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The Analysis of Domestic and Foreign Owned Companies in Individual Industries

Michaela Roubíčková [1]

Abstract

The objective of the article is to compare return on equity (ROE) of foreign-owned enterprises with the one of domestic-owned companies. Also other selected parameters are assessed that can affect ROE. ROE represents the bottom line of a company's economic activity that is affected by a number of factors and determines the final outcome for its shareholders. Due to the fact that most companies in the Czech Republic are not publicly traded, ROE is perceived as one of key comparative characteristics for current or potential owners. The author works on the assumption that foreign owners will prefer, due to the higher risk associated with foreign investment, higher ROE of invested capital.

Key words

Return on equity, foreign-owned enterprises, domestic-owned companies, assets, productivity, investment.

JEL Classification: G34, M12.

1 Foreign-owned enterprises and domestic companies in various countries

Empirical studies consistently try to discover the differences in performance of foreign-owned enterprises and domestic companies in various countries, various industries, over time as well as at the level of individual plants. However, empirical evidence of the gap in performance is not convincing. In some studies foreign companies do better than the domestic ones and vice versa. Despite this ambiguity there is a relatively substantial consensus that such differences can be explained by a relatively limited number of explaining factors depending on the chosen performance measure (e.g. productivity, profitability, growth, skills, and wages).

Empirical studies can be split into five groups. The first group comprises financial performance measurement, the second one the variables related to labor force (skills, wages and labor relations), the third group refers to the performance studies before and after merger or acquisition, the fourth one focuses on economic growth and productivity gap between companies, and the fifth group comprises other study types not mentioned above. Only few studies report better results of domestic companies and just some of them report significant differences between companies related to their ownership. Nearly all studies show performance gaps between companies based on the origin of parent companies.

Most of the studies are conducted particularly in the territory of Europe. Bellak and Pfaffermayr [2] dealt with the companies in Austria. Their studies analyzed performance gaps between foreign and domestic firms and in accordance with previous findings their results

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indicate that positive effects of the participation in the multinational company foreign network can be found mainly in productivity and profitability. According to the authors, such differences arise rather from the very MNC base and existence than from the ownership alone. Irrespective of ownership, multinational companies are more similar to each other than their foreign subsidiaries and purely domestic companies. The authors explain investments and growth related deficiencies rather by company characteristics than by foreign ownership. They also examined whether the companies with their parent company based in Germany benefit somehow from the proximity of both countries, common language and similar mentality. However, in their opinion there is no evidence for the benefit emerging from the higher cultural nearness of the firms owned by German entities.

Grasseni [5] focused on the comparison of foreign owned companies and domestic MNC in Italy. His article examines company performance differences and distinguishes between foreign firms of various nation origins and domestic MNC depending on the location of their foreign direct investment. The article deals not only with productivity but also with the differences in average wages, capital intensity and financial and non-financial indicators, namely return on sales (ROS), return on investments (ROI) and indebtedness. The author shows that the results of his analysis indicate remarkable diversity within multinational companies. In particular, it is not possible to identify a straightforward advantage of foreign companies, not even as far as productivity is concerned. Quite interesting results were obtained when attention was focused on ROS and return on investments where the difference in return was changing in line with investment nature. Domestic multinational companies investing just in developed countries reached higher ROS and return on investments in comparison with foreign companies doing business in Italy. On the contrary, the domestic multinational companies that are active just in less developed countries reported the worst performance.

Similar issue in Greece was examined by Notta and Vlachvei [8]. Here just Athens Stock Exchange traded companies were analyzed, both domestic and foreign ones. The results indicate that there are significant differences as to return on assets, profitability per employee, company size, age and profitability. Profitability of domestic firms increases when growth rate increases and foreign capital is efficiently used, while the profitability of foreign firms increases when sales promotion expenses grow and parent company innovation activities increase without higher spending in the host country.

A research carried out in Portugal by Mata and Portugal [7] focused on rather different aspects of company operation. The authors examined survival determinants of domestic and foreign companies. They came to the conclusion that survival was determined by firm ownership, size and growth strategy, its internal organization as well as industry characteristics among which there are growth, economies of scale and industry entry barriers. They have found out that foreign-owned new companies did not show higher chances for survival. On the contrary, both groups of entities respond to mentioned determinants in a similar way.

Of course, the comparison of domestic and foreign companies was made also by economists outside the European continent. Among others, Kimuru and Kiyota [6] can be mentioned who analyzed Japanese firms. Also Erdogan [4] and Bastı, Bayyurt and Akın [1] dealt with company development in the territory of Turkey. However, none of the authors came to the conclusion that there were any significant differences in the performance of foreign- and purely domestic-owned companies.

2 Foreign-owned enterprises and domestic companies in the Czech Republic

As it can be seen from the previous text, the authors of mentioned studies tested various performance determinants and made use of different methods and models (that are not listed above as they were not within the scope of interest). The following indicators have been selected for this analysis: ROE, equity share in assets, long-term assets, investment increase, productivity of labor (value added per employee) and number of employees. All these indicators represent company key characteristics.

ROE is regarded as a dependent variable. It is the result of a company's economic activity that is affected by a number of factors and determines the final effect for the shareholders. Due to the fact that most companies in the Czech Republic are not publicly traded, ROE is perceived as one of key comparative characteristics for current or potential owners. The author works on the assumption (which has been mentioned in the previous text) that foreign owners will prefer, due to the higher risk associated with foreign investment, higher ROE of invested capital. This is the assumption for the first hypothesis:

H1: Correlation of ROE and equity share in assets is positive and higher at foreign companies than in the domestic ones.

Five independent variables were determined for which positive effect on ROE is assumed: equity share in assets, long-term assets, investment increase, productivity of labor (value added per employee) and number of employees. Equity share in assets is the amount of funds invested by the owners related to the total used sources. As assumed, it should affect ROE because, together with higher invested capital, the investor is expected to require higher return. Moreover, for a foreign investor this fact is affected by the risk associated with the entry into foreign countries.

The amount of long-term assets should also affect ROE positively as the more funds are invested in long-term assets, the higher effect should be expected. It differs from the previous variable in that it does not represent just owner's equity. Long-term assets can be funded not only by equity but also by other sources. So what matters here is the ability to make use of them.

Investment increase is a logical consequence of the consideration that a foreign investor brings also capital expenditure that, among others, can be used for new technology, operation modernization, etc. For the same reason also productivity of labor is applied that is assumed to be higher for foreign investors. Number of employees is actually an additional indicator. It is one of the characteristics specifying company size.

H2: Equity share in assets, long-term assets, investment increase, productivity of labor (value added per employee) and number of employees have a substantial impact on achieved ROE.

In the text to follow, basic statistical tools are used so that it can be made clear whether domestic- and foreign-owned firms report statistically significant differences. Besides the mentioned correlation relation which assesses the degree (closeness) of dependence of two variables, the following text uses also multiple regression the aim of which is, by means of a simple relation, to characterize the impact of changes in independent variables on the theoretical level of a dependent variable. ROE is regarded as the dependent variable. Multiple regression is a means of examination of statistical dependence using a model that comprises one dependent variable and several independent variables and, and it represents a simplified reality image. It tries to describe the dependence by means of a specific regression plane equation or, in this case, a regression hyper plane (it comprises 3 and more explaining variables).

Part of it is also explanatory statistics (Table 1) that shows key parameters such as minimum, maximum, mean value for all monitored variables. Also kurtosis and skewness are shown. Kurtosis determines relative distribution steepness or flatness as compared with normal distribution. Positive kurtosis means that the distribution is relatively steep. Negative kurtosis means that the distribution is relatively flat. Skewness determines the degree of asymmetry of distribution magnitude around the mean value. Positive skewness means a distribution with an asymmetry side that deflects towards more positive values. Negative skewness means a distribution with an asymmetry side that deflects towards more negative values.

2.1 Mining and quarrying

In this article, the range of attention is focused on just mining and quarrying companies and the analysis is made on quarterly data for the period of 2007 through 2012 presented in the analyses of the Ministry of Industry and Trade. In this period, relatively few companies were in the monitored sample – on average, there were 8 domestic-owned firms and 12 foreign-owned ones.

However, their number has not increased even now and in terms of sales revenue in the whole industry the monitored sample represents almost 90 %. As to the number of companies, it is not a representative sample of the companies doing this business in the territory of the Czech Republic, on the other hand it is an economically significant branch and that is why it is important to examine it. In the past, such companies, as an aggregate, created economic value added. This trend continued (except for the 1st quarter) also in 2011. However, in 2012 a reversal came when value creation remained around zero for three quarters and sank deeply at the year end. This slump was caused especially by the drop of turnover, and due to the fact that the number of employees (and wages) is more or less stable, the sales slump had an impact on value creation.

The following Table 1 includes descriptive statistics for ROE and 5 independent variables: equity share in assets, long-term assets, investment increase, productivity of labor (value added per employee) and number of employees.

Table 1: Explanatory statistics

	Mean value	Mean value error	Median	Standard deviation	Kurto-sis	Skew-nest	Minimum	Maximum
ROE D	17,41%	0,02	16,39%	0,08	0,52	0,89	6,46%	35,18%
ROE F	12,72%	0,01	14,28%	0,06	-1,23	-0,20	1,88%	22,03%
LA D	37 828 572,54	5 366 034,81	30 267 643,01	26 288 094,46	-1,86	0,27	12 304 838,00	72 419 095,00
LA F	45 498 260,20	5 118 162,56	49 163 706,50	25 073 773,41	-1,99	-0,13	14 861 703,00	72 565 532,00
I D	917 792,85	211 293,27	393 015,00	1 035 121,39	0,82	1,49	150 678,00	3 312 359,25
I F	855 343,06	185 448,30	573 112,50	908 507,44	1,77	1,43	18 820,25	3 512 047,00
EOA D	54,82%	0,01	54,23%	0,04	-0,69	0,29	48,92%	62,78%
EOA F	63,82%	0,02	63,00%	0,10	9,22	2,15	46,19%	69,45%
PP D	1 324 637,21	39 514,59	1 345 358,86	193 581,17	-0,98	0,02	1 015 332,25	1 648 676,63
PP F	1 472 476,74	66 553,33	1 470 930,30	326 043,41	-1,43	0,23	1 085 049,85	2 005 928,97
NOE D	13 137	1 363,17	13 034	6 678	-2,16	0,00	5 658	20 295
NOE F	12 748	1 950,76	12 561	9 557	-2,15	0,00	2 501	23 075

The table shows clearly that in general equity share in total sources at foreign entities is higher as this group demonstrates both higher mean value and median. Foreign companies achieve higher productivity of labor but surprisingly lower ROE, in all monitored values.

2.1.1 Domestic companies

The following Table 2 shows mutual correlation values of individual variables, mainly in order to eliminate multicollinearity in regression statistics. It is apparent that there is very significant mutual correlation between long-term assets and number of employees NOE. Due to the fact that at the same time NOE shows slightly lower correlation dependency with ROE, this indicator was eliminated from further calculation.

Table 2: Mutual correlation values of individual variables

	ROE	*LA*	*I*	*EOA*	*NOE*	*PP*
ROE	1					
LA	-0,63597	1				
I	-0,33208	0,582941	1			
EOA	-0,43932	0,308896	0,096599	1		
NOE	-0,62161	0,959344	0,594402	0,271104	1	
PP	0,269126	0,494985	0,295014	0,154307	0,403975	1

The following Table 3 shows regression statistics without NOE. The results clearly show that the use of selected regression function explains 92,2% of the total variability of ROE. Selection of all parameters is statistically significant at the significance level of 0,01.

Table 3: RESULT without NOE

Regression statistics	
Multiple R	0,960241
R-squared value	0,922063
Set R-squared value	0,905656
Mean value error	0,023488
Observations	24

ANOVA

	Difference	*SS*	*MS*	*F*	*Significance F*
Regression	4	0,124	0,031	56,197	0,000
Residues	19	0,010	0,001		
Total	23	0,134			

	Coefficients	*Mean value error*	*t Stat*	*P Value*	*Lower 95%*	*Upper 95%*
Limit	0,177	0,083	2,140	0,046	0,004	0,350
LA	0,000	0,000	-10,460	0,000	0,000	0,000
I	0,000	0,000	0,215	0,832	0,000	0,000
EOA	-0,556	0,140	-3,958	0,001	-0,850	-0,262
PP	0,000	0,000	10,497	0,000	0,000	0,000

2.1.2 Foreign companies

As to foreign firms, there is also a significant correlation relationship between long-term assets and number of employees (Table 4). However, at these companies long-term assets show a lower correlation relationship with ROE. That is why this time number of employees was included in regression statistics.

Table 4: Mutual correlation values of individual variables

	ROE	*LA*	*I*	*EOA*	*PP*	*NOE*
ROE	1					
LA	0,095251848	1				
I	0,197516826	0,711256	1			
EOA	-0,156913443	-0,5421	-0,2762	1		
PP	0,589682373	-0,63727	-0,27433	0,371557	1	
NOE	0,208931559	0,984966	0,710214	-0,56178	-0,58358	1

The results of performed linear regression (Table 5) indicate that the lower the determination coefficient is, the lower the value by means of which regression function explains the variability of variable ROE, i.e. 75,2%. Moreover, investments and equity share in total sources are not statistically significant at the significance level of 0,01. Long-term assets and productivity of labor remain statistically significant. Productivity of labor turned out interesting already in the previous summary statistics where foreign companies showed higher values than the domestic ones.

