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Volatility Forecasting Models: A Literature Review

*Andreea Avadanei**

1 Introduction

Volatility forecasts are vital for various financial applications. According to Taylor (2005) volatility inputs are widely used for hedging activities, risk management, portfolio optimization, pricing of options and other groups of derivatives. Poon and Granger (2003) underline that based on financial volatility dimension as risk measure, policy makers often use this concept to get an overview on the volatility of financial market and of the economic conditions.

Given the volatility implications, which held the attention of researchers and practitioners alike reflecting its importance for investment activities, value-at-risk analyses or monetary policy making, inter alia, the academic community offers a great amount of publication on various forecasting methods.

However, the large econometrics literature on financial market volatility (inter alia,; Bollerslev, et al., 2006; Kayahan, et al., 2002; Bollerslev and Zhou, 2006; Andersen, et al., 2006; Benavides and Capistran, 2009) did not reach a consensus about which method is best in terms of forecasting accuracy. Thus, it remains a controversial topic.

2 A comparative analysis of various volatility forecasting methods

Poon and Granger (2003) argue that in order to forecast volatility, scholars use basically two classes of models: *time series-based models* and *options based-models*.

Time series models include models based on *past volatility* like historical averages of squared price returns, Autoregressive Conditional Heteroscedasticity-type models (ARCH-type), and we note here ARCH, GARCH (generalized ARCH) or EGARCH (Exponential GARCH), alongside *stochastic volatility* (SV) models.

Option-based volatility models, also known as *implied volatilities* consider Black-Scholes- type models (Black and Scholes, 1973), the free model, and models based on hard data on volatility trading.

However, besides the above-mentioned two main categories, there is a whole plethora of other forecasting methods such as nonparametric, neural networks, genetic programming, and models based upon time change and duration, but their predicative power is considerably lower and they are being used in a substantially smaller number of papers (Poon and Granger, 2003).

The researchers who believe that *time series* volatility forecast models are superior explain their orientation by the fact that they are specifically constructed to capture volatility persistence, as a prominent feature of financial volatility. Other specialists say that compared to time series-based models, implied volatility is superior because it refers to market forecasts and thus is based on a broader set of data and involves a forward-looking component.

Under these conditions, several scholars point to a combined number of volatility forecasts. A deeper analyze of composite specifications for volatility market is extremely important (Patton and Shepard, 2007; Andersen, at al., 2006). For example, Becker and Clements (2008) demonstrate that combination forecasts of S&P volatility is more accurate than individual

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forecasts. A mix of *ex ante* and forward-looking forecasts can also be applied in order to forecast the exchange rate volatility (Pong et al., 2004; Benavides, 2006). The advantage of this approach is that it comprises features of various methods in one single forecast with a greater prediction power of the volatility of different financial assets. Moreover, Timmermann (2006) emphasizes that the combined method displayed strong results in the case of other financial and economic variables too.

Benavides and Capistran (2009) provide empirical evidence that mixed time series and option implied volatility forecasts offer greater accuracy than individual methods, unconditional combination and hybrid forecasts. Their superiority lies in both considering the conditional estimated results of each model under current data, and combining individual forecasts. Their analysis is based on daily spot return of the Mexican peso-US dollar exchange rate and uses intraday exchange rate data with 5 minute time window to design the *realized volatility* (the volatility of the period from time t and $t + \Delta T$) as proxy for daily volatility.

The findings of their study indicate higher accuracy in case of a combination of ARCH-type forecast and an option-based method using time-varying weights. Benavides and Capistran (2009) recommend the application of conditional combination of forecasts for various fundamentals like interest rates, inflation and other financial assets.

Even though both ARCH and GARCH models capture *leptokurtosis* and *volatility clustering* because of their asymmetric distribution they are unable to model the *leverage effect* (stock prices are negatively correlated with volatility changes). Another issue that arises when using GARCH family of models is related to the failure to include the *thick tails properties* of high frequency time series.

In order to overcome these problems, the GARCH family of models was extended to a large number of different specifications such as t-GARCH, asymmetric power ARCH-APARCH, threshold GARCH-TARCH, long-memory GARCH-LMGARCH, fractionally integrated GARCH-FIGARCH, Exponential GARCH- EGARCH or Markov-switching GARCH-MSGARCH widely used to predict stock market volatility with various degrees of accuracy.

Several empirical works have illustrated the power of historical GARCH models (McMillian, et al., 2000; Claessen and Mittnik, 2004; Calvet and Fisher, 2004). By far, the ARCH universe of models is the most popular set of econometric models that describe a series with time-varying conditional variance. Some opinions argue that ARCH class of models offer great quality of volatility forecasts. In the same line, Ederington and Guan (2000) analyze the forecasting accuracy of different volatility models and stress that GARCH (1,1) is generally more suited than historical standard deviation and exponentially weighted moving average models.

However, Maris, et al., (2004) and Loudan, et al., (2000) sustained the power of asymmetries on the forecast performance of GARCH models. Similar, Awartani and Corradi (2005) studied the predictive capacity of various GARCH models and highlighted the power of asymmetric GARCH model over GARCH (1,1). Franses and Dijk (1996) analyzed the performance of the GARCH model and two of its non-linear modifications to predict weekly stock market volatility and recommended the QGARCH (Quadratic GARCH) asymmetric model as best in case of no extreme observations.

Lunde and Hansen (2001) compared a large universe of volatility models based on daily exchange rate data (Deutsche Mark (DM)/\$) and IBM stock prices. The authors analyzed the out-of-sample predictive power of the estimated models and compared various models forecasts to intra-day estimated measures of realized volatility. If comparing the estimated volatility models to a basic ARCH(1) model, the latter is considerably outperformed by other models. Thus, a competing model offers superior forecasting capacity and a much higher accuracy degree. For specialists and practitioners, this is common knowledge, because the ARCH(1)

model does not ensure the necessary level of flexibility to capture the volatility persistence. Unlike the case of ARCH(1), Hansen and Lunde (2001) findings do not indicate much arguments on GARCH(1,1) being outperformed. Their results show that from the rich family of considered competing models, none performs better than GARCH(1,1). This is somewhat unexpected, having in mind that GARCH(1,1) reflects simple announcements impact curve and it cannot produce a leverage effect.

Poon and Granger (2003) offer an extensive examination of the literature by analyzing 93 various out-of-sample volatility forecasting publications and conclude that implied volatility-based forecasts have the greatest predictive power, despite their limited appeal.

Their findings reveal that in case of historical volatility-static, MA (Moving Average) and EWMA (Exponentially Weighted Moving Average), namely GARCH and SV models, their forecasting performance is rather similar. Within the GARCH universe of models, ARCH has a lower predictive power against GARCH model, which is in turn outperformed by asymmetric GARCH.

Hansen and Lunde (2005) center the analysis on the predictive power of forecasts and on the robustness of loss functions sustaining their evaluation. In order to test the performance of two benchmark models, namely ARCH (1) and GARCH(1,1) against other 330 volatility forecasting models, the authors use the SPA (Superior Predictive Ability) test, which involves six loss functions and *realized volatility* as proxy for volatility. They work with data for returns on equity and currency series and conclude by pointing out the weak performance of ARCH(1) compared to other models for both groups of information. As for the GARCH(1,1), it displays a poor forecasting performance only in case of equity data set. The conclusions of the study clearly indicate that a basic model capturing the main volatility features of a series-GARCH(1,1) in this case, can provide the same accuracy of the results as well as more advanced models. However, the authors also prove that the omission of important volatility characteristics such as the leverage effect reduces the quality of the models' forecasts.

Besides the rich literature on *univariate* volatility models, there is a growing body of work that provides evidence on the predictive power of the different *multivariate* volatility forecasting models, using a whole range of evaluation schemes and loss functions to identify the best model.

Despite all the differences, all these papers have at least one common conclusion, and that is the inexistence of one dominant forecasting model. The only publication that uses a truly multivariate loss function underlines that basic models like EWMA have a lower predictive power than the more sophisticated GARCH-class models (Ledoit, et al., 2003).

Given the importance of forecasting for portfolio allocation, as the first step of this process, the response to the allocation problem used in the evaluation of the estimations' performance changes with the dimensions of the covariance matrix. The same Ledoit, et al. (2003) build minimum variance portfolios based on conditional covariance matrix estimates and order the standard deviation of realized standard deviation out-of-sample to identify the best model. Their concluding remarks state that sophisticated models like CCC (Constant Conditional Correlation) or BEKK (Baba, Engle, Kraft and Kroner) provide the lowest standard deviations, while EWMA gives the highest ones.

Gospodinov, et al., (2006) investigate the time series features and forecasting performance of several models in case of the S&P100 index option prices. Due to the availability of data, volatility can be considered as an *observed* rather than a *latent* phenomenon.

Because of the strong persistent nature of volatility as widely underlined in the literature, they model volatility as a long-memory and a slowly mean-reverting process based on two conditional mean models: ARFIMA (Autoregressive Fractionally Integrated Moving Average)

models and Near-integrated AR model.

They also use time-varying volatility models estimated from stock returns: EGARCH and Fractionally Integrated EGARCH (FIEGARCH) models, and SV models.

The GARCH-class of models offers a parametric alternative to estimate and forecast the unobserved volatility process from the asset returns. Because the leverage effect is always present in case of stock price information they apply the Gaussian EGARCH(1,0) of Nelson (1991):

$$(1-\beta L)(\ln(V_t)-\alpha)=g(\varepsilon_{t-1}), \quad (1)$$

where $g(\varepsilon_t)=\gamma \varepsilon_t + \delta/|\varepsilon_t| \cdot \sqrt{2/\pi}$ and $\varepsilon_t \sim N(0,1)$

β =persistence,

γ = leverage effect,

δ =size effect,

ε =error.

Moreover, to display the upward trend in the autocorrelation function of volatility, they use the fractionally integrated (FI)EGARCH (1,d,0) specification:

$$(1-\beta L)(1-L)^d (\ln(V_t)-\alpha)=g(\varepsilon_{t-1}), \quad (2)$$

where d is the fractional integration parameter.

Compared to the GARCH universe of models, the stochastic volatility model is more flexible due to the separate modeling of volatility persistence and of the returns kurtosis. Despite this advantage, because of the latent nature of the volatility phenomenon, the estimation of SV models is particularly problematic.

A deeper analysis of the autocorrelation structure of the forecast errors obtained from EGARCH, FIGARCH and SV model outputs indicates their non-optimal application for *implied volatility* (corresponding to an at-the-money option with expiry at $t + \Delta T$) forecasts because of the complex information content of the latter, involving, *inter alia*, risk adjustments and market imperfections.

Munoz et al., 2007, examine the predictive power of out-of-sample SETAR-Threshold GARCH (SETAR-TGARCH) and SETAR-THSV model against the GARCH and SV model for two return time series: IBEX35 and S&P500. The self-exciting threshold autoregressive model (SETAR), an extension of autoregressive models, has the ability to capture the asymmetric trends of a time series by its local property and attracted the attention of numerous research and practitioners.

The SETAR model is used to model time series in various fields such as oceanography, hydrology, medical sciences and economics. In the financial time series area, threshold models are considered an interesting alternative for modeling both returns and volatility. Many papers present SETAR models as a provider of higher quality forecasts than the previous family of conditional heteroskedastic models.

The inclusion of a threshold in models like GARCH(1,1) and SV offers the possibility to capture the volatility asymmetry level (one of the weaknesses of the GARCH model is that it cannot capture the asymmetry of the volatility). Earlier models such as SETAR, GARCH and SV are a part of the first-generation models class and the result of introducing a threshold is the Threshold GARCH (TGARCH) model or Threshold Stochastic Volatility (THSV).

Munoz et al. 2007, findings showed that SETAR-THSVt (with Student's t innovations) is the

best model for the IBEX35 returns. For this time series with leverage effects on the mean, the introduction of a threshold in the mean and variance equations helps improve the accuracy of the volatility forecasts. In case of the S&P500, the SVt model is flexible enough to beat the threshold models, and the best model is the simplest one. The leverage effect it's irrelevant for both return and volatility.

Yalama and Sevil (2008) use seven GARCH-type models to forecast in-sample of daily stock market volatility in ten different states from January 1, 1995 to February 21, 2007. They start by testing the stationarity of the time series based on Augmented Dickey Fuller unit root test and reject the null hypotheses for all series. The next step is about determining AR, MA, ARMA for every country in order to model the conditional mean. Finally, they estimate the seven GARCH-class models, based on the LM test results which reject the homoskedasticity assumption.

The findings of their paper point out that the accuracy of the forecast volatility model depends on the country structure, and from the *best model* to the *worst forecast* method there is EGARCH, PARCH, TARCH, IGARCH, C-GARCH GARCH, C-GARCH GARCH, GARCH-M which indicates that this group of asymmetric volatility models are superior in forecasting the stock market volatility than the historical models (table 1).

Tab. 1: The best volatility forecasting GARCH class model (as an average of countries)

	the best forecasting GARCH class model → the worst forecasting model						
AEX	PARCH	E-GARCH	TARCH	IGARCH	CGARCH	GARCH	GARCHM
ATX	EGARCH	PARCH	TARCH	GARCH	IGARCH	CGARCH	GARCHM
CAC40	PARCH	E-GARCH	TARCH	IGARCH	GARCH	CGARCH	GARCHM
DAX	EGARCH	PARCH	IGARCH	TARCH	CGARCH	GARCH	GARCHM
DJ	PARCH	TARCH	EGARCH	CGARCH	IGARCH	GARCH	GARCHM
FTSE-100	PARCH	TARCH	EGARCH	IGARCH	CGARCH	GARCH	GARCHM
IMKB-	EGARCH	PARCH	TARCH	CGARCH	GARCH	IGARCH	GARCHM
100IPC	EGARCH	GARCH	TARCH	PARCH	GARCHM	CGARCH	IGARCH
NASDAQ	TARCH	PARCH	CGARCH	GARCH	EGARCH	IGARCH	GARCHM
NIKKEI225	EGARCH	PARCH	TARCH	IGARCH	GARCH	CGARCH	GARCHM
SMI	TARCH	PARCH	GARCH	CGARCH	EGARCH	GARCHM	IGARCH
The best model as average	EGARCH	PARCH	TARCH	IGARCH	CGARCH GARCH	CGARCH GARCH	GARCHM

Source: Yalama, A., Sevil, "Forecasting World Stock Markets Volatility", International Research Journal of Finance and Economics, vol. 15, 2011, p. 172

On the other hand, there is a large body of literature that reports the poor forecasting performance of the GARCH(1,1). Several empirical studies (for example, Franses and Van Dijk, 2000) question the-out-of sample accuracy of the forecasts obtained from GARCH models, evaluated based on the forecasts' Mean Square Error (MSE).

However, there are some opinions that point out to the limited forecasting performance of the GARCH-type models as being deceptive due to the use of squared shocks as proxy for the conditional volatility. As a result, the MSE of the forecasts increase, thus providing an inaccurate evaluation of the GARCH models.

In the vast majority of empirical studies, the evaluation of GARCH (1,1) models accuracy in forecasting volatility is based on comparing its results to the volatility forecasts of a benchmark method that assumes homoskedasticity. Researchers and practitioners compare GARCH(1,1) model with the homoskedastic model using a formal statistical test that evaluates the relative

forecasting power of various econometric models.

Matei (2009) emphasizes the superiority of GARCH model to accurately forecast the volatility of stock returns with large number (thousands) of observations. He explains his choice based on a unidirectional vision of the GARCH-type models performance when compared to any other econometric forecasting method. The quality of the predictions reflects the model's capacity to assimilate the connections between the exogenous variables and the endogenous factors, by considering the autocorrelation and the interaction that may occur within the time series. The author carefully reviews 50 of the most important publications appeared ex ante 2009, papers that were focused on identifying the best and the worst volatility forecasting models in various empirical grounds. This sample of works considered only ARCH/GARCH class of models, without referring to their derivations in both groups. Cases when one author placed an ARCH/GARCH model in one of the two categories and another authors simultaneously mentioned it in another category haven't been counted.

His findings indicate a number of nineteen papers pointing out the superior performance of ARCH/GARCH derivations against other classes of tested methods such as historical volatility models, implied standard deviation models or stochastic volatility models. Out of the total of fifty papers, only six have illustrated the inferiority of ARCH/GARCH-type models proving poor performance in terms of results' accuracy and predictive power.

Another one of his arguments in the favor of GARCH family of models is related to the latent nature of volatility (inherently unobserved), which makes it impossible to exactly measure it. Thus, it can only be estimated. In this light, some of the previously mentioned works offer a new perspective on the debate that surrounds the ranking of the volatility forecast methods. They suggest that the poor performance of GARCH-class models is not a consequence of the technical parameters and building of the model, but rather a result of the incorrect specification of the true volatility measure against which the forecasting power was estimated.

Zumbach (2011) compares volatility forecast with realized and implied volatility. In case of and ARCH forecast, parameters are set a priori. The findings of his study indicate that a forecast based on a I-GARCH(1) process does not fully captures the evolution of realized volatility. An I-GARCH (2) model (two times scales, similar to GARCH(1,1) is more appropriate, while a long-memory LM-ARCH process displays correctly the dynamics of the implied and realized volatility and offers substantially more accurate forecasts for the realized volatility.

Filimonov (2011) analyzes the performances of Multifractal Random Walk (MRW)-based and GARCH-based forecasts when used to determine the volatility of exchange rates and demonstrates the superiority of MRW-based forecast over both GARCH (1,1) and t-GARCH(1,1)-based forecasts.

According to Bacry et al. (2001) MRW is the first multifractal process with continuous dilatation invariance proprieties and stationary increments and a highly attractive option against the classical multifractal models because it does not include any specific scale ratio.

The log-price is given by the following specification:

$$\log P(t) = \lim_{\Delta t \rightarrow 0} \sum_{k=1}^{t/\Delta t} \varepsilon_{\Delta t}[k] e^{\omega \Delta t [k]} \quad (3)$$

where $\varepsilon_{\Delta t}[k]$ is a Gaussian white noise and $\exp(\omega \Delta t [k])$ is a stochastic volatility which logarithm has the covariance function:

$$\text{Cov}[\omega_{\Delta t}[n], \omega_{\Delta t}[n+k]] = \begin{cases} \lambda^2 \log \frac{L}{(K+1)\Delta t}, & |k| \leq \frac{L}{\Delta t} - 1 \\ 0 & \text{otherwise} \end{cases} \quad (4)$$

Due to the increased availability of high-frequency asset price information, in recent years we witness a great amount of research publications on different measures of intraday price-based volatility (McAleer and Medeiros, 2008; Andersen et al., 2009). Several empirical studies indicate that Heterogeneous Autoregressive (HAR) model of Corsi (2009) is a very attractive alternative to build time series models in order to forecast realized volatility parameters (Andersen et al., 2007; Corsi, 2009; Busch et al., 2011). According to Martens et al. (2009) the main advantage of HAR approach is that it can include features like jumps, seasonality, leverage effects or the implications of the macroeconomic news.

Analyzing daily realized range for S&P500 index futures over the period from January 1995 to December 2006, Sokolinskiy and Dijk (2011), argue that copula-based model is superior to popular HAR method for one-day ahead volatility forecasts in terms of efficiency level and results accuracy. Within the large family of used specifications, the Gumbel copula performs best, emphasizing the importance of asymmetry and upper tail dependence for modeling volatility trends.

Febrian and Herwany (2011) use eleven different models supported by two groups of evaluation measures, namely symmetric and asymmetric error statistics to forecast the volatility in the three South-east Asian major capital markets, for JKSE (Jakarta composite index), STI (FTSE Straits Times Index, the benchmark index for Singapore stock market) and KLSE (Kuala Lumpur Stock Exchange index). Following Kumar' (2006) framework, they use 10-year data as in sample and 6-month data as out of sample to design and test the models. Their conclusions indicate GARCH model as best in case of all three indices, even if the GARCH combinations vary from one index to another. For JKSE, KLSE and STI, the respective most accurate and powerful models are JKSE GARCH (2,1), KLSE GARCH (3,1), and STI GARCH (1,1). They choose the model based on the highest Schwarz Information Criterion (SIC) absolute value. Considering SIC values, specifications of AR, MA, ARMA, ARIMA, alongside other derivations of ARCH and GARCH do not provide optimal results. The ARCH LM Test confirms the chosen models; all associated figures are higher than the 0.5% significance level, which shows that the models build do not contain any ARCH factors.

The out-of-sample models do not display a higher accuracy than the in-sample aforementioned models. This result is in the same line with several opinions in the literature who have demonstrated the inaccuracy of out-of-sample models in forecasting bond or stock prices. The findings of Febrian and Herwany (2011) study show that the root mean square error (RMSE) and the mean absolute error (MAE) indicators corresponding to these models have close values, a sign of their similar forecasting powers. RMSE and MAE are two of the most popular ways to test for the forecast performance of a model.

3 Conclusions

The ongoing discussions centered on the best model to forecast the volatility of financial assets returns have led to a significant increase of publications. There is much debate on ARCH-type models versus option implied volatilities. In spite of the general opinion advocating the advantages of option implied volatilities as most accurate method to forecast price returns volatilities, there is no universal consensus on a unique approach. The results of the statistical analysis of forecasts show either worse performance of competing models, or similar statistical accuracy. Recent trends in the macroeconomic forecasting literature indicate more and more the composite forecasts as a good way to enhance forecasting performance.

To summarize, GARCH(1,1) and stochastic volatility model are the most popular nonlinear time series models applied by the financial literature to analyze the behavior of the returns and its volatility.

Each volatility forecasting model has its own advantages and hot spots and considering such large families of techniques build to serve the same scope, it's extremely important to identify between different models the best performing one in terms of efficiency and accuracy level of predictions.

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Volatility Forecasting Models: A Literature Review

Summary

It is widely acknowledged that the accuracy of volatility forecasting has significant implications for traders, investors, risk managers-researchers and practitioners, trying to understand the dynamics of the financial market. The scope of this paper is to present a series of observations on the predictive power of the most popular forecasting models. We investigate the strengths and weaknesses of various models and explain why some perform better than others. Although there is a rich econometrics literature comparing the ability of the in-sample and the out-of-sample forecasting models to provide an exact estimation, there is no general consensus and a unique approach towards the best model.

Key words: Realized volatility; GARCH-class models; Stochastic volatility models; SETAR model, MRW process.

JEL classification: C22, C32, C54, C58.

Optimal Behavior of the Bank with Capital Sufficiency for Meeting Demand on Its Loans

*Andriy Drozd**

1 Introduction

Banks are very special and important agents in economy. Their activity affects all economy so it's important to properly understand their behavior determinants. From the position of financial forecasting, planning and management of credit operations it is very important to develop and use mathematical models and programs of the bank credit activity, that involves not only the methodological support on their implementation, but also modeling key parameters of bank's activity, assessing income under the interest rates on loans, proposing rational or even optimal control.

After the recent bank crisis Basel III proposed for banks to increase their regulatory capital to level, enough for sustaining in cases of future banking shocks. Thus, for banks it is actual to increase their capital to meet this requirement as fast as possible. This article proposes optimal behavior for increasing capital to maximum at some final moment of control. Under assumptions defined in section 3, this also leads to maximizing the profit of banks.

Objectives are: describe the assumptions necessary to construct bank model, on its basis determine the optimal loan rate, maximum profit and maximum capital of the bank at the end of the control period, analyze changes in the optimal interest rate, profit and capital depending on changes in market conditions and restrictions on loan rate.

Literature review presented in section 2. Bank model formalization under defined assumptions proposed in section 3. In section 4 optimal control problem stated and solution found. Results of this problem discussed in section 5. In section 6 modification of optimal control under restrictions on loan rate proposed. Section 7 concludes.

2 Literature review

Views on the problems of bank loans have evolved and became more sophisticated simultaneously with the change of bank operating conditions.

Part of the researchers studied the role of banks in economy. For example, Bhattacharya and Chiesa (1995) studied the problem of ownership of information. Bank regarded as an agent on market of information was studied by Campbell, Kracaw (1980) and Allen (1990). Holmström and Tirole (1993) considered a model that examines the issue of choice between direct and banking (intermediary) funding. The works of Sharpe (1990) and Rajan (1992) examined the question of relationship between banks and borrowers in the dynamics. Gorton and Pennachi (1990) drew attention to banking activities on transformation of assets that are treated as financing risky projects by risk-free deposits. Diamond (1984) proposed theoretical model that presented bank as an institution of delegated monitoring. These results explain why banks as financial intermediaries are exist, and explain key functions they perform, but didn't explain its behavior as commercial firms.

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This latter approach is called industrial organization approach and it studies the decision making of banks on different issues as commercial firm – on fund raising, maximal profit gaining, portfolio optimization and so on. Probably the most well-known model in this class, of the bank-monopoly, is proposed by Klein (1971) and Monti (1972). They described bank from microeconomic point of view, as monopolist at market, optimal loan and deposit rates, which maximizing the profit of bank, proposed there. The idea of monopolistic competition on bank market was presented by Chamberlin (1933) and one of the most common models of this class is Salop model (1979). Oligopolic version of Monti-Klein model was described by Freixas and Rochet (1999).

Problems of lending formation are studied by Blackburn (2008), Chambers et al. (2008), Hellwig (2008), Reinhart and Rogoff (2009), Wheelock (2008).

Modeling of bank in the context of control theory and using the flow model, that is based on ideas of system dynamics by Forrester (1961), studied Gryshyn, Ivanenko, Kapustyan, Kozak, Kuts, Osipenko, Umryk. In particular, Grishin (2001) proposed to consider bank in terms of control theory, and later Grishin (2004) described some incoming and outgoing bank flows. Osipenko (2005) described the flow model with linear functions of loans and deposits and set the problem of optimal control by loan and deposit rates, if all deposits provided are issued as loans. Ivanenko et al. (2011) described the flow model with a linear function of loans and deposits, with uncertainty in the volume of deposits and loans. Author proposed to use software implementation of flow model for training of bank employees in (2010a), and added to the flow model of bank advertising costs and inflow of deposits as an additional result of advertising in (2010b).

However, bank flow model does not have formalized description yet, with this model weren't stated and solved problems which led to optimal loan and deposit rates, maximal profit and maximal capital of bank with optimal control. Insufficient study of issues related to modeling the situation of bank reserve and the assessment of interest income based on interest rates for loans in the banking system led to the urgency of further research in this direction.

3 Model

One approach to modeling of banks and banking activity is to use a flow model of the bank in which the financial flow is a certain amount of money per unit of time. Flow model of bank has a number of differences, such as, flow are continuous in the model; funds, received by one of the input flows can be used to form the output flow of another type. That is, the money received by the bank, mixed in a single money supply, which can be used to form each of the outgoing flows in any proportions. Flow model of bank, in our view, is reasonable for considering of various problems in terms of control theory but still need to be developed more deeply.

Single-contour flow model of bank is describing the activity of commercial banks under the following assumptions.

Assumption A1. All profit is used to increase capital. If increasing of capital is first order task for bank it is natural to capitalize all profit. Due to it, we offer a following formula (1):

$$\dot{x}(t) = \pi(t), \tag{1}$$

where $x(t)$ = the capital of commercial bank at the moment t , $0 \leq t \leq T$
 $\dot{x}(t)$ = capital gains at the moment t ,
 $\pi(t)$ = profit of commercial bank at the moment t ,
 T = the final moment of controlling the bank.

Assumption A2. Bank controls only lending activity. For purpose of simplicity, we ignore deposit activity (therefore, this model applies to credit firms too, and loans are given from bank equity capital), interbank and costs function of a bank. Because of that, the profit consist of interest income from lending activities and it is the difference between the volume of returned loans with interest, and volume of lent loans (formula 2):

$$\pi(t) = L_{in}(t) - L_{out}(t), \quad (2)$$

where $L_{in}(t)$ = volume of returned loans with interest at the moment t ;

$L_{out}(t)$ = volume of lent loans at the moment t .

Assumption A3. The volume of issued loans at a given time depends on loan rate at this moment, thus it is exist reason and possibility in the loan rate controlling (formula 3):

$$L_{out}(t) = f(r_L(t)), \quad (3)$$

where $r_L(t)$ = loan rate at the moment t .

Assumption A4. Relationship between loans volume and loan rate is inverse, that is, the higher the loan rate for other things being equal, the smaller the volume of loans the bank will issue. It logically corresponds to the function of demand for loans.

Assumption A5. The amount of issued loans is in linear dependence from loan rate.

Assumption A6. Bank can issue any volume of loans from its demand function for loans.

Assumption A7. The loan rate is non-negative. Bank do not pays the interest to creditors, thus does not execute unprofitable activities.

Assumption A8. There is no differentiation of credit products, loan rate is single. In bank price creating process price on each product is often depends on one loan rate, called base rate (often it's for 1 year simple interest loans).

Assumption A9. The volume of loans issued is non-negative (formula 4).

$$L_{out}(t) \geq 0. \quad (4)$$

Because the relationship between the volume of issued loans and loan rate is the inverse and linear, it coincides with the function of the demand on loans. We suppose it's function of demand on loans of this concrete bank, so it can be monopolistic or not. It is therefore proposed to write it as (formula 5):

$$L_{out}(t) = L - b \cdot r_L(t), \quad (5)$$

where L, b = coefficients of linear dependence.

Although L and b appear here only as coefficients, we consider it appropriate to interpret them from an economic point of view.

Thus, with zero loan rate (the minimum loan rate for bank) the amount of issued loans will be L . Given this, this coefficient can be interpreted as an investment market capacity, the maximal amount of demand for loans (it is not unlimited due to linear function). So, $L \geq 0$, as at $L < 0$ it is violated the assumption A9.

From the coefficient b depends how much will change the volume of issued loans, if bank change a loan rate. This coefficient can be interpreted as the sensitivity of demand for loans.

Note that to some extent, this indicator characterizes the level of competition, i.e., with increasing competition, it will be higher. Thus, the model can implicitly take into account the presence in the market other banks. Assume $b > 0$ for the assumption A4 of the inverse form of dependence between the volume of issued loans and loan rates. The combination of these indicators we will further call market conditions.

It is considered that the bank has enough capital to give L loans if necessary. Since deposits are not involved, the bank must have sufficient capital for any (including maximal) amount of loans (formula 6), i.e.:

$$x(t) \geq L. \tag{6}$$

Volume of issued loans dependence from the loan rate is shown in Fig. 1.

Since $x(0) = x_0$, then also $x_0 \geq L$.

Assumption A10. Loans with interest returns back at the same time as issued.

Assumption A11. All loans with interest are returning on time.

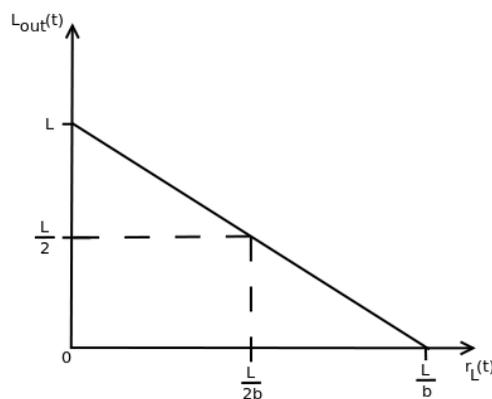
Therefore, the formula for the volume of returned loans with interest can be written as (formula 7):

$$L_{in}(t) = L_{out}(t) \cdot (1 + r_L(t)), \tag{7}$$

Or

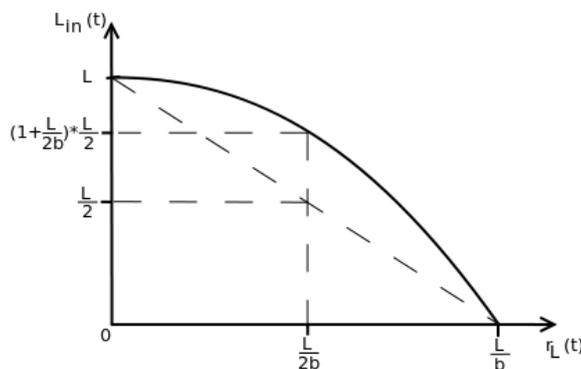
$$L_{in}(t) = (L - b \cdot r_L(t)) \cdot (1 + r_L(t)). \tag{8}$$

Fig. 1: Demand function on loans



Dependence of returned loans with interest rates from loan rate is presented in Fig. 2.

Fig. 2: Dependence of returned loans with interest rates from loan rate



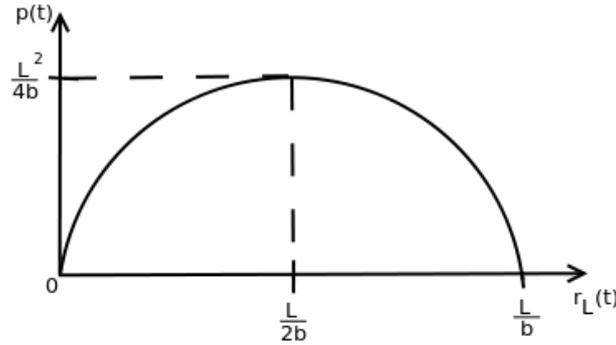
Therefore, in this model are considered three (term, return, interest) of five (term, return,

interest, differentiation, collateral) general principles of lending. Now, under assumptions A1-A11, increase of the bank's capital can be written as (formula 9):

$$\dot{x}(t) = L \cdot r_L(t) - b \cdot r_L(t)^2. \quad (9)$$

Dependence of increase in capital (profit at time t) is shown in Fig. 3.

Fig. 3: Dependence of increase in capital (profit at time t) from loan rate



4 Problem

So, let solve the problem, which is formulated as follows (formulas 10-14):

$$x(T) \rightarrow \max_{r_L(t)}, \quad (10)$$

$$\dot{x}(t) = L \cdot r_L(t) - b \cdot r_L(t)^2, \quad 0 \leq t \leq T \quad (11)$$

$$x(0) = x_0 \geq L, \quad (12)$$

$$r_L(t) \geq 0, \quad (13)$$

$$L_{out}(t) \geq 0. \quad (14)$$

Because increase of capital does not depends on the amount of capital in the current time, maximal capital at the end of control period achieved when bank is maximizing increase of capital at any moment of time during the period of control. That is why this problem has same results as profit maximization problem, which is most common problem in models of commercial banks. Derived from capital gains on the loan rate is (formula 15):

$$\frac{d\dot{x}(t)}{dr_L(t)} = L - 2 \cdot b \cdot r_L(t). \quad (15)$$

In a point of local maximum (because second derivative is negative), it will be zero (formula 16):

$$L - 2 \cdot b \cdot r_L^*(t) = 0 \quad (16)$$

It follows that the optimal loan rate equal to the (formula 17):

$$r_L^*(t) = \frac{L}{2 \cdot b}. \quad (17)$$

The maximal capital increases (or profit) (formula 18):

$$\dot{x}^*(t) = \frac{L^2}{4 \cdot b}. \quad (18)$$

Then the maximal capital of the bank at the end of control is (formula 19):

$$x^*(T) = x_0 + \frac{L^2}{4 \cdot b} \cdot T. \quad (19)$$

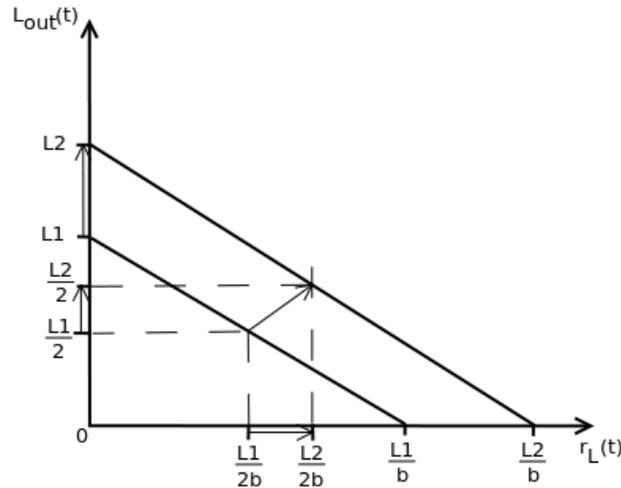
5 Results analysis

Let's analyze how market conditions changes affects bank behavior. If market conditions (L and b) do not change (which is likely in short term period), the volume of lent loans at the optimal lending rate at a time is constant (i.e. in static conditions bank don't need to change loan rate often) and equals $L_{out}^*(t) = L/2$, i.e. half of the maximum amount of demand for loans; profit at optimal loan rates at a time is constant and equals $\pi^*(t) = L^2 / 4 \cdot b$; bank's capital at the end of the control period at optimal lending rate is $x^*(T) = x_0 + L^2 \cdot T / 4 \cdot b$, the bank does not change interest rate for the period of control.

If market conditions changes (which is likely in long term period or in cases of shocks and crisis), the optimal loan rate determined by the same ratio $L/2b$, with an increase in the maximal demand for loans L (with other things being equal) increases optimal loan rate $r_L^*(t)$, optimal amount of credits issued $L_{out}^*(t)$, maximal profit $\pi^*(t)$ and maximal capital of the bank at end of control period $x^*(T)$, as shown in Fig. 4.

This increase in demand can happen due to positive change of customers behavior, increase of customers number (increase in population, new markets), increase of customers income, increase of price on substitute services (credit firms loans, securities), customers' expectations of increase in their income or loan rates in future.

Fig. 4: The volume of credits issued at moment t varies depending on the change of maximal demand for loans



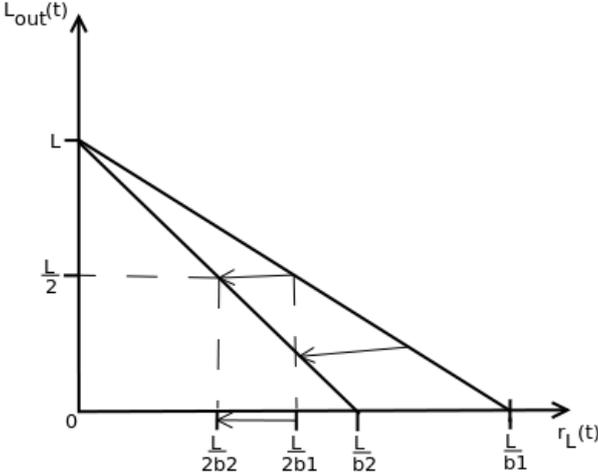
If maximal demand for loans decreases, respectively decreases optimal loan rate, optimal amount of loans issued, maximal profit and capital of the bank at the end of the control period. In other words, when the demand on loans is reduced, the bank must offer more affordable interest rate.

If sensitivity of demand for loans b increases, optimal loan rate $r_L^*(t)$, maximal profit $\pi^*(t)$ and maximal capital of the bank at the end of the control period $x^*(T)$ will decrease.

Conversely, if the sensitivity of demand for loans decreases (market became less competitive), optimal loan rate, optimal profits and capital of the bank at the end of the period with optimal

control will increase. Optimal amount of credit issued $L_{out}^*(t)$ remains unchanged regardless of changes in sensitivity of demand for loans. So, under intense competition the bank forced to reduce loan rate and vice versa - in conditions closer to the monopoly bank will increase loan rate (Fig. 5).

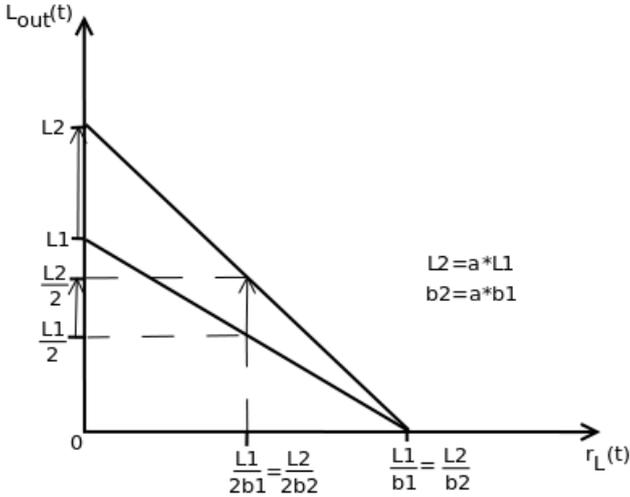
Fig. 5: The volume of loans issued at moment t varies depending on changes in the sensitivity of demand for loans



If the sensitivity of demand for loans tends to infinity, the optimal loan rate tends to zero. This repeats the result of Bertrand paradox - in a perfect competition, where producers of similar goods compete solely on price, profits will be zero, and prices of goods (loan rate) will equal costs. Since capital is own resources for banks (the cost of this resource is zero) loan rate (price) tends to zero.

If maximal demand for loans and the sensitivity of demand for loans changes in the same number of times, the optimal loan rate will not change (Fig. 6). Under linear demand function and given L and b both bank on monopoly market and bank on competitors market (with just share of market with decreased L and b same times) will choose loan rate $L/2b$ as optimal. So, this optimal rate doesn't affects by the type of market – either it monopoly or competition and this model can be used for problem solving on both types of market.

Fig. 6: The volume of loans issued at moment t varies depending on same changes both in sensitivity of demand for loans and maximal demand for loans



Although model does not limit the maximum loan rate, it does not go to infinity. When the demand for loans is zero, there is no meaning in credit activity - the amount of credit issued will be equal to zero $L_{out}^*(t) = L/2 = 0$. So, all results seem adequate to reality.

Monti-Klein model of monopolistic bank under same assumptions achieve similar optimal loan rate, although analysis of these results for linear demand function wasn't made.

6 Restrictions on loan rate

It is possible that regulator may impose some restrictions on loan rate. This section describes how it'll impact optimal loan rate and, thus, bank's behavior.

Suppose, regulator proposes restrictions on loan rate (formula 20):

$$0 \leq r_1 \leq r_L(t) \leq r_2 \leq \frac{L}{b}. \quad (20)$$

Then problem of loan rate optimization for maximization of capital can be formulated by formulas (10-14, 20). With Lagrange method we can compare previously received local maximum of loan rate and boundary loan rates. In case (21):

$$r_1 \leq \frac{L}{2 \cdot b} \leq r_2, \quad (21)$$

it's obvious that optimal loan rate will remain $L/2b$.

In case (22):

$$\frac{L}{2 \cdot b} \leq r_1 \leq r_2, \quad (22)$$

loan rate that maximize profit don't fit in restrictions. So either upper restriction on loan rate is optimal, or lower one. Let's take upper restriction on loan rate as lower restriction plus some positive delta (23):

$$r_2 = r_1 + \Delta, \quad \Delta \geq 0. \quad (23)$$

Then difference between profits with these restrictions can be written as (24):

$$\begin{aligned} & (L \cdot r_1 - b \cdot r_1^2) - (L \cdot r_2 - b \cdot r_2^2) = \\ & = (L \cdot r_1 - b \cdot r_1^2) - (L \cdot (r_1 + \Delta) - b \cdot (r_1 + \Delta)^2) = \\ & = -L \cdot \Delta + 2 \cdot b \cdot r_1 \cdot \Delta + b \cdot \Delta^2 = -\Delta \cdot (L - 2 \cdot b \cdot r_1 - b \cdot \Delta). \end{aligned} \quad (24)$$

If we write lower restriction loan rate as (25):

$$r_1 = \frac{L}{2 \cdot b} + \Delta_2, \quad \Delta_2 \geq 0, \quad (25)$$

then difference between profits with these restrictions is positive (26):

$$-\Delta \cdot (L - 2 \cdot b \cdot r_1 - b \cdot \Delta) = (-\Delta) \cdot (-2 \cdot b \cdot \Delta_2 - b \cdot \Delta) \geq 0. \quad (26)$$

That means that optimal loan rate for problem (10-14, 20) in case (22) is lower restriction (27):

$$r_L^*(t) = r_1. \quad (27)$$

Similar approach applies for case (28):

$$r_1 \leq r_2 \leq \frac{L}{2 \cdot b}. \quad (28)$$

Since (29):

$$r_1 + r_2 = 2 \cdot r_1 + \Delta \leq \frac{L}{2 \cdot b} + \frac{L}{2 \cdot b} = \frac{L}{b}, \quad (29)$$

difference between profits with these restrictions is negative (30):

$$-\Delta \cdot (L - b \cdot (2 \cdot r_1 + \Delta)) \leq 0. \quad (30)$$

That means that optimal loan rate for problem (10-14, 20) in case (28) is upper restriction (31):

$$r_L^*(t) = r_2. \quad (31)$$

As it was discussed in section 5, changes of market conditions may affect the optimal loan rate without restrictions (17) and by that shift optimal loan rate under restrictions between cases (21), (22) and (28).

7 Conclusions

Optimum loan rate, maximum profit and maximum capital at the end of control period for banks, which has only credit activity with capital, sufficient to meet its demand for loans and without delay in terms of repayment of loans, were obtained.

Assumptions for the bank flow model with exclusively lending activities and without delays in terms of repayment of loans and the bank's capital, sufficient to meet maximal demand for loans were formalized, model with such assumptions was constructed and analyzed, capital at the end of control period maximization problem was stated and its analytic solution was obtained.

The results can be used, firstly, to illustrate the credit activity of the bank, secondly, to illustrate the paradox of Bertrand in banking, thirdly, to assess maximal profit and capital depending on market conditions, fourthly, to illustrate and analyze the market situation, when both loan rates, and volumes of issued loans (as in the situation of decline in production) are reduced (which is contradictory to intuitive expectations due to linear demand function), fifth, to further develop bank models, based on these results and to formalize optimal control problems of bank, that will take into account both credit and deposit activities, the delay in terms of repayment of loans and deposits, bank capital that is insufficient to meet maximal demand for loans, interbank, costs function, differentiation of bank products.

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Optimal Behavior of the Bank with Capital Sufficiency for Meeting Demand on Its Loans

Summary

Simple bank model for explaining bank behavior was proposed. Assumptions for the bank flow model with exclusively lending activities and with bank's capital, sufficient to meet its demand for loans were formalized, model with such assumptions was constructed and analyzed, capital at the end of control period maximization problem was stated and its analytic solution was obtained. Optimal loan rate, maximal profit and capital at the end of controlling period were achieved and these results were analyzed. Influence of loan rate restrictions on optimal loan rate was studied. Some issues for further research were proposed.

Key words: Bank; Loans; Profit maximization; Capital maximization; Optimal control; Bank model.

JEL classification: C61, G21.

India: The Next FOREX Derivatives Destination?

*Abhijeet Gaikwad, Kavita Laghate**

1 Introduction

Derivatives in India are not new. Farmers used to enter into Forward contracts to hedge risk against their crops since long. However, there was always a risk of the counter-party defaulting on the contract (which remains even today in case of OTC markets). India is a conservative country and Indians are very careful and cautious when it comes to matters related to money. It has been traditionally observed that Indians tend to resort to safe ways of making money. For ex: keeping money in bank deposits, PPF, NSC etc. However, that outlook is slowly changing now.

2 Derivatives in India

With the knowledge base of the people increasing by the day and owing to higher return on the money in the capital markets, people have started investing money in it. Derivatives market is no different. Derivatives are primarily used for hedging. With the commencement of options, it is now possible to limit one's losses to a certain amount. Given below is a snapshot of the evolution of derivatives market in India.

Tab. 1: Evolution of derivatives market in India

Date	Progress
14 December 1995	NSE asked SEBI for permission to trade index futures
18 November 1996	SEBI sets up L. C. Gupta Committee to draft a policy framework for index futures
11 May 1998	L. C. Gupta Committee submitted report
7 July 1999	RBI gave permission for OTC forward rate agreements (FRAs) and interest rate swaps
24 May 2000	SIMEX hose Nifty for trading futures and options on an Indian index
25 May 2000	SEBI gave permission to NSE and BSE to do index futures trading
9 June 2000	Trading of BSE Sensex futures commenced at BSE
12 June 2000	Trading of Nifty futures commenced at NSE
31 August 2000	Trading of futures and options on Nifty to commence at SIMEX
June 2001	Trading of Equity index options at NSE
July 2001	Trading of stock options at NSE
9 November 2002	Trading of single stock futures at BSE
June 2003	Trading of Interest Rate futures at NSE
13 September 2004	Weekly options at BSE
1 January 2008	Trading of chhota(Mini) Sensex at BSE
1 January 2008	Trading of Mini Index futures & options at NSE
29 August 2008	Trading of currency futures at NSE
2 October 2008	Trading of currency futures at BSE
7 August 2009	BSE-USE form alliance to develop currency and interest rate

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Date	Progress
	derivatives markets
February 2010	Launch of Currency futures on additional currency pairs
29 October 2010	Introduction of Currency options on USD INR

Source: Compiled from BSE and NSE website

As seen from the above snapshot, deliberations for trading in derivatives have been going on for quite long and that the derivative products have been introduced in India in a phased manner. However, derivative market in India is still at its nascent stage and has a lot of potential to expand. BSE and NSE are two main exchanges on which derivatives are traded (USE is the recent exchange which has formed alliance with BSE to develop currency and interest rates derivatives markets) but NSE has more than 96% of the volumes of the derivatives which are traded in India. Let us now have a look at the products traded in the derivatives segment in BSE and NSE separately.

Tab. 2: Products traded in Derivatives segment of BSE

S. No.	Product Traded with underlying asset	Introduction Date
1	Index Futures – Sensex	June 9 2000
2	Index Options – Sensex	June 1 2000
3	Stock Options on 109 Stocks	July 9 2001
4	Stock futures on 109 Stocks	November 9 2002
5	Weekly Option on 4 Stocks	September 13 2004
6	Chhota (mini) Sensex	January 1 2008
7	Futures & Options on sectoral indices namely BSE TECK, BSE FMCG, BSE Metal, BSE Bankex and BSE Oil & Gas	N.A.
8	Currency Futures on US Dollar Rupee	October 1 2008
9	Currency Options on US Dollar Rupee (launched on USE)	October 29 2010

Source: Compiled from BSE website

Tab. 3: Products traded in Derivatives (F&O) segment of NSE

S. No.	Product Traded with underlying asset	Introduction Date
1	Index Futures – S&P CNX Nifty	June 12 2000
2	Index Options – S&P CNX Nifty	June 4 2001
3	Stock Options on 233 Stocks	July 2 2001
4	Stock futures on 233 Stocks	November 9 2001
5	Interest Rate Futures – T- Bills and 10 Years Bond	June 23 2003
6	CNX IT Futures & Options	August 29 2003
7	Bank Nifty Futures & Options	June 13 2005
8	CNX Nifty Junior Futures & Options	June 1 2007
9	CNX 100 Futures & Options	June 1 2007
10	Nifty Midcap 50 Futures & Options	October 5 2007
11	Mini index Futures & Options – S&P CNX Nifty index	January 1 2008
12	Long term Option contracts on S&P CNX Nifty index	March 3 2008
13	Currency Futures on US Dollar Rupee	August 29 2008
14	S&P CNX Defty Futures & Options	December 10 2008
15	Currency Options on US Dollar Rupee	October 29 2010

Source: Compiled from NSE website

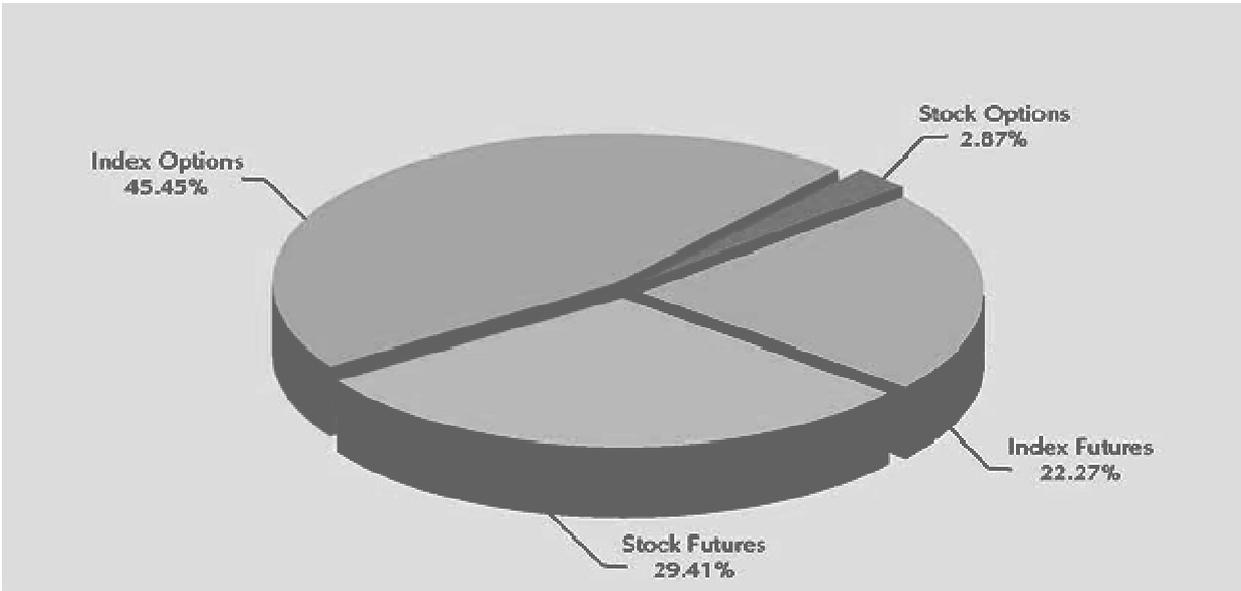
Tab. 4: Business growth of derivatives

Year	Index Futures		Stock Futures		Index Options		Stock Options		Total		Average Daily Turnover (₹ cr.)
	No. of contracts	Turnover (₹ cr.)	No. of contracts	Turnover (₹ cr.)	No. of contracts	Notional Turnover (₹ cr.)	No. of contracts	Notional Turnover (₹ cr.)	No. of contracts	Turnover (₹ cr.)	
2011-12	28335422	745169.96	33363538	862171.65	160090747	4531302.96	6653288	180998.38	228442995	6319642.87	114902.60
2010-11	165023653	4356754.53	186041459	5495756.70	650638557	18365365.76	32508393	1030344.21	1034212062	29248221.09	115150.48
2009-10	178306889	3934388.67	145591240	5195246.64	341379523	8027964.20	14016270	506065.18	679293922	17663664.57	72392.07
2008-09	210428103	3570111.40	221577980	3479642.12	212088444	3731501.84	13295970	229226.81	657390497	11010482.20	45310.63
2007-08	156598579	3820667.27	203587952	7548563.23	55366038	1362110.88	9460631	359136.55	425013200	13090477.75	52153.30
2006-07	81487424	2539574	104955401	3830967	25157438	791906	5283310	193795	216883573	7356242	29543
2005-06	58537886	1513755	80905493	2791697	12935116	338469	5240776	180253	157619271	4824174	19220
2004-05	21635449	772147	47043066	1484056	3293558	121943	5045112	168836	77017185	2546982	10107
2003-04	17191668	554446	32368842	1305939	1732414	52816	5583071	217207	56886776	2130610	8388
2002-03	2126763	43952	10676843	286533	442241	9246	3523062	100131	16768909	439862	1752
2001-02	1025588	21483	1957856	51515	175900	3765	1037529	25163	4196873	101926	410
2000-01	90580	2365	-	-	-	-	-	-	90580	2365	11

Source: Compiled from BSE and NSE website

NSE has been very active in the derivatives segment and number of products traded on NSE is more than that traded on BSE. A number of derivative products have been introduced in India as can be seen from the above tables. Index and stock futures and options were the first products to be traded and recently the RBI allowed the trading of currency derivatives in India. The derivative market has grown quite substantially during the last decade. The table above shows the turnover of the derivatives segment of the market since its inception. The growth is almost exponential and the market has grown leaps and bounds from 2000 to 2012(an increase of 2, 67, 115 % in the total turnover over the specified period). The average daily turnover has increased by 10, 44, and 469 %. Both the total and average daily turnovers have shown a slight dip from 2007-08 to 2008-09 when the sub-prime crisis had hit the US markets and consequently all the markets world over. A chapter on ‘Analysis of Derivatives turnover’ towards the end has been devoted to carry out the mathematical analysis of the derivatives market.

Fig. 1: Product wise turnover of F&O at NSE



Most of the derivatives market in F&O is dominated by Index options. This is followed up by stock futures, index futures and stock options. Index options are the clear leader in the product-wise turnover of futures and options segment in NSE during 2009-10. The turnover in the index options category was 45.45% of the total turnover in the F&O segment of NSE, followed by stock futures and index futures which saw a y-o-y growth of 29.41% and 22.27% respectively (in 2009-10 compared to the previous year). This trend continued in the first-half of 2010-11 with Index options constituting around 58% of the total turnover in this segment. The turnover of index options zoomed by 111% during the first-half of 2010-11 compared to the corresponding period in the previous fiscal.

From Table 5, it is pretty clear that derivatives segment has grown at a much faster pace than the cash segment. While the increase in the derivatives segment from 2000-01 to 2009-10 is an astonishing 7, 46, 778 % (Yes, it is seven lakh forty six thousand seven hundred and seventy eight percent!!) it is only 209 % for the cash segment. This is a clear indication of the dominance of the derivatives segment over the cash segment.

Tab. 5: NSE Cash & Derivatives Segment Turnover (in Rs. Cr)

Year	Cash Segment	Derivatives Segment
2009-10	41, 38, 023	1, 76, 63, 666
2008-09	27, 52, 023	1, 10, 10, 483
2007-08	35, 51, 038	1, 30, 90, 477.75
2006-07	19, 45, 285	73, 56, 242
2005-06	15, 69, 556	48, 24, 174
2004-05	11, 40, 071	25, 46, 982
2003-04	10, 99, 535	21, 30, 610
2002-03	6, 17, 989	4, 39, 862
2001-02	5, 13, 167	1, 01, 926
2000-01	13, 39, 510	2, 365

Source: Compiled from NSE website

Tab. 6: Product wise Derivatives Turnover at NSE and BSE (in Rs. Cr)

Year	Index Future		Index Option		Stock Option		Stock Future	
	NSE	BSE	NSE	BSE	NSE	BSE	NSE	BSE
2009-10	39, 34, 389	96	80, 27, 964	138	1, 40, 16, 270	0	51, 95, 247	0
2008-09	35, 70, 111	11, 257	37, 31, 502	9	1, 32, 95, 970	0	34, 79, 642	9
2007-08	38, 20, 667	2, 34, 660	13, 62, 111	39	94, 60, 631	15	75, 48, 563	7, 609
2006-07	25, 39, 575	55, 491	7, 91, 913	0.06	52, 83, 310	6	38, 30, 972	3, 516

Source: Compiled from SEBI Annual reports

The product wise Derivatives turnover shown above re-iterates the fact that turnover of Derivatives at BSE is far less than the turnover of Derivatives at NSE. A closer examination of the table reveals that Index option has grown the most over the given years: be it on NSE or on BSE. Also, BSE is becoming less and less inactive in the derivatives segment.

Tab. 7: Number of Contracts traded at NSE & BSE Derivatives Segment

Year	Number of Contracts	
	NSE	BSE
2009-10	67, 92, 93, 922	9, 028
2008-09	65, 73, 90, 497	5, 15, 588
2007-08	42, 50, 13, 200	74, 53, 371
2006-07	21, 68, 83, 573	15, 45, 169
2005-06	15, 76, 19, 271	103
2004-05	77, 017, 185	5, 31, 719
2003-04	5, 68, 86, 776	3, 82, 258

Source: Compiled from SEBI Annual reports

Tab. 8: BSE Cash & Derivatives Segment Turnover (In Rs. Cr)

Year	Cash Segment	Derivatives Segment
2009-10	1, 37, 881	234.13
2008-09	1, 10, 008	12, 266
2007-08	15, 78, 857	2, 42, 309
2006-07	9, 56, 185	59, 006
2005-06	8, 16, 074	9
2004-05	5, 18, 715	16, 112
2003-04	5, 03, 053	12, 452
2002-03	3, 14, 073	2, 478
2001-02	3, 07, 292	1, 922
2000-01	10, 00, 032	1, 673

Source: Compiled from SEBI Annual reports

3 FOREX Derivatives in India

Now that we have seen the status of the overall Derivatives market in India, let us look at the development of FOREX Derivatives in India. With the advent of liberalization, money from other countries started flowing in India. The diagram below shows the FOREX Reserves in India since 1991. The FOREX Reserves have increased over the years and at present amount to around US \$ 300 bn.

Fig. 2: Foreign exchange reserves

Source: RBI monthly bulletin May 2011 issue

FOREX Derivatives in India have been growing at a steady pace. The percentage share of India in the world FOREX Derivatives is very low. Table 9 gives the share of India in percentage terms.

Tab. 9: India's share in the global FOREX Derivatives Market

Year	Percentage share of India
1998	0.1
2001	0.2
2004	0.3
2007	0.7
2010	0.9

Source: BIS Triennial Survey, 2010

The table clearly indicates that share of India in the global derivatives market is very low (almost negligible). However, it may be noted that the percentage share of India is nevertheless, increasing. The FOREX derivatives products that are traded in India are: Forwards, Options, Swaps, Currency futures and Currency Options.

Tab. 10: Business growth in Currency Futures in India

Month/ Year	USDINR		EURINR		JPYINR		GBPINR		USDINR	EURINR	JPYINR	GBPINR
	No. of Contracts	Traded Value (Notional) in ₹ mn	No. of Contracts	Traded Value (Notional) in ₹ mn	No. of Contracts	Traded Value (Notional) in ₹ mn	No. of Contracts	Traded Value (Notional) in ₹ mn				
Apr-09	7,851,502	393,857							206,620			
May-09	13,682,468	664,315							318,203			
Jun-09	15,724,507	753,627							267,400			
Jul-09	19,886,011	965,229							318,298			
Aug-09	18,672,623	903,957							394,756			
Sep-09	22,251,896	1,077,888							360,603			
Oct-09	32,267,958	1,508,430							447,812			
Nov-09	33,794,926	1,575,541							493,018			
Dec-09	41,004,341	1,914,147							406,200			
Jan-10	60,223,714	2,767,419							615,612			
Feb-10	49,093,914	2,276,337	2,888,980	184,164	53,026	2718	76,265	5533	622,656	9,930	968	3,911
Mar-10	58,039,720	2,642,413	2,820,999	174,620	146,393	7273	125,740	8613	407,390	11,980	1,810	6,693
2009-10	372,495,580	17,443,161	5,709,979	358,783	199,419	9,991	202,805	14,146	4,858,568	21,910	2,778	10,604
Apr-10	75,411,437	3,359,080	1,608,481	95,989	9,786	467	55,463	3786	563,226	21,834	538	5,655
May-10	75,021,152	3,438,519	2,591,211	149,680	17,842	903	114,665	7696	762,391	20,192	1,342	4,029
Jun-10	68,341,107	3,187,766	1,371,201	78,212	46,094	2383	79,131	5465	944,121	19,395	6,281	7,341
Jul-10	43,199,013	2,028,844	1,538,240	92,370	62,361	3343	125,240	8977	826,468	22,412	3,335	5,765
Aug-10	41,273,073	1,929,224	1,190,935	71,785	79,854	4379	95,776	7003	908,783	20,866	10,667	4,106
Sep-10	60,535,055	2,783,444	748,696	45,116	191,847	10522	110,876	7959	800,905	23,760	14,099	4,146
April- September 2010	363,780,837	16,726,876	9,048,764	533,152	407,784	21,998	581,151	40,886	4,805,894	128,459	36,662	31,042

Source: NSE

Note:

Currency Futures on Additional Currency Pairs were introduced w.e.f February 01, 2010. (New currency pairs EUR-INR, GBP-INR and JPY-INR futures contracts)

After an impressive start in the latter half of 2008, the Currency futures on the NSE witnessed exponential growth during 2009-10 and continued to flourish in the first-half of 2010-11. Table above presents the growth in the currency futures volumes and open interest on the NSE. The number of traded contracts and the trading value in this segment has increased by more than ten-times each in 2009-10, compared to that of 2008-09. Similarly, the trading volumes in the currency futures segment grew by around 260% in the first-half of 2010-11 compared to the corresponding period in 2009-10. The average daily trading volume zoomed to INR 1,55,805 crores in 2009-10 compared to INR 1,167 crores in 2008-09. During April-September 2010-11, the average daily trading volume whizzed to INR 13,533 crores.

During 2009-10, total turnover was the highest at MCX-SX (INR 19,44,654 crore) followed by NSE (INR 17,82,609 crore) and BSE (Rs.0.04 crore) At NSE, the share of top ten members in volumes of currency derivatives segment increased to 72.1 percent at the end of March 2010 from 56.8 percent at the end of March 2009. Their share in open interest of currency derivatives segment was 35.3 percent at the end of March 2010 as compared to 34.3 percent at the end of March 2009. The share of top ten members in volumes and open interest at MCX-SX were 60.5 percent and 35.9 percent, respectively at the end of March 2010. In BSE, the share of top ten members in volume and open interest fell to zero after being 100 percent in May 2009.

Tab. 11: Trend in the Currency Futures segment

Table : Trends in the Currency Futures Segment

Month/ Year	MCX-SX			NSE			BSE		
	No. of Contracts Traded	Turnover (Rs.crore)	Open interest at the end of Month	No. of Contracts Traded	Turnover (Rs.crore)	Open interest at the end of Month	No. of Contracts Traded	Turnover (Rs.crore)	Open interest at the end of Month
1	2	3	4	5	6	7	8	9	10
2008-09	2,98,47,569	1,48,826	990	3,27,38,566	1,62,563	1,313	1,82,469	869	0
2009-10	40,81,66,278	19,44,654	1,951	37,86,06,983	17,82,609	1,964	8	0.04	0
Apr-09	75,47,128	37,858	532	78,51,502	39,386	1,039	2	0.01	0
May-09	1,20,53,551	58,469	987	1,36,82,468	66,431	1,504	6	0.03	0
Jun-09	1,41,98,087	67,985	931	1,57,24,507	75,363	1,285	0	0	0
Jul-09	1,81,88,940	88,290	1,665	1,98,88,011	96,523	1,531	0	0	0
Aug-09	1,86,48,790	90,292	2,363	1,86,72,623	90,396	1,933	0	0	0
Sep-09	2,26,36,371	1,09,666	1,992	2,22,51,896	1,07,789	1,739	0	0	0
Oct-09	3,28,49,655	1,53,630	2,235	3,22,67,958	1,50,843	2,109	0	0	0
Nov-09	3,46,66,197	1,61,641	2,340	3,37,94,926	1,57,554	2,297	0	0	0
Dec-09	4,25,13,360	1,98,498	1,985	4,10,04,341	1,91,415	1,896	0	0	0
Jan-10	6,35,91,431	2,92,345	2,758	6,02,23,714	2,76,742	2,852	0	0	0
Feb-10	6,47,73,311	3,22,635	2,531	5,21,12,185	2,46,875	2,976	0	0	0
Mar-10	7,64,99,457	3,63,345	1,951	6,11,32,852	2,83,292	1,964	0	0	0

Source: NSE, BSE, MCX-SX.

Tab. 12: Share of Top 10 member in Currency Derivatives segment

Table : Share of Top 10 members in Currency Derivatives Segment of NSE, BSE and MCX-SX

(Percent)

Year/Month	Share of top 10 members in percentage					
	NSE		BSE		MCX-SX	
	Open Interest	Volume	Open Interest	Volume	Open Interest	Volume
1	2	3	4	5	6	7
2008-09	36.59	50.62	99.80	99.79	53.77	59.75
2009-10	36.52	69.38	100.00	100.00	35.87	53.19
Apr-09	39.23	57.53	100.00	100.00	43.57	68.32
May-09	41.41	57.34	100.00	100.00	60.51	70.28
Jun-09	44.53	60.20	0.00	0.00	56.20	67.19
Jul-09	40.68	62.72	0.00	0.00	55.50	62.35
Aug-09	45.26	65.48	0.00	0.00	51.17	54.12
Sep-09	42.91	69.37	0.00	0.00	48.69	55.19
Oct-09	42.09	74.92	0.00	0.00	50.77	53.27
Nov-09	42.79	74.47	0.00	0.00	47.46	54.03
Dec-09	43.43	77.14	0.00	0.00	45.95	63.02
Jan-10	39.64	77.49	0.00	0.00	41.46	63.30
Feb-10	40.92	69.40	0.00	0.00	46.17	60.10
Mar-10	35.28	72.04	0.00	0.00	35.87	60.53

Source: NSE, BSE, MCX-SX.

We have already dealt with OTC and exchange traded markets. Let us now have a look at the size of FOREX derivatives in these markets. As stated earlier, Forwards contracts are traded on OTC market and Futures on the Exchange traded market. Here we will look at the comparison between OTC Currency Forward Market and Futures on USD/INR. Currency Futures trading (USD/INR) started in India on August 29, 2008. However, trading takes place mainly on NSE and MCX-SX. Let us first have a look at the turnover in USD/INR Futures in comparison to turnover in OTC Forward market. Have a look at the table below:

Tab. 13: Comparison between OTC Currency Forward Market and Futures on USD/INR

Month	Forward turnover INR/ other currency (\$ billion)	Exchange (NSE + MCX-SX) turnover (\$ billion)	Exchange (NSE + MCX-SX) turnover % of OTC Forward turnover
November 2008	87.77	6.30	7.19
December 2008	89.60	9.38	10.50
January 2009	65.66	9.89	15.09
February 2009	61.29	12.92	21.10
March 2009	92.04	19.40	21.13
April 2009	73.24	15.40	21.07
May 2009	75.10	25.74	34.31
June 2009	76.21	29.92	39.26
July 2009	65.35	38.08	58.27
August 2009	62.62	37.32	59.60
September 2009	62.22	44.89	72.15
October 2009 *	80.99	65.12	80.40

Source: RBI, NSE, MCX-SX (BSE has no trading in Currency Derivatives products) * Data for OTC market available till October 2009

As seen from the table shown, the percentage of Futures turnover as a percentage of OTC Forward turnovers is increasing month by month. The percentage share has already reached a significant level (80.40 in October 2009). Thus, there is a 'shift' as far as trading in OTC and Exchanges is concerned and the shift is positively towards the Exchange traded market.

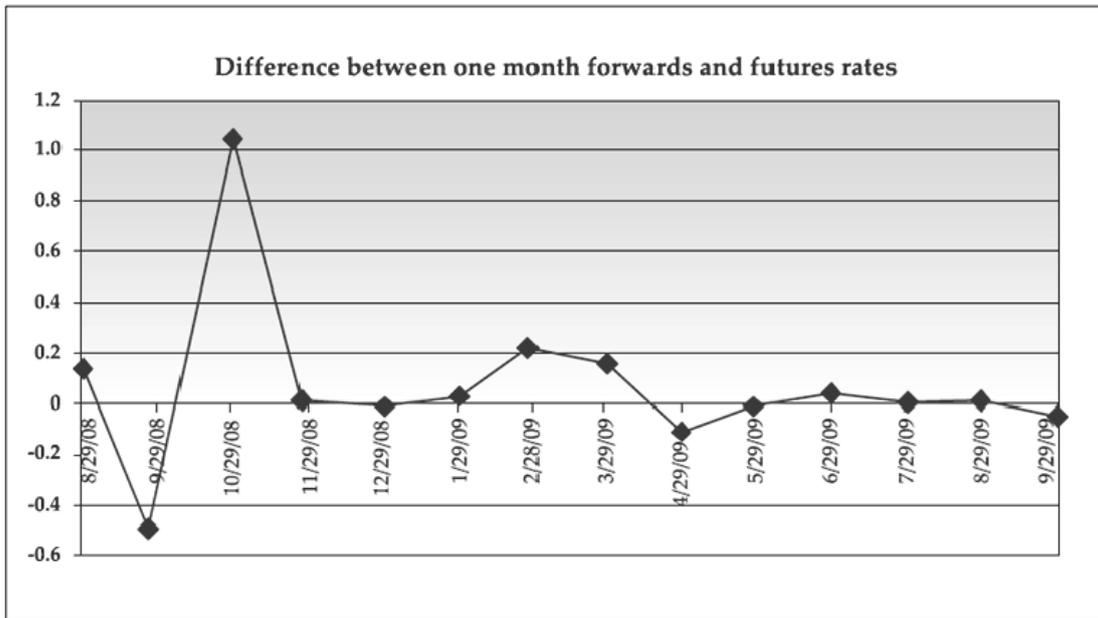
The bid ask spread gives an indication of the cost and ease with which a contract can be traded. A narrow bid ask spread means that the costs of entering and exiting a trade are low. Consequently, a liquid market requires the bid ask spread to be narrow. It can be observed from the Table below that around 95 percent of the trading at NSE and 99 percent of trading at MCX-SX in USD: INR futures takes place at a narrow spread of less than or equal to half a paisa as against only around 7 percent for OTC currency forward market.

Tab. 14: Bid Ask spread in Exchange traded USD: INR market vis-à-vis OTC forward market

Spread Interval (INR)	Cumulative Forward	Cumulative NSE USD/INR Futures	Cumulative MCX-SX USD/INR Futures
0.0025	0.58	62.98	88.58
<=0.005	6.53	94.74	98.97
<=0.01	49.25	99.92	99.93
<=0.02	99.54	99.98	100
<=0.03	100	99.98	100
<=0.04	100	99.99	100
<=0.05	100	99.99	100
<=0.1	100	100	100

Source: NSE and MCX-SX; For OTC market: Reuters; For Currency Futures: NSE trade data and MCX-SX trade data

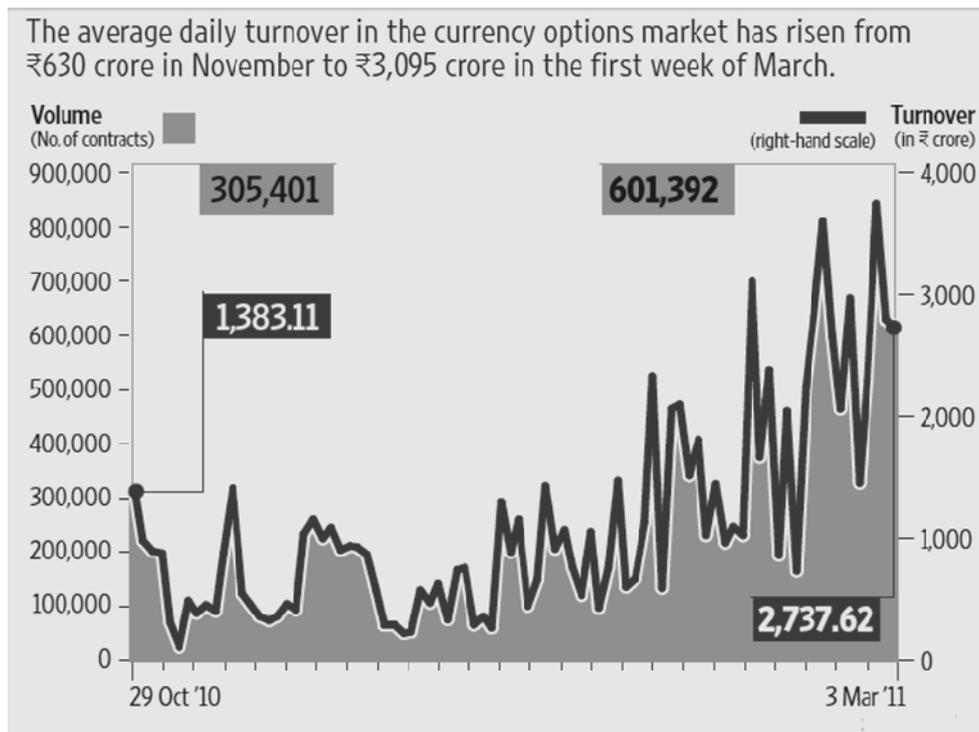
Fig. 3: Difference between one month USD/INR Forwards and Futures



Source: NSE and MCX-SX; For OTC market: Reuters; For Currency Futures: NSE trade data and MCX-SX trade data

The line diagram above shows the difference between one month USD/INR Forwards and Futures. As can be seen from the line diagram, the difference between the two is more or less getting converged towards zero i.e. the rates are becoming almost equal. This is particularly the case between April 29 2009 and September 4 2009. This essentially means that arbitrage opportunities between the two markets are diminishing by the day.

Fig. 4: Daily turnover of Currency Options



Source: NSE and USE website

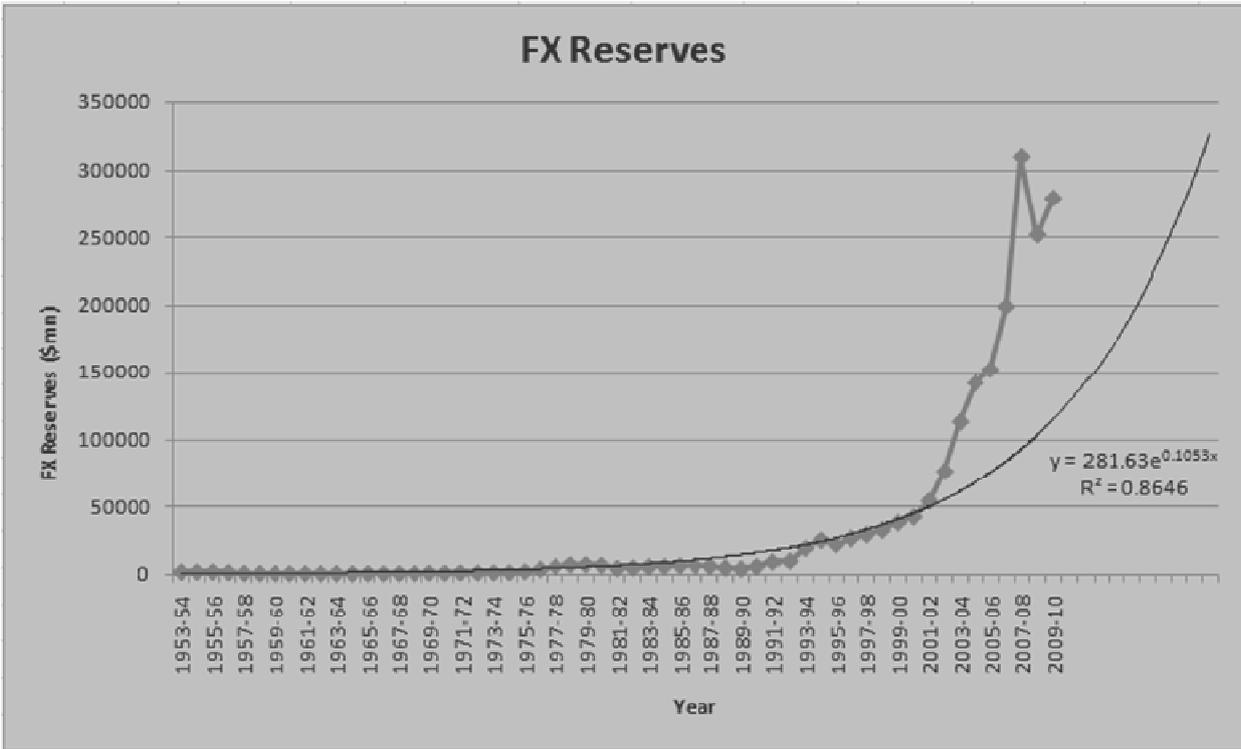
Exchange-traded currency options were introduced on 29 October 2010, after NSE received approval from market regulator Securities and Exchange Board of India (SEBI) and the Reserve Bank of India (RBI). The trading volume in the currency options market has grown over threefold on the National Stock Exchange (NSE) between November 2010— when the product was launched—and February 2011. So far, retail investors and smaller companies, which find it easier to hedge their positions on the bourse than through over-the-counter (OTC) transactions, have driven up volumes. The average daily turnover in the currency options market rose from INR 630 crore in November 2010 to INR 1,915 crore in February 2011 and further to INR 3,095 crore in the first week of March 2011.

4 Mathematical Analysis of FOREX Derivatives Market in India

Having gone through the market for derivatives in India and particularly the FOREX Derivatives, we now move on to the mathematical analysis of the same. Here we carry out various mathematical analyses and based on the results obtained, try to gauge the dynamics of the FOREX derivatives market.

The line diagram above in Figure 5 shows the FOREX reserves in India since 1954. The FOREX reserves have grown almost exponentially and the exponential curve is a pretty good fit with the actual curve. This can be concluded from the R2 value which is equal to 0.8646 (R2 is equal to 1 for perfect correlation) indicating a strong correlation between the exponential curve and the actual curve. In fact since 2001-02, the FX Reserves have grown more than exponentially.

Fig. 5: Growth of FOREX Reserves in India



Source : RBI website

The data shown is till 2010. However, with the exponential equation shown, we have extended (extrapolated) it for a further period of further 5 years. From the above table it is estimated that the FX Reserves will touch around \$350 bn in 2015. At present it is already hovering around the \$300 bn mark. So, we can assume that it will cross the \$500 bn mark.

Tab. 15: Growth of Currency Futures in India (INR mn)

S. No	Year/Month	USD/INR	EUR/INR	JPY/INR	GBP/INR
1	Apr-09	393857			
2	May-09	664315			
3	Jun-09	753627			
4	Jul-09	965229			
5	Aug-09	903957			
6	Sep-09	1077888			
7	Oct-09	1508430			
8	Nov-09	1575541			
9	Dec-09	1914147			
10	Jan-10	2767419			
11	Feb-10	2276337	184164	2718	5533
12	Mar-10	2642413	174620	7273	8613
13	Apr-10	3359080	95989	467	3786
14	May-10	3438519	149680	903	7696
15	Jun-10	3187766	78212	2383	5465
16	Jul-10	2028844	92370	3343	8977
17	Aug-10	1929224	71785	4379	7003
18	Sep-10	2783444	45116	105222	7959
Total		34170037	891936	126688	55032

Source: NSE,SEBINote: Futures other than USD/INR were introduced in Feb 2010

Currency Futures were introduced in India in October 2008. Initially only USD/INR Currency Futures were allowed. Subsequently, Cross-Currency Futures (Currency pairs which do not include USD) were allowed to trade since February 2010. From the above table, we can see that the traded value in USD/INR Futures increased by 22.27 % from Apr -09 to Sep-10. The increase for EUR/INR, JPY/INR and GBP/INR for the period Feb-10 to Sep-10 was -75.5 %, 3771.3% and 43.84% respectively. This shows that EUR/INR Futures have in fact shown a downward trend in terms of the traded value. This may be partially attributed to the Euro sovereign debt crisis of 2010. Also, among the Currency Futures, JPY/INR has risen the sharpest with a growth of a whopping 3771.3% in value terms. The pie chart below shows the relative weights of each of the Futures (for the period Feb-10 to Sep-10).

The Currency Futures market in India is dominated by USD/INR and it has a share of around 97% of the total value of the traded contracts in India. This has clear implications that USD is the most traded currency in India. However, in terms of growth, JPY has a clear dominance in India. It remains to be seen as to what will be the effect of the recent Tsunami in Japan on these trends. GBP/INR Futures have grown very little at 43.84%.

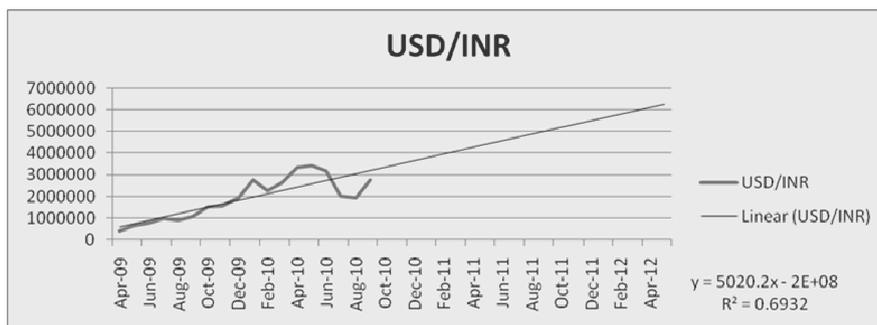
Fig. 6: Currency Futures in India



Let us now look at each of the currency futures and their behaviour over the months since their inception. The line graphs shown below represent the turnover volume on the Y-axis and the months/years on the x-axis. The graphs have been tried to fit into a trendline and the R^2 values are calculated for the same. The following benchmarks have been used:

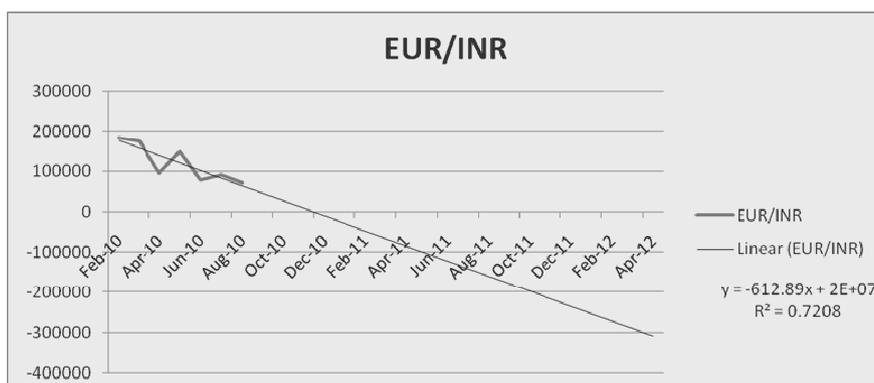
Value of R^2	Inference
$R^2 = 0$	No correlation between the trendline and the actual movement of turnover
$0 < R^2 < 0.5$	Weak correlation between the trendline and the actual movement of turnover
$0.5 < R^2 < 1$	Strong correlation between the trendline and the actual movement of turnover
$R^2 = 1$	Perfect correlation between the trendline and the actual movement of turnover

Fig. 7: USD/INR



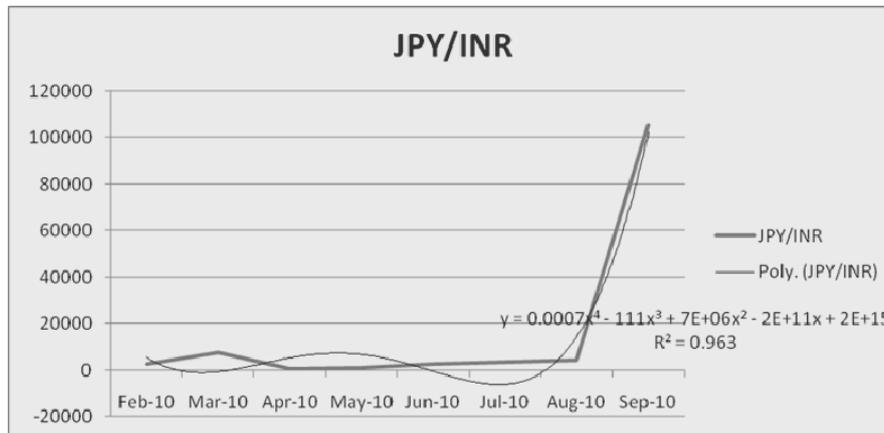
The trendline that fits best for the turnover pattern of USD/INR is a straight line whose equation is as shown in the above figure. The R^2 value is 0.6932 which indicates a positive correlation between the linear trendline and the movement of actual turnover. Using the equation we can predict the possible turnover of USD/INR Futures in the coming months/years.

Fig. 8: EUR/INR



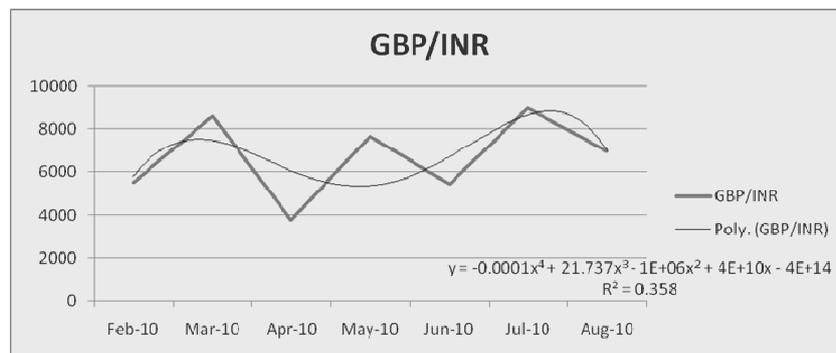
As discussed earlier, EUR/INR Futures have actually dropped in value terms and this we have partially attributed to the Euro sovereign debt crisis. However, R^2 value in the case for a straight line trendline is 0.7208 which shows a very strong correlation with actual turnovers over the months. Nevertheless, this trend seems to be a one-off case and we should wait for some more time before drawing any conclusion.

Fig. 9: JPY/INR



The Futures JPY/INR have increased the most since its inception. As can be seen from the above line diagram, the best fit to the trend is a fourth order polynomial and R^2 value for the same is 0.963 which indicates a very strong correlation with the actual turnover pattern. In fact, for the period of Jul-10 to Sep-10, the turnover has grown more than exponentially. Going by this trend, it wouldn't be surprising if JPY/INR becomes the most traded product in India in the years to come.

Fig. 10: GBR/INR



The Futures on GBP/INR pair have been the most volatile following no particular pattern in particular. Even a fourth order equation doesn't fit in the given context as we see that R^2 in this case is 0.358 which shows a weak relationship between the trendline equation and the actual turnover pattern. Also, as we have seen earlier, the Futures on GBP/INR haven't improved much in terms of the value of the traded contracts since its introduction(grown only by 43.84%).

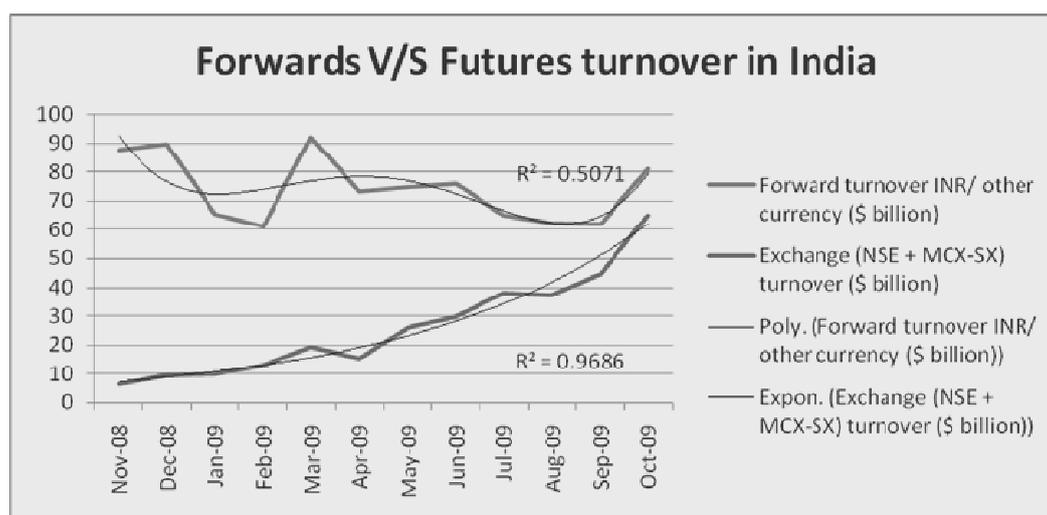
From the Table 16, it is seen that Currency Options market in India has increased by 391.2% which is very impressive considering the fact that this increase has taken place between November 2010 and March 2011, i. e. within a period of less than 5 months. This also shows the potential of Currency Options market in India.

Tab. 16: Growth of Currency Options in India

Month/Year	Turnover (INRCrores)
November 2010	630
February 2011	1195
March 2011	3095

Source: NSE and USE website

Fig. 11: Comparison between Currency Derivatives in India : Forwards and Futures



Source: For OTC turnover: Reuters For Currency Futures turnover : NSE and MCX-SX

As seen from the above diagram, Futures market has grown almost exponentially (R² value of 0.9686) and that it is fast catching-up with the Forwards market which hasn't grown substantially over the same period. The best trendline that fits the turnover pattern for Forwards is a second order polynomial with a R² value of 0.5071 which doesn't show too strong a relationship with the actual turnover pattern. Thus, we can clearly decipher that Currency Futures market is growing more rapidly as compared to Currency Forwards market in India.

5 Conclusions

We have so far seen what are FOREX markets, Derivatives, Derivatives in India, FOREX Derivatives in India. We also tried to do some mathematical analysis on FOREX Derivatives in India and tried to find out whether they follow any particular pattern. Well, we found that some products follow a pattern (JPY/INR Futures follow almost an exponential pattern) and some products are volatile in nature in that they do not follow any fixed pattern (for example GBP/INR). However, one thing that can be positively concluded from the analysis is that the derivatives market in India is becoming more and more liquid and that it is growing at a much faster pace than the cash market. The introduction of currency options has heralded a new chapter in the derivatives segment in India and has received tremendous response from the traders and alike. Regulatory bodies like the RBI and SEBI have been very proactive in the derivatives segment and the introduction of various derivatives products in a phased manner has been phenomenal.

However, as the number of products introduced is increasing, the very nature of Derivatives market is becoming more and more complex. In the case of OTC markets, since the contracts are customizable, the parties attached to the contracts are under no compulsion to follow a fixed set of rules as is done in the Exchange traded markets. There is always a risk of counterparty

defaulting on the contract in case of OTC markets. Not that the risk is not there in the Exchange traded market but as discussed earlier, the presence of a clearing house acts as an insurance cover in case the counter party defaults. Nevertheless, Indian Derivatives market is poised to grow at a very rapid pace in the years to come.

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India: The Next FOREX Derivatives Destination?

Summary

India has grown as a deep and liquid FOREX market over the years. The Indian financial system has evolved impressively in the recent past, especially after liberalization. India is relatively less susceptible to global crises than most other countries. This can be attributed to the robust banking system in India. The Reserve Bank of India (RBI) is the apex body in India which regulates the financial system in India. The RBI, in conjunction with the Securities and Exchange Board of India (SEBI), regulates the financial markets in India. The financial markets have a number of segments and one such segment is the Derivatives segment. The present work focuses on the Derivatives market in India with special focus on Foreign Exchange (FOREX) Derivatives, its evolution in India, current scenario and future outlook.

Key words: Financial markets; Derivatives; FOREX; India.

JEL classification: D53, G12.

Activities of Insurance Companies in Replay to the Negative Effects of Climate Change Observed in Agriculture

*Aleksandra Hećka**

1 Introduction

The temperature rise of the air on Earth that has been observed for over 50 years now produces the following changes, including: acidification of the oceans, altered precipitation patterns, the melting of glaciers, sea and ocean level rise, and other. These phenomena affect a variety of life aspects, comprising, amongst others, the following sectors: energy, transport, water resources, ecology, health, society and, primarily, agriculture. A growing number of entities start considering climate change to be hazardous, and try to reduce the likelihood of its occurrence or, if that cannot be prevented, minimise its consequences. For that purpose, insurance, that is one of the financial methods for risk control, is more commonly used.

Thus, climate change plays a significant role for insurance and reinsurance undertakings that may encounter problems without proper tools and solutions for the developing climate change. This issue should be treated as a challenge by insurance sector that will aim at developing specialist and innovative insurance products providing the protection against climate risk, promoting prevention against the intensity of damage-causing phenomena, supporting transformation to the energy-efficient and low-carbon economy, or participating in the creation and implementation of effective adaptation strategies.

2 Awareness of climate change among insurers

Since insurance industry numbers among the sectors most vulnerable to the effects of climate change, insurance representatives feel obliged to respond to the risk it carries.

With regard to the dimension of this phenomenon, most of the insurance undertakings have become aware of the need for a thorough analysis of the effects of climate change on future insurance losses. As the insurance company Allianz has shown in its surveys, climate change increases the number of insurance losses based on extreme weather phenomena by 37% within 10 years on average. Furthermore, the value of the losses in the year when major natural disasters occurred totals approximately 1 trillion dollars.

Most of the insurers start to understand that the risk of natural disasters brought by climate change creates a financial hazard to their business. In 2008, economic losses caused by natural disasters stemming from weather phenomena amounted to approx. 130 billion dollars worldwide, of which 44 billion had insurance coverage. What is more, the value of the losses deriving therefrom grows faster than the population or inflation index.

As it follows from the 2007 PricewaterhouseCoopers' survey involving 100 representatives of insurance sector from 21 countries, climate change ranked fourth out of thirty-three in a rating of the key risks faced by insurers; natural disasters ranked second. Most of the remaining risks also correlate with climate change. A year later, Ernst & Young surveyed over 70 analysts from insurance sector worldwide to compile the top 10 list of the major risks that must be faced by

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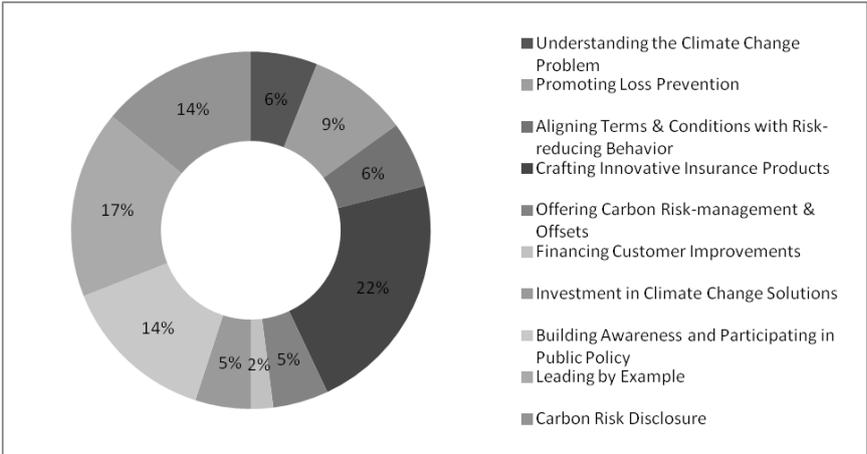
insurers. Climate change turned out to come in first, and the remaining ones are also related to this hazard. The researchers were surprised to find out that this risk, commonly considered in long-term categories, was referred to as a strategic one, i.e. jeopardising insurance undertakings in a short-term perspective.

The response to the phenomenon of climate change and the way of dealing with the risk carried by this change are focal issues for insurance companies.

Most of insurance undertakings are still largely focused on managing the financial risk associated with climate change. However, a growing number of insurers and reinsurers, as well as other representatives of insurance sector (actuaries, brokers, agents, risk managers, etc.), perceive this hazard as a chance to reduce risk and develop their business, this way increasing their income. Their participation in the market is evident e.g. in their awareness of the hazards brought by climate change, the promotion of state-of-the-art technologies based on the so-called clean energy, and the development of innovative products and insurance services.

In 2009, the Ceres company engaged in testing the phenomenon of climate change produced yet another report which – owing to the cooperation of insurance (244 from 29 countries) and reinsurance undertakings, and moreover, the representatives of the sectors other than insurance (energy sector, government agencies) – presented 643 examples of the actions undertaken to minimise the risk of climate hazards.

Fig. 1: Prevalence of Insurer Climate Activities: 2008



Source: Mills, E. (2009): From Risk to Opportunity: 2008 – Insurer Responses to Climate Change, op.cit., pp. 1.

As the report shows, 544 actions were undertaken by insurance undertakings, 58 – by insurance organisations, and 41 – by brokers and agents. Furthermore, 62 actions not included in the classification due to the cooperation with insurance entities were performed by the other organisations. Most of the actions were conducted in the United States (240) and Great Britain (140). As for the number of the actions associated with climate change, the most active is Europe (46.5%), North America is in the second place (40.6%), Asia is the third (8.1%), and Australia and Oceania come in fourth (3%). The fewest actions were taken in South America and Africa, with 1 action per continent (that is 0.15% each). International organisations are responsible for 10 out of the 643 performed actions (1.5%).

A strong interest from the entities participating in the study allowed for drawing up a catalogue of actions that may support the enhancement of the protection against natural disasters, and adoption to climate change through the reduction of climate-related risks. This is made possible e.g. by introducing energy-efficiency improvement schemes to the undertakings’ business strategies, designing “green” buildings, optimising the exploitation of motor vehicles, and

controlling carbon dioxide emissions.

The actions listed above make up an open catalogue. New ideas and solutions for climate change issues systematically appear. It is important to keep in mind that the cooperation between insurers and the representatives of other economy sectors is the key to success in this field.

The representatives of the supply side in the Polish insurance market, who provide insurance for agricultural crops,¹ are also aware of the changing climate and the resultant increase in the number of losses. As it follows from their observations, the value of an individual loss is increasing. In the first place, insurers tend to notice the growing incidence of the phenomena including drought (that has occurred every 3-4 years over the past decade), negative effects of hibernation, or spring frost. This year, the occurrence of the two latter risk seems to be particularly severe. Due to the frosts that occurred in Poland in early May 2011 (with the air temperature even as low as -10°C), a lot of crops were damaged, including: early potatoes, corn, rape, strawberries, and field vegetables. According to the estimates by the Wielkopolska Agricultural Chamber (Wielkopolska Izba Rolnicza), the losses incurred by tree and shrub crop growers will amount to 60-100%.

