9	1	0	43	65.2%	3024	221	70	60	13	3	4.5%	15	6	5	5	4	66	100.0%	3213	221	49	35	0
	Funding per backer	20	30.3%	973.81	255.00	48.69	25.00	0.00	43	65.2%	3630.32	270.27	84.43	59.52	35.20	3	4.5%	108.50	57.50	36.17	31.00	20.00	66	100.0%	4712.63	270.27	71.40	52.42	0.00
	Pitch Video	20	30.3%	11	1	1	1	0	43	65.2%	38	1	1	1	0	3	4.5%	3	1	1	1	1	66	100.0%	52	1	1	1	0
	Days	20	30.3%	762	60	38	30	13	43	65.2%	1498	60	35	30	8	3	4.5%	118	48	39	40	30	66	100.0%	2378	60	36	30	8
	Reward Levels	20	30.3%	162	15	8	8	3	43	65.2%	354	22	8	8	2	3	4.5%	30	11	10	10	9	66	100.0%	546	22	8	8	2
Photography	Funding Target	7	50.0%	54000	25000	7714	5000	500	4	28.6%	36600	16800	9150	9000	1800	3	21.4%	77000	55000	25667	18500	3500	14	100.0%	167600	55000	11971	5000	500
	Final Funding	7	50.0%	7435	6405	1062	200	0	4	28.6%	43138	16935	10785	11547	3109	3	21.4%	740	715	247	25	0	14	100.0%	51313	16935	3665	281	0
	Funding ratio	7	50.0%	47.07	25.62	6.72	4.00	0.00	4	28.6%	531.65	172.72	132.91	129.07	100.80	3	21.4%	4.57	3.86	1.52	.71	0.00	14	100.0%	583.29	172.72	41.66	4.70	0.00
	Backer number	7	50.0%	119	92	17	4	0	4	28.6%	491	223	123	111	47	3	21.4%	9	8	3	1	0	14	100.0%	619	223	44	8	0
	Funding per backer	7	50.0%	276.21	69.62	39.46	33.00	0.00	4	28.6%	348.66	145.99	87.17	70.20	62.28	3	21.4%	114.38	89.38	38.13	25.00	0.00	14	100.0%	739.25	145.99	52.80	54.77	0.00
	Pitch Video	7	50.0%	7	1	1	1	1	4	28.6%	4	1	1	1	1	3	21.4%	2	1	1	1	0	14	100.0%	13	1	1	1	0
	Days	7	50.0%	227	48	32	30	25	4	28.6%	160	60	40	35	30	3	21.4%	125	60	42	35	30	14	100.0%	512	60	37	30	25
	Reward Levels	7	50.0%	44	11	6	6	3	4	28.6%	40	12	10	11	6	3	21.4%	27	14	9	7	6	14	100.0%	111	14	8	7	3
Publishing	Funding Target	23	50.0%	355070	70000	15438	10100	120	20	43.5%	156425	40000	7821	6000	250	3	6.5%	168000	100000	56000	60000	8000	46	100.0%	679495	100000	14772	8000	120
	Final Funding	23	50.0%	31182	13886	1356	125	0	20	43.5%	454430	287342	22722	6773	474	3	6.5%	6398	4550	2133	1073	775	46	100.0%	492010	287342	10696	1321	0
	Funding ratio	23	50.0%	180.80	63.12	7.86	4.07	0.00	20	43.5%	3354.89	718.36	167.74	119.44	100.15	3	6.5%	59.24	56.88	19.75	1.29	1.07	46	100.0%	3594.93	718.36	78.15	26.28	0.00
	Backer number	23	50.0%	391	151	17	4	0	20	43.5%	7604	4242	380	79	20	3	6.5%	42	20	14	14	8	46	100.0%	8037	4242	175	21	0
	Funding per backer	23	50.0%	1085.61	197.16	47.20	47.50	0.00	20	43.5%	1613.93	416.44	80.70	56.94	19.75	3	6.5%	416.99	227.50	139.00	134.13	55.36	46	100.0%	3116.53	416.44	67.75	56.00	0.00
	Pitch Video	23	50.0%	16	1	1	1	0	20	43.5%	16	1	1	1	0	3	6.5%	2	1	1	1	0	46	100.0%	34	1	1	1	0
	Days	23	50.0%	788	60	34	30	14	20	43.5%	664	60	33	30	10	3	6.5%	81	30	27	30	21	46	100.0%	1533	60	33	30	10