Table 5: RESULT without LA

Regression statistics	
Multiple R	0,867182695
R-squared value	0,752005826
Set R-squared value	0,699796526
Mean value error	0,032400908
Observations	24

ANOVA

	Difference	*SS*	*MS*	*F*	*Significance F*
Regression	4	0,060485	0,015121	14,40368	0,000
Residues	19	0,019947	0,00105		
Total	23	0,080432			

	Coefficients	*Mean value error*	*t Stat*	*P Value*	*Lower 95%*	*Upper 95%*
Limit	-0,188	0,085	-2,197	0,041	-0,366	-0,009
LA	0,000	0,000	3,395	0,003	0,000	0,000
I	0,000	0,000	-0,635	0,533	0,000	0,000
EOA	-0,108	0,086	-1,256	0,224	-0,287	0,072
PP	0,000	0,000	7,236	0,000	0,000	0,000

3 Conclusion

The paper objective was, based on the analysis of economic development parameters of private companies under domestic control and private companies under foreign control in mining and quarrying industry in the period of 2007 to 2012, to assess whether the performance of the companies that are basically subsidiaries of multinational corporations (MNC) is higher. Multinational companies show certain specifics just for the reason that their business crossed the border of their parent country.

There is a number of interesting and important issues related to MNC that have been described in literature such as the motives of internationalization forms and strategies, impact on host countries, political aspects of MNC business, new forms of international business financing, social responsibility, the relation between headquarters and subsidiaries or branch offices, specific mechanisms used for MNC business coordination, etc. As a key topic still the very reasons for MNC occurrence can be counted.

Nevertheless, this paper's focus was on company performance represented by reported return on equity (ROE) which is a significant indicator for company owners as it indicates the ability to recover invested funds. Since foreign owners, in a sense, assume higher risk by the fact that they enter the territory of a foreign country (according to the author no diversification can be considered as to strategic, not portfolio investments in a globalized world), it would be logical to require higher return on invested funds. However, that is not the case for the monitored sample of companies. The first hypothesis that was put forward - ***H1: Correlation of ROE and equity share in assets is positive and higher at foreign companies than in the domestic ones*** – was not confirmed because at domestic companies it was -0,44 and at the foreign ones -0,16. Moreover, equity share in assets is not statistically significant at the level of 0,01. Although foreign companies achieved higher productivity of labor, however surprisingly lower ROE in all monitored parameters.

Also, domestic and foreign companies differed in the fact that investments and equity share in assets at foreign companies are not statistically significant at the level of 0,01 so they do not have any significant impact on ROE variability. Productivity of labor and long-term assets remain statistically significant. At domestic companies all monitored variables included in the analysis are statistically significant. Thus hypothesis - ***H2: Equity share in assets, long-term assets, investment increase, productivity of labor (value added per employee) and number of employees have a substantial impact on achieved ROE*** was confirmed just for domestic companies.

It is apparent that the results can be distorted by the specifics of the monitored industry. That is why the author aims, within the next research, to analyze also other selected industries the nature of which will be different. These will be for instance manufacturing industry, generation and distribution of electric power, gas, heat and air condition supply, water supply and the business related to waste water, waste and sanitation, and building industry.

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Effect of profitability on the use of finance sources in categories according to profitability of selected business branches

Petra Růčková[1]

Abstract

For efficient fuctioning of companies it is also important to use financial means in such way that they are available in sufficient amount and in time and, that they do not burden financial management of companies with unnecessary costs. In economic theories it may be spoken of capital structure management as just financing of investments from long-term finance sources may have a significant effect on subsequent efficiency of projects. The aim of the paper is to find out how return on equity is affected by the structure of finance sources and by the development of an economic cycle. We will also focus on differences in structure of finance sources for various levels of efficiency. From the view of methodology, the following methods of statistic analysis were used: indicators of debt/equity ratio, return on equity and gross domestic product.

Key words

Capital structure, finance sources, return on equity, debt/equity ratio, economy performance, correlation, comparison, analysis.

JEL Classification: G 30, G32

1. Introduction

One of the principal issues of financial management of a company—besides setting the total amount of the necessary capital—is the choice of a suitable structure of sources of financing its activities. In various sources of financial theories, a capital structure is defined as a structure of long-term capital from which fixed assets are financed. There is a whole number of theories dealing with capital structure management. They may be divided into two groups: trade-off theories and pecking order theories. The theories are characteristic of their accentuation of various factors. The trade-off theory puts emphasis on taxes and their impact of capital structure, the pecking order theory emphasizes the availability of information and thus the information asymmetry. According to Myers (1984), there are at least two key consequences of the theories. The key consequence of the trade-off theory is gradual adapting of the capital structure leading to meeting the aim of the company. The pecking order theory uses a strict finance structure. Myers claims that these are two basic frames in which the capital structure should be managed.

From the view of an interest tax shield and thus the static trade-off theory, it is true that each crown of an interest payment may be used as a tax shield, however, as for example DeAngelo and Masulis (1980) point out, there is a number of companies for which the benefit of tax deduction does not apply, as they report clear operational loss. Thus it may be presumed that companies reporting a lower level of taxable incomes will also report a lower level of debt financing. Previous studies already brought surprising evidence of a very weak effect of the aspect on the decision-making process about the use of debt financing. The tax

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benefit of debt showed as unconvincing in the studies. For example Bradley et al. (1984) brought evidence that companies with sufficient non-debt shields have a better lever ratio than those having lower tax shields. The study is also verified by Titman and Wessels (1988) who proved that considerable non-debt shields in the form of clear operational loss or great volume of investment do not have to have sufficient taxable incomes in order to fully use benefits of a tax shield. Mackie-Mason (1990) remarks that most companies prefer a non-debt shield in the form of increased capital expenses than the debt shield. Mostly it is a result of experience in companies – if they experience a loss, then in time of creating an operational profit they prefer to realize investments, as the loss may be realized again in the following years.

The pecking order theory comes out of the fact that due to the existence of unfavourable choice the company primarily uses retained profit, then debt financing and only then it gets to raising other internal finance sources for its financing. In the pecking order theory the relation to capital structure is explained on the basis of the information asymmetry between managers and other people (Kislingerová, 2004). It causes different evaluation of issued securities by relevant target groups. Therefore companies prefer to issue securities least sensitive to the information available. If they need free finance, they first use internal sources, then debt and the last choice is to issue new equity. It follows the view of company managers, not interests of company owners. The theory comes out of the fact that companies and their management prefer the use of internal sources to external ones. Thus it comes to creating a hierarchic order of the use of sources of investment financing from those most preferred to those least used; the most often used are internal finance sources, then classical external finance sources and only the last choice for raising finance sources is issuing shares.

If we consider whether to use debt or internal financing, then we have to consider the following facts. Debt financing has a tax deductible part contrary to internal financing. Debt burdens the total finance policy of the company regardless global economic conditions, which mainly show in the long-term horizon. And the approach to debt financing is very strongly influenced by the shareholders´ right to a share on liquidation balance, as the legislation prefers creditors´ rights in this sense and, a share on liquidation balance is only a residual income. Mainly the two last factors may considerably limit the stated positive of debt financing, which is tax deductibility. However, the capital structure may also be different in various business branches, which is affected by many internal and external factors. The differential may result from the property structure of companies, from seasonal effects as well as from the whole number of other factors. The capital structure is of substantial importance for high-quality development of a company and it also conditions its healthy financial development. The capital structure is also connected to the evaluation of the return on equity, as the return is a measure of ability of a company to create new sources, to gain profit by using the invested capital. By measuring the ROE, we express the profitability of the capital invested by shareholders. It is an indicator by which the investors may find whether their capital is reproduced with a relevant rate corresponding to the risk of the investment.

The aim of the paper is to find how the return on equity is affected by the structure of finance sources and by development of the economic cycle. We will also focus on differences in the structure of finance sources for various levels of efficiency. From the above-stated theoretical aspects and in order to meet the aim more easily, we may deduce the following hypotheses that will be the subject of the research:

- From the view of the structure of finance sources, the use of internal finance sources predominates in the Czech Republic, regardless the economic performance in individual business branches.
- Total economic situation and return on equity affect the use of external finance sources.

- The increase in the use of external finance sources does not cause the increase in efficiency measured by the return on equity.

2. Relation of selected indicators in branches as wholes

In the paper we will be observing the structure of finance sources in five selected business branches which conclusively enough characterize the Czech economy. For this analysis we use comparison of selected indicators (debt/equity ratio – D/E, return on equity – ROE and gross domestic product development – GDP) and their mutual correlation.

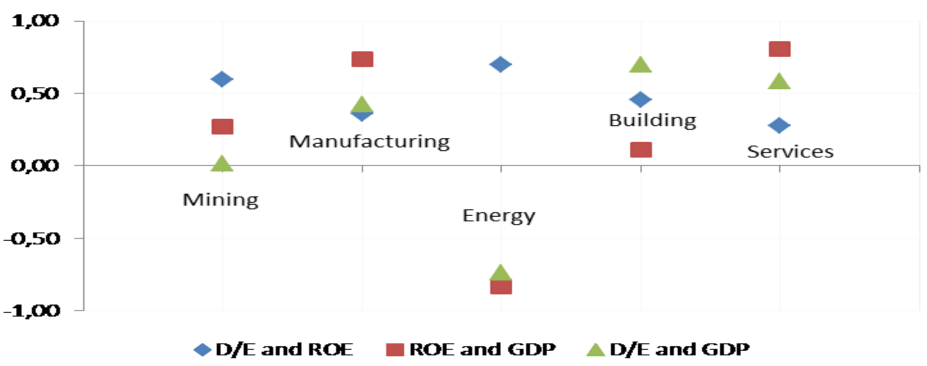
Table 1: Structure of finance sources in selected branches as wholes from 2005 to 2011

	2005	2006	2007	2008	2009	2010	2011
Mining	0,5366	0,8079	0,7026	0,6423	0,5825	0,6067	0,6548
Manufacturing	1,0384	1,0146	0,9031	0,9047	0,8754	0,9420	0,9904
Energy	0,5318	0,5318	0,7551	1,0255	0,9544	1,1541	1,1812
Building	1,77	1,91	2,26	1,81	1,69	1,55	1,70
Services	1,7229	1,6145	0,9647	0,8396	0,9224	0,8950	0,9772

Source: own calculations and processing based on branch analyses of the Ministry of Industry and Trade

The weakest willingness to use external finance sources is reported in mining, where we have seen values with higher rate of use of external capital in no single observation. In all monitored years the use of internal finance sources prevailed. On the other hand, in building it may be stated that the use of external finance sources prevails in a very distinct way and that no single monitored period reported prevalence of internal finance sources. The other business branches prefer to use internal finance sources in most periods – no matter whether the economy was in the phase of growth or decrease. If larger use of external finance sources is reported, then only slightly above the value of 1. The exception is services at the beginning of observations, they have balanced their financial structure with other business branches since 2007. If we draw our attention to the relation of the use of finance sources and the return on equity, or gross domestic product (the effect of the use of external finance sources with the economic cycle development has been also researched), then it may be stated that from the development between 2005 and 2011, relations shown in the following figure have emerged. It might be expected that the return on equity should increase together with growth of the indebtedness rate, the return on equity should increase as GDP grows and, the indebtedness should increase together with growth of the investment realization.

Figure 1: Correlation of D/E, ROE and GDP in individual categories of business branches



Source: own calculations and processing based on branch analyses of the Ministry of Industry and Trade

It is obvious from the figure that relation between ROE and D/E ratio does really lay in the zone of positive correlation or, in a concurrently developing relation. It means that efficiency on the level of equity grew together with the willingness to use external finance sources from 2005 to 2011. However, strength of the relation is various, as three out of five monitored branches report the correlation coefficient below 0.5. In the other two relations, results are not that clear as in ROE and D/E ratio. Positive correlation of ROE and GDP is confirmed in four business branches, and two largest business branches by number of companies, i.e. processing industry and services, reported the highest level of correlation above 0.5. Thus it was only proven that these business branches critically participate in creating the GDP. Building, which is stated as a strongly procyclic business branch by textbooks of economy, and which also participates in starting the economic growth, has not proven this fact from the view of relation of return on equity and gross domestic product. The relation is almost uncorrelated. What is interesting is the position of power engineering where we may register a negative correlation, which could indicate that beter results are reached in the period of the economic crisis. As far as the use of finance sources is concerned, positive correlation may be registered in services and building, which means that growth of gross domestic product also means growth of willingness to debt, or to greater use of external finance sources. Slightly weaker willingness to use external finance sources when the economy grows is registered in the processing industry. Again, a negatively correlated relation is registered in power engineering. An uncorrelated relation is reported by mining. With such results of relations of basic quantities, we have come to a question, whether the efficiency already reached by a company has an affect on decision-making about the choice of the type of financing.

3. Relation of the selected indicators according to economic performance of companies in selected business branches

Another analysis is focused on that whether there may be dissimilarities from the view of use of external finance sources in companies with the highest efficiency and in companies having possible problems. This comes out of a study by Graham (2000) who proved that paradoxically, large, liquid and most efficient companies with low financial distress costs use debt financing in a very conservative way. Thus the debt conservatism rather gets to verify the results of the pecking order theory. This fact was researched in four groups according to the efficiency development.