Nevertheless, insurers do not see eye to eye about acknowledging the changing environmental conditions as climate change. They pay particular attention to the methods for climate change exploration. Those who agree with the sceptics about the theory of climate change caused by man believe that this is just a natural cycle in the Earth's history. Additionally, as these phenomena occur on a long-term basis, they perceive issues in the method for examining those cycles.

3 Directions of changes in the Polish agricultural insurance in the context of the climate change

Most of the Polish insurers and reinsurers do not see the need for introducing new insurance products due to climate change. Insurance undertakings are not radical about this issue; they are only trying to adapt to these changes as flexibly as possible. However, it must be admitted that although the examples of the actions performed by insurers and reinsurers are lacking, some of them are interested in such changes. To provide an example, Concordia Polska applies sale modifications, this way prioritising the interest of its clients. Additionally, the representatives of PZU S.A. guarantee that comprehensive insurance may also be implemented; however, as these services will be costly, they may not generate farmers' demand for this sort of products. Conversely, the new definition of drought introduced into the act on subsidised agricultural insurance that includes the Climatic Water Balance, i.e. except air temperature, it also takes account of access to water, reduction in conditional franchise level, or insurance coverage for the losses caused by the frost between the 15th and 30th April, is an interesting example of a government initiative.

In the light of the observed climatic phenomena, insurers notice the need for some changes within agricultural insurance, e.g. obligatory information about rotating crops, cultivating crops more resistant to high temperatures, applying plant protection products. For example, Concordia Polska TUW and PZU S.A. provide a system of increases and discounts in the tariff for risks depending on the variety (resistance class): the better and more resistant the variety, the lower the rate; nevertheless, they do not recommend any crops because of the principles of market

¹ Since 2011, agricultural insurance has been offered in Poland by four insurance undertakings, including two mutual insurance companies. They comprise the following insurers: PZU S.A., Concordia Polska TUW, TUW "TUW", HDI Asekuracja TU S.A. The share of agricultural insurance in insurance companies' portfolios is insignificant, and does not exceed several percent. Although PZU S.A. is the leader with its 80% share in the market, the share of this sort of insurance in its entire portfolio totalled only 6.47% in the year 2009.

competition. The amended conditions of state-subsidised insurance are the central problem for the representatives of the leading Polish agricultural insurer. What is more, since there is no state reinsurance covering the risks other than drought, insurance undertakings are in a way forced to raise the prices of their product. As the insurers emphasise, the lower the state subsidies, the higher the rates. Interestingly, to retain the universalism of insurance – with the intensity of negative weather events – reinsurance from the budget should also be considered for other common events such as spring frost or the adverse effects of hibernation. The representatives of insurance undertakings are sceptical about index insurance, since the rate calculation is complicated, and so is the answer to the question to what extent such insurance would cover a farmer's losses, and to what extent this would be a typical agricultural insurance. Furthermore, PZU S.A. tries to avoid implementing the insurance that has not been thoroughly explored in the technical aspect. Nevertheless, it is aware that risks, in particular improper hibernation and spring frost, must be redefined to prevent the problem occurring during claim settlement.

According to an interesting opinion offered by a representative of the Polskie Towarzystwo Reasekuracyjne S.A., farmers do not perceive the occurring phenomena as climate change. He believes that this tendency should be prevented by the government that intends to fulfil its aims regarding contribution to the development of agriculture that is a key state sector. This is mainly focused on socio-economic aspects within which the government wishes to improve competitiveness of agricultural farms, and protect them against bankruptcy. The PTR representative identifies the errors in insurers' sales management, as well as in the mechanism itself. The risks not accepted by the insurance undertaking bear sluice-gate rates (e.g. 20% of the insurance sum for drought risk on weak soils at PZU), and the same commission rate as the cheaper risks (e.g. hail) accepted, or even desired by this insurance undertaking. Therefore, one may believe that the commission level should discourage the insurer from offering this type of insurance.

The presented responses of the Polish agricultural insurance market to climate change lead to a conclusion that Polish insurers and reinsurers deal with this phenomenon in either of the two ways: they raise the prices of insurance, or forego offering this product on the market. Such actions seem highly insufficient from the agricultural producers' perspective.

4 Solutions suggested by global insurers concerning agriculture

As opposed to the domestic market, there is a global tendency for the solutions regarding climate change in various insurance fields (designed both for individual consumers, and for enterprises) including, e.g. motor insurance, property insurance, D&O, life assurance, and many others. Agriculture is a domain particularly vulnerable to the adverse impact of climate change effects. This is why the solutions applied by insurers and other entities operating in insurance sector regarding agricultural crops and breeding farmanimals are of significant importance.

4.1 Promoting loss prevention

Risk management and burden of claims control are a key challenge for insurance sector. Physical methods for dealing with risk are becoming of interest again, and may play a vital role in the maintenance of the insurance options for coastal areas and other higher-risk territories. Although the upgraded construction standards and improvements in spatial development are relevant starting points, insurers still encounter many barriers. The representatives of insurance sector more frequently notice the enormous value and relevance of all energy-efficient and renewable-source technologies that reduce infrastructure's vulnerability to losses. What is more, they see the need for improving the management of forests, agricultural areas and marshes. Nevertheless, the scope of their operations within all these domains is still incomparably low compared to the tasks they perform within their business framework.

As the representatives of an American insurer Hartford Financial Securities state, they are zealous supporters of improved methods for spatial development, and more efficient enforcement of particular entities' compliance with construction standards. What is more, Hartford remains the opponent of subsidising and promoting development investments in the territories exposed to the occurrence of natural disasters.

While most of the emissions of greenhouse gases are produced by energy sector, it turns out that these gases may be significantly reduced in forestry and agriculture. As studies show, deforestation of lands generates approx. 20% of greenhouse gas emissions caused by human activity. A more effective forest land administration may contribute to the reduction in gas emissions by minimising the areas vulnerable to fires (the main source of CO₂ emissions and the related human health problems), and reduce flood and mudflow risks that are frequent consequences of deforestation. Moreover, proper forest administration may protect plants against the negative impact of pests and diseases. The application of relevant agricultural treatments also contributes to the isolation (sequestration) of the carbon dioxide accumulated in soil that enhances plant resistance to drought. Another example of actions is the protection of swamps and mangrove forests that number among the richest ecosystems on Earth. Research shows that the losses caused by the 2005 Hurricane Katrina in the United States would have been lower if those areas had not been previously deforested. To provide an example, Tokio Marine Nichido, one of the largest Japanese insurers, aware of the cyclone-related hazards, is involved in the activities for the protection of mangrove forests. On its initiative, since 1999 nearly 5.5 hectares of mangrove forests have been reforested in Indonesia, Burma, and Vietnam, as well as on Fiji and the Philippines; they still continue their activities. AIG, another insurance undertaking, has also included a forest protection project in its scheme for the reduction of carbon dioxide and greenhouse gas emissions conducted with a view to compensate for, or reduce the emissions occurring in other localities. One should bear in mind that the increased number of forest areas intensifies evapo-transpiration which in turn intensifies water cycle and precipitation on a regional scale that in effect improves water balance.

Another type of insurers' activities may be the promotion of adaptation actions in agriculture that should be aimed at reducing the appearing hazards and losses, and using the potential benefits generated by this process. The examples of such actions have been described in the Staff Working Document supplementing the White Paper on Adapting to Climate Change developed in Brussels in 2009. On a farm level, they comprise:

- adaptation of the time-limits for crop-related actions, such as planting, sowing and cultivation,
- technical solutions, e.g. orchard protection against the losses caused by frost, or the improvement of ventilation and cooling systems in animal pens,
- selection of crops and varieties that are better adapted to the expected vegetation period and access to water, and more resistant to new temperature and humidity conditions,
- adaptation of crops using the existing genetic variety, and the new possibilities offered by biotechnology,
- enhanced efficiency of pest and disease control via improved monitoring, crop rotation of diverse crops, and integrated methods for combating pests,
- more effective use of water by reduced water losses, improvement in irrigation practices, water recycling and storage (ploughing across the slope)
- soil use improvement though increased water retention in order to retain the water in soil and maintain the landscape by preserving its features regarding the provision of housing to farm animals,

- introduction of farm animals breeds more resistant to heat, and relevant adaptation of the feeding models for the animals under thermal stress.

The role of insurers in promoting loss prevention could be reduced to extending the agricultural crop insurance by an increase/discount system corresponding to the preventive actions taken by farmers that are aimed at minimising the effects of the observed climate change. Such a solution could be encouraging for the farmers who run their own business activities, particularly those who perform preventive actions.

Additionally, an application for the agreement concerning agricultural insurance with the Polish insurance undertakings may arouse controversies, since a farmer is not obliged to furnish the information about adapting the farming work time-limits, the conducted pest control, or the effective use of water resources. The implementation of detailed questionnaires regarding the applied methods for growing crops and breeding animals would give insurance undertakings an opportunity to adapt more successfully to the changing climatic conditions, and provide farmers with more efficient risk management systems in their business activities.

Another solution making it easier for farmers to adapt to climate change may be the so-called agricultural consulting system provided by insurers. It would be aimed at promoting knowledge (including insurance awareness) among farmers, and encouraging them to implement new methods for agricultural farms, and apply cutting-edge technologies.

4.2 Crafting innovative insurance products

Insurers are still searching for the new methods to extend their business activities, at the same time supporting the management and the sharing of the climate change-related risk. According to the European Commission, *“insurance sector could develop new insurance products for reducing risks and vulnerability before disasters strike. Insurance premiums anticipating climatic changes could provide incentives for private adaptation actions.”*

4.2.1 Micro-insurance

According to the definition by International Association of Insurance Supervisors (IAIS), micro-insurance plays a protective role for the persons with low income, providing protection against various types of risks in return for regular payments that are dependent on the probability of the occurrence of a particular risk, and the cost caused by it. As the name indicates, the concept of micro-insurance is its limited scope: both the contribution, and the insurance coverage is offered on a micro scale.

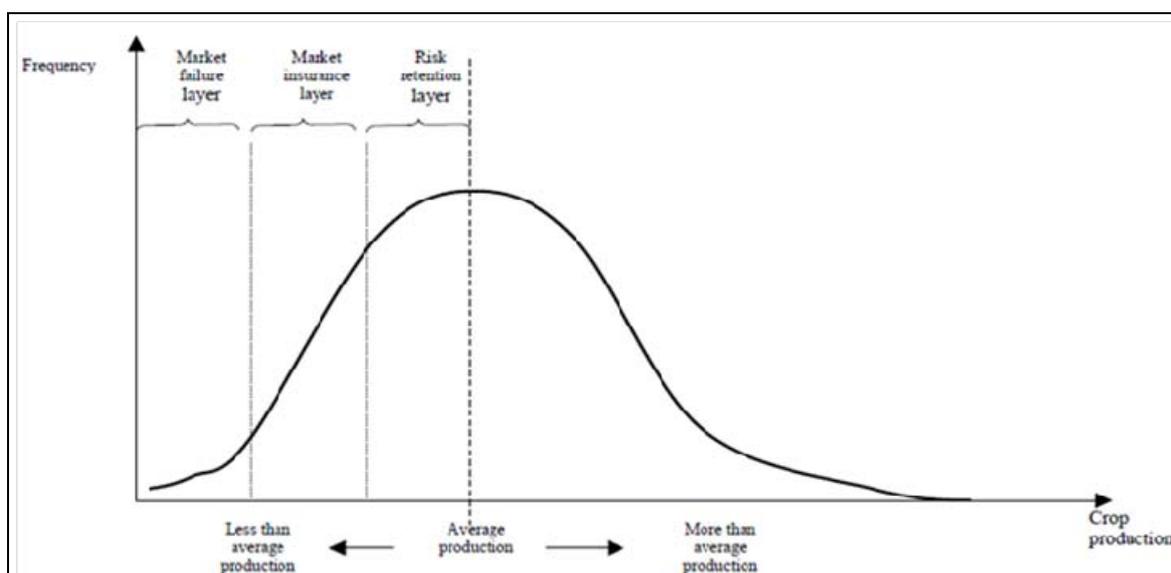
As the study by Lloyds shows, the risks most commonly addressed by persons with low income comprise mainly the risk of a critical illness, the unexpected death of the sole family’s breadwinner, displacement caused by natural disasters including hurricanes or floods, and the risk of crop destruction in rural areas.

Without an efficient tool for risk management, low-income households will continue to be vulnerable to losses; what is more, they will be unable to undertake the actions for reducing the adverse effects of random events, ultimately leading to the so-called poverty trap. These processes reflect a limited ability of those households to engage in investing, and generating income that would help them minimise their poverty.

Depending on the scope of production and its potential divergence from the average, relevant methods for financial risk management are applied. In the first category, agricultural production is on a medium level, the possible shocks do not disturb the functioning of the farm, and the agricultural producer prevents the risk. Here, financial solutions are either reduced to spending the savings, obtaining informal loans from friends or other persons, or limiting the consumption. These negative production shocks that lie on the risk retention level do not require the employment of complex financial mechanisms. The next layer involving an even greater

agricultural production decrease as compared to the previous case is the so-called market insurance layer, where agricultural insurance plays a prominent role. Loans and credits offered by specialist financial institutions are an alternative to insurance. Where these are absent, farmers are forced to continue the strategy of selling their assets that may lead to the future poverty trap. However, as long as such insurance is easily available, insurers do not take an interest to offer their products below or above this layer, and what is more, agricultural producers do not find purchasing those services necessary. The insured's self retention, as provided for in the insurance contract, usually equals the risk in the retention phase. Insurers do not pay out the compensation exceeding the specified insurance coverage; they also tend to exclude particular risks, and do not insure them at all. Those excluded risks, as well as the risks exceeding the maximum coverage, make up the last level: market failure.

Fig. 2: Risk Layering in Agricultural Production



Source: Arias, D. - Covarrubias, K. (2006): Agricultural Insurance In Mesoamerica: An Opportunity to Deepen Rural Financial Markets, Inter-American Development Bank, 2006, pp. 26.

The impact of strongly negative shocks on agricultural production (e.g. a considerable price fall for agricultural products on the market, or the occurrence of extreme weather phenomena including droughts, hurricanes or floods), and consequently, its significant divergence from the average production level, should imply government actions aimed at providing assistance to the affected farmers. Unfortunately, government assistance is frequently provided on an ad hoc basis, and consists in ex post unconditional aid payments in the case of natural disasters. Micro-insurance is the solution designed to reach the citizens excluded from state assistance, and provide them with a social protection mechanism.

4.3 Index-based insurance

Although typical insurance for agricultural production and breeding farm animals is available, the index-based insurance seems to be an interesting alternative. This sort of insurance protects farmers against correlated risk including the occurrence of weather extremes, e.g. drought, flood, hurricane, or earthquakes. This may also be applied to cover unexpectedly low yields or mortality in farm animals caused by negative climate change. The value of compensation under such insurance does not depend on the loss incurred by the insured, but on the objective index level most commonly including: a specified temperature (maximum, minimum, average), precipitation, wind force per a specified time unit, or the scale of an earthquake. The index value is calculated against the readings taken at synoptic stations using the special measuring devices.

The payout is made once the particular index level with the threshold set out in the insurance contract has been exceeded. Public access to the index rate and its objectivity ensure that it is closely correlated with the actual losses sustained by a farmer, and is based on back data. In the first place, the use of this instrument eliminates moral and motivational hazard, adverse selection and asymmetric information. What is more, index insurance reduces transaction and reinsurance costs, and guarantee simple distribution and fast payout of compensation.

Unfortunately, one of the basic and most controversial disadvantages of this instrument is the base risk understood as a discrepancy between the amount granted for exceeding the particular index level, and the amount reflecting the actual loss incurred by the farmer. Moreover, a reliable and independent index measurement system (e.g. precipitation gauges) on an adequately large geographical area seems to be indispensable.

When analysing the European examples of index-based insurance, the following three countries deserve special attention: Great Britain, Spain and Austria that have implemented these insurance products. In 1998, the index insurance scheme was initiated in Great Britain, based on a statistical yield volume (published by Home Grown Cereals Authority), and futures pricing (LIFFE). The scope of insurance guaranteed payout of compensation in the case of a 10% crop yield fall, and a 5% price fall. As a result of insignificant interest in the product, the insurance was taken off the market in the following season. Currently, only two systems for indirect index insurance function in the European Union. Since 2001, the index insurance system covering pastures, based on plant rate (vegetation) monitored by satellite detection has been working in Spain. Conversely, in 2007 index insurance based on meteorological data was implemented in Austria. Their objective is to protect arable crops against drought risk.

The example given above would allow the farmers with minimum protection provided by insurance to efficiently avoid the adverse consequences of random events, such as drought. Furthermore, this solution may become more significant in the face of the current climate change, as the rates on which this sort of insurance is based, are changing.

4.4 Public-private partnership

Public-private partnership is one of the methods for performing public tasks that always involves a private partner (using his capital, knowledge, skills and experience).

In the context of agricultural crops insurance, a concept of systemic solution embracing farmers as the principal beneficiary, based on the cooperation between the government and insurance sector has emerged. An example of this solution is SystemAgro developed by Munich Re, a leading global reinsurer.

This product is a response to the issue of climate change in agricultural sector, and the growing hazard of food shortage for the increasing world population. It provides an opportunity for the new coverage offer from insurers. While SystemAgro is based on public-private partnership, its operating principles have been created by the insurers using their over 30 year experience in agricultural crops insurance. They have developed a risk management tool for agricultural production. All the terms and conditions of the insurance required to ensure a constant development of agriculture are governed and guaranteed by the law. These comprise, e.g.: the principles of the access to the insurance, the transparency of the insurance terms and conditions, the principles of premium calculation, and the claim settlement process.

As SystemAgro is based on four pillars, its success depends on the coincidence of all these elements. These pillars are:

- *B- Backing*: means government subsidies to insurance premiums.
- *L – Loss Sharing*: means financial support from the state in the event of natural disaster losses.

- *O – Open*: means that SystemAgro is available to all farmers.
- *C – Central and uniform*: reflects the structure and uniformity of the conditions for all of the persons covered by insurance.

SystemAgro is a win-win-win model, i.e. all of the three parties involved in the agricultural insurance system based on public-private partnership derive some benefit. The state's benefit is the enhanced and thriving agricultural sector at all times, and not only during a natural disaster; farmers receive a profitable and affordable scope of risk coverage for their business within this scheme; and insurers may use their knowledge and know-how through the cooperation with the state and farmers, offering the latter a comprehensive insurance coverage.

To adapt the domestic law to the EU recommendations, Poland has also introduced the model of public-private partnership cooperation that can be illustrated with the example of subsidised insurance. The reason why this solution has been selected was little interest in crops insurance among farmers. In those circumstances, the intensity of weather phenomena, or the lack of state support, made individual agricultural producers discontinue their agricultural production. Nevertheless, it should be mentioned that the partnership system between the state and the insurers does not always function properly. For example, the insurance coverage for the most common Polish cereals provided as part of the subsidised insurance, is generally offered on a minimum level (hail risk) which makes it the cheapest option. Insurance undertakings (e.g. Concordia Polska TUW) are either not interested in insuring the crops grown in the areas affected by adverse weather phenomena including flood and drought (despite the identification system and reinsurance for this risk), or they apply sluice-gate rates with an average premium totalling approx. 10% of the insurance coverage (the risk of drought in Wielkopolska [Greater Poland], Kujawy and Pomorze [Pomerania]). As a result, the rate is not subsidised from the state budget, the price of crops insurance is high, and it becomes unaffordable for farmers.

5 Conclusions

The effects of climate change are becoming the subject of a number of discussions among scientists, politicians, economists, and the society. Numerous scientific studies confirm the outlook for the following decades with further global warming as the most probable scenario. Agriculture is the business sector particularly vulnerable to the adverse consequences of climate change. The changes taking place in agriculture play a significant role for the insurers and reinsurers who offer the products dedicated for this sector. To minimise the risk stemming from the negative effects of climate change, global insurers take various actions devised to neutralise and prevent those effects.

According to the information provided in this paper, one may conclude that the Polish insurance undertakings do not undertake sufficient actions on climate change. The author believes that the above examples of the solutions implemented by international insurers may inspire the domestic market. Furthermore, scientists and experienced farmers should be more open to share their knowledge, and make insurance undertakings aware of the fact that some actions including the use of new varieties or plant protection products, have already become a global standard.

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Activities of Insurance Companies in Replay to the Negative Effects of Climate Change Observed in Agriculture

Summary

Currently, climate change is one of the most commonly observed natural phenomena worldwide. There are many sectors vulnerable to the effects of climate change, including agriculture that should be given particular attention due to its great dependence on weather conditions. Enhanced occurrence of negative weather changes including hurricanes, floods, downpours, droughts and other, and the resulting process of water management disturbance, create a serious hazard for agricultural production. Furthermore, research shows that global warming causes the increase in the number of various pest species, as well as the incidence of plant diseases, and weeds. Since the phenomena described above generate losses totalling billions every year, they are vital to the operations of insurers and reinsurers offering agricultural insurance. The present paper presents the impact of climate change observed in agriculture on the operations of international and Polish insurance and reinsurance undertakings. The aim of the study is to show that the Polish insurers, as opposed to their international counterparts, show insignificant concern about this issue despite being aware of the hazards posed by climate change. The nature of the activities undertaken by international entities on the insurance market is particularly important from the perspective of the Polish agricultural insurance market's growth potential in the context of protection against the negative effects of climate change.

Key words: Climate change; Agricultural insurance; Loss prevention; Public-private partnership; Micro-insurance

JEL classification: G22, Q54.

Investment Climate and Investment Attractiveness: Estimation Technique

*Ganna Kharlamova**

1 Introduction

Investing is the knowledge rather than numerology. Reliable assessment and analysis of the investment climate let to better guide regional and sector investment flows, to improve the business climate, to reduce risks of investing and strategic planning, to conduct a relevant and flexible investment policy and effective investment marketing. However, there is still no single method of assessment of investment attractiveness of regions, industries and enterprises that could be “one-size-fits-all” (for all states or at least for some groups of states).

The aim of the paper is to offer reasonable, from a theoretical and methodological point of view, method of the investment climate’s assessment based on the ranking assessments of its components’ investment attractiveness. Logic of method’s developing defines the following stages:

- I. Draft components of the investment climate.
- II. Identify the conceptual range and clarify categories.
- III. Match a system of indicators and methods for assessment of investment attractiveness.
- IV. Conduct a comprehensive and systematic monitoring of the investment climate with further developing of strategies to strengthen state's investment attractiveness.

2 Literature review

History of assessment of state-recipient’s investment attractiveness (IAt) or the investment climate (IC) has nearly 50 years. One of the first can be called world investment survey of Harvard Business School (1969). As the basis of comparison they had chosen an expert scale that included characteristics of each country by the following factors: the legal environment for foreign and domestic investors, the possibility of capital export, the position of the national currency, political situation, inflation rate, the use of the national capital. Reasonable, that such set of indicators was not enough adequately to display the whole range of conditions that usually are taken into account by investors.

Further development of methods of comparative evaluation of investment attractiveness was devoted to including a larger set of quantitative (statistical) indicators and expansion of the system parameters that are estimated by experts.

Among the foreign methods we can also mention: BERI index, evaluation ratings of advanced global economic journals such as "The Economist", "Fortune", "Euromoney", and the most authoritative expert agencies "Moody's", "Standard & Poor's". These techniques are based on applying the method of expert estimates and differ mainly by a list of factors taken into consideration when examined.

Over the last decade in the CIS, mainly in Russia and Ukraine, appeared a lot of new as domestic as well as specially adapted to national realities foreign-borrowed methods of

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estimation of investment attractiveness of regions. Among them are the following best-known: "Expert-RA" Agency's method, method developed by the team of authors of Ministry of Economy (RF) and RAS (Ryazanov, 2001), N. Klimova's method (1999), I. Blank's method (1995), Institute of Reforms' method (2000). The following assessment approaches to IAt were not conducted for industries and groups of enterprises.

In addition, there are some "episodic" domestic methods of evaluation of investment attractiveness (matrix model of Protskiv (2005), Haydutsky's method (2004), method of expert-analytical center "Socium" (2005), Kharlamova's method (2003, 2004, 2005)). "Episodic" character of them is called so because they were conducted only once, for the particular data base of objects, but they are interesting for productive criticism, which gives impetus to further research.

It should be noted that the motion in study of this issue in the scientific thought is expressed in increasing number of scientific publications, but it is characterized by a certain uniformity of approaches. The main shortcoming of the existing studies is the lack of consistency, complexity of the approach. In addition, among (mainly domestic) researchers still has no consensus on how to assess the investment attractiveness, but no consensus in defining it as a concept. Even there is no consensus on the process of ranking of investment attractiveness of objects (investees).

Thus, the current methodology of assessment of investment attractiveness is not perfect and requires optimization of the list of directions and criteria of analysis, the best combination of retrospective and prospective estimates, that will be adequately reflected in the terms of the interests of various investors and their groups.

It is necessary to transit to a new quality level, which implies the need to develop problems on the following standpoints:

- eliminate dependence from expert opinions and weighting coefficients chosen from expert reasoning;
- clearly define categories, which are considered as the "investment climate", "investment activity", "investment attractiveness", "investment potential", "investment risk";
- form the assembly of indicators that characterize the degree of favourability of investment climate. Because of its specification these indicators supposed to act as elastic to changes in the investment situation;
- structuring of method due to levels of the economy through an integrated monitoring of the investment climate.

3 Investment categories

Investment climate of the host country is constantly under the influence of transformations and changes. Assessment of investment climate, in fact, is a market instrument for optimizing the flow of capital, based on certain well-defined set of indicators that are analyzed.

In our view, the development of methodology for rating of investment objects (regions, sectors of economy, industries, enterprises) we should begin with specification of economic terminology. As still there is no clear, universal definition of such categories as "investment attractiveness", "investment potential", "investment activity" and etc. in the literature on the subject (mostly domestic, national literature), undetermined which of them is a broader concept. Authors apply these terms differently (not unversally) in their papers.

We propose to define the category "investment climate" - as a system of investment relations, which are shaped under the impact of wide range of interrelated processes of economic, political, social, psychological, innovative, infrastructural, regulatoric, environmental, criminal

nature. This generally is reflected:

- as objectively existing capacity of the country (region, industry, enterprise) for investing activity (characterized as investment potential);
- as the level of expected return and challenges for investments in the object (investee) (characterized as investment risks);
- as existing investment processes in the country (characterized as an investment activity).

Thus, the *investment climate* we can define as a system of conditions for investing in the country, which integrally combines such components as the investment potential, the investment risk and the investment activity of its regions, economic sectors, industries and individual companies.

We propose to define the main categories as follows:

- *investment activity of the investee* - the intensity of involvement of the investments in it.
- *investment potential of the investee* - objectively existing features of the object that help it to compete with other similar objects (competitors for investments) on the bases of the availability of economic, social and other objective conditions that are important for investment activity of the object. Here we are talking about narrow meaning of "investment potential". In broad terms, the investment potential of a state (like Ukraine) - a level of ability to attract foreign direct investments (FDI) and the level of socio-economic development of a state under the impact of FDI inflows.
- *investment risks of the investee* - conditions under which incomplete realization of the investment potential of the investee is possible because of some negative factors of internal or external influence.
- *investment attractiveness of the country* - a country's image and position in the global movement of investment capital compared to other countries-recipients of FDI arising from the investment potential and investment risk of its individual economic and territorial components, i.e. the dynamics of the investment climate.

Thus, the investment climate of the investee (country, region, sector) we consider as its sustainable state, and the attractiveness is so-called its "body language", "mimic", signal to investors, the invitation to take part in investing. From this perspective, there is an economic and philosophical juncture of investment problematics: the investment - as the economic process and as a dialectical aspect of classical philosophy. Dialectics of the investment process we observe in the aspect of the Law of mutual transition of quantitative changes in quality: qualitative changes occurring in the objective world, are made only on the basis of quantitative changes (Nadolniy, 2004). In other words, imposing the Law on investment iproblematic is: changes in the investment climate (quantitative changes) cause a change of investment attractiveness (qualitative change), which in future may change the investment climate due to a jump - the transition from old to new quality (Kharlamova, 2006).

This approach allows to distinguish between investment climate and investment attractiveness: and not only between their content but also between their future implementation. Hence, there is a dialectical interdependence between the investment climate and investment attractiveness. If the object of study is the investment attractiveness, then it acts as the result factor in the statistical and mathematical models, and the investment climate – as a factor.

Investment attractiveness from the point of view of a potential foreign investor should be considered as a multilevel system that includes country, region, economic sector, industry, enterprise, project. Balance of these levels for different investors may have different meaning

and coherence. In most cases, investors are interested in all levels of competitive advantages at such meaningful location scale: from general to specific. Priorities may vary depending on the purpose of an investor.

4 Estimation technique: data base of indicators

The basis of our technique is on the method of comparison of investees and investment conditions. As part of our method each object (region, sector, industry) is seen through the prism of competitive federalism, i.e. as quasicorporation, competing for investment incomes with other objects - quasicorporations. The most significant competitive advantage or, conversely, the weaknesses in the competitive position of an object (in terms of assessment of the prospects of investing in them) reflects in the positioning of the object in the system of investment-significant factors, i.e. factors that form the activity of investors toward the object (region, sector, industry). Under our concept a region (industry, sector) is considered as a completely open system and the volumes of FDI incomes in it are determined by the region's (industry, sector) attractiveness to potential investors.

Development of a method for the assessment of investment attractiveness, that will meet current trends in regional and sectoral developing is possible only through a thorough selection of a set of variety of indicators on the basis of which the investment attractiveness will be determined. Criteria for selection of statistical indicators for further calculation the rating of investment attractiveness of regions (sectors, industries) are following:

1. indicator must be relevant, adequate to the realities;
2. indicator should have a clear quantitative expression, be compact, dynamic, and relatively predictable;
3. indicator should be available for rating-making person, so easily reached in open access - the official statistical publications or the official web-sites of statistical agencies. This requirement is, firstly, because of the need to save time and financial costs for monitoring, and secondly, guarantee reliability and adequacy of the results;
4. ability to get "fresh" data for monitoring areas (semi-annually, annually).

Thus, a potential investor may, by the first wish, self-sufficiently to specify (or output) parameter in the model and to calculate rating on the desired level using the proposed estimation technique.

Based on the detailed characteristics of the motivational factors we propose to systematize indicators for the analysis of investment attractiveness of regions (sectors, industries). Fundamentally we should take in account as objective statistics as well as the subjective requirements of investors, meeting of which is essential for high-image ratings of investment attractiveness of the region or industry. Note that some indicators can be positive from the standpoint of classical economic performance, but for investors - be unacceptable. Conversely, indicators that in the overall point of view are negative, can have a positive value for the investor. Systematics of the indicators and the nature of their evaluations should take into account not only the present interests of investors, but also meet their investment strategies and to comply with the economic policies of the host country.

All statistical indicators of objects (regions, sectors, industries) are systematized due to 3 components of investment attractiveness of the investee: investment potential (IP), investment activity (IA) and investment risk (IR), which in its turn include such relevant factors:

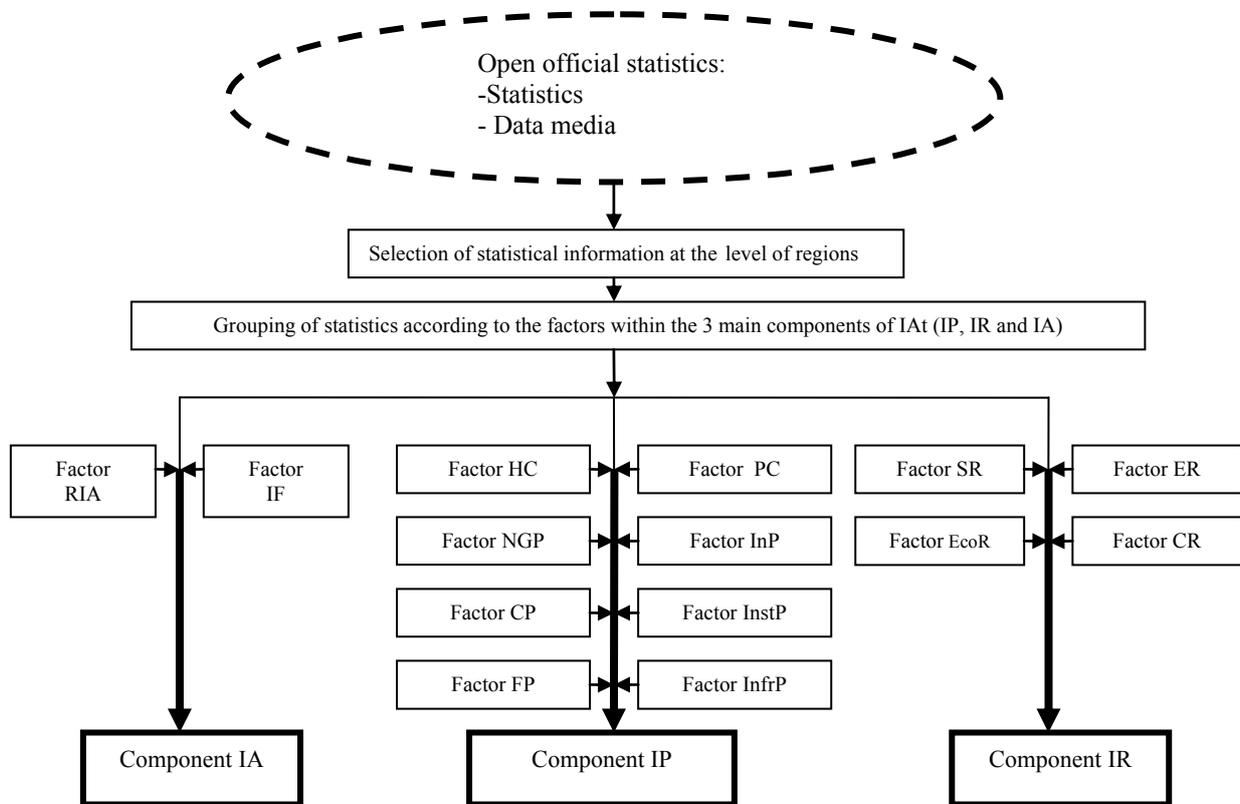
- IP: PC - industrial capital, InP - innovative potential (innovation environment), InstP - institutional potential, InfrP - infrastructure potential, HC - human capital, NGP - natural and geographical potential, CP - consumer potential, FP - financial potential;

- IR: SR - social risks, ER - economic risks, EcoR - environmental risks, CR - criminal risks;
- IA: IF - investment inflows; RIA - indicators of retrospective investment activity.

Involving of indicators of retrospective investment activity is an important innovation we proposed in our original method that have significant advantage over other methods. Because under terms of a moving investment environment the determination of long-term rate of investment attractiveness is quite problematic as the main factors are under constant changes. Though we suggest just the point (for a year) ranking of investment objects (regions, sectors, industries) on the basis of investment attractiveness, but in view of retrospective investment activity of objects.

Therefore, we developed the following logical scheme of grouping of indicators to assess the investment attractiveness (on the sample of regional level) (Fig. 1).

Fig. 1: Logical scheme of grouping of indicators



Source: Authorial compilation

We offer such procedure for calculating an integral estimation of investment attractiveness based on formalizing of operations of comparison, carried out in 8 stages (Tab. 1).

Tab. 1: Procedure of calculating an integral assessment of investment attractiveness

# of a stage	Description
Stage 1.1.	Selection of statistics: $\{x_{ni}\}$
Stage 1.2.	Standardization of indicators: $x^*_{ni} = \frac{x_{ni}}{x_n}$ (1)
Stage 2.	Correlation analysis (ρ) as a criterion for selection of indicators: $\rho \geq \pm 0,5$, $\rho \rightarrow \max$, for exclusion of multicollinearity (factors - indicators of IP and IR groups, the dependent variable - indicator of subgroup IF)

Stage 3.	Establishment of the database $\{x^*_{ni} \mid \rho_{x^*_{ni}} \geq \pm 0,5\}$ - adjusted and standardized data set
Stage 4.	Clustering of objects by each indicator using k-means cluster analysis
Stage 5.	Application of the author's ranking technique for objects on the level of factors
Stage 6.	Apply authorial ranking system for giving an integral assessment to each object at the level of three integral components of IA _t (IP, IR and IA) (assigning each object to a particular area of investment attractiveness), putting a certain place in the ranking to each object
Stage 7.1.	Calculation of the effectiveness of the investment potential's realization for the object (E) as the ratio of its investment activity to its potential: $E = IA_{t+1} / IP_t \quad (2)$
Stage 7.2.	The calculation of Spearman's rank correlation coefficient (η) or the degree of density of correlation ($\rho_{IP-IA(+1)}$) between the integral assessment of investment potential and the investment activity in the next period
Stage 8.	Presentation of the results, application of a marketing approach to develop investment strategies for further positioning and promotion of rated objects

Source: Authorial compilation

Firstly, using the author's ranking system ("skating") we determine assessment for each object at the level of each factor and then – at the level of investment attractiveness' components (IP, IR, IA).

All indicators are divided on positive and negative based on the direction of their impact on the investment attractiveness. In our method we include as positive – indicators of IP and IA, and as negative – indicators included in IR component. Note that at stage 4 we considered that the lowest index value will receive the best estimate in IR component and the worst - the highest. So, the proposed by us the using of methods of cluster analysis and authorial "skating" system takes into account the direction of indicator's impact and avoid additional calculations.

The basic principle that is putted in base of the author's ranking system ("skating") - taking into account the principle of absolute (mostly) majority.

Our approach can be considered as adequate to the stated objectives of the study. Not engaging of subjective "expert weights" are the clear advantage in favor of the use of author's ranking system for integral assessment of investment attractiveness, because of undoubted objectivity of the results.

We consider that it is appropriate to represent the results of ratings in dynamics of changes: calculate annual rankings, get new charts and assess the movement of objects in the ranking as "success" (or "failure") of implementation of the strategic investment decisions. Principle of the dynamic evaluation of ratings of investment attractiveness, in our view, must be "dynamic of the rating instead of the rating of dynamics" (because the latter usually does not reflect the real picture of quality and quantity changes in the investment area of the country). In general, the construction of dynamic ratings is appropriate in terms of the assessment not only per a certain time, but also incounting of dynamic changes that occur over time. Such approach allows more solid conclusions regarding retrospective, current, and hence, also a prospective investment situation in the region (sector, industry).

We propose to apply marketing approach based on the interests of a recipient of FDI for the developing of an investment strategy for positioning of rated objects (regions, sectors, industries).

Marketing of FDI inwards has optimally to combine the two fundamental issues:

- On the one hand, to assist maximum attracting of foreign investments,

- On the other hand, to ensure the interests of the host economy.

The investee – whether region, or economic sector, or industry, or project – is a commodity on the capital market, although a specific one. Therefore, to increase the demand for such "goods" the deliberate, well-constructed marketing strategy of its promotion is required. Note that the usage of marketing approach in the system of regional and sectoral investment is entirely possible and even desirable in view of the fact that the inherent principles are universal. In developing of the state investment policy it is necessary to apply classical laws and methods of marketing and strategic management, which has not been taken into account for example in Ukraine.

If investors are considered as those who "provide (produce) specific services" and the investees at all levels - as "consumers of these services," then the hallmark of investment marketing is that the target groups for search and organization of its optimal distribution are not "customers" of service (in this case - investments), but their "producers", i.e. individual and legal persons who potentially can and wish to invest. Hereat the effectiveness of such marketing of investments is dependent on both participants of this process. And here the appropriate is one of the basic principles of classical advertising (Moral Code of Harvey McKay): "The worm should be liked by fish, not by fisher."

Marketing positioning should be based on the results of rating investment survey, followed by selection of strategies for different groups of investors and various groups of potential targets. Ranking of objects (regions, sectors, industries) by key groups of factors - components of investment attractiveness - will let to keep current the areas of complex programs to improve the investment attractiveness of a particular object, identify its forward-looking orientation and possible effectiveness, identify national priorities.

5 Conclusions

To summarize, we developed the concept and system of integral assessment of investment attractiveness, which reveals the sequence of evaluation procedure as follows:

1. Selecting of a specific level (region, sector, industry) to assess IAt, composition of a massive of objects to compare,
2. The overall selection of indicators and statistics to assess IAt at the chosen level,
3. Grouping of selected indicators by components of IAt,
4. Selection by means of correlation analysis an optimal set of parameters-indicators, a creation of database for further assessment of IAt at the selected level,
5. Breakdown of objects of the chosen level for the values of each parameter-indicator by means of cluster analysis,
6. Calculation of integral assessments and determination of the position of objects of the chosen level by the separate factors,
7. Calculation of integral assessments and determination of the position of objects of the chosen level by the separate components of IAt,
8. Ranking of objects by integral assessment of IAt,
9. Application of marketing approach to the analysis of the results with the gain to develop strategies to attract potential investors.

We have to mention that such complex authorial estimation technique was the first such complex proposed method in Ukrainian scientific and practical activity and received its recognition in science and practice there.

From a practical point of view authorial complex evaluation technique of the investment climate attractiveness does not require especially significant human and financial costs on collection and formation of the data base and direct monitoring of the investment climate in a host state-receptient. It is fully based on the information resources that are available in the public access. The easement of calculation processes for rating assessment is implemented by using of MS Excel, PP Statistica.

Thus, the authorial method, despite its simplicity, makes it possible to receive in-line rating product.

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Investment Climate and Investment Attractiveness: Estimation Technique

Summary

The scope of this paper is to propose author's original complex and easy working procedure of investment climate's attractiveness estimation (on the level of regions, economic activities (sectors), and industries of a state) that could be useful for potential investor and a governor at the regional and industrial levels. Noting, that globalization of world economy bringing to valuate activity of international investment processes and that foreign direct investments became the source of states' financing, we have to admit - the investment potential of most states (mostly CIS states) is not used in an optimal way. In addition, efficiency of the incoming investment capital is very low. So a goal of the research was to apply the new special method for working out a complex approach to improve investment situation and suggest an approach to raise the investment efficiency, in particularly that of the foreign direct investments. The object of the research is the investment climate of a state-recipient and assessment of its attractiveness, strategies of investment policy of a state-recipient based on complex rating estimation technique results.

Key words: Foreign direct investments; Investment climate; Rating estimation..

JEL classification: F21, G24.

Fractal Markets Hypothesis and the Current Financial Crisis: Scaling, Investment Horizons and Liquidity[#]

Ladislav Krištoufek^{}*

1 Introduction

Efficient markets hypothesis (EMH) has been a hot topic since its introduction in 1960s (Fama, 1965, 1970; Samuelson, 1965). For its simplicity and intuitive logical structure, EMH has been widely accepted as a cornerstone of the modern financial economics. Since the very beginning, EMH has been criticized on several fronts, mainly theoretical – that it is only a set of practically meaningless tautologies (LeRoy, 1976) – and empirical – that it is frequently violated and financial markets are at least partially predictable (Malkiel, 2003).

In his pioneering paper, Fama (1970) describes the efficient market as the one where all available information are already reflected in the asset prices. In his later work (Fama, 1991), he defined the efficient market through the language of mainstream economics as the one where prices reflect available information to the point where marginal gain from using the information equals marginal cost of obtaining it. Based on this assertion, the efficient market is defined as a random walk (Fama, 1965), contrary to Samuelson's formulation through a martingale (Samuelson, 1965). Either way, the efficient market leads to a Brownian motion of the asset prices, i.e. a process with independent and identically normally distributed increments. Apart from uncorrelatedness of the increments (autocorrelations have been shown to vanish for lags higher than units of minutes Stanley et al. (1999)), the implications of EMH has been widely rejected in empirical studies (Cont, 2001). However, the most severe shortcoming of EMH is its ignorance to extreme (and sometimes devastating) events on the capital markets, which theoretically should have never happened (Stanley, 2003).

EMH has far-reaching implications, which are discussed in majority of financial economics textbooks (Elton et al., 2003) – investors are rational and homogeneous, financial returns are normally distributed, standard deviation is a meaningful measure of risk, there is a tradeoff between risk and return, and future returns are unpredictable. To some extent, all of these implications can be easily attacked with empirical analysis. For our purposes, the first implication of homogeneous investors is crucial. It implies that all the investors use the available information in the same way and thus they operate on the same investment horizon (or theoretically the same set of investment horizons). However, it is known that capital markets comprise of various investors with very different investment horizons – from algorithmically-based market makers with the investment horizon of fractions of a second, through noise traders with the horizon of several minutes, technical traders with the horizons of days and weeks, and fundamental analysts with the monthly horizons to pension funds with the horizons of several years. For each of these groups, the information has different value and is treated variously. Moreover, each group has its own trading rules and strategies, while for one group the information can mean severe losses, for the other, it can be taken a profitable opportunity. This

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environment creates a very complex system, which can be hardly described by oversimplified EMH.

On contrary, fractal markets hypothesis (FMH) (Peters, 1994) has been constructed based on the most general characteristics of the markets. In its core, it is based on a notion completely omitted in EMH – liquidity. According to FMH, liquidity provides smooth pricing process in the market, making it stable. If liquidity ceases, market becomes unstable and extreme movements occur. In the literature, FMH is usually connected with detection of fractality or multifractality of the price processes of financial assets (Peters, 1994; Onali and Goddard, 2009, 2011). However, it has not been put to test with respect to its predictions about causes and implications of critical events in the financial markets. In this paper, we analyze whether these predictions fit the observed behavior in the stock markets before and during the current worldwide financial crisis (2007/2008–?). Mainly, we are interested in the behavior of investors at various investment horizons as well as in scaling of the market returns. To do so, we utilize a sliding window estimation of generalized Hurst exponent $H(q)$ with $q = 2$ (usually called local or time-dependent Hurst exponent). Moreover, we introduce several new measures of trading activity at different investment horizons based on decomposition of Hurst exponent and variance scaling.

The local Hurst exponent approach has been repeatedly used to analyze potential turning and critical points in the stock market behavior. Grech and Mazur (2004) studied the crashes of 1929 and 1987 focusing on behavior of Dow Jones Industrial Index and showed that the local Hurst exponent analysis can provide important signals about coming extreme events. In the series of papers, Czarnecki, Grech and Pamula (Grech and Pamula, 2008; Czarnecki et al., 2008) studied the critical events of the Polish main stock index WIG20 and again presented the local Hurst exponent as a useful tool for detection of coming crashes (together with log-periodic model of Sornette et al. (1996)). Domino (2011, 2012) further studied the connection between local Hurst exponent behavior and critical events of WIG20 index. Kristoufek (2010) applied the similar technique on detection of coming critical points of PX50 index of the Czech Republic stock market and uncovered that the functioning is very similar. Morales et al. (2012) broadened the application of time-dependent Hurst exponent on a wide portfolio of the US stocks and showed that the values of Hurst exponent can be connected to different phases of the market.

In this paper, we show that behavior of the time-dependent Hurst exponent is connected to various phases of the market. Moreover, we uncover that there are some common patterns before the critical points. Most importantly, the current financial crisis is detected to be connected with unstable trading and unbalanced activity at different investment horizons which is asserted by FMH. The paper is organized as follows. In Section 2, we give basic definitions of fractal markets hypothesis. Section 3 describes multifractal detrended fluctuation analysis, which we use for the generalized Hurst exponent estimation, and introduces new measures of trading activity at specific investment horizons. In Section 4, we test whether the assertions of FMH are actually observed in the real market. All three analyzed indices – DJI, NASDAQ and S&P500 – share several interesting patterns before and during the current financial crisis, which are in hand with FMH.

2 Fractal markets hypothesis

Fractal markets hypothesis (FMH) was proposed by Peters (1994) as a follow-up to his earlier criticism of EMH (Peters, 1991). The cornerstone of FMH is a focus on heterogeneity of investors mainly with respect to their investment horizons. Investors with different investment horizons treat the inflowing information differently and their reaction is correspondingly distinct. Specific information can be a sell signal for a short-term investor but an opportunity to buy for a long-term investor and vice versa. The existence of investors with different horizons assures a stable functioning of the market. When one horizon (or a group of horizons) becomes

dominant, sell or buy signals of investors at this horizon will not be met with a reverse order of the remaining horizons and prices might collapse. Therefore, the existence and activity of investors with a wide range of investment horizons is essential for a smooth and stable functioning of the market.

FMH was further developed and five definitions (statements) were proposed (Rachev and Weron, 1999; Weron and Weron, 2000):

- *FMH1*: The market consists of many individuals with many different investment horizons.
- *FMH2*: Information has a different impact on different investment horizons.
- *FMH3*: The stability of the market is predominantly a matter of liquidity. Liquidity is available if FMH1 holds.
- *FMH4*: Prices reflect a combination of short-term trading (technicians) and long-term valuation (fundamentalists).
- *FMH5*: If a security has no bond with the economic cycle, there will be no long-term trend. Trading, liquidity and short-term information will be dominant.

FMH1 reacts to the fact that market consists of different types of investors with respect to their investment horizon. The market consists of the investors with investment horizon from several seconds and minutes (market makers, noise-traders) up to several years (pension funds). Investors with short investment horizon focus on technical information and crowd behavior of other market participants. On the other hand, investors with long investment horizon base their decisions on fundamental information and care little about crowd behavior. FMH1 and FMH2 thus emphasize the heterogeneity of investors. Not only have the investors different investment horizons but the information has different effects on the investors in forming of expectations which is in contrary to EMH. FMH3 states that liquidity is brought to market by many investors with many different investment horizons. If a short-term investor experiences relatively high loss, it is a buying opportunity for a long-term investor and vice versa. If market switches to the place of many investors of several, or extremely only one, investment horizons, trading becomes stuck, unstable and prone to extreme movements. Single negative information can turn market into a downward spiral. The last two definitions are rather implications of the first three and are not necessarily needed. Fractal markets hypothesis thus suggests that during stable phases of the market, all investment horizons are equally represented so that supply and demand on the market are smoothly cleared. Reversely, unstable periods such as "crises" occur when the investment horizons are dominated by only several of them so that supply and demand of different groups of investors are not efficiently cleared. These two implications give us features to look for in the market behavior. FMH is tightly connected to a notion of multifractality and long-range dependence in the underlying series. Process X_t is considered multifractal if it has stationary increments which scale as

$$\left\langle |X_{t+\tau} - X_t|^q \right\rangle \propto \tau^{qH(q)} \quad (1)$$

for integer $\tau > 0$ and for all q (Calvet and Fisher, 2008). $H(q)$ is called generalized Hurst exponent and its dependence on q separates the processes into two categories – monofractal (or unifractal) for constant $H(q)$ and multifractal when $H(q)$ is a function of q . For $q = 2$, we consider long-range dependence of the increments of the process X_t . As this case is the most important for us as it characterizes scaling of variance (and we treat variance as a sign of a trading activity), we label $H \equiv H(2)$ further in the text. Hurst exponent H is connected to asymptotically hyperbolically decaying autocorrelation function $\rho(k)$, i.e. $\rho(k) \propto k^{2H-2}$ for $k \rightarrow \infty$. For $H = 0.5$, we have a serially uncorrelated process; for $H > 0.5$, we have a persistent

process; and for $H < 0.5$, we an anti-persistent process. Persistent processes are visually trending yet still remain stationary, whereas anti-persistent processes switch their sign more frequently than random processes do.

3 Scaling of stock returns

In this section, we present the method we use for the estimation of generalized Hurst exponent – multifractal detrended fluctuation analysis (MF-DFA) – and several novel measures connected to a trading activity at various trading horizons. MF-DFA is applied here because it is standardly used in the local Hurst exponent literature (Grech and Mazur, 2004; Grech and Pamula, 2008; Czarnecki et al., 2008; Kristoufek, 2010) and compared to other methods, such as generalized Hurst exponent approach (Di Matteo et al., 2005; Di Matteo, 2007; Kristoufek, 2011), it provides wider range of scales to analyze. As we want to compare as many investment horizons as possible, such a distinction leads to MF-DFA.

3.1 Multifractal detrended fluctuation analysis

Multifractal detrended fluctuation analysis (MF-DFA) is a generalization of detrended fluctuation analysis (DFA) of Peng and his colleagues (Peng et al., 1993, 1994). Kantelhardt et al. (2002) proposed MF-DFA to analyze scaling of all possible moments q , not only the second one ($q = 2$) as for DFA. One of the advantages of MF-DFA and DFA over other techniques is that it can be applied on series with $H > 1$, i.e. a higher order of integration.

In the procedure, one splits the series of length T into segments of length s . For each segment, a polynomial fit $\hat{X}_{s,l}$ of order l is constructed for the original segment X_s . In our analysis, we apply a linear fit so that $l = 1$ and we will omit the label onwards. Note that the filtering procedure can be chosen not only from polynomial fits but also from moving average, Fourier transforms and various others (Kantelhardt, 2009). Detrended signal is constructed for each segment as $Y_s = X_s - \hat{X}_s$. Fluctuation $F_{DFA,q}^2(i, s)$ is defined for each sub-period i of length s as

$$F_{DFA,q}^2(i, s) = \left(\sum_{i=1}^{\lfloor T/s \rfloor} Y_{i,s}^2 / s \right)^{1/2} \quad (2)$$

As T/s is not necessarily an integer, we calculate the fluctuations in the segments starting from the beginning as well as from the end of the series not to omit any observation. By doing so, we obtain $2\lfloor T/s \rfloor$ fluctuations $F_{DFA,q}^2(i, s)$. The fluctuations are then averaged over all segments with DFA,q length s to obtain the average fluctuation

$$F_{DFA,q}(s) = \left(\sum_{j=1}^{2\lfloor T/s \rfloor} F_{DFA,q}^2(j, s) / 2\lfloor T/s \rfloor \right)^{1/q} \quad (3)$$

The average fluctuations scale as $F_{DFA,q}(s) = cs^{H(q)}$ where $H(q)$ is a generalized Hurst exponent and c is a constant. For $q = 2$, we obtain standard DFA for a long-range dependence analysis. Hurst exponent is usually estimated only for a range of scales s between s_{min} and s_{max} . The minimum scale is set so that the fit in each segment can be efficiently calculated and the maximum scale is set so that the average fluctuation for this scale is based on enough observations.

3.2 Scaling-based liquidity measures

Estimation of Hurst exponent compresses all the information from the dynamics of the process into a single value. However, the procedure can be also decompressed to give us some

additional information. From the economic point of view, the segment's length s can be taken as a length of an investment horizon. Fluctuation corresponding to the horizon s can be then taken as a proxy for activity of traders with a horizon of s . From our previous discussion about situations of market instabilities in FMH framework, we propose several new measures.

Trading activity of investors with very short investment horizons can be approximated with $\hat{F}(0) = e^{\hat{c}}$, which is an estimate of fluctuation at horizon $s \rightarrow 0$. In an unstable market, it is assumed that investors at the very short horizons will be the most active ones. Also, some long-term investors might shorten their horizons Peters (1994). Therefore, we assume that close to and during market turmoils, $\hat{F}(0)$ will increase compared to the stable periods. In a stable market, all investment horizons are represented uniformly (or at least approximately uniformly). During critical points, the long-term investors either restrict or even stop their trading activities and the short-term investors become dominant. Trading activity and thus fluctuations F^2 at shorter trading horizons will be higher than rescaled trading activity at longer horizons. Therefore, Hurst exponent H would be decreasing shortly before and during the turbulent times at the market. This is in hand with the definition of irregular market of Corazza and Malliaris (2002).

In a regular market, the scaling of variance should be stable, i.e. fluctuations F^2 for different horizons s should lay on a straight line. If any of the investment horizons becomes dominant, the scaling would be less precise. To measure such dispersion of trading activity at different investment horizons, we introduce F_σ , which is a standard deviation of rescaled fluctuations, and F_R , which is a range of rescaled fluctuations.

During turbulent times, both F_σ and F_R are expected to increase. In a similar manner, we also define a ratio F_r between rescaled fluctuations of the horizons with the maximal and minimal rescaled fluctuation. In an ideal market with uniformly represented investment horizons, we would have $F_r = 1$. The further F_r is from 1, the less stable is the scaling and thus also the less stable the market is.

4 Application to the current financial crisis

4.1 Data and methodology

To check whether the implications of FMH hold, we apply the proposed methodology to the daily series of three US indices – Dow Jones Industrial Average Index (DJI), NASDAQ Composite Index (NASDAQ) and S&P500 Index (SPX) – between the beginning of 2000 and the end of 2011. As it is widely believed that the crisis started in the USA and spilled over to the other parts of the world, we choose the US indices because they should signify the coming and continuing crisis the best. If the predictions of FMH hold, we expect local Hurst exponent to be decreasing before the critical point and remaining below $H = 0.5$ during the crisis. In a similar way, trading activity at the short horizons $\hat{F}(0)$ should be increasing before the crisis and remain high during the crisis compared to the more stable periods. The very same expectations hold for F_σ and F_R . For F_r , we expect the values to be further from one before and during the crisis times.

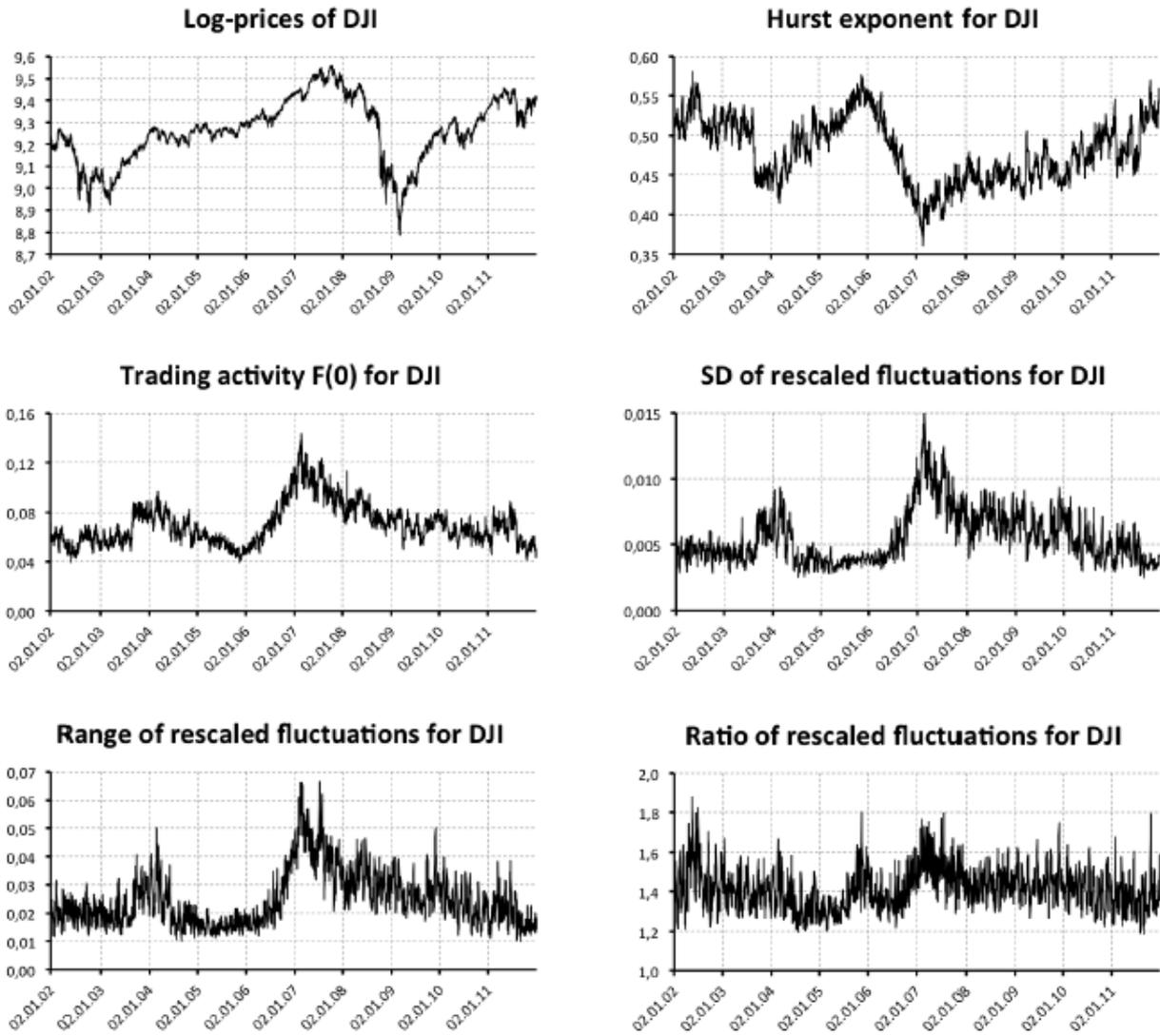
We use a moving (sliding) window procedure to the dataset. The window length is set to $T = 500$ trading days (approximately two trading years) and a step to one day. For MF-DFA, we set $s_{min} = 10$ and $s_{max} = T/10 = 50$. This way, we can estimate H , $\hat{F}(0)$, F_σ , F_R and F_r and comment on their evolution in time and during various phases of the market behavior. To meet stationarity condition, which is essential for correct Hurst exponent estimation, we filter the raw series with GARCH(1,1). Therefore, the analysis is made on filtered series defined as $fr_t = r_t/h_t$, where fr_t is a filtered return at time t , r_t is a raw return at time t , defined as $r_t = \log(S_t/S_{t-1})$ with S_t being a

stock index closing value at time t , and h_t is a conditional variance obtained from GARCH(1,1) at time t . The GARCH-filtering is a crucial addition to the methodology because without comparable volatility in different time windows, we would not be able to say whether e.g. an increase in $\hat{F}(0)$ is caused by changing structure of investors activity or just an increase of variance across all scales (investment horizons).

4.2 Results

Results for all three analyzed indices are summarized in Figs. 1–3. All the indices reached their post-DotCom bubble maxima in the latter half of 2007, which were followed by progressively decreasing trend culminating at the turn of 2008. Similarly to the indices all over the world, the US indices lost around half of their value during that approximately 1.5 year – the loss accounted for 53.78%, 61.22%, and 56.77% for DJI, NASDAQ and S&P500, respectively. However, all three indices have been strongly increasing since the bottoms in the beginning of 2009 and have almost recovered all the losses by the end of 2011.

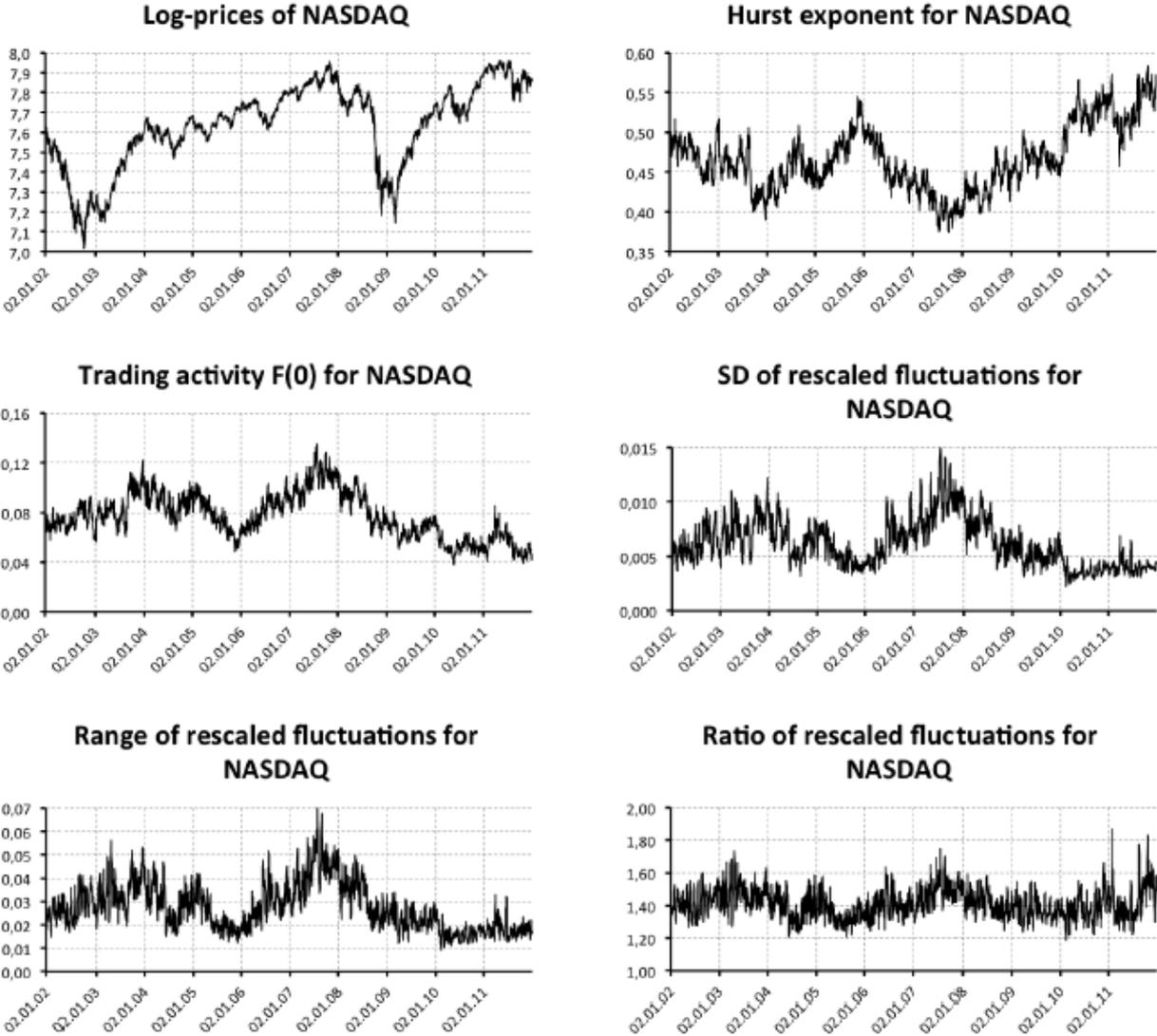
Fig. 1: Results for DJI indes



For all three indices, we observe very similar patterns in the behavior of all variables of interest. Starting with the behavior of the local Hurst exponent, we can see that for all indices, H followed strong decreasing trend from the break of 2005 and 2006 till the beginning of 2007.

For NASDAQ, the trend followed even to the second half of 2007. Such a behavior can be attributed to a changing structure of investors' activity – increasingly more trading activity was taking place at short investment horizons. The end of these strong downward trends of H is connected to the end of soaring gains of all the analyzed indices. For NASDAQ, the end of the local Hurst exponent trend can be even connected to attaining the maximal values in 2007. Afterwards, the local Hurst exponent follows a slow increasing trend for all three indices. However, H remains below the value of 0.5, which is associated with a random behavior, for a rather long period. The lengths of these periods vary across the analyzed indices – the longest for S&P 500, which is the index with the lowest gains after the crisis. These two phenomena might be connected because for NASDAQ, which has been the most increasing market of the three after the crisis, we observe the values of H even above 0.5 in 2010 and 2011. Note that values of $H > 0.5$ indicate dominance of long-term traders (a higher trading activity at long investment horizons) and thus a belief in good prospects of the market situation.

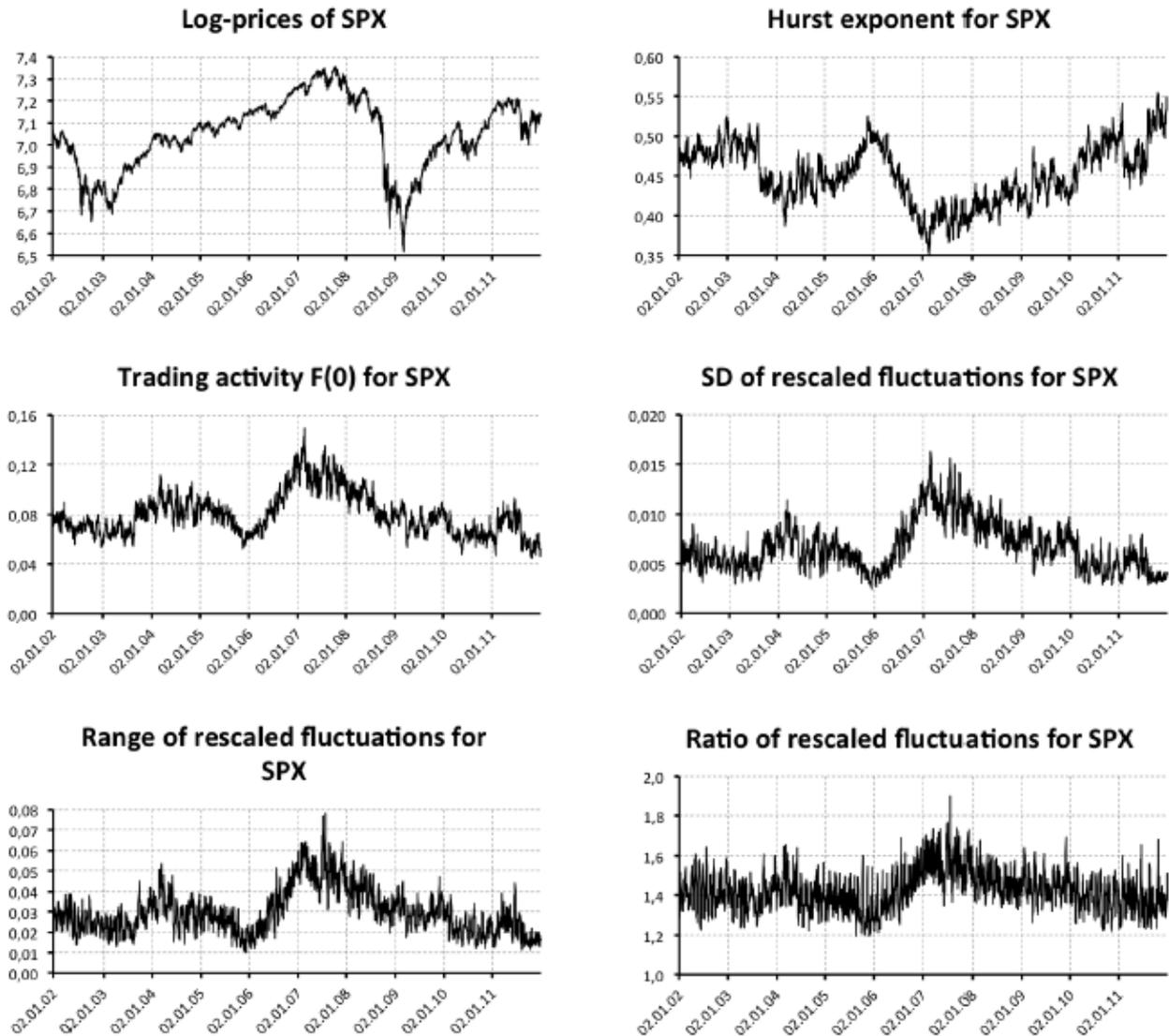
Fig. 2: Results for NASDAQ index



When we look at the short horizons trading activity $\hat{F}(0)$, we observe that it was increasing in very similar period as Hurst exponent was decreasing the in the previous paragraph. The measure increased from values of approximately 0.04 up to over 0.12 for all three analyzed indices. After reaching its peak, the trading activity at the short horizons was slowly decreasing

back to the original levels of the beginning of 2006. Again, we observe differences in the duration of this downward trend. For NASDAQ, the pre-crisis levels of short-term trading activity were reached around the beginning of 2009 and since then, the activity has remained relatively stable. On contrary, DJI has not reached the pre-crisis levels yet and S&P 500 got back to the pre-crisis levels during 2010. Even though the durations and magnitudes of short-term trading activity vary between the analyzed markets, we observe that the most critical points of the crisis were connected to increased trading activity of short-term investors.

Fig. 3: Results for S&P 500 index



The other two measures – standard deviation of rescaled fluctuations F_σ and range of rescaled fluctuations F_R – tell a very similar story. Since both are the measures of instability of variance scaling across different investment horizons, this is not surprising. The results are actually very alike to the dynamics of estimated fluctuations at very short investment horizons discussed in the previous paragraph – very rapid increase starting in 2005/2006 turning which followed to the first half of 2007 (and again longer for NASDAQ). According to FMH, unevenly represented investment horizons imply complicated matching between supply and demand at the financial market. Therefore, the increasing instability of trading activity at different investment horizons indicates growing problems of this supply–demand matching. After the strong increases between 2006 and 2007, both measures started decreasing afterwards. However, only NASDAQ

has recovered the pre-crisis stability levels.

The last measure we present – the ratio between trading activity at the horizon with the highest and with the lowest activity – uncovers quite similar results. Note that even in the calm periods before the last crisis, the ratio is not equal or close to one as it theoretically should be (for a perfectly scaling variance). Between the beginning of 2006 and the first half of 2007, the ratio increased from around 1.2 up to 1.6 for all three indices. Notably, the following decreasing trend was the fastest for NASDAQ while it took much longer to DJI and S&P 500 to recover. However, the results for this last measure are probably the weakest as the measure is very volatile in time.

5 Conclusions

Efficient market hypothesis is unable to describe the behavior of the financial markets during the last (current) crisis starting in 2007/2008 in a satisfying way. We analyze whether an alternative approach – fractal markets hypothesis – gives more reasonable predictions. The cornerstone of FMH is liquidity connected to the trading activity at different investment horizons. If the investors with different horizons are uniformly distributed across scales, supply and demand for financial assets work efficiently. However, when a specific investment horizon (or a group of horizons) starts to dominate the situation in the market, the supply–demand matching ceases to work and a critical point emerges. To test whether this crucial assertion of FMH holds for the current crisis, we used the local Hurst exponent approach as well as the introduced set of new measures of trading activity based on Hurst exponent decomposition.

We found that the behavior at various investment horizons is quite well described by the FMH before and during the current crisis. Analyzing three stock indices of the USA – DJI, NASDAQ and S&P 500 – we showed that the local Hurst exponent decreases rapidly before the turning of the trend, which is in hand with previously published results (Grech and Mazur, 2004; Grech and Pamula, 2008; Czarnecki et al., 2008; Kristoufek, 2010). Moreover, with a use of the new measures of trading activity, we uncovered that investors' trading activity indeed changes before and during the crisis period compared to the preceding stable periods. Before the crisis, the structure of trading activity at different investment horizons changed remarkably with rapidly increasing activity at the shortest horizons, i.e. short-term investors started to dominate and long-term investors showed no faith in a continuing growth. Also, the stability of investment horizons representation changed before the current turbulent times. Uniformity of investment horizons representation started to cease before an outburst of the crisis. During and after the most severe losses, the indicators started to stably return to the pre-crisis levels. However, they fully recovered only for NASDAQ index while DJI and S&P 500 are just attaining the former stability. Note that NASDAQ, which is the index with the fastest recovering investment horizons measures, is also the index which returned to the pre-crisis values the fastest.

Summarizing, we have showed that fractal markets hypothesis gives reasonable predictions of market dynamics in the turbulent times. Trading activity at various investment horizons ensuring efficient clearing of supply and demand in the market, which guarantees high liquidity, turns out to be a crucial attribute of a well-functioning and stable market.

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Fractal Markets Hypothesis and Current Financial Crisis

Summary

We investigate whether fractal markets hypothesis and its focus on liquidity and investment horizons give reasonable predictions about dynamics of the financial markets during the turbulences such as the current financial crisis. Compared to the mainstream efficient markets hypothesis, fractal markets hypothesis considers financial markets as complex systems consisting of many heterogeneous agents, which are distinguishable mainly with respect to their investment horizon. In the paper, several novel measures of trading activity at different investment horizons are introduced through scaling of variance of the underlying processes. On the three most liquid US indices – DJI, NASDAQ and S&P 500 – we show that predictions of fractal markets hypothesis actually fit the observed behavior quite well.

Key words: Fractal markets hypothesis; Scaling; Fractality; Investment horizons; Efficient markets hypothesis.

JEL classification: G01, G14, G15.

Shareholder Activism of Responsible Investors

*Marina Milevskaya**

1 Introduction

The growing presence of responsible investors among the shareholders raises the question of their impact on social and environmental policy of the company. We discuss whether their activism has the power to change the standards of responsible business policy. In other words, to what extent these responsible investors are able to influence, for example, the choice of size of an environmental pollution. There is no theoretical model of an influence of responsible shareholders on company activity. This allows examining their impact on the real economy, particularly in terms of the global financial crisis. The first objective of the paper is to provide an analytical framework of a stock market economy, in which the emergence of coalition of responsible investors with incentives to monitor and restructures companies can be discussed. We construct an expanded model, where the functions of agents of this economy are rewritten, in particular we introduce the factor of corporate reputation that influences the choice of investments and the factor of shocks of production that put businesses in uncertain conditions of their activity. During the research we examine the model of environmentally responsible investor activism in the absence of the foreign sector (closed economy) and government (there is only the private sector). In previous studies there were two main effects: the direct effect of responsible investment and the effect of signaling. This paper examines another possible effect of the presence of responsible investors as the main shareholder of polluting industries; investors can vote for a modernization of production to reduce environmental pollution. The existing literature does not offer modeling of this type of shareholder activism.

With regard to this specific factor model it should be noted, that there is no theoretical framework that introduces this aspect in the process of investors' decision-making. An example is the recent research paper of Puncheva Petya (2007) [1] which takes an interdisciplinary approach to explain the role of corporate reputation and she finally proves that shareholders estimate the social and pragmatic legitimacy of the company and its reputation. In this paper we try to model and internalize this factor which enables stimulate the participation of company management in the non profit activity to improve its image.

2 Literature review

The paper of Meir Statman (2000) [2] describes two main effects of the actions of responsible investors:

1. Investment actions effect.
2. Effect of policy.

Andrea Beltratti (2003) [3] constructs a macroeconomic model to find the general equilibrium with SRI. The model has two heterogeneous agents, two periods and two types of securities (irresponsible stocks and "safe" bonds). It examines the impact of SRI on the price of the securities. Important factors in the model are wealth of responsible investor and diversification opportunities. One way, the relative size of the wealth of economic agents is crucial. And another way if the company has the unique traits to become the subject of diversification, it has

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no strong incentive to be more responsible. The agent made the choice of consumption and investment. The author analyzes the impact of the heterogeneity of agents and externalities of production (as an indicator of corporate social responsibility). It is assumed that the production function depends directly on the loans and specific exogenous shock for each company (negative and positive). The authors consider the externality associated with the specificity of socially responsible investments, in this particular case they interpret it as the negative effect of demand of loans from the company A ("polluting industry") on the utility of agent i ("responsible investor"). The model is simple and it can not show any significant consequences. It concludes that SRI does not have strong impact when the number of responsible investors is small and there are a lot of possibilities for diversification.

In the following papers (2010-2011) [4], [5] Lammertjan Dam, Ben J. Heijdra provide the conception of "warm-glow effect" developed by James Andreoni in 1990 to explain impure altruism. Instead of being only motivated by an interest in the growth of welfare of recipients of investments, the "warm-glow investors" have also the utility of the act of giving, that is to say, they have a selfish motivation. This motivation can arise, for example, from the desire to have a reputation of socially responsible people or philanthropists. These papers analyze the impact of SRI on quality of environment and abatement economy. The authors examine whether environmental policy is effective when consumers themselves have an incentive lied to the "warm-glow motive" to internalize the environmental externalities in their functions. It is found that their responsible behavior partly ensure the positive effects on environmental quality of the abatement policy. The "warm-glow" motivation imposes an implicit tax on the value of the polluting company. It assumes that investors can choose only the "pure" bonds or stocks of irresponsible corporations. The effect of warm-glow requires a growth of premiums to induce them to purchase these shares. The paper assumes also that there is no risk, so the bonds and stocks are perfect substitutes and moreover it analyzes the consequences of two environmental chocks: (1) The continued growth of non-expected level of public abatement financed by taxes and (2) the temporal increase of "warm-glow" parameter.

The impact of the actions of responsible investors on business decisions and social policy is also examined by Amir Barnea, Robert Heinkel and Alan Kraus in the paper of 2005 [6]. There are three categories of companies: polluting, clean and reformed, and two types of investors: neutral and green. The authors find the Nash equilibrium for three levels of capital costs. When the costs of reform are small responsible investors can significantly change the economic situation, investments in irresponsible companies fall which reduces the total investment. If these costs are large, responsible investors lose power. If costs are middle, the economy receives the maximum of investment if there are only responsible or irresponsible investors.

Now we can consider the paper lied with an activism of general shareholders. Ernst Maug [7] examines the role of liquidity in financial market in surveillance of company policy. He assumes that the greater liquidity should discriminate against the desire of large shareholders to participate in the management of the company. However, the results of model show that there is the positive impact of liquidity on corporate control. In this paper he constructs theoretical economics and the process of decision-making to discuss the effect of the presence of "blockholders". The concept of "monitoring" is used synonymously with "shareholder activism". There is a problem of free-riding because small shareholders benefit from the efforts of large investors and do not pay for it. We analyze the equilibrium size of the major shareholder, he brings two effects: "lock-in-effect" (the ability to control has value) and "liquidity effect" (in the stock market after buying large shares there are few stocks which reduces liquidity). The other unobvious result: the liquid market allows to solve the problem of free-riding, because in the less liquid market the potential shareholders do not want to buy a lot of stocks to avoid problems of inflexibility.

Finally we consider the literature related to the analysis of the role of reputation. Previous research generally assumes that a good reputation is a resource of competitive advantage. In her paper Sabrina Helm (2007) [8] defines reputation as "the business valuation carried out by its shareholders", according to their affect and knowledge. She argues that reputation is an intangible asset of the company. Helm also adds that reputation is a socially shared image and a consensus on what is his behavior in a given situation. It is based on collectively held expectations about the ability of a company and its willingness to satisfy the interests of different agents, for example, those of consumers, investors and suppliers.

3 Model of environmentally responsible investor activism

3.1 Expanded model of responsible investor activism

To better adapt the theoretical model to reality, we can introduce the new conditions. We assume that responsible investors are more stable and loyal to the green company. To differentiate it says that during the financial crisis ordinary investment fund does not buy stocks due to stock market panic. The expanded model has T periods and the letter t is the period number. There are three types of companies: g (green), p (polluting) and r (reformed). The total

number of firms is $N(E_g + E_p + E_R)$. E_g uses only green capital K_g that brings no loss to the environment; E_p - only capital K_p (polluting technology) and E_R buys K_g and K_p . Suppose that the price of capital K_g is greater than K_p , if not the company E_p has already replaced it and become E_R . To focus on the choice of technology (green or polluting) in this model the labor market is not considered. For simplicity, it says the price of capital includes costs associated with its treatment.

K_p^{it} and K_g^{it} mean polluting and green capital of firm i. and their prices are P_{Kp}^t and P_{Kg}^t .

There is the minimum level of capital that the company i has to pay: $K_p^{\min it}$ and $K_g^{\min it}$. This is explained by the existence of supply contracts to ensure continuity of production. One can choose the following contract: it must still pay 70% of the previous level (t-1) of capital.

This helps avoid large fluctuations in output $CP^{it} = P_{Kp}^t * K_p^{it} + P_{Kg}^t * K_g^{it}$ - The total

cost of production of firm i. $CP^{it} = P_{Kp}^t * K_p^{it}$ For polluting companies and

$CP^{it} = P_{Kg}^t * K_g^{it}$ for green businesses. $Y^{it} = \Gamma^{it} * f(K_p^{it}, K_g^{it})$ - the final result of

production of firm i (its price is equal to one). Γ^{it} is an exogenous shock that is subjective for

each company. There are two production shocks: positive $\Gamma^{it} = (1+\theta)$ and negative $\Gamma^{it} = (1-p)$.

Finally we describe the function of profit: $\Pi^{it} = Y^{it} - P_{Kp}^t * K_p^{it} - P_{Kg}^t * K_g^{it}$.

DIV^{it} - total dividends paid by firm i. Here one may understand how the company compensates the environmental damage. We assume that to declare as reformed company the

polluting company pays the fixed amount $S^{it} = S$. For example, this payment includes the price of the advertising campaign and the payment in fund of type of Greenpeace and so on. For

simplicity it is the same for all firms and all periods of time. The purchase of K_g^{it} may be covered by the differences in dividends of green and neutral shareholders. By reducing their dividends shareholders may favor the modernization (through purchase of green capital) of production to reduce its negative impact on the environment. If the number of responsible investors increases, the company is becoming more ethical.

To finance the costs companies issue shares: X^{it} and P_x^t - the number and price of shares

issued by firm i. $FD^{it} = P_x^t * X^{it}$ is the demand of financial resources which is equal to the supply of shares issued by the firm i.

$FD^t = FD_p^t + FD_g^t + FD_R^t = P_x^t * (X_p^t + X_g^t + X_R^t)$ - the demand of financial

resources of three types of firms (= total supply of shares). $FD^{i0} = CP^{i0}$ it means that the demand of financial resources is equal to production costs of firm i in the period zero. In

subsequent periods it satisfies this condition: $FD^{i(t+1)} = \max \{0, CP^{i(t+1)} - (\prod^{it} - DIV^{it})\}$.

The number of investors is I. There are two types of investors: neutral investors, I_n , they may

invest in polluting companies (I_n^p) and reformed (I_n^R) and green investors, I_g , they prefer

green companies (I_g^g) and reformed (I_g^R). $FR^0 = FR_g^0 + FR_n^0$ - the financial resources of green and neutral investors at time zero. At first it was the personal wealth of investors (eg, savings), then it includes dividends and difference between purchase and sales price.

3.2 Dynamics of model

To prove the necessity of reforms and investments in reformed companies, we write the necessary relationships:

1) $FD_g^t < FR_g^t$ - the part of green investors are motivated to invest in the reformed enterprises.

2) $FD_p^t > FR_n^t$ - neutral investor resources are insufficient to meet total demand of polluting firms, the share of polluting industries is motivated to be reformed.

We can assume the following scenario of business development. In the period (t-1) firm i suffers from negative exogenous shock of the production and a part of neutral investors sells their shares if the situation is serious (the crisis continues) the company may decide that it will require the additional resources of green investors \Rightarrow it pays the amount S to give a signal

positive $\Rightarrow E_p$ becomes $E_R \Rightarrow A_g^{it} \uparrow \Rightarrow (A_g^i / A_n^i) \uparrow \Rightarrow U_g^{kt} \uparrow$. If it creates the coalition, dividends fall to the minimum level and the company gains the full benefits of the

presence of a coalition of loyal shareholders and it may invest more in the modernization of its production. But if the negative shock lasts for several periods, responsible shareholders may leave the company and the firm began buy only the polluting capital K^p , because it is cheaper (transformation to E^i_p). If this company has not ultimately a failure, it must always increase dividends to attract neutral investors (for them it is a primary motivation). If the company is reformed but there is no green coalition of shareholders, its state is the most dynamic. This is a case that must be analyzed in more detail.

The dividend policy of each type of business.

1) At first we should stress that green business can pay less dividends, because it offers to green investors psychological dividends. E^g does not pay a compensation for environmental damage because it does not harm the environment. So we can assume that the minimum level for the green company is 15% of profit: $div^i_g = 0,15 * \Pi^i_g$.

2) E^p must pay the largest dividends because it uses only the neutral investors' capital. And E^p which lost the confidence of green investors (ex E^R) must pay the largest dividend to be sure that its costs are covered. Levels preferred by neutral investors are 0.35 and 0.40%.

$$div^i_p = 0,35(\text{ou } 0,40) * \Pi^i_p .$$

3) Regarding the reformed enterprises, with the presence of a coalition of shareholders, they propose finally only 0.20% of profit. Without coalition the desirable level of dividends is 0.25%.

The success of reforms of the company depends heavily on its green reputation; it must have enough responsible shareholders to buy the green capital, as these are the additional expenses. The likelihood of attracting new investors depends positively on the number of negative shocks of reformed enterprises already existing. This is the result of business rating by their level of attractiveness. The positive signal (payment of S at time t) will give its consequences only in the period $(t + 1)$, because green investors need to see, that the company does it. In addition these actions may attract ordinary investors, because the latter could decide that if the company after a negative shock $(t-1)$ increases its costs, it has good prospects of its future development. So it may be noted here that the strong responsible policy is also good for the general reputation of the company and vice versa (refuse, it means discourage everybody, what is why a "new" polluting company pays more dividends). But it is a more complicated case, so in this model neutral agents consider only the history of shocks and the dynamics of dividends.

The consequences of this theoretical model will be considered for four periods: $t = 0$, $t = 1$, $t = t$ (interim period) and $t = T$. Other periods will be ignored because the state of enterprises is very dynamic. The probabilities of production shocks are not known, they are random, the beginning ($t = 0$) all firms are identical (polluting companies and green businesses respectively), in the period T inversely all businesses have the differences, they can be easily differentiated by their reputation, by the level of production, or through the dividends, the polluting and green capital and so on. There are the best and worst companies for neutral and green agents. Let's start with the zero period:

Period $t = 0$:

Investors have the financial resources $FR = FR_g + FR_n$ and they buy the shares. Suppose that all firms offer the same number of shares. That is to say the company i receives $FD^i = FR / N$ and offers securities $P_x^0 * X^{i0} = FD^i$. At first there are only polluting and green companies. After the issuance of securities the second stock market has to be to facilitate exchange of securities between investors.

Green businesses prefer responsible investors' capital, because they require only 15% of profit as dividends. Investors who do not buy stocks of green companies wait until the next period for the appearance of reformed enterprises, because they can not invest (this is a condition of aversion of polluting enterprises). Green businesses receive $P_x^0 * X^{i0} * E_g$. And the rest of resource of green investors is $(FR_g - P_x^0 * X^{i0} * E_g)$, the amount they can invest in

reformed companies in the first period. The green company i bought K_g . Production costs are $CP^{i0} = P_{Kg}^0 * K_g^{i0} = FD^i$. Profit and dividends are the following: $\Pi_g^{i0} = Y^{i0} - P_{Kg}^0 * K_g^{i0} = \Gamma^{i0} * f(K_g^{it}) - P_{Kg}^0 * K_g^{i0}$; $DIV_g^{i0} = 0,15 * \Pi_g^{i0} = 0,15 * (\Gamma^{i0} * f(K_g^{it}) - P_{Kg}^0 * K_g^{i0})$.

Polluting companies can sell their shares only to neutral investors. They choose one of two possible strategies: Either buy the capital K_p and stay polluting E_p in period $t = 1$. Either buy K_p and pay S to become E_R and attract ethical agent resources.

If the polluting firm i prefer the first strategy, it receives: FR_n / E_p and purchases capital K_p . Production costs are $CP^{i0} = P_{Kp}^0 * K_p^{i0} = FR_n / E_p$. Profit and dividends are calculated:

$\Pi_p^{i0} = Y^{i0} - P_{Kp}^0 * K_p^{i0} = \Gamma^{i0} * f(K_p^{it}) - P_{Kp}^0 * K_p^{i0}$; $DIV^{i0} = 0,35 * \Pi_p^{i0} = 0,35 * (\Gamma^{i0} * f(K_p^{it}) - FR_n / E_p)$.

If firm i want reforms and give the positive signal, it pays S . Production costs are $CP^{i0} = P_{Kp}^0 * K_p^{i0} + S = FR_n / E_p$. Profit and dividends are calculated: $\Pi_R^{i0} = Y^{i0} - P_{Kp}^0 * K_p^{i0} - S = \Gamma^{i0} * f(K_p^{it}) - P_{Kp}^0 * K_p^{i0} - S$; $DIV^{i0} = 0,35 * \Pi_R^{i0} = 0,35 * (\Gamma^{i0} * f(K_p^{it}) - FR_n / E_p)$.

Now we discuss in detail the actions of agents in this hypothetical economy. It is assumed that if on stock market there is no buyer of specific title, the seller must keep it. A part of companies is suffering from negative exogenous shock and others are gaining positive exogenous shock. Four

possible cases exist for polluting companies:

First case: $E_p^{i0} \Rightarrow E_p^{i1}$ and a negative exogenous shock of the production (1-ρ): neutral investors want but can not sell their shares, as environmental investors are unwilling to buy because of polluting policy of the company, and other neutral investors do not find them attractive because of reduced profit (and dividends). The company can not offer the new shares

for the same reasons to fund the growth of production, it can use only $0.65\% * \Pi_p^{i0}$ to pay minimum costs of production, because dividends ($0.35\% * \Pi_p^{i0}$) will be used by existing shareholders to invest in other businesses to diversify the portfolio. Table 1 describes the flow of funds:

1. For firm i resources are received from sale of new shares. The losses include dividends (the portion of profit) paid by i and invested in the business j.
2. For investors: positive flows include dividends and growth in share price, the losses are related to lower stock prices.

Tab. 1: State of finance of polluting enterprises that suffer from negative shock and finances of their shareholders

	IN polluting business	OUT polluting business
t=0	$P_x^0 * X^{i0}$	0
t=1	$0,65\% * \Pi_p^{i0} = 0,65\% * [(1-\rho) * f(K_p^{i0}) - P_{Kp}^0 * K_p^{i0}]$ (1) 0,65% - Refinancing rate = 1 - dividend rate	$0,35\% * \Pi_p^{i0} = 0,35\% * [(1-\rho) * f(K_p^{i0}) - P_{Kp}^0 * K_p^{i0}]$ (2)
Existing shareholders of i		Existing shareholders of i
t=0	0, in the beginning shareholders receive nothing	$- P_x^0 * X^{i0}$
t=1	$(P_x^1 - P_x^0) * X^{i0} + 0,35\% * \Pi_p^{i0} = (P_x^1 - P_x^0) * X^{i0} + 0,35\% * [(1-\rho) * f(K_p^{i0}) - P_{Kp}^0 * K_p^{i0}]$ (3)	0, new investors do not arrive

Second case: $E_p^{i0} \Rightarrow E_R^{i1}$ and a negative exogenous shock (1-ρ): the part of neutral investors may sell their shares to green investors; their number depends on the relative number of other successful reformed companies. The company could potentially sell the new shares (and raise its production), it also depends on negative shocks of other reformed enterprises. Suppose H environmental investors bought the new shares and D investors are displaced by new ones (see Table 2).

Tab. 2: State of finance of reformed enterprises that suffer from the negative shock and finance of their shareholders

	IN reformed business	OUT reformed business
t=0	$P_x^0 * X^{i0}$	0
t=1	$\text{Max}\{0, P_x^1 * X^{i1}\}$ (bought by H) $+0,75\% * \Pi_R^{i0} = \text{Max}\{0, P_x^1 * X^{i1}\} + 0,75\% * [(1-\rho) * f(K_p^{i0}) - P_{Kp}^0 * K_p^{i0} - S]$ (4)	$0,25\% * \Pi_R^{i0} = 0,25\% * [(1-\rho) * f(K_p^{i0}) - P_{Kp}^0 * K_p^{i0} - S]$ (5)
Existing shareholders of i		Existing shareholders of i
t=0	0, in the beginning shareholders receive nothing	$- P_x^0 * X^{i0}$
t=1	$D * (P_x^1 - P_x^0) * X^{i0} + 0,25\% * \Pi_R^{i0} = D * (P_x^1 - P_x^0) * X^{i0} + 0,25\% * [(1-\rho) * f(K_p^{i0}) - P_{Kp}^0 * K_p^{i0} - S]$ (6)	$- P_x^1 * X^{i1}$, they are environmental investors (H) that buy its stocks

Third case: $E_p^{i0} \Rightarrow E_p^{i1}$ and an exogenous positive signal $(1+\theta)$, neutral existing shareholders remain and new shares are purchased partly thanks to dividends received by investors of groups I - III and the remaining part by the investors (D) leaving companies in the second group (see Table 3).

Tab. 3: State of finance of polluting firms that earn positive shock and finance of their shareholders

	IN polluting business	OUT polluting business
t=0	$P_x^0 * X^{i0}$	0
t=1	$P_x^1 * X^{i1} + 0,65\% * \Pi_p^{i0} = P_x^1 * X^{i1} + 0,65\% * [(1+\theta) * f(K_p^{i0}) - P_{Kp}^0 * K_p^{i0} - S]$ (7)	$0,35\% * \Pi_p^{i0} = 0,35\% * [(1+\theta) * f(K_p^{i0}) - P_{Kp}^0 * K_p^{i0} - S]$ (8)
Existing shareholders of i		Existing shareholders of i
t=0	0, in the beginning shareholders receive nothing	$- P_x^0 * X^{i0}$
t=1	$D * (P_x^1 - P_x^0) * X^{i0} + 0,35\% * \Pi_p^{i0} = D * (P_x^1 - P_x^0) * X^{i0} + 0,35\% * [(1-\rho) * f(K_p^{i0}) - P_{Kp}^0 * K_p^{i0} - S]$ (9)	$- P_x^1 * X^{i1}$, neutral investors buy additional new shares.

Case Four: $E_p^{i0} \Rightarrow E_R^{i1}$ and an exogenous and positive shock $(1 + \theta)$ (see Table 4). These companies attract green investors. Neutral investors of the first group, who would buy these securities, do not, because they can not sell their shares.

Tab. 4: State of reformed business finance that gains from a positive shock and finance of their shareholders

	IN reformed business	OUT reformed business
t=0	$P_x^0 * X^{i0}$	0
t=1	$P_x^1 * X^{i1} + 0,75% * \Pi_R^{i0} = P_x^1 * X^{i1} + 0,65% * [(1+\theta) * f(K_p^{i0}) - P_{Kp}^0 * K_p^{i0} - S]$ (10)	$0,25% * \Pi_R^{i0} = 0,35% * [(1+\theta) * f(K_p^{i0}) - P_{Kp}^0 * K_p^{i0} - S]$ (11)
Existing shareholders of i		Existing shareholders of i
t=0	0, in the beginning shareholders receive nothing	$-P_x^0 * X^{i0}$
t=1	$D * (P_x^1 - P_x^0) * X^{i0} + 0,25% * \Pi_p^{i0} = H * (P_x^1 - P_x^0) * X^{i0} + 0,25% * [(1+\theta) * f(K_p^{i0}) - P_{Kp}^0 * K_p^{i0} - S]$ (12)	$-P_x^1 * X^{i1}$, environmental investors buy new shares.

The interim period:

Investors have preferences. In this section we determine the factors of the utility function of investors. The functions are different for ordinary and green investors. When investors compare companies, it can use the following two factors: a factor of wealth received - the amount of dividends received from firm i and an intangible factor - the company's reputation, in other words, the past history of company, if it is good or bad. In addition the reputation reflects its values and performance in the areas of social responsibility, quality of products and services, the employment policy, financial market position, governance and management [1]. Yet both types of investors consider the different parameters. For example, the neutral investor looks at the number of periods with positive and negative impacts of production, it helps understand the "success story" of the company. The company with the highest number of positive shocks is the most stable and it goes bankrupt with smaller probability than the other. And in addition ordinary investor receives only real benefits - dividends. During the economic crisis all dividends go down, but there are shareholders who earn over other investors. It can be applied by comparing dividend of firm i with its maximum at time t. All these conditions can be described formally:

$$NRP^{it} = \varphi_1 * \frac{NP(\Gamma > 1)^i}{NP(\Gamma < 1)^i}$$
, where $NP(\Gamma > 1)^i$ and $NP(\Gamma < 1)^i$ it means respectively the number of periods with positive and negative shock of firm i. and NRP^{it} is the ordinary reputation of the firm i in the period t for neutral investors. The second parameter is the following:

$$d^{it} = \frac{div^{it}}{div^{max t}}$$
, where $div^{max t}$ is the maximum of dividends in the period t. Now we can

write the utility function of investments in stocks of the neutral agent k. $U_n^{kt}(d^t, NRP^t) =$

$a^* \sum_{i=1}^P (d^{it})^\alpha + b^* \sum_{i=1}^P (NRP^{it})^\beta$, where P means the portfolio of shares purchased by the investor k.

Now we consider the ethical preferences of investors. We construct the business rating, for them in addition to the success story we examine the level of corporate responsibility in the eyes of environmental agents. It describes the parameters of the model below.

$$GRP^i = \varphi_1 * \frac{NP(\Gamma > 1)^i}{NP(\Gamma < 1)^i} + \varphi_2 * \frac{NP(A_g^t - A_g^{t-1} > 0)^i}{NP(A_g^t - A_g^{t-1} < 0)^i} + \varphi_3 * \frac{NP(S > 0)^i}{NP(S = 0)^i}$$

The second factor allows analyzing the dynamics of green shareholders A_g^t in the board of the company, if their number is still increasing; this shows the stable trend of creation of strong coalition of ethical investors which can minimize environmental losses by modernization of production. To monitor and improve the policy of environment protection they vote for the replacement of K_p by K_g . We can ignore the dynamics of capital K_g in the above expression, because it directly depends on A_g . The third factor is related to the initiative of the company's managers, who want to reshape the company. They can pay S , even if production receives a negative shock. This underlines the great desire of the company to have environmentally responsible policy. It is a policy of signal. The opposite situation, that of denial of this policy is also quite possible.