	Reward Levels	23	50.0%	144	16	6	6	1	20	43.5%	171	18	9	9	2	3	6.5%	29	11	10	9	9	46	100.0%	344	18	7	7	1
Technology	Funding Target	2	66.7%	12000	10000	6000	6000	2000	1	33.3%	10000	10000	10000	10000	10000	0	0.0%						3	100.0%	22000	10000	7333	10000	2000
	Final Funding	2	66.7%	75	45	38	38	30	1	33.3%	10000	10000	10000	10000	10000	0	0.0%						3	100.0%	10075	10000	3358	45	30
	Funding ratio	2	66.7%	1.95	1.50	.98	.98	.45	1	33.3%	100.00	100.00	100.00	100.00	100.00	0	0.0%						3	100.0%	101.95	100.00	33.98	1.50	.45
	Backer number	2	66.7%	3	2	2	2	1	1	33.3%	233	233	233	233	233	0	0.0%						3	100.0%	236	233	79	2	1
	Funding per backer	2	66.7%	52.50	30.00	26.25	26.25	22.50	1	33.3%	42.92	42.92	42.92	42.92	42.92	0	0.0%						3	100.0%	95.42	42.92	31.81	30.00	22.50
	Pitch Video	2	66.7%	2	1	1	1	1	1	33.3%	1	1	1	1	1	0	0.0%						3	100.0%	3	1	1	1	1
	Days	2	66.7%	50	35	25	25	15	1	33.3%	45	45	45	45	45	0	0.0%						3	100.0%	95	45	32	35	15
	Reward Levels	2	66.7%	12	8	6	6	4	1	33.3%	9	9	9	9	9	0	0.0%						3	100.0%	21	9	7	8	4
Theater	Funding Target	11	16.7%	217700	100000	19791	8000	1500	54	81.8%	251453	40000	4657	3500	100	1	1.5%	1500	1500	1500	1500	1500	66	100.0%	470653	100000	7131	4000	100
	Final Funding	11	16.7%	17340	5330	1576	1021	0	54	81.8%	289976	40903	5370	4575	304	1	1.5%	0	0	0	0	0	66	100.0%	307316	40903	4656	3867	0
	Funding ratio	11	16.7%	185.44	54.53	16.86	8.13	0.00	54	81.8%	6968.25	304.00	129.04	114.94	82.57	1	1.5%	0.00	0.00	0.00	0.00	0.00	66	100.0%	7153.69	304.00	108.39	107.45	0.00
	Backer number	11	16.7%	204	89	19	6	0	54	81.8%	3904	269	72	61	16	1	1.5%	0	0	0	0	0	66	100.0%	4108	269	62	55	0
	Funding per backer	11	16.7%	1124.44	410.00	102.22	53.49	0.00	54	81.8%	3963.12	351.76	73.39	65.39	15.20	1	1.5%	0.00	0.00	0.00	0.00	0.00	66	100.0%	5087.56	410.00	77.08	64.34	0.00
	Pitch Video	11	16.7%	11	1	1	1	1	54	81.8%	48	1	1	1	0	1	1.5%	1	1	1	1	1	66	100.0%	60	1	1	1	0
	Days	11	16.7%	467	60	42	36	30	54	81.8%	1676	60	31	30	12	1	1.5%	54	54	54	54	54	66	100.0%	2197	60	33	30	12
	Reward Levels	11	16.7%	90	14	8	9	3	54	81.8%	409	16	8	7	3	1	1.5%	1	1	1	1	1	66	100.0%	500	16	8	7	1

Table 3 Entrepreneurial team structure

Team structure	Frequency		Successful		Unsuccessful	
	#	%	#	%	#	%
One female	93	22.1	64	68.8	29	31.2
One male	227	53.9	105	46.3	122	53.7
Two female	9	2.1	7	70.0	2	30.0
Two male	13	3.1	9	69.2	4	30.8
One female / one male	10	2.4	5	50.0	5	50.0
Three female	1	0.2	1	100.0	0	0.0
One female / two male	1	0.2	1	100.0	0	0.0
Three female / one male	1	0.2	1	100.0	0	0.0
Four male	1	0.2	1	100.0	0	0.0
Organisation	65	15.4	35	53.8	30	46.2
Total	421	100.0	229	54.4	192	45.6

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