When classifying companies into groups in conditions of the Czech Republic we also use the INFA model of the Ministry of Industry and Trade, in which companies are classified into four basic categories considering partial parameters of an economic added value – costs of equity, non-risk interest rate and parameter of company efficient behaviour evaluation – return on equity. According to these criteria, the categories are as follows:

- Category I includes companies creating an economic added value, and values of return on equity are higher than values of costs of equity;
- Category II includes companies whose ROE is not higher than costs of equity but they are higher than return of risk-free assets[2];
- In Category III, there are companies whose ROE is lower than return of non-risk assets but still having a positive ROE;

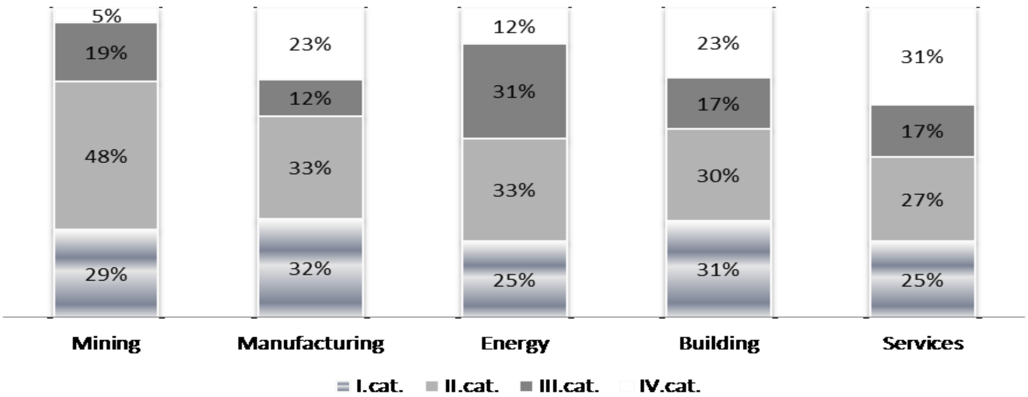
[2] Risk-free interest rate is derived from state obligations in the Czech Republic. Development is recorded in the following table:

	2005	2006	2007	2008	2009	2010	2011
Risk-free rate	3,53%	3,78%	4,24%	4,55%	4,67%	3,71%	3,51%

- Category IV includes companies whose profitability is negative or, they have a negative value of equity.

The classification of a company into one of the categories itself implies the level of management of a company.

Figure 2: Structure of shares of companies in individual categories in 2011



Although 2011 may be considered as a year with a demonstrably low dynamics of growth, it is obvious from the figure that in all business branches, companies of Categories I and II are more than a half of the total number of companies in the relevant branch. That may be seen as positive because more than a half of the monitored companies report efficiency higher than the non-risk interest rate. According to the above-mentioned study, it should be true and it will also be the hypothesis to follow, that companies classified in Category I will be of greater willingness to use internal finance sources and, with a worse position up to Category IV the willingness to use external finance sources will be greater.

The first monitored group is that of selected business branches in which there are companies having reported values of the return on equity above the level of costs of equity, thus from the view of efficiency they proved to earn not only more than the current costs but also more than the alternative costs.

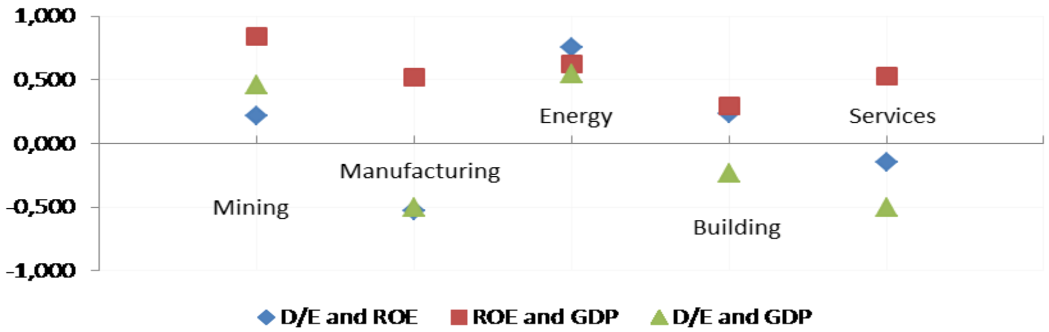
Table 2: Structure of finance sources in selected branches according to individual categories from 2005 to 2011 – Category I (D/E ratio)

	2005	2006	2007	2008	2009	2010	2011
Mining	0,48	0,85	0,90	0,77	0,59	0,80	0,87
Manufacturing	0,82	0,84	0,70	0,66	0,66	0,76	0,83
Energy	0,54	0,60	0,77	0,92	0,84	1,21	1,14
Building	1,76	1,95	2,23	2,01	1,59	1,40	1,27
Services	0,80	0,86	0,84	0,78	0,45	0,65	0,74

Source: own calculations and processing based on branch analyses of the Ministry of Industry and Trade

It is apparent from the table that the two largest branches – processing industry and services – namely companies creating an economic added value, have a slightly increasing willingness to use external finance sources in time, however, from the view of the use of capital, the use of equity prevails in all the monitored years. Greater willingness to use external finance sources is reported only by power engineering and by building, though here, too, the dominant position of external sources is rather that of short-term finance sources. Thus it is obvious that what Graham claimed in his study (2000) may be seen in companies with the best economic results in the Czech Republic that means that even in such companies in the Czech Republic we may see certain debt conservatism. At the same time, as Figure 2 shows, the use of external finance sources in the processing industry rather leads to a negative relation, which means that when the use of external finance sources grows, the efficiency falls. The only distinct positive relation of the use of external finance sources and return on equity is seen in the area of power engineering, specifically in the area of production and distribution of electricity, gass, heat and conditioned air. The other two positive relations are not much convincing and they rather imply an uncorrelated relation, without a mutual relation. From this point of view it would be irrelevant for mining and building, which sources of financing would be used by these companies.

Figure 3: Correlation of D/E, ROE and GDP in companies in Category I



Source: own calculations and processing based on branch analyses of the Ministry of Industry and Trade

Concerning the relation of ROE and D/E ratio to GDP, it is clear at first sight that efficient companies have a correlated relation with the development of gross domestic product. All the monitored business branches reported a positive correlation with the value higher or equal to the value of 0.5 in this relation. The only exception being building, where the value of the correlation coefficient decreased to the level of 0.3. Thus in this category it may be proven that efficiency of the best companies develops depending on the development of the economic cycle. From the view of the use of external finance sources, the situation is not that clear. Only two business branches reported a positive correlation, which means, when the economy grows, so does the willingness to use external finance sources in Category I companies in mining and power engineering. In the processing industry, building and services, there is a negative correlation registered, which means that external sources are used in these branches when performance of the economy decreases. Moreover, in case of the processing industry, this fact is more or less verified by the relation of D/E and ROE.

In the second category, there are companies that reported return lower than the alternative costs of equity, but at the same time it is higher than the non-risk interest rate. It might be expected here that companies could behave in a similar way as they still report sufficient efficiency from the view of the obtained bonus for the risk taken from the point of view of owners. However, already the structure of finance sources report significant differences, as seen in Table 3.

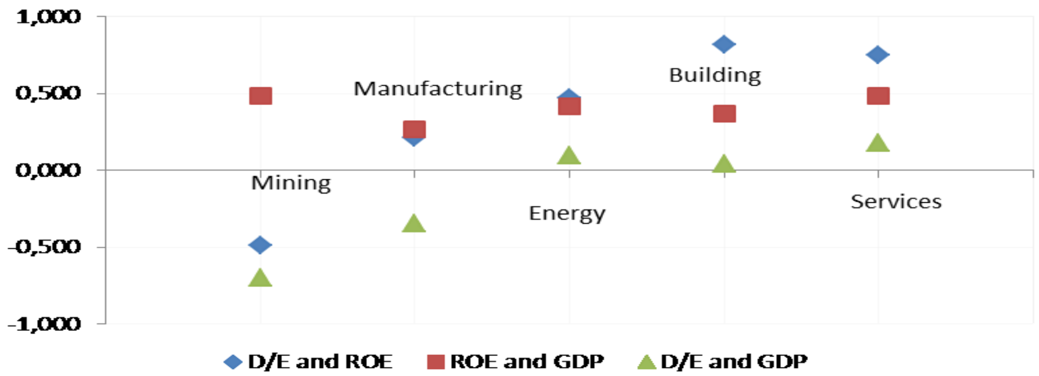
Table 3: Structure of finance sources in selected branches according to individual categories from 2005 to 2011 - Category II (D/E ratio)

	2005	2006	2007	2008	2009	2010	2011
Mining	1,22	0,51	0,40	0,38	0,71	0,46	0,47
Manufacturing	1,04	1,05	1,16	0,86	0,91	1,06	0,98
Energy	1,00	0,55	0,80	1,03	0,80	0,82	0,89
Building	1,95	1,63	2,21	1,47	1,90	2,19	2,07
Services	1,14	1,10	1,37	0,86	1,40	1,25	1,31

Source: own calculations and processing based on branch analyses of the Ministry of Industry and Trade

It is apparent from the table, contrary to the previous category, that greater willingness to use external finance sources has shifted from the area of power engineering to the area of services. The continual willingness to use more external sources is in the category of building, which is a completely natural phenomenon, though, as it is a branch with general tendency to external long-term finance sources. Since 2009, building has been using up to twice as larger share of external sources than the internal ones. In services, short-term external finance sources slightly prevail in the external sources. The processing industry and power engineering use sources in a balanced way, mining use significantly more internal finance sources in this category. Again, there will be an interesting relation of the used finance sources and return on equity, which is shown in Figure 4.

Figure 4: Correlation of D/E, ROE and GDP in companies in Category II



Source: own calculations and processing based on branch analyses of the Ministry of Industry and Trade

Just as in Category I, also in this category there is a positive correlation with development of gross domestic product even though the relation is weaker in this category. The strongest values of positive correlation were on the level of 0.5 in mining and in services. The other business branches have values of the correlation coefficient a bit lower. The relation of D/E and ROE is different. While in the first category, the processing industry reported a negative relation of used external finance sources and efficiency of companies, then in this category the relation is already positive, which means that flow of external capital could cause growth of the return on equity more often than in most efficient companies. A change also happened in mining where correlation came from relatively positive relation to negative values. In this branch it was also true that a greater use of the external capital may be registered in times when the economy has a tendency to fall, which rather implies the use of external finance sources for purposes of financial insufficiency than for purposes of investments to development of business. The same situation is in the processing industry. In this sense it rather takes us to an idea that business with customers could cause delay of payments even in the monitored companies and thus an increase in short-term external finance sources. In the other business branches the relation of gross domestic product and finance sources is not of such importance.

The third category, as it has been said, includes companies that are profitable on the one hand, but on the other hand they do not profit on the level of non-risk interest rate, which may mean, of course, and it probably will mean that they will gain external finance sources under conditions when they will not be able to profit in order to absorb the cost interest rates from external sources. This fact will handicap their use in favour of the return on equity.

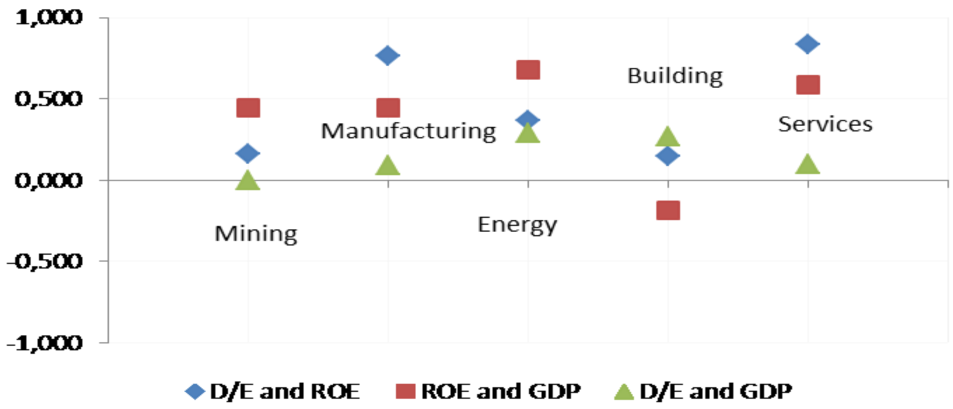
Table 4: Structure of finance sources in selected branches according to categories from 2005 to 2011 – Category III (D/E ratio)

	2005	2006	2007	2008	2009	2010	2011
Mining	0,32	0,35	0,20	0,40	0,27	0,63	0,42
Manufacturing	0,78	0,75	0,85	0,88	0,80	0,60	0,60
Energy	0,21	0,24	0,45	0,39	0,35	0,29	0,44
Building	0,81	0,98	1,76	1,18	0,65	1,46	0,88
Services	0,58	0,50	1,06	1,13	0,74	0,45	0,42

Source: own calculations and processing based on branch analyses of the Ministry of Industry and Trade

It is also apparent from Table 4 that this category uses equity to a noticeably greater extent—with only minor exceptions. The exception being building which uses more external finance sources in three out of seven monitored periods. Though in this branch it is possible that it is also given by the fact that credits are negotiated for long periods and a greater share of external sources may be a result of inertia. A different situation from the view of the used finance sources contrary to the previous two categories is also mutually reflected in the relation of the monitored quantities. It is shown in Figure 5.