It described the intangible factor of green reputation, now we look at the dividends received by responsible shareholders. The choice of green or reformed business brings to responsible investor the feeling of satisfaction ("happiness") that can even compensate financial losses (e.g., reduction of dividends). Now we add the additional amount (psychological dividends) to ordinary dividends and the second parameter of the utility function takes the following form:

$$bd^{it} = \frac{div^{it} + bon^{it}}{div^{max t} + bon^{max t}}, \text{ where } bon^{max t} \text{ is the maximum level of psychological dividend}$$

in period t (this is a company with minimal environmental losses). And bon^{it} is the psychological dividends received from investment in firm i. Now we construct the final

formulation of the utility function of agent k: $U_g^{kt}(bd^t, GRP^t) = c^* \sum_{i=1}^P (bd^{it})^\rho + d^* \sum_{i=1}^P (GRP^{it})^\phi$, where P is the portfolio of shares purchased by the investor k.

The bonus can offset the losses of real dividends which explain the fact that during the crisis responsible shareholders are more resistant to the stock market panic, that is to say, to the massive sale of securities. They prefer to stay with his company and support the purchase of green capital not to push ahead for the environmental pollution.

In turn the company must compare these minimums costs with the existing resources. After purchasing the green capital the function of reformed companies obtains the following form:

$$\Pi_R^{it} = \Gamma^{it} * f(K_p^{it}, K_g^{it}) - P_{Kp}^0 * K_p^{i0} - P_{Kg}^0 * K_g^{i0} - S$$

The choice of strategy depends on the following:

- 1) The past history, if there was enough negative shocks which decrease its ability to reinvest in its production costs and pay the minimum dividends. In addition adverse shocks discourage neutral agents, because they appreciate only this factor;
- 2) The number of other polluting companies with positive production shock. Because the company wants to be insured against bankruptcy, which becomes more real with the stronger competition for the resources of ordinary investors. The responsible policy allows to diversify and widen the choice of potential sources of investments, including those of ethical agents.

The strategy may take the following form:

Pay S if $\frac{E_p(\Gamma>1)}{E} > h$ and $\frac{NP(\Gamma>1)^i}{NP(\Gamma<1)^i} < 1$, it means that the share of successful polluting enterprises is more than the chosen parameter h and the company i do not have enough success.

The last period (t=T):

It is assumed that at the last period all possible coalitions are created. This means that this economy has the following state. Part of the reformed enterprises with coalitions produce the minimum pollution and thanks to loyal shareholders, they may be more stable even during the crisis of production. Polluting companies, who can not reform or they have already rejected responsible policy, works only with the neutral part of investors that receive high dividends by saving on costs. The most volatile situation is in the rest of the reformed enterprises. Its shareholders include ordinary investors, who could not purchase the securities of polluting firms, and responsible green investors, whose number is not enough to create a new coalition. The latter case provides dynamic financial market in this hypothetical economy.

Suppose finally that there exists one and only one company from each reputation level. This means there is the best and worst companies for each type of investors. The best (by reputation level) reformed enterprises were able to attract the maximum resources of responsible investors, producing the minimum level of pollution and create all possible coalitions of green shareholders. The best polluting companies (with the maximum profit, because it is a main factor in the neutral reputation) are supported only by neutral investors, who have had the fortune to choose them in the conditions of uncertainty and random shocks of production. All green companies, except companies that have failed due to unfortunate history of negative shocks of production, use only the resources of green investors, because their level of dividends is very small for neutral agents.

4 Conclusions

The objective of this paper was to examine the influence of the presence of responsible shareholders on performance and policy of enterprise policy and the real economy. We built the theoretical model with responsible shareholders that concerns about corporate policy which allowed examining the consequences of the emergence of a coalition of green investors who have strong incentives to monitor pollution or modernize production. We present the model extended, where we introduced the factor of corporate reputation that influenced the choice of investments and the factor of production shocks that put businesses in uncertain conditions of their activity.

Regarding reputation, it should be noted that before this paper there was no theoretical framework that introduces this aspect in the process of decision making of responsible investors. In this paper we have internalized this factor which encouraged the participation of company managers in the non profitable activity to improve its image. In future work, we extend the

model by introducing the public sector (government) and foreign funds of socially responsible investments. It is an open economy where the government may also become the major shareholder of companies and introduce ethical values.

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Shareholder Activism of Responsible Investors

Summary

The growing presence of responsible investors among the shareholders raises the question of their impact on social and environmental policy of the company. We discuss whether their activism has the power to change the standards of responsible business policy. In other words, to what extent these responsible investors are able to influence, for example, the choice of size of an environmental pollution. There is no theoretical model of an influence of responsible shareholders on company activity. The first objective of the paper is to provide an analytical framework of a stock market economy, in which the emergence of coalition of responsible investors with incentives to monitor and restructures companies can be discussed. We construct an expanded model, where the functions of agents of this economy are rewritten, in particular we introduce the factor of corporate reputation that influences the choice of investments and the factor of shocks of production that put businesses in uncertain conditions of their activity.

Key words: Green investors; Ecological responsibility; Socially responsible investing (SRI); Environmental economics; Financial markets.

JEL classification: M14, O16, G11, A13.

The Review of the Impact of Information on Stock Markets Research

*Rastislav Molnár**

1 Introduction

The theoretical background of this study comes from (Fama, 1970 and 1991). (Fama, 1970) splits the market efficiency to three forms.¹ Then he reviews empirical studies on each of mentioned three forms of market efficiency. He suggests the strong form of market efficiency is good approximations of the reality for investors, despite only limited number of agents have the access to the so-called insider information. In his later article (Fama, 1991) claims the research in the area has grown so big, a full review is impossible. He is also concerned about studies on market efficiency, which models are tested jointly with the asset-pricing models. Studies reflect proper prices, but proper according to the underlying asset-pricing model. Despite his concerns about the use of joint tests, he concludes the cleanest evidence on market efficiency comes from event studies.

This study reviews research on the impact of information on stock markets, or as classified by (Fama, 1970 and 1991) the studies on semi-strong form of market-efficiency or event studies respectively. It is motivated by the extensive body of the literature on given topic dating from 1970s until now, yet not systemized in terms of information event they study. This paper is organized around two topics. The first is to set up the categorization in the research studying the impact of information on stock markets. The second topic is to provide reader the insight on the possible future development in the research area.

The contribution of the first topic is a comprehensive review of the previous literature and easy to compare classification. It should be taken as a basic tool, which could be enhanced in the future. The second topic should reveal recent developments in the field to the reader and to point out possible future research.

The rest of the paper is organized as follows. Chapter 2 focuses on the building the research classification tool. Chapter 3 is the literature review. Chapter 4 reveals future trends, mainly in the computer science research. Chapter 5 contains the conclusion on reviewed and reveals possible future directions of the research.

2 Research classification

Following is the classification of research papers on the topic of the impact of information on stock market. Main classification parameters are the information type, the market and the methodology. Other classification parameters are studied time period, sample size and finding of the relation. Subchapters introduce each classification parameter in the greater detail.

2.1 Information types

The research on the information impact on stock market covers virtually any type of the information. However, some information types are being studied more extensively than other.

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¹ Weak (only historical prices are incorporated into stock prices), semi-strong (all public information are incorporated into stock prices) and strong (all public and private information are incorporated into stock prices) form of market efficiency.

Table 1 shows the number of papers out of 41 research papers included in this review focusing on given information type.

Tab. 1: The number of research papers focusing on given information type category

Information type	Number of papers*
Environmental information	4
Buy/Sell recommendations	6
Financials	4
Macroeconomic announcements	9
Public attention (media coverage)	4
Asymmetric information	3
Firm-specific information	3
Industry specific information	1
Corporate governance	1
Other information types	6

* Number of research papers reviewed by this study focusing on given information type

2.2 Studied markets

As for the studied markets, most studies focused on the US stock. Only limited number of articles focused on the European markets or other international stock exchanges. It is not surprising 35 out of 40 papers focused on the US market. Surprising is the fact, developed European stock markets were not well covered by researchers in papers covered by this review. The explanation can be this review focus on the papers written in the English only, while there may be larger number of papers written in the local language.

2.3 Methodology of the research

Methodology used in reviewed papers could be split into three categories. The first is the event study methodology. The event study methodology was introduced by Fama, Fisher, Jensen and Roll in 1969.² According to the Binder (1998) this article was cited more than 500 times over the 25 year period from the publication. Event study became widely popular in the financial and accounting research. Binder (1998) mentioned first areas where this methodology was used were price performance and new information dissemination studies. This is documented by fact event study methodology is one of three major methodologies used by reviewed papers.

What is the event study methodology? The initial task is to define the event the research focuses on and the period over which the stock prices will be examines, so called event windows. It is usual to define the event window period to be larger than the period of interest, allowing the examination of periods surrounding the event. After the event identification, the restrictive criteria on firms are imposed. After these two steps the abnormal returns is measured. MacKinlay (1997) defined two common choices for normal return modelling: the constant mean return model and the market model. Empirical results should lead to the insights relating to the event. To distinguish between several possible explanations, additional analyses may be concluded.

The second category is ARCH models. Autoregressive Conditional Heteroskedasticity or ARCH model is a tool used to characterize changing variances. Bollerslev, Chou, & Kroner (1992) reported it has been used in several hundred research papers since its introduction by Engle in 1982. It is the model enabling the time varying variances and covariance. Usefulness of this is,

² MacKinlay (1997) argued the first published paper using the event study was an article by Dolley published in 1933. However Fama, Fisher, Jensen and Roll published paper widely cited and influencing recent studies.

according to the Engle (1982), documented by the fact previous research found the uncertainty associated with different forecast periods to vary over time. ARCH models therefore improve the performance of the least squares models and are able to forecast more realistic variances. The most of reviewed studies used the GARCH or Generalized Autoregressive Conditional Heteroskedasticity, the model incorporating mean reversion. Meaning the variance tends to be persistent based on the long run average.

The third methodology category is regressions. This category is a universal for all studies which haven't based their methodologies on event studies or ARCH models, but developed their own, usually multiple linear regressions. These studies often chose one or more determinant variables for the information type studied. Then incorporate their variables into traditional asset pricing models such as Fama-French Three-factor model or Carhart's Four-factor model to control for market risk, size, price and momentum.

2.4 Other classification parameters

As for the other classification parameters, they are straightforward and vary from study to study. The main reason to report the period studied and the sample size is to provide a reader with an overview of the robustness of the reviewed research and possibly some implications on the findings. Findings are reported to provide a reader, in connection with other classification parameters, quick, but robust insight about the reviewed paper.

3 Research review

Studies covered by this review include papers as old as Davies & Canes (1978), but also as recent as Birz & Lott (2011) or Nguyen, Moshirian, & Pham (2011). As Table 2 shows studies cover a wide range of information types. Dominant market studied is the US stock market and the most of studies use one of three main methodologies.³ Moreover Table 2 reports on the period studied, the sample size, if available and determines whether there have or haven't been found a relation between the stock and information types.⁴

Interesting is a fact, methodology is not clustered by information types studied, but virtually any methodology considered is applied to any information type defined. Another conclusion made based on the data provided in the Table 2 is all reviewed papers found the relation or the relation was not clear. In the next subchapters, papers are being reviewed in greater detail. Chapters are organized by defined information types, where articles on the given information type are reviewed together.

Table 2 contains 41 articles reviewed in this paper. Articles are classified based on 3 main and 3 supporting characteristics. The information type distinguishes main types of the information studied in the article. Market classifies the market studied and research methodology reveals the main methodology used in the article. Please note all ARCH models are referred to as "ARCH models" despite the most of articles used GARCH model. Period studied and sample size help to determine the robustness of the study. Sample size refers to the number of "information" observed by authors, not to the number of firms studied. Findings could have three possible values, Yes for the relation found (the information type has the impact on stock), Not clear for mixed or not significant results and No for no relation found.

³ As it is visible in the Table 2, three main methodologies are regressions, event study and ARCH models.

⁴ The relation can be for example between the information type and stock price or between the information type and the volatility.

Tab. 2: Classification of previous research

Article	Information type	Market	Research Methodology	Period studied	Sample size	Findings
Piotroski & Roulstone (2003)	Asymmetric information	US	Regression	1984-2000	NA	Yes
Huddart & Lang (2002)	Asymmetric information	US	Regression	1985-1994	175***	Not clear
Lee & Liu (2007)	Asymmetric information	US	Regression	1983-2004	NA	Yes
Abarbanell & Bernard (1992)	Buy/Sell recommendation	US	Regression	1976-1986	NA	Not clear
Hendricks, Kempa & Pierdzioch (2012)	Buy/Sell recommendation	Germany	ARCH models	2002-2009	6 135	Yes
Liu, Smith & Syed (1990)	Buy/Sell recommendation	US	Event study	1982-1985	852	Yes
Zhang (2006)	Buy/Sell recommendation	US	Regression	1983-2001	458 263	Yes
Brennan, Jegadeesh & Swaminathan (1993)	Buy/Sell recommendation	US	Regression	1977-1988	NA	Not clear
Davies & Canes (1978)	Buy/Sell recommendation	US	Regression / Event study	1970-1971	785	Yes
Carretta, Farina, Martelli, Fiordelisi & Schwizer (2011)	Corporate governance	Italy	Event study	2003-2007	197	Yes
Hamilton (1993)	Environmental information	US	Event study	June 1989	436	Yes
Koehler & Cram (2000)	Environmental information	US	Event study	June 1989	436	Yes
Lorraine, Collison & Power (2004)	Environmental information	UK	Event study	1995-2000	32	Yes
Khanna, Quimio & Bojilova(1998)	Environmental information	US	Regression	1989-1994	91	Not clear
Lee, Mucklow & Ready (1993)	Financials	US	Event study	1988	606	Yes
Chen & Zhao (2007)	Financials	US	Regression	1985-2005	NA	Not clear
Zarowin (1989)	Financials	US	Regression	1971-1981	NA	Yes
Sloan (1996)	Financials	US	Regression	1962-1991	NA	Yes
Hou (2007)	Industry-specific information	US	Other - VAR model	1963-2001	NA	Yes
Kalev, Liu, Pham & Jarnecic (2003)	Firm-specific information	Australia	ARCH models	1995-2000	259 734	Yes
Maheu & McCurdy (2004)	Firm-specific information	US	ARCH models	1962-2000	NA	Yes
Moshirian, Nguyen & Pham (2011)	Firm-specific information	Australia	Regression	2002-2007	NA	Yes

Article	Information type	Market	Research Methodology	Period studied	Sample size	Findings
Graham, Nikkinen & Sahlstrom (2003)	Macroeconomic announcements	US	ARCH models	1995-2001	716	Not clear
Hardouvelis (1987)	Macroeconomic announcements	US	Other - Least-squares model	1979-1984	NA	Yes
Pearce & Roley (1984)	Macroeconomic announcements	US	Regression	1977-1982	NA	Yes
Albuquerque & Vega (2008)	Macroeconomic announcements	US / Portugal	Regression	2002	301	Yes
Birz & Lott (2008)	Macroeconomic announcements	US	Regression	1991-2004	293 530*	Yes
Patelis (1997)	Macroeconomic announcements	US	Regression / ARCH models	1962-1994	NA	Not clear
Schwert (1981)	Macroeconomic announcements	US	Regression	1953-1978	NA	Not clear
Hanousek, Kocenda & Kutan (2008)	Macroeconomic announcements	Central Europe	ARCH models	2003-2006	1 372	Not clear
Buttner, Hayo & Neuenkirch (2009)	Macroeconomic announcements	Central Europe	ARCH models	1999-2006	1 534	Yes
Pyun, Lee & Nam (2000)	Other - Arriving information	Korea	ARCH models	1990-1994	NA	Yes
Frazzini (2006)	Other - Disposition effect	US	Regression	1980-2002	NA	Not clear
Goh & Ederington (1993)	Other - Changes in corporate bond rating	US	Event study	1984-1986	428	Yes
Campbell, Gordon, Loeb & Zhou (2003)	Other - Information security breaches	US	Event study	1995-2000	84	Not clear
Shelor, Anderson & Cross (1991)	Other - Natural disaster	US	Regression	1989	1**	Yes
Kilian & Park (2007)	Other - Oil prices	US	Other - VAR model	1973-2006	NA	Not clear
Mitchell & Mulherin (1994)	Public attention (Media coverage)	US	Regression	1983-1990	752 637*	Yes
Fang & Peress (2009)	Public attention (Media coverage)	US	Event study	1993-2002	NA	Yes

Article	Information type	Market	Research Methodology	Period studied	Sample size	Findings
	coverage)					
Antweiler & Frank (2004)	Public attention (Media coverage)	US	ARCH models	2000	1 559 621	Yes
Chan (2003)	Public attention (Media coverage)	US	Regression	1980-2000	NA	Yes

* Number is calculated from average reported in the paper, ** The paper studied only 1 event, *** Some of 175 companies were included in the study, however the exact number is not clear

3.1 Asymmetric information

Studies on the asymmetric information focus could be split into two sub-groups. The first group represented by Huddart & Lang (2003) and Piotroski & Roulstone (2004) focused on the behaviour of informed market participants. These insiders potentially carry insider information that is not incorporated in stock prices, but affects them. Huddart & Lang (2003) found the low firm-wide option exercise month is followed with large excess stock returns. Interesting finding is exercise decisions of junior employees contain as much price relevant non-public information as exercise decisions of senior employees. Piotroski & Roulstone (2004) investigated trade-generating activities of three informed market participants. Authors found insider transactions improving the incorporation of firm-specific information into individual stock prices, analysts activities positively correlated with stock return synchronicity and institutional investors accelerating the incorporation of the information into prices.

The second group is represented by Lee & Liu (2011), the information asymmetry is studied from the point of factors accounting for the asymmetry of individual firms. Authors used the information-based trading, price impact, analyst earnings forecast dispersion and institutional ownership variables to measure price informativeness. Their finding is the volatility caused by noise decreases with price informativeness, while volatility caused by information has non-linear relationship.

3.2 Buy/Sell recommendation

Papers studying the buy/sell recommendations focus on the variety of sources. Abarbanell & Bernard (1992) studied the analysts' reaction to the earnings information. They have found the underreaction of analysts' forecasts to earnings. Hendricks, Kempa, & Pierdzioch (2011) studied the impact of good and bad news on stock market volatility, they have done it through the study of banks' buy and sell recommendations. Their main finding is the in the rising market, buy recommendation lower the volatility and sell recommendations rise it. Impact of news (buy/sell recommendations) is, according to them, not clear in falling market. Liu, Smith, & Syed (1990) studied relatively cheap to get and widely dispersed recommendation of the "Heard-on-the-Street" column of The Wall Street Journal. According to them the column has the impact on stock prices on the publication day. They conclude the buy and sell recommendations have symmetric impact.

Zhang (2006) studied the role of information uncertainty through the analyst forecast revisions. He found greater information uncertainty producing higher expected returns after good news and lower expected return after bad news. Brennan, Jegadeesh, & Swaminathan (1993) studied the relation between the stock price response and the number of analysts following a firm. They have found the more analysts. The faster is the response, adjusting for firm size. Davies & Canes (1978) found the secondary dissemination of analysts' recommendations significantly affects stock prices.

3.3 Corporate governance

The paper Carretta, Farina, Martelli, Fiordelisi, & Schwizer (2011) focused on the corporate governance news and their impact on the stock prices. They have found the investors at Italian stock exchange are influenced by the content and communication tone of the corporate governance news. Authors also argue, investors are influenced by rumours about corporate governance of a firm prior to the event.

3.4 Environmental information, they have found

Hamilton (1995) studied the stock price reaction to the pollution data. He has found negative relation between firms reporting the Toxics Release Inventory (TRI) and the abnormal returns at time of the first release of the information. Cram & Koehler (2000) re-evaluated Hamilton

(1995), they have found similar results than original Hamilton's paper. Authors concluded pollution is news. TRI was examined also by Khanna, Quimio, & Bojilova (1998). They have found repeated provision of environmental information to lead to the significant negative abnormal returns. Moreover they have found the relation between the magnitude of losses and on-site releases or off-site transfers.

The effect of the publicity about environmental performance was studied by Lorraine, Collison, & Power (2004). They have found the relation between fines imposed on firms and share price response.

3.5 Financials

Despite the general information type is "Financials" three out of four reviewed papers focus on the effect of earnings information. Lee, Mucklow, & Ready (1993) studied the impact of earnings on the spreads and depths. Zarowin (1989) examined the overreaction to the corporate earnings information. Authors of both found the stock reaction on the earnings. Sloan (1996) focused on the information about future earnings contained in the accrual and cash flow components of current earnings. He has found investors are unable to fully reflect the information contained in the accrual and cash flow components of current earnings, until the information impacts future earnings.

Chen & Zhao (2008) focused their research on the future cash flows and expected discount rates. They have found the cash flow news to be more important than discount rates. Moreover they have found a positive relation between cash flow news and stock returns.

3.6 Industry-specific information

The only paper on the industry-specific information reviewed in this study is Hou (2007). This paper studied the diffusion of industry information. He has found the lead-lag effect between big and small firms. He argued big firms then to lead small firms within the same industry. This effect is driven by the response of small firms to negative news on big firms.

3.7 Firm-specific information

Firm-specific information is the information type which deals with the information specific for a firm. Kaley, Liu, Pham, & Jarnecic (2004) studied the arrival rate of selected news and its impact on the conditional variance. They have found the relation. Maheu & McCurdy (2004) focused on jumps in the stock return. They have found a positive impact of public information flows on the volatility. Company announcements of Australian companies were studied by Nguyen, Moshirian, & Pham (2011). Authors found the public information strengthen the relationship between the order book imbalance and stock returns.

3.8 Macroeconomic announcements

Graham, Nikkinen, & Sahlstrom (2003) studied the importance of scheduled macroeconomic news. They have found 5 out of 11 announcements have significant influence on stock valuation. Similarly Hardouvelis (1987) studied 15 macroeconomic variables and found the relation for some of them. Pearce & Roley (1985) examined 4 macroeconomic announcement types and found the relation for 3 of them, but discount rate. Birz & Lott (2011) found the relation between news on GDP and unemployment and stock returns. Patelis (1997) examined shifts in monetary policy and Schwert (1981) analysed stock price reaction to the news about inflation. Both authors found the relation.

Albuquerque & Vega (2009) studied the impact of foreign (US) macroeconomic news on local (Portuguese) stock market. They have found the US public information does affect Portuguese stock market returns. Similarly to the Albuquerque & Vega (2009) two papers on Central European stock exchanges Hanousek, Kocenda, & Kutan (2008) and Buettner, Hayo, &

Neuenkirch (2010) concludes the same. Foreign macroeconomic news has a significant impact on Central European financial markets.

3.9 Public attention (Media coverage)

Mitchell & Mulherin (1994) studied the relation between the number of daily news announcements by Dow Jones & Company and market activity measures (trading volume and market returns). They have found a direct relation, however this was not particularly strong. Fang & Peress (2009) focused on the mass media. They have studied the relation between media coverage and expected stock returns. They have found stock without media coverage earning higher returns than stock with high media coverage. The study of posts on two main internet stock message boards was conducted in Antweiler & Frank (2004). Authors have found the market volatility prediction ability of the posts. They have also found the relation between the posting activity and returns on the next day which was negative. Chan (2003) focused on headlines about individual companies. His findings were consistent with the hypothesis investors underreact to public signals and overreact to perceived private signals.

3.10 Other information types

Other information types is the category which covers studies of special relations or studies which cannot be classified into another category. Pyun, Lee, & Nam (2000) studied the trading volume as a proxy of information arrival. They have found it reduces the persistence of the conditional variance. Frazzini (2006) studied the “disposition effect”, the tendency of investors to ride losses and realize gains. He has found investors’ underreaction to bad news announcements. The impact of bond rating changes was studied by Goh & Ederington (1993). They have found the downgrades associated with deteriorating financial prospects is a new negative information to the market, but downgrades due to changes in firms’ leverage are not. Campbell, Gordon, Loeb, & Zhou (2003) examined the effect of information security breaches on stock. They have found the relation, but the reaction varies according to the nature of the assets affected by the breach.

Shelton, Anderson, & Cross (2001) examined the effect of the California 1989 earthquake on real estate related stock prices. Not surprisingly they have found the relation as the earthquake conveyed important new information to the market. Kilian & Park (2009) studied the effect oil prices have on stock prices. They have found mixed results as some dimensions of oil prices are related to the news while others are not.

4 Recent trends – the computer science research

Looking at the papers reviewed by this study, one can conclude there is no “recent” trend in the studies on the information impact on stock. As for the methodology and type of the information studied it is equally dispersed over time with both old and recent studies using event studies, regressions or ARCH models. As for the studied market there is a recent trend to focus on markets other than US markets.

Interesting new trend is the computer science research focused on building models possibly predicting stock prices. For example Deng, Mitsubuchi, Shioda, Shimada, & Sakurai (2011) proposed a stock price prediction model able to extract data from time series data, news and comments on the news and predict the stock price. They test their model on numerical data only, yet missing text contents. Their results show they were able to outperform other prediction methods. Hagenau, Liebmann, Hedwig, & Neumann (2012) focused on the enhancement of existing text mining methods to evaluate the information content of financial news. They claim their approach is selecting semantically relevant features and reduces the problem of over-fitting when applying a machine learning approach. They claim to achieve 62 to 65% accuracy. I believe the combination of computer science and financial research should be a recent trend in

the field of information impact on stock markets.

A comprehensive study combining both the knowledge of financial research and the computer science research on predicting models is still missing. Also the extensive study able to cover broader set of information types and try to reveal relations between them haven't been conducted yet.

5 Conclusions

The aim of this research was to provide the reader with a comprehensive overview on the research done in the area of information impact on stock. This was accomplished by setting up the research systemization framework. The framework was created as simple, yet sufficiently informative tool for researchers, to enable easy comparison between different articles on information impact on stock markets. In total 41 research papers on the topic were reviewed and systemized using mentioned tool. Reading this review the reader should be have a complete picture about the articles written on the topic, markets studied and methodologies used.

I believe the trend to connect the financial research with the computer science research will be more common in the future. As the number of recent papers suggests, this collaboration can be very beneficial. It allows for more robust models and better hypothesis testing using computers.

In the line with the Chapter 4 I see the direction of future research as follows:

- “Traditional” type studies with focus on other than US markets
- New, comprehensive, studies focusing on more than one information types while accounting for the relation between them ⁵
- Studies taking the advantage from the mixture of the computer science and financial research, such as development of comprehensive prediction models

I hope studies of the second and third type will begin to appear in the future as I see these have the potential to contribute heavily both to the theory and to the investors. Theory will receive complex view on the topic and test models on robust data sets. Investors will be able to take the advantage of possible revealed arbitrage opportunities and potentially the market will become more efficient.

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⁵ According to the (Fama, 1970) so-called event studies are concerned with one kind of the information generating event and this statements is valid also for recent studies.

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The Review of the Impact of Information on Stock Markets Research

Summary

The aim of this paper is to review the research on the impact of information on stock markets. It develops a tool for the research classification and based on it review 41 papers. Second it provides a view on the recent trends in the area and concludes with ideas for future research.

Key words: Stock return predictability; Information disclosure; Firm specific news; Market efficiency.

JEL classification: G14.

Dynamic Approach to Portfolio Diversification: Case of CEE Countries

*Michael Princ**

1 Introduction

A portfolio diversification is one of the most crucial procedures how to improve returns of investment. The cornerstone of portfolio theory was established by Markowitz (1952), which proposed basic approaches to optimum portfolio selection.

The main target of the following work is to describe possible strategies, which can investor use to optimize her portfolio in terms of dynamic analysis based on DCC MV GARCH model proposed by Engle (2002). Two main strategies consist of equally weighted (EW) and global minimum variance (GMV) portfolios.

An equally weighted portfolio selection was employed in an augmented form e.g. in Solnik (1974) or Solnik (1991) which described possible portfolio performance on a basis of variance measures and quantified a space for diversification. While EW portfolio does not require sophisticated methods for estimations, it is suitable to serve as a kind of benchmark as in DeMiguel et al. (2009).

In a comparison to traditional mean-variance approach e.g. in Markowitz (1995), method used in this study focuses mainly on a variance of portfolio. It assumes that future returns are unknown, because historical prices already included all relevant information and thus cannot be used for profit maximization in future, which is consistent with efficient market theory as in Fama (1970). Otherwise there would be an opportunity for arbitrage trading, which would contradict an actual assumption of fully efficient markets.

2 Literature review

The following study is analysing a degree of international interdependence in a region of CEE countries, which was earlier described e.g. in Babetskii et al. (2007), with more emphasize to portfolio theory as was mentioned earlier.

While it was proven that financial series can be described by an implicit existence of GARCH processes as was shown e.g. in Bollerslev (1986) in case of developed markets or central European markets in Vošvrda and Žikeš (2004). There is a possibility to re-estimate classic portfolio measures like in Markowitz (1952), where a simplified and static approach was employed, but now in a more complex way.

A dynamic approach offers more possibilities and moreover it can show a possible evolution of the diversification processes. A dynamic model using conditional correlation/covariance matrix based on GARCH modelling was developed by Engle (2002), who designed the DCC MV GARCH model and started also an application to portfolio creation processes. The model was justified and widely used in many interesting studies e.g. Engle - Sheppard (2001) or Cappiello et al. (2006). Thus this work aims at a well proven method, which can be used in a risk management. The paper is trying to extend previous methods and to offer more methodological tools how to interpret outcomes of dynamic models.

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3 Methodology

3.1 DCC MV GARCH Model

The econometric model used in the study is derived from a model originally defined as follows, see also Engle (2002):

$$r_t | \Psi_{t-1} \sim N(0, H_t) \quad (1)$$

$$H_t = D_t R D_t \quad (2)$$

$$D_t^2 = \text{diag}\{\omega_i\} + \text{diag}\{\kappa_i\} r_{t-1} r'_{t-1} + \text{diag}\{\gamma_i\} D_{t-1}^2 \quad (3)$$

$$\varepsilon_t = D_t^{-1} r_t \quad (4)$$

$$Q_t = S(u' - A - B) + A \varepsilon_{t-1} \varepsilon'_{t-1} + B Q_{t-1} \quad (5)$$

$$R_t = \text{diag}\{Q_t\}^{-1} Q_t \text{diag} Q_t^{-1} \quad (6)$$

A relation (1) describes a classic assumption of normality with assumed stationarity of underlying processes, while denoted matrix can be decomposed in a way proposed in (2). An equation (3) expresses the assumption that each subset follows a univariate GARCH process. Following equation (4) describes behaviour of residual terms with respect to input data, namely analysed returns. Finally relations (5) and (6) describe matrix composition necessary for the estimation and iteration processes. Without the assumption of normality in (1), the estimator would be only quasi maximum likelihood estimator (QMLE). The log likelihood function for the estimator is described in a relation (7).

$$\log(L) = -\frac{1}{2} \sum_{t=1}^T \left(n \log(2\pi) + 2 \log(D_t (r'_t D_t^{-1} D_t^{-1} r_t - \varepsilon'_t \varepsilon_t) + \log(R_t (\varepsilon'_t R_t^{-1} \varepsilon_t)) \right) \quad (7)$$

which is being maximised through estimated parameters, which fulfil conditions (1) to (7). The log-likelihood function can be further divided into two main parts (8) and (9):

$$\log(L)(\theta, \varphi) = \log(L_V)(\theta) + \log(L_C)(\theta, \varphi) \quad (8)$$

$$\log(L_V)(\theta) = -\frac{1}{2} \sum_{t=1}^T \sum_{i=1}^n \left(\log(2\pi) + \log(h_{i,t}) + \frac{r_{i,t}^2}{h_{i,t}} \right) \quad (9)$$

The equation (9), reflecting volatility $\log(L_V)(\theta)$, is a sum of individual univariate GARCH log-likelihood functions, which can be maximized separately. This emphasizes a need of prior estimations of all involved univariate GARCH models. While a second term of (8) $\log(L_C)(\theta, \varphi)$ describes conditional correlation parameters, which are maximized individually. A final two stage estimation is described in equations (10) and (11).

$$\hat{\theta} = \arg \max \{L_V(\theta)\} \quad (10)$$

$$\max_{\phi} \{L_C(\hat{\theta}, \phi)\} \quad (11)$$

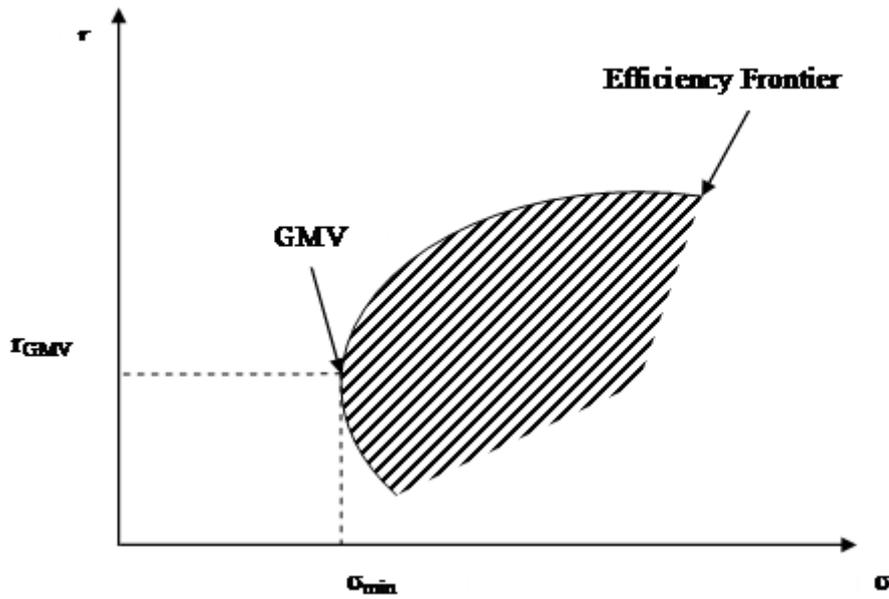
For further information about estimation of proposed parameters see also Engle (2002), Pelagatti - Rondena (2006) or Princ (2010).

3.2 Diversification strategies

Diversification strategies may differ; they are dependent on initial assumptions, which comply with a goal of the investor. Further text uncovers differences between a simple benchmark method represented by EW portfolio, which minimizes effort exercised on the optimization process, and GMV portfolio, which uses a re-weighting technique maintaining

minimum variance during an investment period. DCC MV GARCH model provides conditional correlation/covariance matrices, which are necessary to achieve the dynamic analysis of both approaches. While the EW portfolio is only measured by dynamic model, GMV portfolio uses DCC MV GARCH model as a premise and thus marks the lowest possible bound (Fig. 1). All following methods are normalized with respect to worse scenario, which assumes fully correlated markets.

Fig. 1: GMV Representation in CML Model



The variance of portfolios is computed on a basis of estimated GARCH(1,1) processes and computed correlation/covariance matrices, which were estimated through DCC MV GARCH models. The concrete definition of a variance of assumed portfolios is as follows:

$$\sigma_p^2 = \sum_{i=1}^n w_i^2 \sigma_i^2 + \sum_{i=1}^n \sum_{j=1, j \neq i}^n w_i w_j \sigma_i \sigma_j \quad (12)$$

The computation formula is a classic form of a portfolio variance mentioned e.g. in Elton - Gruber (1991).

3.2.1 Equally Weighted Portfolio

The equally weighted portfolio (sometimes also marked as 1/n or 1-n portfolio) is a common diversification tool used in portfolio theory, while decision criteria are rather simple and presume only a naive way how to diversify, see also DeMiguel et al. (2009). Because the method presumes simple assumptions, it is plausible to mark it as a benchmark for more sophisticated methods. Any other way achieving lesser variance or possible higher yield can be marked as more effective as a benchmark and thus achieving a higher bound of portfolio effectiveness. In an opposite way a portfolio with higher values of volatility or lower yield could be marked as ineffective. This methodology gives a straightforward background for a furthermore portfolio performance analysis.

The weights for EW portfolio are defined in a following way:

$$w_i = 1/n \quad (13)$$

$$\sum_i^n w_i = 1 \quad (14)$$

3.3 Global Minimum Variance Portfolio

While all efficient portfolios lie on the efficient frontier, GMV one at the beginning of that frontier and it has lowest volatility amongst other efficient portfolios, but it does not mean that it should achieve a better performance in a term of higher returns, because solely the variance is optimized (see Fig. 1). The mathematical construction of the GMV portfolio can be expressed in a following way.

$$\min_w = \frac{1}{2} w' \Sigma w \quad (15)$$

$$\sum_i^n w_i = 1 \quad (16)$$

We can assume that we have an opportunity to invest into n number of assets; weight w of assets is multiplied by the covariance matrix Σ with functions of the optimization process of GMV portfolio.

The weights of GMV portfolio that minimizes the portfolio variance are at first calculated assuming that weight can get only positive values. While there is no argument describing mean in GMV portfolio construction, constraint on mean is not necessary. Further information can be found in Frahm - Memmel (2010). The key part is in that equation is finding the covariance matrix denoted as Σ , which is estimated by DCC MV GARCH model. There is actually a possibility to estimate even a portfolio including short selling when lower bound for weights $w > 0$ is relieved, which can result into a leveraged purchase of individual stock indices (individual weight can excess value 1). The GMV portfolio including short-selling will be noted as unbounded GMV (UGMV), because lower limit of weights is no longer bounded.

4 Data

4.1 Discription

All following data series are maintained on a daily basis, which offer suitable environment for investors optimizing their strategies. A daily frequency can be described as a HF data approach, while there is still a space for UHF data sets, which would be interpreted more difficultly, because of too high number of opportunities for trading. The analysis includes various developed markets in order to offer a broad space for diversification. It namely means only one representative index is chosen from each country i.e. ATX for Austria, BUX for Hungary, DAX 30 for Germany, PX for Czech Republic and finally WIG 20 for Poland.

An observed data sample includes 5 national indices dating from 5th January 2000 until 31st December 2010, which means that sample includes many important events of a recent economic history.

Data estimated in the routine were calculated in a logarithmic form of returns as is described in a relation (17).

$$r_t = \log(p_t / p_{t-1}) \times 100 \quad (17)$$

where p_t stands for closing value of computed index. This means that input values of national stock indices were transformed into daily returns r_t computed as Close-to-Close value in percentage points.

Because of a lack of data sample synchronization, data samples were sorted by a custom

programmed routine, for details see Princ (2010), to overcome possible problems with unique state holidays or other days when exchanges were closed. The algorithm approves only opening dates common for all countries, in order to capture comparable correlations among all markets and to set a common window for observed trading window. The data sample restriction was chosen rather than a possible expansion with zero values to dates with no input, which would otherwise cause a probable underestimation of conditional variances estimated by individual GARCH (1,1) processes.

4.2 Testing data series

4.2.1 Stationarity

To ensure necessary assumptions of the proposed DCC MV GARCH model preliminary tests were employed. Analyzed time series were tested for an existence of stationarity and normality.

To confirm stationarity Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test was used, see also Kwiatkowski et al. (1992). The test assumes a hypothesis that observed time series is stationary. KPSS test has a following test statistics:

$$\hat{\eta}_\mu = \eta_\mu / s^2 = T^{-2} \sum S_t^2 / s^2(l) \quad (18)$$

while its asymptotic distribution is defined as:

$$\hat{\eta}_\mu \rightarrow \int_0^1 V_2(r)^2 dr \quad (19)$$

where $V(r)$ = standard Brownian bridge.

The proposed KPSS test is complementary to unit root tests such a Augmented Dickey-Fuller (ADF) test for further details see also Said-Dickey (1984) or Banerjee (1993). A composition of both tests can identify stationarity or integration of time series to make it clear whether all initial assumptions are met. The test statistic of ADF test is as follows:

$$DF_\tau = \frac{\hat{\gamma}}{SE(\hat{\gamma})} \quad (20)$$

while $\hat{\gamma}$ is computed after using following model:

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \dots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t \quad (21)$$

Hypothesis of ADF test presumes existence of unit root in the data series.

4.2.2 Normality

One of the assumptions, proposed in DCC MVGARCH model, was normality of observed time series. When time series would comply with assumed normality the final estimator would be MLE. In case that normality would be violated estimation is still possible, but estimators would be only QMLE. To test the normality of time series Shapiro-Wilk test was chosen. The actual test statistic is described at (22), further details can be found in Shapiro-Wilk (1965).

$$W = \frac{\left(\sum_{i=1}^n \alpha_i x_{(i)} \right)^2}{\sum_{i=1}^n (x_i - \bar{x})^2} \quad (22)$$

Hypothesis of Shapiro-Wilk (S-W) test presumes normality of observed data series.

4.2.3 Test application

Test proposed in previous subchapters were applied on observed time series. A summary of

computed values of proposed tests is in Table 1.

Tab. 1: Test results

	KPSS	ADF	S-W
ATX	0.1612 (-)	-13.2372 (***)	0.8514 (***)
BUX	0.1299 (-)	-14.1636 (***)	0.8931 (***)
DAX	0.2521 (-)	-13.4956 (***)	0.9164 (***)
PX	0.1341 (-)	-12.7325 (***)	0.8579 (***)
WIG	0.1077 (-)	-13.1387 (***)	0.9382 (***)

Source: Author's calculations, where (***) indicates p-value lower than 1 %, (**) indicates p-value between 1 and 5 %, (*) indicates p-value between 5 and 10 %, (-) indicates p-value higher than 10 %

The Table 1 shows that KPSS test hypothesis cannot be rejected even at 10% significancy level indicating that stationarity of all data series cannot be rejected. Results of ADF test indicate that existence of unit root can be rejected in favour of alternative that data series do not contain unit roots even on 1 % level. We can thus conclude that all data series can be regarded as stationary and not having unit root.

In case of normality the hypothesis that data series are normally distributed was rejected, this causes that all estimators have to be marked as QMLE instead of maximum likelihood estimators.

5 Model estimations

DCC MV GARCH was estimated resulting into a complex correlation/covariance matrix including all the mentioned markets. Table 2 shows parameters obtained at phase, when all univariate GARCH models were estimated, which is a necessary condition to estimate DCC MVGARCH model. Table 2 contains parameters of estimated GARCH(1,1) models with their standard errors, it confirms that stationarity condition of all GARCH processes is valid i.e. that for all models it is true that sum of their estimated parameters is lesser than 1 ($\omega + \alpha + \beta < 1$), for further details see Bollerslev (1986).

Tab. 2: Univariate GARCH Estimates

	ATX	BUX	DAX	PX	WIG
ω	0.0000	0.0000	0.0000	0.0000	0.0000
std.error	0.0000	0.0188	0.0180	0.0000	0.0185
α	0.1116	0.0956	0.0926	0.1168	0.0536
std.err	0.0199	0.0000	0.0138	0.0141	0.0000
β	0.8672	0.8776	0.8989	0.8524	0.9405
std.err	0.0202	0.0195	0.0000	0.0104	0.0110

Source: Author's calculations

Individual dynamic conditional correlations (DCC) between observed markets are depicted in Figures 2–6, they indicate DCC between market described in a title and remaining indices of the whole data sample. Dynamic conditional correlations, which are showed in Figures 2-6 to be increasing over time, indicate that a space for diversification is decreasing over time, which is

consistent with Solnik (1991). Following computations are conducted as in-sample analyses.

Fig. 2: DCC of ATX index

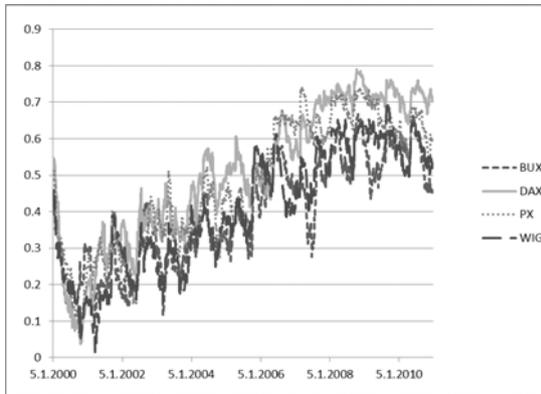


Fig. 3: DCC of BUX index

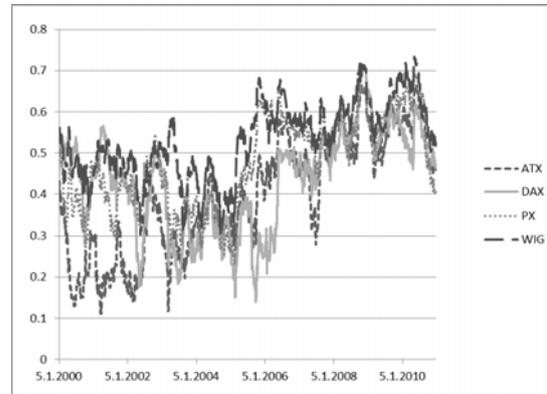


Fig. 4: DCC of DAX index

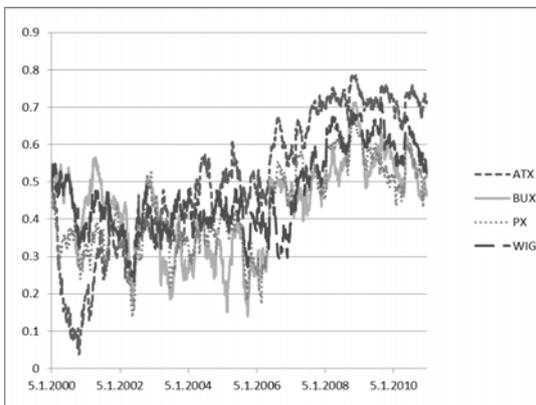


Fig. 5: DCC of PX index

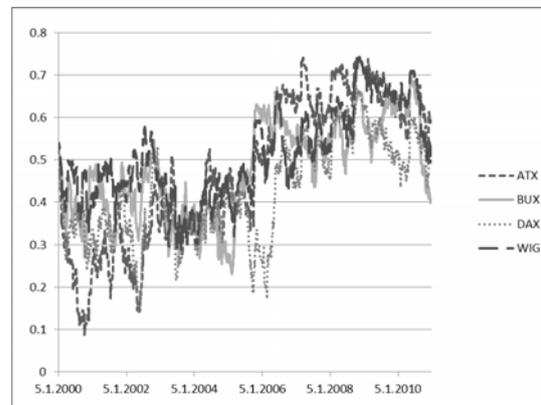
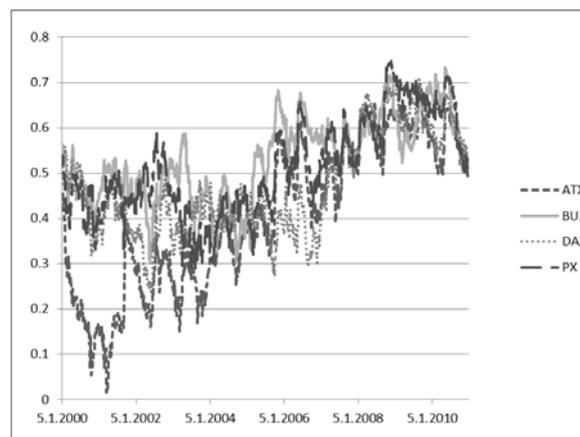


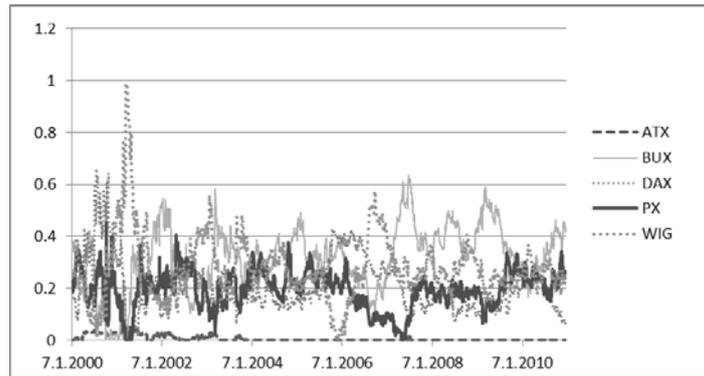
Fig. 6: DCC of WIG index



Source: Author's calculations

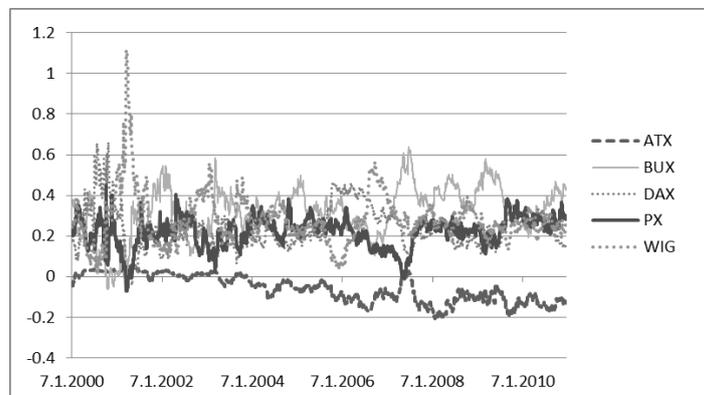
Weights derived from diversification strategies were computed on a basis of previously mentioned methodology using computed conditional correlations and covariances, optimization techniques used BFGS (Broyden–Fletcher–Goldfarb–Shanno) method using OxEdit 5.10, see also Doornik (2007). A graphical interpretation of computed weights is described in following figures. Figure 7 shows weights computed in a case of a normal GMV portfolio, while figure 8 shows unbounded GMV portfolio (UGMV), which offers short-selling possibilities.

Fig. 7: Weights of GMV Portfolio



Source: Author's calculations

Fig. 8: Weights of UGMV Portfolio



Source: Author's calculations

5.1 Performance analysis

Values of weights were used in order to construct portfolios held by a fictional investor for one day period. It means that observed indices are bought using data obtained at time t and sold at time $t+1$, which means that a data sample is shortened by one observation. The construction presumes existence of investment assets with an exactly same pattern as analysed index, which are commonly offered on financial markets. Amount received at time $t+1$ is fully reinvested in a same way as at time t . This recursive method is used for the whole data sample. The final outcome describes Table 3, where are described basic statistics.

Tab. 3: Performance Comparison of Proposed Portfolios

	EW	GMV	UGMV
mean	1.000135	1.001575	1.001799
median	0.999245	0.998988	0.998868
skewness	0.790431	1.65046	2.336299
st. dev.	0.012594	0.029057	0.031648
minimum	0.891007	0.689818	0.689818
maximum	1.109538	1.317087	1.355428

Source: Author's calculations

Table 3 shows that although GMV and UGMV portfolios were constructed at time t as minimum variance portfolios their returns are more variable in longer period than EW portfolio

servicing as a benchmark. While standard deviation of one day returns is higher in case of U/GMV portfolios, these portfolios gained also other properties. They performed better than benchmark on average with a positive skewness. This propose an idea that lower variance at time t is transformed to higher returns in average when we analyse time series in a longer period, which is consistent with findings of Yilmaz (2010), where Istanbul Stock Exchange was analysed, but in contrary to Yilmaz (2010), this study emphasize an international dimension of portfolio theory.

6 Conclusions

The work proved that international diversification was decreasing during time in a case of analysed countries. Findings are consistent with study Iben and Litterman (1994), which found a gradually decreasing diversification among North America and European region, or Lewis (2006). There were identified lowering opportunities for international diversification, which was confirmed in a case of observed CEE stock market indices. This offers another clue for a possible increased home bias of equity market investors.

The study also confirms possible positive effects of portfolio diversification based on dynamic analysis, which is consistent with findings of Yilmaz (2010). It can be concluded that a dynamic approach to portfolio theory has a substantial potential for improvements of optimization methods, which can be analysed during further research.

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Data sources:

- Reuters Wealth Manager; www.thomsonreuters.com
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Dynamic Approach to Portfolio Diversification: Case of CEE Countries

Summary

The paper focused on measuring of diversification effects in terms of variance minimization among different portfolios. DCC MV GARCH model of Engle (2002) was employed in order to obtain conditional covariance matrices, which were used as a basis for a further modelling. The analysis includes a composition of various portfolios. A purpose of the work is to set a guidelines and bounds of diversification effects with respect to methods and data sets. The study confirms possible enhancing effects of portfolio selection made on a basis of dynamic analysis.

Key words: Dynamic modelling; Conditional correlation; Diversification effect.

JEL classification: C32, E44, F36, G14, G15.

Delta-Hedging of Interest Rate Risk in Longterm Contracts: An Application of the Cairns-Model

*Sven Balder, Daniel Schwake**

1 Introduction

Funded retirement arrangements like pension funds and life insurance products have extreme long-term claims, exceeding 50 and 60 years. These liabilities are mostly financed by bonds with maturities way shorter on the asset side. Besides the duration gap produced by the lack of liquid long-term bonds, the providers and asset managers of such products have to deal with the risk of interest rates maturing in decades. Due to the separation of responsibilities and the otherwise unwanted complication, the interest rate risk management of these (quite big) portfolios - also called asset liability management (ALM) - is often done with a so called overlay. The interest rate sensitivity is managed by adding corresponding derivatives - mostly swaps - without affecting the strategic asset allocation. Besides bonds, such portfolios could include equities and other asset classes. Still, one usually concentrates on the bonds when it comes to interest rate risk, because of their relative high portfolio portion and the ambiguous interest rate sensitivity of other asset classes.

A common practice in measuring sensitivity to interest rate changes is the PV01-approach. This duration based method measures interest rate risk as the change in value due to a parallel shift of the interest rate curve. Based on these sensitivity measures a swap overlay is usually introduced to (statically) hedge interest rate risks. Although this method seems suspiciously easy for the academic world, it is quite wide spread under practitioners.

In the meanwhile the risk-neutral model-family for interest rates introduced by Cairns:04a simultaneously models short- and longterm interest rates. Adequately calibrated, the Cairns-model proclaims to deliver realistic simulation of the whole interest rate curve. The Cairns-model should thus be ideal for managing interest rate risks of long-term pension funds and life insurance products. The model being quite an elaborate approach, we decided to concentrate on its two-factor version. Based on the two risk factors we derive interest rate sensitivity measures, which we then use in (statically) hedging interest rate risks of a portfolio of assets and liabilities. For the construction of the swap-overlay, we introduce an algorithm that is rule-based and model independent. Given an interest rate model, the algorithm computes the interest rate sensitivity of portfolios containing assets and liabilities. It then adds swaps and forward swaps to the portfolio in order to hedge its interest rate risks. The hedging performance of the model-based sensitivities is then compared to the one delivered by the PV01-approach, both in a backtest and in a Monte Carlo simulation. Interestingly, our empirical analysis, based on European swap rates (June 2000 - June 2010) actually underlines the practical use and popularity of the PV01 approach.

In this paper we thus take the analysis of the Cairns-model one step further and test whether this most promising approach is able to deliver a value added in the risk management of long-term portfolios. In its two-factor version, and based on the European historical data, the Cairns-model is in deed able to robustly hedge interest rate risks. Interestingly, we are able to also demonstrate the hedge effectivity of the more (simple) PV01 as well. Both in the backtest and in the Monte

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Carlo framework, this duration based method delivers results that are quite comparable with the one delivered by the Cairns model. Future research might extend the model to a third risk-factor. Besides the European market, the empirical analysis should also use Data from other markets like the USA or Japan. Furthermore, the construction of a more dynamic hedge might be fruitful as well.

The rest of the paper is organized as follows; in Section 2 we briefly discuss the model offered by Cairns. Section 3 deals with the problem of calibrating the model to market data. In line with lutz:06 we use a Kalman-Filter for estimating the model parameters. Section 4 shows how this model can be used to compute interest rate sensitivities. Furthermore, we shortly address the valuation of interest rate sensitivity in the PV01 approach. In Section 5 we illustrate the use of swaps and forward swaps in hedging interest rate sensitivity. In Section 6 we turn to the realistic example of hedging a pension fund. Whereas the algorithm is introduced in Subsection 6.1 and the results of the backtest and the Monte Carlo simulation are given in the Subsections 6.3 and 6.2, respectively. Section 7 then concludes the paper.

2 The model

Due to the unique and somewhat complex characteristics of interest rate instruments (e.g. defined maturity), numerous models for interest rate changes have been introduced, aiming on

- the arbitrage-free and risk-neutral valuation of interest rate derivatives, and on
- realistic modeling of interest rate changes.

Most of the celebrated arbitrage-free models like Vasicek (1977), Cox et al. (1985) or the milestone of time-continuous models of Heath et al. (1992) focus on the valuation of short- and middle-term contingent claims. The more recent market models of Brace et al. (1997) and Miltersen et al. (1997) have retained this objective. Thus, all these models are only conditionally applicable for extreme long-running contracts. In the meanwhile, the approaches of Wilkie (1995) or Yakoubov et al. (1999) deliver more realistic simulation of long-term interest rates needed for instance in the risk management of life insurers. Yet these time-discrete approaches are not designed for the valuation of interest rate instruments and their short-term risk management.

Based on the framework of Flesaker and Hughston (1996), Cairns (2004) introduces a family of models that aim to satisfy both the arbitrage-free evaluation and the realistic modeling of interest rates with diverse maturities.¹ Cairns (2004) defines the dynamics of the zero-coupon bonds $P(t; T)$, maturing in T as follows:

$$P(t, T) = \frac{\int_{T-t}^{\infty} H(u, X(t)) du}{\int_0^{\infty} H(u, X(t)) du} \quad (1)$$

These bond prices are a function of the specified martingale family

$$H(u, x) = \exp \left[-\beta u + \sum_{i=1}^n \sigma_i x_i e^{-\alpha_i u} - \frac{1}{2} \sum_{i,j=1}^n \frac{\rho_{ij} \sigma_i \sigma_j}{\alpha_i + \alpha_j} e^{-(\alpha_i + \alpha_j) u} \right] \quad (2)$$

This process is in turn a function of n correlated Ornstein-Uhlenbeck processes, driven by independent Brownian motions \hat{Z}

¹ For a more detailed introduction of the framework of Flesaker and Hughston (1996) and the derivation of the formulas of Cairns (2004) see appendix A of this paper.

$$dX_i(t) = \alpha_i(\mu_i - X_i(t))dt + \sum_{j=1}^n c_{ij} d\hat{Z}_j(t) \quad (3)$$

The matrix $C = (c_{ij})_{i,j=1}^n$ is defined in such a manner that CC' represents the correlation matrix for the processes, $X_1(t), \dots, X_n(t)$.

The stochastic differential equation equals

$$X_i(t) = e^{-\alpha_i t} X_i(0) + \mu_i(1 - e^{-\alpha_i t}) + \sum_{j=1}^n c_{ij} \int_0^t e^{-\alpha_i(t-s)} d\hat{Z}_j(s) \quad (4)$$

Given suitably parametrized values for the constants, β , α , σ , ρ , μ , and an appropriate number of factors, Cairns (2004) shows that the model satisfies the following

1. all interest rates are positive
2. all interest rates can get close to zero
3. the model is mean reverting
4. long periods with both relatively high and low interest rates are possible
5. par yields for long-term bonds should have realistic probabilities of reaching both high and low values
6. the model is preferably time homogeneous
7. the constant parameters in the model need no regular recalibration

While most of these characteristics have already been targeted by other models, points (4) and (5) are the ones that distinguish the Cairns-model at most. For the derivation of these characteristics, the α -parameters as seen in Equation 3 are vital. These are the parameters that drive the mean-reverting Ornstein-Uhlenbeck processes. Given at least one quite low α -term, one factor X is subject to long cycles, feeding through to long cycles in interest rates. Furthermore, such a parameter would allow par yields on long-term bonds to vary over a wide range. Furthermore, Cairns (2004) shows that β is a kind of a long-term forward interest rates.

3 The calibration of the model parameters

3.1 The Kalman-Filter Approach

Our calibration of the two-factor Cairns-model is based on the extended Kalman-filter-approach. We have used the algorithm for calibrating spot rates as illustrated in Lutz (2006).² The main steps of this algorithm are briefly introduced in the following.

For this purpose we first define a measure- and a transition formula. Let y stand for the q -number of spot rates available. Whereas each spot rate has a maturity of $m_i, i = 1, \dots, q$. The model-value of these spot rates is given as

$$R(t, t + m_i) = -\frac{1}{m_i} \log P(t, T) = \frac{1}{m_i} \log \left(\frac{\int_0^\infty H(u, X(t)) du}{\int_{m_i}^\infty H(u, X(t)) du} \right) \quad (5)$$

$=: G_i(X(t); \theta)$

The measure formula, which gives back the relation between the realized and the modeled rates

²For the Kalman-filter-approach see also Babbs and Nowman (1999).

is defined as

$$\begin{aligned}
y_t &= G(X(t); \theta) + \varepsilon_t; \quad \varepsilon_t \sim N(0; R(\theta)) \\
\text{with a } G(X(t); \theta) &= \begin{pmatrix} G_1(X_t; \theta) \\ \vdots \\ G_q(X_t; \theta) \end{pmatrix} \\
\text{and } R_t(\theta) &= \begin{pmatrix} v_1^2 & 0 & \dots & 0 \\ 0 & v_2^2 & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & v_q^2 \end{pmatrix}
\end{aligned} \tag{6}$$

The vector θ contains $8 + q$ parameters $(\mu_1, \mu_2, \alpha_1, \alpha_2, \rho_{12}, \sigma_1, \sigma_2, v_1, \dots, v_q)$ that have to be estimated. Because of the nonlinearity of $G(x; \theta)$ we use the extended Kalman-Filter-Approach that first linearizes the function. Using $\frac{\partial}{\partial x_i} H(u, x) = H(u, x) \sigma_i e^{-\alpha_i u}$, the gradient

$\nabla_x = G_j(x; \theta) = \left(\frac{\partial}{\partial x_1} G_j(x; \theta), \frac{\partial}{\partial x_2} G_j(x; \theta) \right)$ is defined as

$$\frac{\partial}{\partial x_j} G_j(x; \theta) = \frac{1}{m_j} \left(\frac{\int_0^\infty H(u, X(t)) \sigma_i e^{-\alpha_i u} du}{\int_0^\infty H(u, X(t)) du} - \frac{\int_{m_j}^\infty H(u, X(t)) \sigma_i e^{-\alpha_i u} du}{\int_{m_j}^\infty H(u, X(t)) du} \right). \tag{7}$$

The linearized measuring equation can be written as

$$\begin{aligned}
y_t &\approx G(\hat{x}_{t|t-1}; \theta) + D_{t|t-1}(X_t - \hat{x}_{t|t-1}) + \varepsilon_t \\
\text{with } D_{t|t-1} &= \begin{pmatrix} \frac{\delta}{\delta x_1} G_1(\hat{x}_{t|t-1}; \theta) & \frac{\delta}{\delta x_2} G_1(\hat{x}_{t|t-1}; \theta) \\ \vdots & \vdots \\ \frac{\delta}{\delta x_1} G_q(\hat{x}_{t|t-1}; \theta) & \frac{\delta}{\delta x_2} G_q(\hat{x}_{t|t-1}; \theta) \end{pmatrix} \in \mathbb{R}^{q \times 2}
\end{aligned} \tag{8}$$

Considering the transition equation we are interested in the process of two factors under the real-world measure. As stated by Lutz (2006), due to the time-discrete version of Equation 4 the two factors (X) have a multivariate normal distribution and can be written as

$$\begin{aligned}
X(t + \Delta t | X(t)) &= \underbrace{\begin{pmatrix} \mu_1(1 - e^{-\alpha_1 \Delta t}) \\ \mu_2(1 - e^{-\alpha_2 \Delta t}) \end{pmatrix}}_{=: F_0(\theta)} + \underbrace{\begin{pmatrix} e^{-\alpha_1 \Delta t} & 0 \\ 0 & e^{-\alpha_2 \Delta t} \end{pmatrix}}_{=: F_1(\theta)} \begin{pmatrix} X_1 t \\ X_2 t \end{pmatrix} + \eta(t) \\
&= F_0(\theta) + F_1(\theta) X(t) + \eta(t) \\
\text{with } \eta(t) &\sim N(0; Q(\theta)) \\
\text{and } Q(\theta) &= \left(\frac{\rho_{ij}}{\alpha_i + \alpha_j} (1 - e^{-(\alpha_i + \alpha_j) \Delta t}) \right)_{i,j=1}^2
\end{aligned} \tag{9}$$

Starting with a given parameter θ and an unconditional expected value for the risk factors $x_{0|0}$,

and the covariance matrix for these factors P_{00} , the calculation steps are

1. The information in $t-1$ is used to calculate the ex ante proxies for t as follows

$$\hat{x}_{t|t-1} = F_t^0(\theta) + F_t^1(\theta)\hat{x}_{t-1|t-1} \quad (10)$$

$$P_{t|t-1} = F_t^1(\theta)P_{t-1|t-1}F_t^1(\theta)' + Q_t \quad (11)$$

2. Given the new information y_t , forecasting error e_t its covariance matrix $F_{t|t-1}$ as calculated using the following equations

$$e_t = y_t - G(\hat{x}_{t|t-1}; \theta) \quad (12)$$

$$F_{t|t-1} = D_{t|t-1}P_{t-1|t-1}D_{t|t-1}' + R_t \quad (13)$$

3. The proxies can then be corrected as follows

$$\hat{x}_{t|t} = \hat{x}_{t|t-1} + \underbrace{P_{t|t-1}D_{t|t-1}'F_{t|t-1}^{-1}}_{K_t} e_t \quad (14)$$

$$\hat{x}_{t|t} = \hat{x}_{t|t-1} + K_t e_t$$

$$P_{t|t} = (I - K_t D_{t|t-1})P_{t|t-1} \quad (15)$$

4. The value of the log likelihood function is calculated in the following manner

$$\log L(y; \theta) = -\frac{1}{2} \sum_{t=1}^T n \log(2\pi) + \log |F_{t|t-1}| + e_t' F_{t|t-1}^{-1} e_t \quad (16)$$

The steps 1-4 are then repeated until $\hat{\theta} = \text{argmax} \log L(y; \theta)$ is found.

3.2 The results of calibration

In order to test our calibration technique we ran the calculation with simulated interest rate curves. Given the starting values with lower and upper bounds as seen in Table 1 we simulated the spot yields with the following yearly maturities: 1 - 10; 20; 30; 40; 50. The measuring error for each maturity $\varepsilon_t \sim N(0, \nu^2)$ was simulated with $\nu = 0.001$. In each one of the 300 simulations, 25 monthly interest rate curves were generated. These were then calibrated using the extended Kalman-Filter approach. The average calibrated parameters and their standard deviations are also given in Table 1.

Tab. 1: Calibration Results of Simulated Interest Rate Curves

	μ_1	μ_2	α_1	α_2	σ_1	σ_2	ρ_{12}	β	ν
Simulation Input:									
Parameters	-1.20	0.87	0.48	0.07	-0.62	0.43	0.44	0.06	0.001
Calibration Input:									
Start Values	-2.00	2.00	0.30	0.05	-0.60	0.50	0.40	0.04	0.001
Lower bound	-4.00	-4.00	0.20	0.02	-0.80	0.02	0.02	0.02	0.000001
Upper Bound	10.00	10.00	0.80	0.2	0.80	0.60	0.60	0.08	0.01
Calibration Results:									
Mean	-1.56	2.17	0.38	0.15	-0.84	0.62	0.50	0.06	0.001
Standard Deviation	3.09	1.49	0.11	0.02	0.15	0.13	0.09	0.00	0.00

While the results for the parameters $\alpha_1, \alpha_2, \sigma_1, \sigma_2, \rho_{12}, \beta$ seem to be quite robustly calibrated, the calibration of parameters μ_1 and μ_2 seems to be unstable. Notice, however, that under the risk neutral measure the parameters have the value nil. Their calibration is thus only possible using the implicit processes for X_1 and X_2 under the real world measure. Furthermore, as we will see in Section 4, the two parameters do not play any role in the measurement of interest rate sensitivity.

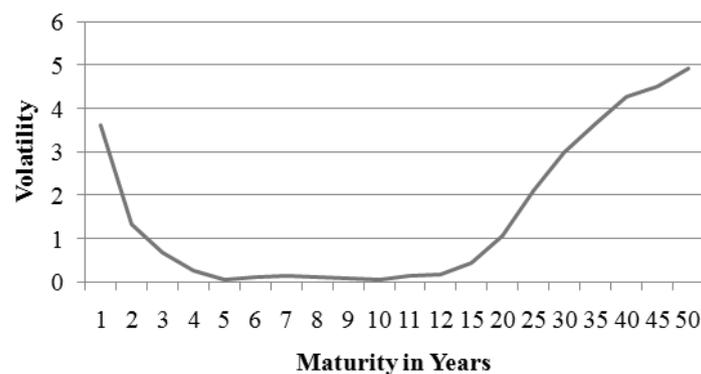
After demonstrating the calculation ability of the Kalman-Filter, we used the same approach to calibrate the Cairns parameters using historical data. For this purpose we took European monthly swap rates in the sample period June 2000 - June 2010, with the following yearly maturities: 1-12; 15; 20; 25; 30; 35; 40; 45; 50. The interest rate curves can be seen in Figure 9(a).³ In addition to the eight parameters, 20 standard deviation values of the measuring error had also to be calibrated.

Tab. 2: Calibration Results of Historic Interest Rate Curves

	μ_1	μ_2	α_1	α_2	σ_1	σ_2	ρ_{12}	β	$\log L$
Simulation Input:									
Calibrated Parameters	-2.12	8.98	0.44	0.03	0.43	0.60	-0.59	0.03	16,677

The calibration values for ν of each maturity as seen in Figure 1 show the quite good fit, the two-factors-model is able to get between the years 9 - 15. For short term yields as well as for maturities exceeding 30 years, the calibration seems to deliver somewhat less accurate results. This might results from the fact that the calibrated model integrates only two risk factors. Three and more factors might minimize the measuring error.

Fig. 1: Volatility of the Measuring Error



4 Interest rate sensitivity

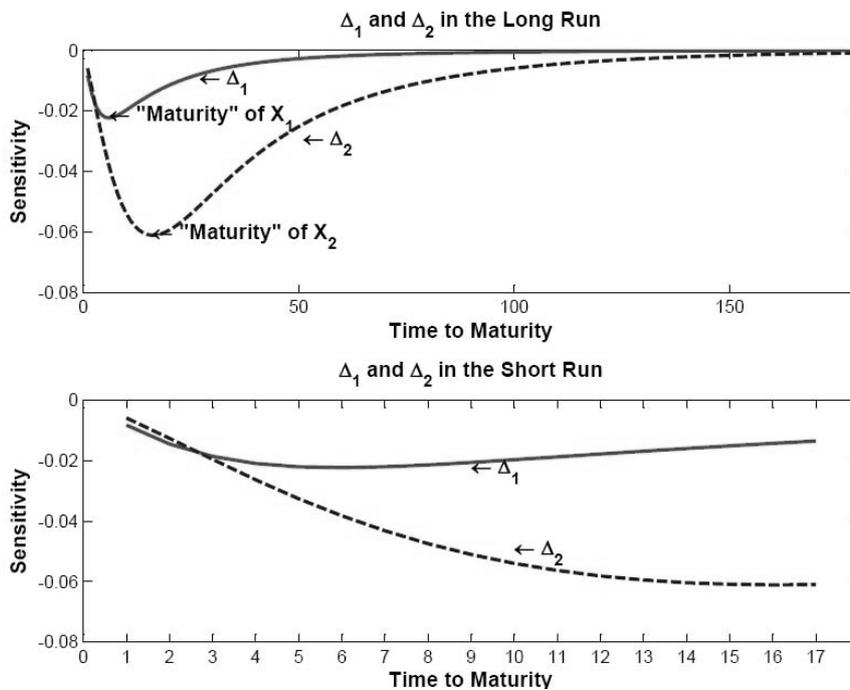
Using the presented model above, we would like to manage the sensitivity of portfolios with respect to changes in interest rates. As noted by Cairns (2004), the presentation of the bond prices as a function of the short rate is impossible. This hinders the differentiation of the bond prices with respect to interest rates. We therefore offer the derivative with respect to the risk factors as an alternative and name it delta Δ_i . Using the basic dynamics for the Cairns-model given in Equation 1 gives

³Our calibration on the basis of growing time windows delivered quite stable parameters, implying that no continuous recalibration is needed.

$$\Delta_i = \frac{\delta P(t, T, X(t))}{\delta X_i} = \frac{(\int_{T-t}^{\infty} \sigma_i e^{-\alpha_i u} H(u, X(t)) du) (\int_0^{\infty} H(u, X(t)) du)}{(\int_0^{\infty} H(u, X(t)) du)^2} - \frac{(\int_0^{\infty} \sigma_i e^{-\alpha_i u} H(u, X(t)) du) (\int_{T-t}^{\infty} H(u, X(t)) du)}{(\int_0^{\infty} H(u, X(t)) du)^2} \quad (17)$$

Figure 2 shows the usual course of delta as a function of time. In the model framework used, two factors, X_1 and X_2 drive the bond prices. The deltas shown are the sensitivities of the bond prices with respect to these risk factors. While the first factor is driven by $\alpha_1 = 0.44$, the second mean-reverting parameter is $\alpha_2 = 0.03$. The second risk factor being the one function to longer cycles, it is also the driver behind long-term interest rates. For instance, bonds with maturities of 10 years are way more sensitive to changes in X_2 than in X_1 , as seen in Figure 2. Notice that the delta-values first rise (absolutely), reaching a "maturity level", which seems to vary from one factor to another. At some point in time the sensitivity measures always converge to zero.

Fig. 2: Interest Rate Sensitivity with Respect to Maturity



The following calibrated parameters are used: $\mu_1 = -2.12$; $\mu_2 = 8.98$; $\alpha_1 = 0.44$; $\alpha_2 = 0.03$; $\sigma_1 = 0.43$; $\sigma_2 = 0.60$; $\rho_{12} = -0.59$; $\beta = 0.03$

Quantifying risk in this manner, we follow Jarrow and Turnbull (1994) searching for strategies to hedge delta. In step with common practice, we shall also use their bucket-building approach when it comes to hedge complex portfolios with multitude instruments. The hedge is not done on the portfolio level but on the level of time intervals - also called buckets - in which a high correlation of interest rates is assumed. The hedge could have been done in a more dynamic approach, yet this would imply continuous adjustment. The purpose of such hedges rather to guarantee the needed liquidity for future time periods. The hedge achieved by the introduced model is then compared with the one achieved by the popular PV01-approach.

The PV01-Approach

This approach is based on the duration concept and measures sensitivity as the change of the

present value (PV) due to a parallel shift of the interest rate curve of 1 basis point (01).⁴

In this duration based approach, sensitivity is measured as the valuation change of an - here zero bond - due to a parallel shift of the interest rate curve of 1 basis point. A zero bond with the notional amount has the following sensitivity to changes in the interest rate

$$PV\ 01 = \frac{1}{10000} \cdot \frac{\partial P(t,T)}{\partial R(t,T)} = \frac{1}{10000} \cdot \frac{\partial (N \cdot e^{-R(t,T)(T-t)})}{\partial R(t,T)} = -10^{-4} (T-t) \cdot N \cdot P(t,T) \quad (18)$$

The PV01-measure is thus an approximation for the present value change due to a parallel shift, leaving possible non-parallel shifts unobserved.

5 Using swaps in hedging

In the following section we illustrate how swaps can be used in hedging interest rate risks of portfolios containing assets and liabilities. The compatibility of swaps is easily seen by duplicating the interest rate derivatives. The value at time t of a swap settling in t_0 , maturing in t_n and paying a fixed rate c can be written as

$$V^{swap}(t) = P(t, t_0) - \sum_{i=0}^n c \cdot P(t, t_i) - P(t, t_n), t \in [0, t_n] \quad (19)$$

The swap can thus be duplicated in the following manner. The fixed leg is seen as a portfolio of zero coupon bonds with c as their face values. The floating leg is duplicated using a position in a bond maturing with the swap in t_n , and a contrariwise bond maturing at the end of the forward period in t_0 . In a payer (receiver) swap a short (long) position is build up in t_0 and a long (short) position is build up in t_n .

The floating leg can thus be written as

$$V^{float}(t) = P(t, t_0) - P(t, t_n), t \in [0, t_n] \quad (20)$$

Whilst the fixed leg is duplicated in the following manner

$$V^{fix}(t) = \sum_{i=1}^n c(t_0, t_n) \cdot P(t, t_i), t \in [0, t_n] \quad (21)$$

This means that the fixed leg will have sensitivities towards interest rate changes on every payment date of the swap. Yet the more relevant sensitivities will arise from the floating leg. A (spot) swap will demonstrate such a sensitivity at its maturity, while forward swaps will have significant sensitivities at maturity as well as at their first fixing date. This makes swaps, especially forward swaps interesting in hedging interest rate sensitivities of portfolios with a duration gap as shown bellow. In our case, we will handle interest rate sensitivity given by delta of the Cairn's model. Notice however, that the described technique can be applied for all other sensitivity factors (e.g. PV01). Besides the mathematical derivation of the swap overlay, we will use a simplified portfolio to visualize the technique.

The considered portfolio consists of one liabilities refinanced by one asset. The liability has a face value of 2 and matures in the time period $t = 4$. The asset, a zero-coupon bond, has a face value of 1.6 and matures already in the time period $t = 1$. The cashflows and the implied sensitivities generated by the asset and the liability are given in Tab. 3. Using the Cairns-model to calculate the discount function, the net present value of the portfolio is (almost) zero. This means that the funding-status (present value of the assets/present value of the liabilities) equals 1.

⁴ The method is also called DV01 (dollar value).

The funding-status being equal to 1 means that using his assets, the portfolio holder would be able to redeem his outstanding obligations. Yet if interest rates change, the value of his liabilities might exceed the value of the assets. The most straight forward method to hedge this risk is to sell the bond and buy an alternative bond maturing in time period 4, bearing the same face value the liability does. In this simplified example, such a method would probably be the one applied. In more realistic portfolios, this might become problematic, due to the fact that long-term bonds are quite illiquid, if not inexistent. In step with common practice, we will show how the portfolio could be delta-hedged without changing its structure, leaving the strategic and tactical allocation to the asset managers. For this purpose we will use one swap (also called swap-overlay). At least in theory, such a swap-overlay will have an initial net present value of zero.

Tab. 3: Example

Time Period m	Cashflow	Discount Factors	$\Delta_{1,m} \cdot 10^4$	$\Delta_{2,m} \cdot 10^4$
Before Overlay				
1	1.60	0.9430	-173.26	-111.03
2	0.00	0.8797	0.00	0.00
3	0.00	0.8148	0.00	0.00
4	-2.00	0.7513	348.33	-381.15
After Overlay				
1	-0.05	0.9430	5.08	3.25
2	0.13	0.8797	-20.98	-16.33
3	0.13	0.8148	-23.11	-21.51
4	-0.22	0.7513	39.02	42.69

The following parameters are used: $\mu_1 = -2.34$; $\mu_2 = 3.75$; $\alpha_1 = 0.48$; $\alpha_2 = 0.06$; $\sigma_1 = 0.30$; $\sigma_2 = 0.30$; $\rho_{12} = -0.59$; $\beta = 0.07$

Strictly speaking we have four time periods, in which we can have cashflows and thus four potential sensitivities to be hedged. In more realistic situations more time periods are involved (e.g. 50 years and more) and the number of swaps needed to generate a perfect hedge might become problematic.⁵ Assuming a relative high correlation between the interest rate sensitivities of neighboring time periods, buckets of sensitivities are build for given time intervals. In this example the most granulate bucket structure would contain four buckets - with one payment period each - that all have to be hedged. For that purpose we would need exactly four swaps. The methodology shall be shown using one swap that hedges the payment time period $t = 1$.

First the sensitivities $\Delta_{1,m}^p$ of the portfolio are calculated as follows

$$\Delta_{1,m}^p = \Delta_{1,m} \cdot CF_m, m \in [1, \dots, M] \quad (22)$$

Whereas M is the portfolios's time of maturity and CF_m stands for the netted cashflow at time period m . $\Delta_{1,m}$ is calculated using Equation 17, where i stands for the risk factor considered. For our example these deltas are given in Table 3. In the equation bellow, the vectors beg_j and end_j contain the starting and ending time periods of the N^{bucket} time buckets considered. So that for each bucket j the sensitivities are calculated in the following manner

⁵ A rising number of swaps implies more management costs and risks due for example to collateral management fees and the counterparty risk.

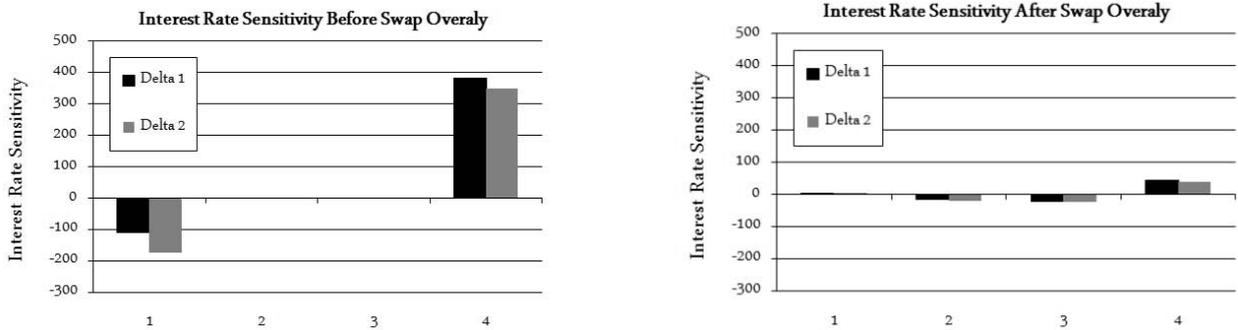
$$\Delta_{i,j}^{bucket} = \frac{end_j}{beg_j} \Delta_{i,m} \cdot CF_m, j \in [1, \dots, N^{bucket}], i \in [1, 2] \quad (23)$$

In this example, the buckets contain one time period only and the calculated deltas are seen in Table 3 above. In order to hedge bucket j that starts in the time period k we need a swap with the notional $N_{swap,j} \in (-\infty, +\infty)$ that either matures in k or has its settlement date in k . The hedge as a function of the notional of the swap is given by

$$\begin{aligned} \Delta_{1,j}^{bucket}(N_{swap,j}) &= \frac{end_j}{beg_j} \Delta_{1,m} \cdot CF_m + \Delta_{1,k} \cdot N_{swap,j} \stackrel{!}{=} 0 \\ \text{AND} \\ \Delta_{2,j}^{bucket}(N_{swap,j}) &= \frac{end_j}{beg_j} \Delta_{2,m} \cdot CF_m + \Delta_{2,k} \cdot N_{swap,j} \stackrel{!}{=} 0 \end{aligned} \quad (24)$$

Notice that if the buckets contain only one time period each, the hedge is reached through $N_{swap} = CF_k$. In that case the swap notional would simply mirror the cashflow in k . Using this methodology, we would like to hedge bucket 1 using a swap with a settlement date in $t = 1$ and maturity date $t = 4$ using Equation 24. As expected, the receiver swap has a notional of 1.6 thus mirroring the cashflow of the zero bond.⁶ The initial sensitivities (here Δ_1 and Δ_2) of the portfolio are seen in the left sub-figure. The sub-figure of the right shows the sensitivities after including the receiver swap, illustrating how a receiver swap reduces the interest rate sensitivity in time period 1 and 4, perfectly hedging the Δ_1 and Δ_2 in first time period.

Fig. 3: Interest Rate Sensitivity Examples



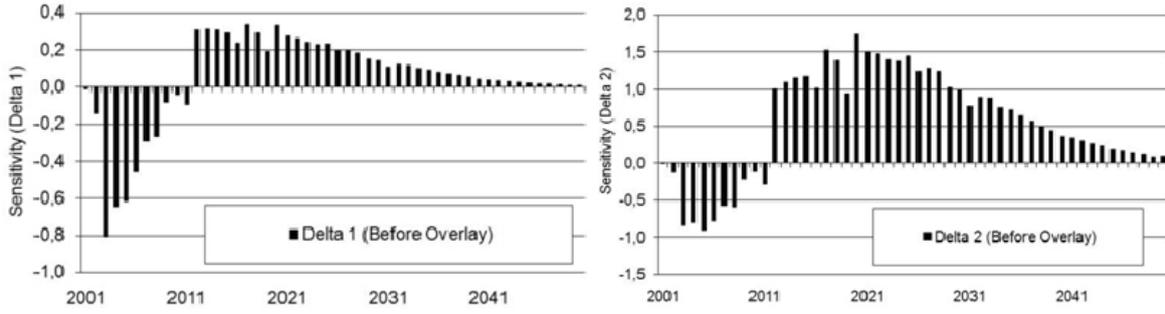
6 A swap-overlay

6.1 Algorithm for an optimal overlay

After illustrating the general methodology of hedging interest rate risk with swaps, we turn to a somewhat more elaborate example. We consider an exemplary pension fund with realistic features, leaning on the portfolio illustrated by Bemann (2008). The pension fund is closed, meaning that the received future cash flows can only come from the assets held. Figure 4 shows the interest rate sensitivities of the netted cash flows, measured in Δ_1 and in Δ_2 . The figures demonstrate the different dependence, the sensitivity parameters have on time to maturity. Both Δ_1 and Δ_2 exhibit decreasing sensitivity parameters with increasing time to maturity. This stands in line with the higher volatilities of shorter interest rates. In the years following 2010, Δ_2 seems to be significantly larger than Δ_1 , showing the responsibility of the second risk factor for the longer-term interest rate dynamics. The figures resemble the common course of sensitivities, pension funds usually exhibit.

⁶The swap rate using the Cairns-model with the parameters given in Table 3 is 7.838%.

Fig. 4: The Course of Interest Rate Sensitivity of an Exemplary Pension Fund



In contrary to the given example above, for this realistic portfolio the choice of the overlay swaps shall be done on the basis of an algorithm. Taking advantage of the negative and positive sensitivity bars, the algorithm introduces forward swaps that hedge one negative (positive) bar at their settlement date, using the corresponding positive (negative) bar at their maturity date. In case only negative or only positive bars remain, the algorithm introduces (spot) swaps that hedge the sensitivity at the maturity date. The algorithm considers buckets of sensitivities as described above. In this example, the most granulate bucket structure would contain 50 buckets - each containing 1 payment period. In order to perfectly hedge the given bucket sensitivities, the number of (forward) swaps needed has to equal the number of buckets p . Technically speaking, any given p swaps would perfectly hedge the sensitivity buckets. The proposed algorithm offers a rule based and objective approach for choosing the swaps.

Algorithm 1: An algorithm for choosing p swaps to net interest rate sensitivity

Calculate Δ_1 and Δ_2 as in Equations 17.

for $i = 1$ to p do

 for $i = 1$ to p do

 if $n_i = 0$ then

 Calculate the delta values for each bucket to be netted

$$\hat{\Delta}_1(i) = \Delta_{1,i}^{bucket} = \frac{end_i}{beg_i} \Delta_{1,m}^{port} \cdot CF_m$$

$$\hat{\Delta}_2(i) = \Delta_{2,i}^{bucket} = \frac{end_i}{beg_i} \Delta_{2,m}^{port} \cdot CF_m$$

 end if

 end for

 Calculate $\Delta_{min}^j = \min(\hat{\Delta}_1)$ and $\Delta_{max}^k = \max(\hat{\Delta}_1)$.

 if $\Delta_{min}^j < 0$ and $\Delta_{max}^k > 0$ then

 Build an appropriate forward swap

 set settlement date: $t_0^i = beg_j$

 set maturity date: $t_n^i = beg_k$

 set swap rate: $c^i = \frac{P(t,t_0^i) - P(t,t_n^i)}{\sum_{z=1}^n P(t,t_z)}$

 else

$\Delta_{net}^l = \max(|\Delta_{min}^j|, |\Delta_{max}^k|)$.

 Build an appropriate spot swap

 set settlement date: $t_0^i = 0$

 set maturity date: $t_n^i = beg_l$

 set swap rate: $c^i = \frac{1 - P(t,t_n^i)}{\sum_{z=1}^n P(t,t_z)}$

 end if

end for

We give the pseudo code of the Algorithm 1 to calculate the swap overlay that hedges the interest rate sensitivity of a given portfolio cashflow \hat{CF} . In the pseudo code, the vectors beg_i and end_i contain the starting and ending time periods of the p buckets considered. The index

$n_i, i \in [1, \dots, p]$ takes on the value 1 once the bucket i has been netted, and 0 otherwise.⁷

After choosing sufficient swaps (settlement date, maturity date and swap rate), a (simple) linear optimization is needed to find the optimal notional amounts. For each chosen swap j and time period i we define s_{ij} as follows

$$s_{i,j} = \begin{cases} \int 1 & t_i = \text{first settlement date} \\ \int c & t_i = \text{payment date prior maturity} \\ (1+c) & t_i = \text{maturity} \\ 0 & \text{elsewhere} \end{cases} \quad (25)$$

For each bucket h and each swap l (and Delta k) we then define

$$s_{hj}^{b,\Delta_k} = \sum_{i=\text{beg}_l}^{\text{end}_l} \Delta_{i,k} \cdot s_{ij}, l \in [1, \dots, m], h \in [1, \dots, N^{\text{bucket}}], k \in [1, 2] \quad (26)$$

The final step in defining the overlay is done by solving the following linear equation and finding the optimal values of the vector N_{swap} , including the notional values of the swaps⁸

$$\begin{pmatrix} s_{11}^{b,\Delta_1} & s_{12}^{b,\Delta_1} & \dots & s_{1m}^{b,\Delta_1} \\ s_{21}^{b,\Delta_1} & s_{22}^{b,\Delta_1} & \dots & s_{2m}^{b,\Delta_1} \\ \vdots & \vdots & \ddots & \vdots \\ s_{p1}^{b,\Delta_1} & s_{p2}^{b,\Delta_1} & \dots & s_{pm}^{b,\Delta_1} \\ s_{11}^{b,\Delta_2} & s_{12}^{b,\Delta_2} & \dots & s_{1m}^{b,\Delta_2} \\ s_{21}^{b,\Delta_2} & s_{22}^{b,\Delta_2} & \dots & s_{2m}^{b,\Delta_2} \\ \vdots & \vdots & \ddots & \vdots \\ s_{p1}^{b,\Delta_2} & s_{p2}^{b,\Delta_2} & \dots & s_{pm}^{b,\Delta_2} \end{pmatrix} \begin{pmatrix} \int N_{\text{swap},1} \\ N_{\text{swap},2} \\ \vdots \\ N_{\text{swap},m} \end{pmatrix} = \begin{pmatrix} -\Delta_{1,1}^b \\ -\Delta_{2,1}^b \\ \vdots \\ -\Delta_{1,p}^b \\ -\Delta_{2,1}^b \\ -\Delta_{2,2}^b \\ \vdots \\ -\Delta_{2,p}^b \end{pmatrix} \quad (27)$$

Again, given 50 buckets -each containing one time period -the swap overlay of 50 swaps would mirror the cashflows of the portfolio, netting the payments and thus hedging all interest rate risks. Using such an overlay the portfolio would be "immune" to interest rate risks.

6.2 Backtest

Based on the algorithm given, we put the hedge-strategy to real time test, using the framework of proposed by Bemmann (2008). We backtested the strategy in the sample period June 2000 - June 2010. We thus assume to have calculated the overlay on June 2000 and then waited 10 years without changing its structure. The used swap rate curves are seen in Figure 9(a). This is the same sample period we used in order to calibrate the parameters of the Cairn's model, based on the extended Kalman-filter-approach as already presented. We chose this in-sample analysis, because we are interested in the general functionality of the model and the hedge-strategy. An out-of-the-sample analysis would include the influence of the prediction power of the model and

⁷Although the algorithm is inspired by the method proposed in bemmann:08. It differs in its criteria for choosing the relevant buckets and the respective swaps and for the most part, it does not remain in the stepwise optimization. Our algorithm rather uses a linear optimization for the perfect hedge.

⁸This methodology is constructed to hedge two sensitivity parameters, but could be used in order to hedge l or more factors as well.

the calibration approach, an unnecessary complication at this stage.⁹

The considered portfolio has assets with a net present value of 464, 6850m. The liabilities have a net present value of 536, 5047m. We thus introduce a cash account with 41, 8197m, initializing the funding status at 1. To perfectly cashflow-hedge the portfolio, an overlay of 50 swaps is needed. Using the described algorithm such an overlay would have a notional amount of 589.67m. Such a granulate bucket structure is not realistic. Due to the quite large exposure and the number of swaps, it bears additional counterparty risk and would imply substantial management costs (e.g. due to collateral fees, etc.). In our approach, we use a less granulate bucket structure as seen in Table 6.2. The hedge strategy is thus a combination of cashflow as well as fair value hedge, standing in line with common practice.

Bucket Number	1	2	3	4	5	6	7	8	9
Begin	2001	2002	2003	2006	2011	2016	2021	2031	2041
End	2001	2002	2005	2010	2015	2020	2030	2040	2050

Given this bucket structure we need 9 swaps with a much smaller notional amount in order to hedge the arising interest rate risk of the portfolio. In the Monte Carlo framework, which will be explained in more detail in the next chapter, we calculate an overlay with a notional amount of 440.38m.

	Life Time	Receiver/Payer	Notional	Swap Rate
Before Overlay				
Swap I	2003 – 2021	Receiver	142.24	6.31%
Swap II	2006 – 2031	Receiver	149.20	6.36%
Swap III	2021 – 2041	Receiver	20.99	6.02%
Swap IV	2000 – 2011	Payer	24.67	5.92%
Swap V	2000 – 2031	Payer	42.88	6.12%
Swap VI	2000 – 2041	Receiver	33.62	6.10%
Swap VII	2000 – 2002	Payer	8.51	5.34%
Swap VIII	2000 – 2001	Receiver	0.07	5.04%
Swap IX	2000 – 2016	Receiver	18.20	6.05%

Based on the swap curve given in June 2000 and the bucket structure given in Table 6.2 the overlay is calculated throughout these swap.

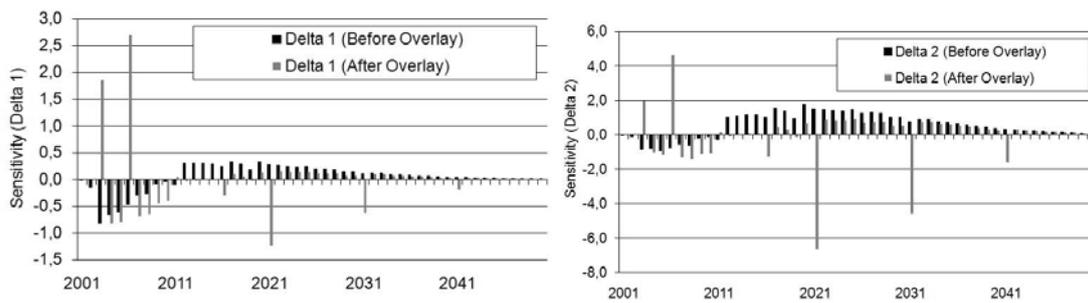
The plotted gray bars in the Figures 6(a) and 6(b) show the sensitivities remaining after the introduction of the overlay. This figure shows the extreme sensitivities that are built on the level of the payment dates. Yet, on the level of the buckets the sensitivities are hedged.

Besides comparing the performance of the Cairns-based strategy with a non-hedged portfolio, we draw a swap overlay minimizing the PV01 of the bucket structure as a further benchmark. For this hedge 9 swaps and forward swaps with a total notional of 419.35 are needed. The smaller notional amount is due to the fact that the PV01-approach hedges only one risk factor. In general, the calculated overlay is very similar to the one based on the Cairn's model.

In the subsequent periods the discount curve of June 2001 is taken in order to value the assets, the liabilities and the swaps overlay. The assets maturing in 2001 will pay their notional into the cash account, and liabilities maturity in 2001 will be payed out of the same account. Furthermore, swaps and forward swaps that have a payment period in 2001 will used the cash account as well. This calculation is done on a years basis until June 2010. Throughout the backtesting period the swap overlay is not readjusted.

⁹The calibrated values have already been used in the simulation above.

Fig. 5: The Course of Interest Rate Sensitivity of an Exemplary Pension Fund



The figures exhibit Delta 1 and 2 before and after the hedge on the level of the payment dates. On this level extreme sensitivities might be built (like the negative bar seen in the year 2021). Still, on the level of the buckets, Delta 1 and 2 are hedged.

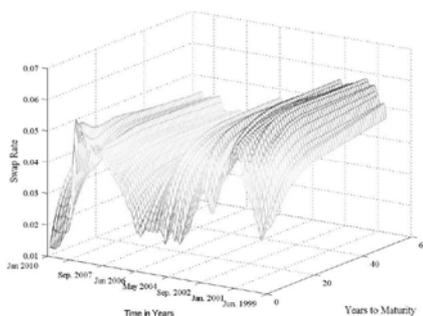
Again, Figure 8(a) demonstrates the monthly swap curves in the backtesting period. The recent decline in interest rates is through the last discount curve evident. This development would have influenced the funding status of our portfolio massively as seen in Figure 8(b). While the funding status of the non-hedged portfolio would have reached app. 0.7, a Cairns-based swap overlay would have assured a status of near 1. Besides the interest payments, this is possible through the increase of the value of the overlay, mirroring that of the net assets as seen in Figure 8(d). 8(c) compares the funding status when the PV01 approach is used for the calculation of the swap overlay. Both approaches seem to deliver quite similar results.

Note that asset managers would probably readjust such static hedges frequently (e.g. on a monthly basis). Still, our static approach is able to deliver a quite robust hedge so that we at this part did not see the necessity for a dynamic hedging strategy.

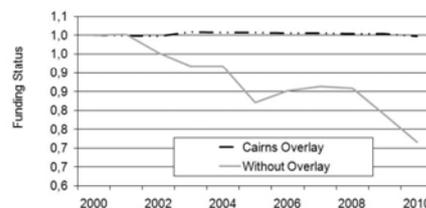
6.3 Monte Carlo simulation

The above delivered backtest results show the compatibility of the model in one historical path. In this chapter we analyze the behavior of the strategy on the basis of a Monte-Carlo approach. Based on Equation 3 we simulate 5.000 values for two risk factors, generating discount factors with maturities 1 - 50 years.¹⁰ The simulation is based on the following parameters: $\mu_1 = -2.12$; $\mu_2 = 8.98$; $\alpha_1 = 0.44$; $\alpha_2 = 0.03$; $\sigma_1 = 0.43$; $\sigma_2 = 0.60$; $\rho_{12} = -0.59$; $\beta = 0.03$. Figure 7 demonstrates 500 of the simulated discount curves. Besides modeling parallel shifts, the model is able to reconstruct different shapes for the varying curves.

Fig. 6: Swap-Overlay for a Pension Fund

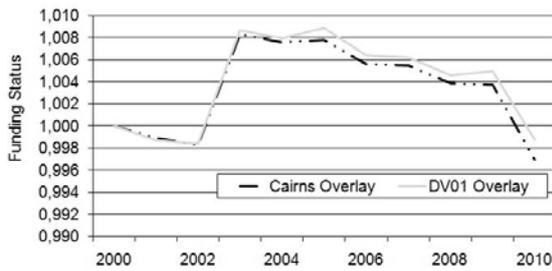


(a) Historical Swap Rates

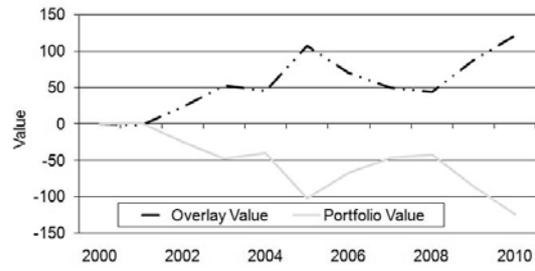


(b) Funding Status With and Without an Overlay

¹⁰ Although the risk factors are generated for one month in advance, the structure of the portfolio is assumed to stay constant, avoiding unnecessary complications.