Figure 5: Correlation of D/E, ROE and GDP in companies of Category III



Source: own calculations and processing based on branch analyses of the Ministry of Industry and Trade

With the exception of the relation of return on equity and development of gross domestic product in building, the analysed quantities reported a rather correlated relation from 2005 to 2011. The structure of finance sources and development of gross domestic product in the areas of mining, processing industry and services appears to be with no mutual relation. The processing industry and services also showed the most distinct relation between the structure of finance sources and return on equity. Their return on equity grew together with the use of external finance sources. A distinct correlation is also in the relation of return of equity and development of gross domestic product in the area of power engineering. This category proved the basic relation – when the volume of the used external finance sources grows, so does the return on equity.

The last category includes companies that reported loss in the relevant period. The greatest share is created by companies from the area of services where there are 31 per cent out of the total number of the analysed companies. From the view of the structure of finance sources it is apparent that in essence we may not speak of management of finance sources.

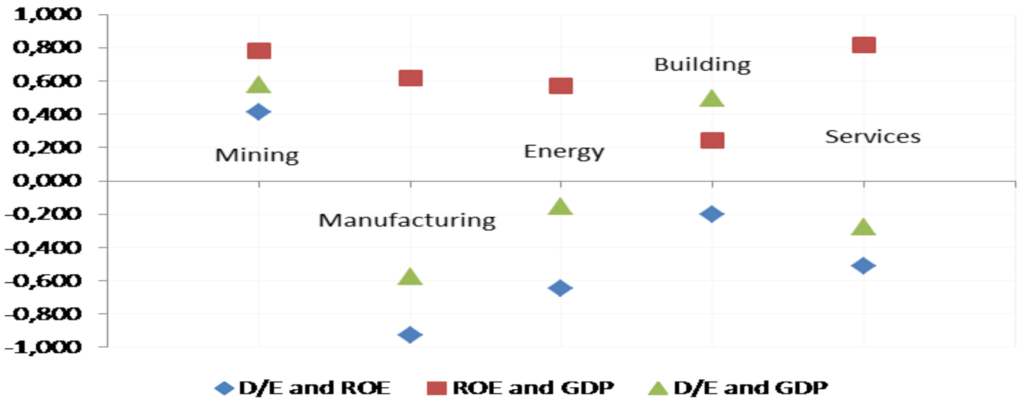
Table 5: Structure of finance sources in selected branches according to categories from 2005 to 2011 – Category IV (D/E ratio)

	2005	2006	2007	2008	2009	2010	2011
Mining	0,16	0,35	0,35	33,35	0,29	0,27	0,48
Manufacturing	3,51	3,24	1,88	2,17	1,29	2,32	2,58
Energy	2,51	1,17	1,42	2,25	4,13	2,23	1,29
Building	1,01	1,18	3,51	1,63	6,69	2,31	3,70
Services	3,07	2,54	1,02	0,81	1,01	2,82	3,05

Source: own calculations and processing based on branch analyses of the Ministry of Industry and Trade

It is apparent from Table 5 that the use of external finance sources outbalances the internal sources up to several times. In services, which reported the greatest share of loss-making companies, in average the value of external sources is double the internal sources. However, the other business branches report very high values of D/E ratio, i.e. high dominance of external finance sources. But it is also obvious from Figure 6 that when there is an inflow of external finance sources, these companies report a falling value of the return on equity. With the exception of mining, this negatively correlated relation was reported by all the business branches.

Figure 6: Correlation of D/E, ROE and GDP in companies of Category IV



Source: own calculations and processing based on branch analyses of the Ministry of Industry and Trade

The relation of both quantities to gross domestic product is slightly different. A negatively correlated relation may be found in the used external finance sources and gross domestic product in the processing industry, power engineering and services, which may be evaluated as rather negative from this point of view (due to the reported loss), as when the performance of economy falls, then the use of external finance sources grows. However, as it was stated, it is very difficult to speak of management of financial structure in this category, as it is a rather question of possibility to gain any means in this context. A positive correlation in all business branches may be found in the relation of return on equity and development of gross domestic product. However, it may not be said, that the bad total economic situation was the only reason for the bad situation in companies.

4. Conclusion

From the theoretical point of view, the effect of profitability of a company on the use of external finance sources is examined. Supporters of the trade-off theory state that profit-making companies tend to use other external finance sources for the reason of existence and functionality of a tax shield. If companies are profit-making, then under conditions changed in no other way, their available financial means grow, risk from the view of general availability of financial means decreases and, at the same time, the availability of debt financing under favourable conditions from the view of debt expenses increases as well. It also means that when profitability grows, then the probability of bankruptcy as well as financial distress expenses decrease. It gets to the core of the statement of trade-off theories about a positive relation between the return on equity and the used debt financing. To the contrary, the pecking-order theory claims that when there are internal finance sources, these will be preferred as a result of non-existence of additional transaction costs. External sources will be used only in case of lack of undistributed profit. When the profitability grows, so does the effort to retain profit and excess of retained profit leads to the lower value of debt. From the view of this theory, debt is rather seen as a signal of inadequacy from the view of profitability. As a result, a negative relation between profitability and growth of the use of external finance sources is expected.

The paper dealt with the structure of finance sources which is usual in selected business branches, as well as with the deviations from the usual structure of sources on various levels of profitability. The structure of finance sources was observed by means of the indicator of deb/equity ratio. The results are summarized in the following table.

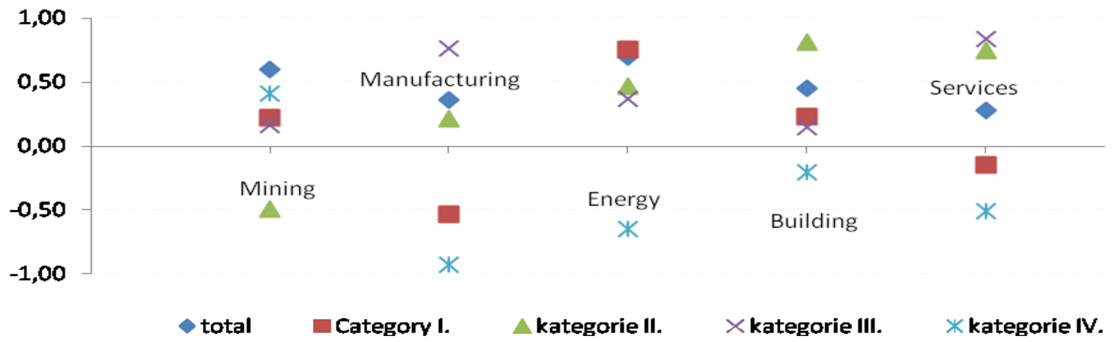
Table 6: Average values of D/E ratio in branches as wholes and in branches according to the economic performance

	Total	Cat. I.	Cat. II.	Cat. III.	Cat. IV.
Mining	0,62	0,75	0,59	0,37	4,49
Manufacturing	0,96	0,75	1,01	0,75	2,43
Energy	0,84	0,86	0,84	0,34	2,14
Building	1,81	1,74	1,92	1,10	2,86
Services	1,21	0,73	1,20	0,70	2,05

It is apparent from the table that efficiency has an effect on the use of external sources, however, it may not be claimed that the greater efficiency – the greater willingness to use external finance sources. It is obvious that sometimes there are considerable deviations from the average value in the given business branch as a whole. A greater use of external finance sources is evident only in building and services. In building, the lowest willingness is in the category where companies are close to potential problems, as they report efficiency lower than the non-risk interest rate, but they still make profit. This feature is apparent in all business branches and in all branches of Category III. The average value of D/E in Category III is always lower, which leads to smaller use of external finance sources. In Category IV we may not speak of capital structure management—it is rather an effort to ensure any financal means. If we disregard Category IV, then the greatest willingness to use external finance sources is apparent in Category II. Based on this, we could conclude that only in companies that do not consider creating the profit as sufficient from the view of possibility of total financing and that are interested in development of the company, then here the willingness to use external sources grows. Nevertheless, the first hypothesis—that from the view of the structure of finance sources, the use of internal finance sources predominates in the Czech Republic, regardless the economic performance in individual business branches—is verified in three out of five monitored business branches. The hypothesis is declined for building and it cannot be clearly verified for services in Categories II and IV.

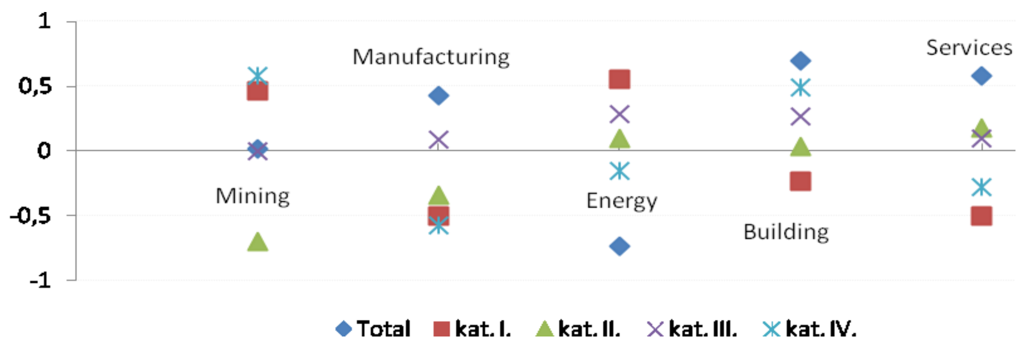
Another hypothesis focused on the relation of profitability, measured by ROE, and the use of external finance sources, measured by D/E ratio. It was to verify the hypothesis that the increase in the use of external finance sources does not cause the increase in efficiency measured by the return on equity. In order to verify the hypothesis, the result would have to be a negative correlation between the return on equity and D/E ratio. The results are summed up in the following figure.

Figure 7: Correlation of return on equity and debt/equity ratio in branches as wholes and in branches according to their economic performance



A negative correlation may be verified only in Category I of the processing industry and in Category II of mining. In Category I of services the relation is almost uncorrelated. Other negative results are connected with Category IV where we have already stated that growth of external sources is caused by insufficient creation of profit and thus, the result is a natural consequence. In other categories of other business branches, positive correlation was reported, which means that the hypothesis formulated by static trade-off theories had been verified—when the use of external finance sources grows, so does the return on equity. The last hypothesis dealt with in the paper was the fact that the total economic situation and the return on equity affect the use of external finance sources. The situation is shown in Figure 8.

Figure 8: Correlation of debt/equity ratio and GDP in branches as wholes and in branches according to their economic performance



The situation for this hypothesis is not clear either. From the view of branches as wholes, a positively correlated relation is reported in two largest business branches – processing industry and in services, just as in building. In this context we might claim that when the situation in the economy improves, the willigness to use external finance sources grows, too.

However, in most groups monitored, the relation is not correlated to a greater extent (the value of correlation coefficient is below 0.5), but it comes close to an uncorrelated relation or a relation with negative correlation. The most considerable is the second group of mining and power engineering as a whole. Profitability has been discussed above and, as it has been said, efficiency may not be clearly considered as a factor for decision-making about the use of external finance sources.

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Project risk management as the part of the enterprise risk management

Daniela Rybárová [1]

Abstract

Management of risk is an integral part of good management. It is an iterative process that is best embedded into existing practices or business processes. Risk management can be applied to an entire organization, at its many areas and levels, at any time, as well as to specific functions, projects and activities. Risk management process should be applied at many levels in an organization. It should be applied at a strategic level and at tactical and operational levels. It should be applied to specific projects, to assist with specific decisions or to manage specific recognized risk areas.

Key words

Project Risk Management, Enterprise Risk Management, Risk Identifications, Risk Analysis, Risk Evaluation, logical framework matrix, failure mode effect analysis

JEL Classification: D02, G31

1 Manažment rizika ako základ dobrého riadenia

Manažment rizika je procesom trvalého zlepšovania cieľovo orientovaného riadenia podniku. Za podmienky kontinuálneho uplatňovania, umožňuje skvalitňovanie rozhodnutí a zlepšovanie podnikových výsledkov. Napriek tomu, je riadenie rizík v určitej miere empirická záležitosť závislá od skúseností, vedomostí a vnímania rizika jednotlivcami tímu. Preto sa musí manažment rizika premietnuť aj do podnikovej kultúry a ovplyvniť presvedčenie, hodnoty a správanie sa všetkých zainteresovaných strán. Význam zavedenia efektívneho riadenia rizík v podniku je predovšetkým v tom, že umožňuje:

- tvorbu kvalitnejšej základne pre určenie stratégie,
- redukciu šokov a nepríjemných prekvapení,
- zvýšenie pravdepodobnosti dosahovania cieľov podniku,
- získanie výhody prvého kroku rýchlejším prispôsobením sa okolnostiam,
- redukciu času manažmentu venovaného „haseniu požiarov“,
- koncentráciu na vykonávanie správnych vecí správnym spôsobom,
- rýchlejší prienik do nových oblastí podnikania,
- zvýšenie možnosti dosahovania navrhovaných zmien,
- získanie konkurenčnej výhody.

Manažment rizika nemá v podniku postavenie samostatného riadiaceho systému, ale stáva sa **integrálnou súčasťou dobrého riadenia**. Zavedenie celopodnikového manažmentu rizika vyžaduje vytvorenie vhodnej kombinácie podnikovej politiky, stratégie, kultúry procesov a štruktúr, ktoré budú spoločne zamerané na zabránenie vzniku alebo obmedzenie veľkosti strát a súčasne realizáciu potenciálnych príležitosti. To umožní účinnú aplikáciu riadenia rizík v celom podniku. Úspešnosť riadenia rizík je determinovaná rozsahom podpory zo

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strany vedenia podniku, rozsahom pridelených zdrojov a rozsahom povedomia o riziku. Vedenie podniku musí aktívne podporovať implementáciu a rozvoj riadenia rizík v podniku, pričom všetci pracovníci nesú zodpovednosť za riadenie rizík v oblastiach spadajúcich pod ich kontrolu.

Účinnosť manažmentu rizika sa zabezpečuje systematickým aplikovaním politík, praktík a prostriedkov k odhadu a kontrole rizika sústreďujúc sa na zabezpečenie kontinuity podniku predovšetkým orientáciou na dosahovanie cieľov podniku bez ohľadu na náročnosť podmienok v budúcnosti. Komplexné odporúčania pre dosiahnutie účinnosti riadenia rizík vo forme princípov (zásad) v zmysle najnovších poznatkov v oblasti riadenia rizík a praktických skúseností široko koncipovaného odborného tímu sa nachádzajú v norme ISO 31000:2009. Norma zdôrazňuje požiadavku na zavedenie manažmentu rizika pre všetky činnosti podniku a do všetkých rozhodovacích procesov. Vyžaduje celopodnikové riadenie rizík, na rozdiel od napr. Normy STN 01 0380 Manažérstvo rizika, ktorá odporúča zaviesť riadenie rizika aspoň v niektorých oblastiach, napr. samostatne pre projekty. Skúsenosti však ukazujú, že uvedené riešenie nie je dostatočne účinné. Dôvodom je, že ak má podnik pracovať ako systém, musí byť ako systém riadený. Každá časť celku má svoje funkcie a úlohy v systéme a význam žiadnej súčasti nemôže podceňovaný alebo preceňovaný.

2 Špecifiká manažmentu rizika projektov

Základom zvládnutia riadenia rizika investičných projektov je pochopenie podstaty projektu, investícií a projektového cyklu investičných projektov. Projekty možno charakterizovať ako **unikátny, jedinečný a časovo ohraničený súbor činností, ktoré sa odlišujú od rutinných činností svojim obsahom, cieľom a rizikom.** Riziko je teda vlastne jedným z rozmerov projektov. **Investície sú charakterizované kapitálovými výdavkami,** ktorých návratnosť závisí na budúcich „stavoch sveta" a schopnosti podniku dosiahnuť plánované efekty v budúcnosti. Základom hodnotenia investície sú očakávané peňažné toky odhadnuté na niekoľko rokov dopredu, čo zvyšuje možnosť odchýlok od plánovaných zámerov. Rešpektovanie rizika je základom investičného rozhodovania. Pre všetky investičné projekty platí, že investície musia priniesť väčší efekt, ako sú výdavky s nimi spojené. Podniky, ktoré investujú, musia obetovať súčasnú spotrebu v prospech budúcej, očakávajú zvýšenie príjmov v budúcnosti. Úspešnosť projektu teda nezávisí len od úspešného priebehu realizácie investície, ale aj od schopnosti podniku čo najvhodnejšie využívať aktíva získané investíciou po uvedení do prevádzky.

Príprava a realizácia investičných projektov predstavujú určitý časový úsek, na ktorého začiatku je identifikácia základnej myšlienky projektu a jej postupné spracovávanie až do podoby hotového projektu, na základe ktorého je možné uskutočniť samotnú investíciu. Tým celý proces nekončí, ale pokračuje realizáciou investície, jej uvedením do prevádzky a samotnou prevádzkou, ktorá má priniesť požadované efekty až po likvidáciu investíciou obstaraných aktív, resp. pomyselnú likvidáciu podľa dĺžky hodnoteného obdobia (ak sa investíciou obstarali budovy, ktoré po ukončení hodnoteného obdobia sa budú v podniku ďalej používať). Tento časový úsek sa nazýva **projektový cyklus**. Je rozdelený na etapy, ktoré určujú súbor činností, nástrojov a techník na realizáciu jednotlivých procesov v projekte. Úspešný projekt musí absolvovať všetky etapy projektového cyklu, čo možno dosiahnuť skúseným riadením počas celej jeho životnosti.

Riziko projektov sa posudzuje (formou celého procesu manažmentu rizika) vo všetkých fázach životného cyklu. Rozsah a forma požadovaných výstupov z posúdenia rizika závisí od účelu a charakteru rozhodnutí, s cieľom pomôcť pri rozhodovaní v každej fáze životného cyklu.

2.1 Úlohy manažmentu rizika v jednotlivých etapách životného cyklu:

a) Vo fáze tvorby projektov (predinvestičná etapa) :

- posúdenie prípustnosti rizík projektu;
- vylepšenie návrhu a procesu vývoja z pohľadu ako negatívnych tak pozitívnych dôsledkov rizika;
- identifikáciu rizík, ktoré majú vplyv na ciele projektu v ďalších fázach životného cyklu;
- zreálnenie očakávaní a tvorby cieľov, ak napríklad očakávania nie je možné z pohľadu charakteru a závažnosti rizík dosiahnuť, nie je vhodné pokračovať s vysoko nastavenými cieľmi a vykonávať nákladné opatrenia na ich dosiahnutie, je potrebné prispôsobiť ciele a posúdiť, či daný vývoj je akceptovateľný.

b) Vo fáze realizácie (investičná a prevádzková etapa) manažment rizík má za cieľ znížiť prekvapenia a zvýšiť pravdepodobnosť dosiahnutia cieľov, čo vyžaduje:

- posudzovanie rizika s ohľadom na zmenu predpokladov, výskyt nových udalostí, situácií a okolnosti majúcich dopad na ciele vzhľadom na skutočnosti, ktoré boli brané do úvahy pri posudzovaní rizík vo fáze tvorby;
- tvorbu postupov a usmernení umožňujúcich znižovať pravdepodobnosť vzniku rizika alebo zmierňovať dopad rizika, ak jeho vznik nie je možné ovplyvniť;
- nastavenie monitorovacích systémov a kontrolných mechanizmov;
- tvorbu postupov pre núdzové podmienky.

Stanovenie rizík v základných rysoch prebieha už pri výbere projektov pred ich detailným spracovaním. Slúži ako základ pre rozhodovanie o začatí prác na projekte, o organizačnej úrovni pre schvaľovanie projektu, o stanovení projektového tímu a zodpovedných pracovníkov pre daný projekt. Súhlas predstavuje začiatok prípravy projektu. Z pohľadu manažmentu rizík je potrebné identifikovať riziká každej etapy projektového cyklu už v etape tvorby projektu. Ich odhad a premietnutie do hodnotenia je zložitý proces, ktorý podstatnou mierou ovplyvňuje rozhodnutie o prijateľnosti projektu vo fáze schvaľovania a zároveň vytvára bázu pre riadenie rizika projektu v etape investičnej a prevádzkovej.

2.2 Identifikácia rizík projektu

Posúdenie prípustnosti rizika vo fáze tvorby projektov si vyžaduje vymedzenie projektu z hľadiska času, cieľov a vzťahov, čo sú dôležité parametre pre identifikáciu, následne pre analýzu a hodnotenie rizika (v príspevku sú rozoberané len dané etapy procesu manažmentu rizika, čo samozrejme neznižuje význam a potrebnosť všetkých etáp procesu riadenia rizík). Identifikácia rizík spočíva v hľadaní, vymedzení, kategorizácii a popísaní rizík, ktoré môžu ovplyvniť projekt. Pričom je rovnako potrebné zohľadniť aj vzájomnú závislosť zdokumentovaných rizík, ktorá podstatnou mierou ovplyvňuje pravdepodobnosť ich vzniku a závažnosť ich dopadu. Predpokladom komplexnosti identifikácie je systémový prístup.

Identifikácia rizík je procesom určovania zdrojov rizika a náhodných, neplánovaných udalostí, či faktorov vzhľadom k aktivitám, výsledkom a cieľom projektu, ktoré môžu ovplyvniť projekt negatívne alebo pozitívne. Na identifikáciu a popis vývoja rizík sa využívajú predovšetkým expertné metódy zamerané na získanie verbálneho odhadu rizík projektu. Metódy by mali umožniť zmapovať všetky oblasti zdrojov rizika projektu, aby nedošlo len k náhodným výberom rizík s vylúčením určitých oblastí, ktoré by zostali nespracované. Presné určenie metód, ktoré slúžia na identifikáciu a ktoré až na následnú analýzu rizika však nie je úplne jednoznačné a líši sa v závislosti od autora zaoberajúceho sa problematikou hodnotenia rizika, od účelu a tiež rozsahu, v akom sa metódy použijú. Pri výbere metód identifikácie a analýzy rizika je dôležitá rovnaká línia informácií. Najčastejšie vopred vybrané metódy analýzy determinujú aj metódy identifikácie, ich obsah, rozsah a štruktúru potrebných informácií, resp. sú využívané komplexné metódy umožňujúce skĺbiť etapy identifikácie, analýzy a hodnotenia.

Na identifikáciu zdrojov rizík je možné použiť **metódu Delphi, brainstorming (burza nápadov), rozhovory, poučenie z historických projektov,** pričom tieto metódy sú využívané ako základ pre ďalšie metódy. Napríklad pomocou brainstormingu sa realizuje **What if Analysis (ktorá môže pripravovať** podklady napr. pre metódy logický rámec, analýzu stromu udalostí), **SWOT analýza (SWOT analýza má široké použitie, môže byť vygenerovaná ako východisko už vo fáze súvislosti, môže byť zoznamom interných a externých rizík, a ohodnotením ich významnosti a rovnako môže byť metódou analýzy)** a pod. Poučenie z historických projektov sa stáva východiskom **Analýzy kontrolným zoznamom (Checklist Analysis).** Účelom kontrolného zoznamu je predovšetkým porovnanie projektu so štandardnými projektovými a prevádzkovými postupmi. Pre rozdelenie rizík projektu vzhľadom k životnému cyklu je vhodné použiť napr. **logický rámec** projektu, ktorý sa používa predovšetkým pri projektoch financovaných zo štrukturálnych fondov. Zdrojmi rizika v etape realizácie investície sú predovšetkým čas, rozpočet a dosiahnutie požadovaného účelu projektu. V prevádzkovej etape, po uvedení investície do prevádzky sú to predovšetkým dosiahnutie plánovaných výnosov a udržanie prevádzkových nákladov. To sú len základné okruhy zdrojov, ktoré je možné ďalej rozanalyzovať napr. pomocou metódy stromu problémov, alebo task analýzy[2]. Priradenie udalostí k jednotlivým zdrojom, ktoré môžu aktivizovať zdroje rizika je možné pomocou stromu udalostí, kde je možné zohľadniť aj existujúce kontrolne mechanizmy. Úlohou nie je použitie všetkých metód, ale ich vhodný výber a zoskupenie podľa logickej nadväznosti s ohľadom na požadovaný cieľ.

2.3 Analýza rizika projektu

Analýza rizika začína **zmapovaním existujúcich opatrení** na ošetrenie identifikovaných rizík a následne v kontexte s existujúcimi opatreniami sa stanovujú pravdepodobnosti, že identifikované riziká nastanú a ich následky. Analýza by mala zahrňovať celý rozsah pravdepodobností a potenciálnych následkov. Vynásobením pravdepodobnosti a príslušného následku sa získa **úroveň (miera) jednotlivých rizík.**

Použitím rôznych typov analýz sa rozširuje poznanie rizík a vytvárajú sa kvalitné podklady pre rozhodovanie o ošetrení rizík, a výbere najvhodnejších a nákladovo primeraných foriem ošetrenia rizík. Podrobnosť analýzy závisí od rizika, účelu analýzy a od informácií, dát a zdrojov, ktoré sú k dispozícií.

Kvalitatívna analýza používa na opis veľkosti potenciálnych následky a pravdepodobnosti nastatia dôsledkov slovné hodnotenie. Slovná stupnica môže byť upravená tak, aby vyhovovala okolnostiam. Na maticové zobrazenie rizika sa využíva metóda univerzálnej matice **Matica následkov a pravdepodobnosti (Consequence/probability matrix).** Určujúcim prvkom pre umiestnenie rizika do matice rizík je odhadovaný dopad rizika na projekt a jeho pravdepodobnosť. Pohľad na konkrétne predpokladané riziko v matici rizík poskytuje obraz o prijateľnosti či neprijateľnosti uvedeného rizika a umožní porovnanie jednotlivých rizík. Jednu z podôb matice popisuje aj norma STN Manažérstvo rizika s naznačením spôsobu nakladania s rizikami, ktoré sa nachádzajú vo vymedzených poliach matice. **Výhodou** je graficky prehľadné umiestnenie rizík, z ktorého je jednoznačne identifikovateľná závažnosť každého rizika pre všetky zúčastnené strany. **Nevýhodou** je, že

[2] Metódy sú rozpracované v Rybárová, D., Grisáková, N.. Podnikateľské riziko. Bratislava : IURA EDITIN, 2010. 63 – 87 s. ISBN 978-80-8078-377-8

jednoduchosť a subjektívny charakter metódy môže viesť k povrchnému, formálnemu prístupu k tvorbe danej matice.