(c)Funding Status with aCairns-and aPV01Overlay



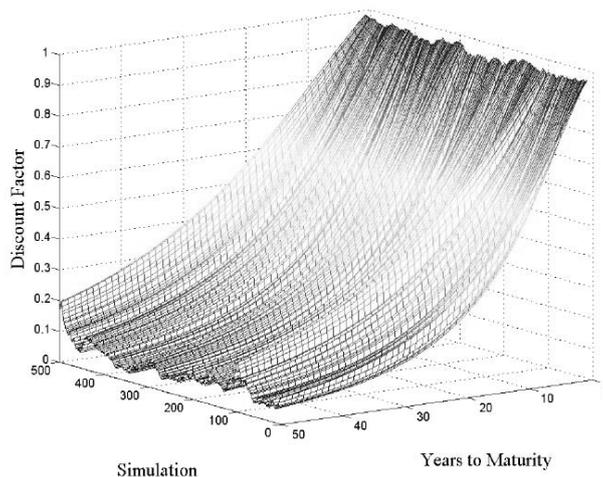
(d) PortfolioValue and Overlay Value

Table 4 concludes the distribution parameters of the simulated funding status for the strategies in comparison. While the average and median values deliver no differences, the hedge becomes evident through the comparison of the minimum and maximum values. While a non-hedged portfolio would have funding status ranging from 0.74 to 1.49, the PV01-overlay would shrink that range to 0.9562 -1.0132. The Cairns-overlay would then minimize the range to 0.9587 - 1.0090. This is also present, when comparing the short fall probabilities. Using the target funding status of 0.98, the Cairns-overlay decreases the probability from 77% to 7%, while the PV01-overlay still has a short probability of 10%.

The delivered results are also evident in Figure 8. Sub-figures 8(a), 8(b) and 8(c) show the histograms of the different strategies, strengthening the stated results. Figure 8(d) plots simulated funding status of the non-hedged portfolio and hedged portfolio in comparison, showing the hedge efficiency and the avoided volatility.

The results delivered show that the algorithm offered is model consistent. This means that if the model parameters are accurately calibrated, the demonstrated strategy would deliver a plausible hedge. Although quite insignificant, the hedging of two factors would deliver a slightly better hedge than the sole hedging of parallel shifts (PV01-approach).

Fig. 7: Simulated Discount Curves



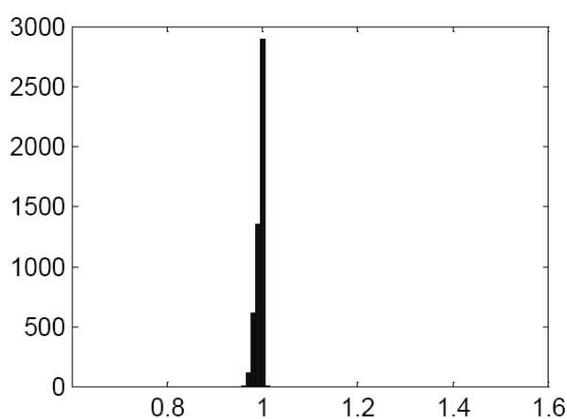
The figure shows only the first 500 simulation results. The following calibrated parameters are used: $\mu_1 = -2.12$; $\mu_2 = 8.98$; $\alpha_1 = 0.44$; $\alpha_2 = 0.03$; $\sigma_1 = 0.43$; $\sigma_2 = 0.60$; $\rho_{12} = -0.59$; $\beta = 0.03$

Notice that the simulation is based on parameters calibrated on the interest rates curves in the same sample period as the one used for the backtest. Hence it is evident that these parameters would simulate curvatures that equivalent to the ones observed in the sample period. This explains the quite good performance of the PV01-approach and indeed underlines its practicability and status under practitioners.

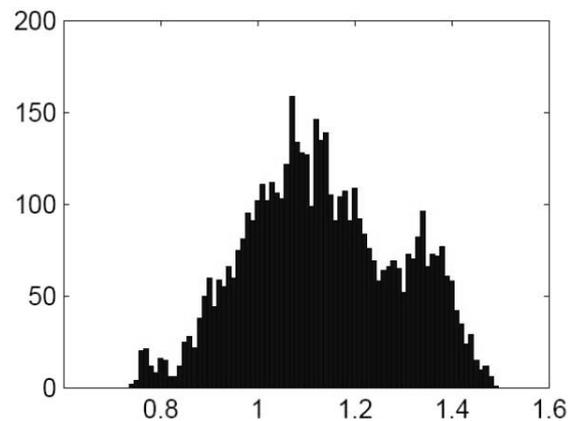
Tab. 4: Distribution Parameters of the Simulated Funding Status in Comparison

	Cairns-Overlay	No Overlay	PV01-Overlay
Minimum	0.9587	0.7417	0.9562
Maximum	1.0090	1.4866	1.0132
Median	0.9966	1.1236	0.9958
Average	0.9939	1.1336	0.9933
Standard Dev.	0.0077	0.1559	0.0085
Prob. ≤ 1	77%	20 %	74 %
Prob. ≤ 0.98	7 %	17 %	10 %
Prob. ≤ 0.96	0 %	13 %	0 %

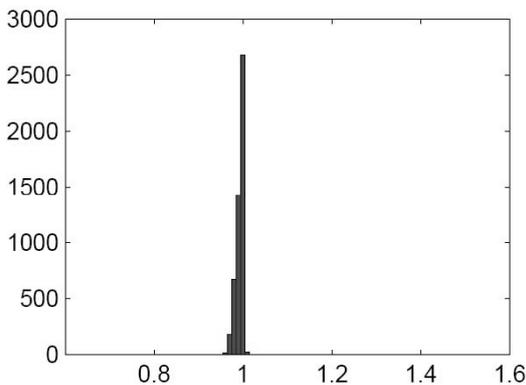
Fig. 8: Swap-Overlay for a Pension Fund



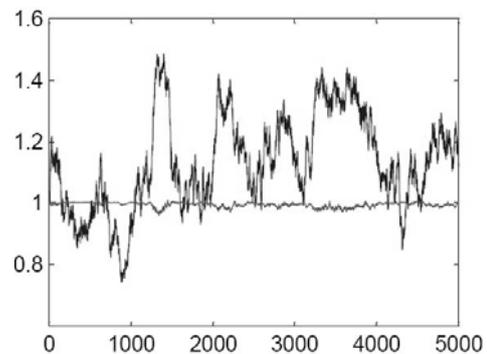
(a) Distribution of the Funding Status with an Overlay (Cairns)



(b) Distribution of the Funding Status without an Overlay



(c) Distribution of the Funding Status with an Overlay (PV01)



(d) Hedged and Unhedged Funding Status in Comparison

7 Conclusions

In the management of interest rate risks arising from long-term portfolios consisting of assets and liabilities asset managers commonly use duration based methods like the PV01 approach. On the basis of this method they measure and hedge the sensitivity to interest rate changes. We have compared the hedge-effectivity of the PV01-approach with the one achieved when using the two-factor version of the model presented by Cairns (2004). After all, this arbitrage-free approach models short-and long-term interest rates simultaneously and proclaims to be ideal for

the management of long-term interest rate risk.

After introducing the Cairns model and its main features, we used the model in order to derive a formula that quantifies interest rate sensitivity. We defined the measures derived as delta 1 and 2, respectively. We then demonstrated the use of the extended Kalman-filter approach in calibrating the parameters of the model. Our purpose being the hedging of interest rate risks arising from long-term pension fund like portfolios, we described the compatibility of swaps and forward swaps in managing sensitivities of such portfolios. Subsequently we introduced a rule-based algorithm that hedges interest rate risks of pension fund like portfolios on the basis of an overlay of swaps and forward swaps. Notice, however, that this mechanism is model independent and can be easily expanded for models with more than two-factors.

Based on the hedging-algorithm developed, we compared the performance of an exemplary but quite realistic pension fund that had no protection with funds protected by an overlay of swaps, one based on the two-factor version of Cairn's model and one based on the PV01-approach (one factor). We did not intend to perfectly (cashflow-)hedge the portfolio, consisting of long-term liabilities and assets with a somewhat shorter term. We rather took the more realistic approach of building buckets. Our portfolio had 50 yearly payment dates, the structure we chose consisted of only 9 buckets that had to be netted. Still, testing the performance in a backtest framework with the sample period June 2000 -June 2010, both strategies (Cairns and the PV01-approach) were able to significantly hedge the interest rate risks of the portfolio without the need of dynamic readjustment. This means that at least in the last 10 years -9 swaps are (almost) able to perfectly hedge interest rate risk of a whole pension fund.

Based on the model parameters calibrated on the swap curves of the same sample period, we tested the hedge-strategies in a Monte Carlo-framework. This framework allows a twofold analysis. On the one side, it shows the model-consistency of the introduced algorithm. Due to the fact that the Cairns-model is able to simulate quite realistic scenarios, such a Monte Carlo-framework further offers an applicable tool to quantify the interest rate risk for long-term portfolios.

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Delta-Hedging of Interest Rate Risk in Longterm Contracts: An Application of the Cairns-Model

Summary

Long-term portfolios consisting of assets and liabilities often exhibit a significant sensitivity to changes in interest rates. For the management of the interest rate risk arising from such portfolios asset managers usually use duration based approaches like the PV01-method. In the meanwhile the model family proposed by Cairns (2004) proclaims to deliver arbitrage-free valuation of interest rate derivatives and an ideal framework for the management of long-term interest rate risks. In the paper, we use the two-factor version of the Cairns-model in order to hedge interest rates of long-term portfolios and in order to test the hedge-effectiveness of the commonly used PV01-approach. For this purpose we first derive interest rate sensitivity measures on the basis of the Cairns-model. Based on the extended Kalman-filter approach we calibrate the model and demonstrate the behavior of the sensitivity measures derived. We then use these measures in order to hedge interest rate risks of a pension-fund-like portfolio. The hedging-strategy we introduce for this purpose is based on plain vanilla interest rate swaps; it is rule-based and model independent. We then put the Cairns model and PV01 approach to the test using one historical path (European interest rates, June 2000 -June 2010) as well as on the basis of a Monte Carlo simulation. Both analyses show that the strategy delivered is quite robust in eliminating interest rate risks. Interestingly, our analysis actually underlines the practicability and compatibility of the PV01-approach.

Key words: Cairns Model; Delta Hedging; Interest Rate Risk; Extended Kalman-Filter; Swap-Overlay; DV01; PV01; Duration Gap.

JEL classification: E43, E47, G12, G23, C13.

Editorial note:

Due to the restrictions on a paper's extent in the hard copy of *Conference Proceedings*, the appendix, which is referred to in the paper by author, is published on the attached CD medium *Conference Proceedings* only.

Valuation of Credit Default Swaps with Wrong Way Risk: Model Implementation and a Computational Tune-Up[#]

*Dmitri Grominski, Daniel Schwake, Tobias Sudmann**

1 Introduction

Ever since the collapse of Lehman Brothers, financial institutions have realized that they and their counterparties in the over-the-counter (OTC) derivatives market are default-prone. Adequate pricing of OTC derivatives cannot rely on the default-free assumption any further, and must incorporate an adjustment for the counterparty credit risk. The computation of this so-called credit valuation adjustment (CVA) can turn out to be a much more elaborate task than pricing the (default-free) OTC derivative. While pricing plain vanilla OTC derivatives is usually done with closed form solutions, adequate CVA computation for these derivatives will most probably require numeric approaches. Given the input parameters, the valuation of credit default swaps (CDS) for instance is quite straightforward, the incorporation of counterparty credit risk requires much more elaborate model as will be discussed in the following paper.

The significance of counterparty credit risk has also drawn the attention of the regulators. While fair value accounting according to IFRS and US-GAAP require the incorporation of CVA, the regulatory framework (Basel III) has introduced new capital charges for the volatility caused by this price adjustment. After all, the incorporation of CVA means that prices will decline (rise) in a decrease (increase) of the credibility of the counterparty, implying yet higher price variability especially in a financial crisis.¹

One of the possibilities for investors to reduce counterparty credit risk is to buy protection in form of CDS. The use of CDS as a hedge against counterparty credit risk is recognized by the regulator, and might lead to a capital charge reduction. Although CDS actually have the purpose of hedging these risks, they might exhibit significant counterparty credit risks themselves, as there are OTC traded. These risks have to be measured and managed.

One of the special characteristics of CDS contracts is the so-called "wrong way risk" they incorporate, i.e. the possible dependence between the Reference Entity and the Counterparty. During the subprime crisis this phenomenon became quite for holders of senior structured notes that were protected by monoline insurers. As the credit quality of structured notes started systematically to deteriorate, monolines had difficulties honoring all their debt. This led some monolines to file for bankruptcy, thereby exposing note holders to two simultaneous credit events. Monoline insurers were protecting a concentrated exposure to structured credit, so their default risk became highly dependent on the insured entities. Before the financial crisis - when both senior structured notes and monolines appeared to be solvent - such protections did not

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¹ According the Basel Committee of Banking Supervision (2011) "Under Basel II, the risk of counterparty default and credit migration risk were addressed but mark-to-market losses due to credit valuation adjustments (CVA) were not. During the financial crisis, however, roughly two-thirds of losses attributed to counterparty credit risk were due to CVA losses and only about one-third were due to actual defaults."

seem to require any credit valuation adjustments. After the crisis, however, banks had to start managing their exposure to monolines and to disclose the fair value adjustments due to embedded default risk, i.e. CVA.

In their work, Brigo and Capponi (2010) introduce a numerical approach for calculating CVA for CDS. In contrast to previous research, Brigo and Capponi (2010) consider the default of the party doing the calculation and its correlation to the defaults of the Counterparty and the Reference Entity.² Assuming bilateral Counterparty risk, this approach generates symmetric and arbitrage free CVA. The most elaborate part of this computation is the generation of the default probability structure of the reference entity conditional on the default of either the investor or the counterparty. Brigo and Capponi (2010) suggest the use of the Fractional Fourier Transformation (FRFT) technique for this purpose.

In this paper, we introduce the precise and practical algorithm for this numerical approach and display the steps needed for the FRFT technique. We focus on the calculation of the density functions of the CIR-process and the derivatives of the Copula function. In addition, we offer a computational tune-up for the calculation of the conditional value of the CDS through a lognormal approximation. Throughout a variety of examples we show that this robust approximation delivers satisfying results, while requiring less computational power and less excessive implementation than the FRFT approach. The used code (written in R) for the main functions of the algorithm is given in the appendix.

The article is organized as follows: Chapter 2.1 revisits the theoretical and valuation framework, while Chapter 2.2 illustrates the proposed algorithm. In Chapter 2.3 we address the modeling of defaults through intensity processes and Copula functions. Chapter 2.4 describes the computation of the exposure at default (e.g. the value of the CDS at default of either the Investor or the Counterparty). Chapter 2.4.1 demonstrates the computation of the needed Copula derivatives, while Chapter 2.4.2 illustrates the FRFT technique. In Chapter 2.4.3 we then introduce an alternative to the FRFT technique, backing our approximation with a variety of scenario calculations. A realistic case study with market data is given in Chapter 3, while Chapter 4 gives a concluding remark.

2 The framework of the model

2.1 Credit valuation adjustment for credit default swaps

Before moving to the detailed explanation and application of the needed functions and parameters of the algorithm, we will first describe the valuation methodology of CVA for OTC derivatives in general and for CDS in particular. For this purpose we will distinguish between two names, an Investor (name 0) and a Counterparty (name 2), while the computations are done from the Investor's perspective.

The value of an OTC contract, not accounting for the credit default of the counterparties, can be written as the risk neutral discounted cashflow of the contract, and defined as $\mathbb{E}_t \{ \Pi(t, T) \}$. In order to take account for the counterparty credit risk arising from the default of the Investor and the Counterparty, we need to adjust the (default-free) derivative price.

The adjustment is done through the risk neutral value of the terms, quantifying the credit risk of both the Investor and the Counterparty. We are thus interested in quantifying the scenarios, in which the default of the Investor (Counterparty) implies a loss for the Counterparty (Investor). Being the long (short) the Investor will bear a loss from the default of the Counterparty only when the value of the contract at the default time of the Counterparty is positive (negative), and vice versa. The adjustment is thus undertaken in order to price the probability that the holder of

² For unilateral valuation see Brigo & Capponi (2008).

a liability defaults.

Let τ_0 and τ_2 be the default times of the Investor and the Counterparty, respectively. T stands for the maturity of the contract. Following Brigo and Capponi (2009), we define the following scenarios

$$\begin{aligned} A &= \{\tau_0 \leq \tau_2 \leq T\} & B &= \{\tau_0 \leq T \leq \tau_2\} \\ C &= \{\tau_2 \leq \tau_0 \leq T\} & D &= \{\tau_2 \leq T \leq \tau_0\} \end{aligned} \quad (1)$$

LGD_0 and LGD_2 are the loss given default ratios (LGD) of the Investor and the Counterparty, respectively. The value in time t of an OTC contract, maturing in T , can thus be allocated to three terms - each having its risk neutral probability - and can be written as follows

$$\mathbb{E}_t \{ \Pi^D(t, T) \} = \mathbb{E}_t \{ \Pi(t, T) \} \quad (S.1)$$

$$+ \mathbb{E}_t \{ LGD_0 1_{A \cup B} D(t, \tau_0) [-NPV(\tau_0)]^+ \} \quad (S.2) \quad (2)$$

$$- \mathbb{E}_t \{ LGD_2 1_{C \cup D} D(t, \tau_2) [NPV(\tau_2)]^+ \} \quad (S.3)$$

Again, the values are given from the perspective of the Investor. The first term (S.1) quantifies the value of the contract without counterparty credit risk adjustment. In that case, the value is the risk neutral discounted cash flow of the contract $\Pi(t, T)$. The second term (S.2) includes the default of the Investor. In this case, the relevant exposure amount is the net present value (NPV) of the contract at default time of the Investor τ_0 . The discounted negative NPV multiplied by the loss given default ratio of the Investor LGD_0 is the valuation adjustment „in favor“ of the Investor. In the third term (S.3) the Counterparty defaults. In this case, the relevant amount is the NPV of the contract at the default time of the Counterparty τ_2 . The discounted positive NPV multiplied by LGD ratio of the Counterparty is the valuation adjustment „in favor“ of the Counterparty. The adjustment of the default-free value is thus the bilateral CVA, which can then be rewritten as follows

$$\begin{aligned} BR - CVA(t, T, LGD_{0,1,2}) &= + \mathbb{E}_t \{ LGD_2 1_{C \cup D} D(t, \tau_2) [NPV(\tau_2)]^+ \} \\ &- \mathbb{E}_t \{ LGD_0 1_{A \cup B} D(t, \tau_0) [-NPV(\tau_0)]^+ \} \end{aligned} \quad (3)$$

If the Investor assumes himself to be default-free, or to have an insignificant credit risk when compared to the Counterparty, he might adjust his price only by the first right term in Equation 3. This would imply asymmetric adjustments by the Counterparty and the Investor. Only when both the Counterparty and the Investor assume both parties to be default-prone, does the generated CVA lead to symmetric pricing.

After displaying CVA in general, we will move to the more specific case of CDS contracts. In such a contract three parties are involved; the protection buyer (i.e. Payer), the protection seller and the (protected) Reference Entity. The buyer pays a premium - either up-front or periodic - to the seller. In contrast, the latter bears the credit risk, and pays the protected notional amount to the buyer when the Reference Entity (e.g. a bond) defaults. Following Brigo and Capponi (2010), the Investor and the Counterparty can be either buyers or sellers of credit protection. In addition, a Reference Entity is introduced (name 1).³ In the first step, the following unadjusted value of the CDS is defined

$$CDS_{a,b}(0, S_1, LGD_1) = \mathbb{E}_t \{ \Pi(t, T) \} \quad (4)$$

³ If the protected asset happens not to be default sensitive, the Reference Entity (name "1") can be removed.

We assume a (deterministic) protection LGD_1 and a periodic premium S_1 in the time interval $[T_a, T_b]$. The protection amount is paid to the buyer at the default time of the Reference Entity τ_1 . Ignoring the default probability of the seller and the buyer for the time being, the value of the CDS from the perspective of the Receiver at time period 0 as suggested by Brigo and Capponi (2010) is given as follows

$$\begin{aligned} CDS_{a,b}(0, S_1, LGD_1) &= S_1 \left[-\int_{T_a}^{T_b} D(0, t)(t - T_{\gamma(t)-1}) d\mathbb{Q}(\tau_1 > t) \right. \\ &\quad \left. + \sum_{i=a+1}^b \alpha_i D(0, T_i) \mathbb{Q}(\tau_1 > T_i) \right] \\ &\quad + LGD_1 \left[\int_{T_a}^{T_b} D(0, t) d\mathbb{Q}(\tau_1 > t) \right] \end{aligned} \quad (5)$$

Whereas α_i represents the time elapsing between payment period t_{i-1} and t_i , measured in years. $\gamma(t)$ is the next payment time period after t . $D(t, x)$ is the (deterministic) discount factor. \mathbb{Q} being the risk neutral measure, $\mathbb{Q}(\tau_1 > t)$ stands for the survival probability of the Reference Entity.⁴ The term in the first brackets represents the expected amount (of premiums) the Receiver will collect. The term in the second brackets is the expected value, the Receiver will have to pay, if the Reference Entity defaults.

In order to translate the more general Equation 2 into the context of CDS, the exposure at default (NPV), being the value of the CDS conditional on the default of either the Investor or the counterparty at a given time period T_j , can be given as follows

$$NPV(T_j, T_b) := CDS_{a,b}(T_j, S, LGD_1) \quad (6)$$

Whereas

$$\begin{aligned} CDS_{a,b}(T_j, S_1, LGD_1) &= 1_{\tau_1 > T_j} \overline{CDS}_{a,b}(T_j, S_1, LGD_1) \\ &= 1_{\tau_1 > T_j} \left\{ S_1 \left[-\int_{\max(T_a, T_j)}^{T_b} D(T_j, t)(t - T_{\gamma(t)-1}) d\mathbb{Q}(\tau_1 > t | \mathcal{G}_{T_j}) \right. \right. \\ &\quad \left. \left. + \sum_{i=\max(a, j)+1}^b \alpha_i D(T_j, T_i) \mathbb{Q}(\tau_1 > T_i | \mathcal{G}_{T_j}) \right] \right. \\ &\quad \left. + LGD_1 \left[\int_{\max(T_a, T_j)}^{T_b} D(T_j, t) d\mathbb{Q}(\tau_1 > t | \mathcal{G}_{T_j}) \right] \right\} \end{aligned} \quad (7)$$

The filtration \mathcal{G}_t models the flow of information of the whole market, including credit. Equation 5 can thus be interpreted as a more general case of Equation 7, in which $T_j = 0$.

After specifying the formula for the expected exposure at the default times of the counterparties,

⁴The fact that the first and last terms come with a positive sign in the equation might be irritating. This results from the building of the partial derivative of the default probability. Let $F(t) = \mathbb{Q}(\tau_1 > t) \Leftrightarrow 1 - F(t) = \mathbb{Q}(\tau_1 \leq t)$, the partial derivative of both functions is thus $\partial F(t) / \partial t = f(t) \Leftrightarrow \partial(1 - F(t)) / \partial t = -f(t)$.

we move to the translation of the bilateral CVA formula seen in Equation 3 into the context of CDS. Plugging Equation 7 in combination with Equation 6 into Equation 3, the formula for bilateral CVA of CDS can be written as follows

$$BR-CVA-CDS_{a,b}(t, T, LGD_{0,1,2}) = LGD_2 \mathbb{E}_t \left\{ 1_{C \cup D} D(t, \tau_2) [1_{\tau_1 > \tau_2} \overline{CDS}_{a,b}(\tau_2, S_1, LGD_1)]^+ \right\} - LGD_0 \mathbb{E}_t \left\{ 1_{A \cup B} D(t, \tau_0) [-1_{\tau_1 > \tau_0} \overline{CDS}_{a,b}(\tau_0, S_1, LGD_1)]^+ \right\} \quad (8)$$

In the first right term an adjustment for the default probability of the counterparty is undertaken. The events (C and D) - in which the counterparty defaults before the other two parties - are considered. $1_{\tau_1 > \tau_2}$ makes sure that only such default events are considered, in which the Reference Entity outlives the counterparty. The sign (+) implies that the CDS value at τ_2 is positive from the perspective of the Investor, meaning that the CDS contract is a liability of the Counterparty.

In the second right term an adjustment for the default probability of the Investor is undertaken. The events (A and B), in which the Investor defaults before the other two parties are considered. $1_{\tau_1 > \tau_0}$ makes sure that only such default events are considered, in which the Reference Entity outlives the Investor. The sign (+) in combination with (-) before the dummy implies that the CDS value at τ_0 is negative from the perspective of the Investor, meaning that the CDS contract is a liability of the Investor.

2.2 An overview of the algorithm

The task of the algorithm proposed by brigo:10 is to compute Equation 8. In the following we will give a high level description to the algorithm, while more detail on the various items will follow in the subsequent sections. brigo:10 use an intensity approach for the modeling of the default dynamics. A copula function models the interdependencies between the defaults of the three entities.

For the computation of the risk neutral probabilities of default as seen in Equation 8, the algorithm uses a Monte Carlo approach, simulating default time periods of the three entities. For the computation of the CDS value conditional on the default of one of the entities, brigo:10 propose a closed form solution, solved using numerical integration. LGD and interest rate (e.g. discount rates) are assumed to be constant.

For the Monte Carlo scheme, the default dynamics are simulated through hazard functions. For this purpose, three independent Cox-Ingersoll-Ross (CIR) processes are used. A default occurs when the integrated CIR process of one the parties exceeds the value of a simulated trigger. While the CIR processes are independently simulated, the triggers of the three parties are interconnected through a Gaussian Copula function, allowing for wrong way risk.

At each simulated default - either of the Investor or of the counterparty, and given that the Reference Entity has not yet defaulted - the exposure at default (the value of CDS) is then computed using Equation 7, meaning that the following survival probabilities of the Reference Entity, conditional on the set of information given by default (either τ_0 or τ_2) are needed

$$1_{C \cup D} 1_{\tau_1 > \tau_2} \mathbb{Q}(\tau_1 > t | \mathcal{G}_{\tau_2}) \quad (9)$$

And

$$1_{A \cup B} 1_{\tau_1 > \tau_0} \mathbb{Q}(\tau_1 > t | \mathcal{G}_{\tau_0}) \quad (10)$$

Each event with a relevant default generates an expected exposure at default. Adding these term

up gives a risk neutral CVA for CDS.

As shown by Brigo and Capponi (2009) the probabilities given in Equation 9 and 10 can be computed in a closed form manner as will be shown in a subsequent chapter. This is actually the most elaborate part of the model, and we contribute a greater part of this paper to explain the needed steps in detail.

2.3 Modeling interdependent defaults

2.3.1 Intensity process

For modeling the default dynamics Brigo and Capponi (2010) use an intensity approach, in which a default is determined, when the integrated CIR process exceeds the exponentially distributed trigger for the first time. The parameters driving the intensity process are inferred from market information. Notice that the intensity processes are independent. Through a Gaussian Copula function, correlated default triggers are generated that assure interdependent default time periods.

For each party the (independent) stochastic intensity is given by

$$\lambda_j(t) = y_j(t) + \psi_j(t, \beta), t \geq 0, j = 0, 1, 2 \quad (11)$$

While ψ is a deterministic function, guaranteeing that the modeled survival probabilities equal the market implicit terms, the dynamics of the stochastic term y are given by the Cox-Ingersoll-Ross framework

$$dy_j(t) = \kappa_j(\mu_j - y_j(t))dt + \nu_j\sqrt{y_j(t)}dZ_j(t), j = 0, 1, 2 \quad (12)$$

Z_j is a Brownian motion. The other parameters of the model are calibrated using implicit market probabilities of default as will be discussed in detail. The intensity (also called hazard) rate λ stands for the instantaneous (short term) default probability. The integrated processes are then given by

$$\Lambda_j(t) = \int_0^t \lambda_j(s)ds, Y_j(t) = \int_0^t y_j(s)ds, \Psi_j(t, \beta_j) = \int_0^t \psi_j(s; \beta_j)ds \quad (13)$$

The use of the CIR short rate framework has some advantages. The dynamics of the process CIR are well researched, making it relative straightforward to implement fast simulation procedures. For the simulation of the intensity dynamics of each party, Brigo and Capponi (2009) offer the following formula

$$y(t) = \frac{\nu^2(1 - e^{-\kappa(t-u)})}{4\kappa} \chi'_d \left(\frac{4\kappa e^{-\kappa(t-u)}}{\nu^2(1 - e^{-\kappa(t-u)})} y(u) \right) \quad (14)$$

where

$$d = \frac{4\kappa\mu}{\nu^2} \quad (15)$$

Where $\chi'_d(o)$ stands for a non-central chi-square random variable with d degrees of freedom. o is the non-centrality parameter. Using the trapezoidal rule, the integrated process $Y(t)$ can then be defined through the following approximation

$$Y(t) = \int_0^t y(s)ds = \frac{1}{2\delta_t} \sum_{z=1}^t y(z-1) + y(z) \quad (16)$$

Where δ_t is a predefined discretization parameter. A further advantage of the CIR framework is

given by its closed-form solutions for bonds. While the instantaneous default probability resembles the short rate, bond prices resemble survival probabilities, which can be written as follows

$$\begin{aligned} Q(\tau_i > t) &:= \mathbb{E}\left[e^{-Y_i(t)}\right] \\ &:= P^{CIR}(0, t, \beta_i) \end{aligned} \quad (17)$$

Bond prices, i.e. survival probabilities in the context of the CIR model are given as follows

$$P^{CIR}(0, t, \beta_i) = A(t, T, \beta_i) \exp\{-\beta(t, T, \beta_i)\} \quad (18)$$

where

$$h = \sqrt{\kappa + 2\sigma^2} \quad (19)$$

$$A(t, T, \beta_i) = \left[\frac{2h \exp(\kappa + h)(T - t) / 2}{2h + (\kappa + h)(\exp(T - t)h - 1)} \right]^{\frac{2\kappa\Theta}{\sigma^2}} \quad (20)$$

$$B(t, T, \beta_i) = \frac{2(\exp(T - t)h - 1)}{2h + (\kappa + h)(\exp(T - t)h - 1)} \quad (21)$$

In order to calibrate the model implied probabilities of default (e.g. from market CDS spreads) for each of the involved entities are needed.⁵ The shift (deterministic) term $\Psi_j(t, \beta)$, mentioned in Equation 12 is defined as follows⁶

$$\Psi_j(t, \beta) = \log\left(\frac{P^{CIR}(0, t, \beta_i)}{Q(\tau_i > t)_{market}}\right) \quad (22)$$

2.3.2 Gaussian copula

Let $\Lambda_i(t)$ be the integrated stochastic process for the default intensity of party i , and ξ_i is the default trigger. The default time period of the same party can be given as such

$$\tau_i(t) = \Lambda_i^{-1}(\xi_i), i = 0, 1, 2 \quad (23)$$

Again, the three CIR processes are independent. The introduction of interdependencies between the default times of the three parties are generated on the basis of a Gaussian Copula that determines the correlated default triggers. One of the advantages of Copula functions is that they enable a separate modeling of marginal distribution functions and the modeling of the independence structure.⁷

The default triggers are defined as exponential random variables with the following uniforms

$$U_i = 1 - \exp\{-\xi_i\} \quad (24)$$

The uniforms from Equation 24 are correlated through a trivariate Gaussian Copula function

⁵For the stripping of the implied probabilities of default we used a standardized software. The software uses an iteration process that seeks the survival probabilities that if plugged into the pricing formula for CDS would deliver the market CDS spread. For the calibration of the CIR parameters for each of the three entities we used a straightforward least square method.

⁶In the initial calibration the deterministic term was kept with the value zero. If, however, the calibrated parameters are changed manually (e.g. due to expert opinions), the definition of the deterministic term given in Equation 22 assures that the model values are still consistent with ones observed in the market.

⁷For a brief use of Copula functions in credit risk modelling see Appendix 4.

$$C_R(u_0, u_1, u_2) = Q(U_0 < u_0, U_1 < u_1, U_2 < u_2) \quad (25)$$

For the simulation of these default triggers we thus only need the following correlation matrix as an input

$$R = \begin{pmatrix} 1 & \rho_{j,h} & \rho_{j,i} \\ \rho_{j,h} & 1 & \rho_{i,j} \\ \rho_{j,i} & \rho_{i,j} & 1 \end{pmatrix} \quad (26)$$

Whereas $\rho_{j,i}$ stands for the correlation coefficient between the default triggers of the parties j and i .

2.4 Computing the exposure at default

2.4.1 The needed copula derivatives

As already stated, the missing information in order to compute the conditional value of the CDS contract - as seen in Equation 7 - are the conditional survival probabilities given in Equations 9 and 10. Following Brigo:09, we define $F_{\Lambda_i(t)}$ as the cumulative distribution function of the cumulative (shifted) intensity of the CIR process of the respective name $\Lambda_i(t)$ and define the following uniforms

$$\bar{U}_{i,j} = 1 - \exp(-\Lambda_i(\tau_j)) \quad (27)$$

Brigo and Capponi (2009) show that the (missing) survival probabilities can be computed as follows⁸

$$\begin{aligned} & 1_{C \cup D} 1_{\tau_1 > \tau_2} \mathbb{Q}(\tau_1 > t | \mathcal{G}_{\tau_2}) = \\ & 1_{\tau_2 \leq T} 1_{\tau_2 \leq \tau_0} \left(1_{\bar{A}} + 1_{\tau_2 < t} 1_{\tau_1 \geq \tau_2} \int_{\bar{U}_{1,2}}^1 F_{\Lambda_1(t) - \Lambda_1(\tau_2)}(-\log(1 - u_1) - \Lambda_1(\tau_2)) dC_{1|0,2}(u_1; U_2) \right) \end{aligned} \quad (28)$$

and

$$\begin{aligned} & 1_{A \cup B} 1_{\tau_1 > \tau_0} \mathbb{Q}(\tau_1 > t | \mathcal{G}_{\tau_0}) = \\ & 1_{\tau_0 \leq T} 1_{\tau_0 \leq \tau_2} \left(1_{\bar{B}} + 1_{\tau_0 < t} 1_{\tau_1 \geq \tau_0} \int_{\bar{U}_{1,0}}^1 F_{\Lambda_1(t) - \Lambda_1(\tau_0)}(-\log(1 - u_1) - \Lambda_1(\tau_0)) dC_{1|2,0}(u_1; U_0) \right) \end{aligned} \quad (29)$$

The scenarios \bar{A} and \bar{B} are given as follows

$$\bar{A} = \{t < \tau_2 < \tau_1\} \quad \bar{B} = \{t < \tau_0 < \tau_1\} \quad (30)$$

Following Brigo and Capponi (2010), the conditional copula values are given as bellow

$$\begin{aligned} C_{10,2}(u_1, U_2) = \\ \frac{\frac{\delta C_{1,2}(u_1, u_2)}{\delta u_2} \Big|_{u_2=U_2} - \frac{\delta C(\hat{U}_{0,2}, u_1, u_2)}{\delta u_2} \Big|_{u_2=U_2} - \frac{\delta C_{1,2}(\hat{U}_{1,2}, u_2)}{\delta u_2} \Big|_{u_2=U_2} + \frac{\delta C(\hat{U}_{0,2}, \hat{U}_{1,2}, u_2)}{\delta u_2} \Big|_{u_2=U_2}}{1 - \frac{\delta C_{0,2}(\hat{U}_{0,2}, u_2)}{\delta u_2} \Big|_{u_2=U_2} - \frac{\delta C_{1,2}(\hat{U}_{1,2}, u_2)}{\delta u_2} \Big|_{u_2=U_2} + \frac{\delta C(\hat{U}_{0,2}, \hat{U}_{1,2}, u_2)}{\delta u_2} \Big|_{u_2=U_2}} \end{aligned} \quad (31)$$

and

⁸In our appendix we have retrieved their proof of the propositions given in Equations 28, 29, 32 and 31.

$$C_{1|2,0}(u_1, U_0) = \frac{\frac{\partial C_{0,1}(u_0, u_1)}{\partial u_0} \Big|_{u_0=U_0} - \frac{\partial C(u_0, u_1, \hat{U}_{2,0})}{\partial u_0} \Big|_{u_0=U_0} - \frac{\partial C_{0,1}(u_0, \hat{U}_{1,0})}{\partial u_0} \Big|_{u_0=U_0} + \frac{\partial C(u_1, \hat{U}_{1,0}, \hat{U}_{2,0})}{\partial u_0} \Big|_{u_0=U_0}}{1 - \frac{\partial C_{0,2}(u_0, \hat{U}_{2,0})}{\partial u_0} \Big|_{u_0=U_0} - \frac{\partial C_{0,1}(u_0, \hat{U}_{1,0})}{\partial u_0} \Big|_{u_0=U_0} + \frac{\partial C(u_0, \hat{U}_{1,0}, \hat{U}_{2,0})}{\partial u_0} \Big|_{u_0=U_0}} \quad (32)$$

where $C_{i,j}$ is the bivariate copula connecting the default time of i and j , while C denotes the trivariate copula connecting the default time of all three parties.

In order to make the computation of the Equations 28 and 29 more clear, we shall distinguish between three different terms needed. While the derivation of the first two terms will be described in the following, the third term will be subject to more analysis in the subsequent chapter.

- 1 $\frac{\partial C_{i,j}(u_i, u_j)}{\partial u_j} \Big|_{u_j=U_j}$
- 2 $\frac{\partial C(u_h, u_i, u_j)}{\partial u_j} \Big|_{u_j=U_j}$
- 3 $F_{\Lambda_i(t)}$

(33)

Due to the specifications of the Gaussian Copula, Terms 1 and 2 can be calculated in a closed form. Term 1 is the partial derivative of the bivariate Gaussian Copula. It is given by Schoenbucher (2005) and recited by Capponi (2009), and can be computed as follows:

$$\frac{\partial C_{i,j}(u_i, u_j)}{\partial u_j} \Big|_{u_j=U_j} = P(U_i < u_i | U_j) = \Phi \left(\frac{(\Phi^{-1}(u_i) - \rho_{i,j} \Phi^{-1}(u_j))}{\sqrt{1 - \rho_{i,j}^2}} \right) \quad (34)$$

whereas $\rho_{i,j}$ denotes the correlation coefficient between i and j , and $\Phi(\cdot)$ stands for the cumulative univariate standard normal distribution function.

Term 2 is the partial derivative of a trivariate Gaussian Copula, and is the bivariate density of i and h , given j is thus given by

$$\begin{aligned} \frac{\partial C(u_h, u_i, u_j)}{\partial u_j} \Big|_{u_j=U_j} &= P(U_i < u_i, U_h < u_h | U_j) \\ &= \Phi_{0,R^*(\Sigma)}(\bar{u}_h, \bar{u}_i) \end{aligned} \quad (35)$$

where $\Phi_{0,R}$ stands for the cumulative bivariate standard normal distribution function, and $R^*(\Sigma)$ is the correlation matrix given by the covariance matrix Σ of the variables \bar{u}_h and \bar{u}_i , which are defined below.

The aim is to write \bar{u}_h and \bar{u}_i in dependence of u_i , u_h while u_j is given. For this, we first compute the Cholesky decomposition of the correlation matrix between the independent uniforms R as given in Equation 26.

$$D^m = \begin{pmatrix} 1 & D_{1,2} & D_{1,3} \\ 0 & D_{2,2} & D_{2,3} \\ 0 & 0 & D_{3,3} \end{pmatrix} = \text{Chol}^T \begin{pmatrix} 1 & \rho_{j,h} & \rho_{j,i} \\ \rho_{j,h} & 1 & \rho_{i,j} \\ \rho_{j,i} & \rho_{i,j} & 1 \end{pmatrix} \quad (36)$$

Notice that $D_{1,2} = \rho_{j,h}$ and $D_{1,3} = \rho_{j,i}$. Given independent values for u_i , u_h and u_j the dependent values for \bar{u}_i , \bar{u}_h and \bar{u}_j can be computed as follows:

$$\begin{pmatrix} \bar{u}_i \\ \bar{u}_h \\ \bar{u}_j \end{pmatrix} = \begin{pmatrix} 1 & D_{1,2} & D_{1,3} \\ 0 & D_{2,2} & D_{2,3} \\ 0 & 0 & D_{3,3} \end{pmatrix}^T \begin{pmatrix} u_i \\ u_h \\ u_j \end{pmatrix} \quad (37)$$

Obviously \bar{u}_i is given by u_i . The dependent uniforms follow normal distributions given by

$$\begin{aligned} \bar{u}_h &= D_{1,2} \cdot u_i + D_{2,2} \cdot u_h && \sim N(D_{1,2}u_i, D_{2,2}^2) \\ \bar{u}_j &= D_{1,3} \cdot u_i + D_{2,3} \cdot u_h + D_{3,3}u_j && \sim N(D_{1,3}u_i, D_{2,3}^2 + D_{3,3}^2) \end{aligned} \quad (38)$$

The covariance of both variables is given by

$$\text{cov}(D_{2,2} \cdot u_h, D_{2,3} \cdot u_h + D_{3,3}u_i) = \text{cov}(D_{2,2} \cdot u_h, D_{2,3} \cdot u_h) + \text{cov}(D_{2,2} \cdot u_h, D_{3,3} \cdot u_i) = D_{2,2} \cdot D_{2,3} \quad (39)$$

Considering the variance given in Equation 38 the conditional covariance matrix we are seeking can be written as follows

$$\Sigma = \begin{pmatrix} D_{2,2}^2 & D_{2,2} \cdot D_{2,3} \\ D_{2,2} \cdot D_{2,3} & D_{2,3}^2 + D_{3,3}^2 \end{pmatrix} \quad (40)$$

The bivariate distribution of the uniforms u_h and u_i conditional on u_j is given by

$$\begin{pmatrix} u_h \\ u_i \end{pmatrix} \Big|_{u_j = U_j} \sim N \left(\begin{pmatrix} u_j \cdot D_{1,2} \\ u_j \cdot D_{1,3} \end{pmatrix}, \begin{pmatrix} D_{2,2}^2 & D_{2,2} \cdot D_{2,3} \\ D_{2,2} \cdot D_{2,3} & D_{2,3}^2 + D_{3,3}^2 \end{pmatrix} \right) \quad (41)$$

2.4.2 Fourier transformation

The third term $F_{\Lambda_i(t)}$ is the cumulative distribution function of the integrated CIR process. Brigo and Capponi (2009) state that this can be done by using the Fourier transformation by inverting the characteristic function of the integrated CIR process.⁹ After all, as noted by Carr and Yor (2003), the characteristic function for $\Lambda(t)$ is well known and is given by

$$\begin{aligned} f(t) &= E[\exp(iu\Lambda(t))] && = \phi(u, t, y(0), \kappa, \eta, \lambda) \\ &&& = A(t, u)\exp(B(t, u)y(0)), \end{aligned} \quad (42)$$

where

$$\begin{aligned} A(t, u) &= \frac{\exp\left(\frac{\kappa^2 \eta t}{\lambda^2}\right)}{\left(\cosh\left(\frac{\gamma t}{2}\right) + \frac{\kappa}{\gamma} \sinh\left(\frac{\gamma t}{2}\right)\right)^{2\kappa\eta/\lambda^2}}, \\ B(t, u) &= \frac{2iu}{\kappa + \gamma \coth\left(\frac{\gamma t}{2}\right)}, \\ \gamma &= \sqrt{\kappa^2 - 2\lambda^2 iu}. \end{aligned} \quad (43)$$

⁹In this context Brigo and Capponi (2009) refer to the methods proposed by Chourdakis (2005).

The imaginary unit is denoted by i . The aim is thus to compute the continuous Fourier transform (CFT), which is defined as follows

$$\text{CFT}[f](\omega) = \int_{-\infty}^{\infty} e^{-it\omega} f(t) dt \quad (44)$$

where ω and t are the spaces of the transformed and the original function, respectively. Following Bailey and Swartztrauber (1993) and Chourdakis (2005), we will be transforming the characteristic discretization of the CFT by the fractional fast Fourier transformation (FRFT). This is a technical adjustment of the fast Fourier transformation (FFT), it again being a fast implementation of the discrete Fourier transformation (DFT). The DFT is defined as

$$\text{DFT}[f_j](\omega) = \sum_{j=0}^{n-1} e^{-2\pi i \frac{jk}{n}} f_j, \quad f_j = f(t_j) \quad (45)$$

and the inverse is given by

$$\text{DFT}^{-1}[\hat{f}_j](t_j) = \frac{1}{n} \sum_{j=0}^{n-1} e^{2\pi i \frac{jk}{n}} \hat{f}_j, \quad \hat{f}_j = \hat{f}(\omega_k) \quad (46)$$

The fractional Fourier transform (FRFT) is defined as

$$\begin{aligned} \text{FRFT}(f_j, \alpha)(\omega_k) = & \sum_{j=0}^{n-1} e^{-2i\pi k\alpha} f(t_j) \\ & (e^{-i\pi k^2 \alpha}) \text{DFT}^{-1} \left[\text{DFT}[x_j] \text{DFT}[y_j] \right] (\omega_k), \quad 0 \leq k < n \end{aligned} \quad (47)$$

where

$$\begin{aligned} x_j &= \left((f_j e^{-i\pi j^2 \alpha})_{j=0}^{n-1}, (0)_{j=n}^{2n} \right) \\ y_j &= \left((e^{i\pi j^2 \alpha})_{j=0}^{n-1}, (e^{i\pi(2n-j)^2 \alpha})_{j=n}^{2n} \right) \end{aligned} \quad (48)$$

In order to deliver a good approximation one has to define appropriate ranges for the respective spaces (t and ω , being the spaces for x_j and y_j , respectively).¹⁰ In order to compute the radius of the ω -space, we used a heuristic approach on the basis of the first and second moments of the CIR process derived by Dufresne (2001). Given a time period t , time to maturity $T-t$, and the CIR parameters $y(t), \kappa, \mu, \nu$ these moments are given by

$$\begin{aligned} E(Y) &= -\frac{y(t)}{-\kappa} - \frac{\kappa\mu}{-\kappa^2} - (T-t) \frac{\kappa\mu}{-\kappa} + e^{-(T-t)\kappa} \left[\frac{y(t)}{-\kappa} + \frac{\kappa\mu}{-\kappa^2} \right], \\ E(Y^2) &= -\frac{y(t)\nu^2}{-\kappa^3} - \frac{5\kappa\mu\nu^2}{-2\kappa^4} - (T-t) \frac{\kappa\mu\nu^2}{-\kappa^3} + e^{-(T-t)\kappa} \left[\frac{2\kappa\mu\nu^2}{-\kappa^4} - (T-t) \left(\frac{2y(t)\nu^2}{-\kappa^2} + \frac{2\kappa\mu\nu^2}{-\kappa^3} \right) \right] + \\ & \quad e^{-2(T-t)\kappa} \left[\frac{y(t)\nu^2}{-\kappa^5} + \frac{\kappa\mu\nu^2}{-2\kappa^6} \right] \end{aligned} \quad (49)$$

The radius ω is subsequently given by

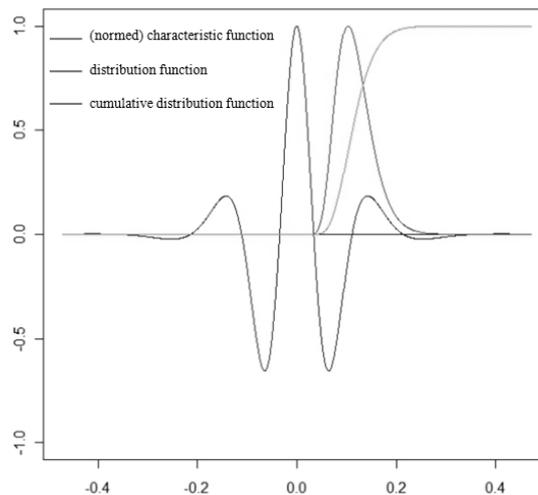
¹⁰We denote with $\tilde{\delta}$ the grid size of the input vector x_j , and with $\tilde{\Lambda}$ the grid size of y_j . Due to the parameter α , the FRFT allows an independent choice for both the grid sizes, where $\alpha = \tilde{\Lambda}\tilde{\delta}$. In the continuous fast Fourier transformation, the inverse relation between the grid sizes ($\tilde{\Lambda}\tilde{\delta} = 2\pi/n$) leads to inefficiencies in the calculations as denoted by chourdakis:05.

$$\omega = E(Y) + \varepsilon \sqrt{E(Y^2) - E(Y)^2} \quad (50)$$

for a predefined parameters ε .¹¹ In the case of the t -space we used an iterative estimation algorithm, screening the convergence of the characteristic function outside the predefined radius. An example for such function is given in the implementation part in the appendix.

Our aim is thus to compute the cumulative distribution function (CDF) through the FRFT as seen in Equation 47. Figure 1 displays the functions involved in this procedure. While the monotone increasing straight greed line stands for the CDF computed by the FRFT, the lognormal like red line is the normalized density function of the integrated CIR-Process. The normed characteristic function of the CIR process is plotted as a blue wavy line.

Fig. 1: Results of the Fractional Fast Fourier Transformation



The figure gives a visual example for the results of the FRFT. The monotone increasing straight greed line stands for the CDF computed by the FRFT. The lognormal-like red shape would be the output of the transform before summing up the results. The (normed) characteristic function of the CIR process and the input needed for the FRFT is plotted through a blue wavy line.

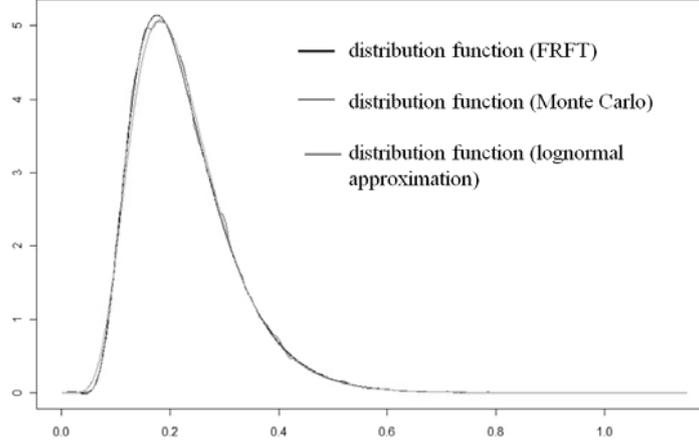
2.4.3 Lognormal distribution - an analytical approximation

The approach presented to compute the cumulative distribution function of the integrated CIR process (of the intensity functions) in the above chapter is indeed a theoretically based methodology. However, this approach is quite extensive in terms of implementation as well as in terms of computational power.¹² Due to the needed definitions of the ranges (i.e. Equation 48), the FRFT-approach might demand an extensive parametrization process. This becomes very relevant, when the CIR parameters of the involved parties vary significantly or if a high number of parties is involved (e.g. in a portfolio of CDS).

¹¹In our calculations, we have found that this parameter can be assumed to be approximately 10. In general ε can be derived from Chebischev inequality.

¹²At least in some occasions - like an ad-hoc computation for traders or if a large portfolio of CDS has to be preliminarily estimated - faster approximations are needed.

Fig. 2: Lognormal Distribution vs. FRFT Approach



The figure gives a visual example for the fit offered by the lognormal approximation of the distribution function of the CIR process. The somewhat wavy red line stands for the distribution function computed through the Monte Carlo scheme. The green line is the distribution function if lognormal-approximation is used. The black line stands for the distribution function when the FRFT technique is used.

Motivated by the visual results as seen in Figure 1, we offer an approximation for the CDF by a shifted lognormal distribution, matching the first three moments of the distribution function. For this purpose, one has only to compute the central moments in order to be able to compute the cumulative distribution function. For the first two moments see Equation 49. Given a time period t , time to maturity $T-t$, and the CIR parameters $y(t), \kappa, \mu, \nu$, the third moment is then given by

$$\begin{aligned}
 E(Y^3) = & -\frac{3y(t)v^4}{-\kappa^5} - \frac{11\kappa\mu v^4}{-\kappa^6} - (T-t)\frac{3\kappa\mu v^4}{-\kappa^5} + e^{-(T-t)\kappa} \left[-\frac{3y(t)v^4}{-2\kappa^5} + \frac{15\kappa\mu v^4}{-2\kappa^6} \dots \right. \\
 & \left. - (T-t) \left(\frac{3y(t)v^4}{-\kappa^4 + \frac{9\kappa\mu v^4}{-\kappa^5}} \right) + t^2 \left(\frac{3y(t)v^4}{-\kappa^5} + \frac{3\kappa\mu v^4}{-2\kappa^6} \right) \dots \right] \quad (51) \\
 & + e^{-2(T-t)\kappa} \left[-\frac{3y(t)v^4}{-2\kappa^5} + \frac{3\kappa\mu v^4}{-\kappa^6} - (T-t) \left(\frac{6y(t)v^4}{-\kappa^4 + \frac{3\kappa\mu v^4}{-\kappa^5}} \right) \right] + e^{-3(T-t)\kappa} \left[\frac{3y(t)v^4}{-2\kappa^5} + \frac{\kappa\mu v^4}{-2\kappa^6} \right]
 \end{aligned}$$

Figure 2 displays the fit of the lognormal distribution. While delivering satisfying results, the lognormal approximation is more economical in implementation terms as well as in terms of computational power. For most, the approximation demands no extensive parametrization process.

In the following Tables 1 - 3 we demonstrate the goodness of fit, offered by our approximation through numerical examples. For this purpose, we took the CIR parameters given by Capponi (2009) for the Investor, Counterparty and the Reference Entity. We computed the CVA of a five year CDS. Table 1 summarized the results of the CVA if the Investor is the Receiver (protection seller). Table 3 sums up the CVA results if the Investor is the premium Payer (protection buyer).

Concerning the scenarios, in which the Investor is the Receiver the results of all models seem to be quite stable. In this case we are able to verify the results delivered by Capponi (2009) in a very accurate and satisfying manner. Concerning the scenarios, in which the Investor is the

Payer, the results display higher uncertainty (see the error terms in brackets).¹³ Although in some more (numerically seen) problematic scenarios, our results are not able to verify the ones delivered by Capponi (2009), deviations between the three model results seem as a whole to lie in an acceptable range, especially if the standard errors are considered.

3 Case study

In the following, we shall elaborate on the steps needed for computing CVA for CDS, using a realistic case study with true market data from 2006 and 2010. For this purpose, we consider an uncollateralized CDS contract on the default of a senior structured note (e.g. CMBS) (name 0). The Investor (name 1) is a bank, buying the protection from a monoline insurance company (name 2). In the first step, we aim to compute the CVA of such a contract on the basis of the market data from 2006. This shall then be compared with the CVA computed using market data from 2010, showing the impact, the financial crisis has had on OTC derivatives. In both years we assume the contract has a maturity of five years, avoiding duration-driven effects.

The Investor is defined as an average bank. We have built the average of the CDS spreads of five leading banks as seen in Table 4. As an exemplary monoline insurer we have taken Assured Corp., displaying the CDS spreads seen in Table 4. For the Reference Entity we assume a constant CDS spread of 30 bps. and 400 bps. in the years 2006 and 2010, respectively. The significant shift in the curve of CDS spreads underlies the deteriorating credibility of all the parties involved due to the financial crisis.

Based on the given CDS spreads, we computed the implied default probabilities for the Investor (the average bank), the Counterparty (the monoliner) and the Reference Entity (the structured note). These are the probabilities one has to plug into the pricing formula of CDS in order to get the CDS spreads observed in the market. The CDS-spreads imply the probabilities of defaults illustrated in Figure 3. Using the closed-form solutions for survival probability given in Equation 18 and the market implied survival probabilities, we calibrated the CIR parameters using a straight-forward LS-method. The calibration results are listed in Table 5, while Figure 4 displays how exact we are able to fit the market curves.

Tab. 1: Comparison of the Model Results Using the Analytical Approximation, the FFT and the Results of Capponi (2009) I

$(\rho_{0,1}, \rho_{0,2}, \rho_{1,2})$	ν_1	0.01	0.1	0.2	0.3	0.4	0.5
(0,0,-0.9)	Lognormal Distribution	25 (1)	25 (1)	25 (1)	27 (2)	26 (1)	24 (1)
	Fourier Transformation	26 (1)	26 (2)	26 (2)	28 (2)	27 (2)	25 (1)
	Capponi (2009)	30 (1)	28 (1)	28 (1)	29 (1)	28 (1)	28 (1)
(0,0,-0.6)	Lognormal Distribution	21 (1)	25 (1)	24 (1)	24 (1)	24 (1)	23 (1)
	Fourier Transformation	25 (1)	26 (2)	25 (1)	25 (1)	24 (1)	24 (1)
	Capponi (2009)	27 (1)	25 (1)	26 (1)	25 (1)	24 (1)	24 (1)
(0,0,-0.2)	Lognormal Distribution	6 (1)	9 (1)	9 (1)	9 (1)	7 (1)	6 (1)
	Fourier Transformation	9 (1)	12 (1)	11 (1)	11 (1)	8(1)	12 (1)
	Capponi (2009)	9 (1)	10 (1)	11 (1)	11 (1)	11 (1)	12 (1)
(0,0,0)	Lognormal Distribution	0 (0)	2 (0)	1 (0)	1 (0)	0 (0)	0 (0)
	Fourier Transformation	0 (0)	2 (0)	2 (0)	1 (0)	1 (0)	6 (1)
	Capponi (2009)	-0 (0)	0 (0)	2 (0)	3 (0)	4 (0)	5 (0)

¹³ In such cases we have found the results to be quite dependent on the discretization parameters of the CDF.

(0,0,0.2)	Lognormal Distribution	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)
	Fourier Transformation	-0 (0)	1 (0)	1 (0)	0(0)	0 (0)	4 (0)
	Capponi (2009)	-0 (0)	-0 (0)	0 (0)	1 (0)	1 (0)	1 (0)
(0,0,0.6)	Lognormal Distribution	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Fourier Transformation	-0 (0)	0 (0)	0 (0)	-0 (0)	-0 (0)	2 (0)
	Capponi (2009)	-0 (0)	-0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
(0,0,0.9)	Lognormal Distribution	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Fourier Transformation	-0 (0)	-0 (0)	-0 (0)	-0 (0)	-0 (0)	1 (0)
	Capponi (2009)	-0 (0)	-0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

The table summarizes the BR-CVA in basis points of the CDS Payer as computed using the lognormal distribution approximation and the Fast Fourier Transformation approach in comparison with the results published by Capponi (2009). The numbers in brackets stand for the standard errors. The Investor (Receiver) has the following parameters: $\gamma_0 = 0.0001$, $\kappa_0 = 0.9$, $\mu_0 = 0.001$, $\nu_0 = 0.01$, $LGD_0 = 0.6$. The Reference Entity has the following parameters: $\gamma_1 = 0.01$, $\kappa_1 = 0.8$, $\mu_1 = 0.02$, $LGD_1 = 0.7$. The Counterparty (Payer) has the following parameters: $\gamma_2 = 0.03$, $\kappa_2 = 0.5$, $\mu_2 = 0.05$, $\nu_2 = 0.5$, $LGD_2 = 0.65$. The risk free interest rate r is set to be 0.03.

Tab. 2: Comparison of the Model Results Using the Analytical Approximation, the FFT and the Results of Capponi (2009) II

$(\rho_{0,1}, \rho_{0,2}, \rho_{1,2})$	ν_1	0.01	0.1	0.2	0.3	0.4	0.5
(0,0,-0.9)	Lognormal Distribution	0 (0)	-0 (0)	-0 (0)	-0 (0)	-0 (0)	-0 (0)
	Fourier Transformation	0 (0)	-0 (2)	-0 (0)	-0 (0)	-0 (0)	-0 (1)
	Capponi (2009)	0 (0)	0 (0)	-0 (0)	-0 (0)	0 (0)	0 (0)
(0,0,-0.6)	Lognormal Distribution	-0 (0)	-0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Fourier Transformation	-0 (0)	0 (2)	0 (0)	0 (0)	-0 (0)	-0 (1)
	Capponi (2009)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)
(0,0,-0.2)	Lognormal Distribution	0 (0)	1 (0)	2 (0)	2 (0)	2 (0)	3 (0)
	Fourier Transformation	0 (0)	1 (1)	2 (0)	1 (0)	2 (0)	2 (1)
	Capponi (2009)	0 (0)	1 (0)	2 (0)	2 (0)	3 (1)	3 (0)
(0,0,0)	Lognormal Distribution	9 (0)	8 (1)	9 (1)	9 (1)	9 (1)	13 (1)
	Fourier Transformation	3 (0)	6 (0)	6 (1)	7 (1)	8 (1)	9 (1)
	Capponi (2009)	6 (0)	5 (0)	7 (1)	7 (1)	7 (1)	6 (1)
(0,0,0.2)	Lognormal Distribution	23 (2)	26 (2)	21 (2)	22 (2)	27 (2)	26 (2)
	Fourier Transformation	22 (1)	22 (2)	18 (1)	20 (1)	26 (2)	19 (1)
	Capponi (2009)	26 (1)	24 (1)	21 (1)	19 (1)	17 (1)	14 (1)
(0,0,0.6)	Lognormal Distribution	60 (5)	58 (5)	57 (5)	62 (5)	62 (5)	67 (5)
	Fourier Transformation	55 (4)	55 (4)	53 (4)	59 (4)	61 (5)	54 (4)
	Capponi (2009)	72 (4)	70 (4)	65 (4)	55 (4)	46 (3)	42 (3)
(0,0,0.9)	Lognormal Distribution	59 (6)	68 (6)	67 (6)	71 (6)	86 (7)	94 (7)
	Fourier Transformation	71 (7)	67 (6)	71 (6)	70 (6)	88 (7)	83 (7)
	Capponi (2009)	77 (6)	83 (6)	78 (6)	66 (5)	64 (5)	62 (4)

The table summarizes the BR-CVA in basis points of the CDS Payer as computed using the lognormal distribution approximation and the Fast Fourier Transformation approach in comparison with the results published by Capponi (2009). The numbers in brackets stand for the standard errors. The Investor (Payer) has the following parameters: $y_0 = 0.0001$, $\kappa_0 = 0.9$, $\mu_0 = 0.001$, $\nu_0 = 0.01$, $LGD_0 = 0.6$. The Reference Entity has the following parameters: $y_1 = 0.01$, $\kappa_1 = 0.8$, $\mu_1 = 0.02$, $LGD_1 = 0.7$. The Counterparty (Receiver) has the following parameters: $y_2 = 0.03$, $\kappa_2 = 0.5$, $\mu_2 = 0.05$, $\nu_2 = 0.5$, $LGD_2 = 0.65$. The risk free interest rate r is set to be 0.03.

Tab. 3: Comparison of the Model Results Using the Analytical Approximation, the FFT and the Results of Capponi (2009) III

$(\rho_{0,1}, \rho_{0,2}, \rho_{1,2})$	Model	CVA	$(\rho_{0,1}, \rho_{0,2}, \rho_{1,2})$	Model	CVA
(0,0,0)	LND	5 (0)	(0,0.9,0)	LND	6 (0)
	FRFT	6 (0)		FRFT	6 (0)
	Capponi	6 (0)		Capponi	5 (0)
(0,0,0.1)	LND	12 (1)	(0,0.99,0)	LND	5 (0)
	FRFT	12 (1)		FRFT	6 (0)
	Capponi	15 (1)		Capponi	5 (0)
(0,0,0.3)	LND	26 (2)	(0,0.5,0.5)	LND	48 (4)
	FRFT	30 (2)		FRFT	46 (4)
	Capponi	37 (2)		Capponi	55 (4)
(0,0,0.6)	LND	64 (5)	(0,0.2,0.9)	LND	61 (6)
	FRFT	52 (4)		FRFT	53 (6)
	Capponi	73 (4)		Capponi	73 (6)
(0,0,0.9)	LND	51 (6)	(0,0.9,0.2)	LND	22 (2)
	FRFT	68 (6)		FRFT	22 (2)
	Capponi	75 (6)		Capponi	21 (1)
(0,0,0.99)	LND	13 (3)	(0.5,0.5,0)	LND	5 (0)
	FRFT	15 (3)		FRFT	5 (0)
	Capponi	25 (4)		Capponi	7 (0)
(0,0.1,0)	LND	5 (0)	(0.2,0.9,0)	LND	6 (0)
	FRFT	5 (0)		FRFT	5 (0)
	Capponi	6 (0)		Capponi	6 (0)
(0,0.3,0)	LND	6 (0)	(0.9,0.2,0)	LND	5 (0)
	FRFT	5 (0)		FRFT	6 (0)
	Capponi	6 (0)		Capponi	7 (0)
(0,0.6,0)	LND	6 (0)	(0.8,0.5,0.2)	LND	21 (2)
	FRFT	6 (0)		FRFT	23 (2)
	Capponi	6 (0)		Capponi	26 (1)
(0.2,0.2,0.2)	LND	21 (2)	(0.5,0.5,0.5)	LND	52 (4)
	FRFT	25 (2)		FRFT	43 (3)
	Capponi	25 (1)		Capponi	58 (4)

The table summarizes the BR-CVA in basis points of the CDS Payer as computed using the lognormal distribution approximation (LND) and the Fast Fourier Transformation (FRFT) approach in comparison with the results published by Capponi (2009). The numbers in brackets stand for the standard errors. The Investor (Payer) has the following parameters: $y_0 = 0.0001$, $\kappa_0 = 0.9$, $\mu_0 = 0.001$, $\nu_0 = 0.1$, $LGD_0 = 0.6$. The Reference Entity has the following

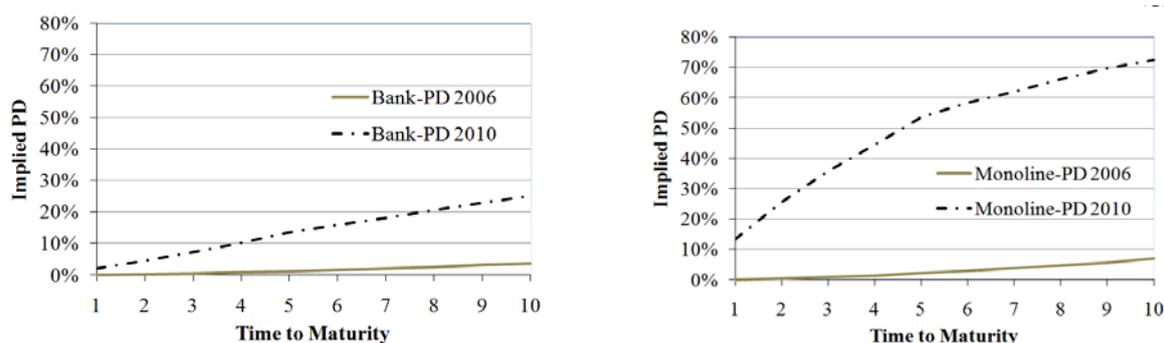
parameters: $y_1 = 0.01$, $\kappa_1 = 0.8$, $\mu_1 = 0.02$, $\nu_0 = 0.1$, $LGD_1 = 0.7$. The Counterparty (Receiver) has the following parameters: $y_2 = 0.03$, $\kappa_2 = 0.5$, $\mu_2 = 0.05$, $\nu_2 = 0.1$, $LGD_2 = 0.65$. The risk free interest rate r is set to be 0.03.

Tab. 4: Credit Default Swap Spreads of five Leading Banks and a Monoline Insurer

07.07.2006	6M	1Y	2Y	3Y	4Y	5Y	7Y	10Y
Banks:								
Deutsche Bank				10	12.8	13.8	16.2	23.2
Santander Bank				11	12.6	13.2	16	21
Barclays Capital				7	9.1	10	11.8	16
Uni Credit				13.2	15.8	16.7	22	27
Citi		5	7.4	9.5	11.1	12.5	18	21
Banks' Average		5	7.4	10.4	12.3	13.2	16.8	21.64
Monoline Insurer:								
Assured Corp.				18	21.6	26	32	41
05.28.2010	6M	1Y	2Y	3Y	4Y	5Y	7Y	10Y
Banks:								
Deutsche Bank	111.3	110.2	125.8	139.7	154.8	163.7	166.4	168.8
Santander Bank	151.1	149.7	161.3	174.1	186.6	194.1	188.6	192.2
Barclays Capital	110.0	109.1	124.2	138.4	150.4	159.8	164.7	168.4
Uni Credit	124.7	123.6	140	153.6	165.1	171.9	176.5	174.3
Citi	138.2	136.9	142	147.5	153.5	176.0	159.0	158.1
Banks' Average	127.1	125.9	138.7	150.7	162.1	173.1	171.0	172.4
Monoline Insurer:								
Assured Corp.	846.3	867.7	888.3	888.5	887.3	914	858.5	826.5

The table summarizes the CDS spreads (in basis points) of five leading banks and a monoline insurance company in the years 2006 and 2010.

Fig. 3: Market Implied Probabilities of Default (PD)



The figures display the market implied probabilities of default of the average bank and an exemplary monoline insurer in 2006 and 2010.

Tab. 5: Calibrated CIR Parameters for the Three Entities

2006	y_0	κ	μ	ν
Bank	0.0003	0.0312	0.0268	0.0942
Reference Entity	0.0057	0.2000	0.0044	0.0000
Monoliner	0.0000	0.1426	0.0152	0.0050

2010	y_0	κ	μ	ν
Bank	0.0025	2.1462	0.0312	0.5000
Reference Entity	0.0719	35.2474	0.0664	0.0040
Monoliner	0.1522	0.0014	0.0009	0.1008

The table summarized the calibration results of the CIR process (intensity process) for the three entities.

Using these parameters we calculated the CVA for the CDS in dependence of the bank being the buyer of the protection in the years 2006 and 2010 on the basis of the proposed lognormal approximation. In each year, we distinguished between several plausible scenarios, depending on a given different correlation matrix.

The results shown in Table 5 are to be interpreted as follows. The initial value of the CDS in 2006 is zero. If the bank had bought a protection from a monoline insurer in 2006, it would have had to adjust the value of the CDS by 30 basis points. This adjustment rises, if the correlation between the default of the note and the default of the monoliner is believed to be higher.

The picture changes significantly in 2010. In the meanwhile the CDS value became 1726 basis points, because the Reference Entity became way more risky, while the CDS spread is kept at the same level like in 2006 (30 basis point).¹⁴ The probabilities of default of both the bank and the monoline insurer rose significantly, too, as seen in Figure 3.

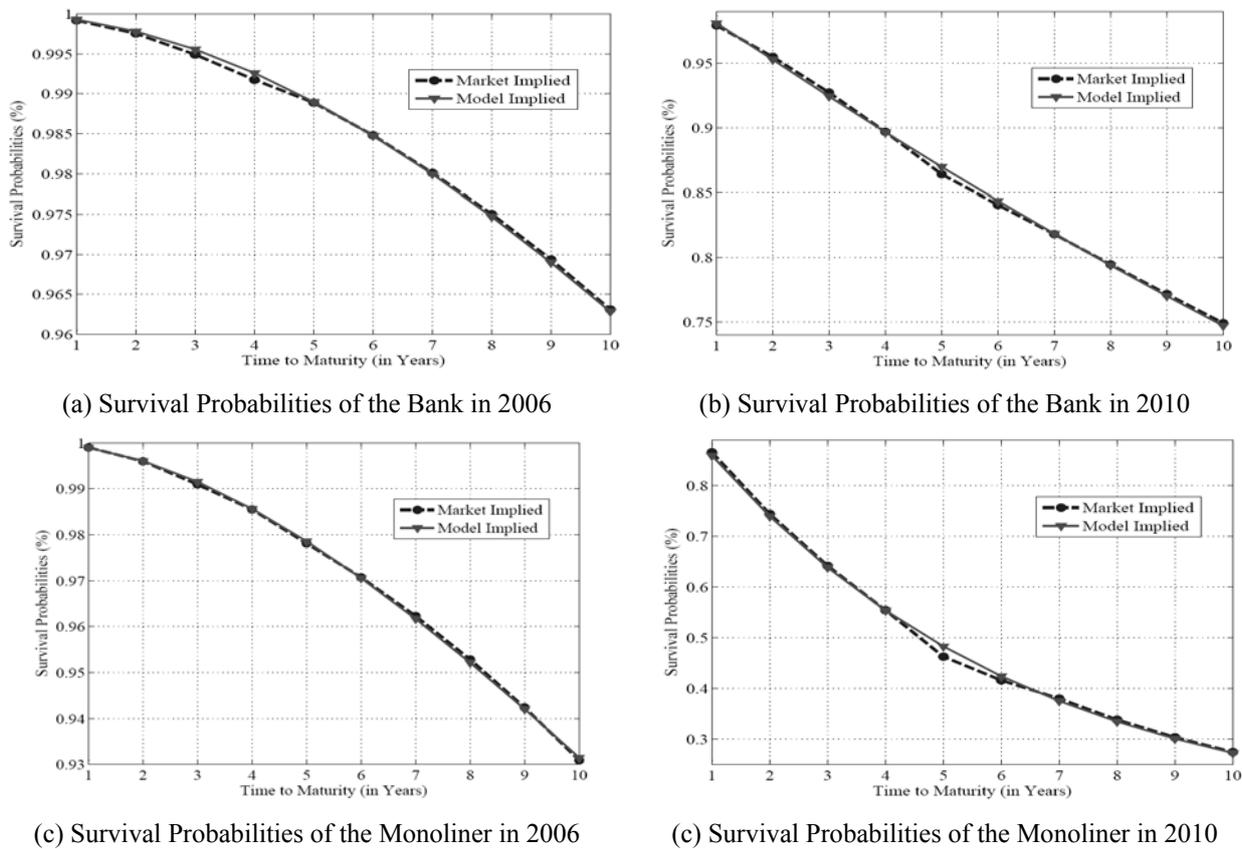
This example illustrates the adjustments that hit many bank during the crisis, where the CVA for CDS rose due to the deterioration of the credibilities of monoline insurers. With one year PDs exceeding 10% , the adjustment that has to be made is in the least 10% of the CDS unadjusted value, and can be up to 19% , depending on the assumed correlation structure. This same (mark-to-market) adjustment would have appeared as a profit in the P&L of the monoline insurer, implying a gain from the worsening of own credit risk.

4 Conclusions

As shown above, the model proposed by Brigo and Capponi (2010) offers a theoretical framework for the fair valuation of CDS that is able to both consider wrong way risk and the own credit risk of the party doing the computation. The model can - for one - be used to explain how financial institutions could benefit from the worsening of their credibility. The model is also able to capture and price dependencies between the involved parties, explaining the high adjustments needed for CDS on structured notes that were brought from monoline insurance companies during the financial crisis. Thus, the model is able to deliver intuitive and robust pricing for uncollateralized CDS contracts. Due to the fact that credit OTC derivatives are usually collateralized, future research should investigate the integration of collateral agreements into the framework of Brigo and Capponi (2010). In this context, Brigo and Papatheodorou (2011) offer such a framework for interest rate swaps. The approach given by Bielecki et al. (2011) for CDS might be promising, too.

¹⁴Note that we assume a constant maturity of five years in order to avoid duration-like effects.

Fig. 4: Market Implied Survival Probabilities vs. Model Implied Survival Probabilities



The figures display the market implied survival probabilities in comparison with the model implied survival probabilities of the average bank and an exemplary monoline insurer in 2006 and 2010, demonstrating the calibration of the CIR processes to market data.

Tab. 6: CVA Results of the Case Study

$(\rho_{0,1}, \rho_{0,2}, \rho_{1,2})$	CVA (2006)	CVA (2010)	CVA (2010) (% of CDS Value)
(0,0.5,0.5)	5 (0)	179 (4)	10%
(0,0.2,0.9)	17 (2)	276 (7)	16%
(0,0.9,0.2)	21 (3)	330 (9)	19%
(0.5,0.5,0)	7 (1)	198 (5)	11%
(0.2,0.9,0)	10 (1)	220 (5)	13%
(0.9,0.2,0)	18 (2)	274 (7)	16%
(0,8,0.5,0.2)	21 (2)	294 (8)	17%

The table summarizes the BR-CVA in basis points of the CDS Payer as computed using the lognormal distribution approximation. The numbers in brackets stand for the standard errors. The CDS has a maturity of 5 years and a CDS-spread of 30 basis points. The last column summons the adjustments w.r.t the value of the CDS in 2010 (1726). The Investor (Payer) is an average bank, the Reference Entity is a structured note and the Counterparty (Receiver) is a monoline insurer. All are assumed to have an *LGD* of 0.6. The CIR parameters of the three parties are given in Table 5.

This paper has given a step-by-step illustration for implementing the model proposed by Brigo and Capponi (2010), especially going into detail about the most elaborate part of the algorithm -

the computation of the survival probability of the Reference Entity conditional on the default of either the Counterparty or the Investor. It has been illustrated in detail how the Fractional Fourier Transform (FRFT) can be used for this purpose. We have also proposed a computational tune-up through a robust approximation, which reduces the complexity of the elaborate implementation and speeds-up the computation, while delivering satisfying pricing results.

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Valuation of Credit Default Swaps with Wrong Way Risk: Model Implementation and a Computational Tune-Up

Summary

In their work, Brigo and Capponi (2010) introduce a numerical approach for calculating credit valuation adjustments (CVA) for credit default swaps (CDS). In contrast to previous research, they consider the default of the party doing the calculation, and its correlation to the defaults of the counterparty and the reference entity. Assuming bilateral counterparty credit risk, this approach generates symmetric and arbitrage free CVA. The most elaborate part of this computation is the generation of the default probability structure of the reference entity conditional on the default of either the investor or the counterparty. Brigo and Capponi (2010) suggest the use of the Fractional Fourier Transformation (FRFT) technique for this purpose. In this paper, we introduce the precise and practical algorithm for this numerical approach and display the steps needed for the FRFT technique. In addition, we offer a computational tune-up for the calculation of the conditional value of the CDS through a lognormal approximation. Throughout a variety of examples we show that this robust approximation delivers satisfying results, while requiring less computational power and less excessive implementation than the FRFT approach.

Key words: Credit Valuation Adjustment (CVA); Credit Default Swaps (CDS); Counterparty Credit Risk (CCR); Fractional Fourier Transformation (FRFT); Wrong Way Risk.

JEL classification: C5, E4, E3, G1.

Editorial note:

Due to the restrictions on a paper's extent in the hard copy of *Conference Proceedings*, the appendices, which are referred to in the paper by author, are published on the attached CD medium *Conference Proceedings* only.

The Impact of Tax Burden and Efficiency of Economic Agents on Their Economic Behavior

*Dmytro Sokolovskyi, Olena Sokolovska**

1 Introduction

In the current context the developing and transition countries face the problems of insufficient revenues, collected in budgets of different level. The economic reforms need rather more costs (i.e. revenues), than stable situation. For this reason, any arrears in developing and transition countries create more problems than in developed ones.

The budget arrears due to direct nonpayment, concealment of income, transferring the economic activity into informal sector leads to budget shortfall. In this situation the threats come from insufficiently clear planning of tax base (number of taxpayers, their revenues), from insufficiently clear behavior rating of economic agents in case of changes in state tax policy and also from insufficiently organized inspection of tax collection. All foresaid can lead to default by economic agents from their obligations.

Our research provides the development of a game-theoretical model of interaction between economic agent and tax authorities.

This approach differs from existing methods (which are widespread in practice) for control of tax rates based on political decisions, the objective of which is to increase the budget revenues, to ease the financial burden on certain industry, to bring the domestic legislation in line with the international one, etc. But in such a case the sufficiently rigorous substantiation of optimality of adopted decision is absent.

2 Literature review

In theory, one of the main aspects of budget nonfulfillment problem is the issue of tax evasion, which is well known in world literature as «tax evasion problem». For purpose of our research the studies of tax evasion by means of game-theoretic modeling are of interest.

The application of game-theoretic tools to solve the problem of tax evasion first was made by M. Allingham, A. Sandmo (1972), in which the simple basic model of interaction between taxpayer and tax inspector was proposed. In 2004 the literature review of the tax evasion theory for last 30 years was prepared by A. Sandmo (2004); in this context we can mention the article of J. Slemrod и S. Yitzhaki (2000), in which they overviewed the main aspects of tax avoidance, evasion and administration.

Hereafter, T. Srinivasan (1973), T. McCaleb (1973), B. Singh (1976), V. Christiansen, (1980), J. Baldry (1984) analyzed problems of optimization of correlation between identifying tax violation and amounts of penalties, and also application of those penalties to struggle with tax evasion.

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The relationship between tax rate levels and tax evasion in a context where the utility of a taxpayer depends on both his own consumption and his relative position with respect to the average declared income of the economy is analyzed in study of J. Panadés i Martí (2002).

Generally, such theoretical studies concern the possibility determination of application of various fiscal instruments (rates of taxes and penalties, probability of tax declaration audit) to counterwork of tax evasion.

Among studies in applied economics, concerned with evaluation of specific figures of tax evasion for certain countries, for purposes of our research we examined the following ones. E. Engel, J. Hines Jr. (1998) have proposed the model of behavior of rational taxpayer, where the current taxpayer' evasion is the decreasing function of his prior evasion. The model was estimated using the data of aggregate behavior of American taxpayers over the 1947-1993 period. Despite the feasibility of proposed approach, it can't be used for our study because it characterizes the individuals' behavior (moreover with American mentality and in conditions of American tax system), but not the enterprises' behavior.

A rational taxpayer also appears in study of G. Coricelli et al. (2007). This article states that the main requirement for individuals to evade taxes will be the positive expected benefit of cheating (positive value of utility function), i.e. the expected benefits are greater than expected costs. But as former study, this one analyses the actions of individuals (the features of their psychological behavior under tax evasion and their emotion), but not the actions of firms; this complicates the possibility of using the results of concerned article for our study.

J. de Melo et al. (1992) in their study compared the tax systems of low-income countries; however they analyzed Madagascar's tax system as a comparative base, which characterizes by various distortionary taxes. Using a 10-sectors model and general-equilibrium calculations, the authors estimated revenue losses from exemptions, tax evasion, and smuggling for three types of taxes: import duties, value-added taxes, excise taxes, moreover to simplify the model they united all these taxes into specific aggregate tax. The application of given model to European transition countries is complicated by reason of presence of less distorting tax system and by reason of model's incompleteness, because in their tax system besides indirect taxes there are direct ones, the impact of which differs from that of indirect taxes.

M. Levin and S. Movshovich (2001), basing on the general equilibrium model, designed the model of tax evasion under penalties and refusal of banks to grant loans. In their investigation authors emphasized on some aspects of consequences of tax evasion, for example, on the bank's refusal to grant a loan to firm, which has evaded taxes, etc. At the same time the mentioned model do not consider the factor of costs of tax inspections, made by tax authorities, and its impact of probability of detection of tax evasion in our study this factor plays an important role. Also, as opposed to analysis of M. Levin and S. Movshovich, we do not use the principle of firms' division into three groups in terms of law-abidance.

We should note that both of mentioned and others investigations, concerning the tax evasion problem in the context of applied economics, unfortunately rarely use the game-theoretic tools. From this perspective we can mention the research of A. Vasin (2002) and V. Lipatov (2005). A. Vasin, starting out from classical model of Allingham-Sandmo-Srinivasan, handles a problem of tax revenue maximization, taking into account that the taxpayer's revenue is a random variable with restrictions to its domain of definition and taking in consideration the different variants of penalty function. The V. Lipatov's model assumes the minimal information about auditing probability and the possibility of payoffs for tax inspectors from taxpayers. As against A. Vasin, who optimizes the actions of tax authority (government), V. Lipatov, deciding the main problem of his research, resolves itself into adopting of agents' decisions, which are satisfactory but not optimal.

Also from researches using the game-theoretic tools we can mention the article of V. Bilotkach (2006), which examined the tax evasion by Ukrainian enterprises through underreporting activity. In the theoretic game the author calculated the equilibrium points for businessman (taxpayer, who can hide part of his profit and offer bribe to official in the case of detecting) and tax inspector, who can take a bribe in exchange for concealment of tax violation. But we should note, that such a model will be feasible only after introducing into the model the third person – a customer (a principal), because if the principal and the tax inspector are all in one, than taking bribes on his part will be absolutely irrational behavior.

But the autonomous analysis of tax evasion problem does not give the exhaustive information about budget nonfulfillment. Insufficiently fulfilled budget often takes place not because the agents do not pay taxes and do not declare their revenues (or another tax base), but because of complexity of identifying the unfairness of their behavior. Such situation can lead to certain problems for economy (transferring the agents' activity into shadow sector, capital flight, reducing of foreign investment etc.)

Thus, the important factor, which determines the actions of all interested parties in tax evasion model, is the probability of detection of taxpayer's unfair actions, and also the possibility of erroneously identified tax violation (in conditions of absence of tax evasion). To our opinion, when we take into account this parameter, that was not considered in research articles mentioned above, that can influence essentially on contractors' behavior.

In this context our model differs from existing ones properly by the fact that, besides of traditional unsecured detection of taxpayers' tax evasion by tax inspector, we also introduce the possibility of recognition the "fair" taxpayer as a tax evading person.

For that, we have introduced into the model the parameters of "transparency" of interaction in the tax system, i.e.: the probability of detection of fact and fictitious taxpayer's tax evasion.

Subsequently, the **purpose of given study** is to discover the impact of tax rates changes on changes in economic agent's behavior in the context of their tax evasion.

3 Tax interaction model

Since the mechanism of taxpaying provides the interaction between agents (taxpayers) and principals (public authorities, which collect and administrate taxes), it is suitable to model that process using a game-theoretic approach.

As the model parameters, defining the cost of various strategies, the following basic economic indicators will be used:

- tax base (R , $R > 0$);
- tax rates (τ , $\tau > 0$);
- amount of penalties for tax evasion – (y) – function of amount of concealed tax;
- cost of tax evasion concealment (depending, particularly, from difficulty of tax evasion in various industries) (v);
- agent's cost of fair activity maintaining (depending from industry) (μ);
- tax authorities' expenditures connected with one inspection of taxpayer (π , $\pi > 0$);
- probability of detection of taxpayers' real evasion by tax inspectors, ($p(\pi)$, $0 \leq p \leq 1$);
- probability of detection of taxpayers' fictional evasion by tax inspectors ($q(\pi)$, $0 \leq q \leq 1$);
- frequency of tax inspections.

In our model of interaction between taxpayer and tax inspector we assumed the following:

- the perfect demand elasticity for firms' production (i.e. the producers do not shift their on consumers);
- the taxpayers practice bounded rationality in their actions, i.e. they try to maximize their revenues, irrespective to means of objective achievement, taking the decisions according to their awareness.
- the motives of behavior and principles of environment valuation are invariable for all economic agents in all industries. Accordingly to this, we conclude that behavior models for firms in various industries must to coincide by structure but to differ by specific values of parameters; the last ones are peculiar for each industry.

At that rate, the model of principal-agent interaction can be described as game (1-5):

$$\Gamma(\text{Pr}, \text{Ag}, G(\text{Pr}, \text{Ag}), H(\text{Pr}, \text{Ag})), \quad (1)$$

$$\text{where } \text{Pr} = \begin{pmatrix} pr_0 \\ pr_1 \end{pmatrix} \quad (2)$$

= set of tax inspector's strategies, pr_0 – to make an inspection of taxpayer; pr_1 – do not make an inspection of taxpayer;

$$\text{Ag} = (ag_0; ag_1) \quad (3)$$

= set of taxpayer's strategies, ag_0 – to evade tax; ag_1 – do not evade tax;

$$G(\text{Pr}, \text{Ag}) = (g_{ij}) = \begin{pmatrix} 0; & \tau R \\ p(\pi)(\tau R + \gamma(\tau R)) - \pi; & \tau R + q(\pi)(\tau R + \gamma(\tau R)) - \pi \end{pmatrix} \quad (4)$$

= tax inspector's payoff matrix;

$$H(\text{Pr}, \text{Ag}) = (h_{ij}) = \begin{pmatrix} R; & (1-\tau)R \\ R - p(\pi)(\tau R + \gamma(\tau R)); & R - \tau R - q(\pi)(\tau R + \gamma(\tau R)) \end{pmatrix} \quad (5)$$

= taxpayer's payoff matrix.

Thus, the game (1-5) describes the interaction between 2 agents: tax inspector and taxpayer; each of them has 2 pure strategies of behavior. The variables of game are divided into the control parameters of government (τ, γ), the control parameters of tax inspector (π), the control parameters of taxpayer (v, μ) and the parameters (and functions) of environment (R, p, q).

In comparison with the classical models [1; 3] and their extensions, which were analyzed in literature review, our payoff functions (1-5) contain the "transparency" functions of interactions between players, p and q . Those functions are the environment parameters (as we have mentioned above), which means that they are not the part of tax inspector's strategy or taxpayer's strategy. I.e. the tax inspector and taxpayer can not to change voluntarily the values of those parameters; the tax inspector can effect on those values by varying the parameter π – amount of costs, directed to control of taxpayer's actions, and the latest – by varying the parameters v and μ .

Assume that the values of those functions can have a significant impact on the behavior both of taxpayer and tax inspector. The answer on question about the interdependence between p и q is not obvious. In a first approximation we can assume that the increase of π leads to increase of p and to decrease of q .

At a first approximation suppose that the increasing of π leads to increase of p and decrease of q ; the increase of v leads to decrease of p and the increase of μ leads to decrease of q .

It is reasonable to assume also that “transparency” parameters p and q generally differ for different taxes and various industries; the values of those parameters depend on the potential ease of concealment of given tax in the given industry. But we should note that in an explicit form the parameters of ease of tax concealment are not statistical data, i.e. they have to be estimated implicitly.

Considering that the equilibrium in mixed strategies in the game is unstable and practically inaccessible, the evolution of agents’ interaction, in accordance with the concrete values of model parameters, will tend to one of four possible Nash equilibria in pure strategies, i.e.: E_{00} = {do not control; to evade}, E_{01} = {do not control; do not evade}, E_{10} = {to control; to evade}, E_{11} = {to control; do not evade}. The possibility of agents’ opportunism shows that we deal with the moral hazard problem.

The conditions of attainment of each mentioned equilibrium are the following:

$$E_{00} : \nu - \mu < \tau R < \frac{\pi}{p(\nu, \pi)(1 + \gamma)}; \quad (6)$$

$$E_{01} : \tau R < \min \left(\nu - \mu, \frac{\pi}{q(\mu, \pi)(1 + \gamma)} \right); \quad (7)$$

$$E_{10} : \tau R > \max \left(\frac{\pi}{p(\nu, \pi)(1 + \gamma)}; \frac{\nu - \mu}{1 - (p(\nu, \pi) - q(\mu, \pi))(1 + \gamma)} \right); \quad (8)$$

$$E_{11} : \frac{\pi}{q(\mu, \pi)(1 + \gamma)} < \tau R < \frac{\nu - \mu}{1 - (p(\nu, \pi) - q(\mu, \pi))(1 + \gamma)}. \quad (9)$$

τR describes both the taxpayer’s tax burden and its efficiency.

Let us consider the variants of mutual arrangement of equilibrium conditions E_{ij} relative to τR .

Comparing (2) and (3) allows concluding that E_{01} always can be attained at values of τR , which are fewer than E_{00} , whereas for E_{01} it is required to meet the condition $\tau R < \nu - \mu$, and for E_{00} it is required to meet the following one $\tau R > \nu - \mu$ (in this case we suggest that E_{01} precedes E_{00} and denote it as $E_{01} \prec E_{00}$). The same is arguable for the relations of other pairs of equilibria: E_{01} precedes E_{11} , as for E_{01} it is required to meet the condition

$$\tau R < \frac{\pi}{q(\mu, \pi)(1 + \gamma)} \quad (\text{see (3)}), \text{ and for } E_{11} \text{ it is required to meet the following one}$$

$$\tau R > \frac{\pi}{q(\mu, \pi)(1 + \gamma)} \quad (\text{see (5)}); \text{ simultaneously, } E_{11} \text{ precedes } E_{10}, \text{ since } E_{11} \text{ in terms of (5)}$$

$$\text{needs to fulfill the condition } \tau R < \frac{\nu - \mu}{1 - (p(\nu, \pi) - q(\mu, \pi))(1 + \gamma)}, \text{ and } E_{10} \text{ in terms of (4)}$$

$$\text{requires to fulfill the condition } \tau R > \frac{\nu - \mu}{1 - (p(\nu, \pi) - q(\mu, \pi))(1 + \gamma)}; \text{ after all, } E_{01} \text{ precedes}$$

E_{10} in terms of comparison of consequences derived from (2) and (4), thus:

$$\tau R < \frac{\pi}{p(\mu, \pi)(1 + \gamma)} \text{ and } \tau R > \frac{\pi}{p(\mu, \pi)(1 + \gamma)}. \text{ It is obvious that by law of transitivity } E_{01}$$

precedes also E_{10} .

Hence, for all possible positive values of model parameters, we can write the following:

$$\begin{aligned} E_{01} < E_{00}, E_{01} < E_{11}, E_{01} < E_{10}; \\ E_{01} < E_{10}, E_{00} < E_{10}, E_{11} < E_{10}; \end{aligned}$$

($E_{01} < E_{10}$ is doubled for symmetry).

The unique variability appears by comparison of E_{00} and E_{11} , the relation of whose depends on $\pi, \nu, \mu, \gamma, p, q$.

$\nu > \mu$ variant. If $p \geq q$, E_{00} unambiguously precedes E_{11} , whereas the attainment of equilibrium E_{00} is possible with τR fewer than $\frac{\pi}{p(\nu, \pi)(1 + \gamma)}$, and thus $\frac{\pi}{q(\nu, \pi)(1 + \gamma)}$, on the other side, the

attainment of equilibrium E_{11} requires to fulfill the condition $\frac{\pi}{q(\mu, \pi)(1 + \gamma)} < \tau R$. Otherwise

($q \geq p$) for E_0 we obtain $\nu - \mu < \tau R$, whereas for E_{11} : $\tau R < \frac{\nu - \mu}{1 - (p(\nu, \pi) - q(\mu, \pi))(1 + \gamma)}$,

and thus $\tau R > \nu - \mu$, i.e. in this case E_{11} precedes E_{00} .

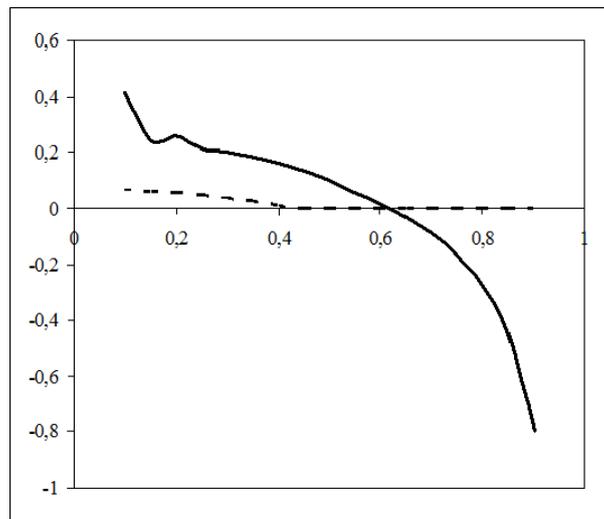
$\mu > \nu$ variant. In this case, the attainment of equilibrium E_{11} , is obviously possible only with $p \geq q$, however it is not the sufficient condition; indeed, the stronger inequality is required:

$$p(\nu, \pi) > q(\mu, \pi) + \frac{1}{1 + \gamma}. \text{ This implies that } E_{11} < E_{00}.$$

Hence, for this pair of equilibriums the following condition holds:

$$\begin{cases} (p > q) \vee (\nu < \mu) & \Rightarrow E_{11} < E_{00}; \\ (p < q) & \Rightarrow E_{00} < E_{11}. \end{cases} \quad (10)$$

Fig. 1: The dynamics of agent's and principal's payoff in the case of an average-efficient agent

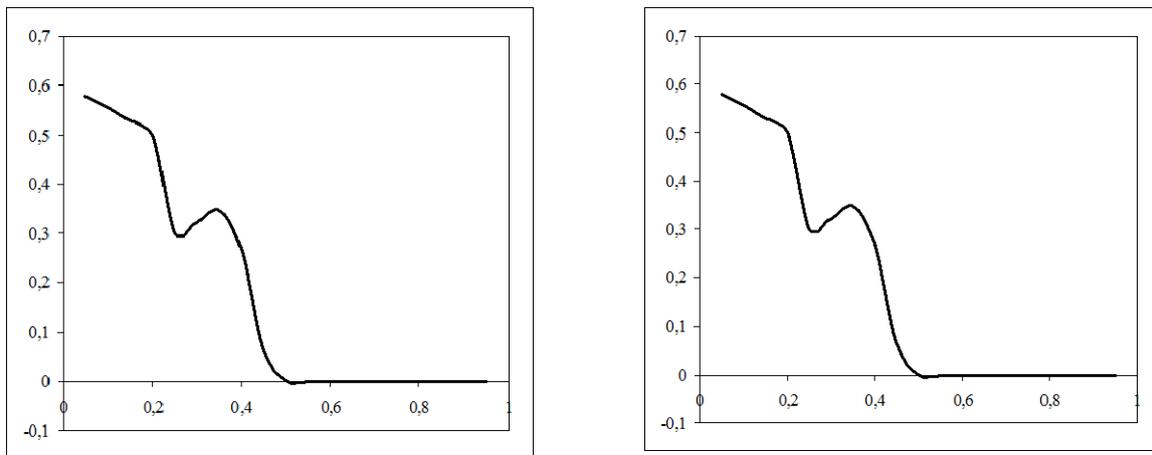


Source: Data source – authorial calculation

By this means, there are 2 variants of evolution of Nash equilibriums in time of of agents' interaction in the process of increase of τR : $E_{01}, E_{00}, E_{11}, E_{10}$ or $E_{01}, E_{11}, E_{00}, E_{10}$. I.e., the general tendency is the following: on the one side the less efficient agents follow the agreement more frequently than more efficient ones; on the other side, the more efficient agents are more frequently controlled.

The simulation of interaction between agents with different efficiency (it is assumed the equal number of agents with equal efficiency), generally, confirms the hypothesis about agent's and principal's payoff (Fig.1), however for certain R the function graph takes on the less predictable form (Fig. 2 a,b) (Sokolovskyi (2009, 2010)).

Fig. 2: The dynamics of principal's payoff (a) and agent's payoff (b) for specific cases of agent's efficiency



Source: Data source – authorial calculation

4 The principle of estimation of industries and taxes according to ease of tax evasion

We referred above to some abstract tax for some abstract industry. It is obvious that some real taxes can be evaded more easily than other ones, and in different industries the same tax can be evaded with different ease. I.e. to define the behavior of separate industry we should define the ease of evasion of defined taxes exactly for this industry, and also e should calculate the specific gravity of each tax in this industry to calculate the ease of evasion from so-called “aggregate” tax.

We assume to estimate the taxes by level of their concealment on the basis of analysis of taxable activities (assets, etc), tax base, taxation features and inspection procedure for each of selected taxes.

To evade tax the taxable activities can be concealed (fully or partially) and it can be changed. Taxpayer can evade taxes, related with the tax base, in the form of unlawful use of tax exemptions (which reduce the tax base), and also in the form of underdeclaration of income and overshooting of costs.

Taxes, related with the foreign economic activity, differ by features of payment; in particular, they are paid after event, as opposed to taxes, nonrelated with the foreign economic activity, for which the reason for paying is the accrual of specified time.

The same thing is for inspection procedure: for taxes, related with the foreign economic activity, the inspection exercises directly at the moment, when product crosses the border; for taxes,

nonrelated with the foreign economic activity, the tax inspections exercise in specified time.

To estimate the ease of tax evasion by firms in various industries we use the similar principles discussed above about valuation of ease of tax evasion for each tax.

We calculate this parameter on the basis of matrices:

$$Ev(Tax \times Ind), V(Tax \times Ind), \quad (11)$$

where Tax = the set considered taxes,
 Ind = the set of industries,

$$Ev_{ij}, i \in Tax, j \in Ind \quad (12)$$

= the ease of i -th tax evasion in j -th industry;

$$V_{ij}, i \in Tax, j \in Ind \quad (13)$$

= the specific gravity of i -th tax in j -th industry.

The ease of taxes evasion in each industry is defined using expert judgments, taking into account such factors as principles of payment of each tax for given industry and also the specific features of concrete industry, having an effect on behavior of economic agents related to this industry.

The ease of aggregate tax evasion in j -th industry can be defined as

$$EvA_j \Big|_{j \in Ind} = \sum_{i \in Tax} Ev_{ij} V_{ij} \quad (14)$$

The parameter of ease of aggregate tax evasion influences on value of p from theoretical model (see (4), (5)). Similarly we can calculate the indicator of ease of evidence of taxpayer's fairness, which influences on value of q .

Hence, on the basis of values of those parameters for each industry, and also of values of "threshold of reproduction on a simple scale" we shall define for which Nash equilibrium the interaction between tax inspector and enterprise (taxpayer) at different aggregate tax rates, will approach, and also at which rate of aggregate tax the enterprises (taxpayers), operating in given industry, will withdraw from market.

5 Conclusions

The identification of agents' behavior in the system of tax levying –matching the nominal rate of aggregate tax to Nash equilibriums on pure strategies – allows calculating for each industry the ratio between the real state revenue and nominal one. Thereat the maximum of given ratio means the optimal aggregate tax rate for given industry.