Semikvantitatívna analýza nahradzuje slovné hodnotenia využívané v kvalitatívnej analýze číselnými hodnotami. Cieľom je rozšíriť možnosti a rozsah hodnotenia v porovnaní s kvalitatívnou analýzou, nie však vyčísliť reálne hodnoty, ako to je v prípade kvantitatívnej analýzy. Keďže však čísla pridelené každému opísanému riziku sa nevzťahujú na reálnu hodnotu, t.j. nevyjadrujú skutočnú veľkosť následkov alebo pravdepodobnosti, je potrebné ich používať len spôsobom zohľadňujúcim obmedzenia daného typu meradla. Semikvantitatívna analýza menej náročná ako kvantitatívna. Na druhej strane pridelené čísla nemusia správne odrážať skutočný význam rizika, môžu viesť k rozporu, nezrovnalosti alebo nevhodným výsledkom. Analýza nie vždy vedie k správnemu rozlíšeniu závažnosti rizík, predovšetkým v prípade vysokých následkov alebo pravdepodobnosti. **Metóda FMEA** (Failure Modes and Effects Analysis - Analýza možných chýb a dôsledkov) je jedným z prvých systematických postupov, pomáha identifikovať, analyzovať a určiť priority možných dôvodov zlyhania rôznych procesov s cieľom ohodnotiť riziká spojené s dôvodmi zlyhania a riziká spojené s následkami zlyhania. V súčasnosti je táto metodika rozšírená hlavne v oblasti kvality, kde umožňuje vyhľadávať potenciálne chyby pri navrhovaní a výrobe výrobkov a uskutočňovať prevenciu vzniku týchto chýb, rovnako je dobra využiteľná pre projekty (Rybárová, Grisáková, 2010).

Kvantitatívna analýza používa pre následky a pravdepodobnosti číselné hodnoty na základe reálnych údajov z rôznych zdrojov napr. plány, rozpočty, projekty. Kvalita analýzy závisí na presnosti a úplnosti číselných hodnôt a vhodnosti použitých modelov. Dôsledky môžu byť stanovené prostredníctvom modelovania výsledkov náhodných udalosti, či súboru udalostí, alebo extrapoláciou dát z experimentálnych štúdií alebo dát z minulosti. Spôsob vyjadrenia dôsledkov závisí od kategórie rizika a rizikových kritérií. Pre kvantitatívnu analýzu je vhodné využiť (Doležal, J., Máchal, P. Lacko, B. a kol., 2012) aj metódu RIPRAN (Risk Project Analysis)[3], ktorá slúži nielen na analýzu, ale aj na identifikáciu a tiež následné kroky procesu riadenia rizika. Môže byť použitá aj na kvalitatívnu analýzu, závisí od formy určenia pravdepodobnosti vzniku a veľkosti dopadu rizika na projekt[4].

V niektorých prípadoch je nedostatočné určiť dôsledok jedným číslom, ale je potrebné stanoviť dôsledky pre rôzny čas, miesta, skupiny alebo situácie. Spôsoby vyjadrenia dôsledkov a pravdepodobností sa budú líšiť v závislosti od druhu rizika a účelu hodnotenia, pre ktoré bude výstup použitý. Riziko sa vyjadruje v peňažných jednotkách a je súčinom výšky dopadu a jeho pravdepodobnosti. Dopad vyčíslený v peňažných jednotkách, najčastejšie predstavuje veľkosť straty vzhľadom k plánovaným výsledkom projektu. Na projekt pôsobí viac vplyvov v závislosti od množstva zdrojov rizík Preto nie je možné celkové riziko projektu počítať len ako súčin jednej hodnoty dopadu a pravdepodobnosti. **Pre využitie v projektoch možno odporučiť identifikované riziká kvantifikovať pomocou pravdepodobnosti a dopadu pre každý rok, započítať do nákladov príslušnú výšku rizika pre príslušné obdobie a vypočítať požadované kritéria hodnotenia projektu (čistú súčasnú hodnotu - NPV).** Pri diskontovaní sa však už používa sadzba diskontného faktora pre bezrizikové investície, pretože riziko je vyjadrené iným spôsobom. Vstupom pre danú analýzu môžu byť údaje získané s analýzy stromu udalostí zostaveného s ohľadom na životný

[3] RIPRAN je ochranná známka registrovaná Úřadem průmyslového vlastnictví Praha

[4] Viac k danej metóde, ako aj k ďalším metódam popisuje Lacko, B. (2012). Riziká a príležitosti. In. Doležal, J., Máchal, P. Lacko, B. a kol., (2012). *Projektový management podle IPMA*. Praha: Grada Publishing, 2012, str. 83-109. ISBN 987-80-247-4275-5

cyklus projektu. Vygenerovaná čistá súčasná hodnota je základom hodnotenia prijateľnosti či neprijateľnosti rizika projektu. **Nevýhodou** je rozsah potrebných odhadov na niekoľko rokov dopredu. S rastom položiek sa zvyšuje riziko skreslenia výsledku, avšak ich umelé znižovanie vedie k podceneniu skutočného rizika. Tu by sme odporučili vypracovať podrobný predpis započítavania dopadu a stanovovania pravdepodobnosti s vopred vymedzenými oblasťami hodnotenia rizika, s možnosťou doplnenia špecifických oblastí vyplývajúcich z originálnych prvkov každého projektu.

2.4 Hodnotenie rizika projektu

Hodnotenie rizika a jeho vplyvu na výnosnosť projektu poskytuje podklady pre investičné rozhodovanie. Samotné rozhodnutie o prijateľnosti či neprijateľnosti projektu závisí teda od nastavených limitov a tolerancií, od kapitálovej náročnosti projektu, od vplyvu projektu na celkovú podnikateľskú činnosť a likviditu podniku, ako aj výnosnosti a dôležitosti projektu pre rozvoj podniku. Ani rizikový projekt nemusí byť zamietnutý. **Závisí od možností podniku riadiť riziko projektu počas celej doby životnosti.**

Výsledkom hodnotenia rizika podnikateľských projektov je posúdenie ich prijateľnosti identifikovaného a analyzovaného rizika. Vo všeobecne je riziko podnikateľského projektu prijateľné, ak pravdepodobnosť dosiahnutia požadovaných efektov je vyššia ako pravdepodobnosť ich nedosiahnutia, pričom je potrebné brať do úvahy aj pravdepodobnosť straty a jej maximálnu výšku.

Základné predpoklady prijateľnosti rizika bez ohľadu na špecifické podmienky sú:

- rovnaké ciele alebo efekty podnikateľského projektu nemožno dosiahnuť iným projektom porovnateľným s hodnoteným projektom z hľadiska zdrojov, ktorého riziko je nižšie (nízko rizikový projekt potrebuje väčšinou oveľa viac zdrojov)
- príprava a realizácia podnikateľského projektu je v súlade s požiadavkami právnych predpisov, ekologických aspektov (každý projekt, ktorý porušuje platnú legislatívu, je neprijateľný)
- realizácia podnikateľského projektu neohrozuje ľudské životy a zdravie.

Pri posudzovaní rizika projektu je potrebné zobrať do úvahy aj charakteristiky podniku. Predovšetkým pomer objemu zdrojov potrebných na realizáciu projektu k celkovými zdrojmi podniku. Ak prípadný neúspech projektu by mohol ovplyvniť nepriaznivo celý podnik, je riziko podnikateľského projektu neprijateľné.

3 Záver

Metódy používané v projektovom risk manažmente sú metódy, ktoré sú využívané v rôznych oblastiach manažmentu a je potrebné ich prispôsobiť potrebám identifikácie a analýzy. Neprispôsobené alebo nevhodné upravené metódy negenerujú potrebné informácie pre jednotlivé etapy procesu manažmentu rizika. Efektívnosť procesu manažmentu rizika závisí od výberu súboru metód a ich logického usporiadania s ohľadom na požadovaný rozsah informácií umožňujúcich širší pohľad na riziko projektu. Metódy by mali umožniť zmapovať všetky oblasti zdrojov rizika projektu, aby nedošlo len k náhodným výberom rizík s vylúčením určitých oblastí, ktoré by zostali nespracované. Presné určenie metód, ktoré slúžia na identifikáciu a ktoré až na následnú analýzu rizika však nie je úplne jednoznačné a líši sa v závislosti od autora zaoberajúceho sa problematikou hodnotenia rizika, od účelu a tiež prostredia, kde sa metódy používajú. Pri výbere metód identifikácie a analýzy rizika je dôležitá **rovnaká línia informácií**.

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Estimation of the cost and profit efficiency of the Slovak banking sector

Iveta Řepková[1]

Abstract

The paper estimates the cost and profit efficiency of the Slovak banking sector during the period 2003–2012. The paper employs the parametric approach, in particular the Stochastic Frontier Approach, to estimate the cost and profit efficiency of individual banks in the Slovakia. The analysis is based on data banks representing almost 80 percent of the total banking assets in the Slovak banking sector. We obtained data from BankScope database and annual reports of 12 Slovak banks. The average cost and profit efficiency was decreasing in the Slovak banking sector during the analyzed period. Estimates of the average cost efficiency ranged the value 29–92% and the average profit efficiency ranged from 56–93%.

Key words

Cost efficiency, profit efficiency, Stochastic Frontier Approach, Slovak banking sector

JEL Classification: G21, C51

1. Introduction

The Slovakia's financial system is bank-based and banks play an important role in the economy. The analysis of efficiency in industry with so many important development milestones is of high interest. Furthermore Berger and Mester (1997) mentioned that the analysis of the banking efficiency is important topic both from a microeconomic and a macroeconomic perspective. From a microeconomic perspective, the efficiency of banks is important because of the increase in competition due to the entering of foreign banks and the improvement of the institutional framework, of regulation and supervision. From a macroeconomic perspective, the efficiency of the banking system influences the cost of financial intermediation and the stability of the entire financial system. An improvement of the performance of banks indicates a better allocation of financial resources and, thus, an increase in the investments favoring economic growth. It gives me a high motivation to study this topic.

In empirical literature the two general approaches are used to assess efficiency of an entity, parametric and non-parametric methods, which employ different techniques to envelop a data set with different assumptions for random noise and for the structure of the production technology. The nonparametric methods are Data Envelopment Analysis (DEA) and Free Disposal Hull, which are based on linear programming tools. The parametric methods most widely used in empirical estimations are Stochastic Frontier Approach (SFA), Distribution Free Approach and Thick Frontier Approach.

The aim of the paper is to estimate the cost and profit efficiency in the Slovak banking sector during the period 2003–2012. For the practical estimation we applied the parametric method, especially the Stochastic Frontier Approach. We use the cost and profit efficiency

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function to estimate the cost and profit efficiency in the banking industry. The paper is organized as follows. Literature review is in Section 2, Section 3 presents methodology and data. Empirical analysis is reported in Section 4. Finally, section 5 concludes this paper.

2. Literature review

Empirical analyses of banking efficiency which included the Slovak banking sector exist several. We mention some of them. Some empirical studies (e.g. Košak and Zajc, 2006; Yildirim and Philippatos, 2007; Bems and Sorsa, 2008; Matoušek, 2008; Mamatzakis, et al., 2008) examined the banking efficiency in several European countries and Slovak banking sector was included in panel data.

Grigorian and Manole (2006), Bonin, et al. (2005) or Fries and Taci (2005) estimated banking efficiency in 1990s and they investigated the impact of bank privatization. The result indicated that private banks were more efficient than state-owned banks, but there were differences among private banks. Privatised banks with majority foreign ownership were more efficient than those with domestic ownership. Rossi, et al. (2004) estimated average cost efficiency 0.67 in the period 1995–2002, while profit efficiency was 0.47. The banking systems of Slovakia showed significant levels of cost and profit inefficiency, indicating that on average banks operate far above (below) from the cost (profit) efficient frontiers. But they found that cost efficiency increased between 1995 and 2002.

Stavárek and Polouček (2004) estimated efficiency and profitability in the selected banking sectors, including Slovakia. They found that Central European Countries are less efficient than their counterparts in the European Union member countries. Their conclusion is the refutation of the conventional wisdom of higher efficiency from foreign-owned banks than from domestic-owned banks, and size is one of the factors that determine efficiency. To achieve high efficiency, a bank should be large, well known, and easily accessible and offering a wide range of products and services, or if small, must focus on specific market segments, offering special products. Any other structure of a bank leads to lower relative efficiency.

Stavárek (2005) examined the increasing value of the efficiency of the Slovak banking sector during the period 1999–2003, but they also found that Slovak banking sector was lower efficient banking sector than other Visegrad countries. The Slovakia’s banking sector was recognized as the less efficient one. Vincova (2006), who applied the Data Envelopment Analysis to estimate banking efficiency in Slovakia during the period 2000–2004, found that the average efficiency slightly decreased and the number of efficient bank also decreased. Iršová and Havránek (2011) estimated banking efficiency in five countries of Central and Eastern Europe including Slovakia. In Slovakia the results showed that the average cost efficiency was 51.8% and profit efficiency reached 43.2% in the years 1995–2006.

Baruník and Soták (2010) estimated the influence of different ownership forms on efficiency of Czech and Slovak banks using stochastic frontier approach during the period 1996–2005. They found that the foreign-owned banks were bit more cost efficient than domestic private banks, state-owned banks were significantly less cost efficient when compared to domestic private banks. Anayiotos, et al. (2010) estimated relative efficiency of banks in emerging Europe before the recent boom, just before the crisis and right after the crisis using the Data Envelopment Analysis. Their results suggested that the banking efficiency in Slovakia decreased during the pre-crisis boom and also fell during the crisis. They found the significant decreased in efficiency during the period 2004–2009.