The actual confirmation of developed hypotheses will contribute to revisit the economic behavior model of both of taxpayer and tax inspector; and after certain extension it will contribute to develop a theory of principal and agent.

The successful implementation of given model allows defining the relation between tax rates on the one side and state revenues, agents' revenues and tax evasion level on the other side. This will make possible the performance evaluation of existing tax burden in different industries. According to this, the practice guidelines can be elaborated for the state tax policy development.

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The Impact of Tax Burden and Efficiency of Economic Agents on Their Economic Behavior

Summary

The paper provides the development of a game-theoretical model of interaction between economic agent and tax authorities. This approach differs from existing tax evasion models by introducing the additional parameters, characterizing the cost of different variants of agents' activity, and also the "transparency" of interaction in the tax system. The dependences, generalizing the traditional patterns of economic behavior of agents, re obtained. The principles of estimation of industries by criterion of ease of tax evasion, and also the valuation of different taxes by the same criterion are considered.

Key words: Tax evasion; Game theory; Nash equilibrium; Economic behaviour.

JEL classification: C72, H26, H30.

The Role of Prudential Risk-Oriented Banking Supervision in Ensuring the Financial Stability of Banking System

*Kateryna Tsytsyk**

1 Introduction

Current world economic circumstances as well as integration processes put forward a number of requirements to banking system of a country. First of all it concerns the increase of commercial banks' stability and stabilization processes in banking system. This goal can be achieved only providing more efficient banking supervision for it is banking supervision that is the main guaranty factor of financial stability in banking system of the country. In its turn increase of functional efficiency of banking supervision will be provided while transferring its priorities to actual bank risks and redirection of supervision function of state bodies immediately upon the efficiency on its management system.

2 The concept of “efficient prudential banking supervision”

The issue of bank regulation and supervision was studied by many Ukrainian and foreign scientists. Namely, an essential niche is occupied among the representatives of overseas researches by P. Davis (2009), D. Llewellyn (2004), J. Carmichael (2004), F. Mishkin (2001), A. Fleming (2004). An important focus in investigation of banking supervision problem is pointed out in researches of such Ukrainian economists as V.V. Krylova (2010), V.I. Mishchenko (2011), S.V. Naumenkova (2011), O.I. Petryk (2010), I.A. Shvets (2011) etc.

But taking into account complication of the problem in question, we believe, that it advisable to research fundamentally both theoretical and practical aspects of bank supervision concept. Firstly one should pay special attention to the system of appraisal of risks in banks.

Supervision and regulation of banking is one of the basic conditions of providing financial stability in the country. Historically, necessity in development of banking supervision appeared due to social significance and responsibility of the commercial banks toward society.

Banking in its essence is based on confidence to banks owner and managers on behalf of clients and investors. As a result of banks' inability to pay there appears a lack of trust that causes currency disorganization and increase of public pressure. Therefore, banks are traditionally supervised thoroughly by means of specially formed state bodies.

Banking supervision is a number of actions performed by banking supervision authority in terms of given competency and accordingly to regular norms to provide stable banking functioning in the country and protection of its loaners and borrowers interests.

The basic functions, relying on the system of banking supervision are the following:

- support of monetary and financial stability and if necessary implementation of bank's financial recovery,
- providing efficient banking on the ground of capital quality and bank's assets. Also banking supervision includes evaluation of internal control, risk-management level,

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internal banking operations and financial circumstances in an organization,

- protection of investors interests (realization of bank's operation supervision, namely of the ones, which are not able to perform liabilities concerning their investors).

On the other hand, there are such main tasks and directions in banking supervision and regulation:

- development and spread of wide scope of supervision regulations in credit organizations,
- consideration of requests and claims applied by banks including the claims dealing with licenses,
- monitoring and supervision of banking i.e. financial analysis, control of performance of legal norms and regulations,
- on-site inspections,
- introduction of compulsory measures demanding banks' implementation of new procedures and practical approaches for solving the indentified problems.

Along with this, a special place in the system of banking regulation and supervision takes prudential supervision, which is the specific means of monitoring and evaluation of the commercial banks' risks.

Resolution of the National Bank of Ukraine "About the organization of internal audit in commercial banks of Ukraine" dated March 20, 1998 № 114 defines prudential supervision, as a system of banking supervision where the main attention of supervision is paid on the regular assessment of general financial condition, operating results and quality of banking management (Resolution of the National Bank of Ukraine № 114, 1998). The methodology of prudential supervision allows studying bank's compliance with applicable laws, regulations of the National Bank of Ukraine, economic standards and so on.

Frederic S. Mishkin follows the opinion that prudential supervision, in which the government establishes regulations to reduce risk taking and then supervisors monitor banks to see that they are complying with these regulations and not taking on excessive risk, is thus needed to ensure the safety and soundness of the banking system of the country (Mishkin, 2001, p.8).

It is important that banking supervision essentially is always secondary to banking. Thereby, the regulator, providing prudential supervision of banks, designed to ensure conditions of stability both for individual credit institutions and banking system in general. However, it should be noted that the functions of prudential banking supervision don't include a comprehensive monitoring of banking transactions, and therefore interference into current activities of financial institutions is not provided.

Modern trends in banking systems of developed countries demonstrate in practice that prudential banking supervision is efficient merely in circumstances where the basis of its organization is a system of risk-management.

On the other hand, we should pay attention to the fact that the level of risk-management efficiency is an indicator of the stability of the bank in general. Obviously, the resistance of one element, that is banking institutions, ensures the stability of the banking system on the whole. Therefore, prudential banking supervision based on risks' assessment is an effective nowadays because it focuses not on carrying out general control over the banks' activities, but it can determine the level of financial and credit institutions' stability by analyzing the efficiency of risk-management system.

In the context of banking system risk-oriented supervision defines the scope of activities that collectively pose an unacceptable risk to the banking system. In general, this approach allows

developing and proposing the uniform definitions of banking risk that can be used in practice.

Moreover, representatives of the banking supervision while using this approach should determine how certain existing or potential problems, which the bank or banking system is facing with, affect the nature and level of risks in the bank. Despite the fact that banking institutions are constantly exposed to the risks while carrying out profit-oriented transactions it is necessary to manage properly the level of risk and control it.

According to the concept of risk-oriented banking supervision, responsibility for controlling of risks rests on the governance and supervisory board of the bank. National Bank of Ukraine, as a chief banking supervisor, determines how well the bank manages risk over the definite period, but not only evaluates the situation at the particular time. In terms of risk-oriented supervision National Bank of Ukraine serves as a supervisor rather than an inspector. In addition, risk-oriented banking supervision allows the National Bank of Ukraine to carry out preventive supervision, while focusing both on the risks of individual banks and systemic risks of the banking system in general.

However, in spite of an adequate level of banking supervision's investigating, the issue of economic essence of the "efficient banking supervision" concept remains open and non-examined.

Thus, the system of efficient banking supervision is a complex of measures aimed to prevent the systemic risk in banking sector and focused on increasing transparency and efficiency of the banking system.

The main issues of the efficient banking supervision are:

- who should carry out the control under banking institutions – definition of the banking supervision's structure;
- whether it is appropriate to establish a single supervisory authority for all financial sectors in total - definition of the scope of control of the banking supervision;
- how independent should be supervisory authority from the effects of banking institutions and political entities - determination of the banking supervision's level of independence (Davis - Obasil, 2009, p.13).

In addition, an effective system of banking supervision should have clear responsibilities and objectives for each authority involved in the supervision of banks. Each such authority should possess operational independence, transparent processes, sound governance and adequate resources, and be accountable for the discharge of its duties (Basel Committee on Banking Supervision, 2006, p.2).

In this way, efficient banking supervision is largely based not on ensuring the implementation of quantitative supervisory regulations by banks, as creation the motives for them not to prejudice to creditors and depositors while carrying out the activities. This is the basic principle of prudential risk-oriented banking supervision. Thus, it is clear that improving the functional efficiency of banking supervision will be ensured only in conditions of transferring its priorities to the real banking risks.

Another aspect of improving the efficiency of prudential banking supervision is optimization of its system. This process follows an idea that banking supervision should be organized in such way, that we can achieve the objectives by the least resources when increasing the operating efficiency of the process.

It should be noted, that today the central element of the modern concept of banking regulation and supervision for Ukraine is New agreements on capital, or Basel II. Effective usage of approaches recommended by Basel II, is essential for improving the quality of banking

regulation. In Ukraine, complete introduction of Basel II is going to be provided by 2016, whereas the countries of the G-20 are going to implement Basel III by the end of 2012.

Implementation of Basel II recommendations is one of the factors of increasing banking system's competitiveness in Ukraine. The main reason of it is that Basel agreement on capital provides new approaches to banking regulation and supervision, the main purpose of which, in addition to the capital adequacy of banks, is improving of risk-management systems that promote stability of banking system.

So, the question of improving the functional efficiency of prudential banking supervision involves the development of its substantial component and focus on real risks of banking. This should be provided with the development of methods of banking regulation that meets the objective of risk-oriented supervision through development of practical skills of employees who are performing supervisory functions.

Another aspect of improving the efficiency of banking supervision is the pragmatic task of achieving the objectives of supervision by using the less amount of resources, namely improving operational efficiency or "productivity" of supervision.

3 Risk-management system of a bank as an object of risk-oriented prudential banking supervision

In order to investigate the issue of effectiveness of prudential risk-oriented banking supervisors we have to recess in its essence. As far as the risk-management system of the bank is the main object of prudential supervision, it's necessary to examine it deeper.

Banking institutions while organizing the system of risk-management, above all, must be guided by the legal documents and the recommendations of the National Bank of Ukraine as the major banking supervisory authority of the country.

In our days, are distinguished nine types of banking risks: credit risk, liquidity risk, interest rate risk, market risk, currency risk, operational and technological risk, reputation risk, legal risk and strategic risk (Resolution of the National Bank of Ukraine № 114, 2004). All these groups of risks must be taken into consideration by banks in order to build an effective system of internal management.

Thus, the resolution of the National Bank of Ukraine "Guidance on the banks' inspection "The system of risks' assessment" of March 15, 2004 № 104 shows that risks' evaluation should reflect both actual and potential risk profile of the bank (Resolution of the National Bank of Ukraine № 114, 2004). Accordingly, the strategy and action of the banking supervision are based on this assessment.

The main purpose of the bank's risk management is to promote the increase the value of the bank's equity, while ensuring the goals of many others interested parties, such as: customers and contractors, directors, employees, supervisory board and shareholders, supervisory authority, rating agencies, investors and creditors, and other parties.

It should be noted, that the risk-management system of a bank primarily should be based on the principle of break-even, while ensuring a reliable and continuous process of identifying, evaluating, controlling and monitoring all types of risks at all the levels. Furthermore, it should be taken into account the mutual influence of different categories of risk in order to ensure the optimal level of correlation between profitability and the level of risk, which assumes the financial institution.

For instance, Ukrainian commercial bank "Bank of Regional Development" has organized the system of risk-management of the bank in such way, that it provides to perform the following tasks:

- coordination of all structural units of the bank, while developing and implementing the procedures and measures to reduce the risks;
- comprehensive assessment and analysis of specific types of risk on the basis of statements obtained from the structural units;
- calculation and passing proposals for setting limits on certain types of risks to the Committee on Asset and Liability Management;
- development and providing proposals for optimizing the assets' and liabilities' structure of the bank to the Committee on Asset and Liability Management in order to reduce risks;
- working-out the stress-scenario in case of crisis circumstances (Official site of the Bank "Bank of regional development").

In turn, other Ukrainian banking institution "Finance and Credit" provides the system of risk-management, based on the special concept. Thus, the main objectives of this concept of risk-management of the bank are:

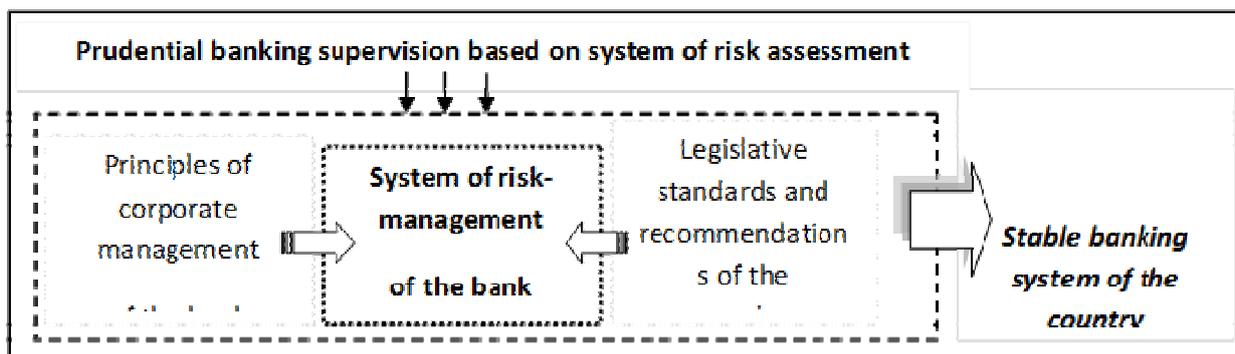
- determination the level of tolerance of the bank to risks;
- segregation of the duties and responsibilities of the bank's structural units over the process of risk-management;
- establishing a common methodology of risks' identification and assessment over the bank's active operations and application different measures for their optimization;
- providing an efficient system of decisions' support that are related to the level of inherent risk in business processes;
- providing banking operations in accordance with established procedures and regulations;
- compliance with requirements of the National Bank of Ukraine on standards and other restrictions;
- effective cooperation of the bank's units at all organizational levels over the risk-management process;
- insuring the viability of the bank in crisis situations;
- optimization of the expected gains and losses;
- increasing of financial stability, credit rating and image of the bank (Official site of the Bank "Finance and credit").

In this way, the basic principles of organization the risk-management process and analysis of the Ukrainian banks' practice let us come to the list of conclusions. Thus, we reckon that in order to ensure the stability of the bank, the risk management system should be organized as a continuous process that could cover all structural levels: from the management level and to the level where direct risks appear immediately.

The process of introduction the integrated system of risk-management in the bank will influence on the strengthening and increasing of the depositors' and investors' confidence. Moreover, this activity is one of the priorities of each banking institution in Ukraine.

However, the proper organization of an effective system of risk-management in the bank has a positive effect not only on the activities of the banking institution, but also has a system-wide value for the country on the whole (see Figure 1).

Fig. 1: The economic role of the bank's risk-management system in ensuring the stability of the banking system



In this way, we reckon that the bank's risk management system is optimal and effective only in the cases where it is based on the principles of corporate management of the bank, on the one hand, and on the legislative and legal standards and recommendations of the supervisory authority - on the other.

Summarizing all, that was mentioned above, we consider that prudential risk-oriented banking supervision plays an important role in ensuring the financial stability of the banking system. However, we should remember that functioning of the system of prudential banking supervision and risk monitoring at the state level cannot be an alternative for banks in creating their own internal methods of analysis and systems of risk-management.

During the next few years Ukrainian banks have to solve the problem of creating efficient systems of risk-management. In this aspect, it is important to use international experience and remember that the establishment of risk-management practices has not been completed yet. The universal method of constructing these systems cannot be create in principle, because each bank is unique, focused on its own market niche, capabilities of its employees, established connections, etc., that is why the mechanical copying of successful risk-management models, created with a particular bank, will lead likely to negative consequences and significant losses.

4 Conclusions

Our research has shown that proper risk-management in each bank, under the influence of well-functioning system of prudential supervision, eventually leads to the unique synergistic effect in the banking system, so that helps to improve its stability in general.

We argue that prudential risk-oriented banking supervision plays an important role in ensuring the financial stability of the banking system. Thereby this actual issue requires further study and consideration using the range of supplemental economic methods and tools.

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The Role of Prudential Risk-Oriented Banking Supervision in Ensuring the Financial Stability of Banking System

Summary

The article is devoted to the research of prudential banking supervision, as one of the key factors for financial stability's ensuring in the country. The essence of effective banking supervision is defined. The main ways of improvement of the bank's risk-management system are mentioned. Particular attention is paid on the study of fundamental principles of banking risk-management system's organization.

Key words: Banking prudential supervision; Banking risks; Financial stability.

JEL classification: E58, G21, G28.

Contemporary Budget Support's Mechanisms of Structural Adjustments of Economy of Ukraine

*Roman Tsytsyk**

1 Introduction

For today the topic of budgetary policy is very important, as the economy in the country in post-crisis period is unstable and weak, so it is necessary to develop new conceptual approaches to the directions and mechanisms of the realization of budgetary policy and turn it into an effective instrument of social and economic development of the country. The state uses the budget for concentration and purposeful distribution of financial resources for giving public services and implementation of national programs. Thanks to it the government can influence the development of social production and create incentives for efficient use of available resources.

For the purpose of achieving sustained and sustainable economic development the budgetary policy should be directed to the implementation of structural adjustment of economic complex of the country, creation of adequate infrastructure to market conditions, growth of competitiveness of domestic business, provision of economic growth through innovation, implementation of active policy of forming a fair relationship between business and employees that should be the basis of income rise of the population, and first of all of increasing wages and enhancing its stimulation role.

2 Specialized budgetary funds

The questions of budgetary policy, budgetary settlement of structural adjustment is reflected in the works of the domestic scientists: V.Andrushchenko, Z.Varnalii, O.Vasylenko, V.Vyshnevskiy, S.Hasanov, V.Heiets, T.Iefymenko, T.Zatonatska, Y.Ivanov, V.Kudriashov, I.Lunina, I.Liutyi, V.Melnyk, T.Ohon, V.Oparin, K.Pavliuk, Y.Pasichnyk, S.Slukhai, A.Sokolovska, V.Tropina, V.Fedosov, I.Chugunov, A.Chukhno and others.

At the same time at this stage of social and economic development of Ukraine it is important to define the main principles, directions and forms of state support of structural adjustment, which will increase the level of correspondence of budgetary expenditure of perspective kind to national priorities in economy. The above mentioned demonstrates the relevance, theoretical and practical significance of the scientific research.

The necessity of state support of structural adjustment of economy is recognized by practically all developed countries of the world, but each of these countries has appropriate financial and institutional mechanisms, based on fundamental principles, namely:

- separation of budgetary funds, which are used for current and future goals;
- use of state funds for socially significant projects that correspond to the programs of strategic development of countries;
- control of society by efficient use of budgetary funds.

It is established, that in general they can be grouped in two categories: mechanisms used within the state budget, and mechanisms that operate on the principles laid down in the organization of

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the budget process, but within individual institutional units outside the budget. Those belonging to the first category, as a rule, use the mechanism of the budget of the development, those relating to the second - state funds, programs, national plans and others (Zatonatska T., 2008, p.17).

The prerequisite of state funding expenditures of prospective nature should be:

definition of profitable sources of expenses of strategic character and introduction of the model which excludes financing of these expenses by a residual principle;

availability of clear and transparent procedures for development expenditures according to their conformity to social and economic strategy of the country and the set priorities;

establishment of appropriate level of public control for expenditures and their effectiveness (Zapatrina I.V. – Lebedeva T.B., 2006, p.39).

During the last years in Ukraine the first steps are taken to the legal regulation of the proposed mechanism of financing of costs of development at the national level and the budget of local finance development. At the same time such financial instruments of solving perspective questions of development, as development banks and other specialized funds are widely used in the world.

Analysis of existing mechanisms of realization of the concept of two budgets and opportunities for their usage in Ukraine has proved that the budget of the development is the best mechanism to ensure structural adjustment and economic growth in Ukraine. Stabilization Fund is used as a tool for economic growth, mainly in countries with a large share of energy exports, and Ukraine can only be used as a tool indirect impact on the implementation of government strategy for sustainable economic growth by reserve funds to offset the negative for the country's price fluctuations. It is expedient to use in the Ukraine Institute of National Development Bank to fund programs that promote rapid economic growth to a new technological base as an alternative to loans from the state budget.

Thus, Article 71 of the Budget Code of Ukraine defines the specific sources of the budget formation of development of local budgets and trends, which can spend its money (Відомості Верховної Ради, 2001, p.189).

Budget receipts of development of local budgets include:

- proceeds from the sale of property which is in communal ownership, including the sale of land of nonagricultural purpose;
- funds from repayment of loans provided from the relevant budget till the enactment of this Code, and interest paid for their use;
- resources transferred from another part of the local budget according to the decision of the appropriate Board;
- borrowings made in accordance with the Code and other laws of Ukraine (except te occasion provided in Article 73 of the Code);
- subsidy from other budgets for investment projects (Зapatріна I.B., 2008, p.18).

Budget expences of development of local budgets include:

- repayment of the main sum of the debt to the Autonomous Republic of Crimea and local self-government (excluding debt which forms according to the conditions which is defined in Article 73 of the Budget Code of Ukraine);
- capital investments;
- contributions of authorities of the Autonomous Republic of Crimes and local

governments in the statutory funds of economic entities.

The budget of development finances the costs for infrastructure development, construction of public facilities, purchasing of new equipment, redemption of land. Infrastructure development applies to public investment, such as traffic routes, objects of public utilities, treatment facilities, outdoor lighting, disposal of solid waste, new transport routes, which leads to significant social and economic effect.

Infrastructure development does not only improve the quality of the citizens' life, but also makes a lot of premises to the development and activities of enterprises. Good roads reduce time spending and transportation and increase the speed of goods delivery, enabling them to implement regional and national markets. If enterprises can expand their sales markets, they can fully use their facilities and equipment to enhance their productivity and profitability, which in its turn increases tax revenues to the budget. The benefits of constructing public facilities, purchasing new equipment are less weighty and obvious but no less important. The new building of civil registration or palace of creativity for children and youth can become a proud of community, and purchase of modern equipment for the hospital or school computer classes will provide a new level of service, and this will increase the value of the property. Investments in energy saving technologies will save money etc. (Official site of the Foundation for Local Self-Government of Ukraine).

For example, most governments in the United States distinguish investment from current expenditures. Governments at the state level and local governments separate investment and operating costs for several reasons. Firstly, investment is often financed by single, targeted sources. Separation of articles for the purchase of capital equipment ensures that the targeted income for capital equipment is actually spend on these needs. The second reason for the separation of the development budget and current budget is the difference in decision-making. Preparation of the budget of development includes a list of projects, then their ranking: all projects - or almost all are compared with one another. By way of financing and implementation of projects, new programs are added to the list, and the process repeats. Except for making budget priorities, the programs are not compared with one another and are not ranked, programs usually last each year, so there is no need to prepare a list of programs and determine their priority (Kyrylenko O.P. - Malyniak B.S., 2007, p.114).

The third reason for making a separate process of the budget of development is that its time limits are different from the current budget schedule. In the current budget, everything happens during a fiscal year: investment projects, in comparison, can be planned and carried out for years. Far-reaching planning and review are required for several reasons. Firstly, any errors in the investment project can be corrected only with considerable expense. An error in the current budget can be corrected during the year, or reviewed the next year. Secondly, investment projects - particularly in infrastructure development - tend to coordination, require close attention to the sequence of actions. For example, the project of pavement replacing may be preceded by replacement of water supply and sewage pipes.

The schedules of these two budgets also differ because investment often occur unevenly. The budget of development allows authorities to plan far in advance comparing with the current budget, which saves money for large programs or allocates costs for them more evenly for a period of several years. Finally, investment projects, which often suffer from change of orders of excessive costs, require tighter supervision than regular programs. A separate budget of development encourages closer oversight of the project, in addition, it allows to keep separate records of investment projects, which contributes to realization of control according to the consumption level.

3 National targeted investment programs

Development of the budget regulation of structural adjustment of economy is not possible without improving the methodological approaches to the formation of national targeted programs and budget programs as components of a long-term strategy of social and economic development. The state targeted programs that exist today, must be reviewed and grouped in appropriate aggregate programs, each of which is aimed to implementation of a specific national agenda, contained in a long-term social and economic development. In its turn, each state target program should consist of a series of budget programs that will ensure its implementation. Duplication should be avoided in similar actions in various budget programs that leads to the dissipation of funds and reduces the efficiency of their use (Boiko Z. - Iurii S., 2007, p.59).

It is advisable to introduce the practice of annual review of programs with the priorities of economic development, intermediate results of their implementation and the available budget needs for funding. While viewing current or approving new national target programs the preference should be given to those that offer reasonable and calculated investment projects and have investment and innovative character (Запартіна І.В., 2008, p.22).

Successful implementation of approved national target programs largely depends on the provision of funding in accordance with duly approved schedule. Because these programs have long-term nature and require significant financial investments, the question of consistency of funding for the entire period of the promising features of the budget for the specific period appear. Failure to provide such consistency since the approval of the program leads to possible risks of underfunding, and thus failure of the planned objectives and, consequently, loss of expected macroeconomic benefits, time and budget. In order to solve the contradiction between the long-term national target programs and the operational nature of their funding, it is necessary to develop and implement methods of coordination with the process of forming budget in the medium term. This method should provide opportunity for review of national target programs in accordance with budget expectations for the medium-term perspective (Zaichykova V., 2007, p.78).

So, today, the Ministry of Finance of Ukraine drafted the basic directions of budgetary policy for 2012, based on the provisions of the program of economic reforms for 2010-2014 "Prosperous Society, Competitive Economy, Effective State" and the Concept of the State Economic and Social Development of Ukraine for 2012 (Official website of the Ministry of Finance of Ukraine). In this project a number of national targeted programs, which are expected to perform within the priorities of social and economic sphere, among which the problem of structural adjustment of economy finds its colorful display. These programs include the following:

- State Target Program of Preparation and Holding of the EURO 2012 Football Championship in Ukraine;
- State Target Economic Program on Energy Efficiency for 2010-2015;
- State Target Program on Village Development of Ukraine for the period till 2015 (in part of holding systematic reforms in agriculture complex through the establishment and development of large commodity, high-production agriculture, agricultural market infrastructure, implementation of investment and innovative projects in agriculture, further improving of the mechanism of the government support to achieve competitive agricultural sector in the domestic and foreign markets);
- State Target Economic Program of Modernization of Municipal Power System for 2010-2014;
- State Program of Urban Electric Transport for 2007-2015;

- State Target Economic Program "Nuclear Fuel of Ukraine";
- National Target Scientific and Technical Space Program of Ukraine for 2008-2012;
- State Target Program for Reforming and Developing Ukraine's Defense Industry until 2013
- State Target Scientific and Technical Program "Nanotechnologies and Nanomaterials" for 2010-2014;
- National Target Environmental Program of Radioactive Waste Management, and the priority projects of construction, reconstruction and modernization of power stations and trunk lines within the Energy Strategy of Ukraine until 2030, etc. (Official website of the Ministry of Finance of Ukraine).

Determination of orientation of fiscal policy on economic restructuring requires a review of the term "development expenditures", which should be formed on the basis of budget programs. The current definition of expenditures does not fully meet the essence of program-target method of budget planning and reduces its ability to manage results. In this context it is necessary to overview in budget terminology the definition of "capital investment" (Stenicheva I.B., 2009, p.25).

4 Relationship between state budget and local budgets

The necessary conditions of structural adjustment of Ukraine's economy and stability of the budget system is now the conducting of fiscal policy directed on the maintenance of the harmonious combination of the principles of budget Unitarianism with elements of decentralization, reformation of these relations with the improvement of the distribution of transfers from the state budget on the basis of transparent and objective criteria, based on a clear separation of budgetary powers and stable revenue sources for the budget.

The mechanism of redistribution of budget funds between the various links of the budget system that worked before, did not answer the principles of autonomy and financial independence of local authorities. Administrative methods of management dominated, as a result the relationship between central and regional authorities were administrative in nature (Liutyi I.O. – Demydenko L.M., 2006, p.3).

The degree of financial independence of local government characterizes the independence of the state in general, the potential possibilities of realization of structural reforms and its economic development, level of democratic rights and freedoms. The state cannot successfully grow and prosper economically without giving guarantees of financial independence to local authorities. It is an objective need for the formation of new economic relations (Liutyi I.O. – Demydenko L.M. – Subbotovych Iu.L., 2006, p.10).

Today one of the primary purposes is to expand the financial base of local government. It is necessary to introduce new mechanisms of intergovernmental relations, which should provide a gradual equalization of provision of administrative units by budget funds while creating incentives for local authorities and government to rationalization of the performance of local budgets and increasing their revenue base (Kyrylenko O.P. - Malyniak B.S., 2007, p.121).

The precondition for financial independence of local government is a reasonable, from the point of view of economic feasibility, decentralization of power and adequate distribution of powers, responsibilities, and hence the financial and economic basis between the center and regions, local government. The limits of financial independence of local government must always be defined by legislation, so that the law should clearly define the functions of local government and according to them sources of resources that will make financial support for these functions (Pikhotskyi V., 2010, p.33).

At the present stage it is necessary to enhance the investment component of state and local budgets in the direction of increasing costs and improving their structure to ensure the structural adjustment of the economy of Ukraine. The main sources of forming of the financial resource of the budget of development are the following: the Stabilization Fund, revenues from privatization of state property, dividend income of state enterprises (corporations) and other corporate structures involving the state, funds from the sale of state shares in authorized capital of commercial banks. At the central level the costs of the budget of development should be directed primarily to the equity of the state that are to compete for co-financing of export and import-investment projects and programs in innovative modernization of industry and local level - to finance infrastructure projects. The measures of innovation and investment orientation of the budget include: on the expenditure side - increasing cost of developing of high-tech economy, science, education, resource projects, in the revenue side - lower taxes, which affect the mobilization of investment resources. Taking into consideration the necessity of solving two opposing objectives by the state (to provide the balance of the budget and performance features of the investment lever) should evaluate the possibility of reducing the expenditure part and accordingly reducing the tax burden (Запагіна І.В., 2008, p.27).

Another direction of budget of development costs – support of credit operations on export of high technology products under signed contracts (including costs associated with working capital of enterprises), and implementation of programs conversion hopeless defense production. The distribution of these funds should be made on a competitive basis under the rule of law and transparency.

Urgent question is to strengthen the investment component of local budgets (in the scientific literature substantiates the thesis of the budgeting of local 13, which resources should be used to finance investment projects of local significance). This work can be done in the context of reform of intergovernmental relations in the direction of increasing the revenues of local budgets in order to enhance the investment component in the structure of their costs. It is advisable to develop projects in selected areas of local budgets with the need to strengthen their investment component (as an experiment), including the introduction of practice development and implementation of regional development budgets, consisting usually of medium-term.

Sources of financial resources of local budgets can be: excess volume of local taxes, tax on real estate (non-residential buildings and facilities, as well as separate living quarters), revenues from privatization of public property, income from the placement of municipal securities, dividend income of community enterprises (corporations) and other corporate structures involving the local community, proceeds from land sales.

It is necessary to accelerate the implementation of fiscal instruments to stimulate regional development, according to the Law of Ukraine "On Stimulation of Regional Development." This should be done on a scientific basis considering the concrete parameters of social and economic development of the state and its regions. It is advisable to expand the practice of creditors, in particular through the issue of regional or municipal debt capital securities (credit securities), and create a system of regional (municipal) lending of nongovernment investment projects (Bilyi I.O., 2010, p.197).

So, today, the Ministry of Finance of Ukraine drafted the basic directions of budgetary policy for 2012, based on the provisions of the program of economic reforms for 2010-2014 "Prosperous Society, Competitive Economy, Effective State" and the concept of the state economic and social development of Ukraine for 2012. In this project, the mentioned areas of support of regional economic growth:

- support of sustainable economic development of the regions considering the balancing of national and regional interests;

- concentration of the state support of regional development in one budget program - the State Regional Development Fund;
- gradual increase of the unit weight of local budgets in the consolidated budget of Ukraine by improving intergovernmental relations and increasing self-sufficiency of local budgets;
- improving of methodological and regulatory basis of the targeted program method in the budget process at the local level, the application of this method while preparing and executing of local budgets in the pilot regions;
- implementation of the programs of regional development in the medium term prospects;
- carrying out of the actions provided by agreements on a regional development of the regions, concluded between the Government of Ukraine and the corresponding councils;
- Amendments to legislation to ensure financial and institutional cooperation at the local level, etc. (Official website of the Ministry of Finance of Ukraine).

Thus the development of the budget mechanism of structural adjustment should be based on improving the budget for local development and institutionalization of the budget of development at the national level by making certain changes to the conceptual organization of the budget process and the formation of an effective institutional model of the system of budget regulation.

5 Conclusions

Thereby, we analyzed the approaches and mechanisms of budget support of structural adjustment of economy of Ukraine by means of budgetary regulation, used in the world, in particular, such as budget development, stabilization and investment funds, state programs etc. The challenges emerging in the process of the development of the world economy and the internal features of Ukraine's economy, cause the necessity of further investigation of provision of the competitiveness of Ukraine's economy and creation of a new product of higher quality, formation of innovative processes, development of measures about updating of the model of economic development of Ukraine on the modern competitive basis.

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Contemporary Budget Support's Mechanisms of Structural Adjustments of Economy of Ukraine

Summary

The article is devoted to the problems of the budgetary policy in the context of structural economic adjustment in Ukraine. The basic mechanisms of budget support of structural economic adjustment are defined and analyzed: specialized funds of monetary recourses, state target investment programs, relationships of the state budget with local budgets. A number of measures of budget support of structural changes on the sample of the Program of Economic Reforms 2010 – 2014 “Prosperous Society, Competitive Economy, Effective State” and a concept of the state program of economic and social development of Ukraine for 2012 are suggested.

Key words: Budgetary policy; Structural adjustment; Budgetary mechanism; Budget of development; Local budget.

JEL classification: E62, H30, H61, H72, O23.

Is Today the Post-Crisis Time for the Banking System of Ukraine?

Nataliya Versal^{*}

1 Introduction

Ukraine - a country that emerged in post-Soviet space and over the past 20 years is trying to create a banking system that effectively acted as intermediary in the calculations, and in lending. During the independence period banking system of Ukraine faced the crisis three times.

Firstly, the crisis occurred in the early 1990s, when banks were created very quickly and also quickly disappeared due to lack of the strategies creation understanding, the lack of ALM techniques and understanding the principles of risk management. In addition, in 1993 annual inflation rate exceeded 10,000%.

Subsequently, the situation stabilized, because in 1996 in Ukraine was introduced its own, more or less stable currency. In the same year, for the first time a comprehensive document appears, which was based on the methodology of Basel I, in the field of banking regulation. This step allowed to monitor the situation in the banking sector and maintaining the proper level of the banking system stability. In fact, until now this document underlies banking regulation. Both Basel II and Basel III could not be established in Ukraine. This is not reluctant to introduce new technologies of regulation, but rather a lack of innovative financial instruments that generate risks, such as structured instruments. By the way, the crisis of 1997-1998 actually had not significant consequences for the banking system of Ukraine. Also, it had not implications for the stock market.

The next crisis in the banking system took place in 2004 and was occurred due to political situation in the country. For the first time in Ukrainian history, banks have faced a problem known in the West as bank run. That's why serious problems appeared in the banking sector. National Bank of Ukraine (NBU) began to provide stabilization loans to prevent the further deployment of crisis. For two months - November and December 2004 - about 4 billion (0,8 bln USD) in Ukrainian national currency hryvnya (UAH) were withdrawn from deposit accounts of the population or about 3% of banks' liabilities. But this crisis was quickly overcome, mainly due to strict measures of the central bank and a stable situation in the economic sphere.

However, the latest crisis, which confronted the banking system of Ukraine, was the most profound and destructive. Of course, it certainly linked to the global financial crisis. However, the initial reasons of its occurrence were different factors, and further effects of the global financial crisis were only imposed on the crisis in Ukraine.

2 Identification of the banking crisis

First note that the manifestation of the crisis in the banking system was tardy in Ukraine compared to Europe and USA. If in the U.S. crisis started in 2007 and in the early 2008 migrated to Europe, in Ukraine it was launched in October 2008. The migration of the crisis from the U.S. to Europe was quite obvious and expected due to the close links in the financial sector, the crisis in Ukraine has become an unexpected phenomenon, especially in the financial sector.

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Banking crises have their own special nature and extremely negative consequences, which is caused by the specific functioning of the banking sector. Thus, according to recent studies proved that the result of banking crises is the loss of up to 10% of annual GDP (Hoggarth, Reidhill, 2003). Nevertheless, the systematic study of these phenomena began from the 80th. Since early 90's IMF starts to pay attention to the crisis in the banking sector. In the 1998 appeared an official definition of a banking crisis as a situation where banking panic or run of deposits are observed, the inability of banks to convert liabilities in time and state intervention becomes widespread in the functioning of the banking sector.

According to A. Demirguc-Kunt and E. Detragiache in the same year an alternative definition of banking crisis was offered, which is based not only on qualitative but also quantitative characteristics, and therefore under the banking crisis is proposed to understand the situation in which at least one condition executed (Demirguc-Kunt, Detragiache, 1998):

- share of bad assets to total assets in the banking sector exceeds 10%;
- the costs of implementing measures to improve the situation in the banking sector amounted more than 2% of GDP;
- the result of problems in the banking sector was nationalization of a significant part of banks;
- the withdrawal of deposits, application of emergency actions by the regulation institutions and implementation of state deposit guarantee mechanisms.

According to this method of determining banking crises during 1980-1995 31 banking crisis took place, including 23 crises occurred in developing countries (India, Venezuela, Nepal, Indonesia and others), and 8 in developed countries (Italy, Sweden, Norway, Israel, USA and others).

Of course, if we use this approach, we can confirm that in 2008 in Ukraine was classic banking crisis. Thus, the volume of bad loans in the banking sector of Ukraine increased from 18,015 mln UAH on 01.01.2009 to 36,497 mln UAH on 01.06.2009. Accordingly the share of bad loans in the loan portfolio increased more than twice - from 2.27% to 4.89% for the six months.

In more than 20 banks from 176 operating in Ukraine were introduced not only the temporary administrations, but also the moratorium for creditors on different dates. Overall, the share of assets belong to banks with temporary administration in the general assets of the banking sector amounted to more than 9%. Respectively, the deposits share of these banks in total deposits of the banking sector exceeded 15%, which was extremely dangerous. In 2009, the Government of Ukraine decided to nationalize three of fifteen banks affected by the crisis. Government became the owner of 99.97% shares of JSC "Rodovid Bank", 99.94% shares of JSCB "Kyiv" and 84.21% shares of AB "UGB". In general, the assets share of these banks in the assets of the banking sector was 2.7%, respectively household deposits - 4.6%.

The bank run affected the banking sector in October-November 2008 extremely sharp - during this period were withdrawn about 33 bln UAH (circa 4 bln USD). As a result, NBU on 11.10.2008 decided to limit the transactions in amount achieved by each bank on the date of decision. The same concerned also loans in foreign currency counterparts, which have no foreign exchange earnings. In order to stop bank run banks have been entrusted the explanatory work with their clients. At the same time the media has reported that the central bank introduced a six-month moratorium on early withdrawal. The absence of such direct rules in the NBU regulations explained in way that due to the Civil Code investor has the right to take his deposit earlier.

Also due to the extremely difficult situation on the foreign exchange market was determined maximum spread between the buying and selling rate of foreign currency in amount of 5%.

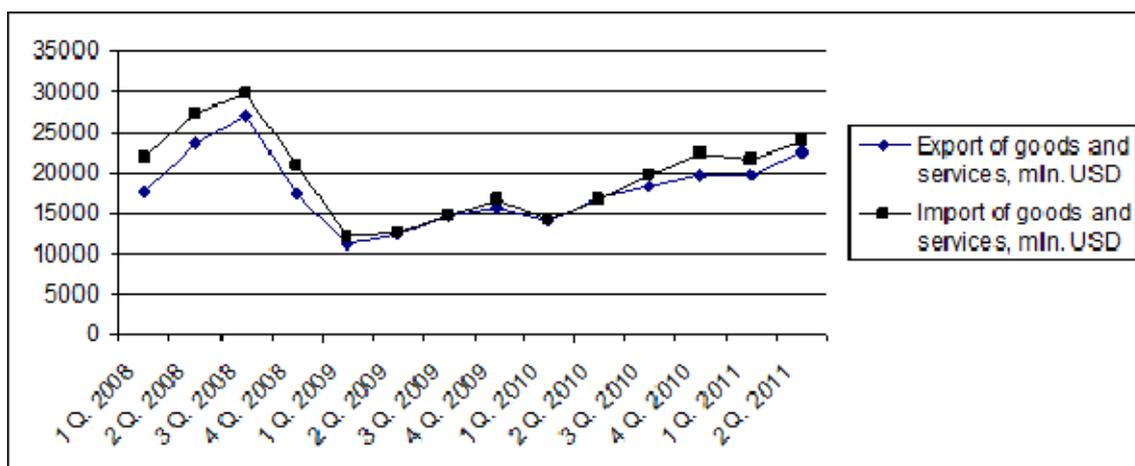
NBU initiated the increase of deposits compensation amount from 50 thousand to 150 thousand UAH (circa 18750 USD) in case to stop the bank run. Previously was considered that it is necessary to increase this sum up to 200 thousand UAH. This was affirmed by relevant changes from 31.10.2008 to the Law of Ukraine "About Individuals Deposit Guarantee Fund". This amount is sufficient to return the deposits of more than 90% of depositors. Despite these actions, in January - May banks deposit portfolio declined by 12.5% or 44,684.5 mln UAH, including individuals' deposits by 10.1% or 21,716.5 mln UAH. Of course, statistics show stabilization in the banking sector, but it doesn't indicate the restoration of confidence in it. However, the above method of determining the banking crises has certain disadvantages, particularly in the part that has the hereditary effect, rather than preventive. The crisis is identified after period when this fact becomes obvious. Besides, the cause of the crisis still isn't revealed.

3 The causes of the banking crisis in Ukraine

From our point of view, the main factors of the banking crisis in Ukraine are following:

- reduction in exports and, consequently, the loss of a significant proportion of foreign exchange and the presence of a constant tendency excess of imports over exports;

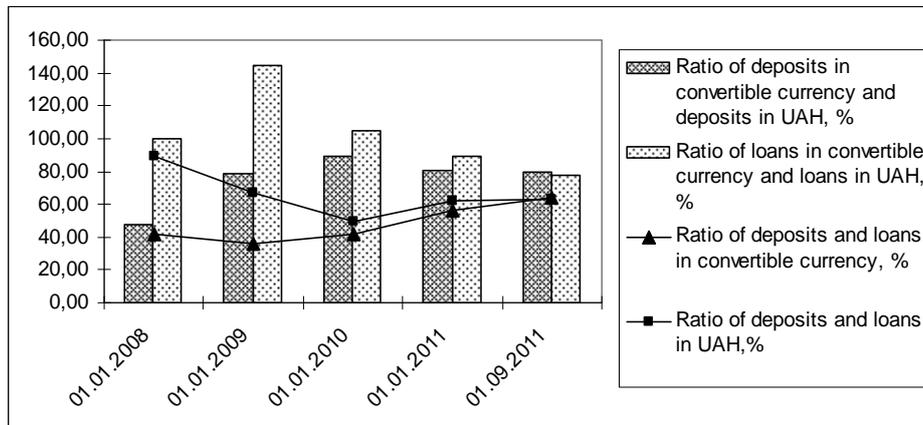
Fig. 1: Dynamics of exports and imports of goods and services (1. 4. 2008 - 2. 4. 2011)



Source: National Bank of Ukraine, authorial calculation

- significant loans portfolios in foreign currencies of domestic banks. Thus, it is clear from fig. 2 that people today do not trust the national currency, because of proportion between amount of deposits in hard currency and in UAH increased after the crisis by 2 times and today nearly 44% of all deposits denominated in hard currency. The same situation is observed in loans. This is especially obviously on 01.01.2009. Further the ratio reduction of loans in hard currency and in UAH is due to direct prohibition of NBU to lend in foreign currency. Our conclusions of lack of the trust in the Ukrainian national currency also confirmed by the fact of coverage ratio decreasing of loans in UAH by deposits in UAH and, vice versa, increasing the coverage ratio of foreign currency loans by foreign currency deposits (fig.2).

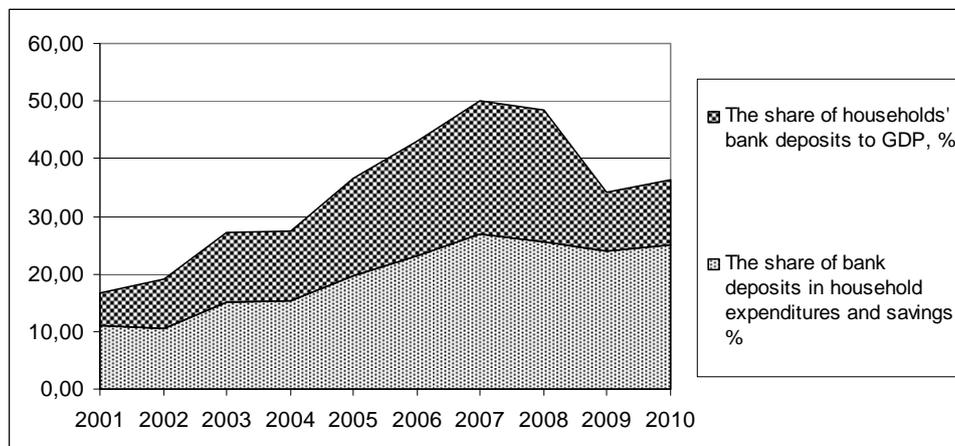
Fig. 2: Dynamics of ratios of deposits and loans in UAH and in hard currencies in January 1. 2008 – September 1. 2011



Source: National Bank of Ukraine, authorial calculation

- the presence of panic among depositors. In 2008, the panic of depositors became more threatening, and the withdrawals volume of population from the accounts (again during two months) in amount 33 bln UAH, which is higher by 8 times than in 2004, but the share of liabilities amounted only 4%. Although it should be said that households quickly returned to save their money in the banks (fig. 3).

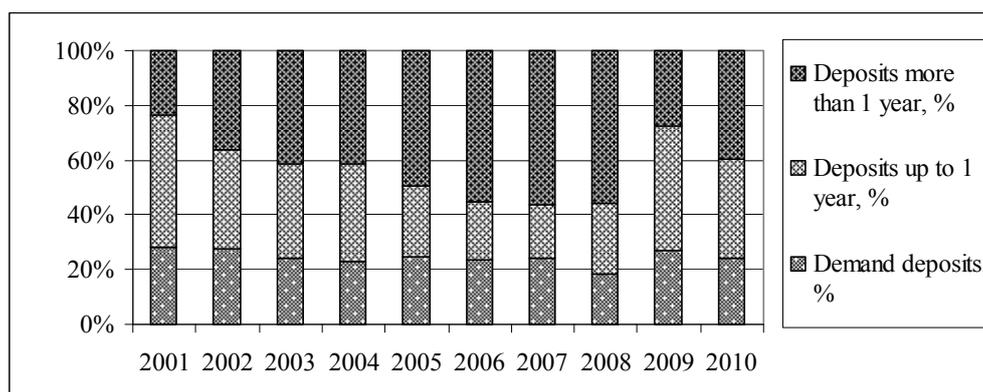
Fig. 3: Dynamics of the share of households' bank deposits to GDP and the share of bank deposits in household expenditures and savings in 2001 – 2010



Source: National Bank of Ukraine, authorial calculation

If we analyze the structure of households' bank deposits by maturity during 2001 - 2010 it is apparent tendency of population to long-term investments in banks in the pre-crisis period (fig. 4). If demand deposits approximately are the same level and the average, their share does not exceed 25%, than the deposits with a maturity over 1 year are constantly gaining new positions and their share of the overviewed period increased to 55.73% in 2008. However, the crisis made their adjustments and the share of deposits over 1 year was 27% in 2009 and in 2010 - 40%.

Fig. 4: The structure of households' bank deposits by maturity in 2001 – 2010



Source: National Bank of Ukraine, authorial calculation

Of course, the NBU has supported the banks very actively during the crisis, but the banking system was unprepared for the events that unfolded in the future in economy.

Firstly, there was a massive reduction of workers and, consequently, loosing of usual income. Undoubtedly, this has impact on reducing demand in the economy. As a result, companies could not sell products in their usual volumes which did the crisis deeper. However, for banks it was a terrible factor, because it was situation of overall default for loans. The share of problem loans immediately increased in the banks. The banks were not prepared for the course of events and started acting illogical. Firstly, understanding and aware of the problematic situation, banks began to raise interest rates on loans even to solvent borrowers. This was done for compensating losses by loans that have been problematic. As a result, solvent borrowers in a reduction of wages also became insolvent. In other words, the banks translated all the problems, including their own, to borrowers. Secondly, the volume of NPLs was significant for the banks, but they had no any experience of management of bad debts. As a result, most banks availed the services of collectors, also has spread methods of hard collection. If in the short term for banks such measures had a positive effect, in the long term - negative effect. As a result, households are not ready to take new loans today, because they are fear the repeat of the situation. The general economic situation is not conducive to the restoration of credit.

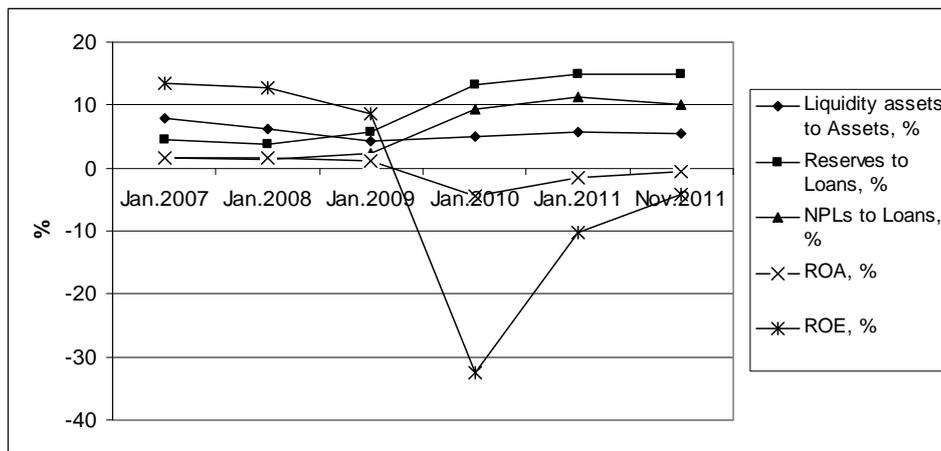
4 The efficiency of the banking activity during the crisis and the post-crisis time

Although that 80% of bank assets were loans, today we have extremely negative situation about the quality of loan portfolio and in accordance with the profitability of banks (fig. 5).

At first view it seems that the situation is improving: the volume of problem loans is reducing, ROA and ROE are increasing, but today it's impossible to speak about restoring of stability in the banking system, but on the contrary, the situation is dramatically worsens. There are two factors that tend over the banking system: the devaluation of national currency and the insufficient liquidity.

NBU is trying to stabilize the situation in the monetary area by all possible methods, including the introduction of requirements for foreign exchange transactions entirely through banks and in the presence of documents which is identifying a person to execute foreign exchange transactions. In fact, this step resulted in reducing of the demand for currency by households. Also due to the emergence of reports about problems in the European Union and information on the possible elimination of the euro the demand for euro is reducing.

Fig. 5: Dynamics of basic indicators of banks' activities in 1. 1. 2007 – 1. 11. 2011



Source: National Bank of Ukraine, authorial calculation

The lack of banks' liquidity is also extremely dangerous, especially in the context of devaluation and inflation expectations. The main factor, in this case, is the behaviour of households. If the regular depositors panic took place, crisis weakened banks could not meet its obligations.

The major question is doubtful: how to prevent these two factors? The single answer does not exist. Stabilization in the monetary area is possible only if the export activities of Ukrainian producers will intensified, and the country has enough foreign currency. On the other hand, the devaluation of national currency will have a positive effect on export growth and a negative effect on imports volume. Although the official currency in which payments are made in the country is UAH won't cause serious collapse of the banking system, especially in the context of an existing ban on foreign currency loans.

The stabilization in the area of the bank liquidity's increasing is difficult to implement, because it is not only a problem of resources, especially long-term, but also of their placement. From the perspective of the resources formation, it's impossible to talk about an additional infusion of funds from NBU today, because in the result we will have high inflation. Also the access for banks to international financial markets closed, also because of the uncertainty in the country. From the perspective of asset allocation, there are such problems: insufficient number of high-quality borrowers, the lack of active stock market. And all these problems are not generated by the banking system but by the state economy.

5 Conclusions

The influence of global financial crisis has been more destructive to Ukrainian banking system than influence of previous crises. The crisis was identified in accordance with methodology proposed by Demirguk-Kunt, Detragiache (1998): the volume of NPLs doubled for the first half crisis year and exceeded 10% of the loan portfolio; bank run resulting in extraction of more than 10% of the public deposits in the short term; government expenditures on recapitalization of troubled banks and also their credit backing. The main causes of the crisis in the banking system of Ukraine were the decline of the exports and a loss of significant part of foreign exchange earnings, which had negative impact on economy in Ukraine; significant portfolios of loans and deposits in foreign currencies considering that main payment currency is hryvnya and earnings of majority of economic agents are denominated in national currency; lost trust to banking system. The current situation of Ukrainian banking system could be reflected using such indicators as ROE, ROA, Reserves to Loans, NPLs to Loans. However, dynamic analysis of the above – mentioned indicators do not demonstrate stabilization. Thus, ROE and ROA remain below zero level. NPLs to Loans remains stable high – more than 10%; and Reserves to Loans is

constantly increasing considering that lending has been almost stopped. Today, the lack of liquidity and threat of further national currency devaluation have become the major threats for Ukrainian banks.

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Is Today the Post-Crisis Time for the Banking System of Ukraine?

Summary

This paper has examined the features of the functioning of the Ukrainian banks during the time of the global financial crisis and the post-crisis time. The main causes of the crisis in the banking system of Ukraine were the decline of the exports and a loss of significant part of foreign exchange earnings, significant portfolios of loans in foreign currencies, bank runs. The deepening of the crisis was caused by the increase of the NPLs part more than 10% of the loan portfolio. Today, the banking system of Ukraine is still in a difficult position, but the main problems are the devaluation of national currency and the lack of liquidity.

Key words: Banking; Financial Crisis; Banking Crisis; Ukrainian banking system.

JEL classification: G21.

The Influence of Corporate Governance and Ownership Structure Attributes on Performance Following the Revised Code on Corporate Governance in Malaysia

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1 Introduction

Research examining the influence of corporate governance and ownership structure patterns on corporate performance is extensive in the Accounting and Finance literatures (e.g., Conyon and Peck, 1998; Eisenberg et al., 1998; Claessens and Djankov, 1999; Dehaene et al., 2001; Demsetz and Villalonga, 2001; Sun et al., 2002; Joh, 2003; Leng, 2004; Baek et al., 2004; Chen et al., 2005; Mak and Kusnadi, 2005; Maury, 2006; Ang and Ding, 2006; Mohd Ghazali, 2010). These two dimensions (governance and ownership structure) which demonstrate how companies are governed and owned arguably affect corporate performance (Conyon and Peck, 1998). However, in Malaysia, ownership is highly concentrated (Claessens et al., 2000) and poor corporate governance mechanisms were partly blamed for the Asian financial turmoil (Leng, 2004). Since the 1997 Asian financial crisis, most Asian countries including Malaysia adopted corporate governance mechanisms to mainly restore the confidence of the investors in the economy. Malaysia, for instance, restructured its corporate governance code in 2001 and again very recently in the year 2007. Despite the reformations on the code of corporate governance in its betterment, there are still some criticisms over the effectiveness of the corporate governance practices in Malaysia (Meng, 2009). Similarly, corporate ownership in Malaysia continues to be in the hands of few individuals, usually family members and their close friends (Claessens et al., 2000; Mohd Ghazali, 2010).

The empirical studies agree to disagree the association between corporate governance (e.g., Conyon and Peck, 1998; Dehaene et al., 2001) and/or ownership structure aspects (Chen et al., 2005; Maury, 2006) and corporate performance. This could partly be due to the different governance structures, cultures, and time frames investigated by prior studies. This study examines factors influencing corporate performance of Malaysian public listed companies after the revised code of governance in 2007 and also soon after the recent global financial crisis. In this study, factors influencing the corporate performance is categorised into corporate governance and ownership structure patterns as well as company specific variables. Prior studies had called for the examination of the influence of corporate governance factors on corporate performance in a period not too close to the implementation of the corporate governance guidelines in Malaysia (Mohd Ghazali, 2010). Hence, the present study is motivated to examine the impact of governance and ownership structure variables on firm value by analysing nine years after the implementation of the code and two years after the revision of the governance code in Malaysia.

In addition, a handful of prior studies had looked into how corporate ownership and governance dimensions affect corporate performance before and during the 1997 Asian financial crisis (Joh, 2003; Baek et al., 2004). It is believed that corporate governance systems (and to some extent ownership structure) affect firm performance during a financial crisis period of time (Mitton,

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2002). This view had been empirically validated by prior studies that showed companies with specific ownership and governance structures suffered less during the 1997 Asian crisis (Baek et al., 2004). The present aims to provide answers to the following research question:

RQ: *What corporate governance and ownership structure variables influence the corporate performance of companies in Malaysia?*

The empirical results of the study show that one corporate governance variable namely number of board meetings significantly and negatively associated with corporate performance of the sample companies. Two control variables namely company size and leverage also significantly related to corporate performance. Reduced regression model indicates that the number of board meetings remains to be significant whilst government ownership is statistically significant. Leverage (gearing) also holds to be significant factor influencing the firm performance of companies in Malaysia.

The contributions of the study are two fold. First, given the insignificance of the outside directors and board size, the results of the study seem to suggest that corporate governance attributes in Malaysia even after the revised code are not still effective in aiding the performance of Malaysian listed companies. This could be due to the inapplicability of the code to the Malaysian business environment as the corporate governance code had been adopted from other cultural environments (Mohd Ghazali, 2010). Hence, the regulatory authorities may want to reconsider further amendments on the code of corporate governance. Secondly, the results suggest that the recent global financial crisis did not alert the board of directors of the Malaysian companies in discharging their duties effectively.

The remainder of the study is organised as follows. The next section reviews relevant literature and develops the hypotheses of the study. The third section discusses the methodology of the study while section four presents the results of the study. Finally, section five provides some concluding remarks.

2 Literature and hypotheses development

2.1 Corporate governance and corporate performance

The current study examines four aspects of corporate governance mechanisms namely, family members on the board, independent non-executive directors, board size, and number of board meetings. Family members on corporate boards is considered as a tradition of business in Malaysia (Mohd Ghazali and Weetman, 2006) while the latter three governance variables are recommended ones in the Malaysian code of corporate governance (MCCG). Public listed companies in Malaysia must disclose in their annual reports the proportion of independent directors in the board, the number of board size, and the number of board meetings held during the year.

2.1.1 Family members on the Board

It is a mandatory requirement for public listed companies in Malaysia to disclose the family relationship among the directors sitting in the board and any family relationship between the directors and the major shareholders of the firm. Claessens et al. (2000) reported that 67.2% of 238 Malaysian sample companies are family owned while Mohd Ghazali and Weetman (2006) found that family members on corporate boards reach as high as 73% in Malaysia. Despite the high family ownership and the crowdedness of family members in the board in the Malaysian environment, it seems that little is known on the association between family members in the board and corporate performance. However, studies conducted in the U.S. found that family controlled firms outperform than non-family controlled companies (Anderson and Reeb, 2003; Villalonga and Amit, 2004). The general theoretical understanding is that family business reduces the agency-principal conflict between the management and the shareholders (Maury,

2006). Thus, the lesser organizational conflict could perhaps contribute to corporate performance.

Companies listed in Malaysia are highly governed by family members. Hence, to that end, it could be expected that such companies would perform better financially. However, the revised code of governance in the year 2007 might have encouraged Malaysian companies to induce to their board of member professional outsiders who could enhance better corporate practices.

We are not aware of a prior study that empirically examined the influence of family members in the board to corporate performance. Hence, due to the absence of a prior study on the association between family members and corporate performance, the study formulates the following null hypotheses:

H1: There is no significant relationship between family members and corporate performance of companies in Malaysia.

2.1.2 Independent Non-executive Directors (INDs)

Listed Malaysian companies' board of directors must have INDs making up at least one-third of the board and firms must also disclose the one-third requirement in their annual reports. Independent directors represent the interests of minor shareholders and their presence is required to monitor and control the actions of executive directors (Jensen and Meckling, 1976). Fama and Jensen (1983) also contest that more outside directors might lead to better inside control and corporate governance structures. The central notion is that the outside directors are meant to serve as a check-and-balance of the managing executive directors and outside minority shareholders. Should INDs perform their "monitoring role" effectively rather than their "perceived monitoring role", then the performance of the firm is assumed to increase.

Ample empirical studies had been conducted to associate corporate performance with INDs (Coles et al., 2001; Dehaene et al., 2001; Chin et al., 2004; Chen et al., 2005; Leng, 2004; Mohd Ghazali, 2010; Kim and Lim, 2010). Significant positive association was documented by Dehaene et al. (2001) and Kim and Lim (2010). In the Malaysian environment, Leng (2004) and Mohd Ghazali (2010) both found no association between corporate performance and INDs. There have been eyebrows raised over the real independency of the outside directors in the Malaysian context (Mohd Ghazali and Weetman, 2006; Meng, 2009). The revised code on governance in 2007 might have improved the corporate governance practices in Malaysia. Hence, the current study aims to examine the relation between outside directors of Malaysian companies and firm performance following the revised code in 2007 as well as post the financial crisis. The outside directors of the Malaysian companies are expected to strive for the accountability in discharging their corporate activities following the financial crisis. The revised code coupled with the crisis may push the outside directors to discharge their duties effectively. Hence, the above theoretical and empirical discussion leads the development of the following hypotheses:

H2: There is a significant positive relationship between INDs and corporate performance of in Malaysia.

2.1.3 Board Size

Small board size is advocated in corporate governance in bettering the performance of companies (Jensen, 1993). Larger board size is generally believed to be ineffective in coordination; communication and quick decision making by being dispersed in opinions and non-cohesive in decision making (Lipton and Lorsch, 1992; Jensen, 1993). Lipton and Lorsch, (1992) contends that larger board size is easier for the executive directors to control. It is also claimed that larger board size reduces efficiency due to the increased difficulty in achieving agreement on decisions (Chiang, 2005). On the other hand, larger board size could lead to better

firm performance because of the divergent skills, knowledge, and expertise brought into the table of discussion (Mohd Ghazali, 2010). Similarly, Chiang (2005) views that ‘decision-making precision’ is less if the number of directors are small because issues might not be teased out adequately. Due to perhaps these conflicting viewpoints, the revised code on corporate governance in Malaysia in 2007 did not recommend any preferable size for board of directors of Malaysian listed companies. However, the revised code recommends that “every board should examine its size, with a view to determining the impact of the number upon its effectiveness” (MCCG, 2007, p. 12).

Despite the opposing theoretical arguments, most prior empirical studies seem to have pointed the finger to the same direction and documented negative relationship in associating board size and corporate performance (Yermack, 1996; Conyon and Peck, 1998; Eisenberg et al., 1998; Liang and Li, 1999; O’Connell and Cramer, 2010). Mak and Kusnadi (2005) also found negative association between board and corporate performance in a sample of Malaysian and Singaporean firms. However, Mohd Ghazali (2010) did not find any association between board and corporate performance in the Malaysian environment. Nevertheless, the study of Coles et al. (2008) observes that larger and complex companies’ firm performance is associated positively with larger board size but smaller and less complex companies’ firm performance is negatively related with board size. Because most prior studies documented negative relationship between board size and firm performance, the current study expects that the board size would inversely relate to corporate performance in Malaysia. Hence, the following alternative hypothesis is formulated:

H3: There is negative relationship between board size and corporate performance of companies in Malaysia.

2.1.4 Board Meetings

Frequent board meetings may indicate well-functioning and active board members (Khanchei, 2007). Board of directors that frequently hold meetings could lead to a quick recovery from poor corporate performance (Vafeas, 1999). However, there are also costs associated with frequent board meetings such as keeping busy with executive members that would have involved other corporate activities. Increased board meetings could also suggest that there is a danger to the company’s performance. Hence, frequent board meetings could indicate that the company did not perform well during a particular period of time, thus, additional board meetings might have been held to seek for solutions for the deteriorating performance of a company. To date, we are not aware of any empirical study that examined board meetings against the corporate performance. Hence, the absence of a prior study leads the study to develop the following null hypotheses:

H4: There is no significant association between board meetings and corporate performance of companies in Malaysia.

2.2 Ownership Structure and Corporate Performance

This study in addition to governance attributes captures two ownership structure patterns namely, director ownership and government ownership. Malaysian business environment is characterised by owner-managed entities where directors hold substantial shares of corporate ownership. Similarly, a notable proportion of corporate ownership is in the hands of the Malaysian governmental bodies (see, Claessens et al., 2000; Mohd Ghazali, 2010). Hence, since these variables are known features of corporate ownership in the Malaysian environment, the current study considers them in examining the ownership patterns that determine corporate performance.

2.2.1 Director Ownership

Director ownership is the percentage of shares owned by executive directors (Eng and Mak, 2003). Jensen and Meckling (1976) claimed that higher managerial ownership leads to lower agency problem. It is perhaps for this reason that managers that own substantial corporate shares have additional incentives to maximize firm value (Mohd Ghazali, 2010). The conventional agency theory posits that the higher the managerial ownership, the better the corporate performance. However, Jensen and Ruback (1983) disagree and argue that the higher the managerial ownership, there is higher possibility that these managerial owners act conservatively in making corporate decisions in an endeavour to secure their managerial positions. Several prior studies empirically tested the theoretical understandings of agency theory in relation to director ownership and firm performance (Daily and Dalton, 2004; Chiang, 2005; Mak and Kusnadi, 2005; Mohd Ghazali, 2010). Daily and Dalton (2004) found positive association between director ownership and corporate performance consistent with the agency theory rationale. However, Chiang (2005) documented negative relationship between managerial ownership and corporate performance. In the Malaysian context, both Mak and Kusnadi (2005) and Mohd Ghazali (2010) reported no correlation between director ownership and corporate performance. The revised code on corporate governance in 2007 may encourage owner-managed companies in Malaysia to be alert in ensuring better governance practices which could reflect better corporate performance of those companies. Mixed results of prior studies make it difficult to form a prediction in formulating the following null hypotheses:

H5: There is no significant relationship between director ownership and corporate performance of companies in Malaysia

2.2.2 Government Ownership

Government ownership is observed as another significant feature in studies that look at corporate ownership in Malaysia (Claessens et al., 2000; Mohd Ghazali, 2010). There are two theoretical understandings of government ownership in relation to corporate performance. For one, companies where government is a substantial shareholder may perform poorly compared to purely privatised entities. Sun et al. (2002, p. 1) explains this is due to the “government's lack of transferable residual claims, government's choice of social and political policy goals over profit maximization, the government's employment of staff based on political connections rather than ability to perform, or the greater information asymmetries and higher transaction costs in the government”. Consistent with the above argument, Bai et al. (2004) found negative association between government ownership and firm performance. In contrast, Ang and Ding (2006) reported that government linked companies had higher valuations and also better corporate governance practices than a control group of purely privatised entities in Singapore. Similarly, Sun et al. (2002) empirically documented that government ownership and firm performance are positively related in China. This positive relationship between government ownership and firm performance in China also remained whether government ownership is represented by state share ownership or by legal person share ownership. In Malaysia, Mohd Ghazali (2010) documented significant positive relation between government ownership and corporate performance. The present study expects that the government ownership element in Malaysia would positively relate to corporate performance of the sample companies. Hence, the current study formulates the following alternative hypotheses:

H6: There is significant positive association between government ownership and corporate performance of companies in Malaysia.

2.3 Control variable (company characteristics)

The present study controls two company characteristics variables namely, company size and leverage consistent with prior studies (Sun et al., 2002; Ang and Ding, 2006). Larger companies

have been associated significantly and positively with corporate performance (Leng, 2004) but also see Mohd Ghazali (2010) for negative association. Hence, this study expects that there is a significant positive association between company and corporate performance. On other hand, more profitable companies might be reluctant to seek additional debts as there is less need of additional resources. Thus, it is expected that there is negative association between leverage and corporate performance of companies in Malaysia.

3 Research method

The sample of the present study was selected using systematic stratified random sampling whereby the population is divided into non-overlapping sub-populations. This sampling method is used in order to have a representative sample across the sectors listed in Bursa Malaysia. Bursa Malaysia classified listed companies under nine categories viz, plantation, mining, property, consumer products, industrial products, construction, trading/services, technology, and finance. To be consistent with previous studies (e.g., Mak and Kusnadi, 2005; Mohd Ghazali, 2010), companies in the finance sector were excluded from the target population. The initial sample which was the result of a two-rounding sample process consisted of 100 companies. After excluding missing data, the final sample consists of 85 listed companies on Bursa Malaysia in the year 2009. This sample represented 11% of the entire population listed on Bursa Malaysia and at least 10% of each sector.

The year 2009 was chosen because it represents soon after companies experienced but recovered from the recent global financial crisis. The year 2009 also represents two years after the revised code on corporate governance in the Malaysian environment. Thus, it is sensible to investigate whether the revised code on governance in 2007 aided the betterment of corporate performance in Malaysia (Mohd Ghazali, 2010). The corporate annual reports of the selected companies were downloaded from the individual websites of the sample companies.

3.1 Measurement of Dependent and Independent Variables

Corporate performance is measured using return on assets (ROA) and return on equity (ROE). This is consistent with prior studies that considered different measures of profitability (Joh, 2003). ROA is derived from net income to total assets of the companies whereas ROE is calculated as net income to total equity. As discussed in the hypotheses development section, the study also examines eight independent variables. The measurement and operationalization of the independent as well as dependent variables is detailed in table I.

3.2 Regression Model

In determining the relationship between corporate governance, ownership structure, and company characteristics, the following multiple regression model was developed:

$$\text{ROA / ROE} = \beta_0 + \beta_1\text{FMB} + \beta_2\text{INDs} + \beta_3\text{BoDSize} + \beta_4\text{BMeetings} + \beta_5\text{DirOwn} + \beta_6\text{GovSub} + \beta_7\text{Size} + \beta_8\text{Lev} + e \quad (1)$$

Tab. 1: Research Variables, Operationalization, measurements, and data sources

Variable Name	Variable Acronym	Variable Type	Operationalization	Data Sources
Return on Assets	ROA	Dependent	Net income to total assets	Annual Reports
Return on Equity	ROE	Dependent	Net income to total equity	Annual Reports

Variable Name	Variable Acronym	Variable Type	Operationalization	Data Sources
Family Member of the board	FMB	Independent	Proportion of family members on the board to total directors	
Independent Non-Executive Directors	INDs	Independent	Proportion of independent non-executive directors to total number of directors	Annual Reports
Board Size	BSize	Independent	Number of directors on the board	Annual Reports
Board Meetings	BMeetings	Independent	Number of board meetings held during the year	Annual Reports
Director Ownership	DirOwn	Independent	Proportion of shares held by executive and non-independent directors including their deemed interests to total number of shares issued	Annual Reports
Government Ownership	GovSub	Independent	1 if the government is a substantial shareholder, 0 other wise	Annual Reports
Company Size	Size	Independent	Total Sales	Annual Reports
Leverage	Lev	Independent	Debt ratio	Annual Reports

4 Findings and analysis

4.1 Descriptive statistics

Table 2A presents descriptive statistics on both the continuous dependent and independent variables of the study. The corporate performance of the companies measured as ROA (1.97%) and ROE (2.25%) indicate that the average performance of Malaysian companies is low. This could be due to the influence of the recent global financial crisis which hit the financial aspect of companies in Malaysia. Turning to the independent variables, family members on corporate boards is as high as 75% with an average figure of 22.61%. This is inline with prior claims that the family dominance on corporate boards is a traditional feature of the Malaysian corporate environment. Despite the mandatory requirement of the MCGG that the public listed companies in Malaysia must have INDs comprising at least one-third of the board membership, the results show that (28.57%) some companies do not comply the mandatory requirement even after the revised code in 2007. This is inline with recent prior studies that found listed companies in Malaysia do not apply the one-third INDs requirement (Said et al., 2009). The average board members of the companies are 7.84, which is similar to the number advocated by Jensen (1993). Board meetings range from 2 to 27 with a mean score of 5.71. Only one company had the 27 board meetings reported in this study. With regards to ownership structure variables, director ownership is as high as 74.72% of corporate ownership with a mean figure of 29%. The high

ownership percentage of directors is a further indication that a significant number of companies in Malaysia are owner-managed companies. This finding is similar to the 71.71% reported by Mohd Ghazali (2010) in Malaysia. Table 2B provides categorical descriptive analysis of government ownership. The results indicate that 27.1% of the sample companies have the government as a substantial shareholder. This figure is less than the figure reported by Mohd Ghazali (2010) (64%) but higher than the figure documented by Claessens et al. (2000) (13.4%).

Tab. 2: Descriptive Statistics of Continuous Independent Variables (Untransformed) and Descriptive Statistics of Categorical Independent Variable (Untransformed)

Variables	N	Min	Max	Mean	Std. Deviation	Skewness	Kurtosis
ROA	85	-0.2625	0.1704	0.0197	0.0761	-1.109	2.513
ROE	85	-1.1432	0.6596	0.0225	0.1939	-2.727	16.576
Family mem. board	85	0.0000	0.7500	0.2261	0.1991	.207	-1.142
INDs	85	0.2857	0.7500	0.4496	0.1122	.810	-.103
Board size	85	5.0	14.0	7.84	2.0693	1.010	.794
Board meetings	85	2.0	27.0	5.71	2.9513	4.885	32.564
Dir Own	85	0.0000	0.7472	0.29	0.2166	-.017	-1.086
Size	85	7366000	15783466000	1020138121	2663632828	4.486	20.650
Leverage	85	0.0241	0.9123	0.4174	0.2065	.231	-.454

		Frequency	Percentage
Government Shareholding			
Government is a Substantial Shareholder	1	23	27.1
Government is NOT a Substantial Shareholder	0	62	72.9

4.2 Multivariate regression results

Before multiple regression analyses are conducted, it is a prerequisite to check normality and multicollinearity concerns of the dependent and among the independent variables. The descriptive analyses indicate that the dependent and some of the continuous independent variables are not normally distributed as shown by their 'skewness and kurtosis' values (tabulated in Table 2B above). Hence, consistent with the approach suggested by Cooke (1998), both the dependent and independent variables were transformed to normal scores. Such transformation would distribute the variables to their normal scores, and hence, the statistical analyses would be more meaningful. Company size measured as total sales has been transformed by its natural log consistent with (Joh, 2003). The study also checked multicollinearity among the independent variables using Person correlations. The results, which to economise the space are not reported, indicate that there is no multicollinearity among the independent variables to even the most stringent cut-off figure of 0.7. Variance Inflation Factor (VIF) and tolerance values further indicate (as reported in the regression models below) that there is no multicollinearity concerns in the present study.

Tab. 3: Multiple Regression Results Using ROA – Full Mode

Variables	Beta	t-value	Significance	Tolerance	VIF
Constant		-3.858	0.000		
Family M. Board	0.072	0.637	0.526	0.635	1.574
INDs	-0.092	-0.862	0.391	0.719	1.391
Board Size	-0.044	-0.437	0.663	0.795	1.257
Board Meetings	-0.241	-2.433	0.017**	0.833	1.200
Dir Own	-0.080	-0.733	0.466	0.689	1.452
GovSub	0.130	1.258	0.212	0.765	1.307
Size	0.400	3.758	0.000**	0.720	1.388
Gearing	-0.497	-5.041	0.000**	0.838	1.193
Adjusted R²			31.5	* Significant at 10% level.	
F Statistic			5.821	** Significant at 5% level.	
Significance			0.000	***Significant at 1% level.	

Table 3 above provides the results of multiple regression analyses. The results show an Adjusted R² of 31.5% and the model is statistically significant at 0.000. The explanatory power of the present study captures about 32% of the variation in the firm profitability and suggests that the extent to which the current set of independent variables can explain the dependent variable. The results show that one corporate governance variable namely, board meetings is statistically significant and negatively associates at the 5% levels with corporate performance. The negative relation between corporate performance and board meetings seems to imply that frequent board meetings is an indication of poor performance and the increase in board meetings could be a strategy to seek to a quick recovery from poor corporate performance (Vafeas, 1999). The two control variables namely, company size and leverage are also statistically significant at the 1% significance level in determining the corporate performance of the sample companies (Leng, 2004). Consistent with the expectation, company size positively relates to corporate performance whilst leverage negatively associates with firm value. The results show none of the ownership structure variables is statistically significant in determining corporate performance. This is ironic given the significance of director and governmental ownership in the Malaysian business environment.

Tab. 4: Multiple Regression Results Using ROA – Reduced Model

Variables	Beta	t-value	Significance	Tolerance	VIF
Constant		-1.351	0.181		
Family M. Board	0.112	0.925	0.358	0.645	1.550
INDs	-0.045	-0.429	0.669	0.848	1.179
Board Meetings	-0.180	-1.740	0.086*	0.878	1.139
Dir Own	-0.115	-0.988	0.326	0.694	1.441
GovSub	0.260	2.482	0.015**	0.861	1.161
Gearing	-0.407	-3.954	0.000***	0.892	1.122
Adjusted R²			20.7	* Significant at 10% level.	
F Statistic			4.652	** Significant at 5% level.	
Significance			0.000	***Significant at 1% level.	

To tackle with the above scenario, a reduced regression model (excluding board size and company size) has been run. The reduced regression model presented in Table 4 below incorporates six independent variables. The results show an Adjusted R² of 20.7% and the

model is statistically significant at 0.000. In the reduced regression model, board meetings holds its negative association but now is marginally significant at the 10% significance levels in determining corporate performance. However, government ownership which represents ownership structure variables becomes statistically significant at the 5% significance levels in determining corporate performance. This is consistent with prior studies in Malaysia (Mohd Ghazali, 2010). Leverage, as the sole control variable in the reduced regression, remains to be statistically significant and negatively correlates with firm performance at the 1% significant level (Leng, 2004).

4.3 Additional robustness tests

Using ROE as a dependent variable, multiple regression analyses were conducted to find out if different measures of corporate performance are determined by the independent variables under study. The first regression model was run using the full set of independent variables as mentioned above. The results, not tabulated, show that the Adjusted R² of the full regression model is 16.9% (lower than the equivalent model when ROA was used, 31.5%). However, similar to the above regression model, when ROE was regressed against the full set of independent variables, board meetings (5% levels), company size (1% level), and leverage (5% levels) were statistically significant with the same directions. When the regression model was reduced to six independent variables, only government ownership is positive and statistically significant at the 5% significance levels. The additional robustness results which report the ROE as dependent variable seems to suggest that the overall results are almost the same irrespective of the dependent variable used.

5 Conclusions

The objective of the present study was to investigate factors influencing corporate performance of Malaysian public listed companies soon after the recent global financial crisis. In line with prior studies, factors influencing the corporate performance were categorised as corporate governance attributes, ownership structure patterns, and firm-specific characteristics (Joh, 2003; Baek et al., 2004; Mohd Ghazali, 2010). Despite the abundant studies that gauged corporate performance determinants in the past, little is known on the factors that influence the financial performance of Malaysian companies post the financial crisis. Hence, the current study strived to contribute to the body of literature by examining the governance and ownership attributes in the Malaysian context. Based on examination of 85 non-finance companies in the year 2009, the descriptive results indicate that family members on the board and director ownership are still significant features of companies in Malaysia consistent with prior studies (e.g., Mohd Ghazali, 2010). Using ROA as dependent variable, the multiple regression analyses revealed that board meetings, company size, and leverage are statistically significant determinants of the corporate performance of Malaysian companies. Board meetings and leverage negatively associated whilst company size positively related to corporate performance. Reduced regression model using the same dependent variable shows that government as a substantial shareholder is statistically significant in determining corporate performance.

The study also measured ROE as a dependent variable in an attempt to see if different measures of corporate performance are robust to the findings of the study. The full regression model using ROE shows similar results when ROA was regressed against the independent variables, that is, number of board meetings, company size, and leverage were significant determinants of corporate performance. The reduced model using ROE, however, shows that only government as a substantial shareholder is statistically significant.

The results of the study have several implications. First, despite the significance of board meetings, other governance variables namely INDs and board size were not significant in all multiple regression models in explaining the corporate performance of Malaysian companies.

The fact that these variables are not significant even after the revised code in 2007 could further fuel prior claims that the corporate governance code in the Malaysian environment does not still suit the Malaysian corporate environment as the code has been originally adopted from other cultures (i.e., Hampel Report in the UK) (Mohd Ghazali, 2010). This could also suggest that the revision in 2007 may not have been as productive as it should. Thus, Malaysian authorities may want to reconsider the appropriateness or applicability of the governance code on the Malaysian business environment anew.

Notwithstanding the above implications of the study, the study is not without limitations. First, the study only examined a single year data in examining the determinants of corporate performance. Future studies may wish to examine the corporate performance of Malaysian companies in a longitudinal manner that is, incorporating years before and after the revised code. Such studies could provide a comparison between different time frames; hence, the results would be more meaningful. Secondly, future studies may also attempt to obtain data of several countries. This could help highlight the differences in corporate governance practices of the several countries, hence, benefiting other countries to strive governance improvement.

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The Influence of Corporate Governance and Ownership Structure Attributes on Performance Following the Revised Code on Corporate Governance in Malaysia

Summary

This paper examines the influence of corporate governance attributes and ownership structure patterns on corporate performance of Malaysian public listed companies (PLCs) following the revised code on corporate governance in the Malaysia. A sample of 85 companies was selected on the basis of a stratified random sampling procedure to allow a representative sample of the various sectors listed on Bursa Malaysia. Based on data extracted from 2009 annual reports, corporate performance was captured using accounting performance indicators (ROA and ROE). Multiple regression analysis was used to assess the influence of the governance and ownership structure attributes on firm performance. One corporate governance variable namely, number of board meetings was found to have a significant association with corporate performance of the sample companies. Two control variables viz, company size and leverage also significantly related to corporate performance. Reduced regression model indicates that the number of board meetings hold to be significant whilst government ownership becomes statistically significant.

Leverage (gearing) also remains to be significant factor influencing the firm performance of companies in Malaysia. Despite the significance of board meetings, other governance variables such as independent directors and board size were not significant in the multiple regression models. Hence, the results imply that the corporate governance restructuring did not have much impact on the firm performance of Malaysian listed firms. Most prior studies on the association between corporate governance and ownership structure and corporate performance predate the revised code on corporate governance in Malaysia. Thus, this study can be considered the first to have examined the association between these patters after the revised code.

Key words: Corporate performance; Corporate governance; Ownership structure; Annual reports; Malaysia.

JEL classification: G34.

CreditMetrics and the Czech Republic's Environment

*Petr Čermák**

1 Introduction

While providing services, financial institutions all around the world are exposed to different types of risk. According to Mejstřík, Pečená and Teplý, the classification used depends on sources of the underlying uncertainty. They divided risks a financial institution faces into two groups – financial risks and non-financial risks. Market risk, credit risk and liquidity risk are examples of financial risks. Operational risk, legal risk, taxes, political risk etc. represent non-financial risks.¹ The most important risk for a bank institution is credit risk, which represents 50-70% of all banking risks.²

This paper builds up on my master thesis written in 2010; we will deal with credit risk and its calculation for a hypothetical portfolio by using an optional model developed in the 1990s by J. P. Morgen, known as CreditMetrics, which uses the Value at Risk methodology to determine the risk of a portfolio using data provided by external rating agencies and publicly known data in the Czech business environment. Results will be compared with the approach proposed by the Bank for International Settlements, known as Basel accord.³

The goal of this paper is to again analyse the Czech market after two years which were strongly influenced by the debt crisis in Europe and slowdown of the world economy; to find out whether CreditMetrics is or is not a relevant method measuring credit risk. To confirm our hypothesis, a hypothetical portfolio containing Czech corporate bonds will be created. Last but not least, the paper will deal with the hypothesis whether this alternative model might be used in private companies to estimate credit risk of their customers in the Czech Republic.

Since the CreditMetrics model was introduced in 1997, several theoretical papers dealing with this approach have been written, in which the authors have compared it with other credit risks models based on the Value at Risk (VaR) approach, expanded the model and studied it using real data from different regions, countries, and different portfolios.

The best-known papers in which authors compared the CreditMetrics framework with other models were written by Michel Crouhy, Dan Galai and Robert Mark (2000), and Michael B. Gordy (2000). They described the main principles of models using not only comments, but also mathematical equations.⁴

Moreover, B. Gordy introduced a simplified model of CreditMetrics, in which he assumed only

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¹ Mejstřík, Pečená, Teplý (2008), p. 139.

² Mejstřík, Pečená, Teplý (2008), p. 141.

³ More information about Basel I accord can be found e.g. in Mejstřík, Pečená, Teplý (2008), Balin (2008), or in International Convergence of Capital Measurements and Capital Standards (July 1988, updated to April 1998). More information about Basel II can be found e.g. in International Convergence of Capital Measurements and Capital Standards. A Revised Framework (June 2006), or in Decree No. 123/2007 Coll., as amended by Decree No. 282/2008 Coll.

⁴ Another paper dealing with all VAR alternative models for credit risk was published by Alexis Derviz and Narcisa Kadlčáková (2001). They focused on data requirements and institutional pre-conditions for their implementation. Especially, they paid attention to models' application in the Czech Republic. In all of these papers, advantages, disadvantages, assumptions and examples of models are mentioned. A brief comparison is also made in a study written by Sayan Luangtrakulroong.

two credit states (default and non-default). The simplified CreditMetrics model was also used in works such as Marins and Saliby (2007), Finger (1999a) and Glasserman and Li (2005).

Several papers were written only on the CreditMetrics approach. Three of them were written by Christopher Finger. In the first paper⁵, he focused on three different techniques which can be used either to approximate, or directly compute the conditional portfolio distribution (Finger, 1999a). In this paper, Finger mentioned that “*Monte Carlo simulation is attractive for its flexibility*”⁶, but “*it suffers from relatively slow convergence*”⁷. Therefore, he wanted to find out other conditional approaches as alternatives to Monte Carlo simulation; he analysed the Law of Large Numbers method, Central limit theorem method⁸ and Moment Generating Function. The second paper by Christopher Finger deals with credit derivatives.⁹ Christopher Finger’s credit derivatives are represented by credit default swaps¹⁰ which are in a portfolio with bonds.

In most papers which studied the CreditMetrics framework using real data, companies which were publicly traded were used in the portfolio because of their publicly known ratings. These companies were rated by credit rating agencies, and it was believed that there were no mistakes. However, nowadays not all companies have ratings.¹¹ Therefore we have to use other tools to determine a company’s position on a market. For these companies (not rated companies), probably the most sensitive calibration problem in the CreditMetrics framework is the estimation of country and industry weights¹² and asset correlation. This specific problem was studied by Lutz Hahnenstein (2004).

Lastly, we will mention a paper written by Jaqueline Terra Moura Marins and Eduardo Saliby (2007), which focused on the simplified CreditMetrics framework using Monte Carlo simulation based on Glasserman and Li’s (2005) paper.¹³ They found out that “*importance sampling, in its standard shape or in association with Descriptive Sampling, has proved to be useful in obtaining more precise estimates than the ones that would be obtained in the traditional way*”¹⁴.

As we can see from the previously mentioned papers, there has been plenty of literature written on the CreditMetrics framework and credit risk. However, we do miss papers which would be case studies studying data sets from a single country and providing background for domestic banks. We do also miss papers based on internal sources of financial institutions which may create their own credit ratings and migration probabilities. Last but not least, we do miss papers suggesting how this methodology could be used by private companies to estimate their credit risk.

2 CreditMetrics

During the 1990s, when the Bank for International Settlements announced its intention to introduce a capital requirement for market risk and allowed some banks to calculate their risk

⁵ Finger (1999a).

⁶ Finger (1999a), p. 14.

⁷ Finger (1999a), p. 14.

⁸ Key advantage of the Central limit theorem method was that “*we deal explicitly only with the factors that the obligors have in common, and use approximations or closed form techniques to handle the factors that are idiosyncratic to the individual obligors*”. (Finger, 1999a, p. 24)

⁹ Finger (1999b). The same problematic was also analyzed by Lloyd and Telikepali (1998).

¹⁰ More about credit default swaps can be found in e.g. Hull (2007), chapter 21, pp. 539 – 563.

¹¹ Non-publicly rated obligor firms are typically medium- and small-sized companies.

¹² The weights express the portion of asset return volatility that is firm idiosyncratic or specific.

¹³ Marins and Saliby used a simplified vision of CreditMetrics proposed by Glasserman and Li (2005) in which they considered only the default risk. Glasserman and Li (2005) described another methodology in calculating portfolio credit risk, namely, the importance of sampling procedure for normal copula model of portfolio credit risk.

¹⁴ Marins and Saliby (2007), pp. 13 - 14.

exposures using internal models based on the Value at Risk framework (VaR)¹⁵, banks started to develop their own models to estimate a capital requirement. Firstly, internal models were used to calculate market risk¹⁶; lately, they were also used to calculate credit risk.

In general, credit risk models that deal with the recovery rate (RR) and the probability of default (PD) have developed during the last 40 years in such a way that we are able to group them into two main categories:¹⁷

- Credit-pricing models
- Portfolio credit value-at-risk (VaR) models¹⁸

One of the most demanding models using the Value at Risk approach is CreditMetrics. It is a framework for “*quantifying credit risk in portfolios of traditional credit products (loans, commitments to lend, financial letters of credit), fixed income instruments, and market-driven instruments subject to counterparty default (swaps, forwards, etc.)*”¹⁹.

CreditMetrics was defined by J.P.Morgan in 1997 in cooperation with the Swiss Bank Corporation, the Bank of America, KMV Corporation, the Bank of Montreal and others as a first available portfolio model using the Value at Risk approach for evaluating credit risk for untradeable assets. The CreditMetrics model uses the Merton-type model^{20 21} of the firm’s value and is understood as a “mark-to-market” model.

CreditMetrics does not rely only on one segment of a portfolio risk, but the risk can be seen

¹⁵ More about the Value at Risk approach can be found e.g. in Jorion (1997), Down (1998), and Holton (2003). The main idea of Value at Risk models is that they estimate the maximum possible losses on certain percentile levels.

¹⁶ Market risk “*refers to the risk to an institution resulting from movements in market prices, in particular, changes in interest rates, foreign exchange rates, and equity and commodity prices*”. (Market risk, Monetary Authority of Singapore, February 2006, p 3). More about Market risk can be found e.g. in Jorion (2000) or Down (2005).

¹⁷ This group division was used by Atlman, Resti and Sironi (2004), p 184. They later divided credit pricing models into three approaches (“first generation” structural-form models, “second generation” structural-form models and reduced-form models). More about these approaches can be found in Atlman, Resti and Sironi (2004), pp. 184 – 189.

¹⁸ In this group, we classify models introduced in the second half of the 1990s: KMV (KMV-Moody’s), CreditRisk+, CreditMetrics and CreditPortfolioView. KMV model is based on the work by R. Merton, which was published in 1974 in the Journal of Finance. (Good description of KMV – Moody’s, the Merton Model and its application to the Czech market can be found e.g. in Peška (2007)). Pros and cons of KMV – Moody’s model can be found e.g. in Derviz, Kadlčáková (2001) and Jarrow, Turnbull (2000). CreditPortfolioView is used to “*simulate the joint conditional distribution of default and migration probabilities for various rating groups in different industries, for each country, conditional on the value of macroeconomic factors like the unemployment rates, foreign exchange rates, government expenditures and the aggregate savings rate*”. (Crouchy, Galai, Mark (2000), p. 113.). More information about CreditPortfolioView can be found e.g. in Bluhm (2003) and Crouchy, Galai, Mark (2000). Advantages and limitations of the CreditPortfolioView can be found e.g. in Derviz, Kadlčáková (2001). The CreditRisk+ model was introduced by Credit Suisse Financial Products in 1997. The fundamental background of this framework can be found in Credit Suisse First Boston International (1997), which is the core document for this framework. The main principals of the CreditRisk+ framework in comparison with other industry models are written e.g. in Crouhy, Galai, Mark (2000), Gordy (2000). Its use in the banking sector is described in Gundlach, Lehrbass (Eds.) (2004). Pros and cons of this approach can be found e.g. in Derviz, Kadlčáková (2001), Bluhm (2003) and Crouchy, Galai, Mark (2000).

¹⁹ J.P.Morgan (1997a), p. 1.

²⁰ Robert Merton proposed a possible application of the Black-Scholes option pricing formula, introduced in 1973, into corporate finance in his paper on valuation of corporate debt, published in 1974. The Merton model is assumed to be an asset-based model and it is considered to be the first modern credit risk model. For more details, how the Merton model works etc., see Merton (1974). More information about the Black-Scholes option pricing formula and its application in the financial world can be found e.g. in Hull (2007), chapter 13, pp. 287 – 324. The application of Merton’s model on the Czech portfolio was done by Peška (2007).

²¹ In the CreditMetrics approach, Merton’s option pricing model is used to estimate joint migration probabilities for a pair of obligors and correlations between the credit qualities of every issuer. More about this will be discussed later in this chapter.

across several dimensions, such as a rating category, the maturity of an underlying asset, an industry and a country in which a debtor operates, and a product type (bond, credit derivatives etc.).

The general framework of the CreditMetrics model proceeds in four building blocks, which can be seen in Chart 1.²² The general framework is used in case of more developed portfolios, containing more than two or three instruments.²³ In such a case, Monte Carlo simulation²⁴ is used to calculate the full distribution of portfolio values.²⁵

2.1 Assumptions of the CreditMetrics model

The CreditMetrics approach is based on several assumptions, some of these assumptions seem to be crucial and have caused many discussions among economists.^{26 27}

First, it is assumed that **all obligors can be divided into rating classes according to their creditworthiness**. This division is mostly done by credit rating agencies, such as Moody's and Standard and Poor's; Standard and Poor's divides creditors into categories (AAA, AA,..., Default) and sets default probabilities and migration probabilities for every category, which leads to another assumption. In general, it is believed that issuers of debts were put in a correct category; otherwise, it would cause misleading results in estimations of credit risk.

Second, obligors rated in the same category are said to be **credit-homogenous**²⁸, having the **same probability of default and migration probabilities between classes**.²⁹ These migration probabilities and probabilities of default are calculated from historical datasets using a simple average procedure. Therefore, they need to be constantly observed and recalculated. It is highly probable that their value will change during the business cycle – the probability of default will be lower in boom and “good times”, and will be higher in recession. These measurements require long sectional data sets, which creates additional costs for banks if they want to determine their own internal data inputs.

Third, **interest rates, exposures and forward rates are deterministic**.³⁰ CreditMetrics and all other models (KMV – Moody's, CreditRisk+ and the CreditPortfolioView) do not determine these rates and take them for granted. However, every banking institution has its own dealing department (financial market department), where these rates are determined and might differ from other financial institutions on the market. Therefore, the results of the CreditMetrics model will vary from institution to institution.

Fourth, another important assumption is the **time horizon** over which the risk is assessed. Normally, a year is a sufficient time horizon over which credit risk is measured.³¹ However, it may differ according to exposure. If we have loans paying a coupon every six months, we can

²² About these four building blocks speaks e.g. Crouhy et al. (2000).

²³ Should a simple portfolio structure (a portfolio consisting of two or three bonds) occur, slightly different methodology is used to estimate credit risk. This approach is described in J.P. Morgan's Technical Document (J.P.Morgan, 1997a).

²⁴ More information about Monte Carlo simulation can be found e.g. in Fabian, Klüber (1998), Glasserman (2004), Jorion (2000) and Down (1998).

²⁵ How to proceed with Monte Carlo simulation in CreditMetrics can be found e.g. in Crouhy, Galai and Mark (2000), p. 79 where step by step determination of credit risk is described. More information about the Cholesky decomposition which is used in Monte Carlo simulation can be found e.g. in Higham (1990).

²⁶ Some criticism can be found in Derviz and Kadlčáková (2001), Crouhy, Galai and Mark (2000).

²⁷ Based on these assumptions, limitations and weaknesses of this model have been discussed by several authors, such as Gronychová (21/12/2008), Derviz and Kadlčáková (2001), Crouhy, Galai, Mark (2000)

²⁸ Gronychová (21/12/2008).

²⁹ Crouhy, Galai, Mark (2000).

³⁰ J.P.Morgan (1997a), Derviz and Kadlčáková (2001), Crouhy, Galai, Mark (2000).

³¹ J.P.Morgan (1997a), Derviz and Kadlčáková (2001), Crouhy, Galai, Mark (2000).

modify the time horizon and all necessary conditions, such as probabilities of defaults, migration probabilities etc., to six months.

Fifth, the CreditMetrics approach **does not assume market risk**. Only credit risk is assumed and calculated. However, the nature of credit risk is linked with market risk.

Last but not least, firms have a very **simple capital structure**; they are financed by equity. Also, a firm's equity price may be taken as a proxy for the asset value of the firm that is not directly observable.³² As a result, debtors' equity returns approximate their asset returns³³, which leads to an assumption that firm's asset value is assumed to "*follow a standard geometric Brownian motion*"³⁴.

3 CreditMetrics framework applied to a Czech portfolio

The second chapter of the paper analyses a hypothetical Czech portfolio, which we have created from companies traded on the Prague Stock Exchange. The first goal is to calculate its capital requirement using the CreditMetrics framework which will be then compared with Basel II approach. Second goal is to show which banks operating on the Czech market use the CreditMetrics framework and which use the Basel II approach when calculating minimum capital requirements. The final goal is to discuss whether the CreditMetrics framework can be used by private companies (except banks) to estimate/mitigate their credit risk.

3.1 Overview of the Czech market

Unlike in the United States or in other western countries, the Czech market³⁵ is not large. Most Czech common stock companies are traded neither on the Prague Stock Exchange, nor on the RM-SYSTEM Czech Stock Exchange (RM-SYSTEM). Only the largest Czech companies, such as ČEZ, Telefónica O2, UNIPETROL, and several foreign companies, such as Deutsche Telecom AG and Vienna Insurance Group, are quoted in Czech Koruna and traded on the Prague Stock Exchange, or on the RM-SYSTEM. Several companies are quoted on the Prague Stock Exchange and on the RM-SYSTEM, but their shares are rarely traded, such as Tesla Karlín, TOMA a.s. and Léčebné lázně Mariánské Lázně.

For our further purposes, we had to analyse which companies are rated by rating agencies (Standard and Poor's and Moody's) and are listed on the Czech market. We focused only on companies which quoted their shares on the Czech market (the reason why we want to use only these companies will be explained in the following sub-chapter). We divided them into two groups – financial institutions (FI) and corporations (C). We will use corporations that have shares quoted on the Czech market for creating our hypothetical portfolio. The results of our analysis are in Table 1 (see Appendix).

In comparison to previous research in 2010, several companies have been downgraded by either Standard and Poor's, such as Telefonica O2, or by Moody's, such as Erste Group Bank AG. This confirms the negative development on financial markets, their volatility and slowdown of the world economy. Further development of the economy will be influenced by the debt crisis in Europe, situation in the European Union/Eurozone, especially at the periphery.

3.2 Hypothetical portfolio

Unless we have obtained data from a financial institution that might use internal models to determine a rating of any institution, or from a multinational corporation which has its own

³² Crouhy, Galai, Mark (2000), p. 72.

³³ Derviz and Kadlčáková (2001), Crouhy, Galai, Mark (2000).

³⁴ Crouhy, Galai, Mark (2000), p. 73.

³⁵ Speaking about the Czech market, we understand trades that are done on the Prague Stock Exchange and the RM-SYSTEM.

credit department,³⁶ calculating the minimum capital requirement using the CreditMetrics framework requires external rating provided by credit rating agencies.

When we created our portfolio, we built on Lutz Hahnenstein (2004), who examined a German portfolio and simplified the general assumptions of the CreditMetrics framework; he did not take into account cross-country risk when calculating correlations between loans.

We will follow these ideas in our paper just to simplify our analysis. If we had not considered only bonds denominated in CZK, we would have dealt with market risk, especially currency risk. Other problems would have been caused by different accounting systems and tax systems. Taking all bonds denominated in one currency and issued by corporations operating in one country, we can forget about the above mentioned risks.

We created our portfolio from corporate bonds whose shares are quoted in Czech Koruna on the Prague Stock Exchange – New World Resources N.V. (NWR), ČEZ, Telefónica O2, Philip Morris ČR and Central European Media Enterprises Ltd. (CETV). Unfortunately, most of these corporations have not issued bonds in CZK, but in euros or in U.S. dollars.³⁷ Therefore we had to create a hypothetical corporate bond portfolio denominated in Czech Koruna based on real bonds denominated in euros. We took two bonds per corporation to obtain a portfolio that contained ten different bonds; we used ratings provided by Standard and Poor's.