Mentioned studies examined efficiency in several banking sector, on contrast Stavárek and Šulganová (2009) estimated banking efficiency in Slovakia. They applied the parametric Stochastic Frontier Approach and Cobb–Douglas production function on commercial banks in the period 2001–2005 and found that the average efficiency increased and their results point out a better ability of Slovak banks to use the inputs in the production process.

The empirical literature review concluded that only few studies examined the Slovak banking sector individually. Most of the empirical studies research several banking sector which included Slovakia and the second findings is that the most studies examined banking efficiency during 1990s. Thus, the literature review shows the motivation for this paper. This paper could fill the gap following time line in the empirical literature.

3. Methodology and data

The stochastic frontier approach originated with two papers Meeusen and Van Den Broeck (1977) and Aigner, et al. (1977), which were published nearly simultaneously. Both papers are themselves very similar and they appeared shortly before a third SFA paper by Battese and Corra (1977). The SFA approach is one of the structural approaches to study efficiency. It is based on the economics of cost minimization or profit maximization by banks, and thus starts with a standard cost or profit function with factors of input, output, and their respective prices. It estimates the minimal cost or maximum profit based on these functions, and generates distance of its cost or profit to the frontier value. The SFA approach treats the observed inefficiency of a bank as a combination of the inefficiency specific to the bank and a random error, and tries to disentangle the two components by making explicit assumptions about the underlying inefficiency process. The parametric approach has the advantage of allowing noise in the measurement of inefficiency. However, the approach needs to specify the functional form for cost or profit.

3.1 Cost efficiency

Cost efficiency measures the performance of banks relative to the best-practice banks that produces the same output under the same exogenous conditions. Cost efficiency function is based on a cost equation that relates a bank's cost to variables that incur those expenses, such as output levels and input prices. The cost equation contains a composite error structure that distinguishes random cost fluctuations from cost inefficiencies. To put it simply, the cost function describes the relationship between the cost with quantities of output and input variables plus the inefficiency and random error. The following cost equation:

$$C_{it} = f(y_{it}, w_{it}, z_{it}) + \varepsilon_{it}, \qquad (1)$$

where C_{it} measures the total costs of a bank *i* incurs at time *t*, including operating and financial costs, y_{it} is a vector of outputs, w_{it} is a vector of input prices, z_{it} represents the quantities of fixed bank parameters, such as physical capital and equity and ε_{it} is the error term. The error term ε_{it} is composed of two parts:

$$\varepsilon_{it} = \mu_i + v_{it}, \qquad (2)$$

where μ_i represents the inefficiency term that captures the difference between the efficient level of cost for given output levels and input prices and the actual level of cost and v_{it} is the random error. More specifically μ_i and v_{it} are assumed to follow the following distributions:

$$\mu_i \sim N^+(0, \sigma_\mu^2), \qquad (3)$$

$$v_{it} \sim N^{+}(0, \sigma_v^2). \tag{4}$$

We assume μ_i follows a half-normal distribution. Alternatively, μ_i can be modelled to follow a truncated normal distribution or exponential distribution so that it can only take non negative values. It measures the difference of bank's *i* cost compared with that of the frontier $f(y_{it}, w_{it}, z_{it})$.

The cost efficiency of the bank can be written in a natural logarithm form as follows:

$$\ln TC = \ln f(y, w, z) + \ln u_t - \ln v_t, \tag{5}$$

where f denotes a functional form.

After estimating a particular cost function, the cost efficiency for bank *i* is measured as the ratio between the minimum cost ($C_{\min}$) necessary to produce that bank's output and the actual cost (C_i):

$$CE_i = \frac{C_{\min}}{C_i} = \frac{\exp[f(y,w,z)]x\exp(\ln u_{\min})}{\exp[f(y,w,z)]x\exp(\ln u_i)} = \frac{u_{\min}}{u_i}, \tag{6}$$

where u_{min} is the minimum u_i across all banks in the sample. Under this formulation, an efficiency score of 0.95 for example, implies that the bank would have incurred only 95 percent of its actual costs had it operated in the frontier.

3.2 Profit efficiency

Despite the wide agreement on the relevance of profit efficiency analysis, the technical difficulties with the measurement and decomposition of profit inefficiency were the main reasons for the small number of empirical studies on banking profit efficiency. Unlike the cost function, the profit function has an additive structure implying that the Shephard type distance functions, which are radial, are not the appropriate dual model of technology (Fare and Grosskopf, 2000). The profit frontier is derived as follows:

$$P = f(y, w, z) + u + v, \tag{7}$$

where *P* measures the profit of a bank, including both interest and fee income, less total costs of a bank, *y* is a vector of outputs, *w* is a vector of input prices, *z* represents the quantities of fixed bank parameters, *u* is the inefficiency term that captures the difference between the efficient level of cost for given output levels and input prices and the actual level of cost, and *v* is the random error term.

The profit function of the bank can be written in a natural logarithm form as follows:

$$\ln P = f(y, w, z) + \ln u_t - \ln v_t. \tag{8}$$

where *f* denotes a functional form. Profit efficiency is measured by the ratio between the actual profit of a bank and the maximum possible profit that is achievable by the most efficient bank.

$$PE_i = \frac{P_i}{P_{\max}} = \frac{\exp[f(y,w,z)]x\exp(\ln u_i)}{\exp[f(y,w,z)]x\exp(\ln u_{\max})}, \tag{9}$$

where u_{max} is the maximum u_i across all banks in the sample. For example, if the profit efficiency score of a bank is 90%, it means that the bank is losing about 10% of its potential profits to managerial failure in choosing optimum output quantities and input prices.

3.3 Data and selection of variables

The data set used in this study was obtained from the annual reports of commercial banks for the period 2003–2012. All the data is reported on unconsolidated basis. The data set consists of data of banks that represent almost 80% of the assets of the Slovak banking sector. We analyzed only commercial banks that are operating as independent legal entities due to the homogeneity of the data set. All foreign branches, building societies, specialized banks or credit unions were excluded from the estimation data set.

In order to conduct SFA estimation, inputs and outputs need to be defined. In the literature in the field, there is no consensus regarding the inputs and outputs that have to be used in the analysis of the efficiency of the activity of commercial banks (Berger and Humphrey, 1997). In empirical literature four main approaches (intermediation, production, asset and profit approach) have been developed to define the input-output relationship in financial institution behaviour. The intermediation approach is considered relevant for banking industry, where the largest share of activity consists of transforming the attracted funds into loans. We adopt intermediation approach which assumes that banks' main aim is to transform deposits into loans. Consistently with this approach, we assume that banks use the two inputs and produce two outputs.

Total costs are the sum of the interest cost and operation cost. Total profit is the sum of interest income and fee income. We employed two inputs (labor and deposits), and two outputs (loans and net interest income). We measure price of labor (w_j) as a ratio of personnel expenses to number of employees, and price a deposits (w_h) as a ratio of annual interest expenses to total deposits. Loans (y_l) are measured by the net value of loans to customers and other financial institutions and net interest income (y_m) as the difference between interest incomes and interest expenses. Descriptive statistics of variables is presented in Table 1.

Table 1: Descriptive statistic of variables

	TC	P	w_j	w_h	y_l	y_m	Z
Mean	157.86	226.99	0.1323	0.8872	1972.73	112.99	315.48
Median	77.91	106.68	0.0265	0.0242	1051.50	42.27	127.00
Min	7.70	7.10	0.0113	0.0079	17.60	3.40	0.50
Max	499.10	876.93	0.7750	53.8260	7266.50	465.70	1245.08
St.Dev.	142.42	224.83	0.2305	5.7420	1971.74	122.43	327.83

The functional form of the stochastic frontier was determined by testing the adequacy of the Cobb Douglas relative to the less restrictive translog. As e.g. Berger and Mester (2003), Munyama (1997), Lang and Welzel (1996) or Fiorentino, et al. (2006), we normalize dependent variable (cost or profit) with all output quantities y by equity capital Z to account for heterogeneity. The frontier models estimated are defined as:

$$\ln\left(\frac{TC}{Z}\right)_{it} = \alpha_1 + \sum_{l=1}^{2}\beta_l \ln\frac{y_l}{Z} + \frac{1}{2}\sum_{l=1}^{2}\sum_{m=1}^{2}\beta_{lm}\ln\frac{y_l}{Z_l}\ln\frac{y_m}{Z} + \sum_{j=1}^{2}\gamma_j \ln w_j + \frac{1}{2}\sum_{j=1}^{2}\sum_{h=1}^{2}\gamma_{jh}\ln w_j \ln w_h + \sum_{l=1}^{2}\sum_{j=1}^{2}\beta_{lj}\ln\frac{y_l}{Z_l}\ln w_j + \ln u_{it} + \ln v_{it}, \tag{10}$$

where C is total cost, y_l, y_m are the outputs l or m, w_j, w_h are the price of inputs, u_{it} is the random error, v_{it} is the inefficiency term, i denotes the bank (i = 1, ..., N) and t denotes time (t = 1, …, T).

$$\ln\left(\frac{P}{Z}\right)_{it} = \alpha_1 + \sum_{l=1}^{2}\beta_l \ln\frac{y_l}{Z} + \frac{1}{2}\sum_{l=1}^{2}\sum_{m=1}^{2}\beta_{lm}\ln\frac{y_l}{Z}\ln\frac{y_m}{Z} + \sum_{j=1}^{2}\gamma_j \ln w_j + \frac{1}{2}\sum_{j=1}^{2}\sum_{h=1}^{2}\gamma_{jh}\ln w_j \ln w_h + \sum_{l=1}^{2}\sum_{j=1}^{2}\beta_{lj}\ln\frac{y_l}{Z}\ln w_j + \ln u_{it} - \ln v_{it}, \tag{11}$$

where P is total profit.

The use of duality implies the necessity to impose the following homogeneity restrictions:

$$\sum_{l=1}^{2}\beta_l = 1, \sum_{j=1}^{2}\gamma_j = 0, \sum_{h=1}^{2}\sum_{k=1}^{2}\gamma_{hk} = 0. \tag{12}$$

Berger and Mester (2003) indicated that normalization by equity capital has economic meaning. The dependent variable (profit) becomes the return on equity (ROE) or a measure of how well banks are using their scarce financial capital. Banking is the most highly financially leveraged industry. Shareholders are mostly interested in their rate of return on equity (ROE), which is a measure closer to the goal of the bank than maximising the level of profits. Normalization by the financial equity capital also follows from the choice of equity capital as a fixed input quantity. Equity capital is very difficult and costly to change substantially except over the long run. Equity capital is preferred as a normalization variable besides being the fixed input quantity. Furthermore, if equity was not specified as fixed, the largest banks may be measured as the most profit efficient simply because their higher capital levels allow them to have the most loans (Munyama, 1997).

4. Empirical analysis and results

The cost and profit efficiency function is estimated using the maximum likelihood estimation of parameters in the Cobb-Douglas (Battese and Coelli, 1995). The computer programme FRONTIER 4.1 developed by Coelli (1995) has been used to obtain the maximum likelihood estimates of parameters in estimating the technical efficiency. The programme can accommodate cross sectional and panel data; cost and production function; half-normal and truncated normal distributions; time-varying and invariant efficiency; and functional forms which have a dependent variable in logged or original units.

Table 2 presents the results of the cost efficiency of the Slovak banks within the period 2003–2012. The value of average cost efficiency was in the range 29-92%. The development of the average efficiency show that the efficiency score was decreasing in the period 2003–2012.

In the period 2011–2012 the average efficiency was decreasing, we can suppose that this development was as a result of the financial crisis. Because the analyzed outputs (loans net interest income) decreased in the balance sheet of the individual banks. Although household demand for loans was stimulated by low interest rate, the situation in the corporate sector was different. As result of weakening demand for loans and tight credit standards, the outstanding amount of corporate loans initially recorded lower growth and then began to decrease in 2011 and 2012.

Table 2 Cost efficiency of the Slovak banks (in %)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	*Mean*
CSOB	N/A	N/A	75	78	67	47	40	90	62	26	*60*
DEXIA	80	54	38	47	58	61	81	89	69		*64*
Primabanka										40	*40*
OTP Banka	98	58	43	51	56	54	52	82	67	33	*59*
Postova banka	98	49	39	51	59	52	53	79	53	24	*56*
Privatbanka	96	67	62	77	66	77	62	91	79	47	*72*
SLSP	97	48	37	48	47	50	41	85	60	21	*53*
Tatra banka	93	40	32	41	48	55	37	78	53	23	*50*
UniCredit Bank	98	69	54	41	52	47	39	76	55	24	*55*
Volksbank	80	49	39	45	53	60	38	86	60	29	*54*
VUB	92	35	25	49	48	49	44	75	53	20	*49*
Istrobanka	90	45	39	56	55	62					*58*
Citibank	90	50	41	70	79	57	100				*69*
Mean	*92*	*51*	*43*	*55*	*57*	*56*	*53*	*83*	*61*	*29*	

Privatbanka reached the high value of the cost efficiency, the second most efficient bank was Citibank and the third most efficient bank was OTP Banka. Any bank did not operate at the 100% score of the cost efficiency. In contrast, the lowest average cost efficient bank was Primabanka and Všeobecná úverová banka (VUB), which reached the average cost efficiency 49%, thus 51% of the cost was not required for the outputs. We can mentioned that robust and reliable estimation results should require appropriate number of inputs and outputs involved in the estimation in relation to the number of banks in dataset. The Slovak banking sector is relatively small and consisted of limited number of banks, which restricts comprehensiveness of the model. Two inputs and two outputs cannot capture the banking business completely.