Nominal values of corporate bonds were estimated based on their rating and company size. Hypothetical limits were set for investments in each rating class: A rating – 450 million CZK, BBB+ rating – 300 million CZK, BB- rating 200 million CZK, A- rating 400 million CZK and B rating 150 million CZK. The summary of our hypothetical portfolio is Table 2.

3.3 Value at risk and CreditMetrics

The CreditMetrics framework was applied to the portfolio described in Table 2. The time horizon was chosen to be one year. We used Monte Carlo simulation to calculate its credit risk; the hypothetical portfolio contained 10 different bonds. We compared our results with Basel II approach which is broadly used by financial institutions.

Our corporate bonds had ratings ranging from A to BB-, which indicated certain risk that one of the debtors would not be able to repay his debts (either coupon payments or the principal payment at the bond's maturity), especially for companies rated BB- (NWR) and B (CETV). The probabilities of debtors' upgrade, downgrade and default are considered in the transition matrix proposed by Standard and Poor's.³⁸

Before we could start applying Monte Carlo simulation to the portfolio, we had to first recalculate the bond values at the end of the given time horizon (one year) for every possible rating class change (a bond will upgrade, downgrade, default or remain in the same class). To be able to recalculate the bond values, we had to define the forward zero curve for years 2013 – 2018.³⁹

We used formula

³⁶ Multinational corporations, which are active in different countries around the world and are exposed to credit risk, such as oil companies and energy companies, have their own credit departments where credit risk of company's customers is estimated/evaluated. These companies have invested huge amount of money in order to develop internal models which help them to mitigate credit risk of their customers.

³⁷ For more details, see: Reuters, or web-pages of each corporation.

³⁸ The Global corporate Transition Matrix (%) (1981 – 2011) is available at:
<http://www.standardandpoors.com/ratings/articles/en/us/?articleType=HTML&assetID=1245294052949>

³⁹ The derivation of the forward zero curve is described in Table 7 in the Appendix.

$$PV(I_2) = \sum_{t=0}^T \frac{CF}{(1+f_t^{I_2})^t} + \frac{FV}{(1+f_T^{I_2})^T} \quad (1)$$

where CF is future cash flow, FV is face value (nominal value), and $f_t^{I_2}$ is the forward rate for time t and rating class I_2 , information about bonds from Table 3 and forward rates from Table 7 to recalculate bond values in different states at the end of a one-year time horizon. In case of default, the value of a bond was estimated as a product of a recovery rate⁴⁰ and the bond's nominal value. All possible values of each bond can be found in the Table 4. As we had two bonds per company, we added a coupon as a description which corporate bond was meant.

Other data we had to take into account were correlations between corporations' assets. We could not accept the assumption that assets were not correlated, which is sometimes used to simplify the approach. However, as we took corporate bonds denominated in one currency and issued by Czech corporations, or, at least, corporations present on the Czech market, we did not have to deal with market and country risks, and approximated this assumption into the correlation structure.

We derived the correlation matrix using asset returns for each corporation, assuming the asset returns were normally distributed. We took available data on a daily basis, covering the period from 19 May 2008 to 24 February 2012 (952 observations), and calculated daily returns for all assets.⁴¹ From this dataset we were able to calculate the correlation matrix,⁴² and, using the procedure of Cholesky decomposition,⁴³ we derived a lower triangular matrix,⁴⁴ which is a necessary input in Monte Carlo simulation.

The last unknown variable to derive before starting Monte Carlo simulation was the threshold value for each corporation. The threshold values helped us to determine which credit rating should be assigned to each corporation.

Let us assume that a generated rating falls between the threshold values for BBB- rating and BB+ rating; then the new rating of a corporate bond will be BB+. Generally, a corporate bond will have a rating I if a generated scenario has greater value than the threshold value for rating I, and lower value than the threshold value for rating I+1, thus

$$\Phi^{-1}(\text{cum. prob.}_I) < \text{generated scenario} < \Phi^{-1}(\text{cum. prob.}_{I+1}) \quad (2)$$

After deriving all necessary information, we were able to start Monte Carlo simulation. We generated 20,000 portfolio scenarios to better describe the distribution of portfolio values. For each scenario, we obtained a portfolio value at the end of a given time horizon. Having 20,000 scenarios of portfolio values, we could present histograms of the portfolio value scenarios.

In Chart 2, we presented the distribution of all portfolio values divided into 29 intervals. We compared our distribution of portfolio values with the normal distribution. The histogram of portfolio values showed that the actual distribution of portfolio values could not be approximated by the normal distribution as the data set was not well-modelled by the normal distribution.

⁴⁰ We took the recovery rate equal to 50% (recovery rate = 1-LGD, where LGD is 50%). Choosing the LGD equal to 50% was based on the Basel II approach and its recommendations. Telling whether the recovery rate should be 50% or 51,3% or any other value is hypothetical. Nobody could say what the real value of the recovery rate is for each company. In some cases it can be almost 0%, in other cases it might be over 50%...

⁴¹ The data were taken from the Patria plus database.

⁴² See Table 5 in the Appendix.

⁴³ Cholesky decomposition is described e.g. in Higham (1990).

⁴⁴ See Table 7 in the Appendix.

⁴⁵ The threshold values can be provided to readers upon request.

To confirm our suspicion, we used the normality test.⁴⁶ The hypothesis was tested at the significance level $\alpha = 5\%$.

Null hypothesis: portfolio values were normally distributed.

Statistics: Chi-square(2) = 13961,995 with p-value = **0.0000**

According to our normality tests, we rejected the null hypothesis; the portfolio values were not normally distributed.

Another interesting finding from the histogram of portfolio values was that most of the scenarios did not undergo any rating change.

The first statistics to be computed from the distribution of portfolio values were the mean and the standard deviation.

- the mean of the portfolio value was 3,254,445,567 CZK
- the standard deviation of the portfolio value was 100,989,087 CZK

However, we could not use these statistics to define the portfolio's risk, because of the shape and characteristics of the actual distribution.

If we assumed that bond values were normally distributed, we could estimate the VaR at confidence level 99% (95%) using the general formula. Thus the 5% VaR for this hypothetical portfolio would be equal to

$$\begin{aligned} VaR(1-\alpha) &= normsinv(1-\alpha)\sigma_p = VaR(95\%) = normsinv(95\%)*\sigma_p = \\ &= 1.65*100,989,087 = 166,112,268\text{CZK} \end{aligned}$$

and the 1% VaR would be

$$VaR(99\%) = normsinv(99\%)*\sigma_p = 2.33*100,989,087 = 234,935,750\text{CZK}$$

However, these numbers did not correspond to the actual situation as we assumed a normal distribution of portfolio values. Due to this misleading assumption, the true VaR of the portfolio was underestimated. We had to take into account the actual distribution of portfolio values to compute the true VaR.

The actual VaR was then calculated as the difference between the expected value of the portfolio (the mean) and the actual value of the portfolio corresponding to a chosen percentile level.

Then the 1% VaR for the portfolio was

$$VaR(99\%) = 3,254,445,567 - 2,832,942,005 = 421,503,562\text{CZK}$$

and the 5% VaR

$$VaR(95\%) = 3,254,445,567 - 3,065,027,420 = 189,418,147\text{CZK}$$

The capital requirement for our portfolio would depend on the chosen confidence level.

3.4 Comments on the results

We calculated the minimum capital requirement for our portfolio using CreditMetrics framework. To compare our results with a framework which has to be used by European banks,

⁴⁶ There are several tests that can be used to determine whether a data set can be approximated by the normal distribution or not, such as the Jarque-Bera test, the Doornik-Hansen test, the Chi-squared test etc.

we also estimated the capital adequacy of our portfolio using Basel II approach.⁴⁷ The results of our analysis are in Table 1.

Tab. 1: Summary of results

Approach		Minimum capital requirement
Basel II	Foundation IRB	192,380,593 CZK
CreditMetrics	Normal distribution – VaR (99%)	234,935,750 CZK
	Normal distribution – VaR (95%)	166,112,268 CZK
	Actual distribution – VaR (99%)	421,503,562 CZK
	Actual distribution – VaR (95%)	189,418,147 CZK

Source: Author

Basel II determined the minimum capital requirement to cover unexpected losses of our hypothetical portfolio to be approximately 192.4 million CZK. The minimum capital requirement represented approximately 6.2% of the portfolio’s nominal value.

The goal of this thesis was not using Basel II, but applying an optional internal model that financial institutions might use to calculate the credit risk of their portfolios. Using CreditMetrics requires many data inputs that are estimated or approximated, and might cause underestimation or overestimation of credit risk – they influence calculation and simulation procedures.

First, external rating provided by rating agencies might be influenced by corporations themselves. They need to look better in their creditor’s view and are willing to pay for better rating.

Second, considering the forward zero curve, forecasting an exact forward rate for 10 years is not possible. We cannot be sure what the interest rate would be, or the PRIBOR rate in two months, in a year. How can we estimate forward rates for ten years? Forward rates are only rough numbers.

Third, the transition matrix should be mentioned as it is defined by external rating agencies. Generally, the transition matrix is defined for American corporations, European corporations, or for the whole world. Migration probabilities do not have to correspond to the real situation on the Czech market.

Another crucial point in our calculations was the normal distribution. We could not follow the results provided by the VaR based on the normal distribution. The assumption based on the normal distribution underestimated, in our case, the “true” VaR (95%) at least by 23 million CZK.

Finally, the calculation of capital requirement using Monte Carlo simulation in the CreditMetrics model depends on the confidence level. Generally, we asked if “next year is a bad year, how much can it expect to lose with a certain probability”⁴⁸ Taking the 5% VaR, the economic capital requirement for unexpected losses would be approximately the same as using the Basel II approach. However, taking the 1% VaR, we assume that the bad year would occur once every 100 years, the economic capital requirement for unexpected losses would be much greater than the Basel II capital requirement.

⁴⁷ We calculated the minimum capital requirement based on Decree No. 123/2007 Coll., as amended by Decree No. 282/2008 Coll. Probability of default was provided by „anonymous international bank“. The calculation can be provided to readers upon request.

⁴⁸ Saunders, Allen (2002), p. 91.

3.5 CreditMetrics and Banks on the Czech market

In the previous part, we wrote several fundamental reasons why we believed the Basel II approach (the foundation IRB) is a “better” model if we wanted to calculate the minimum capital requirement for credit risk. Here we present the research results to prove our findings. We addressed banks operating in the Czech Republic and asked them whether they use Basel II approach, or any optional framework to quantify credit risk. The summary of our research is in the Appendix, Table 8. Based on the result of the research, banks operating in the Czech Republic do not use optional internal models to quantify credit risk. Their calculations of credit risk are based on Basel II legislation.

3.6 CreditMetrics and private corporations in the Czech Republic

Not only financial institutions/banks assess credit risk of their portfolios, but also big international companies have their own credit department in which credit risk of customers is calculated and risk of potential bad debts is mitigated. However, models which are used in those companies are mostly based on two “states”: “default” and “non-default”.

Should a customer be not in bankruptcy/insolvent, a risk category is assigned to the customer. Unlike Standard and Poor’s, multinational corporations do not use 17 different risk categories to distinguish creditworthiness of their customers, but their approach is simplified to 5-6 risk categories, including bankruptcy. A risk category is granted to the customer based on different type of information, such as external ratings, financial strength of the company, market development, industry and country risk. Each category assigns a different probability of default, but no Transition Matrix between risk categories might be determined as only two states can occur.

Furthermore, taking into account all assumptions and weaknesses of general CreditMetrics framework, it would required more than only more sensitive analysis of customers (more risk categories with probabilities of default and probabilities of transition), but also a determination of forward zero curve. Moreover, most of small-/medium-sized companies do not issue bonds, or any other financial instrument.

All in all, the general CreditMetrics framework cannot be used in private corporations to estimate credit risk of their customers on the Czech market as it would require too high investments in determining inputs for the model, or coming up with a simplified framework which could work for such a small market as in the Czech Republic.

4 Conclusions

In the paper, we have examined credit risk using the CreditMetrics framework on a hypothetical portfolio a bank has to face in the Czech Republic. The aim was to find answer whether this optional model could be used in the Czech Republic to estimate credit risk of a portfolio.

In doing so, we have examined the Prague Stock Exchange and the RM-SYSTEM and used two different approaches, which evaluate credit risk of a portfolio: one that bank has to use (Basel II), the other that is optional (CreditMetrics). We have also asked financial institutions, which operate in the Czech Republic, if they use CreditMetrics, or other models to calculate credit risk.

Even though we have shown that using the CreditMetrics framework and Basel II, might lead to similar credit risk estimation (see Table 1), we reject the hypothesis that the CreditMetrics model is a relevant method of measuring credit risk in the Czech business environment. We recommend using models based on Basel II legislation. To support our conclusion, we will mention several reasons.

First, the Czech market is not large; only a few companies are traded on the Prague Stock Exchange and the RM-SYSTEM, and are rated by either Standard and Poor’s or Moody’s.

There are only five corporations, which are rated by external rating agencies, and whose stocks are traded. Therefore, for an external user, who does not use internal rating models developed by financial institutions (if they do have it) to define a rating and is dependent on data provided by external rating agencies, the possibility to choose corporations is very limited.

Second, most of Czech corporate bonds are issued in American dollars, or in euros, and, if they are traded, they are quoted on foreign markets, such as in Germany and Great Britain. Corporate bonds issued in Czech Koruna are either not traded, or were issued by corporations which are not rated by external rating agencies. If corporate bonds issued in other currency than Czech Koruna were taken into account, we would have to take into account exchange rate risk in revaluating bond values.

Third, the CreditMetrics framework requires many data inputs that are estimated or approximated, and might cause underestimation or overestimation of the capital requirement – they influence calculation and simulation procedures.

Forth, another crucial point in the CreditMetrics calculation is the correlation matrix. We recommend using a multi factor analysis, which uses sets of indices, such as industry and country indices, and different industry and country weights to estimate the correlation between obligor assets, instead of estimating the correlation matrix based on asset returns; this methodology requires time series of share prices. Unfortunately, we had to work only with 952 observations. Such a limited time series may influence the real correlation structure between assets.

Fifth, the calculation of capital requirement using Monte Carlo simulation in the CreditMetrics model depends on the confidence level.

Finally, based on our research, no financial institution operating in the Czech Republic uses CreditMetrics to estimate the capital requirement for unexpected losses. They use internal models based on Basel II.

All in all, we have shown that CreditMetrics is not a relevant method of measuring credit risk in the Czech business environment and it is not used by financial institutions operating in the Czech Republic. Moreover, it would also be problematic for a private multinational corporation to use the general CreditMetrics approach to estimate credit risk of its portfolio.

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CreditMetrics and the Czech Republic’s Environment

Summary

Credit risk is the most important risk a financial institution has to deal with. The Bank for International Settlements proposed an analytical model which allows banks to calculate capital requirements for credit risk of an investment portfolio. Also several optional models were developed by financial institutions to measure credit risk.

This paper analyse an optional framework based on external rating and transition matrix, CreditMetrics. Building on the theoretical part, a hypothetical portfolio containing Czech corporate bonds is introduced; using the Basel II approach and the CreditMetrics approach, its capital adequacy is calculated. Furthermore, the results of our research, in which several banks operating in the Czech Republic were asked whether they use CreditMetrics, other optional models, or Basel II, are presented. Finally, we discussed whether CreditMetrics can be used by private companies to estimate credit risk of their portfolio/customers.

Key words: CreditMetrics; Basel II; Monte Carlo Simulation; Credit risk; Value at Risk.

JEL classification: C63, G11, G17.

Editorial note:

Due to the restrictions on a paper's extent in the hard copy of *Conference Proceedings*, the appendix, which is referred to in the paper by author, is published on the attached CD medium *Conference Proceedings* only.

Corporate Governance and Product Related Voluntary Disclosure: An Analysis of Biotech Firms

*Luminita Enache, Antonio Parbonetti**

1 Introduction

Lev et.al. (2004) shows that managers of R&D-intensive firms will be careful in providing specific information to the capital market to avoid competitive disadvantage. In the same vein, Jones (2000) argued that the higher proprietary costs the lower will be the level of voluntary disclosure in R&D intensive-firms.

Lev et.al. (2004) demonstrate that voluntary disclosure is significantly different and increases by 21% between initial screening stage (0.28) and clinical testing subsample (0.49). Given the design of Lev et.al. (2004) study, we cannot tell whether the amount and form of the product-level disclosure were influenced by outside parties, since much of the analysis was conducted at the product-level instead of firm-level (Hribar, 2004). Therefore, there can be others firms-level unidentified characteristics that may impact on biotech firms voluntary disclosure.

Because the competitive costs related to disclosure are relevant in the biotech sector and could discourage the dissemination of information, company governance mechanisms could play an important role on the board by in orienting the amount of disclosure in the biotech sector. Specifically, appropriate “internal monitoring packages” may force managers to disclose more information, to the reduction of agency costs linked to information asymmetries.

Different from the Lev et.al. (2004) study that examine how different competitive cost proxies relates to the extent of product-voluntary disclosure by biotech IPOs, we want to understand how corporate governance mechanisms impacts on the heterogeneity of firms-related information disclosed by biotech companies. Specifically, we provide information about how corporate governance works, controlling for firms' innovativeness and products at various stages, to determine its disclosure choices.

Baysinger and Hoskisson (1990) underlines that independent directors are not homogeneous in terms of ability to monitor. In other words, our classification of independent directors in insiders, business experts, support specialists and community influentials help to sort their ability to monitor. Additionally, because of their background, directors may value differently the costs and benefits of disclosure, thus affecting companies' disclosure behavior in a different way.

Our sample consists of all biotechnology companies publicly listed on the U.S. Stock Exchange without interruption during the five year period, from 2005 to 2010. The final sample comprises 432 firm-year observations with complete data for analysis.

To measure the quantity and quality of voluntary disclosure by the biotech companies we rely on Lev et.al. (2004) study and we construct a disclosure index for each sample firm's annual report, for all biotechnology products under various stages of development.

Using fixed-effects models, we find that the voluntary disclosure across companies is higher than the voluntary disclosure between various stages of product under development. Our results

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show that corporate governance plays a role in orienting the heterogeneity of product-level disclosures provided by US biotech companies.

2 Literature review

Positive agency theory (Jensen and Meckling, 1976; Williamson, 1981; Fama and Jensen, 1983) provides a framework for linking corporate governance to voluntary disclosure. According to agency theory a company with high agency costs will try to reduce them by increasing the extent of voluntary disclosure and employing an “intensive” monitoring devices, like the presence of outside directors on a corporation’s board. Voluntary disclosure is a function of the governance structure of the firm and managers’ attitudes to voluntary disclosure changes accordingly to the trade-off of the costs and benefits involved.

Theoretical and empirical studies on voluntary disclosure benefits have been shown that voluntary disclosure: decreases the cost of capital [e.g., Brown (1979); Barry and Brown (1985); Easley and O’Hara (2004); Hughes et.al.,(2007)] by raising the price of stock relative to the share price of firms not disclosing that information, reduce the information asymmetries between informed and uninformed investors and hence improves the firm’s stock liquidity [e.g., Glosen and Milgrom (1985); Amihud and Mendelson (1986); Diamond and Verrecchia (1991); Kim and Verrecchia (1994)] and generally affects shareholders’ wealth [Richardson and Welker (2001); Lev (1992)].

Disclosure is not costless, as it is associated with the emergence of proprietary and litigation costs [Dye, 1986; Prencipe, 2004; Skinner, 1994, 1997]. The cost of disclosure is the threat to competitive advantage caused by providing proprietary information to competitors.

Because disclosure is selective, managers exercise discretion in the disclosure of information. Previous theoretical models of voluntary disclosure [Verrecchia, 1983] predicts that, in the presence of disclosure-related costs, firms will disclose only when their performance level exceeds a certain threshold, while below the threshold will not. In the presence of rational trader expectations, managers exercise discretion “choosing the point (the threshold level of disclosure) above which he disclosed what he observes, and below which he withholds his information” (idem, p. 179). The reason behind this is that managers will attend to signal what they knows to achieve economic benefits [see, Spence, 1973; Grossman and Milgrom, 1981]. Although, due to litigation concerns, Skinner (1997) document that managers provide a more timely disclosure of adverse earnings news in order to lower the expected legal costs. In the same vein, Lev [1992] assert that managers voluntary disclosed adverse earnings news “early”, before the mandated release date, to reduce stockholder litigation costs.

Moreover, voluntary disclosure is positively associated with firm size [Lang and Lundholm (1993), Raffournier (1995)], with the number of analysts following a firm [Lang and Lundholm (1996)] as well as the listing status and earnings margin [Singhvi and Desai (1971)]. Chow and Wong-Boren (1987) show that financial leverage, proportion of assets-in place are associated with voluntary disclosure choices.

Williamson (1984) has introduced the theoretical framework relating disclosure quality to corporate governance. Based on that, in the last decade a series of empirical researchers has studied how different corporate mechanisms impact on the extent of voluntary disclosure [Gul and Leung, 2004; Ho and Wong, 2001; Eng and Mak, 2003; Cormier et al., 2005; Li et al., 2008].

Eng and Mak (2003) conducted a study on 158 companies listed on Singapore Stock Exchange and they found that board composition, measured by the proportion of outside directors have a negative impact on the amount of corporate voluntary disclosure. Gul and Leung (2004) documented a negative relationship between expert outside directors and the level of voluntary

information. In the same vein, Forker (1992) in a study on UK companies, focusing on corporate governance mechanisms, such as the presence of non-executive directors and audit committee document that both mechanisms does not influence the disclosure of share-option compensation in the annual reports. Ho and Wong (2001) using a weighted relative disclosure index in measuring voluntary disclosure in the Hong Kong context, found that family-controlled firms have a negative impact on the extent of voluntary disclosure.

The results are consistent with Eng and Mak (2003), Barako et.al. (2006) studies that argue that when the firm has a higher proportion of outside independent directors on the board there is a substitutive relationship between both mechanisms, meaning that outsiders exercise a stronger and higher monitoring and control role over managers (Williamson, 1984) and therefore, there is a lower need to decrease information asymmetries by increasing the extent of voluntary disclosure.

Conversely, Cheng and Courtenay (2006) suggest that board independence is positively associated with voluntary disclosure, the effect being highly significant for firms with boards dominated by a majority of independent directors. In a sample of Hong Kong listed firms, Leung and Horwitz (2004) find a positive relationship between the board independence and voluntary segment disclosure. Li et.al. (2008) in study based on UK companies document a significant positive association between the proportion of independent directors on corporate boards and voluntary disclosure. Cheng and Jaggi (2000) showed a positive association between firms' discretionary decisions to increase the level of independence on the audit committee above the suggested minimum and the proportion of independent directors. Moreover, Cerbioni and Parbonetti (2007) document a positive relationship between the proportion of independent directors and voluntary disclosure for European biotech companies.

The empirical evidence on these studies, shows mixed and controversial results. These may be due to specific institutional settings (Hong Kong, Singapore, UE, US, etc) and/or firm-specific characteristics, the different institutional environments across countries, outside investor rights and legal enforcement [La Porta et. al., 1998; Leuz et.al. 2003], the measurement of corporate governance and voluntary disclosure variables [Dalton et.al., 1998, Ahmed and Courtis, 1999] or different research contexts play a key role in determining the level of voluntary disclosure. Ahmed and Courtis (1999, p.36) argued that "these inconclusive results could be due to differences in socio economic and political environments between countries."

Previous research on governance and voluntary disclosure mainly focused on the agency theory perspective, however results are unable to confirm if corporate governance and voluntary disclosure acts as complementary or substitute mechanisms of control. Corporate governance and voluntary disclosure can be seen as complementary mechanisms, when internal decision making mechanisms, as board of director strengthen the extent of voluntary disclosure. Instead, if the relationship is substitutive, one corporate governance mechanism may substitute for another one, and companies will choose to improve one at the expense of the other one (Rediker and Seth, 1995, p.88). For example, if a company chooses a monitoring mechanism, like the presence of an outside director on a firm's board this may indicate that the firm is being closely monitored already and there is a lower probability that the firm will increase its disclosure level. Also, if information asymmetry in a firm can be reduced as a consequence of "internal monitoring packages", the need of having additional governance devices is smaller.

While previous papers [Gul and Leung, Ho and Wong, Eng and Mak] concentrated mainly on the well known agency theory classification into independent and executive directors, following Hillman et.al., (2000) and Baysinger and Zardkoohi (1986) typology of board members and ulterior empirically studied by Markarian and Parbonetti (2007), we classify independent directors into four categories, as following: business experts, community influentials, support specialists and insiders.

3 Methodology

3.1 Sample design and data collection

The sample of our study consists of all active biotechnology firms listed on the U.S. Stock Exchanges without interruption from 1 January 2005 until 31 December 2010. Further we restrict our sample of biotechnology companies to only those firms that have product under development, excluding gene therapy, medical devices and research service companies. First we obtained the list of all biotechnology companies listed on the major stock markets in US and sequent we collect from firms' webpages each Annual Report on form 10-K, that companies file in registration with the Securities and Exchange Commission (SEC).

In order to conduct our research we rely on the Business Section of the 10-K form (part I), precisely on the drug development programs, that provides key information about the various products under development of each biotechnology company. The 10-K form includes financial as well as nonfinancial information and it is divided in three parts: Part I includes an overview of the business, the risk it faces, product and market information, Part II contains financial results for the year and management discussion and Part III identifies the firm's directors and large investors.

We hand-collect data concerning products under various stage of development [initial screening, preclinical, clinical (phase I, phase II and Phase III) and FDA review] specified in the Food and Drug Administration (FDA) approval process. Following the approach suggested by Guo et.al. (2004) we build the Product Disclosure Index, that consists of five information categories: product specifications, target disease, clinical trials, future development plans, and market information. "These information items capture the relevant aspects of the firm's proprietary information on products under development...unavailable publicly and is therefore the most important category of information disclosed" [Guo et.al., (2004), p. 15]. Appendix A indicates the components of the disclosure index and the individual score assigned. This methodology allows us to build both a product score and subsequently a firm disclosure score for each company of our sample.

- Table 1 -Table 2 here -

3.2 Measurement of variables

3.2.1 Dependent variable: voluntary disclosure.

To measure the extent of firms level voluntary disclosure by the biotechnology companies. we followed the approach developed by Lev et.al. (2004) and build a firm disclosure index. The disclosure index contains five categories: product specifications, target disease, clinical trials, future development plans, and market information. For each category it is assigned a score according to the information provided. The maximum score which a product under development disclosure could earn for all the five categories (previously specified) is 30 if the product is on a clinical phase of development or beyond (phase I, II, III or FDA review) and 22 if the product under development is in screening, IND or preclinical phase, according to the FDA classification on the various phase of development of biotech products.

Table 3 provide the information regarding the scoring procedure for the firm disclosure index, on each item included on the product specifications, target disease, clinical trials, future development plans, and market information categories included. We hand collect the information for a total number of 2845 products under development under various stage of development that US biotech companies has in their portfolio (see Table 4).

- Table 3 here -

3.2.2 Governance related variable

Data pertaining the board composition is hand-collected from the DEF 14-A proxy statements form. We analyzed the biographical information regarding the board members and following the board members typology advanced by Hillman et.al. (2000) and Baysinger and Butler (1986) we classify the board members as into the following categories: business experts, community influential, support specialists and insiders. Table 4 provides some examples of the board director's biographical information stated by companies and the subsequent classification assigned.

Insiders are directors who have been employed or are acting on the board as active managers or former employees, example being CEO, president or vice-president of the firm, that are engaged to perform the day-to-day activities. They are endowed with the expertise, knowledge of daily working activities of the firms and provide firm-specific information (Fama and Jensen, 1983) about the organization actions.

Business experts are former or retired executives of other organizations, they provide organizational legitimacy for the firm, serves as channels of communication between companies, supply advice and counsel on internal operations (Mace, 1971). All these characteristics makes them an key resource to the firm. However, the presence of business experts on the board may result in a better monitoring and this can lead to a smaller need to reduce the information asymmetries by increasing the amount of the information, pointing the substitutive relationship between governance and disclosure.

Support specialists provides linkages and specialized expertise outside the firm's product market in different strategic areas, like capital markets, law, insurance, public relations and helps firms to have an easier access to financial capital and legal support. Even if, they differ from business expert category, in the sense that they lack general management expertise, support specialists perform an important support function to the top managers in dealing with specialized decision problems. Moreover, they has the ability to understand, interpret, provide inputs for the product under development process from conceptualization, initiation, development, test, support, modification to implement the right decisions.

Community influential members are non-executive directors, example being retired politicians, members of clergy, academics, leaders of social organizations. They provide "valuable non-business perspective on proposed actions and strategies" [Hillman et.al., 2000], knowledge, experience and linkages relevant to firm's external environment [Baron, 1985]. As noted by [Hillman et.al. 2000:242]: "Their expertise and influence with the community forces can help the firm to avoid costly mis-steps when its actions might inadvertently conflict with the interests of those groups".

- Table nr 4 -

In a study of Singapore firms, Cheng and Courtenay (2006) found no significant association between board size and voluntary disclosure. By focusing on Hong Kong listed firms, Gul and Leung (2004) study found that CEO duality (CEOs who serve also as chairman of the board) is associated with lower levels of voluntary disclosure being weaker for those firms that have higher proportion of outside directors on the boards. Instead, Cheng and Courtenay (2006) document the absence of a significant relationship between duality and voluntary disclosure.

3.2.3 Control variables

Previous studies identified a list of corporate characteristics to have an impact on corporate voluntary disclosure. Corporate size, listing status, profitability and leverage have been found to be the most significant corporate variables associated with higher disclosure levels (Marston and Shrikes, 1991; Ahmed and Courtis, 1999). Following Dedman (2004) we measured firm size as

the total market value of the firm. Leverage is measured as the ratio of total debt to total shareholders' equity. Profitability has been found to have a positive and significant relation with voluntary disclosure. Lang and Lundholm (1993); Meek et.al. (1995); Ho and Wong (2001); Camferman and Cook (2002) among others, found that high performing firms are more likely to voluntarily disclose information. We defined profitability as the ratio of profit to assets. Ownership concentration was used also as a control variable. We defined ownership concentration as the percentage of common outstanding shares held by board members. To control for time-variation effects we use year dummies for all the models in our study.

3.3 Data analysis

We consider fixed-effects model to be the most suitable for our empirical analysis and the following models are specified:

$$\begin{aligned}
 \text{Disclosure index} = & \\
 & \alpha + \beta_1 \text{PATENTS} + \beta_2 \text{PRECLINICAL} + \beta_3 \text{BE} + \beta_4 \text{SS} + \beta_5 \text{CI} + \beta_6 \text{IND} + \\
 & \beta_7 \text{NBOD} + \beta_8 \text{CEO} + \beta_9 + \beta_{10} \ln \text{AT} + \beta_{11} \text{ROE} + \beta_{13} \text{LEVERAGE} + \beta_{14} \text{YEAR} + \varepsilon
 \end{aligned} \tag{1}$$

We use as dependent variable the disclosure index, calculated as shown in Appendix A.

All other independent variables are defined as follows:

Patents	Proportion of patented products of total number of products
Preclinical (PRECL)	Proportion of products under screening, development, IND application and preclinical over total number of products per company
Clinical (CL)	Proportion of products under phase I, II and III of development over total number of products per company
Business Experts (BE)	Proportion of business experts members of board of directors
Support specialists (SS)	Proportion of support specialists members of board of directors
Comunity influentials (CI)	Proportion of comunity influentials members of board of directors
Board of directors (NBOD)	Number of members
CEO duality (CEO)	Dummy variable equal to 1 if CEO is also chairman, 0 otherwise
Independent directors (IND)	Proportion of independent directors
Directors shareholding (SHARE DIR)	Proportion of common outstanding shares owned by board members
Profitability (ROA)	Return on assets
Size (lnAT)	Company size, measured as Natural logarithm of total assets
Leverage (lev)	TotalDebt/shareholder's equity
Year dummies	5 Dummies (2005-2009)

4 Empirical results

In this section we present the empirical results of our study. We first report the univariate analysis in the Section 4.1. and then in Section 4.2 we report the results of our fixed-effects model estimation.

4.1 Descriptive statistics

Table 5 presents the descriptive statistics for the dependent and independent variables used in the study. Our dependent variable, the firm's overall product-related information as measured by the disclosure index has a mean disclosure score of 0.30, with a range of 0.10 to 0.82. The

proportion of products under stage 1 of development (screening, development, IND and preclinical) has a mean of 0.32 compared to the proportion of products under stage 2 of development (phase I, II and III and FDA review) that is 0.72, meaning that firms have on average more products in clinical and under the FDA approval process. The proportion of business experts (BE) on the board has a mean of 0.33, while the proportion of insiders (INSIDERS) has a mean of 0.31, the proportion of support specialists is of 0.23 and, the proportion of community influentials (CI) is of 0.14. On average, the proportion of business experts has the highest presence on the board, followed by insiders and then, by support specialists and community influentials. The ratio of independent directors (IND) to total directors on the board was 0.77, and the average number of director on board is approximately 8 (7,87). Table 6 shows that in 42 % of the companies, the CEO is also the chairman of the board.

-Table 5 here -

4.2 Multivariate analysis

Table 6 provides the results for the fixed-effects regression models. Model 1 investigates the relationship between the *discl_index* (firm disclosure index) and the variables of interests, concentrating on the impact of independent directors on the firms' voluntary disclosure. As regards our variables of interest only preclinical variable has an effect on the extent of disclosure of biotechnology firms. The estimated coefficient is positive and statistically significant (at the 10%). Model 2 considers the future information disclosure index (defined as the sum of future plans and market information disclosure index) as the dependent variable. The CEO duality negatively impact the amount of information disclosed. In the model 3 we provides the results for the relationship between *past_info* disclosure index (defined as the sum of product specifications, target disease and clinical trials disclosure index) and corporate governance variables as well as the control variables. The proportion of independent directors appears to have a negative and significant impact on past information disclosure index. The preclinical coefficient estimation maintain the expected sign as in the previous models.

-Table 6 here-

Tabel 7 present the results of our estimation using fixed-effects model for testing the impact of corporate governance variables on the extent of voluntary disclosure. In the model 1, we consider the impact of independent directors on biotech firms' voluntary disclosure. Independent board members do not have an statistically significant impact on the amount of the information disclosed.

- Table 7 here-

We disaggregate the annual report disclosures into past information and future information to better understand the impact of corporate governance on firms' voluntary disclosure. Table 8 details the regression results for the past information disclosure. We consider as main board variables IND, BE, the interaction term between independent directors and the proportion of products under preclinical phase of development, as well as the interaction term between independent directors that are business experts, support specialists or community influentials and the proportion of products in preclinical stage. We add to our model the traditional governance variables, as the NBOD and CHCEO and the control variables OWN, ROA, LEV and lnAT. In Model 1, we report the results including the proportion of independent directors on the board, and the results suggest that firms with boards consisting of a larger proportion of independent directors are associated with low levels of past information disclosure by biotech companies. The results in Model 2, show that the coefficient of IND and the interaction term *IND_PRECL* are not significant. In the Model 3, 4 and 5 we present the results for BE and *BE_PRECL*, SS and *SS_PRECL* and CI and *CI_PRECL* respectively. We found a negative and significant ($p\text{-value} \leq 0.10$) impact of the independent members and the proportion of products

in preclinical phase of development on the extent of past information voluntarily disclosed by biotechnology companies, while the coefficient of business experts is not significant (Model 3). In the model 3 the interaction term, SS_PRECL is a negative and significant meaning that when products are in the preclinical phase of development, maybe because the competitive costs, support specialists tend to protect the private information by exercising a lower pressure on managers to disclose the information. The regression coefficient for the NBOD is positive and significant. Finally, in the model 5 our variables of interest, the proportion of community influentials members on the board of directors (CI_IND) and the CI_PRECL has a negative and significant impact on the extent of past information disclosed by the biotech companies.

-Table 8 here-

Table 9 reports regression results for the impact of the governance variables on the extent of future information disclosed by U.S. biotech companies. In the Model 1 we present the results for the IND, in the Model 2 the IND and the interaction term, IND_PRECL and Model 3, 4 and 5 considers the effect of the classification of board members into business experts, support specialists and community influentials and the interaction with the proportion of preclinical products of biotechnology companies. Model 1 and 2 presents the results for independent directors and the interaction with the preclinical products. The coefficient estimation for the IND and IND_PRECL are no longer significant while the PRECL coefficient estimation is negative and significant ($p\text{-value} \leq 0.1$) meaning that firms with a higher proportion of preclinical products tend to provide less future information disclosed by biotech companies. Business experts seems to not have any impact on the extent of future information (in the Model 3), instead support specialists has a positive and significant impact (at 5% level) on the extent of future voluntary disclosure. When there are high levels of products in preclinical stage of developments, support specialists tend to withhold the information, in this way protecting the firm against adverse action taking by competitors (Model 4). As highlighted by model 5, community influentials has a negative effect on the biotech future disclosure and a positive one when firms are characterized by a high proportion of preclinical products. In all the models of our regression estimation the coefficient of CEO duality (CHCEO) is significant and negative, meaning that when the CEO is also the Chairman of the Board of directors, firms tend to disclose less. This results is consistent with Gul and Leung (2002) that document a significant and negative relationship between duality and voluntary disclosure. Disclosure about the firm's future product development plans (this may include information regarding the plans to test the product on other diseases or in combination with other drugs) and market information may affect investors and others' market participants perceptions, which further can increase the firm's market value.

-Table 9 here-

In order to quantify the extent of firms voluntary disclosure provided by biotech companies, following the methodology proposed by Lev et.al. (2004), we build a disclosure index to capture the information on the properties of the product under development (product specifications), information on the intended use of the product (target disease), information on the success of the product in the clinical trials (clinical trials), information on the firm's future development plans (future plans) and ultimately, information on the product's market potential.

We disaggregate the total disclosure index into product specifications disclosure index, target disease disclosure index, clinical trials disclosure index, future plans disclosure index and market information disclosure index to better understand the impact of corporate governance on the extent of voluntary information provided by biotech companies.

Table 10 provides the regression results for the product specifications disclosure index. By using fixed-effects model, we found a significant and positive impact of patents (our proxy for

competitive costs) on the extent of product specifications voluntary disclosure. Regarding corporate governance variables, we do not found a significant impact on the product specifications disclosure index.

-Table 10 here -

Table 11 provides the results of the impact of corporate governance variables on the target disease disclosure index. As regards our variables of interests, in the model 1, we observe a positive and significant effect of the interaction effects of BE_PRECL, as opposed to the coefficient estimation of SS_PRECL (Model 2) and CI_PRECL (Model 3). For the other corporate governance and control variables we do not found any impact on the target disease disclosure voluntary disclosure.

-Table 11 here-

Table 12 show the regression results for the clinical disclosure index. The results of model 1 shows that independent board directors has a negative and significant effect on firms' voluntary disclosure. Moreover we also found that increased presence of outside directors that are business experts in associated with high levels of voluntary disclosure (in the Model 1), whilst in the Model 2 when independent directors are support specialists, they will tend to reduce the extent of voluntary information when products are in the preclinical phase of development.

-Table 12 here-

Tabel 13 presents results of the fixed-effects coefficient estimations using as the dependent variable the future plans disclosure index that is regress on a series of corporate governance and control variables. Model 1 shows that preclinical products (PRECL) and CEO duality (CHCEO) are negatively associated to future plans disclosure. The results in Model 2 lend evidence that when firms have support specialists on the board voluntary disclosure of future information increases. However, the interaction variable SS_PRECL is negative and highly significant ($p\text{-value} \leq 0.01$). it implies that, for a given percentage change in preclinical products, support specialists impact is more pronounced than for clinical products , probably because of the competitive costs protection. This has not been shown in the prior literature. This findings are consistent with the notion that independent directors may complements for firms' voluntary disclosure. Similarly, the results in Model 3 shows that when independent directors are community influential members, disclosure levels decreases. This findings also adds to prior research that has examined the corporate governance and voluntary disclosure by showing that because of their background independent directors may value differently the costs and benefits of disclosure, thus affecting companies' disclosure behavior differently.

-Table 13 here-

Table 14 reports the results using fixed-effect coefficient estimation considering the market information disclosure index. As can be seen (Model 1-3) independent directors do not have a significant impact on the extent of market information disclosure.

-Table 14 here-

5 Conclusions

Baysinger and Hoskisson (1990) underlines that independent directors are not homogeneous in terms of ability to monitor. In other words, the classification of independent directors in business experts, support specialists and community influentials help to sort their ability to monitor. Additionally, because of their background, directors may value differently the costs and benefits of disclosure, thus affecting companies' disclosure behavior in a different way.

Our results show that corporate governance plays a role in orienting the heterogeneity of

voluntary disclosures provided by US biotech companies. We find a positive association between support specialists and firms voluntary disclosure when drugs-in-process are in preclinical phase of development. The result is consistent with the complementary relationship between outside directors and voluntary disclosure in monitoring managers.

The results of this paper shed light on our understanding of corporate governance structure and underlying agency and proprietary costs. Corporate governance standard setters should consider the various directors' competences when asserting the optimal design of corporate governance mechanisms.

The paper contributes to the previous literature by providing evidence that corporate governance affects the proprietary costs of disclosure. In particular, we provide evidence that the traditional distinction between independent and non independent directors do not fully capture the variety of directors competencies sitting on the board. Our research has a number of limitations. The endogeneity issue between the presence of independent directors and voluntary disclosure may be deeper investigated. Further research will certainly shed light on this important research area.

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***Corporate Governance and Product Related Voluntary Disclosure:
An Analysis of Biotech Firms***

Summary

The objective of this study is to assess the impact of corporate governance on firms' product-related disclosure of biotechnology companies in the presence of agency and proprietary costs. In order to conduct this investigation we use regression analysis employing data compiled from 10-K forms and proxy statements. We hypothesize that voluntary disclosure – considering the approach suggested by Lev et.al., (2004) – is a function of governance structure measured by a set of independent variables based on the board of directors typology proposed by Hillman et.al. (2000) and Baysinger and Butler (1985). The results of this study will shed light on our understanding of corporate governance structure and underlying agency and proprietary costs. The study further explores and provides useful insights and practical implications for corporate governance standard setters. They should consider the various competences of board members such as skills, expertise, knowledge and specific functions of individual directors in expressing the impact of corporate governance on firms' voluntary disclosure.

Key words: Corporate Governance; Biotechnology Voluntary Disclosure; Proprietary costs; Board composition.

JEL classification: G34, M41.

Editorial note:

Due to the restrictions on a paper's extent in the hard copy of *Conference Proceedings*, the appendix and tables, which are referred to in the paper by author, are published on the attached CD medium *Conference Proceedings* only.

How Does Management Accounting Contribute to Performance Measurement?#

*Zbyněk Halíč**

1 Introduction

Recently significant changes have taken place in society and business environment. These changes are reflected also by a need to consider practical ways of use traditional tools and methods of performance management. Undoubtedly management accounting which is often referred to as the backbone of information management ranks among these tools.

One of the fundamental prerequisites for the successful development of each company is the ability to ensure a satisfactory performance level. Obtaining abundance of high quality information, which reflect the level of business performance and help all involved bodies to understand in what direction and why the performance is developed, as well as the possibility of controlling the way they should develop, requires the existence of quality and complex information system and management control system. Under the terms of such a corporate information system, particularly in matters relating to financial performance, an accounting subsystem plays an important role. Accounting is always associated with decision-making tasks of various subjects and therefore it should enable them to take the right decisions related to the company.

This paper is the first output which has been processed within the project supported by the Internal Grant Agency of the University of Economics in Prague “The Role of Management Accounting in Performance Measurements”. Nevertheless, it is a follow-up paper to earlier ones, which were processed within the project “The Role of Accounting Information in Financial Performance Measurements” (also supported by the Internal Grant Agency of UEP).

The prior project was focused mainly on the financial performance of an enterprise, whereas a new project focuses on broadly defined performance (see definition of CIMA, 1982), which comprehensively reflects the condition and development of a firm. That is why the prior project was devoted primarily to issues of performance measurement and management using mainly financial information, while the new project extends the scope on non-financial criteria and especially on issues of integrity of financial and non-financial measures.

The core of earlier outputs was measuring and assessing financial performance by external users of financial information (Halíč, 2010) and performance management from managers’ viewpoint (Halíč, 2011).

It should be noted that although the financial performance seems to be a key factor in the management control, it is still only a partial aspect that affects more complex performance at a broader level of understanding. The relationship between generally conceived performance and financial performance of the company (primarily from manager’s point of view) will be an issue of this paper and particularly of further research.

The paper has been processed as an output of a research project The Role of Management Accounting in Performance Measurements registered by the Internal Grant Agency (University of Economics, Prague) under the registration number F1/13/2012.

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In this regard, the paper (and the related research) focuses mainly on the following objectives:

- to analyse the developmental tendencies of management accounting and financial performance measurement;
- to analyse the role of management accounting in performance management system and to assess its importance, but also highlight areas where management accounting suffers from its limitations,
- to assess to what extent the information needs of managers are compatible with the information needs of external users, and consequently to consider whether it is better to design two separate information systems or not.

2 Performance of an enterprise and its management

Business performance can be generally defined as the characteristic, which assesses whether the business process helps to achieve business goals within a defined time period. If so, this characteristic should also measure the extent it occurs and assess what factors contribute to it. According to Wagner (2005) the above definition implies the following context: The objectives of an enterprise are resultant of objectives of all subjects that enter into a relationship with the company. The assessment always depends on the questions for whom and for what purpose is the performance assessed (assessment of performance is a purpose-oriented evaluation).

Other sources characterize performance measurement in the same way – for example as “the process of assessing the proficiency with which a reporting entity succeeds, by the economic acquisition of resources and their efficient and effective deployment, in achieving its objectives” (See CIMA, 1982).

Determination of targets and objectives of different involved subjects is crucial for the interpretation and conception of performance. The traditional determination of the objectives of an enterprise was historically oriented primarily to maximizing value for business owners. This concept is based on shareholders theory. The performance achieved is then understood primarily as increasing the value of capital invested by the owner of the company. This kind of performance can be suitably described by the financial measures, which results in understanding the performance only as its financial (value) component. Whether financial measures can reflect generally conceived business performance or not will be examined in the chapter “The Relationship between Financial Performance Measurement and Management Accounting”.

In the course of time stakeholders theory has more and more forcefully come in useful. This theory is based on the assumption that the aim of the company is not only to meet the expectations of its owners, but also expectations of other interested bodies in its vicinity (Stakeholders). For many of these interested subjects many aspects are more important than the company’s financial results. Performance is then to be understood in a broader context. In such a situation it is not possible to simplify the performance by reducing to its financial (value) component. This extensively perceived performance can no longer be assessed solely through financial (value) indicators and measures that are not able to evaluate non-financial¹ aspects of business.

While managing performance the managers strive to influence the economic subjects’ development by a rational way – so that they would be able to fulfil the aims they have been founded for (see Král, 2007). High-quality and sophisticated performance measurement system is one of the fundamental prerequisites for the successful business process management. The status of performance measurement system within the enterprise information system will be

¹ Examples of non-financial aspects can be “quantities” such as customer satisfaction and loyalty, the level of corporate culture, ability of the company to innovate, etc.

further discussed in the chapter “Content and Scope of Management Accounting”.

3 User differentiation of performance measurement

The very first question that should always be related to performance measurement is: “For whom do we actually measure the performance?” In general, it is possible to answer: “For anyone who has something to do with the company and therefore needs to be informed about its performance”. On the other hand, not all stakeholders perceive and understand the performance in the same way. This is because each of them uses the information obtained by other means.

It is purposeful to divide all the involved subjects into two groups according to whether they have the opportunity to directly influence the activities, whose performance is under consideration, or haven't. External users have many reasons to be interested in business performance. Wagner summarizes the most important of reasons as follows (for more details see Wagner, 2009, pp. 55 – 56):

- they need to reach a decision about their relationship to the organization;
- they need to enforce their rights to the organization;
- they need to influence the direction of development of the organization;
- they need to regulate performance and behaviour of agents;
- they need to compare the performance of the organization to other subject's performance.

Internal users also have many reasons to be interested in the company's performance. The essence of all these reasons is conception of performance measurement, which is understood by the internal users not only as a desire to obtain “mere” information about the performance, but especially as high-quality information support for management control. In order to have good business prospects for survival in the long run, it is necessary to look far enough into the future when managing and influencing business activities to achieve a satisfactory level of performance. Factors that determine the long-term growth potential (employee skills, customer satisfaction and loyalty, corporate databases, etc.) are either very difficult measurable or not measurable at all in the accounting system. The only financial measures have already ceased to reflect the evolution of this dimension of performance and should be enriched with non-financial, especially strategically oriented criteria. On the other hand, financial measures have a kind of sovereign status. Fulfilment of the objectives of the company and all stakeholders is eventually just the proper way to achieve good financial results (financial performance) in the strategic time horizon.

In the context of the above-mentioned differentiation of decision-making tasks of individual subjects that are interested in the business, it is necessary to adequately distinguish the data within the accounting system. The natural result of these claims is the separation of accounting designed for external users (i.e. interest groups outside the enterprise) from accounting designed for internal use (accounting as an information support of management control).

The natural emergence of two separate accounting systems may not – and even should not in my opinion – necessarily imply two different approaches to the conception of performance measurement. The different needs of different users require a different structure and sometimes even different content of output information or statements about the performance achieved, but they not require different conception of performance itself. The information technology has developed and expanded in such way that they offer almost limitless possibilities of supporting managerial decision making and management control as well as possibilities of ensuring the information needs of all other stakeholders.

If the external and internal users require different information it is not necessary – what is more,

it is not even correct during the boom of database tools and technologies – to archive this information in two different data stores in a different structure for each of them. The correct way is archiving of data in one central data store, in which each piece of information has a number of different attributes that reflect different views of different groups of users. Differentiated demands for performance information is then simply a matter of filtering data in the required database dimension and required structure. It is not a matter of the need to obtain different underlying data.

This consideration can be further generalized. This integration goes far beyond areas of financial and management accounting and associates data of many professional disciplines such as marketing, management, logistics or others, including information from the external environment of the company. Only such a complex integration of information allows comprehensive assessment of business performance, regardless of whether the entity's performance is assessed by subjects standing inside or outside the company.

4 Content and scope of management accounting

It is necessary to define some additional concepts before examining the relationship between performance measurement system and management accounting system. The performance and its conception were discussed in the previous chapter. Now it is necessary at least briefly define the content and conception of management accounting. These issues will be furthermore elaborated in subsequent chapters of this paper. Meeting the objectives of this paper requires not only assessing the role of management accounting in business performance measurement, but also assessment of the role of accounting in general in this process.

Management accounting is a very important tool for measuring and subsequently managing the financial performance of an entity.

Methods and tools of management accounting in various companies largely differ. It results in the lack of a coherent approach to management accounting. Almost all professional texts, which are focused on accounting theory, are aimed primarily on financial accounting. Publications aimed at the management accounting are then engaged in particular applications of management accounting tools in than conceptual issues of accounting theory.

Despite the absence of a comprehensive approach we can find a number of content definitions of management accounting. For example the definition of the Chartered Institute of Management Accountants (CIMA) of the United States of America can be mentioned: “Management accounting is the application of the principles of accounting and financial management to create, protect, preserve and increase value to the stakeholders of profit and not-for-profit enterprises, both public and private. Management accounting is an integral part of management, requiring the identification, generation, presentation, interpretation and use of information relevant to:

- formulating business strategy;
- planning and controlling activities;
- decision-making;
- efficient resource usage;
- performance improvement and value enhancement;
- safeguarding tangible and intangible assets;
- corporate governance and internal control” (see CIMA, 1982).

During recent years management accounting has undergone continuous development.² One of its key features is the fact that it has been increasingly extending beyond the principles of double-entry accounting. That is because of the requirements for timeliness and originality of various reports and other information. Other methodological elements are often applied in a modified form. Management accounting is thus understood as a system of value (financial) information aimed at purposeful selection of both accounting information and information from other subsystems of the information system of an enterprise as well as from the surrounding environment. The motivation of carrying out such special-purpose selections of information is to provide a range of information for decision making as wide as possible.

The result of the need to ensure information support for emerging methods and tools for measuring performance management accounting covers information that is beyond accounting method. When management accounting seeks to integrate such information into its field, it goes beyond traditionally-based accounting system. This aspect we will be discussed in the chapters “Dual Concept of Financial and Management Accounting” and “Trends in the Conception of Performance and Development of Management Accounting”.

5 Developmental trends of financial performance measurement

Requirements on management (and therefore necessarily also the measurement) of financial performance as a major factor in future growth potential of the business have evolved over time. The evolution, of course, must be reflected by appropriate development of management accounting, as the central instrument of management control. This development causes deepening and strengthening of the dual conception of financial and management accounting.

A number of developmental tendencies pervaded the text in previous chapters of the paper. At this point I consider it appropriate to summarize and organize these tendencies into a list. However, it does not pretend to be a complete listing, but rather strives to highlight the most important trends in measuring the financial performance and in the development of management accounting, which is an important tool for this measurement.

The performance of the company has been increasingly perceived as a potential for future success and growth, rather than as a simple glance in the past. The main task of measuring performance is to help to find answers to questions how our present and future decisions and actions contribute to the future benefit (see Wagner, 2005, p. 47). Business performance has been thus increasingly seen as a strategic parameter. In the long term, dynamics and success of business development and thus its performance depends mainly on the quality of its strategic management. Strong focus on the future requires the valuation of assets and liabilities, and consequently costs and revenues, based on expected future benefits or sacrifices (estimated present value of future benefits and sacrifices, estimates of market prices, etc.). Management accounting has adapted quite successfully for these requirements, while financial accounting in this regard remains – and must remain – more prudent and consequently more conservative. Valuation tied to future expectations is characterized by very high level of subjectivity, which is unacceptable in financial accounting, where is much more room for risk of abuse of information asymmetry between users and producers of reports informing about the performance.

An important amount of economic resources is spent during the innovation part of product lifecycle. The benefit of these resources, however, is approved by the revenue recognition much later than the expense had incurred. The matching of realized revenues and incurred costs should be based on the length of product lifecycle, rather than on traditional fixed (usually shorter) period. (For more details see Král at al., 2010.) Then it brings much higher information potential. This aspect primarily refers to the creation and use of intangible assets which are

² Developmental tendencies are discussed below in more detail.

cornerstones of competitiveness of the companies today. These assets therefore belong among the most important items of assets (of balance sheet). Time period in which the company achieves benefits from the intangible assets is usually delayed in comparison with the period in which the economic resources were sacrificed and activities that have established the potential to generate future benefits were undertaken. At the moment of sacrificing these economic resources (which means creating of intangible assets) only estimating of future benefits is possible. In this regard financial accounting suffers for its prudence again.

Just described time mismatch between the sacrifice of economic resources and getting the benefit from them is caused by increasing tendency to overcome the discontinuity of performance measurement. This limitation stems, inter alia, from performance measurement based on a fixed time period, for which the desired parameters are planned and budgeted. However, the final comparison may be made only when the evaluated process itself and all its direct consequences had been completed. Such aggregated information on the achieved performance can satisfy external users, whose mission is not to actively influence the business. However, such information is insufficient for company's management needs. Managers need to know not only information about the performance as whole, but especially detailed information about the factors that led to its achievement. Such information is, of course, obviously useful for external users too. Knowledge of the causes of performance achieved is an important aspect in further decision-making, because it allows making much better forecasts of future development. Managers of a company are responsible for its management, so they need information on performance as soon as possible. So that it is possible to influence and control the development of performance. It is too late to obtain such information when all processes have already taken place. In terms of time, therefore, demands for information of different groups of users are fundamentally different.

Another trend identified by Wagner (2005) and Král (2007), means the perception of performance as an internal source of the ability to achieve success in the external (market) environment. The objectives of the company and the chosen ways to achieve them, are usually formulated by managers of the company, however, the final performance recognized is always up to the external environment. This trend leads to the perception of business performance as the ability to satisfy the demands of all stakeholders and not only of the owners' ones. This idea is based on stakeholders theory and comes true in practice for example by application of analytical performance measures (an example was mentioned above – it is Balanced Scorecard). In this regard, customer worth of paying special attention, because his or her decision to buy or not to buy the product of the company determines a competitive position of the company and the level of financial performance achieved.

6 Developmental tendencies of management accounting

Changes in business environment are accompanied by development in the understanding, perceiving and measuring of performance. These changes must be, of course, reflected in the management accounting to be able to respond in a flexible way.

Many current trends stem from the effort to highlight the strategic perspective and its information support. In this context, however, the performance should be seen in broader concept than just as financial performance. In this chapter we will focus on developmental trends that are directly connected to shift in perception of the financial component of performance. These may include in particular (see Král, 2007):

- management accounting as a financial (value) information system;
- financial and non-financial management integrity;
- change in time parameters of accounting information for operational and tactical

management;

- multidimensionality of management and its information support.

6.1 Management accounting as a financial (value) information system

Management accounting is still linked to traditional concept of accounting information, however, especially the pressure on the timeliness, richness and originality of the information for future decision-making makes it necessary to abandon the strict application of all elements of the accounting methodology. The information is often transformed beyond the double-entry accounting principles (such as product costing).

This trend is also documented by the above mentioned effort of management accounting to react to current issues of performance measurement. The effort results in increasing the scope of management accounting. Management accounting is defined rather by its user orientation (i.e. focus on the needs and demands of managers) than by the type of information (which would meet the characteristics of genuine accounting information) (Wagner, 2005).

6.2 Financial and non-financial management integrity

There has been an increasingly strong pressure on linkage financial information with the natural (material) aspect of the business process. Complex performance measurement systems such as Balanced Scorecard, which links financial performance measures with a number of non-financial (natural) criteria, can be a suitable example.

The integrity also presents itself by tight linking of value quantities with natural aspect of the business process. It is necessary to see the specific operation or activity behind each piece of value information as well as the specific purpose of the expenditure of reasonable amount of economic resources.

6.3 Change in time parameters of accounting information

This change relates primarily to information for operational and tactical control. Pressure on the speedy presentation of accounting information is evident. Management accounting is abandoning the principles of reliability and relevance, because they necessarily imply a rigidity and delay of information. Management accounting focuses on providing a variety of reports reflecting the managerial needs with minimal time delay.

Due to the risks arising from information asymmetry the information with a high level of reliability has of course exceptional value in financial accounting. It is usually associated with reduction in timeliness of such information, however, it is an acceptable sacrifice for information credibility gained. It is not necessary to assume such strong conflict between interests of users and producers of management accounting information. It is therefore not necessary to separate the information that meets defined and harmonized requirements for the reliability from other information. It is possible to use not quite reliable and objective but timely information without a greater risk.

6.4 Multidimensionality of management and its information support

Manager, who manages business in today's complex and aggressive business environment, requires good information on the development of relevant variables in many aspects (points of view) simultaneously. These days it is standard practice to monitor information in the management line (aspect) of products, activities, sub-processes, processes, responsibility centres, customers, sales territories, distribution channels and possibly other useful aspects.

In my opinion, the financial accounting does not utilise the potential for assessment of financial performance, because it does not use the number of above mentioned aspects, in which information could be monitored. Financial accounting shows the reality only in a single aspect.

While trying to find one – the most correct – point of view seems to be quite naive and by far not the best, financial accounting still sticks to this effort quite stubbornly. Evidence is the approach of IASB, which is reflected by the conceptual framework of IAS / IFRS. It says that the financial statements which meet the needs of investors also meet the most of needs of other users (see IASB, 2005).

Each group of users has its own information needs. If it is possible to strive for fulfilment of needs of all the groups, it is a shame to settle for a compromise approach described above. Demands of all stakeholders can never be fully satisfied in this case.

The generally accepted definitions of accounting features include the view of accounting as the purpose-oriented model of a company. Groups of many interested people, who strive for different goals, imply a lot of purposes, for which the accounting could and should serve. Monitoring and reporting of information in several aspects (dimensions) together (which is much easier these days thanks to the level of information technology development)³ would greatly increase the explanatory power of financial statements.

This approach obviously implies the need to differentiate between user groups. While using the internal information system of a company workers on different positions have different access rights to data store, it is also possible to differentiate between external users. For example, an investor who holds 40% of shares or bank that contributes significantly to the capital of the company will gain more detailed information in different structure than for example ordinary employees or even competitors.

7 The role of management accounting in performance assessment

Performance management can be considered as a primary goal of managers. Managing business performance means influencing the development of the company that was entrusted to manager's care in order to optimally fulfil the objectives which the company has been founded for. Such a responsible task can be performed only with a sufficiently wide range of adequate source information.

Thoughts about the role of management accounting in financial performance measurement, of course, cannot depend on whether management accounting itself (respectively its tools) can measure business performance, but rather on its integration with other systems and on its role in these relationships.

Performance management should necessarily integrate all the functions of a high-quality management control system, which means organizational function, planning function, controlling function, motivation function and last but not least, the information function, which penetrates all the above mentioned. Management accounting can be considered as an information tool of performance management system, so it can be characterized as an information-oriented performance management subsystem.

Now it is necessary to revert to question what is actually the scope and extent of management accounting. Former in the text the integration of information from financial and management accounting as well as from other professional disciplines (marketing, management, logistics or others) including information from the external environment of the company was commented. This complex integration of information leads to the fact that management accounting goes beyond its traditional scope (which means orientation exclusively to accounting and/or financial information).

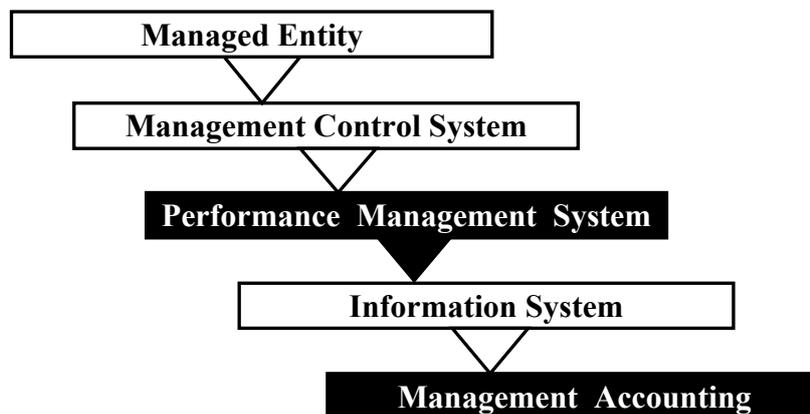
³ Let us mention the possibility of storing data in one central data store, in which each piece of information has a number of different attributes that reflect different views of different user groups. Differentiated demands for performance information are then only a matter of filtering data in the required structure and in the required database dimension due to database technologies and tools.

This complex and modern perception of management accounting means linkage with other fields related to the comprehensive management of the company. It can ensure the performance measurement methods in a wider meaning by comprehensive information support.

In the traditional approach to performance (for example in accordance with CIMA’s definition, as defined above in the text) only financial (value) measures are included in scope of management accounting, while the measures of performance are often based as well on natural criteria. That is why the management accounting as an information support for the performance management system plays only a partial role.

The fact that the role of management accounting in performance management system is only partial, however, does not imply that management accounting, which has traditionally focused rather on operational and tactical level of management control, is not an appropriate management tool. The possibility of effective strategic performance management must necessarily be supported by effective operational and tactical procedures. In this regard, the role of management accounting is important. It is necessary to become aware of its proper linking to strategic objectives.

Fig. 1: Hierarchy of Management Control



Source: Author’s own elaboration

The mutual hierarchy makes clear that both management accounting and performance management system are influenced primarily by demands for efficient management control. However, this relationship should be also seen in reverse order. A prerequisite of effective management control is that both the performance management system, as well as management accounting system operate in conformity with each other and provide high-quality information to enable appropriate assessment of reality. That is the irreplaceable function of both these systems.

8 Conclusions

Turbulent and aggressive competitive environment of today’s world increasingly forces organizations to understand business performance rather as a future potential ability to succeed in the marketplace than as plain view on the present or the past. A high-quality information system becomes a necessity. Accounting subsystem includes financial information, which creates conditions for effective management of financial performance. Such information helps all interested parties to understand the direction and causes of company’s development.

While managing performance the managers strive to influence the economic subjects’ development by a rational way – so that they would be able to fulfil the aims they have been founded for. Financial performance, which is based on traditional financial indicators, is a

hierarchically subordinated item of complex evaluation of business performance. It is just one – albeit important – part of the performance.

Performance measurement is significantly affected by user dimension. From the perspective of business management performance is a very broad-perceived characteristic, which reflects whether the company meets its objectives or not. From the perspective of external users performance is narrowed to assessing the financial performance and is limited by the accounting regulations.

However, the natural emergence of two separate accounting systems may not (and even should not) necessarily imply two different approaches to the conception of performance measurement. The different needs of different users require a different structure and sometimes even different content of information about the performance achieved, but they not require different conception of performance itself.

As it was said above, the performance of the company has been increasingly perceived as a potential for future success and growth, rather than as a simple glance in the past. Business performance has been thus increasingly seen as a strategic parameter. Increasing tendency to overcome the discontinuity of performance measurement has been taking place. This effort stems from performance measurement based on a fixed time period, for which the desired parameters are planned and budgeted. However, the final comparison may be made only when the evaluated process itself and all its direct consequences had been completed. Performance has been increasingly perceived as an internal source of the ability to achieve success in the external (market) environment. The objectives of the company and the chosen ways to achieve them, are usually formulated by managers of the company, however, the final performance recognized is always up to the external environment. Management accounting has adapted quite successfully for these requirements, while financial accounting in this regard remains – and must remain – more prudent and consequently more conservative.

These changes must be, of course, reflected in the management accounting which is an important tool for measuring and managing performance to be able to respond in a flexible way. Developmental trends that are directly connected to shift in perception of the financial component of performance may include:

- management accounting as a financial (value) information system;
- financial and non-financial management integrity;
- change in time parameters of accounting information for operational and tactical management;
- multidimensionality of management and its information support.

Comprehensive performance management system (as being perceived by managers) requires besides financial criteria also a number of natural criteria. Performance management system goes far beyond the management accounting itself. Management accounting can be considered as an information tool of performance management system, so it can be characterized as an information-oriented performance management subsystem. The role of management accounting in performance management system is only partial, but still crucial.

Despite the dynamic development of financial accounting, thanks to which external users have better information on the development of performance, there are many important aspects that are still denied to external users. They receive information broken down according to whether the transaction relates to the core business or not. However, despite increasing emphasis on the assessment of future benefits (fair value valuation) all the information is bounded by demands for prudence and reliability, which can significantly weaken their explanatory power. Reports

compiled in several dimensions together would allow satisfying the demands for reliability and prudence of information displayed as well as enabling reporting of information which could support decisions on future matters, although burdened with a much greater degree of subjectivity.

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How Does Management Accounting Contribute to Performance Measurement?

Summary

The paper concerns measuring and reporting of performance of an enterprise. During these “post-crisis” days the financial-based criteria are often loudly criticized. That especially disappointed in the strategic decision making, because they often seem to be removed from the substance of the assessed activities. The paper is concerned with measuring and reporting of performance of an enterprise primarily from manager’s point of view. In its first part it deals primarily with the connection between the performance of an enterprise in general and financial performance. In subsequent part it is about the relation of performance management and

management accounting. Then it summarizes the most important developmental tendencies of financial performance measurement and management accounting.

Key words: Performance Measurement; Management Accounting, Developmental Tendencies.

JEL classification: M41.

Discretionary Reporting of Initial Public Offerings in Specific Industries[#]

Peter Ising^{*}

Summary

This paper contributes evidence to the discretionary accounting choices in the years around initial public offerings (IPOs) in specific industries. I use several models with focus on various accounting choices (e.g. inflating sales) and enhance them by including year indicators. The partitioning variables for accruals detect opposed discretionary behaviour over time and especially around an IPO. I distinguish between accrual management and real activities management. Five models test for earnings accruals; these are Healy, Jones, modified Jones, Dechow/Dichev and McNichols. For sales accruals I test with one model. For measuring real activities my methods cover the management of cash flows, R&D, inventory, production costs, COGS, SG&A, discretionary expense and gains on asset sales. All models are tested across pooled industries versus individual industries. The results show significant differences of discretion in specific balance sheet items depending on particular industries. Furthermore the outcomes indicate systematic patterns of discretion in pre- versus post-IPO years and in the reversals. To the best of my knowledge this research design of pre- versus post-IPO years is new and not used either in a combination of specific accounting variables nor for individual industry groups nor in an IPO setting. This new approach gives insight in discretionary behavior before and after IPOs and helps investors when pricing firms.

Key words: IPO; Earnings management; Accruals.

JEL classification: G24, G39, M41.

[#] **Editorial note:** Upon author's request, only the summary of accepted paper is included in the Proceedings. For further information on paper, please contact the author directly.

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Is There Some Opportunistic Discretion While Applying the Impairment Test of Goodwill? An Empirical Analysis

*Mateja Jerman**

1 Introduction

In 2001 Financial Accounting Standard Board (FASB) approved Financial Accounting Standard 141 (FAS 141) and Financial Accounting Standard 142 (FAS 142) which introduced a radical change in accounting for goodwill. A few years later, in 2004, International Accounting Standard Board (IASB) moved ahead the American Standards, with the issuance of International Financial Reporting Standard 3 (IFRS 3) and the revised versions of International Accounting Standard 36 (IAS 36) and IAS 38. Standards changed the unit of account for goodwill and took a different approach on how goodwill has to be subsequently accounted after its initial recognition. Goodwill is no longer subject to amortization, but it is in accordance with IFRS 3 tested for impairment. For the purpose of impairment testing goodwill is assigned to cash-generating units (CGUs). Companies have to recognize an impairment loss when the carrying amount of the CGU exceeds its recoverable amount.

Since the allocation of goodwill to cash-generating units and the calculation of recoverable amount (when active prices are not available) is subject of discretion (Carlin – Finch 2010), studies suggest that management performs impairment testing of goodwill opportunistically (Segal, 2003; Beatty – Weber, 2006; Zang, 2008; Ramanna – Watts, 2011).

The present study aims to perform an empirical analysis of incentives that might influence management to act opportunistically while applying the impairment test of goodwill. Research based on IFRS users are lacking, particularly in times of financial crisis. The present study is performed on the sample of German publicly traded companies which prepare their annual accounts in accordance with IFRS, focusing on the period 2008-2010.

2 Theoretical background

Studies that were focused on opportunistic discretion of goodwill impairment testing can be divided to those that focused on the year when the new accounting rules were introduced (Segal, 2003; Beatty – Weber, 2006; Zang, 2008; Hamberg et al., 2011; Van de Poel et al., 2009; Verriest – Gaeremynck, 2009; AbuGhazaleh et al., 2011) and those that focus on subsequent periods (Guler, 2006; Cowan et al., 2006; Ramanna – Watts, 2011). The segregation is important since the impairment losses in the period of adoption were treated differently from subsequent periods. In the case of American FAS 142, impairment losses were treated as the bellow the line expenses (using the cumulative method of accounting) and as such did not have an impact on the income from continuing operations. Subsequently, impairment losses became a part of above the line income statement. On the other hand in the case of IAS 36 implementation the retroactive method was in use. Adoption write-offs were charged to opening retained earnings (no effect on income). Afterwards, impairment losses became a part of expenses from continuing operation (the same as FAS 142).

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As can be noted, adoption write-offs treatment differs from the one that was used afterwards. In the case of FAS 142 first time implementation write-offs impacted the income from discontinued operations, while in the case of IFRS the impact was evidenced in equity capital. Researchers have emphasized that companies which security prices are less affected by income from discontinued operation were more likely to recognize larger impairment losses and thus avoid or minimize impairments in the future when they take part of income from continuing operations (Bens – Heltzer, 2005). Management was more likely to take impairments even in the case of retroactive method (implementation of IAS 36) when the charges did not appear on the net income (Lapointe-Antunes et al., 2008).

Majority of studies were focused on American FAS 142 (Segal, 2003; Beatty – Weber, 2006; Zang, 2008; Guler, 2006; Cowan et al., 2006; Ramanna – Watts, 2011), while discretion choices were subject of investigation in the case of IFRS by Hamberg et al. (2011), Van de Poel et al. (2009), Verriest and Gaeremynck (2009) and AbuGhazaleh et al. (2011). The most notable is the study of Ramanna and Watts (2011), performed on the sample of US companies, which includes incentives that influence discretion and factors that facilitate discretion.

Little research has been done after the first year of impairment test implementation (Guler, 2006; Cowan et al., 2006; Ramanna – Watts, 2011), especially in the case of IFRS users.

To date the most commonly explored incentives that stimulate managers to act opportunistically relate contracting motives. In the case of goodwill impairment testing the contracting motives that were already subject of empirical testing concern: covenant slack (Beatty – Weber, 2006; Zang, 2008; Ramanna – Watts, 2011), changes of chief executive officers (Segal, 2003; Riedl, 2004; Guler, 2006; Zang, 2008; Masters-Stout et al., 2008; Hamberg et al., 2011) and management's compensation (Beatty – Weber, 2006; Hamberg et al., 2011; Ramanna – Watts, 2011). Lately, studies (Ramanna – Watts, 2011) focus also on factors that facilitates discretion (number of CGUs, unverifiable net assets), deriving from the current standards in use.

2.1 Contracting motives and opportunistic discretion

Companies with more tight debt covenants will be stipulated to act more opportunistically, to avoid possible violations of covenants and thus incur higher cost of financing. Since, often the inclusion/exclusion of goodwill in covenants is not disclosed (Ramanna – Watts, 2011), authors often use as a proxy the debt ratio (Zang, 2008; Godfrey – Koh, 2009) or financial leverage ratio (Hamberg et al., 2011). Only Beatty and Weber (2006) and Ramanna and Watts (2011) were those who analyzed the impact of covenant slack on goodwill impairment.

It is supposed that companies with higher debt ratio will have a lower financial slack and be more favorable to record lower impairments (Cotter et al., 1998). In the survey of Easton et al. (1993) debt ratio resulted as one of the most important factors that influence the decision of chief executive officers about impairments of assets. On the basis of 82 Australian publicly traded companies Cotter, Stokes and Wyatt (1998) provided evidence that companies with higher debt ratios recorded lower impairments of long-lived assets.

Beatty and Weber (2006) were the first that explored the impact of debt covenants on discretion of goodwill impairments (in the case of FAS 142 implementation). Companies with less slack in net worth covenant threshold were less likely to record goodwill impairments. Ramanna and Watts (2011) applied a similar approach, but upgraded the research by including the periods after the introduction of FAS 142. The variable in use was measured as the product of debt ratio and an indicator if the firm has a net worth or net income based debt covenant. The measure resulted as negatively associated with impairment losses of goodwill.

On the other hand Zang (2008) used as a proxy for debt covenants the leverage ratio. Transitional impairment losses of goodwill resulted as relatively smaller for more highly leveraged firms. Lapointe-Antunes et al. (2008) in the case of Canadian companies found out

that firms with higher than target (industry) leverage recorded lower transitional goodwill impairment losses.

Moreover, it is argued that management with a longer tenure is associated with lower impairments of goodwill (Beatty – Weber, 2006; Ramanna – Watts, 2011). Management with a longer tenure has probably made the original acquisition decision and is thus not favorable to the recognition of goodwill impairment since it might suggest that the purchase price was too high. On the sample of American companies, both, Beatty and Weber (2006) and Ramanna and Watts (2011) confirmed the stated hypothesis. More often authors provided evidence that chief executive officer changes lead to higher impairments of goodwill (Zang, 2008; Masters-Stout et al., 2008; Lapointe-Antunes et al., 2008; Hamberg et al., 2011). This was the case of FAS 142 introduction (Zang, 2008) and transition goodwill impairment losses in Canadian context (Lapointe-Antunes et al., 2008).

Management's compensation is also supposed to have an impact on decision about goodwill impairment. If the management is remunerated on the basis of accounting numbers, impacted by the impairments of goodwill, it will not be favorable to recognize write-offs (Hamberg et al., 2011). It is argued that the highest proportion of cash compensation is accounting-based (Watts – Zimmerman, 1978). Usually, written on net income and thus, including the effect of impairment loss. Beatty and Weber (2006) found out that managers with earnings-based bonuses which did not include transitional impairment losses (special items in the income statement) recorded lower impairment losses when adopting FAS 142. In the case of Ramanna and Watts (2011) 57% of the companies which did not record impairment had a variable remuneration in the form of cash bonus, while in the companies where impairment loss was recorded this was the case only in 39% of the companies. The test of association resulted as statistically significant.

2.2 Factors that facilitate discretion

Empirical studies about the factors that facilitate goodwill discretion are lacking. Ramanna and Watts (2007) were the first who explored factors that might lead to opportunism of managers. From their point of view the discretion can be aligned to (Ramanna – Watts, 2007, p. 2):

- Number of CGUs and size of CGUs;
- The proportion of unverifiable net assets.

Beatty and Weber (2006) and Lapointe-Antunes et al. (2008) were those who investigated the relationship between the number of CGUs and impairment of goodwill, while Vanza, Wells and Wright (2010) were exploring the impact of the number of CGU on impairment of long-term assets (including goodwill, tangible fixed assets and inventory).

Authors are not completely coherent regarding the impact of CGUs' number on discretion choices. Ramanna and Watts (2007) demonstrated that more numerous CGU lead to lower impairments of goodwill. Similarly, Zhang and Zhang (2007) in their empirical research, based on the sample of American companies, found out that in the process of acquisition a larger proportion of purchase price surplus (over the fair value of net identifiable assets) was allocated to goodwill (and less to previously not recognized intangible assets) in the case of companies with more numerous segments (proxy for CGUs). The analysis shows that companies believed that more discretion would be present in cases where more segments were formed.

On the other hand Lapointe-Antunes et al. (2008) believe that more numerous CGUs make more difficult the redistribution of losses among CGUs. However, the results of their empirical analysis did not confirm their expectations. Companies with more numerous CGUs recorded less goodwill impairment. Similarly, Ahmed and Guler (2007) state that more numerous CGUs are connected with lower extent of discretion. In their empirical analysis, based on American

publicly quoted companies they found out that goodwill of companies with more numerous CGUs explains a higher extent of stock prices in comparison with goodwill allocated to less CGUs. *Ceteris paribus*, more numerous are CGUs less discretion is present while allocating goodwill to CGUs. On the basis of present day studies the relationship between the number of CGUs and subsequent discretion in impairment testing is still not clear.

The proportion of unverifiable net assets was subject of analysis in the case of Zhang and Zhang (2007) and Ramanna and Watts (2011). Zhang and Zhang (2007) found out that companies allocated less purchase price surplus (over the fair value of net identifiable assets) to goodwill in cases when the share of unverifiable net assets was smaller. More goodwill was recognized in companies with larger proportions of unverifiable net assets. In the case of Ramanna and Watts (2011) higher unverifiable net assets were associated with lower impairments of goodwill.

3 Research framework

3.1 Research question and methodology

Since studies have shown that companies act opportunistically, while applying the impairment test of goodwill, we are interested if:

Is there any discretion while applying IAS 36 in the case of European companies?

In order to answer the research question we focus our analysis on German publicly traded companies in the period 2008-2010. The sample consists of companies with market indications of goodwill impairment; i.e. those that have the book value of equity capital higher than the market value; M/B ratio < 1 at the day of balance sheet for each financial year (in accordance with the methodology of Beatty – Weber, 2006; Vanza et al., 2010; Ramanna – Watts, 2011). Firstly, companies where M/B ratio was less than one for two consecutively years were selected (in accordance with the methodology Ramanna – Watts, 2011) to enhance the power of tests, but the sample resulted too small.

We excluded financial institutions and companies with no goodwill on their balance sheet. The final sample resulted in 200 observations. The financial data were gathered from the database Datastream, Worldscope and hand collected from the annual reports.¹

According to the methodology of Ramanna and Watts (2011), firstly, the presence of positive private information hypothesis was tested. We examined whether non-impairment firms are more likely to show evidence of net share repurchase activity (repurchase of own shares) or net insider buying (directors' purchases of shares). For this purpose we used the test of association.

For the empirical testing of discretion the logistic regression analysis is used. The distribution of the dependent variable (impairment of goodwill) is asymmetric and takes value between 0% and 17% (measured as goodwill impairment of the year over previous year assets). Only 26% of the companies in the sample recorded impairment. That is why multiple regression analysis (used by Segal, 2003; Ramanna – Watts, 2011) or tobit analysis (Cowan et al., 2006; Beatty – Weber, 2006; LaPointe-Antunes et al., 2008; Zang, 2008; AbuGhazaleh et al., 2011) are not appropriate (Hopkins, 2011). In the logistic regression analysis the dependent variable is a binary variable. Logistic regression was already used by Guler (2006), Van de Poel et al. (2009), Verriest and Gaeremynck (2009).

¹ Data about the own shares repurchase, directors' dealings, changes of management, management remuneration and number of CGUs were hand collected from the annual reports.

The model used can be expressed as follows:

$$Imp_i = \text{Intercept} + \beta_0 * (\text{Incentives for opportunism}) + \beta_1 (\text{Reporting discretion}) + \beta_2 (\text{Control variables}) + \varepsilon_i \quad (1)$$

In the above equation Imp_i is measured as 1 when a company recorded impairment and 0 when no impairment was present. Independent variables are measured as follows.

Incentives for opportunism:

- changes of chief executive officers (ΔCEO_s); it is a dummy variable that equals to one if there has been a change in chief executive officers in time t and t-1 and zero otherwise (according to the methodology Riedl (2004) and Zang (2008). It is deemed that newly appointed management has incentive to impair goodwill to avoid impairments that might arise in the future. It is expected when there is a change in key management that impairment loss of goodwill is more likely to occur.
- management's compensation (*bonus*); it is a dummy variable that equals to one if the chief executive officers received a cash based bonus in the year t and 0 otherwise. Previous empirical analysis has shown that cash compensation is usually based on accounting profit (Beatty – Weber, 2006; Ramanna – Watts, 2010). Managers with an accounting based compensation are not willing to record an impairment loss.
- debt ratio (*debt%*); measured as the amount of debt over total assets. It is expected that firms with higher debt ratio are not favorable to impairment of goodwill.
- *big bath* and *smoothing* variables are calculated according to Riedl (2004). Big bath and smoothing variables are based on earnings change between year t-1 to t, scaled by year t-1 assets. The big bath variable is the scaled accounting change if it is less than the median negative value, and zero otherwise. Firms with bigger negative changes are expected to have larger goodwill impairments (in our case we expect a higher likelihood of impairments). The smoothing variable is the mirror image of the bath variable. Under earnings management, the smoothing variable should be negatively associated with the goodwill impairments. Large increase in earnings shall lead to a higher likelihood of goodwill impairment.
- impairments of other assets; we expect that firms with higher impairments of long-term assets (impairment of financials – *Imp fin*, impairment of intangibles and property – *Imp int*, impairment of property, plant and equipment – *Imp PP&E*; measured as separate independent variables) have incentive not to recognize impairments of goodwill.

Goodwill reporting discretion:

- number of CGUs (*CGUs*), measured as the number of CGUs,
- verifiable net assets (*VNA*); measured as [cash + investments] : [assets - liabilities]. Higher verifiable assets are expected to allow less discretion and thus lead to higher probability of goodwill impairments.

Control variables:

- proportion of goodwill (*GW%*); measured as goodwill of the previous year over total assets in time t-2,
- *total assets*; measured as total assets of the current financial year,
- changes of ROA (ΔROA); measured as changes of return on assets of the current financial year over previous financial year,
- changes of cash flow from operations ($\Delta CF Oper$); measured as changes of cash from

operations of the current financial year over previous financial year,

- changes of sales ($\Delta sales$); measured as changes of sales of the current financial year over previous financial year,
- changes of net income (ΔNI); measured as changes of net income of the current financial year over previous financial year,
- Market value to book value ratio ($MVBV$); calculated at the day of annual balance sheet,
- Buy and hold return ($Buy \ \& \ hold$); company's stock return from the beginning to the end of the financial year.

3.2 Data analysis and results

Descriptive statistics

Descriptive statistics are presented separately for nominal variables (table 1) and continuous variables (table 2). Goodwill impairment (over total assets) in average represents 0.495% of total assets. One would imagine that the economic non-importance of goodwill impairments might be connected with economical non-importance of goodwill in the balance sheet. However, the results show that this is not the case. Goodwill represents on average 12% of total assets (table 2). Descriptive statistics of non-impairers and impairers show the following. Interestingly, the share of debt is higher in the case of non-impairers (57%) in comparison with impairers (52%). Non-impairers have lower average buy and hold return (-19%) in comparison with impairers (-2%).

Impairments occur at most in 2009, followed by 2008 and 2010 (table 1). CEO changes occurred in 39% of the companies, while cash based bonus was paid in 73% of the cases. Circumstances where big bath techniques might be used were present in 50% of cases, while smoothing variable was present in 37% of cases.

Tab. 1: Descriptive statistics of nominal variables

		Impairment of goodwill		
		No impairment	Impairment	Total
year	2008	53%	35%	48%
	2009	30%	52%	36%
	2010	18%	13%	17%
Δ CEOs	No	66%	48%	61%
	Yes	34%	52%	39%
Bonus	No	24%	37%	27%
	Yes	76%	63%	73%
Big bath	No	53%	42%	50%
	Yes	47%	58%	50%
Smoothing	No	61%	71%	64%
	Yes	39%	29%	37%
TOTAL		148	52	200

Source: Worldscope, Datastream, annual reports, own calculations

Tab. 2: Descriptive statistics

Tab. 2: Descriptive statistics																		
	Impairment of goodwill																	
	No impairment						Impairment						Total					
	Average	Median	St. dev.	Min	Max	n	Average	Median	St. dev.	Min	Max	n	Average	Median	St. dev.	Min	Max	n
GW imp. %	,000	,000	,000	0	0	148	1,902	,369	3,328	0	17	52	,495	,000	1,881	0	17	200
Debt %	57,527	60,120	16,464	11	85	148	52,346	53,085	21,658	10	86	52	56,180	58,305	18,046	10	86	200
Imp fm	15143,689	,000	148817,969	0	1799000	148	10113,077	,000	51375,256	-20788	362400	52	13835,730	,000	130541,237	-20788	1799000	200
Imp int	4082,378	,000	23721,575	0	181600	148	6300,154	,000	15047,705	0	79000	52	4659,000	,000	21786,562	0	181600	200
Imp PP&E	7244,493	,000	39120,172	-7218	402000	148	13590,981	,000	46838,454	-86088	268100	52	8894,580	,000	41237,319	-86088	402000	200
CGU	2,762	2,000	1,567	1	11	148	3,077	3,000	1,426	1	7	52	2,844	3,000	1,534	1	11	200
VNA %	11,523	9,545	10,157	0	57	148	13,424	9,250	11,596	0	52	52	12,017	9,342	10,553	0	57	200
GW %	11,836	6,056	14,436	0	91	148	12,948	9,777	11,835	0	52	52	12,128	6,931	13,780	0	91	200
Assets	5583170,176	344689,500	25181992,510	25714	211922000	148	2892191,635	275140,000	6668718,815	42305	27020900	52	4883515,755	333054,500	21936892,569	25714	211922000	200
ΔROA	-1,168	-1,260	8,926	-33	39	148	-5,576	-3,755	12,607	-38	28	52	-2,314	-1,320	10,166	-38	39	200
ΔCF Oper	-27931,135	-1023,000	1233787,449	-9883000	9743422	148	11911,269	-1627,000	114116,437	-359460	372100	52	-17572,110	-1082,500	1062123,739	-9883000	9743422	200
ΔRevenues	26021,047	8886,000	950578,755	-9450000	3212000	148	109939,038	2060,000	832102,125	-2546880	4053800	52	47683,725	6996,500	919931,204	-9650000	4053800	200
ΔNet income	-166919,480	-2764,500	1326771,070	-13393910	4078039	148	-202982,058	-10712,500	843859,246	-4598339	1033871	52	-176295,750	-3514,500	1217820,608	-13393910	4078039	200
MVBV	,678	,680	,210	0	1	148	,667	,725	,218	0	1	52	,675	,695	,211	0	1	200
Buy&hold	-19,871	-38,474	52,936	-88	191	148	-2,292	-2,077	58,639	-90	223	52	-15,300	-27,510	54,872	-90	223	200

Source: Worldscope, Datastream, annual reports, own calculations

Association of goodwill write-offs with positive private information proxies

Firstly, we analysed if there are any positive private information about the future cash flows of non-impairers that might explain the absence of impairment (information asymmetry). We performed the test of association, comparing the existence of positive private information between non-impairers and impairers (table 3). Positive private information is measured with the presence of net shares repurchase activity and positive net insider buying. Information asymmetry variable takes the value 1 when positive net share repurchase activity or positive net insider buying is present and 0 otherwise.

Tab. 3: Information asymmetry

	InfoAsym = 0	InfoAsym =1	Total	% with private info
No impairment	86	62	148	42%
Impairment	36	16	52	30%
Total	122	78	200	39%
Chi-square = 0.157 > P = 0.05				

Source: Annual reports, own calculations

The analysis reveals that no statistical difference is present while analyzing the existence of positive private information between impairers and non-impairers. The latter was confirmed even with the separate analysis of both variables. On the basis of our results we cannot state that non-impairers have some private information (at least not at the basis of own share repurchase and positive net insider buying) which could explain the absence of goodwill impairment.

In continuation the incentives that could stimulate opportunism and factors that facilitate discretion were analyzed with logistic regression.

Results of logistic regression

Firstly, univariate logistic regression was used to investigate the relation between dependent variable and individual independent variable. The results in table 4 indicate that the impairment of goodwill is twice as likely in companies with a change of CEO. Goodwill impairment is also more likely to occur in companies where management did not receive a cash based bonus. As significant resulted also the share of debt which indicates that firms with higher debt ratio are less likely to record goodwill impairment. In the group of control variables three of them resulted as statistically significant. Positive (and higher) changes of ROA are connected with less likelihood of goodwill impairment. Thus, more profitable companies are less likely to impair goodwill. The time component indicates that companies were almost three times more likely to record the impairment of goodwill in 2009 in comparison with 2008. It seems that the financial crisis lead to a higher likelihood of goodwill impairment only in 2009. Finally, as significant resulted also buy and hold return, but the sign does not seem to be in conformity with the expectations which derive from the literature. On the basis of univariate regression it seems that companies with higher returns of their shares are more likely to impair goodwill.

Tab. 4: Results of univariate logistic regression

		95% confidence interval			
		Odds ratio	Lower	Upper	P value
<i>Incentives:</i>	Δ CEO	2,054	1,082	3,899	,028
	Bonus	,538	,273	1,062	,074
	% debt	,984	,967	1,002	,077
	Big bath	1,519	,803	2,875	,199
	Smoothing	,629	,317	1,248	,185
	Imp. financial assets	1,000	1,000	1,000	0,813
	Imp. intangible assets	1,000	1,000	1,000	0,534
	Imp. PP&E	1,000	1,000	1,000	,358
<i>Reporting discretion:</i>	CGU	1,134	,932	1,379	,208
	Verifiable net assets (VNA)	1,016	,988	1,046	,267
<i>Control variables:</i>	Goodwill (GW%)	1,006	,984	1,028	,617
	Total assets	1,000	1,000	1,000	,476
	Δ ROA	,956	,924	,989	,009
	Δ cash from operations	1,000	1,000	1,000	,816
	Δ revenues	1,000	1,000	1,000	,576
	Δ net income	1,000	1,000	1,000	,854
	MVBV	,789	,177	3,511	,756
	Buy and hold return	1,006	1,000	1,011	,051
	Year				,017
	Year (1)	2,659	1,318	5,363	,006
	Year (2)	1,167	,438	3,107	,758

Source: Worldscope, Datastream, annual reports, own calculations

Univariate logistic regression shows only the relation between single independent variable and the presence of goodwill impairment, but it does not take into account the impact of other independent variables. In reality, the probability of goodwill impairment is impacted by several indicators, thus we have to build a model which explains this relation between dependent and independent variables as much as possible. Because of the limited size of the sample (200 observations) we have to select only a limited set of variable which are going to be included in the model. We are going to include only those independent variable that were significant (or marginally significant) in the bivariate logistic regression analysis (6 variables).

In accordance with the fact that just 52 companies recorded an impairment it would be appropriate to include in the model not more than 5 independent variables. In our case we included as the sixth variable (as a control variable) – the time component (financial year).

We analyzed the presence of possible outliers. In our case we found 3 outliers. They were excluded from the subsequent analysis. The problem of multicollinearity was not present. The results of the multivariate logistic regression are presented in table 5.

Tab. 5: Results of multivariate logistic regression

	β	St. error	Wald	Degrees of freedom	P value	Odds ratio	95% confidence interval	
							Lower	Upper
Δ CEO	,852	,370	5,306	1	,021	2,344	1,135	4,838
% debt	-,015	,010	2,174	1	,140	,985	,966	1,005
Bonus	-,563	,387	2,119	1	,145	,570	,267	1,215
Δ ROA	-,055	,018	9,040	1	,003	,946	,913	,981
Buy & hold	,005	,004	1,374	1	,241	1,005	,996	1,014
Year			1,734	2	,420			
Year (1)	,679	,552	1,509	1	,219	1,971	,668	5,819
Year (2)	,228	,626	,132	1	,716	1,255	,368	4,281
Constant	-,741	,666	1,237	1	,266	,477		

Source: Worldscope, Datastream, annual reports, own calculations

The Wald test demonstrates that the likelihood of goodwill impairment is significantly affected by:

- change of chief executive officers (Δ CEO) – there is a positive relation between Δ CEO and the probability of goodwill impairment,
- change of return on assets (Δ ROA) – there is a negative relation between Δ ROA and the probability of goodwill impairment.

The results are in conformity with the previous literature. As expected the change of chief executive officers affects the probability of goodwill impairment. Other incentives from the previous literature were not significant. Moreover, in the group of economic indicators statistically significant resulted the change of ROA. As expected, positive changes of ROA lead to lower probability of goodwill impairment.

These results indicate that the new impairment rules, at a minimum, are applied differently between new and senior CEOs. New management is more likely to impair goodwill. There is no reason to believe that the arrival of new management would lead to deteriorated results of CGUs to which goodwill is allocated. That is why there is substantiated evidence that new chief executive officers recognize impairments to avoid them in the future, since in the first two years the impairments can be allied to the performance of past management.

According to the fact that the sample consists only of German publicly quoted companies which prepare their accounts in accordance with IFRS the results of this study cannot be generalized to all IFRS users. Further research could expand the sample of European companies, reporting under IFRS.

4 Conclusions

Goodwill impairment test has become subject of more numerous empirical analyses since the FAS 142 was introduced. In accordance with the fact that many subjectivities are present when goodwill is tested for impairment, the presented empirical analysis focused on its value reliability. Studies (Beatty – Weber, 2006; Zang, 2008; Lapointe-Antunes et al., 2008; Ramanna – Watts, 2011) have shown that management has incentives to act opportunistically when applying the impairment test of goodwill.

Most often studies explored incentives as debt covenants, changes of chief executive officers

and management's compensation. The reporting discretion in connection with the impairment process of goodwill as the number of CGUs and the extent of unverifiable net assets were subject of analysis only rarely. The most prevalent study is the one of Ramanna and Watts (2011) indicating that management tends to record lower impairments when more numerous CGUs are defined and when the proportion of net unverifiable assets is higher.

The results of the presented study confirm the findings of previous research (Guler, 2006; Zang, 2008; Lapointe-Antunes et al., 2008) which emphasized that newly appointed management is more likely to record goodwill impairment. At least on the sample of German publicly quoted companies, our research did not find other significant incentives which might lead to opportunistic behavior, deriving from previous literature.

In accordance with the fact that no indication of positive private information was evidenced in the case of non-impairers and in spite of the fact that the sample included companies with market to book ratio less than one, and thus market indicated a need for impairment of goodwill, at least some goodwill had to be impaired.

Further research could expand the sample of European companies which report under IFRS and thus examine if managers have incentives to avoid impairments of goodwill in a broader European context. Further analysis should examine also the characteristics of disclosures about the impairment process (changes of CGUs, methods in use to estimate the recoverable amount, level of disclosures). Since goodwill has become an increasingly important asset for many companies also in the European context, it is crucial to understand its value reliability.

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Is There Some Opportunistic Discretion While Applying the Impairment Test of Goodwill? An Empirical Analysis

Summary

The paper aims to find out if the current IAS 36 in use stimulates managers to convey private information about the future prospects of the company or introduces unverifiable discretion. The presence of discretion, while applying impairment test, was tested on the sample of German publicly traded companies in the period of the current financial crisis, i.e. 2008-2010. Despite

the fact that the sample of companies consists of those with market to book ratio less than one (capital market indicates a need for goodwill impairment), only 26% of the companies recorded a goodwill write-off. The analysis reveals that companies with chief executive officers (CEOs) changes were more likely to record goodwill impairment, than those with no CEOs changes. In times of crisis goodwill reporting discretion variables were not significant. The results of the analysis indicate that even in the case of IFRS users some incentives exist, while recognizing the impairment losses of goodwill.

Key words: Goodwill; Impairment test; Discretion.

JEL classification: M41, M48.

Taxation under the CCCTB

*Simona Jirásková**

1 Introduction

The European Commission (EC) published on 16 March 2011 the proposal for the common consolidated tax base from income tax (CCCTB). The CCCTB is a system of common rules for computing the tax base of companies which are tax resident in the EU and of EU-located branches of third-country companies. Specifically, the common fiscal framework provides for rules to compute each company's (or branch's) individual tax results, the consolidation of those results, when there are other group members, and the apportionment of the consolidated tax base to each Member State. Harmonisation will only involve the computation of the tax base and will not interfere with financial accounts. Therefore, Member States will maintain their national rules on financial accounting and the CCCTB system will introduce autonomous rules for computing the tax base of companies. These rules shall not affect the preparation of annual or consolidated accounts. Under the CCCTB, groups of companies would have to apply a single set of tax rules across the Union and deal with only one tax administration. The local law would apply nominal tax rate applicable to companies in the Member States.

2 Some of the rules in the proposal of CCCTB

Entry into the common consolidated tax base would be optional for companies, i.e. companies that want to use the related benefits may participate in the system, and others may remain in their national system. If an enterprise or enterprise group decide to apply the CCCTB, they will have to remain in the system for at least 5 years.

Eligibility for consolidation (group membership) should be determined in accordance with a two test based on control (more than 50% of voting rights) and ownership (more than 75% of equity) or rights to profits (more than 75% of rights giving entitlement to profit). The two tests should be met throughout the tax year; otherwise, the company should leave the group immediately.

Under the CCCTB, the group would be allowed to add its profits and losses from all subsidiaries throughout the EU together, to reach a net figure. Tax would then be paid on the group's net profit for the whole of the EU.

Tab. 1: Compensation of profit and loss within a group

A CCCTB group consists of companies A, B, C and D. Companies A and B have profit equal to €10 million each; Company C has profit equal to €5 million; Company D has a loss equal to €8 million.

The consolidated tax base for this group is $A+B+C-D = €17$ million.

Source: <http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/11/171&format=HTML&aged=0&language=EN&guiLanguage=fr>

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Taxable revenues should be reduced by business expenses and certain other items. Deductible business expenses should normally include all costs relating to sales and expenses linked to the production, maintenance and securing of income. Deductibility should be extended to costs of research and development and costs incurred in raising equity or debt for the purposes of the business. From corporate tax shall be exempt subsidies directly linked to the acquisition, construction or improvement of fixed assets, subject to depreciation, proceeds from the disposal of pooled assets including the market value of non-monetary gifts, received profit distributions, proceeds from a disposal of shares, income of a permanent establishment in a third country. Deductible expenses shall also include gifts to charitable bodies – the maximum deductible expense for monetary gifts or donations to charitable bodies shall be 0,5% of revenues in the tax year. As non-deductible expenses shall be profit distributions and repayments of equity or debt, 50% of entertainment costs, the transfer of retained earnings to a reserve which forms part of the equity of the company, corporate tax, bribes, fines and penalties payable to a public authority for breach of any legislation, costs incurred by a company for the purpose of deriving income which is exempt pursuant such costs shall be fixed at a flat rate of 5% of that income unless the taxpayer is able to demonstrate that it has incurred a lower cost, save as provided, costs relating to the acquisition, construction or improvement of fixed assets except those relating to research and development.

The total amount of deductible expenses for a tax year shall be increased by the value of stocks and work-in-progress at the beginning of the tax year and reduced by the value of stocks and work-in-progress at the end of the same tax year. No adjustment shall be made in respect of stocks and work-in-progress relating to long-term contracts.

Fixed assets should be depreciable for tax purposes, subject to certain exceptions. Long-life tangible and intangible assets should be depreciated individually, while others should be placed in a pool. Depreciation shall be generally deducted by the economic owner. In the case of leasing contracts in which economic and legal ownership does not coincide, the economic owner shall be entitled to deduct the interest element of the lease payments from its tax base. The interest element of the lease payments shall be included in the tax base of the legal owner. A taxpayer may not disclaim depreciation. Improvement costs shall be depreciated in accordance with the rules applicable to the fixed asset which has been improved as if they related to a newly acquired fixed asset.

Tab. 2: Depreciation of the fixed assets

Type of fixed asset	Useful life in years
buildings	40
long-life tangible assets other than buildings	15
intangible assets	the period for which the asset enjoys legal protection or for which the right is granted or 15 years, if that period cannot be determined
second-hand buildings	40 years, unless the taxpayer demonstrates that the estimated remaining useful life of the building is shorter
second-hand long-life tangible assets	15 years, unless the taxpayer demonstrates that the estimated remaining useful life of the asset is shorter
second-hand intangible assets	15 years, unless the remaining period for which the asset enjoys legal protection or for which the right is granted can be determined
other	Depreciated together in one asset pool at an annual rate of 25 % of the depreciation base

A full year's depreciation shall be deducted in the year of acquisition or entry into use, whichever comes later. No depreciation shall be deducted in the year of disposal. Where an asset is disposed of, voluntarily or involuntarily, during a tax year, its value for tax purposes and the value for tax purposes of any improvement costs incurred in relation to the asset shall be deducted from the tax base in that year. An asset which is disposed of voluntarily must have been owned for a minimum period of three years prior to the disposal.

The tax base, income and expenses shall be measured in EUR during the tax year or translated into EUR on the last day of the tax year at the annual average Exchange rate for the calendar year issued by the European Central Bank or, if the tax year does not coincide with the calendar year, at the average of daily observations issued by the European Central Bank through the tax year. This shall not apply to a single taxpayer located in a Member State which has not adopted the EUR. Nor shall it apply to a group if all group members are located in the same Member State and that state has not adopted the EUR.

The consolidated tax base shall be shared between the group members in each tax year on the basis of a formula for apportionment - giving equal weight to the factors of sales, labour and assets.

$$Share_A = \left[\frac{1}{3} \cdot \frac{S^A}{S^{group}} + \frac{1}{3} \cdot \left(\frac{1}{2} \cdot \frac{P^A}{P^{group}} + \frac{1}{2} \cdot \frac{E^A}{E^{group}} \right) + \frac{1}{3} \cdot \frac{A^A}{A^{group}} \right] \cdot CCCTB, \quad (1)$$

where S = sales,
 P = payroll,
 E = means number of employees,
 A = means sum of assets.

The number of employees shall be measured at the end of the tax year. The asset factor shall consist of the average value of all fixed tangible assets owned, rented or leased by a group member as its numerator and the average value of all fixed tangible assets owned, rented or leased by the group as its denominator.

Tab. 3: Example for CCCTB formula

Example:

Companies A, B and C form a CCCTB Group. The consolidated tax base is 900.
 Company A has capital of 100, wages of 100, 1000 employees and sales in MS A of 10000.
 Company B has capital of 200, wages of 200, 2000 employees, and sales in MS B of 20000.
 Company C has capital of 300, wages of 300, 3000 employees, and sales in MS C of 30000.

The calculation is as follows:

One third of 900 on capital: 100/600 to A, 200/600 to B and 300/600 to C

½ of one third of 900 on wages: 100/600 to A, 200/600 to B and 300/600 to C

½ of one third of 900 on employees: 1000/6000 to A, 2000/6000 to B and 3000/6000 to C

One third of 900 on sales: 10,000/60,000 to A, 20,000/60,000 to B and 30,000/60,000 to D.

A's Tax Base = 50 + 25 + 25 + 50 = 150 – taxed in MS at A's rate

B's Tax Base = 100 + 50 + 50 + 100 = 300 – taxed in MS B at B's rate

C's Tax Base = 150 + 75 = 75 + 150 = 450 – taxed in MS C at C's rate

Source:

<http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/11/171&format=HTML&aged=0&language=EN&guiLanguage=fr>

In the five years that follow a taxpayer's entry into an existing or new group, its asset factor shall also include the total amount of costs incurred for research, development, marketing and

advertising by the taxpayer over the six years that preceded its entry into the group. The sales factor shall consist of the total sales of a group member as its numerator and the total sales of the group as its denominator. Sales shall mean the proceeds of all sales of goods and supplies of services after discounts and returns, excluding value added tax, other taxes and duties.

3 What would the CCCTB mean for the Czech Republic?

Impact of adoption of the CCCTB is necessary to analyze several aspects – firstly in terms of enterprises or enterprise groups and last but not least, in terms of changes in tax collection from corporate income tax for the state budget.

3.1 Users of IFRS required by the law

The Czech Accounting law says: *“Accounting entities, which are issuers of a securities registered on a securities market in some of the member state of European Union, will use International financial reporting standards for bookkeeping and financial reporting.”* Voluntary use of IFRS is allowed to other selected accounting entities. The income tax has to be defined based on profit coming from the but this profit has to be defined in accordance with the Czech accounting regulation (the Accounting law, Notices and Czech accounting standards), ie “without the impact of IFRS”. It is not allowed to use profit given under IFRS for taxation. This means that the companies which use IFRS in their bookkeeping have to calculate the profit in compliance with the Czech accounting regulation too. On the one hand companies which have to use IFRS for accounting and financial reporting invest a lot of money in change of accounting software, in training of their management and accounting employees and have to entirely change their method of accounting but on the other hand they face no small problem, because they must still calculate the profit simultaneously under Czech accounting law to fulfil the requirement of Czech tax law and pay it to the appropriate taxing authority.

Tab. 4: Current situation and situation after acceptance of CCCTB for users of IFRS required by the law

	BOOKKEEPING	FINANCIAL REPORTING	TAXATION
CURRENT SITUATION	IFRS	IFRS	CZECH ACCOUNTING LAW
AFTER ACCEPTANCE OF CCCTB	IFRS	IFRS	CCCTB

For these companies could mean using CCCTB in their taxation simplification and cost saving within one group member as well as cost saving across an enterprise group. First the CCCTB is based on the rules and principles contained in IFRS and thus profit/loss adjustment would be easier. Second one accounting and tax system would be valid for all group members and in the case of business expansion into another country within the EU it would mean application of the same tax and accounting rules.

3.2 Voluntary users of IFRS

Most of companies, which are not obligate to use IFRS as primary accounting system, keep just one (Czech) system of accounting and at the end of the year they convert only the financial statements into the second (IFRS) system. This manner mostly means very pure quality of the financial statements under IFRS if the companies transform from Czech accounting, because there is no compatibility in basic concepts of Czech accounting regulation and IFRS.

Tab. 5: Current situation and situation after acceptance of CCCTB for voluntary users of IFRS

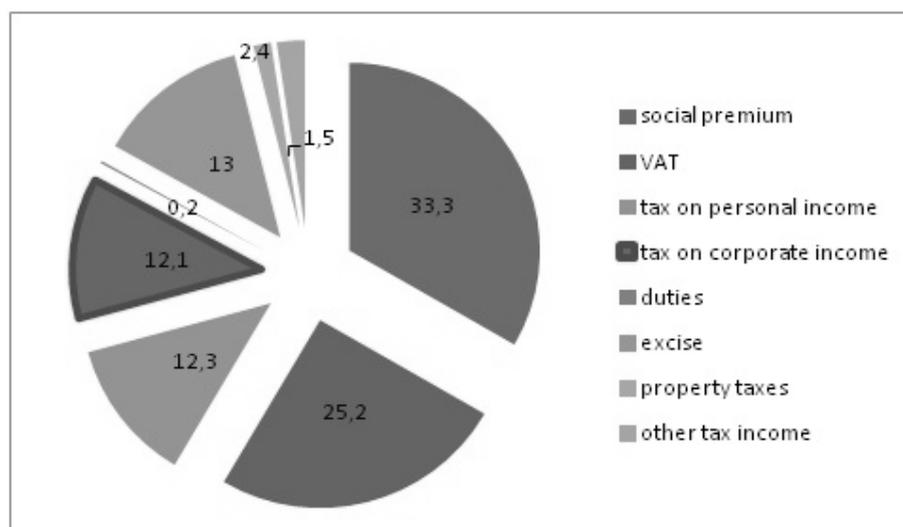
		BOOKKEEPING	FINANCIAL REPORTING	TAXATION
CURRENT SITUATION		CZECH	CZECH IFRS	CZECH ACCOUNTING LAW
AFTER ACCEPTANCE OF CCCTB	1 st manner	CZECH →	↻ CZECH IFRS	→ CCCTB
	2 nd manner	CZECH → IFRS →	CZECH IFRS	→ CCCTB

Voluntary users of IFRS can currently use IFRS for preparation of financial statements but they have to keep bookkeeping under Czech accounting regulation. They usually do so because they want to meet requirements of other users of financial statements than the state authorities. There will be no simplification and cost saving after acceptance of CCCTB, if the Czech accounting law is not changed.

3.3 CCCTB and public budget

Under the CCCTB, groups of companies would have to apply a single set of tax rules across the Union and deal with only one tax administration. A company that opts for the CCCTB ceases to be subject to the national corporate tax arrangements in respect of all matters regulated by the common rules. Taxation of these companies will be regulated by CCCTB system and government of appropriate states can influence only the rate of income tax. Czech Republic received from the companies total income tax more than 90 billion Czech crowns in 2010, this means 18% of total tax collection in 2010.

Fig. 1: Share of tax on corporate income collection in total tax collection in 2010



More than 30 % of corporate income tax collection was formed by following companies.

Tab. 6: Twenty largest taxpayers in 2010

Company	Listed	Company	Listed
1. ČEZ	✓	11. Plzeňský Prazdroj	✓
2. Česká spořitelna	✓	12. ČEZ Distribuce	✓
3. T-Mobile Czech Republic	✓	13. GE Money Bank	✓
4. Česká pojišťovna	✓	14. Raiffeisenbank	✓
5. Komerční banka	✓	15. Dalkia Česká republika	✓
6. Telefónica O2 Czech Republic	✓	16. Kooperativa pojišťovna, Vienna Insurance Group	✓
7. RWE Transgas	✓	17. RWE Gas Storage	✓
8. ŠKODA AUTO	✓	18. ČSOB	✓
9. NET4GAS	✓	19. Agrofert	No
10. Vodafone Czech Republic	✓	20. ČEPS	No

Source: http://byznys.lidovky.cz/kalousek-ocenil-dvacet-nejvetsich-platcu-dani-foy-/firmy-trhy.asp?c=A110513_153242_firmy-trhy_apa

Because these companies use in the vast majority IFRS in financial reporting, it may be considered, that they would choose as a tax system the CCCTB. Also it is not clear the impact of introduction of CCCTB to the state budget and its corporate tax income. The European Commission has carried out first research on the basis of which it was found 3,8 % decrease of corporate tax income for the Czech republic assuming adoption of CCCTB and it should lead to 3 % decline of GDP.

4 Conclusions

Acceptance of CCCTB does not solve current problems of small and medium-sized entities, which are voluntary users of IFRS, but they have to keep bookkeeping in accordance with Czech accounting regulation. They will continue to create financial statements in two system and they will use either the Czech financial statements for determination of tax base (if they will choose taxation under the Czech law of income tax) or financial statements under IFRS (in case of CCCTB choice).

On the other hand business operating across national borders will benefit both from the introduction of cross border loss compensation and from the reduction of company tax related compliance costs. The reduction in actual and perceived compliance costs is expected to exert a substantial influence on firms' ability and willingness to expand abroad in the medium and long term. The CCCTB notably contributes to reduced tax obstacles and administrative burdens, making it simpler and cheaper for companies to expand their activities across the EU. Acceptance of CCCTB for users of IFRS required by the law could mean all the above benefits and cost saving. But Ministry of Finance of the Czech Republic has sometimes signalled to the CCCTB project reserved attitude although it participated in the vocational-technical work on the project and supported some of its parts. Ministry of Finance has rather refused the system of CCCTB, even though it has been given no credible conclusions about suitability or profitability of the project implementation CCCTB for the Czech Republic yet, including the impact on

public budgets. Just because it is also necessary to analyze the impact of the CCCTB not only on the business sector and its change in the payment of income tax, but also effect on the state budget. This can not be done without detailed and specific case studies and research made itself from the Czech Republic.

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- http://download.pwc.com/ie/pubs/ccctb_what_it_really_means.pdf

Taxation under the CCCTB

Summary

The paper is focused on the CCCTB proposal of the European Commission and its basic rules. The concept of the CCCTB has met with a rather reserved attitude in Europe as well as in the Czech Republic because its impact to the state budget is not known. On the other hand, the CCCTB system means simplification of accounting and taxation for companies in the Czech republic (at least for companies which have to prepare financial statements according to IFRS) and a decrease in administrative costs and possibly also the cost of expansion in Europe.

Key words: CCCTB; IFRS; Public budget.

JEL classification: H20.

The Bribery Act 2010[#]

*Lenka Nováková**

1 Introduction

The Bribery Act 2010 is an Act of the Parliament of the United Kingdom that covers the criminal law relating to bribery. It was introduced to Parliament in the Queen's Speech in 2009 after several decades of reports and draft bills, the Act received the Royal Assent on 8 April 2010 following cross-party support. The Bribery Act 2010 came into effect in July 2011 and applies to actions in the UK or anywhere else in the world by any person or business with a close connection to the UK. This includes:

- People who are ordinarily resident and live or work in the UK
- British citizens, including those based or employed overseas
- British businesses
- Organisations that are registered in, or organised under, the laws of the UK
- Organisations that carry on business, even a small part of their business, in the UK

The UK is contributing through the OECD Working Group on Bribery International Business Transactions and the UN Convention Against Corruption to increasing global awareness, enforcement and investigation of foreign bribery.

The Act repeals all previous statutory and common law provisions in relation to bribery, instead replacing them with the crimes of bribery, being bribed, the bribery of foreign public officials, and the failure of a commercial organisation to prevent bribery on its behalf.

The penalties for committing a crime under the Act are a maximum of 10 years imprisonment, along with an unlimited fine, and the potential for the confiscation of property under the Proceeds of Crime Act 2002, as well as the disqualification of directors under the Company Directors Disqualification Act 1986.

2 History

Prior to the Act, British anti-bribery law was based on the Public Bodies Corrupt Practices Act 1889, the Prevention of Corruption Act 1906 and the Prevention of Corruption Act 1916, a body of law described as "inconsistent, anachronistic and inadequate". Following the Poulson affair in 1972, the Salmon Committee on Standards in Public Life recommended updating and codifying these statutes, but the government of the time took no action.

Similar suggestions were brought up in the first report of the Committee on Standards in Public Life established by John Major in 1994. The Home Office published a draft consultation paper in 1997, discussing extending anti-bribery and anti-corruption law. This was followed by the Law Commission's report *Legislating the Criminal Code: Corruption* in 1998. The consultation paper and report were identical to criticism from the Organisation for Economic Co-operation and Development, who felt that, despite the United Kingdom's ratification of the OECD Anti-

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Bribery Convention, its bribery laws were inadequate.

A draft Bribery Bill was announced in the 2002 Queen's Speech, but the draft was rejected by the joint committee examining it. A second consultation paper was issued in 2005 examining the committee's concerns, before the government announced in March that "there was broad support for reform of the current law, but there was no consensus as to how this could be achieved". Following a white paper in March 2009, the Bribery Bill, based on the Law Commission's 2008 report *Reforming Bribery*, was announced in the Queen's Speech. At first given all-party support after its introduction by Jack Straw in 2009, the Bill was, according to *The Guardian* newspaper, subject of attempted obstruction by Members of Parliament from the Conservative Party. This followed pressure from the Confederation of British Industry, who worried that the Bill in its original form would obstruct the competitiveness of British industry.

The Bill was given Royal Assent on 8 April 2010, becoming the Bribery Act 2010, and was expected to come into force immediately. The government instead chose to hold several rounds of public consultations before announcing that it would come into force in April 2011. As of February 2011, Ken Clarke, the Secretary of State for Justice, has yet to publish guidance on the interpretation and use of the Act, and he has announced that it will not come into force until at least three months after such guidance is made available. The Ministry of Justice published the guidance on 28 March 2011.

In October 2011 Munir Patel, a clerk at Redbridge Magistrates Court, became the first person to be convicted under the Bribery Act, along with misconduct in a public office.

3 Preventing bribery and corruption

Most people have some idea what a 'bribe' is – it's a common feature in many gangster movies.

In a recent survey of international companies, 25% of the companies questioned said that they had lost business to corrupt competitors in the last five years. Many of these companies have lost out despite providing more innovative products, superior service and competitive prices.

A spokesperson for one company said, "We don't pay bribes or try to influence decisions unfairly because we don't believe we need to. A company that pays a bribe to win business today will have to pay an even higher bribe tomorrow. We are confident that we can compete on quality, innovation and creativity."

Corrupt business gets second best

An operations manager at XYZ Ltd awarded an IT support contract to ABC Corp in return for a personal bribe. ABC Corp failed to fulfil their obligations under the contract but, because he had accepted a bribe, the operations manager felt unable to take action. As the situation became worse, senior management from XYZ Ltd launched an investigation into the relationship with ABC Corp. The payment of the bribe was discovered. The operations manager was dismissed from his job and now faces criminal charges.

The global fight against bribery is supported by:

International conventions

International bodies such as the United Nations (UN) and the Organisation for Economic Cooperation and Development (OECD) have introduced international standards and conventions to fight bribery across the world.

The UN Convention Against Corruption was introduced in 2005. The convention sets the standard for the prevention, detection and punishment of corrupt activities, including bribery, by governments, public bodies and public officials. The OECD Anti-Bribery Convention establishes legally-binding standards to make it a criminal offence to bribe foreign public

officials in international business transactions.

Local laws

Many national governments have reacted to international conventions by introducing or strengthening their own anti-bribery and corruption laws, often with severe sanctions for both companies and individuals.

For example, in the UK those convicted of a bribery offence face an unlimited fine or up to ten years imprisonment. In Brazil, they face a fine and up to eight years in prison, whilst in China the penalty can be life imprisonment or even the death penalty!

Cross-border laws

Laws introduced by some countries extend beyond their own national boundaries.

The US Foreign Corrupt Practices Act (FCPA) makes it unlawful for any individual or organization connected to the US to bribe a foreign official anywhere in the world.

The UK Bribery Act 2010 makes it an offence for any individual or organization connected to the UK, or that carries out business in the UK, to offer or accept bribes to or from anyone, anywhere in the world.

Improved cooperation between governments and enforcement agencies is also helping the success of bribery investigations worldwide.

Companies' own policies

Companies support international efforts to fight bribery through a series of policies which set out our commitment to comply with international conventions as well as all local and cross-border laws. These policies ensure that all employees and representatives understand that it is never acceptable to pay or receive bribes of any kind, directly or through a third party, to anyone, even in countries where bribes are customary.

Involvement in bribery can have serious consequences for:

Both organizations and individuals involved in or associated with bribery can face serious consequences. So, if you are asked to do anything that could be sensed as a bribe, ask yourself, "Am I really doing what's best for the business? Am I really willing to face the consequences to me personally?"

Organizations that are associated with bribery can face:

- Fines, legal action and compensation claims from those who have lost out as a result of the bribery
- Damage to their reputation which could compromise relationships with customers, suppliers, regulators and competitors
- Financial losses as a result of invalid and unenforceable agreements
- Constraints on the organization's freedom to operate in a region
- Exclusion from the bidding process for contracts

Individuals associated with any form of bribery could face:

- Disciplinary action, up to and including dismissal
- Significant fines
- A prison sentence, in many cases

Potential bribery issues won't always be obvious.

Is it all about cash?

NO, a bribe is any benefit or item of significant value that is given or received to unjustly influence the actions of another in breach of their official or legal duties. Bribes do not have to be paid in cash, but can also include goods or services, gifts, trips, entertainment, hospitality, an offer of employment, a promotion or an honour, the awarding of a contract, an official permit or an administrative decision in the company's favour.

Is it only an offence to offer a bribe?

NO, law enforcement authorities in most of the countries, where global companies operate consider both the giving and receiving of a bribe to be a criminal offence.

Does bribery always involve public officials?

NO, in some countries the penalties for bribing public officials are more severe but, in many of the countries where global companies operate, bribery of public or private individuals (or organizations) are both illegal.

Is it still a bribe if it is paid by someone else?

Bribery can be direct or indirect:

- Direct bribery occurs when someone offers or accepts a bribe themselves
- Indirect bribery occurs when someone allows a third party to make a bribe on their behalf

Offering or giving a bribe via a third party is no different to offering or giving a bribe directly yourself.

4 The UK Bribery Act 2010

The Bribery Act creates the following offences:

1. Active bribery: promising or giving a financial or other advantage.
2. Passive bribery: agreeing to receive or accepting a financial or other advantage.
3. Bribery of foreign public officials.
4. The failure of commercial organizations to prevent bribery by an associated person (corporate offence).

General bribery offences

The crime of bribery is described in Section 1 as occurring when a person offers, gives or promises to give a "financial or other advantage" to another individual in exchange for "improperly" performing a "relevant function or activity". Section 2 describes the offence of being bribed, which is defined as requesting, accepting or agreeing to accept such an advantage, in exchange for improperly performing such a function or activity. Section 3 covers "any function of a public nature; any activity connected with a business, trade or profession; any activity performed in the course of a person's employment; or any activity performed by or on behalf of a body of persons whether corporate or unincorporated". This applies to both private and public industry, and included activities performed outside the UK, even activities with no link to the country.

Under Section 4, the activity will be considered to be "improperly" performed when the expectation of good faith or impartiality has been breached, or when the function has been performed in a way not expected of a person in a position of trust. Section 5 provides that the standard in deciding what would be expected is what a reasonable person in the UK might expect of a person in such a position. Where the breach has occurred in a jurisdiction outside the

UK, local practises or customs should be disregarded when deciding this, unless they form part of the "written law" of the jurisdiction; "written law" is given to mean any constitution, statute or judicial opinion set down in writing.

Offering, promising or giving a bribe.

The UK Bribery Act 2010 creates a general offence covering the offer, promise or giving of a bribe to anyone who is:

- In a position of trust, OR
- Has a role in which they are expected to act in good faith OR
- Has a role in which they are expected to behave impartially

This includes public officials, individual employees of a private company or others working on a company's behalf.

Anyone could commit an offence under the UK Bribery Act 2010 if anyone gives or offers a financial advantage, or any other type of advantage or benefit, to:

- Convince a person to carry out their responsibilities improperly, unfairly or illegally in breach of their duties arising out of their role
- Reward a person for carrying out their responsibilities improperly, unfairly or illegally in breach of their duties arising out of their role

Anyone could also be found guilty of an offence if anyone offers, promises or gives financial or other advantages and benefits to a person if anyone knows, or believes, that it would be improper to accept it.

This offence applies to:

- Advantages and benefits offered directly or indirectly, through an agent or third party
- Advantages and benefits offered to another person in an attempt to influence someone else

What does it mean?

Potential clients and customers will rarely make a purchasing decision unless the product or service they are offered is the right one for them. By trying to influence a business deal through bribery anyone could lose personal credibility and anyone could create the impression that company cannot compete on the legitimate benefits that our products and services can offer.

It's often important to establish a relationship of goodwill in business. Compliance with the UK Bribery Act 2010 doesn't prevent anyone from doing this but it does require anyone to do this in a way that is honest and fair.

Bribery of foreign public officials

Bribery of foreign public officials is a different crime under Section 6, in line with the OECD Anti-Bribery Convention. A person will be guilty of this offence if they promise, offer or give a financial or other advantage to a foreign public official, either directly or through a third party, where such an advantage is not legitimately due. A foreign public official is defined, under Section 6, as "an individual holding legislative, administrative or judicial posts or anyone carrying out a public function for a foreign country or the country's public agencies or an official or agent of a public international organisation".

Offering payments or advantages to a foreign public official

The UK Bribery Act 2010 creates an offence of offering payments or advantages to a foreign public official when the offer is:

- Not permitted or required by the laws in the country where the official is based
- Made in an attempt to influence the official's decisions
- Made in order to gain a business advantage for anyone or the company

This offence applies to:

- Payments and other advantages offered directly to the foreign public official
- Payments and other advantages offered indirectly, through an agent or third party, to a public official on the company's behalf
- Payments and other advantages offered to another person in an attempt to influence the public official

What does it mean?

In some countries it is customary to make small payments to government officials to encourage them to carry out, or carry out more speedily, a role that they are employed to carry out, even if the officials don't have discretion to make or not make a decision.

No matter how small or insignificant the amount, payments like these are not harmless and are not permitted under the UK Bribery Act 2010.

Failure of commercial organisations to prevent bribery

Section 7 creates the "broad and innovatory offence" of the failure of commercial organisations to prevent bribery on their behalf. This applies to all commercial organisations which have business in the UK. The offence is one of strict liability, with no need to prove any kind of intention or positive action. It is also one of mediated liability; a commercial organisation can be guilty of the offence if the bribery is carried out by an employee, an agent, a subsidiary, or another third-party. The location of the third-party is irrelevant to the prosecution— according to David Aaronberg and Nichola Higgins in the Archbold Review, "therefore, a German business with retail outlets in the UK which pays a bribe in Spain could, in theory at least, face prosecution in the UK".

Guidance was published by the Secretary of State three months before the Act came into force. The Guidance sets out 6 principles to be followed by business. They cover such topics as Proportionate Procedures, Top-level Commitment, Risk Assessment, Due Diligence, Communication (including training) and Monitoring & Review.

Prosecution and penalties

Section 10 requires the authorisation of any prosecution by the director of the appropriate prosecution agency before a case can go ahead; this is a shift from the old regime, which required the agreement of the Attorney General for England and Wales. Section 11 explains the penalties for individuals and companies found guilty of committing a crime. If an individual is found guilty of a bribery offence, tried as a summary offence, they may be imprisoned for up to 12 months and fined up to £5,000. Someone found guilty on indictment, however, faces up to 10 years' imprisonment and an unlimited fine. The crime of a commercial organisation failing to prevent bribery is punishable by an unlimited fine. In addition, a convicted individual or organisation may be subject to a confiscation order under the Proceeds of Crime Act 2002, while a company director who is convicted may be disqualified under the Company Directors Disqualification Act 1986.

Other provisions

The scope of the Act's provisions is set out in Section 12. For someone to fall within the Act's authority, they must have either committed a crime inside the United Kingdom, or acted outside

of the United Kingdom in a way which would have constituted a crime had it happened in the UK. For a prosecution in the latter case, the person must have a "close connection" to the UK, which includes being a British citizen, resident or protected person, a company incorporated in the UK, or a Scottish partnership. In general, The Bribery Act applies to UK citizens, residents and companies established under UK law. In addition, non-UK companies can be held liable for a failure to prevent bribery if they do business in the UK.

Section 13 provides the only defence available with the general bribery offences—that the conduct was necessary for the proper functioning of the intelligence services or, when involved in active service, the armed forces. Under Section 14, senior officers or directors in a company which commits a general bribery offence will also be liable for the purposes of the Act. In the case of an offence committed by a partnership, Section 15 provides that the prosecution must be brought in the name of the partnership and not in the name of any of the partners.

Under Section 16, the Act applies to servants of the crown, while Section 17 repeals all previous common law and statutory offences relating to bribery, replacing them with provisions of the Act. Section 18 provides that the Act applies to England and Wales, Scotland and Northern Ireland; while the separate agreement of the Scottish Parliament is usually required in such cases, as is made clear in Section 19, a Legislative Consent Motion was passed on 11 February 2010, allowing for the application of the Act within Scotland.

5 Conclusions

One of the more novel features of the Bribery Act is the offence of failing to prevent bribery. This is the offence which does not require proof that the corporate body did anything, nor that it was dishonest: merely that a person who performs services for the corporate body bribed someone else to gain a business advantage. Corporate bodies could be liable for bribery, they know absolutely nothing about. This has the potential to cause serious embarrassment and heavy fines.

The Bribery Act provides for one defence to this: that the corporate body had in place “adequate procedures” to prevent the bribery from taking place. The nature of these adequate procedures is not set down by law. Each corporate body will need to decide for itself what it will put in place.

Opportunities

Bribery has no place in British business, at home or abroad. This new robust law reflects the UK’s role in the fight against bribery and paves the way for competitive but fair practice. Over time it will have a positive impact on the prospects of UK businesses through enhanced reputation for ethical standards, reduced costs and an international level-playing field.

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The Bribery Act 2010

Summary

Bribery is offering, giving or receiving something of value to encourage or reward something which is unfair, impartial, improper or illegal. Offering, paying or receiving bribes to influence business dealings to public officials or private-sector individuals or organisations, directly or through a third party, is illegal. To fight bribery, every country, every company business and every individual has an essential part to play – the new UK legislation applies to all of us. Organisations and individuals who fail to live up to the standards imposed on them by anti-bribery laws could face severe consequences.

Key words: Bribery; Corruption, Penalty.

JEL classification: G30.

Performance Measurement and Management and Its Interlink with Rewarding of Employee's[#]

Petr Petera^{*}

1 Introduction

The purpose of this review paper is twofold. Firstly, we want to give a concise summary of the main contemporary ideas and trends existing in the area under study. Secondly, ideas and frameworks discussed in this paper served as a basis for designing a questionnaire that is used in the first phase of our research aimed at the level of usage of effective performance measurement and management methods in companies located in the Czech Republic.

The above mentioned questionnaire incorporates results of our research aimed at developing a methodology for quick identification of the quality of PMMS implemented in a company as well as for identifying typical mistakes in these systems.

The problems of performance measurement and management and their relationship with rewarding of employees are studied by researchers from various fields (e.g. managerial accounting, organizational theory, economics, marketing, operations management, human resources management, psychology, sociology, quality movement). This on the one hand leads to a varied scale of inspiring theories, on the other hand the research is not sufficiently coordinated and thus lacks cumulative character (as pointed out e.g. in (Neely, 2007, p. 1-3)).

In-depth overview of the main current research problems can be found in surveys (Neely – Gregory – Platts, 1995), (Bourne – Neely – Mills – Platts, 2003), (Neely, 2005), (Berry – Coad – Harris – Otley – Stringer, 2009) and (Taticchi – Tonelli – Cagnazzo, 2010).

2 Performance measurement and management – definitions, theoretical background, desirable properties

2.1 Definitions

By **performance** we understand a characteristic describing a way (or a process) in which a subject being measured performs a specific activity compared to a reference way (“benchmark”, e.g. chosen objectives) of performing this activity (Wagner, 2009, p. 17). Another inspiring considerations regarding definition of this term may be found in (Otley, 1999) and (Lebas – Euske, 2007). For assessing performance we have to know the objective of the activity and the standard (reference, benchmark).

Objectives can be classified according to various criteria and we consider distinguishing between primary and secondary objectives to be of the fundamental importance. **Primary objectives** are typically set by owners of a company, are subjectively chosen and therefore it is practically impossible to determine whether they are “right” or “wrong”. **Secondary objectives** specify what the company expects from and gives to its stakeholders in order to achieve its primary objectives (Atkinson – Waterhouse – Wells, 1997, p. 28). Secondary objectives are not

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important in their own right, but because they help to fulfil primary objectives and their “quality” depends on how much they really contribute to achieving primary objectives. If chosen correctly, secondary objectives are performance drivers of accomplishing primary objectives and thus their measurement is of utmost importance for holding control over present and future performance of a company. We point out that causal relationship between primary and secondary objectives is always more or less “speculative”. These speculations should be systematically and continually confirmed or disproved and secondary objectives that do not influence primary objectives should be abandoned and replaced with better ones.

Performance measure (PM) is a variable, values of which describe a given characteristic of the object under measurement. We can distinguish primary performance measures (measuring primary objectives) and secondary performance measures (measuring secondary objectives).

Performance measurement system (PMS) as a set of interlinked performance measures, individual phases of performance measurement, subjects conducting measurement and methods used in individual phases of performance measurement (Wagner, 2009, p. 41). PMS is a part of a bigger picture - **performance measurement and management system (PMMS)**.

Stakeholder approach states that company should take into account interests of all stakeholders. In literature it is possible to find a large variety of views - from an opinion that shareholders are the only stakeholders that really matter to an opinion that interests of all stakeholders should be taken into account (for example Neely, Adams and Kennerley (2002, p. 14) suggest that a company should understand what its stakeholders want and need from the company and what the company wants and needs from them). A more detailed analysis of “stakeholding” can be found in Sternberg (1999) and (Atkinson – Waterhouse – Wells, 1997).

2.2 Theoretical background

Our methodology is designed as a set of questions that help to think about measurement and management of performance in a structured way. On the basis of extensive literature review we concluded that for our needs is best suited approach of Neely and his colleagues. We also extensively build upon frameworks listed in chapter 3.2.

2.3 Desirable properties of performance measurement and management systems

Desirable properties of PMMSs can be separated into two categories:

- properties concerning dynamic elements of PMMS (see chapter 2.3.1),
- properties concerning static elements of PMMSs (see chapter 2.3.2).

The quality of PMMS is then determined by the quality of the above mentioned elements and can be estimated, in addition to other indicators, by assessing a degree to which desired properties are met and updating processes put in place.

Of course this distinction is of conceptual nature. In practice it is usually difficult to precisely distinguish these categories as well as individual phases and updating processes of PMMSs dynamics (as described later in this paper).

It is also important to notice that PMMSs exist within a broader context (environment), which should be taken into account. We define “environment” broadly as both internal and external context in which PMMS exists. It is possible to distinguish 3 basic types of interactions between environment and PMMS:

1. Company should strive for creating a positive context of measurement. Spitzer (2007, p. 3) underlines that context of measurement largely determines its effectiveness and notices that the context of measurement is in fact more important than the measurement itself. Detailed recommendations on this topic can be found e.g. in (Spitzer, 2007, p. 56-67) and in (Neely –

Adams – Kennerley, 2002, p. 74).

2. Environment (e.g. competitive environment, business strategy) determines what should optimal PMMS contain and how it should be deployed.¹ This proposition is supported by a contingency theory according to which there is no universally appropriate PMMS. On the contrary – optimal features of PMMS depend on specific circumstances in which a company operates. Fundamental and influential considerations on contingency theory can be found in (Otley, 1980).
3. Performance measurement usually has a strong impact on the environment in which it operates because decisions about measurement influence behaviour of individuals and groups within the organisation (Bourne – Neely – Mills – Platts, 2003).

2.3.1 Dynamics of PMMSs

It is possible to distinguish the following 3 phases of PMMS deployment (Bourne – Mills – Wilcox – Neely – Platts, 2000, p. 757):

- system design,
- implementation of measures,
- use of measures to assess the implementation of strategy & use of measures to challenge strategic assumptions.

These phases are accompanied by 4 continuous updating processes (see chapter 2.3.1.4).

2.3.1.1 System design

This phase can be divided into 2 sub phases. Firstly, it is necessary to identify key objectives which should be measured. Secondly, appropriate measures have to be designed.

Identifying key objectives is of crucial importance. There is a broad agreement that measures should be derived from strategy. Therefore strategy and strategic objectives should be clearly formulated, strategic measures should be chosen and cascaded through the whole company. Throughout literature it is possible to find various recommendations for identifying and selecting measures, synoptically are these recommendations listed in (Neely – Mills – Platts – Richards – Gregory – Bourne – Kennerley, 2000), (Bourne – Neely – Mills – Platts, 2003) and (Neely – Adams – Kennerley, 2002).

On the basis of extensive literature review we can conclude that the most comprehensive approach to the design of performance measures can be found in (Neely – Richards – Mills – Platts – Bourne, 1997). Neely collected a set of 22 requirements that a good “performance measure” should meet and consequently derived a record sheet, structure and elements of which are chosen in such way that they should help to design measures compatible with given requirements. Structure of the performance measure “record sheet” is addressed in chapter 2.3.2.1 of this paper.

2.3.1.2 Implementation of measures

During the implementation phase systems and procedures are put in place to collect and process the data (Bourne – Mills – Wilcox – Neely – Platts, 2000). Compared to the design phase, only few studies aimed at implementation phase exist.

In literature are stressed the following principles of proper implementation of measures:

- efforts to ensure development of required competencies of employees responsible for

¹ In this text we use the term “deployment” as an abbreviation of design, implementation, use and maintenance of performance measurement and management system.

measurement should be taken,

- objectivity of employees responsible for measurement should be ensured,
- object of measurement should be defined as clearly as possible,
- collecting and processing the data needed for measurement should be automatized whenever possible,
- the same data should not be entered more than once (e.g. because of non-integrated information systems),
- data veracity should be checked (Neely – Bourne – Mills – Platts – Richards, 2002, p. 67),
- resistance to measurement should be probed and addressed,
- top management should explicitly support current measurement system and its updating,
- choosing the right managerial team is crucial for success of deployment PMMS; in large organizations establishing of a new function – chief measurement officer (CMO) may be useful,
- selection of measures should be done through discussions with the people involved (customers, employees, managers) (Globerson, 1985, p. 640),
- effectiveness of measurement should be ensured, e.g. by considering whether every occurrence or only appropriately selected sample of measured phenomena should be measured,
- reasonable degree of accuracy should be guaranteed - for example by generating a conflict of reporting interests between the two departments, which should increase reliability of measurement (Globerson, 1985, p. 643-644),
- accuracy of measurement is important, nevertheless striving to maximise it is not always optimal. Costs and time needed for increasing accuracy should be taken into account and compared with gains resulting from higher accuracy. Moreover increasing accuracy may in some occasions lead to unwanted behavioural consequences,
- visualization of results is important; Neely, Adams and Kennerley (2002, p. 47-51) advocate that good visualization should present information in a way conducive to analysis, interpretation and questioning.

2.3.1.3 Use of measures

This phase is again split into two sub phases. Firstly, created measures should be used for determining whether strategy is implemented successfully and whether real performance is good enough in relation to the selected benchmarks. Secondly, assumptions and validity of the strategy should be tested including tests of validity of supposed causal relationships between implemented primary and secondary measures.

Measurement should be used as a tool for performance improvement. Measured performance should be analysed and compared with a benchmark to decide “how good” the performance of a company is. We understand benchmarking broadly as a comparison with any reference element (benchmark) – internal or external, real (e.g. a competitor) or fictive (e.g. “ideal value”), static or dynamic. Globerson (1985, p. 644-645) furthermore suggests to choose such benchmarks (standards) that are motivating and explains different approaches for choosing them. Other well-known and often used methods of performance appraisal and improvement are “best practices” and “best fit”. According to Brown (1996, p. 9-10) targets should be challenging, worthwhile and achievable. Furthermore they should be based on research about what the most important

competitors are doing and on a study of benchmark companies. After comparison of real results and targets, an action should follow. Finally, a new measurement closes the loop.

Globerson (1985, p. 646) distinguishes automated corrective actions which are based on a set of procedures defining how to respond in different circumstances and corrective actions based on voluntary initiative. These problems are also addressed in (Ahrens – Chapman, 2007).

2.3.1.4 Updating processes

According to (Bourne – Mills – Wilcox – Neely – Platts, 2000, p. 758-759) updating processes include reviewing and revising targets and standards (benchmarks), developing individual measures as performance and circumstances change, periodically reviewing and revising the complete set of measures in use and challenging strategic assumptions. Performance measures should be changed especially when situation or strategy of an organization changes (Brown, 1996, p. 8). Updating processes (dynamism of performance measurement systems) are in a greater detail addressed in (Henri, 2010).

Here we want to point out to a not very famous phenomenon called “running down of performance measures”, in-depth addressed in (Meyer, 2002, p. 51-80). The essence of this phenomenon consists in diminishing of differences of measured performance to the point when it is not possible to differentiate good from bad performance. Typical causes are positive learning (diminished variances surrounding a constant mean are caused by positive events), perverse learning (gaming), selection, suppression and social consensus. Unfortunately, as Meyer shows, both positive learning and perverse learning can be triggered by the same performance measure and moreover effects of positive and perverse learning often cannot be easily separated. Thus Meyer concludes that use-it-and-lose-it principle operates in performance measurement.

2.3.2 Features of static elements of PMMSs

2.3.2.1 Performance measures

For the selected performance measures (see also chapter 2.3.1.1) should according to (Neely – Bourne – Mills – Platts – Richards, 2002, p. 70) be clearly defined the following properties: title of the measure, purpose of the measure, business objectives that the measure relates to, desired levels of performance including timescale within which we want to achieve them, formula (procedure for calculation; should be defined in a way that does not stimulate misbehaviour), who measures, source of data, who acts on the data, what do they do? (description of actions that follow if the performance is acceptable or unacceptable; may be defined more or less precisely according to complexity of needed reaction), notes and comments, date/issue number.

The above mentioned “record sheet” was published with various minor modifications and various explanatory notes in several articles and books, e.g. (Neely – Richards – Mills – Platts – Bourne, 1997) and (Neely – Adams – Kennerley, 2002, p. 34-42).

2.3.2.2 Performance measures system

According to views prevailing in the “mainstream” literature, performance measures system should typically meet the following requirements:

- its top measures should be based on company’s strategy,
- strategic measures should be cascaded down through the organization’s structure,
- causal links between primary and secondary PMs should be defined (Kaplan – Norton, 2000),
- be balanced, that is it should contain:

- financial and non-financial (operational) measures (Kaplan – Norton, 1992),
- short-term and long-term orientated measures (Kaplan – Norton, 1992),
- externally and internally orientated measures (Kaplan – Norton, 1992),
- measures of past, present and future performance (Brown, 1996, p.3),
- be integrated both vertically and horizontally (Spitzer, 2007, p. 86-102),
- a reasonable number of performance measures should be kept (alternative formulation can be found in Brown (1996, p. 3-4) - performance measures system should contain the vital few key measures, multiple measures can be combined into a single index); Lynch and Cross (1995, p. 205) underline that there are no right numbers of PMs for any organization; usually there should be at least four PMs (quality, delivery, cycle time and waste), but probably fewer than ten,
- performance measures system should be based around the needs of important stakeholders; this requirement is often stressed by authors who foster stakeholder’s approach, e.g. (Brown, 2006, p. 3), (Neely – Adams – Kennerley, 2002, p. 1-14),
- possible conflicts between PMs should be addressed (Neely – Kennerley – Adams, 2007, p. 13).

2.3.2.3 Performance measurement and management system

Performance measurement and management system is an umbrella term comprising all above mentioned elements. Importance of integration of performance measurement and management is growing and mentioned e.g. in (Wagner – Šoljaková – Matyáš, p. 9).

Neely, Adams and Kennerley (2002, p. 76-81) advocate that primary function of PMS is to enable managers to answer specific questions about how the organization is performing. PMS is robust when its measures are well-designed (see chapter 2.3.2.1) and at the same time PMMS measures right things (is based around needs of important stakeholders) in the right way. All necessary data should be captured, collated, sorted and consecutively analysed, interpreted and acted upon.

Let us summarize common requirements on PMMS mentioned in literature. PMMS should:

- enable to track past performance, record, save, analyse and compare it with benchmarks,
- enable to predict future trends,
- have a positive impact on behaviour of employees (Wagner, 2009, p. 19), (Lynch – Cross, 1995, p. 204),
- reduce uncertainty about measured object, support informed decision-making (Hubbard, 2010),
- be matched with company’s strategy (Neely – Bourne – Mills – Platts – Richards, 2002, p. 11-13),
- be matched with company’s recognition and reward schemes (Neely – Bourne – Mills – Platts – Richards, 2002, p. 11-13),
- be to a large extent positively accepted by employees – as a tool of improvement.

Well, principles mentioned in this paper should not be understood dogmatically, specific circumstances have to be always taken into account. For example Austin and Gittel (2007) give examples of practical situations in which deliberate subversion of widely accepted principles (e.g. that performance should be clearly defined, performance should be measured accurately,

rewards should be contingent on measured performance) brought high performance.

3 Outline of the most widespread performance measures and frameworks

PMMS has to use various measures and it is widely known that in the late 1980s the critique of traditional financial (accounting) measures escalated. Importance of more systematic and intensive usage of non-financial measures was often mentioned, see e.g. Johnson and Kaplan (1987). Well, we want to emphasize that financial measures are still considered to be of the crucial importance by a vast majority of researchers and practitioners. Financial and managerial accounting are a basis on which any performance measurement system should be built upon. Appropriate utilization of contemporary methods of managerial accounting (e.g. absorption costing, marginal costing, standard costing, budgetary control, ABC/ABM, time-driven ABC, target costing, life-cycle costing, customer profitability analysis etc.) is thus an important indicator of high-quality performance measurement system.

Anyway, as a result of critique of financial measures, two types of reaction appeared:

3.1 Financial measures

Before 1980 prevailing criteria were accounting profit, ROI, ROE, ROA, EPS, P/E and ROCE. Unsatisfactory properties of these FPMs lead to a proliferation of new financial measures.

Grant (2000, p. 2-4) points out that today's economic profit players include a wide and growing range of constituents. Major value based performance measures are Stern Stewart's EVA and MVA, HOLT Value Associates' CFROI (described comprehensively in (Madden, 1999)) and LEK/Alcar Consulting Group's SVA and Total Stock Returns (described comprehensively in (Rappaport, 1998) and (Rappaport – Nodine, 1999)). Grant underlines that there are numerous alternatives (modifications) to the mentioned FPMs offered by various consultants. Detailed review of literature dedicated to EVA is in (Sharma – Satish, 2010) and its comprehensive comparison with other measures can be found in (Chari, 2009).

Let's finish our short review of financial performance measures by mentioning an analysis of their strengths and weaknesses given in (Otley, 2007), where their 3 functions are mentioned:

- Tool of financial management – financial planning and control are aimed at three main areas – cash flow, profitability and assets including provision of finance for their purchase. Financial ratios (and their pyramids) allow managers to keep track of a company's financial performance and take actions to keep a company within acceptable bounds.
- Objective of a business organization – accounting and derived FPMs can be seen as the most important objectives of a company.
- Mechanism for motivation and control.

According to Otley FPMs designed for one function should not be used for other functions (e.g. financial planning requires “best estimates” or “conservative estimates”, management control often requires budget estimates set as challenging, yet attainable). In our empirical research we will try to find out which financial measures are used in selected companies and whether organizations are aware of the above mentioned problem.

3.2 Performance measurement frameworks (PMFs)

In this chapter we give a list of those PMFs, which we consider to be the most inspiring. Some of these frameworks (e.g. balanced scorecard, tableau de bord) are widespread in practice, some have not been widely implemented by companies.

- Frameworks primarily created for performance measurement and control:
 - Tableau de bord (Pezet, 2009) dates its origin around 1885) was created and extensively

used for decades in France and thus can be considered to be a precursor to Balanced Scorecard (Chenhall – Langfield – Smith, 2007, p. 276-277). In spite of many similarities, TdB and BSC differ in many aspects. For example (Souissi, 2008) points out that while the Balanced Scorecard highlights strategic aspects, the TdB is more of an operational tool. Well, it is quite difficult to objectively compare TdB with other frameworks mentioned in this chapter as many of these frameworks (including TdB itself) were changing during their existence. More detailed information on TdB can be found for example in (Lebas, 1994), (Epstein – Manzoni, 1997), (Bourguignon – Malleret – Norreklit, 2004), (Cheffi – Rao – Beldi, 2010).

- In the period from 1950 the first serious attempt to integrate financial and non-financial measures was probably project named “Measurement project” which was taken from 1951 in General Electric (Neely – Kennerley – Adams, 2007, p. 144).
- Performance criteria system (Globerson, 1985). This early simple framework is valuable especially because of its clarity, process based approach and emphasis on individual stages of deploying PMMS.
- Performance measurement for world-class manufacturer (Maskell, 1991).
- Performance Measurement Matrix - introduced in (Keegan – Eiler – Jones, 1989).
- Performance pyramid (also called “SMART” - The Strategic Measurement Analysis and Reporting Technique) was introduced around 1989 and described e.g. in (Lynch – Cross, 1995).
- Performance Measurement Questionnaire (Dixon – Nanni – Vollmann, 1990).
- Results and determinants framework - a contingency-based performance measurement model for service industries based on measurement of performance across six dimensions. Managers should develop their own set of performance measures with regard to the three main contingent variables – competitive environment, competitive strategy and service type. The model is described e.g. in (Brignall – Fitzgerald – Johnston – Silvestro, 1991), (Brignall – Ballantine, 1996) and (Fitzgerald – Johnston – Brignall – Silvestro – Voss, 1991).
- Comprehensive performance measurement system (Eccles – Pyburn, 1992).
- Balanced Scorecard; introduced in (Kaplan – Norton, 1992), up-to-date extensive literature review and an attempt to summarize existing findings can be found in (Banchieri – Planas – Rebull, 2011). Interestingly, according to this study no one paper on empirical research aimed at BSC in companies located in the Czech Republic has been published.
- Simon’s “Levers of control” framework (Simons, 1995).
- Cambridge performance measurement system (Neely – Bourne – Mills – Platts – Richards, 2002).
- Stakeholder Approach to Strategic Performance Measurement (Atkinson – Waterhouse – Wells, 1997).
- Integrated performance measurement system (Bititci – Carrie – McDevitt, 1997).
- Otley’s performance measurement framework (Otley, 1999), (Ferreira – Otley, 2005).
- Dynamic performance measurement system (Bititci – Begemann, 2000).
- Performance Prism – comprehensively introduced in (Neely – Adams – Kennerley, 2002). Neely, Kennerley and Adams (2007, p. 144) advocate that performance prism is

more evolution than revolution as it “incorporates the best of the existing frameworks and methodologies”.

- Spitzer (2007) suggested PMF called “performance measurement cycle”. We want to highlight the underlying idea of closed-loop system, which relates both to the continuous improvement of the measured activities and to the continuous improvement of the measuring system itself.
- A hybrid performance measurement framework for optimal decisions (Fukushima – Peirce, 2011).
- Frameworks created primarily for quality management/self-assessment (detailed documents on these models at disposal from relevant institutions and other resources supporting a given model/framework):
 - EFQM – probably the most relevant “quality-based” model from a viewpoint of performance measurement; a history of this model is described in (Conti, 2007) and many important ideas can be found in (Dong – Kumar – Murphy, 2010).
 - Other quality-based frameworks (e.g. Malcolm Baldrige National Quality Award, ISO 9001:2000, Total Quality Management, Six Sigma).

In our empirical research we will try to find out which of these frameworks are used by companies located in the Czech Republic and for which purposes are they primarily used.

4 Performance measurement and management and incentives

For the sake of brevity we cannot address incentives (rewards for performance) into a greater detail here, a paper outlining our views on desired characteristics of rewards systems including incentives has already been published (Peters, 2011).

We only want to shortly point out that the use of incentives is not as straightforward and riskless as some consultants are trying to suggest. Here are some important observations:

- performance of a company depends on performance of its employees, but improving performance of an employee does not necessarily lead to improvement of company’s performance (sub-optimization - optimizing the outcome for a subsystem will in general not optimize the outcome for the system as a whole),
- performance of employees depends on many factors and rewards are only one of these numerous factors,
- incentives may both improve and worsen performance of an employee depending on factors like type of work (creative/highly routinized), hierarchical position, personality of an employee etc. Companies should make assumptions about impact of incentives on behaviour of employees, test these assumptions and continuously update their rewards systems and performance measures used for determining incentives should be continuously selected, analysed and improved to foster desirable behaviour.

5 Conclusions

Firstly, our paper gives a concise review of contemporary approaches to performance measurement and management. In today’s turbulent competitive environment is the importance of performance measurement and management growing and yet it is practically impossible to find a performance measurement framework that would be unambiguously accepted as a reliable tool for improving performance of companies. Nowadays we are not experiencing origination of any “revolutionary” new theories, both researchers and practitioners are trying to test and improve existing methodologies and possibly integrate them. It seems that contingency based

theories will be needed to help companies quickly identify weaknesses of their performance measurement and management systems and find appropriate solution for improving it.

Secondly, the paper outlines characteristics of a methodology for quick evaluation of the quality of implemented PMMSs. It is built upon a structured approach and utilizes distinction of static and dynamic elements of PMMSs. While separation of these elements is of course only conceptual, it makes analysis of these complex systems much easier. Properties of these elements should be analysed separately and later as a whole while taking into account environment in which performance measurement and management system operates. Level of the appropriate utilization of contemporary managerial accounting techniques is also an important indicator of the quality of specific implementation of PMMS and our methodology reflects this fact. Last but not least, basically the same approach is applied to an analysis of rewards systems and interlink of rewards and company's performance. We described our approach to evaluation of rewards systems in Petera (2011). We are convinced that unified methodology it will help companies to systematically analyse their implementation of the mentioned systems. Described methodology is not revolutionary in its nature as it extensively builds on ideas of the frameworks mentioned in chapter 3.2. The methodology is not normative in its nature. It is more a thinking aid than a pre-made solution that fits for all.

We have partially incorporated the current state of this methodology into a questionnaire which is used in our empirical research aimed at the quality of mentioned systems in the largest companies located in the Czech Republic and results of this research will be published in papers prepared within this research project.

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Performance Measurement and Management and Its Interlink with Rewarding of Employee's

Summary

The importance of performance measurement and management is still growing. This paper outlines theoretical background on which is based our research into the quality of performance measurement and management systems implemented in companies located in the Czech Republic. In the second chapter are given definitions of basic terms and the problem of desired properties of performance measurement and management systems is addressed with the help of structured and process based approach. The third chapter gives overview of the main contemporary views on performance measures and performance measurement frameworks. Final chapter shortly explains our view on linking performance measurement with rewards.

Key words: Performance Measurement; Performance Management; Incentives.

JEL classification: M41, M52.

The Impact of IFRS on Income Tax in USA[#]

Jana Roe^{*}

1 Introduction

Accounting has been historically used for different purposes, including tax and financial reporting, each with a set of unique rules. Tax and financial reporting rules have different objectives. This has been historically heavily debated, and the differences are mainly due to the different uses of the two systems of reporting. Historically, the two systems have been both similar and different at times, related or completely separate, depending on the jurisdiction, including legal, regulatory and financing factors. Recently, it has crystallized, that the tension between these two approaches to reporting is a deliberate and gradual shift away from balance sheet reporting of historical costs, to the reporting of current or fair values. Tax reporting within the United States, as opposed to IFRS, has retained a greater adherence to the historical cost principle.

The relationship of tax and financial reporting has caused a debate in literature among academics, professionals, standard setters and others about the movements and the dynamics, and business organizations and other reporting entities are caught in the middle. They are required to comply with both reporting regimes, and so they must continually develop and maintain information systems that properly support both. Since both IFRS and U.S. GAAP is currently allowed as a starting point for tax computation in the United States, it is important from the technical standpoint what accounting rules are currently in effect and which ones will be changing so the U.S. Internal Revenue Service (IRS) can focus on the most important issues that will be impacting tax revenues. From an environmental perspective, since major U.S. companies still use U.S. GAAP, and the IRS has deep knowledge and familiarity of use, regulators must keep up with changing international sentiment to financial reporting and prepare the tax environment for a smooth transition to IFRS.

In this paper, I will summarize the main research areas and questions within this topic examined to date and what we've learned from the work completed thus far. In addition, I will identify the most interesting and important issues for future research. Additionally to reviewing the research in this area and I will identify and describe the major considerations and elements that need to be considered in a transition from U.S. GAAP to IFRS from technical, regulatory and organizational aspects by the IRS.

Recognizing that U.S. companies compete for capital in a global marketplace, the U.S. Securities and Exchange Commission (SEC) is moving quickly to allow large companies to begin using IFRS. If certain milestones are met, a decision will be made on moving to require certain U.S. companies to use it by 2014 and all to do so by 2016. The SEC voted unanimously to propose for comment a roadmap for conversion, with eventual adoption. This transition will not only impact financial statement preparers, it also will have a noticeable effect on tax professionals, due to the intertwined relationship of the tax rules and regulations embedded in U.S. generally accepted accounting principles.

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2 Literature review

2.1 Generally

Hail (2009) wrote a comprehensive article *Global Accounting Convergence and the Potential Adoption of IFRS by the United States: An Analysis of Economic and Policy Factors*, where he writes that accounting standards are one of many important institutional elements affecting financial reporting practices in a country, where a country's institutions include the public and private human-made organizations and conventions that shape economic behavior. These institutions include the legal system, banking system, taxation system, regulatory and enforcement agencies, industry associations, standards bodies, networks of professionals, etc. Further, he describes the effects on taxation, giving examples of the financial statement effects, possible tax legislation changes to protect against losses of revenue, and the need for new tax-planning strategies for firms, who would incur additional consulting costs. The following addresses several projected implications that a transition to IFRS may have on tax rules and regulations, as well as other non-technical areas of tax. The impact of IFRS implementation on local accounting systems has been researched in other countries, for example Zarova and Mejzlik (2009) analyze impact in EU.

2.2 Technical issues

The main research in the tax aspects of IFRS adoption in the USA has focused on the technical issues associated with convergence of U.S. GAAP and IFRS. Technical issues can stem from either tax rules (such as the LIFO conformity rule) or the changing financial reporting guidance (such as the increased shift to mark-to-market accounting under IFRS.) Less research has been done regarding other than technical issues, such as the impact of IFRS adoption on the tax aspects of business, regulation and education.

In the technical area Fosbre (2010), writes about the last-in-first-out (LIFO) inventory accounting method being one of the major roadblocks to U.S. adoption of IFRS, from a policy point of view, focusing on the historical legal and judiciary precedents to LIFO and recent Congressional activity in this area. While valuing inventory using LIFO is prohibited under IFRS, mainly because it does not assign current prices to ending inventory, it is allowed under U.S. GAAP due to the LIFO conformity rule, which mandates that if a Company uses LIFO for tax purposes, it also must use LIFO for financial reporting purposes. Many large U.S. companies use LIFO because in a period of rising prices, it results in significant tax savings and switching to FIFO or another method allowed under IFRS would mean higher tax expense for taxpayers and higher tax revenues for Congress. Therefore, the tension and political lobbying is strong in both areas.

In the LIFO area, Mulford (2008) performed a quantitative study, examining the potential consequences of the elimination of LIFO as part of IFRS convergence, including the balance sheet, cash flow and tax effects of a required move to FIFO from LIFO. Mulford examined 30 U.S. companies with the highest exposure due to LIFO, and found that pre-tax income would be approximately 12% higher and shareholder's equity would be 34% higher in 2007 had they used FIFO. Other effects of the change were found to be cash flow reductions, changes to financial covenants and incentive compensation agreements, adjustments to firm valuation calculations, matching of current prices with current costs and possible loss of earnings management opportunities.

Ko (2011) writes that if the current tax codes were maintained, companies may experience a significant increase in the number of book-tax differences they would be required to track upon incorporation of IFRS into the financial reporting system for U.S. issuers. He also points out that because of the high cost that otherwise would be incurred in maintaining two sets of records, the U.S. Internal Revenue Code (IRC), as well as state and local tax codes and related regulations,

would need to be modified. And when they are modified, companies may experience significant changes to their expected tax liabilities. The SEC (2011) acknowledged that it should work with the IRS and other tax authorities to mitigate the LIFO transitional issue, as well as the transfer pricing arrangements and franchise tax considerations that may be affected in the transition.

Other technical areas discussed in literature by Spalding (2011) include the reversal of inventory write-downs permitted under IFRS but not under U.S. GAAP. The federal tax rules for the lower of cost or market (LCM) valuation method and inventory write-downs generally follow U.S. GAAP. Since U.S. GAAP allows inventory to be valued at either cost or LCM, the tax regulations specify that this method is also acceptable for tax purposes. However, the tax rules limit the application of LCM to non-LIFO methods. A taxpayer may not apply LCM to inventory accounted for under LIFO. Even though LIFO-method taxpayers may not use the LCM for tax purposes, they still may use the LCM for financial reporting purposes without violating the LIFO conformity rule. A transition by U.S. companies from U.S. GAAP to IFRS could have two effects on LCM. First, companies that have to convert from LIFO to another method for book purposes may elect LCM for tax purposes once they receive permission from the IRS to adopt a non-LIFO method. Second, the conversion to IFRS would create an interesting legal question. Since IFRS would represent the new generally accepted accounting principles, taxpayers on LCM would have to apply LCM for tax purposes the same way it is applied under IFRS and reverse any inventory write-downs for subsequent market increases.

Another connection between U.S. GAAP and IRC is in the area of advance payments, where taxpayers must report advance payments for tax purposes upon receipt. However, two provisions allow taxpayers to defer recognition of certain advance payments up to the period in which they report such payments as income for financial statement purposes. Generally, under both U.S. GAAP and IFRS, revenue is recognized from the sale of goods when the risks and rewards of ownership of the goods have passed to the buyer; but they have similar, though not identical, additional criteria that must be met for recognizing revenue.

The last major technical area related to tax and financial accounting in the U.S. is related to research and development costs, examined in detail by Rood (2011). In general, under U.S. GAAP companies must expense both research and development costs as incurred. Under IFRS, companies must treat R&D costs separately. Research costs (the costs associated with the origination of the new "scientific or technical knowledge and understanding") are expensed as incurred. Development costs (the costs of applying the research to a plan or design for production), must be capitalized if those costs create an asset and meet certain other criteria. Specifically, the asset must meet the definition of an intangible asset, it must be likely that future economic benefits attributable to the asset will flow to the entity and the costs of the asset must be reliably measured. A company's tax treatment of R&D costs is independent of the treatment for book purposes. IRC permits taxpayers to expense or capitalize R&D costs. Companies that expense R&D costs for both book and tax purposes will have book-tax differences after adopting IFRS if they chose to continue to expense these costs for tax purposes. So, either they keep two separate books, or request permission from the IRS to switch their tax method to avoid the administrative burden of applying two methods. Electing to capitalize R&D costs for tax purposes, however, will not eliminate the administrative burden of tracking the book-tax difference related to R&D expenses because the timing of the subsequent deductions for capitalized amounts will likely differ for book and tax purposes. For this reason, many companies are likely to retain their current method of expensing R&D costs.

Hail (2009) also points out that change in accounting rules would mean also change in deferred taxes and impact the financial results. This would not only impact the areas discussed above like R&D capitalization, revenue recognition, inventory write-downs, but also issues like leasing, stock-based compensation and hedging activities among others.

2.3 Non-technical issues

The area of other than technical impact of IFRS adoption on the administration of income taxes in the U.S. has not been discussed as much as that of technical issues, as described in the previous section. The tax-related effects of IFRS adoption in the U.S. include political lobbying, administrative burden, regulatory preparedness, professional education and academic impact.

Spalding (2011) describes the tension between the mark-to-market (fair value) accounting supported by IFRS and with convergence efforts, increasingly also by U.S. GAAP, SEC and the accounting profession in the U.S. At the same time, the Internal Revenue Service (IRS), U.S. courts and legislators have recently waged an attack on the mark-to-market method for tax accounting. This tension has created a widening gap between financial and tax accounting in the United States. Spalding concludes that the widening gap has two main effects; macroeconomic and microeconomic. The macroeconomic effect being a difference between tax and financial results, because IRS's objective is a clear reflection of income, vs. FASB's objective is a fair representation of economic activities. These goals do not seem very different but the results often are different. The microeconomic impact would be on the taxpayers, who must maintain two sets of books, supported by separate accounting information systems and reporting. Spalding does not attempt to quantify either effect.

Although the goals and rules under the two accounting systems are different, in practice, tax calculations heavily rely on book numbers, which makes it extremely important for the tax administration in the U.S. to understand the move to IFRS thoroughly. Already in 2009, more than 220 companies used IFRS as a starting point in computing their federal taxable result. In the same year, IRS produced a strategic plan in the case of IFRS adoption in the U.S. Subsequently, in 2010, Treasury Inspector General for Tax Administration (TIGTA) issued a report on the actions that are being taken to address the impact that IFRS will have on U.S. tax administration.

In their report, TIGTA recognizes that IFRS will have an impact on the administration and the taxpayer. The main activities related to IFRS included:

- IRS employees are being provided with IFRS awareness training and guidance
- IRS appropriately coordinated with the tax practitioner community to outline IFRS implementation concerns
- Procedures are being developed to address issues related to the IFRS

Based on these actions, it is clear that the tax administrative aspect of IFRS adoption has started to prepare for the change long before the standards themselves are adopted.

Both federal and state taxes will be affected by IFRS adoption. In Deloitte (2009) wrote that it is expected that a conversion to IFRS will impact a broad range of financial accounting methods. Thus, the financial accounting method changes in an IFRS conversion will require a thorough tax analysis to determine both the permissible and optimal tax accounting methods for both federal and state income tax purposes. To the extent federal taxable income changes in connection with an IFRS conversion, the corresponding change to state taxable income must also be considered. Such consideration will probably be undertaken not only by taxpayers, but also by state taxing authorities. Each state tax jurisdiction will have to decide whether or not their tax regime will follow the federal approach to IFRS. Taxpayers who operate in states that do not adopt changes to federal tax accounting methods may be required to maintain certain legacy accounting systems. These legacy systems will allow them access to information needed to continue filing tax returns in accordance with historical tax accounting methods. In addition to potential changes to state taxable income, companies may also see changes to their state apportionment percentages. State apportionment percentages are generally based on three

factors: gross receipts, property, and payroll. These factors are weighted in accordance with each state's laws and regulations. Overall, IFRS adoption is predicted to impact state income taxes, franchise taxes, state net worth taxes and property taxes.

Companies will not only face tax challenges at home due to the switch to IFRS but will also consider how IFRS could impact their global tax structure. Deloitte writes that the possible impact is associated with product and financial supply chains, intangible transfers, shared service centers and entity rationalization.

Apart from tax administration and regulation issues, the academic and professional community will also play an important role in the overall tax impact of IFRS adoption in the U.S. IFRS curricula are becoming more common on major business universities in the U.S. From the perspective of accounting professionals, the big four accounting firms and professional organizations have organized an education initiative to make sure that all tax professionals from not only the consulting sphere but also from the private sphere working as tax directors know what the change to IFRS means and how to prepare. Examples are PWC, who appointed a US IFRS tax leader and launched a IFRS tax considerations website, complete with advisory and compliance services; all other major accounting firms have similar initiatives and advisory services.

3 Compendium of major areas of impact and suggestions for further research

The technical tax issues related to IFRS adoption identified and described in academic research can be summarized as follows:

- LIFO
- Revenue Recognition
- Capitalization of Research and Development
- Mark-to-market Accounting
- Transfer Pricing
- State Tax Apportionment

However, the issues listed above are not all exhausting, many smaller issues have not been discussed because they presumably do not have a material impact on the tax result. So far, only one paper attempted to quantify the impact of IFRS adoption, in the LIFO area, which was Mulford (2010). Other papers discuss the technical issues but do not quantify the impact.

A detailed study quantifying the impact of IFRS adoption on federal and state income taxes has not been published. One of the reasons is that tax data is not as available as financial reporting data. Another reason is that each Company's tax situation is unique. In the U.S., where Companies have to consolidate their filing for federal income taxes; combine and apportion their filings for state income taxes; and comply with other informational and non-income tax requirements which often rely and use in calculations financial results, the impact of the switch to IFRS will be hard to estimate on collective basis without considering analyzing the possibility of unique situations of enterprises and their tax planning strategies.

The non-technical tax issues related to IFRS adoption either identified in academic research or by the profession can be summarized as follows:

- Macroeconomic effects such as loss of tax revenue
- Microeconomic effects such as increased compliance costs

- Global tax structure of companies
- Training of tax and accounting professionals and tax administrators
- Academic research and educational opportunities

Again, no quantitative research has been performed in this area, and would be much needed, however the quantitative support is not readily available, as access to tax databases is restricted to private sources. Interesting research questions in this would include quantitative analysis of the impact of IFRS adoption on the quality of tax reporting in the U.S., including the impact of IFRS adoption on the gap between taxes that are due and the actual taxes reported (also termed “tax-gap”).

4 Conclusions

A U.S. transition to IFRS will not only impact the preparation of financial statements, it will have a noticeable effect on tax issues, due to the intertwined relationship of tax rules and regulations with U.S. GAAP and the heavy reliance on financial reporting in tax compliance. The tax considerations discussed here are some of the implications that regulators, standard setters, profession, academics and companies may face when converting from U.S. GAAP to IFRS. Regulators and standard setters are considering both tax and accounting rules and their interaction when creating new legislation. The profession is being proactive with continuing education and advisory services analyzing industry impact in the tax reporting and planning area. When it comes to tax compliance, companies must re-examine their procedures for identifying and measuring book-tax differences.

The most profound and best known effect of IFRS concerns the treatment of inventories. Under IFRS, a firm using the LIFO cost-flow assumption for determining cost of goods sold for tax purposes will likely have to request permission from the IRS to change to an alternative method, unless the IRS will change its guidance as a response to the shift in accounting rules. However, other technical areas including many book to tax differences between U.S. GAAP and tax accounting, state tax considerations and transfer pricing and many non-technical areas like IRS agent continuing education, professional education and tax planning by companies will be impacted by the change from U.S. GAAP to IFRS. The challenge for academics is to conduct quantitative research in this area, estimating the impact of the change on both tax liabilities and administrative costs on both the tax collector and the tax payer (macroeconomic and microeconomic impact.)

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The Impact of IFRS on Income Tax in USA

Summary

A U.S. transition to IFRS will not only impact the preparation of financial statements, it will have a noticeable effect on tax issues, due to the intertwined relationship of tax rules and regulations with U.S. GAAP. The tax considerations discussed in this paper are some of the implications that regulators, standard setters, profession, academics and companies may face when converting from U.S. GAAP to IFRS. Regulators and standard setters are considering both tax and accounting rules and their interaction when creating new legislation. The profession is being proactive with continuing education and advisory services analyzing industry impact in the tax reporting and planning area. For tax compliance, companies must re-examine their procedures for identifying and measuring book-tax differences. Technical areas including many books to tax differences between U.S. GAAP and tax accounting, state tax considerations, transfer pricing and many non-technical areas like IRS agent continuing education, professional education and tax planning by companies will be impacted by the change from U.S. GAAP to IFRS. The challenge for academics is to conduct quantitative research in this area, estimating both the macroeconomic and microeconomic impact.

Key words: IFRS; GAAP; Tax; Financial reporting.

JEL classification: M40.

Measurement, Capitalization and Auditing of Intangible Assets and Rights According to Turkish Commercial Law and IAS 38

*Utku Şendurur**

1 Introduction

Intangible rights which occur from creativity and brain child are very important. Nowadays intangible rights play a important role in development of society both in economic and social ways committed to technology. In the world, production centres are changing continuously, idea becomes as valuable as production and economic branches are diversing by the day. Because of this, intangible rights become more valuable in the coming ten years.

Intangible resources range from the intellectual property rights of patents, trademarks, copyright and registered design; through contracts; trade secrets; public knowledge such as scientific works; to the people dependent, or subjective resources of know-how; networks; organizational culture, and the reputation of product and company.(Hall p135,1992)

Intangible resources may be classified as 'assets' or 'skills'. Assets, which are obviously things which one owns, include the intellectual property rights of: patents, trademarks, copyright and registered designs; as well as contracts, trade secrets and data bases. (Hall p135,1992). The intangible resource of reputation may also be classified as an asset due to its characteristic of 'belongingness', and whilst it may be defensible to attack with respect to defamation and libel, it cannot be said to have the property rights of, say a trademark, which can be bought and sold. Skills, or competencies, include the know-how of employees (as well as suppliers and advisers), and the collective aptitudes which add up to organizational culture. (Hall p135,1992). When a company is taken over the acquirer can be confident that he has acquired the acquiree's intangible resources such as patents, but he cannot be certain that he will retain the intangible resources of know-how, culture, or Networks which can ultimately 'walk away'(Hall p136,1992).

There are some difficulties about measurement of intangibles which have not been the subject of an exchange. (Barwise, 1989) raises the more fundamental question regarding the significance of any quantification of shareholders' funds which does not recognize the value of intangible assets. Handy (1990) suggests that businesses will need to become more like entities with respect to the emphasis which is placed on being information/knowledge positive as well as being cash positive. Itami and Roehl (1987) have argued that a characteristic of all successful organizations is the recognition that there is a learning process which runs in parallel to all operations, and that all activities present the potential to both enhance, or degrade, the know-how and reputation elements of the intangible resources. They also argue that at a strategic level this view leads to the selection of strategies which will enrich the 'know-how stock' of the core competencies of the business.

Auditors can be broken open against intangibles under these conditions when they are making an audit. IAS 38 gives some clues, about these concerns, to auditors when they are making audit. In this paper, measurement, capitalization and auditing of intangible assets and rights to Turkish Commercial Law, Turkish Tax Law and Ias 38 are explicated. This paper's contribution

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to research development is to explain how auditor does his/her job due to Turkish Commercial Law and IAS38.

2 Categorization of intangible rights

We can classify intangible rights as intangible rights which do not need obligation to register and intangible rights which do need obligation to register. The reason for classifying intangible rights like this is the confirmation necessity of intangible rights. Obligation to register which mentioned in this paper means, affirmation by public authority to work has been created. Intangible rights which do not need obligation to register is product of two-sided contract. Because of this, there is no need to register by public authority again. But creator of intangible rights which do need obligation to register, to protect their rights, they have to prove that it is a original product and register intangible rights to a public authority.

2.1 Intangible rights which do not need obligation to register

Franchising: A form of business organization in which a firm which already has a successful product or service (the franchisor) enters into a continuing contractual relationship with other businesses (franchisees) operating under the franchisor's trade name and usually with the franchisor's guidance, in exchange for a fee.

Leasing: Arrangements, similar to rent agreements, for the use of property (buildings, cars, office equipment and other items) in return for payments to the owner. The lessee (person taking out a lease) agrees to pay a number of fixed or flexible instalments over an agreed period to the lessor, who remains the owner of the asset (item) throughout the period of the lease.

Goodwill: Goodwill is seen as an intangible asset on the balance sheet because it is not a physical asset such as buildings and equipment. Goodwill typically reflects the value of intangible assets such as a strong trademark name, good customer relations, good employee relations and any patents or proprietary technology.

2.2 Intangible rights which do need obligation to register

Trademark: A trademark is the identity of a specific product, service, or business. A trademark can take many forms, including a name, sign, symbol, color combination or slogan.

Patent: The exclusive right to use documented intellectual property in producing or selling a particular product or using a process for a designated period of time.

Copyrights: Copyright is a set of exclusive rights given to the author or creator of an original work, including the right to copy, distribute and adapt the work. Copyright does not protect ideas, only their expression. In most jurisdictions copyright arises upon fixation and does not need to be registered.

Know-how: The technical knowledge and skill required to do something.

3 Measurement of intangible assets

Intangible assets composed of patent, license, trademark, goodwill, usufructus and copyrights, which have no corpus. These supply entity to privilege and ascendancy. Furthermore, establishment and formation expenses which enclose the expenses for establishment and development of entity are also counted intangible assets as capitalized expenses.

When intangible assets created or bought, they capitalize at the rate of the amount paid for them. Intangible assets are redeemed subjected to depreciation like tangible assets.

3.1 Measurement of intangible assets according to Turkish Commercial Law

There is no specific information about how single proprietorship measure intangible assets in

Turkish Commercial Law (TCL). Because of this, single proprietorship measure its intangible assets on balance sheet value to general provision of article 75 in TCL.

In capital stock companies, to article 459, they have options to choose to write off establishment and formation expenses or capitalized and depreciate them maximum in five years. In TCL article 460, except establishment and formation expenses, rights, privileges, patents, licences, trademarks and other intangible assets like them are include in the balance sheet over their cost value.

Except establishment and formation expenses, valuation measurement for other intangible assets is cost value. But, if intangible asset value is under the cost value, it is possible to choose any measurement method entity wanted.

3.2 Measurement of intangible assets according to Turkish Tax Law

3.2.1 Rights

Rights amortize in their usage time. Usage time must affirm by public authority or determined by a contract. If contract time is only a year, rights write off after end of the period they capitalized. If the period of benefit is unknown or can not be detected depreciation period is five years.

3.2.2 Establishment and formation expenses

Capitalized establishment and formation expenses are measured with book value to Turkish Tax Procedure Law article 282. In the same article it is said that the capitalization of establishment and formation expenses are arbitrary.

3.2.3 Goodwill

Goodwill can only be shown in acquirer entities balance sheets. In other words internally generated goodwill, appears from entities successful operations, can not be shown in balance sheet. Goodwill must be purchased for good and valuable consideration to include in the balance sheet.

Goodwill is measured with book value and capitalized to Turkish Tax Procedure Law article 282. Goodwill amortized in five years with equal payments on their book value.

3.2.4 Redemption of special costs

If estates are hired, expenses about display case, shelves, lightening, ventilation and such facilities like them are capitalized as special costs in Turkish Tax Procedure Law article 272.

Expenditures capitalized as special costs are amortized equal percentages during tenancy in Turkish Tax Procedure Law article 327. This relation does not change if tenancy is prolonged. If we abandon rented place before the end of tenancy, unredeemed expenditures written as expenditures in one go.

If tenancy is unknown, special costs must be amortized in five years to Turkish Tax Procedure Law. Thence, redemption rate is accepted as 20% for special costs in communiqué related with depreciation amortization.

4 Capitalization of intangible rights

IAS38 determine some special conditions to capitalize the expenditures for intangibles.

4.1 Capitalization conditions

- Identifiability: An asset is identifiable if it either(International Accounting Standarts. IAS38):

- is separable from other assets; or,
- arises from contractual or other legal rights.
- Control: An entity controls an asset if the entity has the power to obtain the future economic benefits flowing from the underlying resource and to restrict the access of others to those benefits. Third persons access can be blocked in actual fact or by courts.(Kaval p:339, 2008)
- Future Economic Benefits: The future economic benefits flowing from an intangible asset may include revenue from the sale of products or services, cost savings, or other benefits resulting from the use of the asset by the entity. For example, the use of intellectual property in a production process may reduce future production costs rather than increase future revenues (Turkish Accounting Standarts 38 p:730, 2010).

First step of putting intangibles in to the accounts is, deciding whether the future economic benefit is identifiable or not. Then it must be seperable and controllable. These conditions must be accepted for intangible rights which are gained separately or from corporate combination.

4.2 Capitalization of research and development expenditures

To assess whether an internally generated intangible asset meets the criteria for recognition, an entity classifies the generation of the asset into:

- a research phase; and
- a development phase

No intangible asset arising from research (or from the research phase of an internal project) shall be recognised. Expenditure on research (or on the research phase of an internal project) shall be recognised as an expense when it is incurred (Turkish Accounting Standarts 38, p:738, 2010).

An intangible asset arising from development (or from the development phase of an internal project) shall be recognised if, and only if, an entity can demonstrate all of the following (International Accounting Standarts 38, 2009):

- The technical feasibility of completing the intangible asset so that it will be available for use or sale.
- Its intention to complete the intangible asset and use or sell it.
- Its ability to use or sell the intangible asset.
- How the intangible asset will generate probable future economic benefits. Among other things, the entity can demonstrate the existence of a market for the output of the intangible asset or the intangible asset itself or, if it is to be used internally, the usefulness of the intangible asset.
- The availability of adequate technical, financial and other resources to complete the development and to use or sell the intangible asset.
- Its ability to measure reliably the expenditure attributable to the intangible asset during its development.

4.3 Capitalization of goodwill

Goodwill does not provide capitalization requirements because it is not recognised as an asset and an identifiable resource. In other words, goodwill can not be sold separate from other assets and can not be used in production. But, in Turkey, goodwill is in the uniform chart of accounts in intangible assets.

Goodwill can not be capitalized if it is internally generated to IAS38. Goodwill can be capitalized if there is a business combination or an entity purchase. In this case, paid price is distributed to purchased entities assets and debts. After evaluating all assets and debts with current market value, share to purchased entity from its equity capital at balance sheet, is under the value that paid for the purchased entity, goodwill come into being and written off balance sheet with capitalization. But, this goodwill will not be amortized. After at the end of every year, a depletion in assets test will executed on goodwill instead of this (Kaval p:350, 2008).

5 Auditing of intangible rights

Intangibles have an importance today greater than ever before. A generation ago, about 80% of a typical company's assets were tangible (buildings, equipment, and the like) and 20% were intangible, according to a study by the American Intellectual Property Law Association. By the turn of the Millennium, the relative value of tangible and intangible assets had essentially reversed so that approximately three-quarters of a typical company's assets were intangible assets (Meyer and Patel).

In virtually every case, substantial initial information will need to be gathered and presented before the auditors can efficiently begin their detailed investigation. The types of information that will be needed include (Meyer and Patel):

- **Information concerning the nature of the assets:** In the case of transaction-related audits, the audit team should be fully informed of the details of any transaction for which the audit is being performed, and should be given relevant documents such as a letter of intent, terms sheet or draft purchase or license agreement.
- **Background research:** Some initial background research before the audit begins will greatly increase efficiency downstream. For example, there may be issues peculiar to the law of a particular state or country that must be explored. The technology at issue may be so complex that background research by the auditors will be necessary, particularly if patents are at stake or if there are questions of inventorship.
- **Data gathering:** Someone at the company should be designated to coordinate the gathering of documents and information relevant to the particular subject matter of the audit, and as many documents as possible should be reviewed before the audit begins. Depending upon the scope of the audit, relevant documents may include license and maintenance agreements, distribution agreements, government contracts, federal registration and recordation documents and state commercial code filings.

5.1 Cases which auditor must pay attention

Auditor must pay attention to the following points to make a successful audit about intangible rights. Auditor has to be sure (Kaval p:338, 2008):

- If the asset included in the balance sheet, provides the conditions to include in the balance sheet or not.
- If required explanation made about assets in the footnotes, which are not include in the balance sheet.
- If accurate measurement made about intangible assets or not.

Auditor has to be sure to have satisfactory evidence about the mentioned issues above

5.2 Operation tests

There is a small risk of fraudulent operation when intangible rights are purchasing and selling. Because, intangible rights costs are very high and senior management buy or sell them after a

detailed investigation. Because of intangible rights usages are restricted by access and laws, there is a small risk of fraudulent operation in intangible rights usages. Because of this, there is no need of special internal control systems. Fortiori, there are little problems about measurement and capitalization of intangible rights.

5.3 Material verification tests

Because of intangible rights are not physical and concrete, there is no auditing procedure like counting them. When we are doing verification, we must note the followings:

- We must check licence contracts.
- We must search cases which may occur as compensation in the future.
- We must check, if the assets include in the balance sheet, provide the conditions to include in the balance sheet or not.

5.4 Reporting

Entities which are not reporting according to IFRS, are reporting according to tax laws. It is important that, if the tax declaration is true or not. Entities reporting according to IFRS, publicly held companies, are more important for auditors. Financial statements must be investigated well, considering the points above. Accuracy of footnotes must be investigated also after controlling of intangible prices in the balance sheet.

6 Conclusions

Intangible rights are defined as identifiable non-monetary assets that cannot be seen, touched or physically measured, which are created through time and/or effort and that are identifiable as a separate asset. These are patents, licences, trademark, copy rights, quota rights, franchising, computer programs, films, articles of virtue and goodwill.

We can classify intangible rights as intangible rights which do not need obligation to register and intangible rights which do need obligation to register. The reason for classifying intangible rights like this is the confirmation necessity of intangible rights.

Intangible assets composed of patent, license, trademark, goodwill, usufructus and copyrights, which have no corpus. These supply entity to privilege and ascendancy. Furthermore, establishment and formation expenses which enclose the expenses for establishment and development of entity are also counted intangible assets as capitalized expenses. When intangible assets are created or bought, they capitalize at the rate of the amount paid for them. Intangible assets are redeemed subjected to depreciation like tangible assets.

IAS38 determine some special conditions to capitalize the expenditures for intangibles. An asset must be identifiable, controllable and have future economic benefits.

Auditor must have pay attention to measurement, capitalization and taxation of intangible rights. If asset does not have the conditions for capitalization, it must be denoted in footnotes. Auditor must also be careful about redemption rate. There are some assets which have infinite economic life. In these assets, there are rights which are separable. Auditor must be sure if separable rights are determined accurately or inaccurately.

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Measurement, Capitalization and Auditing of Intangible Assets and Rights According to Turkish Commercial Law and IAS 38

Summary

Intangible rights are assets that are not physical in nature such as patents, trademarks, copyrights, franchising, leasing, business methodologies and goodwill. We can categorize intangible in two groups: Do not need obligation to register and do need obligation to register. If intangible assets created or bought, they capitalize at the rate of the amount paid for them. Intangible assets are redeemed subjected to depreciation like tangible assets to Turkish Commercial Law. Rights amortize in their usage time, capitalized establishment and formation expenses are measured with book value, goodwill can only shown in acquirer entities balance sheet and expenditures capitalized as special costs are amortized equal percentages during tenancy to Turkish Tax Procedure Law. IAS38 determine some special conditions to capitalized the expenditures for intangibles. An asset must be identifiable, controllable and have future economic benefits. Auditor has to be sure to have satisfactory evidence by doing operation and material verification tests. In the world, production centres are changing continuously, idea becomes as valuable as production and economic branches are diversing by the day. Because of this, intangible rights became more valuable in the coming ten years.

Key words: Measurement and capitalization of intangible rights; Turkish Commercial Law; Turkish Tax Procedure Law; IAS38.

JEL classification: M41, M42, K2, K34.

Risks and Importance of Data Migration during the Process of Accounting Information Systems Implementation

*Jana Singerová**

1 Introduction

Accounting information systems are essential part of company information systems and provide information to internal and external users in order to ensure proper decision making, managing, investing. Every information system has its own life cycle and if it comes to the end of this cycle, it is upgraded or changed to another system. This process is called implementation. This article describes one of the important parts of implementation – data migration and related risks with respect to the general accounting assumptions and principles.

1.1 Why is data migration considered as a critical moment of the implementation, what are the major risks

Implementation of a new information system has an impact on the whole company and it is a task as timely, so financially demanding. What is the reason for it? According to Basl and Blazicek, „Information system today supports not just all important company functions, such as finance, human resources, planning, sales, purchasing, logistics including e-business and m-business.“ [See 1]. Minimizing the risk of unsuccessful implementation is usually solved by applying project management to the whole process.

Implementation often results in company processes re-engineering. As a simple example could demonstrate a change in a purchasing process – the new system requires obligatory purchase orders to be entered and approved in the system – and the number of users rises geometrically. Also the document flow could be different – i.e. supplier's invoices are linked to the purchase orders and good receipt notes created and approved in the system, otherwise the payment cannot be processed.

One of the key parts of the implementation is data migration. In the time schedule, migration is located immediately before the going live. Due to the fact, that migration is not a one-time action, but a process, which could last a couple of days or weeks, the proper planning of migration is essential. And though from the first view could be migration considered as a simple task, it is not that case.

„As complex migration of huge amount of data are not executed very often in a company, there is not too much experience with unusual situations, and the likelihood to run into one of the unusual, seldom pitfalls is very high, resulting in significant delay of the whole project.“¹

„Data migration is a key element to consider when adopting any new system either through purchase or new development. Data migration is not a simplistic task and if not given due consideration early in the process of developing or purchasing a new system, it could become a very expensive task.“²

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¹ See www.it-checklists.com/checklist_data_migration.HTML

² See www.infotech.net.org/ntca/datamigration.htm

How can be data migration defined? One of the definitions gives Boockholdt, page 255 [see 2]: „*Conversion is the process of changing from the old system to the now one. During the conversion activity, the project team tests the new system under actual operating conditions. Conversion provides the team with the opportunity to make final modification to the system before the organization relies on it for processing accounting transactions. The project team completes three task during the conversion: data conversion, volume testing, and system changeover.*“

Because is migration long term task, needs to be correctly planned with the respect to the fact, that users needs some, though limited access to use the system.

1.2 What are the risks of a migration

1. Incorrect data – can be caused by manual data entry (keying mistake, carelessness of user) or during the batch input (insufficiently tested migration program used for the data migration can caused an error – for example for transactions in foreign currency program uses incorrect exchange rate). The mistake could occur in cases, when the structure of data is changing and the input data need to be modified (changed, amended).
2. Data are migrated late – can be caused by poor planning – data are correctly migrated, but with such a delay, which has an impact to the in time month end (year end) closing, preparation of the tax return, management reporting, bank reporting etc.
3. Unmigrated data – this can be caused due to the sequential migration together with use of the original system. For example, if the batch input is used for input data from the external systems not linked on-line to the core system, with poor planning could happened, that some batches remain unmigrated („forgotten“). Or if the data structure is changing (long time after the migration) during the production use could be found, that some unmigrated fields are now needed.
4. Multiple migrated data – data are migrated more than once.
5. Data from non-productive system – by mistake are for the migration used data from i.e. testing system or from old backup of the productive system.
6. Non-actual data – once migrated, data in the original system are changed by users. For example in Accounts Receivable or Payable sub ledger are matched invoices with payments and therefore the number of open items has changed. This mistake is a direct consequence of incorrectly set up migration time schedule together with the possibility to change date in the original system.
7. Expensive data – original and new system are so different, which leads to the expensive modification of data. Financial demands could be caused by maximalist approach to the migration (requirement to migrate all data regardless its information value). Second reason is a requirement to migrate all data just by batch inputs (in order to avoid manual data entry), which at the end costs more (additional work on programming).
8. Data without real information value – inability to identify transaction (no name vendors for particular invoice). However data need to be migration, even if the information value is vague.
9. Unlinked data – relations in between particular modules of the system, which are during the productive operation created automatically, could not be created during the data migration. As a result of this, the links between particular transaction cannot be drill down (i.e. purchase order – invoice – payment)
10. User expectation – data migration is not sufficiently clarified with the users (both end users and management). And therefore the disappointment from the user side is a result of the lack

of clarification the expectation about the effortless data migration and about the new look of migrated data. Users are unpleasantly surprised, because „their“ accounting (meaning the current one) perfectly fits. All reports are correct, balances and sub ledgers are reconciled. Management disgruntlement with the report layout (i.e. controlling) is caused mainly by insufficient communication between the management and the implementation team.

1.3 Data migration to the new system

Migrated data could be divided to two basic categories: master data and transactional data. Master data (also reference data) describe structure of the company functioning and represent key part of information system. Master data are relatively stable data, the maintenance is dedicated to the authorized users and authorization is required for every single change. Examples of reference data are: chart of account, journal types, document numbering, cost center, internal orders and project structure, database of partners (suppliers and customers). Appropriate structure of master data contributes to the effectiveness in use of the information system, helps to reduce redundant and inconsistent data. And last, but not least also leads to the effective maintenance.

Transactional data are created continuously during the productive usage and are recorded in the structure of master data. Sources of the origin can be categorized to external (incoming invoices, contracts...) and internal (issued invoices, petty cash documents, wages, property documents etc.). Transactional data are processed in the system by authorized users (i.e. petty cash disbursement can be processed by petty cash clerk only). During the data migration the source of the transactional data is solely the origin system.

Master data differ from the transactional also by the impact of the mistake in the data. Master data have huge impact to the transactional data, but vice versa not. The level of risks is different and also the importance could vary.

1.3.1 Master data

Among the master data are important: chart of accounts, VAT codes, exchange rates, master data of suppliers, customers, controlling data (cost centers, internal orders, projects) etc.

In the attached table is an example of main types of master data with the determination of frequency of change and examples of the mistake impact to the transactional data.

Tab. 1: Main types of master data

Type	Frequency of change	Impact to transactional data
Chart of accounts	low	correct posting
Posting journals	low	clarity and correctness of the posting
VAT codes	low	impact on the tax return
Cost centers, internal orders, projects	medium	impact on management accounting
Exchange rates	frequent	immediate impact on correct posting
Suppliers and customers database	frequent	formal correctness of issued documents (issued invoices) proper payment (incoming invoices) communication with suppliers and customers

The structure and the field length of master data are changing quite often during the implementation. If it is the case, the conversion bridge must be prepared. The conversion bridge specifies exact mapping for old and new structure. The relation might include combinations 1:1, N:1, N:N, 1:N. Specially last two demand requirement for the proper preparation of migrated data, often including high porting of manual work.

1.3.2 Transactional data

Data migration must be performed with respect to the continuity of the accounting (opening and closing balances), and certainly all open items and turnovers must be migrated.

Following table shows examples of transactional data with open item management and with balances only

Tab. 2: Examples of transactional data

Item	Balances	Open item
Opening balances as of 1.1.*)	x	
Opening balances of petty cash and bank accounts	x	
Monthly turnover on control accounts	x	
Monthly turnover on general ledger	x	
Balances and turnover on IFRS accounts	x	
Turnover on expense accounts	x	
Accounts receivable open items		x
Accounts payable open items		x
Received advance payments		x
Paid advances		x
Balances on general ledger accounts	x	
Fixed assets register		x
Inventory		x

*) the date of data migration varies from the beginning of the accounting period (here Jan 1)

Mode of the data migration is depending at the architecture of the new system – if it is a modular system, some data might be migrated via sub ledgers (accounts payable, receivable, fixed asset register etc.).

1.3.3 Time sequence

As a first are migrated master data, followed by the transactional data. Migration of the transactional data depends on the availability in the origin system. Period end closing is often spread in time. The migration schedule should respect this spread. Illustrative migration schedule is shown in following table – the going live date is setup to Monday April 1.

Tab. 3: Illustrative migration schedule

Thu 28.3.	Chart of accounts, posting journals, number ranges, cost centers, internal orders...
Fri 29.3. 6:00 p.m. – Mon 1.4. 6:00 a.m.	Master data of trading partners, exchange rates Inventory A/R open items – system generates invoices last working date A/P open items
Mon 1.4.	Bank account and petty cash balances
April, May	Income statement accounts Opening balances
June, July	Fixed asset register Turnovers
August	Balances on IFRS accounts

As we can see, the time demand of the migration peaks before the start up (planning in hours). In subsequent weeks and months time demands significantly reduces.

In the case, the new information system is linked to other company systems, or is it a integrated system already, the migration of these data needs to be performed as well. Particularly could be named budgets, warehouses, issued purchased orders in all stages of the process, fixed asset register.

These data have their on structure and importance, but don't have such robust relations as an accounting data, which results to the more complicated control. I.e. warranty period, warehouse location, personal data...

2 Acceptation phase with the respect the basic accounting principles

2.1 Data migration acceptance

Correctly set up formal acceptance process is an integral part of each implementation. Král says on page 35 [see 3]: *“Formalization of steps is consider as a set up of obligatory or recommended steps and rules during the processes, activities or actions...”*

The whole migration phase must be supported by very detailed schedule, including time schedule, types of migrations, controls. If migrations programs are use, must be in advance tested and approved. For each type of migration must be in advance agreed form of control and check.

Acceptation is recapitulated in an acceptance protocol, containing all migrated batches received from the origin system, control print outs, description of possible mistakes and form of elimination. The acceptance protocol is approved by designated user.

To ensure superior objectivity of the acceptance phase, the auditors might be involved. For example J.L.Boockholdt [see 2] states on page 145:

„Ideally, most auditor involvement in the SDLC occurs during the system design phase. Auditors review the detailed specification for the system proposed by the project team. They are also heavily involved in the implementation phase, during system testing and conversion. After completion of the development process, and during the operation phase, auditors participate in reviews of the system“.

During the migration planning is important the detailed analysis, which data shall be transferred and in such a scope. To illustrate this part of planning I am listing a sequence of questions, which need to be answered:

- *“Should we bring the data over to the system?*
- *If so, should we bring all or part of the data?*
- *If just part, which parts? – based on creation date? based on status of case open or closed? or some combination of these?*
- *If we choose to bring over data on or after a certain date, which should is be – last 3 months, last months, last year?... should it be all the data?*
- *Should we filter in or out specific data?*
- *Are our desired criteria extractable from the existing database?*
- *Are the desired fields of data importable into the new system”?*³

³ See www.infotech.net.org/ntca/datamigration.htm

2.2 Impact of data migration to the basic accounting principles

Although from the first point of view could be data migration consider as a technical issue of the implementation team, has significant impact to the material content of data in the new system. Accuracy of data migration affect quality of data in the new system not even immediately after the data migration, but in the case of master data also in far future periods, when the migration error can occur, by certain combination of input data, for many years. For this reason technical aspect of quality migration affect contents of accounting performed in the new information system. For example Mejzlik [see 4] states on page 108 risks and errors related to the data migration as one of the risk area if ERP system implementation: *“Some current data might be taken over, however majority of data require restructuring and amending details, for example from existing non automated agendas etc. At such a data migration is necessary to keep the certainty in integrity of migrated data”*.

In next section I would like to point the impact of single aspects of data migration to the basic accounting principles. Check of data migration leads to only important goal: true accounting view in the new system...

2.2.1 True and fair view of the account balances, turnover and accounting reports

The change of the information accounting system often cause change in the mode of the processing the accounting transactions (the same correct result is reached by different way of processing – i.e. can track more parameters, transaction is link to the material management...). In such a case, during the data migration, new requirements need to be met. It is necessary to fulfill all requirements required by new system (or less). To check the accuracy of the data migration, the true and fair view need is taken into the account.

IF the chart of accounts is changed in the connection with the implementation, the method of control of the proper posting is so called “conversion bridge”. Conversion bridge prove the continuity between original and new chart of accounts. The trial balance is other method of control, which helps to check the balances and the total sum.

Type of migrated data	Basic control
open items - accounts payable and receivable sub ledgers	individual account in A/R, A/P balance on control account
open item – general ledger	itemized control balance on general ledger account
turnover on general ledger accounts	monthly turnover on debit and credit on each account
opening balances as of Jan. 1	trial balance as of Jan 1
balances on petty cash and bank accounts	comparison with petty cash journal and bank statements as of the date of migration

2.2.2 Entity

Data migration in the case of company split (or merger) must ensure split (or merger) of data thereby the check of correct data migration into the right company (from the company) can be performed.

If the accounting rules are changing (i.e. leasing in CAS vs. IFRS – in CAS leasing is not consider as an assets, but according the IFRS standards is and it is shown in balance sheet). In such a case, additional data and information are required for proper data migration.

2.2.3 Periodicity

The change of the accounting period definition can be carrying out together with the implementation. The new system can also allow to, apart from the statutory accounting period definition, set up separately mother company accounting period rules and prepare management reports accordingly. The acceptance check is focused on change of these dates.

2.2.4 Going concern

Opening and closing general ledger balances must continue. Even if the accounts are not migrated technical via the opening and closing accounts, the continuity must be 100 %. Going concern principle applied to the data migration check is closely linked to the true and fair view and therefore the trial balance check is performed (taking into consideration the conversion bridge).

Reason for the change in chart of accounts:

- Different architecture of new system – i.e. method of evidencing accounts payable and receivable items. In origin system are items tracked directly in the general ledger (each supplier/customer represents one general ledger account), in the new system are posted to the accounts payable/receivable sub ledger and to the general ledger are posted via control accounts (one for each defined group).
- Origin chart of accounts distinguished the income statement accounts for the tax return purpose at the account level (i.e. Travel and entertainment tax deductible and tax non-deductible), in the new system this is tracked on the transactional level. The simplification of chart of account is obvious.

2.2.5 Objectivity

The document inventory of open items on accounts payable, receivable, general ledger is performed prior the data migration. Data migration is approved in acceptance and confirmed in acceptance protocol. Changes in data (restructuring) are documented and consequently check, or audited. Data posted during the data migration are visible marked as a migrated data (i.e. appropriately chosen posting journal). Migration could be later on audited by internal or external auditor. For example Wilkinson, Cerullo, Raval a Wong-on-Wing on page 522 [see 5] say: *„...internal auditor has an important relationship to the information systems function. An internal auditor... ensure that the controls are being implemented as designed.“*

2.2.6 Monetary unit principle

As a result of implementation can occur a situation, when the mother company use FIFO for the valuation of the inventory, but the origin system data are valued at moving average costs. Consistency principle does not allow to change method of valuation during the accounting period and affect straight the date of migration (in our case can be migration performed at the accounting period end, which mitigate this risk.

Other example is use of different exchange rates for posting of foreign currency transactions. The change from fixed exchange rates (i.e. 1st working day in the month) to daily exchange rates is by Czech law allow. The Accounting act [see 6] states in paragraph 7: *“When using fixed exchange rates, the accounting unit can change this exchange rate by internal policy even during the accounting period”*.

2.2.7 Consistency

The consistency check of used depreciation method is performed for fixed assets and depreciation on each individual item. The revenue recognition date, date of invoice issue, recognition of payment date cannot be changed as an implication of the implementation.

2.2.8 Matching principle

Credit notes and matching cannot be executed during the migration, but need to be processed as a standard transaction of current period or in the origin or in the new system. For example in the origin system one subject represents supplier and customer separately, but in the new system as a one partner. Even this situation is not a reason for matching the transaction during the migration. It only can serve as a supporting document for proper matching in the new system.

2.3 Basic possibilities how to check result of data migration

Basic control tool for the data migration check (the individual balances) is the comparison of trial balances from both systems. The detail of the trial balance is confirmed and agreed in advance. An additional control is reconciliation of accounting reports (balance sheet, income statement).

For line items migration is suitable to select and check representative sample of items. Also reports from both systems can be used for comparison and reconciliation between origin and new system. Reports are defined by advanced users in order to ensure objectivity of such a control. For manual data entry (manual posting to the new system, supporting documents are prepared from the origin system) is necessary to approved all posting journals (i.e. migration to the parallel accounting IFRS books).

Possible technical controls of migrated data according Douglas [see 7], page 146, are:

1. „*Hash total – which is an otherwise meaningless arithmetic total of numeric data, such as invoice number. Like a control total, the hash total can help ensure that key data fields are accurately received from an outside source*“
2. Modulo 11 can be used for check of accuracy in bank details master data. (CNB states in appendix Nr. 1 to the Policy Nr. 62/2004 the correct algorithms for calculation of Modulo 11).
3. For the batch input migration the main control is line number count for each batch compared with number of line posted to the new system. Also the control sum debit and credit side are simple, but effective control.

3 Conclusions

Information systems are today essential for managing the company. Implementation of new information system has impact to all processes in the company including accounting. Re-engineering of processes becomes usually as a result of implementation. Subsequent impact has re-engineering to the data and its structure.

Data migration, as an integral part of implementation, is solved, prepared and performed as an IT task by IT specialists. This usual approach leads in an underestimation of impacts to the substance of accounting. Migration is key element during the development or purchasing of the system and the insufficient preparation can result in significant delay of the whole project.

It needs to be taken into a consideration, that accounting, despite the other parts of information systems, provides the company with the information, which requires, due to the regulations and conclusiveness, special attention. From the IT point of view this attention could appear as a redundant or too formal. Conclusiveness of accounting is subject of external regular auditing and therefore data migration must be treated very carefully. To avoid such a risks, a senior accounting end user could become a member of the implementation team.

This article analyzes and point out the main aspects and risks of data migration to the basic accounting principles (the true and fair view, continuity, going concern, objectivity, historical value and matching principles).

For the purpose of data migration, data are categorized to two main parts: master data and transactional data. Master data represent spine of the company information system and from the maintenance point of view are relatively stable. Properly setup structure of master data helps to the efficient usage of the system.

Transactional data are representing posting of individual company transactions. The posting of transactions exploit master data. Obligatory use of master data ensures clarity and to clarity and unification of transactional data.

Risks of data migration are – incorrect migration from original system, including data migrated late, from non-productive system or from the backup, mistyped data. Risk is also, if data migration become to expensive due to the maximalist approach or due to the bad organization of work.

To ensure minimization of risk is essential to create detailed migration plan with the respects to all accounting requirements and its regulation, consistency and continuity. Choice of proper date of go live day is important as well. Part of migration plan is also detailed time schedule, agreement on acceptance phase and protocols for each type of migration check on data entry and solution for found inconsistencies.

All controls of migrated data lead to clear goal: ensure true and fair view of migrated accounting. One of the main control is reconciliation of trial balances in both systems, and if the chart of accounts have changed, the use of conversion bridge, documenting the exact matching between original and new chart of accounts. The trial balance is used also for the reconciliation of opening and ending balances (continuity principle).

Entity unit test is performed for cases, when the company split or merge and if the accounting rules are changing.

Historical value principle has immediate impact to the choice of the go live data.

Objectivity of accounting data migrated to the new system is supported by document audit. Changes in data caused by different structure are documented and check.

The implementation team supports the auditors, if the extraordinary audit is required.

Migration of accounting data affects quality of accounting reports and ability of internal and external user to make right decisions based on submitted reports from the financial accounting and has therefore an economical impact. Taking into an account, that the data migration is not a daily task and every single migration is unique, might the underestimation carry on extraordinary costs, to the significant delay of the whole project and exceptionally to the failure of the whole project.

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Risks and Importance of Data Migration during the Process of Accounting Information Systems Implementation

Summary

This article is focused on issues of data migration during the information system implementation. Data migration is one of the risk phases of implementation, caused by different data structure or by underestimation of the preparation phase (or both). Describes possible risks related to the data migration and the way of its elimination or minimization. Difference between master data and transactional data are explained from the system point of view and from the accounting point of view. Risks of data migration and impact to accounting are investigated with respect to general accounting assumptions and principles, as a true and fair view, continuity, consistency, entity unit, monetary unit principle. Between basic controls of data migration accuracy belong reconciliation of trial balances and accounting reports, check of representative sample, check of posting journals. Technical controls include has, modulo 11 and control sums.

Key words: Data migration; Control of data migration; System implementation; Accounting assumptions and principles; Acceptation.

JEL classification: M15, M40.

IFRS Impact on Pharmaceutical Companies[#]

*Alexandra-Daniela Socea, Emil Horomnea**

1 Introduction

The focus of our study has been the impact of IFRS adoption on pharmaceutical companies. The study does not seek to cover all of the accounting rules, but focuses instead on some specific issues of the pharmaceutical industry, as intangible assets, research and development (R&D), capitalization of R&D costs, (un)listed shares in exchange for a patent, loans received to fund research and development purposes.

Using a common language of accounting, consistent and internationally compatible rules has now become a necessity of first order. The most important user of financial accounting information, the investor or shareholder, acquired under globalization conditions a great mobility. The decision of capital investment, increase or withdrawal of an investment must be taken in real time. In the modern economy, “time is money” expresses an essential dimension of competition. To avoid additional costs, restatement and indexation of financial statements, he calls for comparable, compatible, reliable and relevant informations (Horomnea, 2010, p. 309).

Recent developments have shifted the approach from the abstract and distant to the concrete and near-term. Conversion to IFRS is inevitable: “if” is replaced by the more relevant term “when”. For some industries, the transition to IFRS presents unique or complex challenges. This is also the case of pharmaceutical industry.

The move to IFRS as a mandatory requirement in the EU and other parts of the world is changing the manner pharmaceutical companies present their business and are perceived by investors, analysts or other users of their accounts.

2 IFRS - some considerations

Trends of globalization and the need for harmonized accounting standards have led to the creation of the International Accounting Standards Committee (IASC). In 1973, the bodies of the accountancy profession in Australia, Canada, France, Germany, Japan, Mexico, Netherlands, United Kingdom, Ireland and the U.S. agreed to establish IASC. Two years later, Belgium, India, Israel, New Zealand, Pakistan and Zimbabwe joined the committee as associate members. Many other countries and national accountancy bodies have continued to join the committee until 1987. (Camfferman-Zeff, 2007, pp. 3-9) In 1981, World Bank, United Nations, Organization for Economic Cooperation and Development (OECD) and other market participants have formed the Consultative Group of the IASC. The International Organization of Securities Commissions (IOSCO) joined the group in 1987. In 1990, the European Commission and the U.S. Financial Accounting Standard Board joined the IASC meetings as observers. (Véron, 2007)

During the early phase of its development IASC provided several accounting alternatives

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coming from different national standards. IOSCO aims a set of accounting standards to be used globally. This objective led IASC to improve standards to obtain the world's permission. In the late 1990s, the IASC has realized that its structure is no longer appropriate with the development and decided to restructure. As a result, in 2000, it was adopted a new "Constitution" and it was set up the IASC Foundation (IASCF) and its subsidiary, the IASB based in London.

In March 2002, the European Parliament called on all listed companies as of January 1, 2005 to adopt IFRS, which was a significant achievement for the IASB. (Armstrong-Barth-Jagolinzer-Riedl, 2010, pp. 31-61) The International Financial Reporting Standards are designed to provide a common set of accounting standards with the ultimate goal of reducing the diversity of international financial reporting.

For a great period of time, U.S. was the leader of accounting standards development field, being the first country to create in 1930 a standard-setting body (FASB). Consequently, U.S. GAAP was regarded as the best available set of accounting standards. (Alali-Cao, 2010, pp. 79-86) Once with the explosion of financial scandals between 2001-2002 this belief has changed.

In 2002, the IASB and FASB have established an agreement of convergence between U.S. GAAP and IAS/IFRS, for which the two bodies jointly develop projects to reduce differences between them. Currently, over 100 countries have implemented IFRS or at least have taken steps to adopt these standards in the future.

The international convergence process raises some specific problems. They are numerous and delicate, since the different contexts of various accounting systems. We mention:

- the language issue: translation problems often mask issues of equivalence between concepts, and replacing a word with another does not guarantee this equivalence;
- the national regulations issue: such countries, where the accounting is less regulated, will find very constraining any international standardization, while other countries, on the contrary, where the normalization is very thorough, they will find no interest in international normalization;
- the problem of economic and social structures that have different roles of accounting information in the countries concerned: each country will seek to guide the international harmonization according to its features;
- the problem of abandonment of sovereignty: it is certain that some countries fear that international normalized attempts prevent them from using the national normalization as a tool of their fiscality and policy.

Other studies mention in addition: the size differences between countries and the high costs to eliminate them (Jermakowicz-Gornik-Tomaszewski, 2006), the local traditions exerting a strong influence on the implementation of new concepts, as the true and fair view (Sucher-Jindrichovska, 2004, pp. 109-141), the fiscality and law based orientation preventing the harmonization process (Vellam, 2004).

IFRS implementation could affect the reputation of a country as modern, organized and well-regulated place to do business. (Jermakowicz-Gornik-Tomaszewski, 2006, p. 191). This is particularly the case of former communist countries that have undergone several reforms. Some might argue that the accounting model changes are easier to realise in countries in transition due to the low impact of accounting tradition. However, impediments to converge are seen more as a problem in the new EU member states. (Larson-Street, 2004, p. 113). According to Nobes and Parker the development of financial reporting in Central and Eastern Europe was inevitably subject of several discontinuities, but no country has completely broken the link with the past and still influences both the pre-communist and the communist period. (Nobes-Parker, 2008, p.

The adoption of IFRS in Europe was based on the objective of creating a strong domestic capital market; given the incapacity of prior regulations (EU Directives) to promote further the required accounting harmonization (Macías-Muiño, 2011, p. 5). Multinational convergence at the highest quality standards is of paramount importance for the adoption of IFRS in the U.S. Among the advantages of applying IFRS we mention the reduction of reporting costs, greater access to world capital markets and increasing ability to move accounting personnel around countries. With these advantages come disadvantages. The greatest disadvantage of converting to IFRS faced especially by U.S. companies is the cost that accompanies this process. An estimate of this cost is provided by SEC (2008), around \$32 million.

In 2000, the SEC initiated a project “The International Concept Release”, which consists of questionnaires containing 26 questions about the quality and acceptability of IAS/IFRS in the U.S. The main question was whether the U.S. SEC should change its position or to accept IAS without modification. SEC received approximately 100 comments. The result of these comments could be summarized as follows: on the idea whether or not IAS are now of a sufficient quality and whether the SEC should accept IAS without changes in place of US GAAP, most Europeans have said “yes, certainly”, while most Americans have responded “not yet”. However, the SEC decided in 2000 that will not accept IAS without reconciling them with US GAAP (Horomnea, 2010, pp. 366-367).

A decade later, a research conducted in 2010 by McEnroe and Sullivan shows that U.S. investors are satisfied with the current accounting model in the U.S. and don't want a move toward IFRS adoption (McEnroe-Sullivan, 2010).

3 Introducing the pharma industry

The pharmaceutical industry develops, produces and markets drugs licensed for use in various treatments. Pharmaceutical companies are similar to others, meaning that they manufacture products to be sold for profit, so that the entity would survive and grow. The difference comes from the high level of risk that characterizes the pharmaceutical environment.

For example, only one out of every ten thousand compounds discovered becomes eventually a drug approved for sale. In the late '90s, pharmaceutical companies spent on average 1.1 billion USD to develop and launch a new drug. Only a decade later, the investment has doubled to 2.2 billion USD, according to a study by Bain&Company. (O'Hagan-Farkas, 2009) On the other hand, the return on capital employed for the development of new drugs has decreased from 9% between 1995-2000 to 4% in 2009.

Basically, there is a generic industry sold legally on the market after the expiry of the patent for innovative product at a price much lower, and a pharmaceutical industry based on research and development. Generics industry flourished with the law “Waxman-Hatch” (1984) which allowed the registration on the market of generics produced after 1962.

The introduction of the Bolar provision in Europe has enabled European manufacturers to develop generic medicines within Europe prior to patent expiry. Previously, this could only happen in certain countries where different patent positions or non-observance or non-existence of patents made it possible.

The pharmaceutical industry is the first in the top industries that invest in research and development. In recent years, the pharmaceutical industry has invested in research and development more than any other industry, even more than IT&C. In 2010, the pharmaceutical industry focused on research and development invested approximately 27.000 million dollars in research and development in Europe. However, this sector faces real challenges. Besides additional obstacles concerning the regulation and escalating costs of R&D, the sector was

severely affected by the impact of fiscal austerity measures introduced by governments in almost all Europe in 2010 and 2011.

U.S. pharmaceutical companies dominate the world's drug markets. Of the world's ten leading drug companies, five are based in the United States. The top nine U.S. drug manufacturers account for nearly 70 percent of U.S. drug sales.

There is a rapidly grow on market and research environment in emerging economies such as Brazil, China and India, leading to a migration of economic and research activities outside Europe to these fast-growing markets. In 2010, the Brazil and China markets have increased by more than 20% compared with an average market growth of 1.8% for the five main European markets and of 3.3% for the U.S. market, according to IMS.

In 2010, North America recorded 42.3% of total global pharmaceutical sales, compared with 29.2% for Europe. According to IMS, 61% of sales of new drugs launched during 2005-2009, were on U.S. market, compared to 22% on the European market.

In another analyst report with a broad view of the industry recently, dr. Timothy Anderson of Bernstein Research looked at the prospects for nine major pharmaceutical companies to 2020. The three companies with the best sales prospects to 2020 are GlaxoSmithKline, Novartis and Bristol-Myers Squibb, Bernstein reported. Those with the "most troubling revenue outlook" are, by far, Eli Lilly and AstraZeneca.

Pharmaceuticals undeniably play an essential role in improving and maintaining health, but managing and controlling cost remains a major challenge for society, including governments and payers.

Making direct comparisons of costs and best practices across EU member states is very difficult due to inherent political differences giving rise to highly variable systems. However, one element is common to all and often focuses the attention: the cost of medicines.

Although drugs represent only around 10% of a country's total healthcare budget, with generics comprising between 1-2%, they are a prime target for cost savings, despite being arguably the most cost-effective part of the healthcare solution. However, the lack of coherent policies and variations in pricing and reimbursement systems, sociodemographics and the management of healthcare within each EU member state make comparisons difficult. One thing is certain, the ageing population and changes in lifestyle automatically bring an increased demand for healthcare and consequent escalation of costs.

Health is a human necessity that in developed economies goes beyond individual interests becoming a collective concern. The social involves political intervention materialized in regulations and national strategies. The regulations cover all aspects of pharmaceutical activity from manufacturing, distribution, marketing, intellectual property, public financing and up to price. Health has an intersectoral character, the other economic, social and cultural fields contributing directly and indirectly to its determination. A good strategy in the pharmaceutical industry should consider the development and projection of demographic, economic and social trends and factors from society or environment that may promote the spread of certain types of diseases.

4 IFRS issues for pharmaceutical companies. What implications?

The most of European pharmaceutical companies such as AstraZeneca, Glaxosmithkline, Merck, Novarits, Novo Nordisks, Roche, Sanofi-Aventis and Schering have already adopted IFRS since 2005 or even earlier. (Lu, 2009, p. 7)

Compared to other industries, the pharmaceutical industry faces many challenges in converting to IFRS and needs more attention because its uniqueness. Since this, we have analyzed some of

the specific issues related to pharmaceutical companies.

There are two categories of intangible assets, those acquired and those internally generated. The accounting treatment of first category is relatively simple, the purchase price being capitalized in the same way as for a tangible asset. For internally generated intangible assets things are more complicated. This category includes also the research and development expenses, subject to specific criteria of recognition by IFRS. Unlike U.S. GAAP that contains several references about research and development costs, the general rule being that they are expensed when they occur; IFRS include a single standard dealing with this issue differently (IAS 38).

The research phase:

Research is an original and planned investigation, realised with the perspective of obtaining scientific or technical knowledge and understanding. An example of research could be a company from the pharmaceutical industry carrying out activities or tests aimed at obtaining new knowledge to develop a new vaccine. The company investigates the unknown and therefore, at this early stage, it is impossible to demonstrate whether or not a drug will generate any probable future economic benefit. As a result, IAS 38 states that all expenditure incurred at the research stage should be written off to the income statement as an expense when incurred, and will never be capitalised as an intangible asset.

The development phase:

Development is the application of research findings or other knowledge in a plan or project for manufacture of new drugs or substantially improved, before commercial production or use. According to IAS 38 development costs are capitalised as intangible assets if all of the following criteria are met:

- the technical feasibility of completing the asset so that it will be available for use or sale;
- the intention to complete the asset and use or sell it;
- the ability to use or sell the asset;
- the asset will generate probable future economic benefits and demonstrate the existence of a market or the usefulness of the asset if it is to be used internally;
- the availability of adequate technical, financial and other resources to complete the development and to use or sell it;
- the ability to measure reliably the expenditure attributable to the intangible asset.

There is no definitive starting point for capitalizing internal development costs. Management must use its judgment, considering the facts and circumstances of each project. A strong indication that a company has met all of the criteria described above occurs when submitting to the regulatory authority for final approval. According to IAS 38, this is the clearest evidence proving the technical feasibility of completing the asset and this is the most difficult criterion to demonstrate. In many, but not all, circumstances, filing for approval from the scientific regulatory body, will be the starting point for capitalization.

In practice, the point where companies meet the criteria for capitalization will vary. For example, it is likely that pharmaceutical companies meet the criteria for recognition later in development phase, because necessary approvals for drugs from FDA or other regulatory bodies should be received before the commercial feasibility of the drug be demonstrated. The cost of an internally generated intangible asset comprises all directly attributable costs necessary to create, produce and prepare the asset in order to be able to operate in the manner intended by the management. If any of the recognition criteria is not met, the expenditure must be recorded in profit and loss account when they occur.

Assuming that the criteria for capitalization of development costs have been met, a natural question arises: what kind of cost can be considered as development expenditure? Referring to pharmaceutical industry, according to IAS 38, the following costs can be considered development expenses directly attributable:

- medical materials used in the development of the drug and clinical trials;
- employee benefits for personnel involved in the investigation and trials, including employee benefits for dedicated internal employees;
- compensation paid to patients or their relatives;
- directly attributable costs such as fees to transfer a legal right and the amortisation of patents and licences that are used to generate the drug;
- overheads that are directly attributable to develop the drug and can be allocated on a reasonable and consistent basis, such as allocation of depreciation of property, plant and equipment (PPE) or rent;
- legal costs incurred in presentations to authorities;
- insurance costs for the risks of unexpected side-effects in patients participating in trials;
- design, construction and testing of pre-production prototypes and models;
- design, construction and operation of a pilot plant that is not of an economically feasible scale for commercial production, including directly attributable wages and salaries.

After the capitalization of costs of a new drug development, the question is to identify factors that should be taken into account when (re)assessment of useful life of capitalized development costs. Useful life is defined as the time an asset is expected to be used by the entity. (IAS 38 R.8) According to IAS 38, management should assess the useful life of an asset both initially and annually. Management must consider a number of factors that are relevant to all industries when determining the useful life of an intangible asset, but in addition it should consider pharmaceutical industry specific factors, such as: (PwC, p. 14)

- duration of the patent right or licence of the drug;
- redundancy of a similar medication due to changes in market preferences;
- impact of bad publicity on a brand name, as for example, a significant fall in sales generated by side-effects of a product or a product recall;
- unfavourable court decisions on claims from drug users;
- regulatory decisions over patent rights or licences;
- development of new drugs treating the same disease;
- changes in the environment that make the product ineffective, as for example, a mutation in the virus that is causing a disease, which renders it stronger;
- changes or anticipated changes in participation rates or reimbursement policies of insurance companies.

After development costs have been capitalized, the asset must be amortized in accordance with the accruals concept for its finite lifetime. Amortisation shall begin only when commercial production began, thus linking income with expenditure for the covered period. Each development project should be reviewed at the end of each accounting period to ensure that the recognition criteria are still met. If the criteria are no longer met, then the previously capitalized costs should be recorded immediately in the profit and loss account.

Regarding the impact on results, although IAS 38 leads to more capitalized costs, the effect on profit should equalize during the development of asset and by the end of its useful life.

Indefinite-life intangible assets:

An intangible asset can be regarded as having an indefinite useful life when there is no foreseeable limit on the period during which the asset is expected to generate positive cash flows for the company. (IAS 38 R. 88) The management of a pharmaceutical company can regard an asset as having an indefinite life in accordance with IAS 38. However, even though the asset is not amortised, management is required to test it for impairment, by comparing its recoverable amount with its carrying value annually and whenever there is an indication that the intangible asset may be impaired. (IAS 36 R. 10)

Pharmaceutical intangible assets that might be regarded as having an indefinite life could include for example, acquired brands or generic products. Technological and medical advances will reduce the number of situations where an indefinite life would apply. As a result of limited patent lives, only in exceptional cases pharmaceutical products would have unrestricted economic lives.

Accounting for receipt of (un)listed shares in exchange for a patent

We consider the following situation: through a collaborative agreement, pharmaceutical company X acquires a patent from pharmaceutical company Y, in order to develop a more complex drug. X will pay for the right acquired by giving Y 5% of its (un)listed shares. The listed shares represent the fair value of the patent. If X is successful in developing the drug and bringing it to the market, then Y will also receive a 5% commission on all sales. Y expects to classify the shares as available for sale.

In such a case, appears the issue of how pharmaceutical company Y should treat the shares received.

Y should initially recognise the shares received as available-for-sale securities at their fair value plus transaction costs that are directly attributable to the acquisition. (IAS 39 R. 43) For the unlisted shares, Y should determine the fair value of the unlisted shares using an appropriate valuation technique as for example, discounted cash flow models, earning multiples or ratios for similar listed entities. Y should also derecognise the patent that is transferred to the company X and should recognise the gain arising from the sale of the patent. The fair value of the shares received represents the amount of the consideration received. (IAS 18.12) Y should not yet recognise any asset relating to the future royalty stream from the potential sales of the drug, because this stream of royalties is contingent upon the successful development of the drug. (IAS 37.31) The revenue will be recognised on an accrual basis, as the royalties are earned. (IAS 18.30)

Loans received to fund research and development purposes

The borrowing costs are recognised as an expense when incurred. They can also be capitalised in accordance with the allowed alternative treatment. (IAS 23.10) A qualifying asset is an asset that necessarily takes a substantial period of time to prepare for its intended use or sale. (IAS 23.4) The cost of an internally generated intangible asset includes all directly attributable costs necessary to create, produce and prepare the asset to be capable of operating in the manner intended by a company, according to IAS 38. Allocations of overheads are made on bases similar to those used in allocating overheads to inventories. IAS 23 “Borrowing Costs” specifies criteria for the recognition of interest as an element of the cost of an internally generated intangible asset. (IAS 38 R. 66)

5 Conclusions

Converting to IFRS can be a real challenge. As we have seen, one issue that hits pharmaceutical companies is treating their intangible assets. According to IFRS, the company must recognize the intangible assets on the balance sheet and relate them to in-progress research and development. On the other hand, GAAP would just expense the intangible assets. The intangible is also such a large issue because some can have useful lives of even twenty years.

IAS 38 has many implications for pharmaceutical companies and because of this; we make some recommendations in order to help them prepare for the necessary actions:

- setting operational phases: it is necessary to accurately establish the practical steps in order to determine the stage at which the development project meets all criteria within IAS 38 and therefore, when should begin capitalizing costs;
- assessing impairment: capitalized development costs will be subject to impairment testing when an impairment indicator is present. It will be necessary a methodology to ensure that sufficient data is captured to allow the assets to be tested for impairment;
- systems: it will be necessary for companies to implement a system for managing time and costs in order to obtain reliable information about development costs.

The move to IFRS as a mandatory requirement in the EU and other parts of the world is changing the manner pharmaceutical companies present their business and are perceived by investors, analysts or other users of their accounts.

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IFRS Impact on Pharmaceutical Companies

Summary

Health is a human necessity that in developed economies goes beyond individual interests becoming a collective concern. The social involves political intervention materialized in regulations and national strategies. The regulations cover all aspects of pharmaceutical activity from manufacturing, distribution, marketing, intellectual property, public financing and up to price. Health has an intersectoral character, the other economic, social and cultural fields contributing directly and indirectly to its determination. Conversion to IFRS is no longer a problem of "if", but a problem of "when". With the advantages of convergence process come also the disadvantages. They are numerous and delicate, since the different contexts of various accounting systems. For some industries, the transition to IFRS presents unique or complex challenges. This is also the case of pharmaceutical industry, the first in the top industries that invest in research and development. The research and development expenses are subject to specific criteria of recognition by IFRS. Unlike U.S. GAAP that contains several references about research and development costs, the general rule being that they are expensed when they occur, IFRS include a single standard dealing with this issue differently. Besides these, there are also other specific issues concerning pharmaceutical companies that require attention when addressed under IFRS.

Key words: IFRS; Pharmaceutical company; Intangible asset; Capitalization of R&D costs.

JEL classification: M41.

Analysis of Due Process in Case of Several IFRSs Currently Being Developed

*Mariana Valášková**

1 Introduction

In the past, the Memorandum of Understanding, the Norwalk Agreement (2002) seems to have begun not only the convergence between international standards and US GAAP, when the IASB and the FASB agreed to work together, in consultation with other national and regional bodies, but also have begun, currently more and more being mentioned, the movement of IFRSs towards global standards. In 2006, setting up the specific milestones to be reached by 2008, brought another step in achieving the convergence process. The exact movement towards global standards has probably started by the update of Memorandum of Understanding as a boards' response to recommendations from the Leaders of G20 in 2009. In updated Memorandum of Understanding, the boards reaffirmed their commitment to the improvement and convergence of IFRSs and US GAAP and also redoubled their efforts to achieve a single set of high quality, global accounting standards, within the context of their respective independent standard-setting process.

Developing of global accounting standards – a single set of high quality, understandable, enforceable and globally accepted IFRSs – is not a simple objective and of course it increases pretensions to whole standard-setting process, which gets into the interest of general public. The paper focuses on the global independent standard-setting process and analyse mainly the single mandatory steps of development a new standard declared by IASB's due process.

2 Due Process

International Financial Reporting Standards (IFRSs) are developed through “due process”. The due process means an international consultation process, an comprehensive and independent process, which involves interested individuals and organisations from around the world to provide transparency into the standards-setting process.

The whole due process takes place in six stages:

- Setting the agenda.
- Planning the project.
- Developing and publishing the discussion paper.
- Developing and publishing the exposure draft.
- Developing and publishing the standard.
- Procedure after the standard is issued.

2.1 Setting the agenda

In order to develop high quality accounting standards the IASB constantly seeks to pick up any signals of a demand for better quality information that is of value to all users and also to preparers. But whether to put potential item to IASB's agenda the IASB mainly follows the

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needs of investors.

IASB's staff helps it to identify, review and raise issues that might have been taken into consideration for future IASB's active agenda. Additionally the IASB takes into account also views and comments from other standard-setters, other interested parties, such as the IFRS Advisory Council and the IFRS Interpretations Committee, staff research and other recommendations. The IASB also receives requests from constituents to interpret, review or amend existing publications.

The important IASB's discussion of potential projects and decision process of adoption a new project take place in public IASB meetings and the approval to add the item to active agenda is done by a simple majority vote at an IASB meeting.

2.2 Planning the project

After adding an item to active agenda, the IASB also has to decide whether to conduct the project alone or as a joint project with another standard-setter. In that case a similar due process is followed under both approaches.

At this stage the IASB may establish a working group. The working group gives the IASB access to additional practical experience, expertise and advice on the concepts, ideas and proposals developed by the IASB and its staff. The purpose of the working group is not to develop proposals. The IASB normally establishes working group for its major projects. Meetings of working groups are announced on IASB's websites, held in public and always chaired by an IASB member. Working group meetings are attended besides by working group members also by board members, staff and observers.

2.3 Developing and publishing the discussion paper

Developing and publishing the discussion paper is not a mandatory step in due process, but IASB uses it as a vehicle to introduce and explain the issues of any major new topic and solicit early comments from different respondents on IASB's proposals comprised in preliminary views of discussion paper.

Typically, a discussion paper includes a comprehensive overview of the issue, a possible new approaches in case of the issue, the preliminary views of IASB and last but not least an invitation to comment.

Discussion paper may result as the first stage of an active agenda project carried out by the IASB or from a research project being conducted by another accounting standard-setter. When the project is conducted by IASB the discussion paper is developed according to staff researches and recommendations, suggestions from IFRS Advisory Council, working group and other invited parties. In other case the IASB may decide that some issues require additional research before adding it to active agenda. These projects are designed as "research projects" of the IASB's research agenda. Research projects are normally carried out by other standard-setter in collaboration with IASB. Research projects requires extensive background information that can be provided by other standard-setter or similar organisation with sufficient expertise, time and staff resources. When the discussion paper results from research project, it means that it is drafted by other standard-setter and published by the IASB after its approval by a simple majority vote.

2.4 Developing and publishing the exposure draft

Development and publication of an exposure draft is a mandatory step in due process. An exposure draft sets out a proposal for a new standard or amendment to an existing standard and represents the IASB's main vehicle for consulting the public.

The proposals of exposure draft are developed on the basis of staff research and

recommendations, on the basis of any discussion paper and especially taking into account comments received on the discussion paper. Also suggestions from IFRS Advisory Council, working groups and accounting standard-setters are taken into consideration.

Publication of an bases for conclusions with an exposure draft is also a mandatory step. Basis for conclusions represents an accompanying material on exposure draft, which provides a additional information and gives reasons for the conclusions in exposure draft.

2.5 Developing and publishing the standard

Final development of an IFRS is carried out during IASB meetings, when the IASB takes into account the comments received on the exposure draft. During these meetings the IASB discusses and resolves the issues arising from commented exposure draft. This phase may result in IASB's decision to expose its revised proposals for another public comment by publishing a second exposure draft. The reasons that result in necessity for re-exposure are when any substantial issues previously not considered have arisen during the comment period on the exposure draft, when sufficient views of constituents were not obtained or when some viewpoints were not comprised in the exposure draft and not adequately discussed and reviewed in the basis for conclusions. If the decision for re-exposure is made, the due process to be followed is the same as for the first exposure draft.

When the IASB is satisfied with reached conclusion on the issues arising from the exposure draft, it instructs the staff to draft the IFRS. After the balloting in favour of publication by the IASB members, the IFRS is issued.

2.6 Procedure after the standard is issued

After the standard is issued, the IASB members and the staff hold meetings with interested parties to discuss and help to understand unanticipated issues related to the practical implementation and potential impact of its proposals. After a suitable time, the IASB may initiate studies through which it reviews an application of the IFRS, changes in the financial reporting environment and comments of the IFRS Advisory Council, the IFRS Interpretation Committee, standard-setters and constituents about the quality of the IFRS. These studies may result in new item to be added to the IASB's agenda.

2.7 Comment letters

Comment letters “play a vital role in the IASB's formal deliberative process”.¹ The IASB solicit public comments on discussion paper, exposure draft of IFRS or amendments to IFRS and draft IFRIC Interpretation or draft amendment to Interpretation. All comment letters are always put on public record by posting them on the IASB's websites. The IASB members review comment letters received during the comment period and the staff normally provide a summary and analysis of them. Summary of comments is also posted on the IASB's websites. The comment period on discussion paper and exposure draft usually lasts 120 days and may be less in urgent cases, but no less than 30 days. For major projects, the IASB normally allows a period of more than 120 days for comments. The comment period on draft IFRIC Interpretation usually lasts 60 days, but may be also less in urgent cases.

3 Analysis of due process in case of several new IFRSs currently being developed

The following text analyses due process in case of three IFRSs, which are currently being developed:

- Conceptual Framework

¹ IFRS Foundation (2012): Due Process Handbook for the IASB, pg. 20.

- Revenue Recognition
- Leases

3.1 Conceptual Framework

3.1.1 Setting the agenda

The Conceptual Framework project was set up to update and refine the existing concepts to reflect the changes in markets, business practices and the economic environment that have occurred since the concepts were firstly developed. The project’s overall objective is to create a sound foundation for future accounting standards that are “principles-based, internally consistent and internationally converged”. Therefore the project was undertaken jointly by the IASB and the US FASB, the US national standard-setter. The new framework builds on existing IASB and FASB frameworks.

The project was added to active agenda in October 2004. The boards conducted the project in 8 phases:

Fig. 1: Phases of Conceptual Framework Project

Phases	Topics
A	Objectives and qualitative characteristics
B	Definitions of elements, recognition and derecognition
C	Measurement
D	Reporting entity concept
E	Boundaries of financial reporting, and Presentation and Disclosure
F	Purpose and status of the framework
G	Application of the framework to not-for-profit entities
H	Remaining Issues, if any

Source: IASB

(<http://www.ifrs.org/Current+Projects/IASB+Projects/Conceptual+Framework/Conceptual+Framework.htm>)

3.1.2 Project planning

The project was undertaken jointly by the IASB and the FASB under the Memorandum of Understanding, where it is described. Any working group wasn’t established in case of the Conceptual Framework project. Project plans are periodically updated and reviewed at boards’ meetings.

3.1.3 Developing and publishing the discussion paper

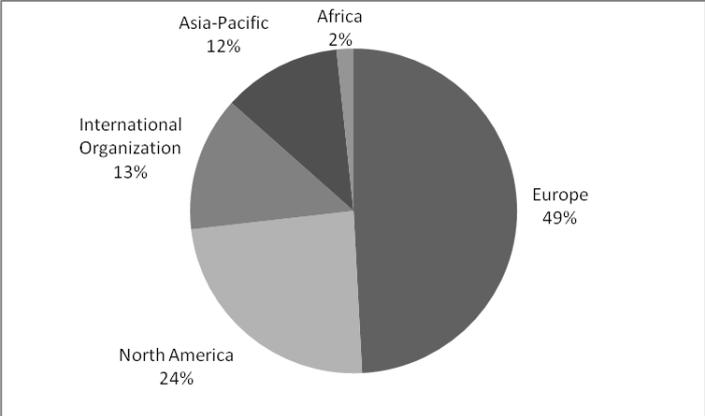
The boards published the discussion paper *Preliminary Views on an improved Conceptual Framework for Financial Reporting: The Objective of Financial Reporting and Qualitative Characteristics of Decision-useful Financial Reporting Information* (Phase A) on 6 July 2006 for comments to be submitted by 3 November 2006, but finally comments were due on 6 November 2006. Comment period of the discussion paper lasted for 123 days, during which 175 comment letters were received (4 more comment letters were received outside the comment period).

The boards published the discussion paper *Preliminary Views on an improved Conceptual Framework for Financial Reporting: The Reporting Entity* (Phase D) on 29 May 2008 for comments to be submitted by 29 September 2008. Comment period of discussion paper lasted for 123 days, during which 72 comment letters were received (12 more comment letters were received outside the comment period).

The IASB published the discussion paper *Measurement Bases for Financial Accounting*

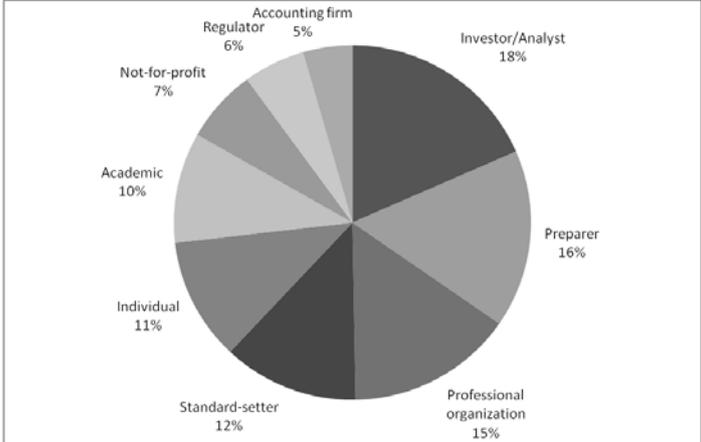
Measurement on Initial Recognition (Phase C) on 17 November 2005 and the comment period was closed on 19 May 2006. Comment period of discussion paper lasted for 183 days and totally 84 comment letters were received. This discussion paper was prepared by staff of the Canadian Accounting Standards Board.

Fig. 2: Comment Letters by Geographic Region – Phase A



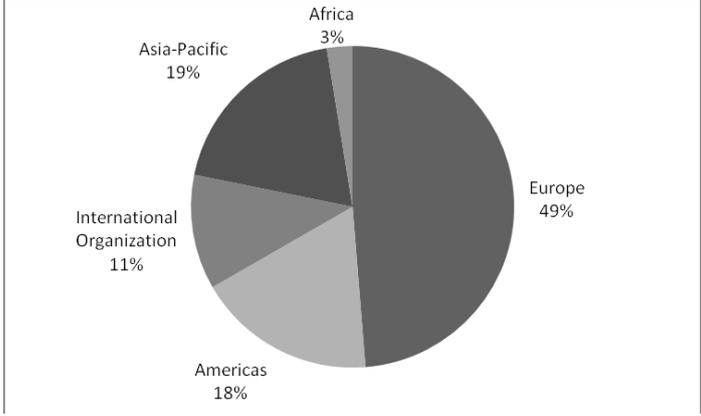
Source: IASB - Comment Letter Summary

Fig. 3: Comment Letters by Respondent Type - Phase A



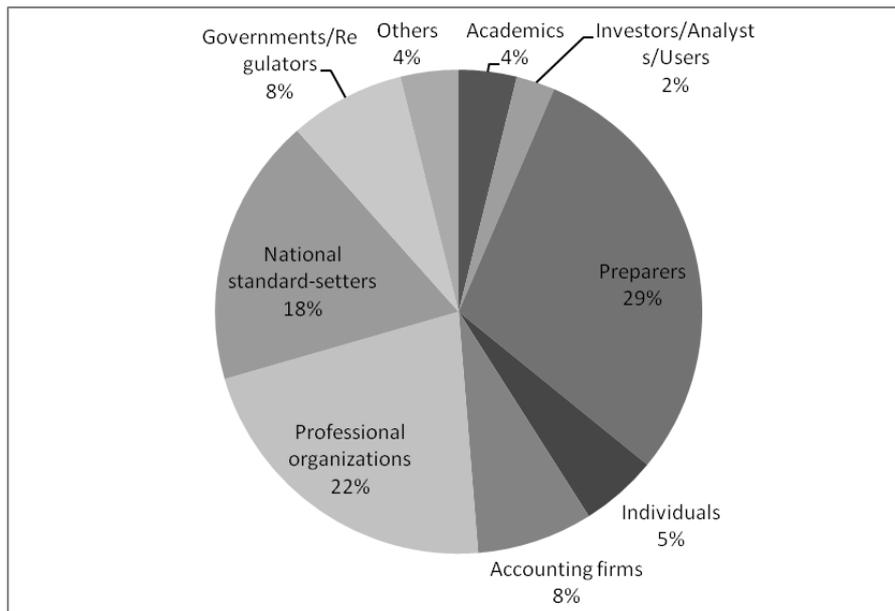
Source: IASB - Comment Letter Summary

Fig. 4: Comment Letters by Geographic Region – Phase D



Source: IASB - Comment Letter Summary

Fig. 5: Comment Letters by Respondent Type – Phase D



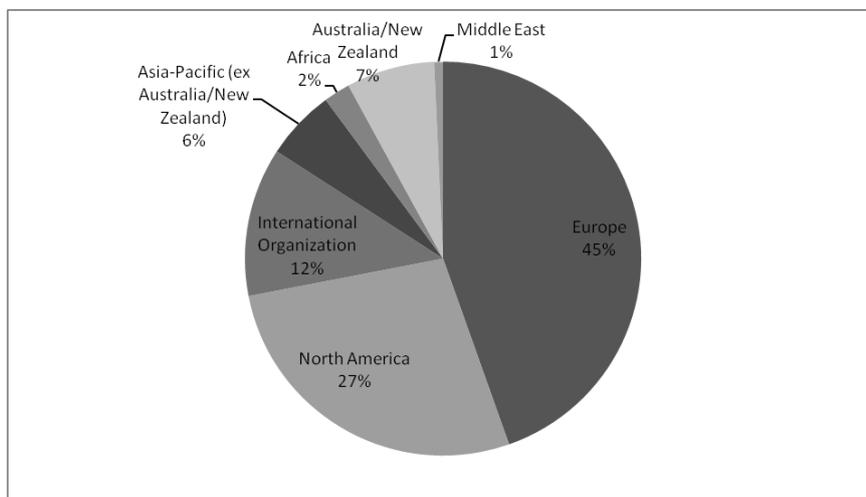
Source: IASB - Comment Letter Summary

3.1.4 Developing and publishing the exposure draft

The boards jointly published the exposure draft *An Improved Conceptual Framework for Financial Reporting: Chapter 1 The Objective of Financial Reporting, Chapter 2 Qualitative Characteristics and Constraints of Decision-useful Financial Reporting Information* (Phase A) on 29 March 2008 for comments to be submitted by 29 September 2008. Comment period of the exposure draft lasted for 184 days, during which 142 comment letters were received (2 more comment letters were received outside the comment period).

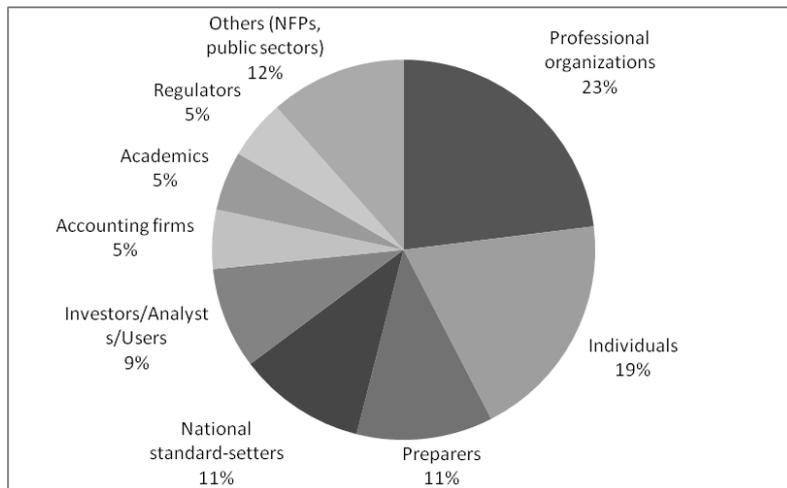
The boards published the exposure draft *Conceptual Framework for Financial Reporting: The Reporting Entity* (Phase D) on 11 March 2010 for comments to be submitted by 16 July 2010. Comment period of exposure draft lasted for 127 days, during which 114 comment letters were received.

Fig. 6: Comment Letters by Geographic Region – Phase A



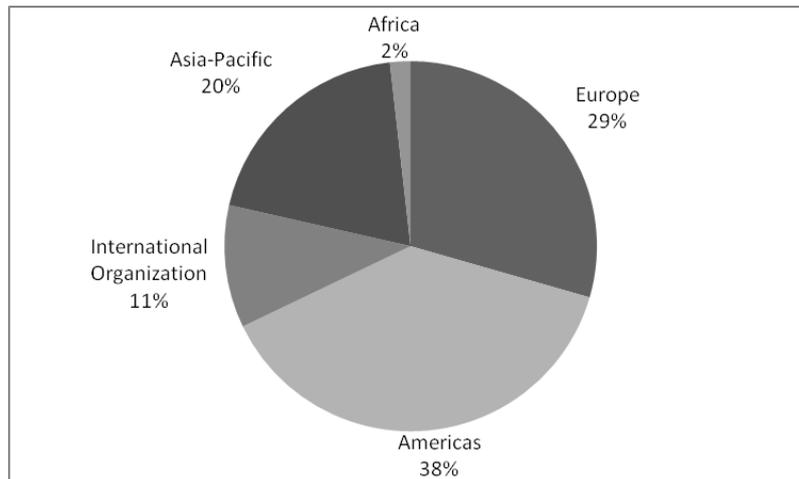
Source: IASB - Comment Letter Summary

Fig. 7: Comment Letters by Respondent Type – Phase A



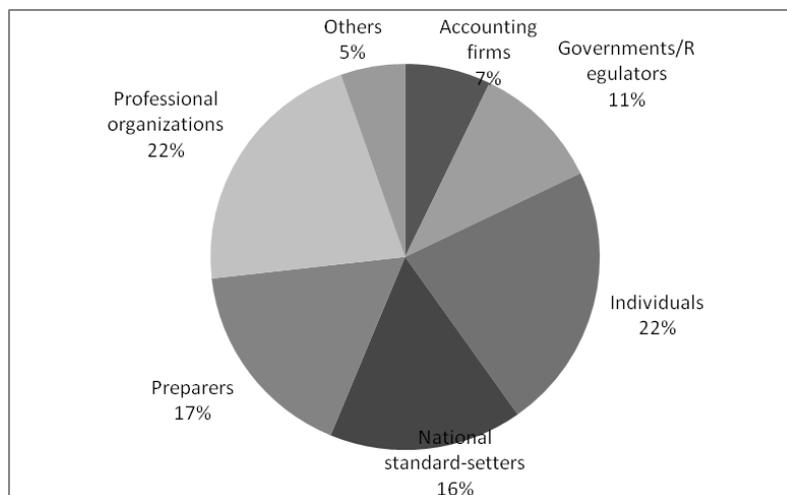
Source: IASB - Comment Letter Summary

Fig. 8: Comment Letters by Geographic Region – Phase D



Source: IASB - Comment Letter Summary

Fig. 9: Comment Letters by Respondent Type – Phase D



Source: IASB - Comment Letter Summary

3.1.5 Developing and publishing the standard

On 28 September 2010 the boards announced the completion of the first phase (Phase A) of their joint project to develop an improved conceptual framework for IFRSs and US generally accepted accounting practices (GAAP). The both of the boards amended sections of their conceptual frameworks by the new Objectives and Qualitative characteristics chapters. The other sections of boards' conceptual frameworks will be amended as they complete individual phases of the project.

Currently the Conceptual Framework project is “paused until the IASB concludes its ongoing deliberations about future work plan”. The boards have considered the comments received on the exposure draft for Phase D Reporting Entity and decided to take a more time to be able to finalise this chapter. The IASB also stated that they expect to recommence development of the Conceptual Framework at the beginning of 2012.

3.2 Revenue Recognition

3.2.1 Setting the agenda

The Revenue Recognition project was set up to clarify the principles for recognising revenue from contracts with customers, all contracts with customers except those in case of leases, financial instruments and insurance contracts, which falls into scope of the other separate standards. The project's objectives are mainly to remove inconsistencies and weaknesses in existing revenue recognition standards, provide a single revenue recognition model comparable across of industries, companies and geographical boundaries, and provide enhanced disclosures. In February 2006 the Revenue Recognition project was already on active agenda of both of the boards.

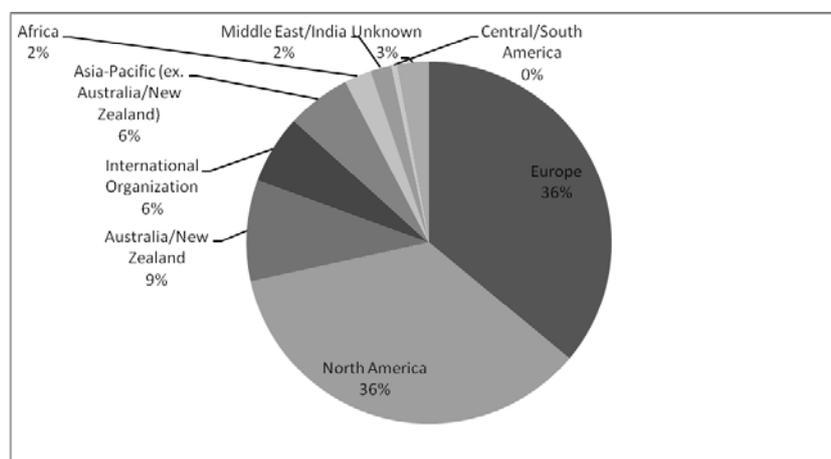
3.2.2 Project planning

The project was conducted jointly by the IASB and the FASB, and it is also one of the Memorandum of Understanding project. Any working group wasn't established for Revenue Recognition project.

3.2.3 Developing and publishing the discussion paper

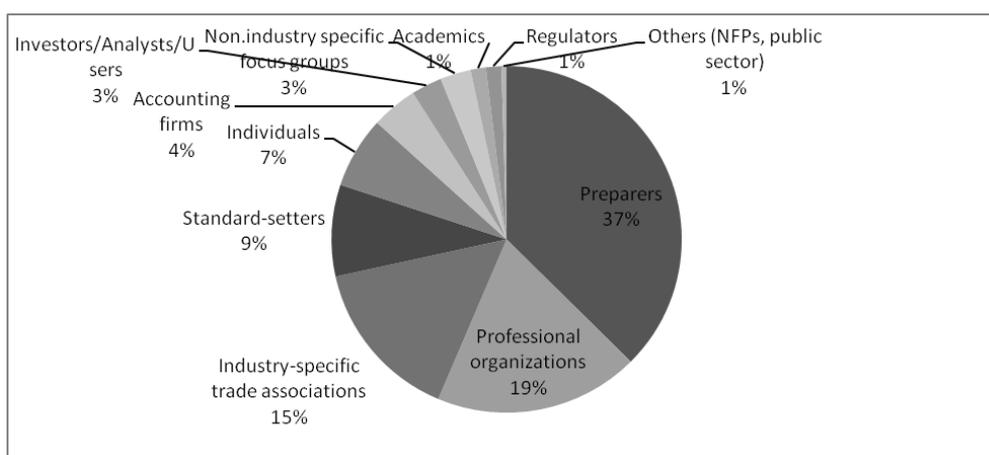
The discussion paper *Preliminary Views on Revenue Recognition in Contracts with Customers* was jointly published on 19 December 2008. The comment period was open till 19 June 2009, which means that it lasted for 182 days. Totally 211 comment letters were received on discussion paper.

Fig. 10: Comment Letters by Geographical Region



Source: IASB - Comment Letter Summary

Fig. 11: Comment Letters by Respondent Type



Source: IASB - Comment Letter Summary

3.2.4 Developing and publishing the exposure draft

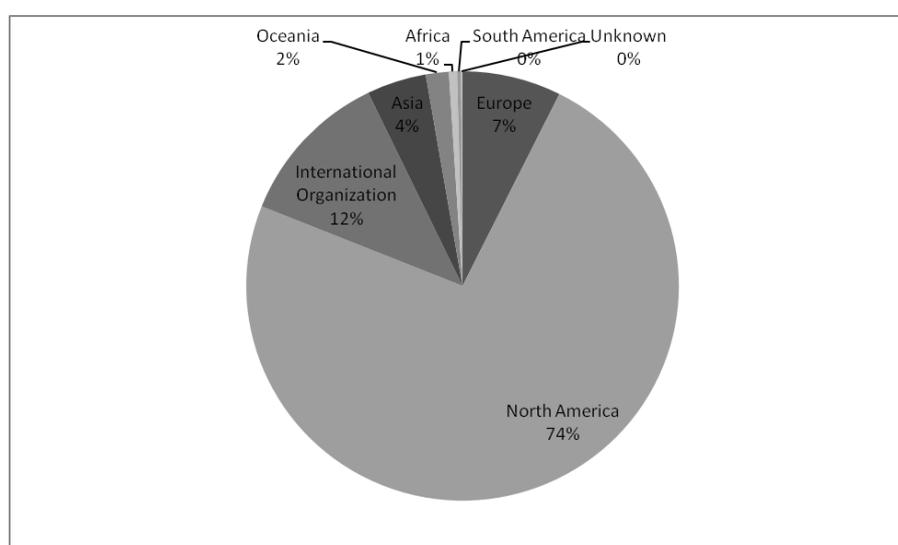
The boards jointly published the exposure draft *Revenue from Contracts with Customers* on 24 June 2010 for public comments to be submitted by 22 October 2010. Comment period of exposure draft lasted for 120 days and 986 comment letters were received.

On 15 June 2011 the IASB and the FASB announced re-exposure of their revised proposals for a common revenue recognition standard. Re-exposing the revised proposals should have given to stakeholders another opportunity to review and comment on boards' revisions. The boards stated that they decided to re-expose the proposals because of the importance of the financial reporting of revenue to all entities and to avoid unintended consequences arising from the final standard.

On 14 November 2011 the IASB and the FASB published a revised exposure draft to improve and converge the financial reporting requirements for revenue from contracts with customers. The revised exposure draft was open for comments till 13 March 2012. For 120 days long comment period the boards received 187 comment letters.

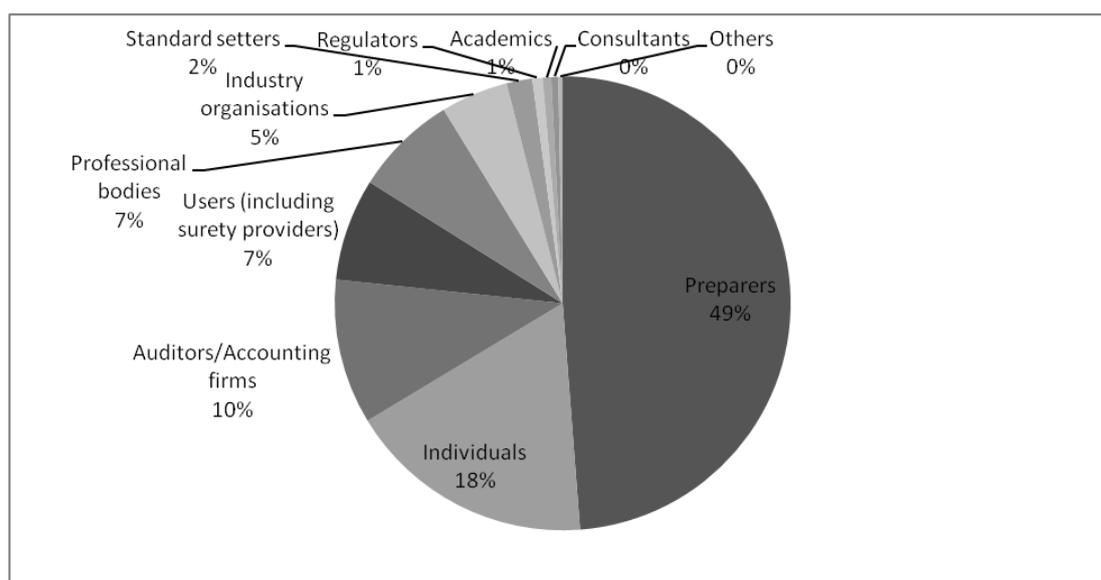
The boards plan to analyse the comment letters received on second exposure draft till half of the year 2012 and to publish the new standard at the beginning of 2013.

Fig. 12: Comment Letters by Geographical Region



Source: IASB - Comment Letter Summary – main issues

Fig. 13: Comment Letters by Respondent Type



Source: IASB - Comment Letter Summary – main issues

3.3 Leases

3.3.1 Setting the agenda

The Leases project was set up to improve current accounting requirements for leases and its main objective is to provide a new single approach to lease accounting that would ensure that all assets and liabilities arising under lease contracts are recognised in the statement of financial position. The current standards have begun to be criticised just for allowing similar transactions to be accounted for very differently. The project was added to active agenda in July 2006.

3.3.2 Planning the project

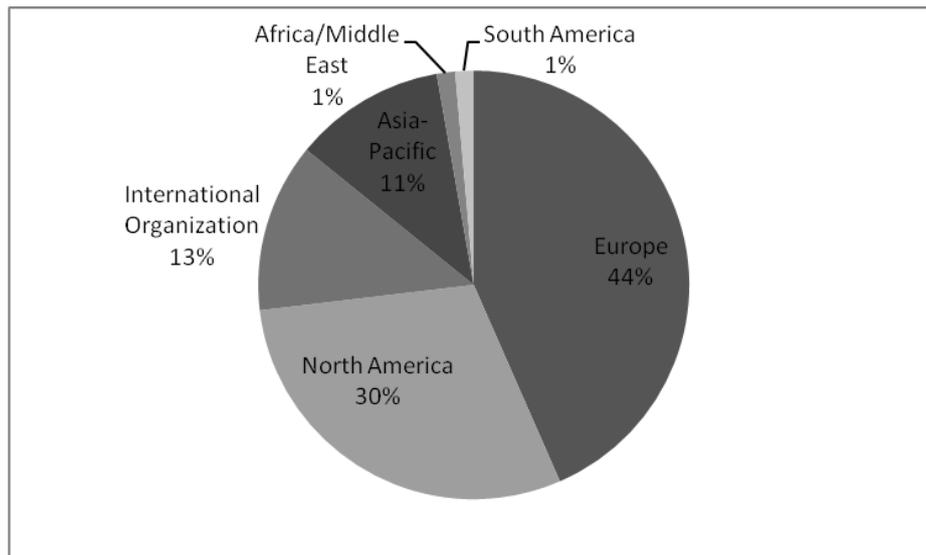
The Leases project was also conducted as joint project of the IASB and the FASB and was taken under the Memorandum of Understanding towards convergence.

In July 2006 the IASB and the FASB posted a notice on their Websites inviting nominations for the working group. The boards' members and staff prepared initial proposals on the membership of the working group and these proposals were reviewed and approved by the Trustees of both of the Foundations. After that the IASB and the FASB established a joint working group for the project of lease accounting. The joint working group means an international group serving both boards. The working group consists of individuals from a variety of backgrounds – preparers, auditors, users of financial statements, subject-matter experts and others. The composition of the working group takes into account the diversity and magnitude of interest in this area.

3.3.3 Developing and publishing the discussion paper

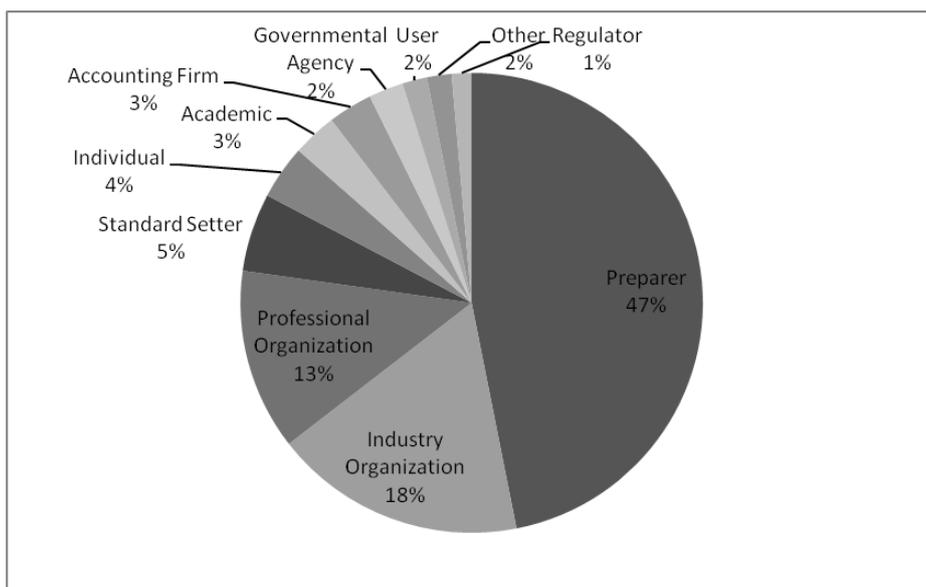
On 19 March 2009 the IASB and the FASB published a joint discussion paper *Leases: Preliminary Views*. The discussion paper was open for comments until 17 July 2009 and during this 120 days long comment period were received overall 318 comment letters (231 during the comment period, 87 outside the comment period).

Fig. 14: Geographical Region



Source: IASB - Comment Letter Summary

Fig. 15: Comment Letters by Respondent Type



Source: IASB - Comment Letter Summary

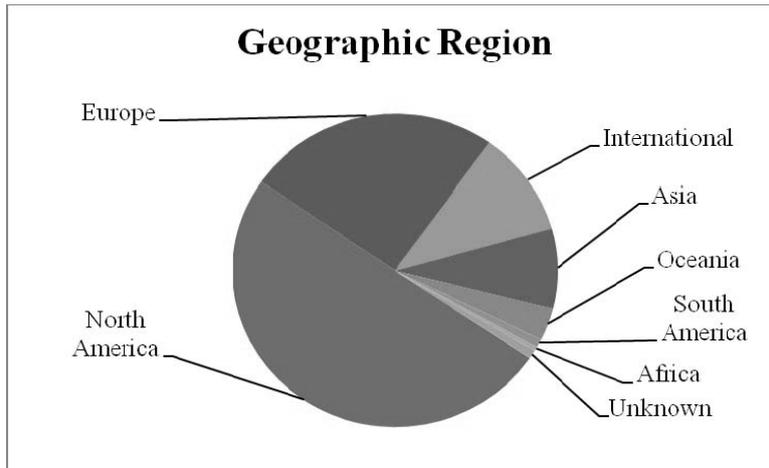
3.3.4 Developing and publishing the exposure draft

On 17 August 2010 the IASB and the FASB published a joint exposure draft Leases. The exposure draft was open for comments until 15 December 2010. During the 120 days long comment period overall 782 comment letters were received.

On 21 July 2011 the IASB and the FASB announced their intention to re-expose revised proposals for a common leasing standard. The boards stated that their decisions taken to this date were sufficiently different from those published in the exposure draft, therefore they decided to re-expose their revised proposals and give another opportunity to interested parties to comment on these revisions.

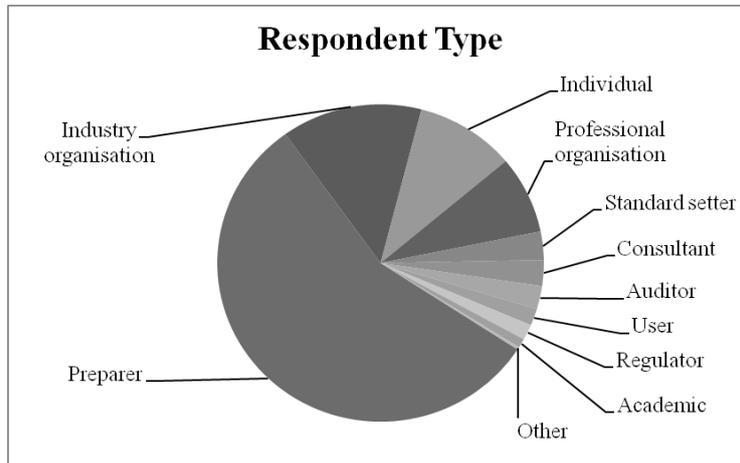
The boards are currently taking more time for meetings and deliberations before they will reach a tentative decision to be published in the re-exposure document.

Fig. 16: Comment Letters by Geographical Region



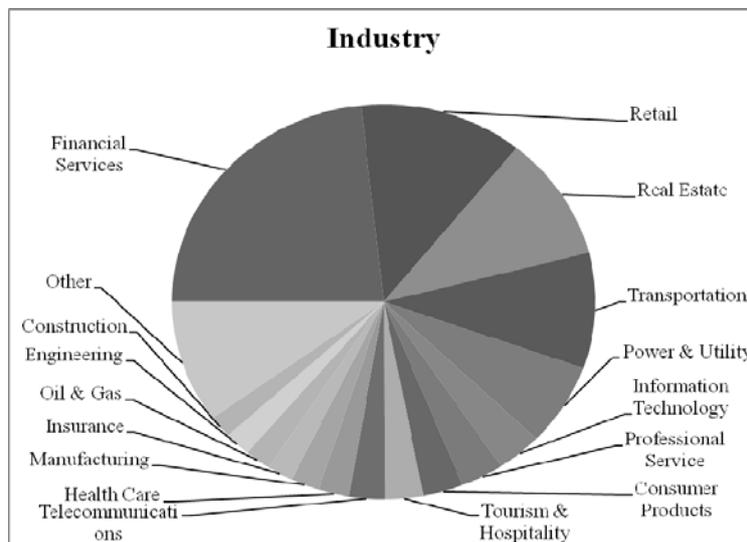
Source: IASB - Comment Letter Summary – main issues

Fig. 17: Comment Letters by Respondent Type



Source: IASB - Comment Letter Summary – main issues

Fig. 18: Comment Letters by Industry



Source: IASB - Comment Letter Summary – main issues

4 Conclusions

All of the analysed projects above are the standards developed by IASB already in the past and they are currently being remade. The necessity to remake the standards developed in the past was brought by the changing conditions. The changing conditions concern not only natural evolution of markets and economies, which are still more open and more connected one to another, but also the change of IFRSs' position. IASB became a world's leading standard-setter under supervision of public authorities and the general public. The international accounting standards then have to adapt to these new conditions. Therefore the IASB is hardly working on it. The Revenue Recognition and Lease projects currently belongs to most major and topical projects of IASB. Their importance is reflected also by the fact that these projects apply to convergence with US GAAP. Recognition of revenues in financial statements is a crucial number to their users in assessing a company's performance and prospects. According to the World Leasing Yearbook 2009 and 2010, leasing activity in 2007 amounted to US\$760 billion and in 2008 amounted to US\$640 billion. Therefore new accounting treatment based on a single accounting model, that would meet the users' pretentions, is expected.

The analysis showed that since adding the project to an active agenda to publishing the first due process document, the discussion paper, it took around two years in case of the Conceptual Framework project and the Revenue Recognition project. In case of the Leases project it took two and three-quarters of the year. Since the end of comment period on discussion paper to date of publishing the exposure draft, it took one year for the Revenue Recognition project and the Leases project. In case of the Conceptual Framework project, it was around the one year and half for both of the phases A and D. In case of completed phase A, it lasted two years since the end of comment period on exposure draft to publishing the Objectives and Qualitative characteristics chapter. For Revenue Recognition project and the Leases project the IASB and the FASB decided to revise the proposals. Since the end of comment period on first exposure draft to an announcement of re-exposure, it took about seven months for both projects. The comment periods on discussion paper and exposure draft lasted usually for three months, only in two cases it took four months. The analysis showed that the IASB try to follow a certain timetable for all the projects. Always some individual aspects play roles for a particular project.

For IASB the collected comment letters are the one of very important material for deliberative process. The analysis showed that the stakeholders are interested in individual projects differently. According to comment letters received, the interest of respondents was much lower for the Conceptual Framework project than for the Revenue Recognition and the Leases projects. These two projects seem to be more topical in these days. Therefore probably the IASB is hardly working on the completion of them as soon as possible and the Conceptual Framework project was paused. The response rate to exposure draft was mostly higher than to discussion paper. While the total response rate of all comment letters received to the Conceptual Framework project was in several hundred, the response rate to the Revenue Recognition project was nearly one thousand and two hundred and to the Leases project one thousand and one hundred. Commented letters received to the Revenue Recognition and the Leases project come from wider range of interested parties and from more diverse range of geographical regions than commented letters to the Conceptual Framework project.

Intention of the paper was to verify the mandatory steps of due process by analysis of several IFRSs currently being developed. The analysis showed that IASB follows the mandatory steps declared by due process. The IASB follows a similar timelines for each project and pays attention to all responses received. Developing a new international standard represents "a long-distance run", a various and interactive process.

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- Other information concerning to focused projects available at: <http://www.ifrs.org/Home.htm>

Analysis of Due Process in Case of Several IFRSs Currently Being Developed

Summary

By updating the Memorandum of Understanding in 2009, where the boards reaffirmed their commitment to the improvement and convergence of IFRSs and US GAAP, the movement towards global standards have been started. The IASB committed to achieve high quality, global accounting standards, within the context of independent standard-setting process (Due Process). International Financial Reporting Standards (IFRSs) are developed through “due process”. Due process comprises six stages. Analysis of three IFRSs (Conceptual Framework, Revenue Recognition, Leases) currently being developed shows that the development of new standards is a time-consuming process with accurately defined timelines and with different aspects showed by stakeholders’ interest, geographic and professional origin.

Key words: Due process; Conceptual Framework; Revenue Recognition; Leases; IFRS.

JEL classification: M41.

Convergence Project „Presentation of Items of Other Comprehensive Income“ within IASB and FASB and Amendments Issued to IAS 1 and SFAS 130[#]

*Zuzana Vlčková**

1 Introduction

The IASB and FASB have been working since 2002 to achieve convergence of IFRS and US GAAP. In 2002 the Boards agreed to cooperate and remove the differences between IFRS and US GAAP. Their cooperation was confirmed by a Memorandum of Understanding known as the Norwalk Agreement. The convergence process primarily takes place through joint projects. I have chosen one of the joint projects which is focused on Comprehensive Income for this paper. Its title is „Presentation of Items of Other Comprehensive Income“. The objective of this paper is to introduce the main changes as a result of the project which were approved by the Boards in both IAS 1 Presentation of financial statements, and US GAAP Standard Comprehensive Income. All Standards that are issued or updated have to pass a Standards Setting Process, in which one of the most important parts is Due Process. Due process means, that the issued draft of the standard has to be published, followed by a comment period, when users are invited to critique and respond with comments. Users are for the most part investors, as well as preparers of financial statements, academics, auditors and others. This paper, besides other aspects, describes and analyses the results of the Due Process.

2 Comprehensive Income definition

The US GAAP Statement SFAS 130 Reporting of Comprehensive Income defines comprehensive income as follows (SFAS 130):

„Comprehensive income is the change in equity of a business enterprise during a period from transactions and other events and circumstances from non-owner sources. It includes all changes in equity during a period except those resulting from investments by owners and distributions to owners.“

It means that the comprehensive income is the income of a company from any transaction that does not involve an owner's investment or distribution to an owner and includes Net Income and other revenue and expense items, gains and losses that are included not in net income but in other comprehensive income. We can also say, that other comprehensive income (OCI) includes unrealized profit or loss.

In US financial statements, according to US GAAP, four types of items are treated as other comprehensive income (Robinson et al., 2009):

- foreign currency translation adjustments,
- unrealized gains or losses on derivatives contracts accounted for as hedges,

[#] The paper is processed as an output of a research project „The analysis of the impact of reducing the financial statements presentation requirements for small entities in the decisions of users of financial statements“ supported by the Internal Science Foundation of the University of Economics, Prague (registration number F1/17/2012)..

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- unrealized holding gains and losses on a certain category of investment securities, namely, available-for-sale securities,
- changes in the funded status of a company's defined benefit post-retirement plans.

IFRS doesn't precisely define the various types of items, but present some examples of items that can be permitted, or required to be presented as other comprehensive income (IAS 1):

- foreign currency translation adjustments on foreign subsidiaries,
- changes in the fair value of available-for-sale financial assets,
- actuarial gains and losses arising on a defined benefit pension plan,
- revaluations of property, plant and equipment,
- changes in the fair value of a financial instrument in a cash flow hedge.

We can see the first problem which complicates comparability of other comprehensive income presented in accordance with US GAAP and IFRS. While US GAAP standard SFAS 130 exactly determine four types of items that can be presented as the items of Other Comprehensive Income, IFRS in the IAS 1 standard only gives examples of items that are permitted or required to be presented as other comprehensive income. It means that there is the big difference between items of Other Comprehensive Income presented in US GAAP and items of OCI presented in IFRS. IASB and FASB started joint project „Presentation of Items of Other Comprehensive Income“ on May 2010 which should improve the transparency, understandability and comparability of comprehensive income presentation. About this project you will read more in the next chapter of this paper. Was the convergence project helpful and were the main objectives accomplished? This question I will answer at the end of this paper.

3 Convergence project „Presentation of Items of Other Comprehensive Income“

Because both Boards believe that items presented in profit or loss and other comprehensive income provide important information about the financial performance of an entity they decided to focus one of their joint projects on presentation of comprehensive income. The convergence project „Presentation of Items of Other Comprehensive Income“ started at the Boards' meeting of 26 May 2010, from which they published an exposure draft of amendments to IAS 1 Presentation of financial statements which had a five-months period for Due Process. The FASB published the draft of the Standard Update Comprehensive Income (Topic 220) which meant codification to the Standard SFAS 130 and had a five-month period of Due Process too. In response to Due Process, the Boards received 139 comment letters, a summary of which was presented in October 2010. These were analyzed and appraised, into a summary report that was issued at a public meeting in November 2010.

The objective of the project was to improve the comparability, consistency, and transparency of comprehensive income presentation, especially for users of financial statements and to increase the prominence of items reported in other comprehensive income. On 16 June 2011 the Boards issued amendments that improved and aligned the presentation of items of other comprehensive income in financial statements prepared in accordance with IFRS and US GAAP. Most of the proposed changes concerned formal requirements on the reporting of Comprehensive Income, such as a format of the statement and its layout. On 17 June 2011 the FASB issued an Accounting Standard Update that would increase the prominence of other comprehensive income in financial statements and facilitate convergence of US GAAP and IFRS. At the same time the IASB issued amendments to IAS 1 Presentation of Financial Statements.

4 Amendments to IAS 1 Presentation of financial statements

Presentation of comprehensive income is only obligatory from the year 2009 in IFRS under IAS 1 as a part of financial statement. This means it is obligatory for financial statements which are constructed for and after the accounting period 2009, while in US GAAP started reporting of comprehensive income already in the year 1997 through the standard SFAS 130 Reporting comprehensive income. It means that using the statement of comprehensive income in IFRS is a result of convergence process between IFRS and US GAAP.

After completion, the joint project was described in the second chapter issued IASB Amendments to IAS 1 Presentation of Financial statements. This describes a large number of changes to presentation of OCI, so for expediency, I have included only the most significant of them in this paper.

The exposure draft of the project „Presentation of Items of Other Comprehensive Income“ proposed as a requirement for presentation of comprehensive income as a single continuous statement, containing both income statement and other comprehensive income in two subsections – profit and loss and OCI. The IASB although suggested the title of the statement „Statement of profit or loss and other comprehensive income.“ Until this time entities had the choice between format of one continuous statement and format of two separate statements. The proposed amendments removed the second of these options. In the due process a majority of the respondent didn't agree with this proposal. One of the arguments was that a single statement would undermine the importance of profit or loss by making it a subtotal. Some respondents expressed the opinion that the items presented in OCI are to significantly different from items presented in profit or loss, and that it would be incomprehensible to report both of them in one statement.

Most respondents required management discretion to choose to present items of profit or loss and OCI in a single statement or in two statements. Because of these comments, and also the FASB's disagreement too, the IASB decided not to make changes to US GAAP and IFRS in presentation of items of OCI, and to keep the opinion to present the items of profit or loss in one statement or two separate statements.

The other significant requirement of the proposal was to present items of OCI in two groups:

- items that will not be reclassified subsequently to profit or loss, and
- items that will be reclassified subsequently to profit or loss when specific conditions are met.

This requirement was intended to clarify the effects that these items may have on profit or loss in the future. Respondents in Due Process mostly agreed with this proposal, but they punctuated it so that there weren't any principles to help accounting entities to determine which OCI items should be reclassified to profit or loss and when they should be reclassified. The IASB confirmed this proposed change and agreed that there weren't any principles for determining which items should be presented in OCI and whether they should be reclassified to profit or loss but the Board promised to deal with the principles in some of the future project.

The IASB Exposure Draft proposed changing the title of the Statement of comprehensive income to „Statement of profit or loss and other comprehensive income“ which was issued only by IASB. FASB didn't agree with the changing the title of the statement. A majority of IASB respondents agreed with this proposal as it would provide a better description of the content of the statement. IASB confirm this proposal for the format of one continuous Statement of comprehensive income.

The last of the significant proposals was requiring income tax on items presented in OCI, which were proposed to be allocated between items that might be subsequently reclassified to profit or

loss and those that will not be reclassified, if those items are presented before tax. Items in OCI could be presented either before tax or net of tax. Respondents generally agreed with the proposal and the IASB confirmed it.

5 US GAAP Standard Update Comprehensive Income (Topic 220)

In June 1997 the FASB issued Statement SFAS 130 Reporting comprehensive income which did not change accounting methods, only the presentation of financial data. This Standard allowed companies to report comprehensive income at the bottom of the income statement, on a separate statement of comprehensive income, or as a column in the statement of shareholder's equity.

As a result of the convergence project, the FASB issued on June 2011 codified Standard Update Topic 220 Comprehensive Income which meant some changes to comprehensive income presentation. Some of the significant ones are presented in this paper.

The most important change was to remove the possibility of reporting comprehensive income as a column in the statement of shareholder's equity. The FASB decided to make this change because it was different to IFRS and made it difficult for users to compare financial statements prepared in accordance with US GAAP and those prepared in accordance with IFRS. The board made the decision that, although several studies have examined the presentation of comprehensive income and found that the majority of companies chose to report comprehensive income in the statement of stockholders' equity.¹ Comment letters received from the users of financial statement showed that most of them agreed with the proposal. They argued that many preparers report OCI in the statement of equity, and that this is for users misguided and all non-owner changes in equity might be reported in the statement separately from owner changes in equity. The second problem was, that most companies wanted to hide the negative OCI in the equity.

After this change, US GAAP requires presentation of profit or loss and other comprehensive income in one statement or two separate but continuous statements, that are equally in accordance with IFRS.

Against the IFRS proposal, which requires presentation of items of OCI in two groups – items that will not be reclassified subsequently to profit or loss, and items that will be reclassified subsequently to profit or loss, FASB doesn't require anything similar. This means that IFRS started to require something, that is not comparable with US GAAP and make the IFRS format a little bit different from US GAAP format of the statement of comprehensive income. I think that this is not in accordance with the objectives of convergence project. Regardless, IASB confirmed this change, and FASB didn't start to work on anything similar.

Another significant proposal of FASB was requirement for presentation of reclassification adjustments by component in both the statement where net income is presented, and the statement where other comprehensive income is presented, for both interim and annual financial statements. Until this time, entities presented reclassification adjustments in statement where other comprehensive income is presented together with a footnote which refers to the notes within specification to the reclassification. This was in accordance with both IFRS and US GAAP. We can see that the proposal of the FASB was again not in accordance with objectives of the convergence project, because the IASB didn't propose any changes which would mean similar form to proposed requirement of FASB.

Most of the respondents (preparers generally) strongly disagreed with the FASB proposal in

¹ The text about studies from the accounting journal: Comprehensive Income: Reporting Preferences of Public Companies By Ganesh M. Pandit and Jeffrey J. Phillips

their comment letters, only few of them (especially users) mentioned that will be easier to find information about reclassification. The group, who disagreed, argued that it would be more costly for preparers, adding unnecessary complexity to financial statements, without providing significant benefit to users of those statements. They asked the Board, at a minimum, to defer the effective date pertaining to reclassification adjustments out of accumulated other comprehensive income. The FASB decided to defer the decision about presenting reclassification adjustments, and on November 2011 issued second Standard Update Comprehensive Income (Topic 220). Except for a lot of insignificant changes such as in text of the last Update issued in June, there was proposed the requirement to present reclassification adjustments with the note about deferral of the Effective Date for Amendments to the Presentation of Reclassifications of Items Out of Accumulated Other Comprehensive Income in this draft. The Board asked three questions about reclassification (FASB Exposure Draft: Proposed Accounting Standards Update Comprehensive Income):

Question 1: Do you agree with the deferral? Why or why not?

Question 2: Are there alternatives that the Board should consider for presenting reclassifications out of accumulated other comprehensive income that would be more cost effective than the one required by Update?

Question 3: If you provide an alternative in Question 2 above, please explain how your alternative would better serve the needs of users of financial statements than current requirements.

For the proposed Update, there was fifteen-day period of Due Process, which ended on November 23, 2011. The Board received 38 comments from which was only 1 came from users, 2 from individuals, 3 from industry, and rest of them from preparers and auditors.

The FASB decided to reconsider the requirements and to weight the benefits of such requirements against the cost to preparers. While the Board is reconsidering the requirements, the Effective Date is deferred. This means that preparers may present the reclassification, only in the statement where other comprehensive income is reported, together with the footnote which refers to the information described in the notes. This method corresponds with IFRS.

6 Conclusions

After the analysis of the comments received by FASB by the November 2011 deadline, a fifth chapter was written. I posted some comments myself:

Why did users partake minimally in the due process?

They are maybe not interested in presentation of comprehensive income and do they use other information for their decision making?

Was the convergence project completed successfully?

One of the objectives of the convergence project was to improve the understandability and transparency of the statement of comprehensive income, mainly for users of the financial statements. From the comments received from both IASB respondents and FASB respondents, we can see that users partake minimally in received comments in all cases. My question is now: Did the change really improve understandability for users? I think that the persons preparing and setting the standard think that project was successful, when in reality, users had a chance to change something and if they didn't use that opportunity, maybe they agree with the proposals, or they don't need such information or format of other comprehensive income is for their decision making.

Another objective of the project was comparability between IFRS and US GAAP. I think that

the Boards work on the convergence project too much focused on the format of the statement of OCI, which is not as important as the content and measurement of items contained within it. I see the biggest problem in the different content of items presented in OCI in IFRS and US GAAP which was described in the second chapter Comprehensive income. I think that the Boards should finish the part of conceptual framework which is focused on measurement first and only after this think about making the joint concept of how items should be presented in OCI.

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Convergence Project „Presentation of Items of Other Comprehensive Income“ within IASB and FASB and Amendments Issued to IAS 1 and SFAS 130

Summary

The objective of this paper is to introduce the main changes as a result of the convergence project which were approved by the IASB and FASB in both IAS 1 Presentation of financial statements, and US GAAP Standard: Comprehensive Income. Although the Boards work on changing standards for long time and the process is difficult, there are still differences between presentation of items of Other Comprehensive Income in accordance with IFRS and US GAAP. Second part of this paper describes analyzing of the due process, in which are the most important groups of respondent users and preparers of the financial statements.

Key words: Convergence process; Comprehensive Income; Financial statements; Due process; IFRS; US GAAP.

JEL classification: M41.

LACH Education System for Nonprofit Organization

*Milan Konečný**

1 Introduction

The article describes LACH educational system for alternative educational system that is suitable for institution-based and driven by non-profit organizations. This is a nonstandard form of the university and its program, which can cause widely due to the flexible, adaptive management program. The system is sensitive to the environment where it operates in. The target group includes students of all ages and mainly deals with the issue of various non-standard groups. System contains educational method, the institution and the control system:

- LACH method - pedagogical method
- GUAA University - General University of Any Age
- SQUID control - controlling method

In the first part of this article there are formulated the problems and goals. Further the course of scientific research development LACH system is described. Scientific research methods, that have been used, are described. The basis for the research is data acquired by observation. It includes educational programs, institutions and management systems. At the end of the chapter there is an analysis of observation and definition of the goals.

The second part of the article contains a general description of the basics LACH educational system, GUAA university and SQUID control system.

The third section describes the specific implementation LUAA Brusperk - Lachia University Of Any Age Brusperk, which is a model example for the creation of the general system. General University is developed by using the abstraction of this model. Proceed through observation, abstraction of feedback and research

In conclusion, there are shown the advantages and disadvantages of the system. In addition there are shown the prospects for further development and implementation.

2 Details for scientific research

2.1 Description of problems and goals

Contemporary educational systems seem to be rather inflexible. It takes a long time they respond to the needs of education. The changes in educational system are realized uneasily because of present legislation and structure of educational organizations. Inflexibility and wrong reaction to the ambience, students and institutions are in, is caused by inflexible educational programs and certificates. However, private institutions are more flexible and need more money.

In some systems teachers look to take the first position and students the second. Programs are made according to the knowledge of teachers and aren't made according to the requirements of market and interests of students. Non standard educators, who have a long practice, are used and the problems with administration often slow down the achievement of intelligence. Non standard students aren't accepted to study or slow down very often.

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The institution that runs flexible rules of education provides good-quality assessment of results and doesn't need a lot of money to run, is missing.

The scientific research is to create an educational system that would be sensitive to the environment, flexible in space and time, open, adaptive, for all ages and levels of low-cost education. The system which would give an opportunity not only students but also non-standard teachers and researchers. The system which would prefer intelligence to education and which would prefer the achievement to educate a student to administration.

2.2 Methods used in the research

In general a lot of methods are used in a research. The most important methods used in this research are:

- Observation - the rank of educational methods, institutions and controlling systems are observed.
- Analysis - the analysis of observation results.
- Modeling - the modeling of pedagogical methods, organization and controlling system
- Abstraction - the creation of the abstract model of the institution described with mathematical formulas
- Verification - the system is verified in practice

The development algorithm:

- Observation
- Fa MAWIS - MATHS WITH A SMILE – private company.
- Svatopluk's centre - Fa MAWIS, Foundation Svatopluk's company Svatopluk's high school.
- Lachia University of Any Age
- LACH educational system

At present the feedback to LUAA and LACH educational system is being realized.

2.3 Observation

To create a new educational system and teaching methods, organization and management, a number of observations in this range have been implemented. They were monitored educational institutions, legislation, training methods, financing, management, teachers and researchers, students, training needs etc.. Description of this research is beyond the scope of this article, as it was monitored over 23 subjects. Examples of the observed types of organization, their activities and methods - universities, secondary schools, primary schools, kindergartens, educational agencies, educational non-profit organizations, employment offices, municipalities, research institutes, academies and so on. Especially FA MAWIS, Foundation Svatopluk's company Lachian community, Lachia University of Any Age, Ostrava University, Office of Labour Frýdek-Místek, Martinek Brusperk Adalbert School, Kindergarten Brusperk, Ministry of Education, Youth and Sports of the Czech Republic.

2.4 The results of observations

Organization and training are:

- Low open the general public.
- Are flexible to the needs of society.

- They are expensive for students.
- The organization is very difficult to operate and poorly led.
- Few independent organization uses adaptive modification of training programs
- Institutions are dependent on the state.
- State institutions have a range of activities unnecessarily tied by rules which hampers the development of human resources.
- Organizations are much more dependent on state subsidies, projects tend to be expensive for students.

3 LACH educational system

In this chapter it will be described an abstract LACH educational system, which consists of three parts - LACH education method, GUAA University, the SQUID control. This model was based on research and feedback-abstraction of long-term observation.

3.1 LACH education method

When creating LACH educational system emerges from the training needs of the region Lachia. Non-homogeneity of the surroundings and an effort to get linked with the needs of region lead to two basic pedagogical methods:

- Individual development of a student.
- Education connected with practice and needs of region.

These two methods are basic ideas for education system ASFIDOS – Adaptive System For Individual Development of Studens and SQUID control system. The aim of this system is to create individual study plan for each student so that it:

- Fortified students strong points.
- Weak points, which are not important, are not developed.
- Programme is implemented adaptively.
- The teacher uses coaching.

These methods are also set up on the basis of our experience with:

- Adult education (Svatopluk's centre).
- Activities at universities (VŠB – Technical University of Ostrava, Pedagogical faculty in Ostrava, Ostrava University).
- Running Svatopluk's high school.
- Activities at elementary school and pre-school organizations

3.2 The basic idea of LACH educational method

Student chooses the programs offered by the University. If you want to achieve a certificate or title submit work. The results must be superior in the level that you choose and whichever gets the title. Results are available in the documentation database and the Internet.

3.3 Basic rules for the title L, LA, LAC, LACH

- The students must demonstrate superior knowledge at the level they choose - basic, medium, high, the highest education.
- It presents knowledge in three areas.

- The certificate's work and its evaluation.

The Commission evaluates the output independently on the course of study. The results are published. The main criterion is the presentation.

Present activities and study programmes are in the following state:

- Lecture - student attends lectures. It doesn't matter what age he or she is. Topics of lectures are different, according to interests.... tourism, ecology, economy, life style...
- Courses - student attends a course. Group of minimally three people. For example English and German language, IT, accounting etc...
- Seminary - student attends a seminar, which can be from one day to one week long, even longer. For example IT.
- Section – departmental - student attends activities of Section - lectures, seminars, round tables. For example Section of mathematical modeling.
- Retraining - program is finished with the certificate of retraining
- Innovative - program is finished with the certificate of educational innovation of a student
- Degrees
 - L - student demonstrates above - standard knowledge at the level of primary school.
 - LA - student demonstrates above - standard knowledge at the level of high school.
 - LAC - student demonstrates above - standard knowledge at the level of university.
 - LACH - student demonstrates above – standard knowledge at the level of after-university education.
- E-learning – we develop e-learning on three levels at LULV:
 - Basic e-learning - Basic e-learning teaching, where communication between student and teacher is arranged through the Internet, e-mail or Skype.
 - LULV e-learning - e-learning programs developed at LULV are used
 - Z e-learning - intermediate e-learning courses are used
- Studio - these programs are multibranch. The leader of Studio passes down knowledge from multiple branches in a group.
- Individual - student works with individual study plan, which is combined with other syllabuses with already set topics.
- Free – student works with individual study plan, which is combined with other syllabuses, no topic is set.
- Accompanying - Student is studying at another school and he consults different problems at LULV.

Some activities are not working in full range. We will develop them in the future.

3.4 Benefits of LACH educational method

- Involvement of all ages.
- Flexible organization for issuing certificates to people who do not have time to work for a classic presentation
- Applicability for the presentation.

- Creating programs according to students' interests.

LACH educational method is still evolving and regulated by the above-described methods and scientific research based on observation. It expands the database of monitored institutions and teaching methods. Abstract model is developed in parallel with the model example of the University LUAA.

4 GUAA university - General University of Any Age

The founder of the University is a nonprofit organization that has the organizational rules and statutes in the foundation deed. Basic characteristics of GUAA are simple and following:

General University of Any Age is an open adaptive system of educational and cognitive activities, which is controlled by the projection process system. Target groups are any age and prefer a special group. The University uses LACH education method and governed by the SQUID control system.

Basic educational programmes

- Lectures for any age.
- Courses, seminars, conferences, retrainee courses.
- Obtaining “degrees” L, LA, LAC, LACH
- E-learning.
- The University uses LACH educational method

Student of the university – attends any activity, **teacher of the university** – implements at least one activity at the university, **research worker of the university** – takes part in cognitive activities of the university.

The university comprises the following organizational units:

- Control - control unit is the same as a control unit of the nonprofit organization.
- Sections - deal with specific problems described in their names, arrange lectures, seminars, and so on.
- Studio - the program is led by leader of the studio.
- Support institution - University Store, University business, University Information Centre, Technology Park and the like.

5 SQUID control

University is controlled by SQUID control system. This a general system for the governance of nonprofit organizations.

Cognitive model. SQUID control system acts as a feedback regulator that controls the implementation projects with the management process into which the information from the evaluation process, the inspection process and information process enter. The input to formulate vision, goals, strategies, and create a database with basic information and form the basic implementation and marketing processes.

SQUID control system has these basic characteristics:

- It controls the system of so-called small projects, which are in SQUID form.
- Small project is described through visions, database of activities, existing and upcoming activities and through history.

- Set of basic activities isn't empty – these activities are undemanding, have low risk rate and they produce small profit.
- SQUID control has supporting financial system.
- Control rule: each project must realize or take a share in minimum of three activities.
- During the time, when system has no new activities, it works on basic activities.

In the control of the university there are sections, studios, and support institutions rated projects.

This system of control means, that the function of university is well-balanced.

6 Lachia Univerzity of Any Age Brušperk

Model example for research into the LACH educational system is LUAA Brušperk, by the following description.

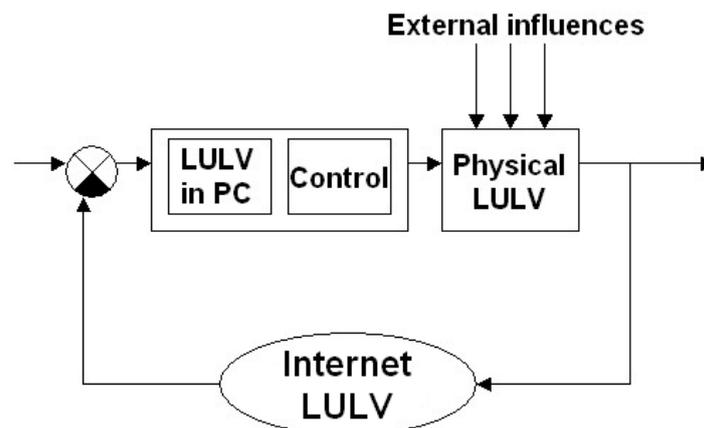
The University was founded in 2002 and is the successor of Svatopluk's center that was founded in 1991 in Brušperk. Founder and keeper of university is Lachia company o.s., which is a non-government non-profit organization. From the establishing document:

Lachia University of Any Age is an open and adaptive system of educational and cognitive activities according to needs and interests of Lachia, with the seat in Brušperk.

Basic principles of university: Chance to study for all population, to share knowledge for non-standard teachers, to participate in the research for non-academic workers as well. This is the most general description of the university. The registration of university is part of Lachia company's statutes, which are registered by home office, c.j. VS/1-1/51076/02-R, 21.2.2005.

The University uses LACH education method and SQUID control system.

Fig. 1: University control



6.1 Organization of the university

The highest authorities of the university are the same as the authorities of Lachia company, o.s. General assembly / the highest authority of the university /, radosta / top representative of the university and statutory representative /, council / it consists of radosta and viceradostas – each of them is responsible for different sphere of function of university/. collegium of radosta – consultative organ of radosta. See www.lassko.cz

6.2 Sections and studios

Inseparable parts of university are sections and studios. Sections deal with specific problems

described in their names, arrange lectures, seminars, and so on. In the studio, the program is led by leader. The most active sections and studio are the following:

Section of projects / production and control of projects/, education /development of educational activities, specially ASFIDOS system /, ecology / Application and propagation of ecological projects in practice/, economy and finances / organization of lectures, courses, seminars, tax and accounting consulting/, photography and movie /photographic and movie activities, courses, seminars, expositions and production/ , mathematical modeling / theory and application of mathematical modeling/, literature, media and publication / literary and medial activities /, informatics / application and development of IT/. Studio of Milan Konečný /solving problems in the area of mathematics, economics, organization, time management and other areas/.

Sections are differently active. They have to make at least three activities during the year. This gives us extensive activity of university.

6.3 Support institutions

As all universities have support institution, this university has them also:

Technology park – the objective is the solution of small technical problems that are related to Lachia locality in cooperation with university.

University library – specialized library with special control system.

University health centre – it deals with health and healthy life style.

PRIVIZ centre - centre, which gives chances to entrepreneurs, institutions, employees and the unemployed in the area of consulting, retraining, inovation, education and intermediation of information and services.

LS Press – the publisher of the university and Lachia company, o.s. We publish articles, collections, textbooks, fiction and notes.

These institutions help the university and the whole region. We employed several workers. We made a database of books, which is unique in region. We organized several lectures and seminars about a healthy life style. We published 60 issues of magazines and 10 publications.

6.4 Cognitive and research activities

We were dealing with following problems: The control theory and its application, development of SQUID control system, time – management and its application, MASV method in controlling, creation and implementation of financial models, media mathematics. From the university development of MASV method were written five articles.

6.5 Stats for students, teachers and researchers

To outline the dimension of university, we quote following statistics:

- Students: present - more than 90 students, past - more than 800 students.
- Teachers: present - more than 20 teachers, past - more than 100 teachers.
- Researchers: present - more than 10 researchers, past - more than 50 researchers.

In the future the great numbers of students, teachers and researchers aren't expected.

6.6 Degrees L, LA, LAC, LACH

It is very hard and prestige to obtain a degree. Two degrees, L and LA, have been awarded so far. Both were awarded to Marek Kozák for his composing, concerts and organization activities.

There are 12 candidates to obtain the degree L, 15 to obtain the degree LA, 25 to obtain the degree LAC and 15 to obtain the degree LACH, in the disciplines: Mathematics, Engineering,

IT, Photo / film, Pedagogy, Etc

6.7 Financial resources of LUAA

The aim of the university is not only to obtain grants and sponsors' gifts. One of the ideas is that the students will participate in financing the university. Current situation: self-financing charges, services, production, business/, sponsorship, grants.

6.8 Location of university

Seats of the university are in following buildings: K Náměstí 500, Brušperk – office, ZŠ Vojtěcha Martínka, Brušperk – office, computer room, small class and the gallery, Národní dům Brušperk – lecture hall. Virtual part of the university is on www.lassko.cz.

6.9 Publishing and project activities of the university

One of the main parameters of university activities is publishing and projects. Publishing of the university is rich: research articles – 5, pedagogical articles – 4, fiction -5, notes – 2, art – 1. University is above standard in publishing, as you can see in references.

The university has rich experience with projects, it deals mainly with so-called small projects. In spite of that it has experience with application of bigger projects, which are subsidized from the EU funds. Lachia company and university got lot of subsidies on small projects in the past. The university is using SQUID control system, which consists of small projects. In present, the university is trying to realize self-finance projects.

7 Assessment of the research and development

LACH educational system is based on a simple idea – assessment of knowledge and results in three disciplines, applicability and readiness for practical utilization. The course of studying in LACH system is secondary. This idea appears very interesting particularly for improving of education levels.

7.1 System benefits

Fast and flexible education, support of regional development, suitable for the unemployed, enables swift reaction to the needs, offers opportunities for a wide range of students, cost effective and widely affordable solution, gives opportunities to alternative teachers and researchers, improves research and development.

7.2 System shortcomings

Despite the flexibility and simplicity of the system, generally it does not seem the professional public fully understands its potential, and the system does not receive positive publicity. The system puts considerably higher demands on the students

7.3 Assessment of LUAA Brušperk

The University is gradually developing. It operates in challenging environment, which on the other hand helps in its own development. The competition strives to reveal the system's weaknesses; by solving them the University becomes more effective and achieves higher standards.

7.4 Further development

The next steps in the LACH system development shall be taken in the area of LACH Certificate – Language Application Computer History.

8 Conclusions

The article analyses an educational system for alternative education, which is suitable for non-

for-profit educational institutions. The system takes a form of a university, which appears to have a wide focus, namely due to its flexible and adaptive educational program and its management control system. In the first part of the article there is described the rationale for design and development of the system, the research methods, the observed objects and the observation findings. The fundamental characteristics of the developed systems are also formulated in the first part.

The second part provides an abstract description of three cornerstones of the system: LACH education method, GUAA university, and SQUID control. The three pillars have been developing by the means of a mutual feedback mechanism based on the experience of the model example and further observations.

The third part contains a model, which verifies the observation-based hypothesis and required corrections. The model is based on real situations and operates in highly competitive environment. The model has been in operation for ten years and is a continuation of Svatopluk's Center, which was established in 1991. The model is dynamic, subject to continuing development, and contains certain openness. Within this year, one of the model components, the Technological part, undergoes a further quality development.

From the very fundamentals of the institution – the adaptive management – it can be seen that this is not a closed-end research, and that the research shall principally ceaselessly continue.

The aforementioned reasons summarize the rationale of this form of educational system, and advocate its further development, through support, presentations and discussions.

Detailed description of the research and the system on its own is beyond the scope of this article and the author is open to provide consultations to any interested party.

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LACH Education System for Nonprofit Organization

Summary

The article contributes to solving problems of non-homogeneous training and management training in non-standard conditions. The problem is solved for the purpose of creating alternative educational methods and the program that is suitable for non-profit organizations with social objectives. It examines the structure of the organization and its management that is adaptive, self-learning and self-financing. The result of the research should be a flexible teaching method and a model organization that would apply the method and helped to solve educational problems where traditional educational institutions are not appropriate. The article describes the development of the educational LACH system which uses non-standard methods - open learning, non-standard titles, the ASFIDOS system (the Adaptive System for Individual Development of Students) and etc. It is a multi-level system - age, education, methods, geography, etc. Target groups of this educational program can be different. The system is adaptive and adjusts to the environment. Generally there are students of any age with different educational goals. In the management there is explored and developed the SQUID control system, which is a strategically marketing project process system. Methodologically the issue is simulated on a specific model example and experience is generalized with the aim to verify and to implement in other organizations. The main result is a concrete realization of a model example of the LS, os – the Lachian Community, os – a non state non-profit organization and LUAA - Lachia University of Any Age with an open and adaptive system of educational and cognitive activities as for the needs and interests of Lachia, with the seat in Brušperk. The method and institutions have been examined for a long time. The LACH system is original and is presented in such a range for the first time.

Key words: Alternative education; Educational system; Nonprofit Organization.

JEL classification: A20.