Table 3 Profit efficiency of the Slovak banks (in %)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	*Mean*
CSOB	N/A	N/A	86	80	73	65	52	82	46	48	*67*
DEXIA	73	83	51	75	60	98	100	98	61		*78*
Primabanka										65	*65*
OTP Banka	92	84	58	72	59	78	68	82	57	57	*71*
Postova banka	87	81	59	72	61	80	72	94	56	51	*71*
Privatbanka	87	88	73	81	69	97	83	99	70	71	*82*
SLSP	97	77	54	64	51	83	62	99	51	56	*70*
Tatra banka	98	77	53	64	51	93	67	90	45	46	*69*
UniCredit Bank	96	88	75	72	52	98	59	100	56	53	*75*
Volksbank	84	78	58	71	56	83	53	95	72	64	*71*
VUB	97	73	41	64	56	95	64	93	54	48	*68*
Istrobanka	80	77	53	72	59	80					*70*
Citibank	96	81	59	74	93	94	99				*85*
Mean	*90*	*81*	*60*	*72*	*62*	*87*	*71*	*93*	*57*	*50*	

The results of the profit efficiency scores of the Slovak banks during the period 2003–2012 are presented in Table 3. The value of average profit efficiency was estimated in the range 56–93%. The development of the profit efficiency is similar as the development of the cost efficiency in the Slovak banking sector. Decrease in banking efficiency was estimated in the period 2003–2012 in the Slovakia. In the period 2011–2012 the average profit efficiency decreased significantly. The decrease in the net profit was registered in the balance sheet of the most Slovak banks. Macroeconomic conditions in the euro area deteriorated severely in 2012.Although household demand for loans was stimulated by low interest rate, the situation in the corporate sector was different. As result of weakening demand for loans and tight credit standards, the outstanding amount of corporate loans initially recorded lower growth and then began to decrease in 2011 and 2012.

We estimated that the most profit efficient was Citibank and Privatbanka which reached the average efficiency over then 80%. We analyzed that Primabanka, Československá obchodní banka and VUB were the lowest efficient during the period 2003–2012. The reason for lower level of efficiency of ČSOB and VUB can be found in the fact that net interest income and total profit decreased during the last two analyzed years.

Average profit efficiency had higher value than average cost efficiency in the most analyzed years (except 2003). Thus, the Slovak banks were more profit efficient then cost efficient in the most of the estimated period.

5. Conclusion

The aim of this paper was to estimate the level of the cost and profit efficiency in the Slovak banking sector during the period 2003–2012. For this purpose, this paper uses Stochastic Frontier Approach, the cost and profit efficiency function. The development of the average cost and profit efficiency showed that the efficiency score was decreasing in the period 2003–2012.

The cost and profit efficiency significantly decreased in the period 2011–2012. It can be caused by decreasing in the total profit and analyzed outputs (net interest income and total loans) in balance sheet of the individual bank. We found that the Slovak commercial banks were more profit efficient then cost efficient in the most of the estimated period.

The average cost efficiency ranged the value 29–92%. The highest average cost efficiency achieved Privatbanka which was followed by Citibanka and Dexia banka. Conversely, the lowest average cost efficiency achieved Všeobecná úverová banka, where the average cost efficiency was only 49%. Estimates of the average profit efficiency ranged from 56–93%. The highest value of the profit efficiency achieved Citibanka, Privatbanka and Dexia banka, while the lowest average profit efficiency reached Primabanka, ČSOB and VUB.

The results of this paper confirm the study of Anayiotos, et al. (2010) who presented that the banking efficiency in Slovakia decreased during the pre-crisis boom and also fell during the crisis. They found the significant decreased in efficiency during the period 2004–2009.

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Financial reporting in Romanian banks – facts and perspective

Raluca Sava[1]

Abstract

Financial reporting on the basis of International Financial Reporting Standards (IFRS) in the Romanian banking system has started in 2005 with the preparation of the consolidate financial statements. Starting 01 January 2012 credit institutions in Romania are applying the IFRS as basis of accounting for the preparation of the individual financial statements. The use of IFRS improves transparency and comparability of the accounts for investors and other stakeholders and consequently can have a positive impact through improving access to capital and funding. The purpose of this paper is to study the evolution of the Romanian banking system in 2011-2012 by comparing the information provided in financial statements before and after implementing IFRS in the individual financial statements.

Key words

IFRS, financial reporting, banks, accounting basis, national regulations.

JEL Classification: M41, G21

1. INTRODUCTION

Economic and financial developments in the internationalization of banking in the context of globalization of financial markets have highlighted the importance of harmonizing the financial information provided by banks, especially about assessment and reporting performance and risks of their activity. In addition, due to financial crisis in recent years, there is an increased pressure for the purposes of international homogenization of accounting rules as the basis of published financial information.

Many developed countries, including the European Union, implemented IFRS in 2005. This was a big step which involved many challenges, but it also brought significant benefits on the long run. Since January the 1st 2005 all listed companies in the European Union have been required to publish their consolidated financial statements in accordance with International Accounting Standards, known as IAS/IFRS.

Financial statements should provide essential information to any interested user of financial information in order to be able to extract a reliable and true picture relevant to the financial position of its company. The international mandatory application of IFRS is a practical demonstration of the latest effort to ensure quality information. The overriding purpose of the application of IFRS is to ensure the implementation of the "fair view" of business on the property structure, financial position and profit or loss. In particular, the principle is that the basic objective of financial statements is to show very clearly the "fair view" of the asset structure, financial position and profit or loss (MacKenzie, 2010) [1].

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2. LITERATURE REVIEW

The economic stability and the power held by the financial institutions play an important role in the national economies. In their studies, Kashyap&Stein, 1994 [2], highlight the fact that the existence of a good banking sector helps accelerate the economic growth while on the contrary the financial instability can cause numerous shortcomings within a country on a macro-economic level.

The mission of the financial institutions is the achievement of profitability as well as the increase of the shareholders' value. Even if banks address numerous flexible and remarkable alternatives to individuals and enterprises, their incentive is to make profits in order to survive on the long – term, (Drehmann&Tarashev, 2011) [3].

According to Gilbert and Wheelock (2007) [4], the most important traditional measures of assessing financial performance are ROE and ROA; these are considered important determinants of profitability and reflect the banks' performance. The Return on Equity (ROE) indicator is a measure of how well a company "reinvested earnings to generate additional earnings" while the Return on Assets (ROA) indicator represents how effectively a business has been using its operating assets.

Barth et al. (2008) [5] state that the increase in the information quality in the financial reports as well as the information provided in the financial statements after the adoption of IFRS, has a strong impact on debt financing. In conjunction, Florou and Kosi (2009) [6] point out that after the changes on the financial reporting system with the development of IFRS, the financial institutions are likely to increase debt "from a larger pool of capital at a lower cost".

Tarca (2004) [7] highlights the financial statements analysis as an important tool of presenting the financial position of an organization. Their analysis and valuation is essential as there is a great diversity of groups (investors, public authorities, shareholders) who are interested in the stated financial results and the management comments about the prospects of banks' growth and vision.

The literature study regarding the benefits of implementing the provisions of IFRS underline different conclusions. The implementation of IFRS in Europe had as main purpose the growth of comparability and financial transparency in reports (Jermakowicz & Gornik-Tomaszewski, 2006) [8] and capital cost reduction.

On the one hand, it is widely argued that IFRS provide higher quality and more comparable accounting information (Armstrong et al. 2010) [9]. Financial reporting under IFRS is argued to be of higher quality because of:

- more extensive and more informative disclosures (Leuz and Verrecchia 2000) [10]; Ashbaugh and Pincus 2001) [11];
- less earnings management due to fewer accounting choices (Ashbaugh and Pincus 2001 [11]; Barth et al. 2008) [5];
- better accounting recognition and measurement rules (Barth et al. 2008) [5];
- and more timely information due to greater emphasis on fair-value (Kim et al. 2012) [12].

In this case, financial statements provide debt holders with more transparent and reliable balance sheet values, as well as better measures of liquidity and economic performance.

On the other hand, opponents of IFRS question their potential advantages because:

- limited accounting choices may result in less "true and fair" view of a firm's underlying economics (Barth et al. 2008) [5];
- the principles-based nature of IFRS increase managerial flexibility which in turn can increase the scope for opportunistic earnings manipulation (Barth et al. 2008) [5];
- the fair-value orientation may reduce accounting conservatism and cast doubt on the reliability of accounting amounts (Schipper 2005 [13]; Muller et al. 2011 [14]);

- and even though true comparability is desirable, to the extent that shared accounting standards result in dissimilar events being treated similarly, information may be destroyed (Lang et al. 2010) [15].

In this case, debt holders are provided with relatively unreliable and opaque accounting information. In the studies of some authors (Jermakowicz & Gornik-Tomaszewski, 2006) [8] (Daske 2006) [16] the fact is underlined that the IFRS doesn't determine a decrease of the capital cost, while other authors demonstrate the contrary (Li, 2010) [17].

3. IMPLEMENTATION OF THE IFRS PRINCIPLES IN ROMANIA

In Romania, the harmonization of regulations and practices regarding transparency growth and the assurance of information comparability within the banking sector is done by the National Bank of Romania. The actual implementation of IFRS is the responsibility of the central bank, as the important and adequate assessments of assets, debts and ownership equity are the founding principles for determining the real prudential indicators. In order to make this happen, NBR has constantly collaborated with commercial banks and the Romanian National Bank Association (ARB) and has benefited from the help of major consulting and audit companies from Romania.

The reform process of the accounting system applicable to credit institutions from Romania was aided by NBR that has promoted the completion of the European regulations with consistent solutions adherent to those of IFRS.

From the IFRS process introduction point of view, these regulations have been implemented at individual level. In regards to the consolidated level (bank groups), the IFRS take-over process was more direct. NBR has included all credit institutions and not only those listed at the stock exchange.

The importance of implementing IFRS by credit institutions within our countries is highlighted by the provisions of new financial treaties/agreements signed with international institutions (EC, IMF, WM).

The change-over to IFRS in Romania was made in multiple stages during the 2006-2012 period. In the beginning, 2006, it was compulsory the introduction of IFRS implementation within consolidated financial institutions.

Following discussions held between NBR, Ministry of Public Finance and ARB (Romanian National Bank Association), in the year 2009, an assessment of the IFRS implementation process within banks as accounting principles was made.

During the 2009-2011 period, the financial reports were drafted using two sets of annual financial situations (one based on Romanian accounting provisions and the second based on individual implemented IFRS but only as information). The legal base for these reports was the NBR Order No.15/2009 that has as sole purpose the preparation of credit institutions for this type of reports and assuring the comparative information. The financial situations drafted in accordance to IFRS were obtained through information re-treatment from the accounting registries (RAS) and were merely for information purposes, without having an impact on dividends, distributable, taxes etc.

In 2010, the National Bank of Romania adopted the IFRS's implementation Strategy by credit institutions, starting with the financial year 2012. Hence, while applying it, the regulatory framework's updating process reached its completion. Also, a series of measures has been taken with the purpose of insuring the transition towards the new standards.

Furthermore, in the first half of the year 2010, the financial reporting framework has been updated according to the requests of the monitoring authority. The legal provisions issued for this purpose were NBR Order No.9/2010 and NBR Order No. 27/2010.

- NBR Order No. 9/2010 asserted the IFRS implementation as accounting principle starting with 2012 and their drafting only by those individual financial institutions in accordance with IFRS;

- NBR Order No.27/2010 foresees that, starting with the year 2012, the accounting operations and the presentation requests of the individual and consolidated financial institutions are those foreseen by IFRS. Furthermore, it has been established that the IFRS provisions implemented by credit institutions are those adopted throughout the EU. From a technical point of view, the order states the regulations regarding economic-financial operations according to the accounting principles foreseen by IFRS as well as the accounting plans and account contents and the similarity table for old and new accounts.

In regards to the accounting regulations a series of goals have been aimed: on the one hand all regulations regarding accounting registrations to allow the implementation of accounting rules foreseen by IFRS and on the other hand to issue reports in accordance with the authorities or with IFRS.

The IFRS implementation as accounting principle (starting with 2012) represents the completion of the Accounting Standards implementation process within the Romanian banking system. This brought upon a series of advantages that helped introduced the IFRS provisions. Of these, the following can be mentioned:

• Presentation of accounting information at user request
• Individual financial situations - consolidated financial situations comparability
• Economies adherent to re-treatment process in order to obtain IFRS financial statements
• Consistent individual vs. consolidated monitoring
• Less confusion from the public's point of view

During this period, the IFRS implementation in Romania has been a major subject of research for the Romanian scholars. In their studies they have focused on:

- the view of major actors involved in financial reporting (users, professional accountants, auditors and standard setter) on IFRS application (Albu et al 2011) [18];
- the perception of the CFOs of the Romanian listed companies on the effects of IFRS implementation and the institutional factors that might influence them (Ionaşcu et al. 2011) [19];
- the perceptions of the main actors from bank on the cost and benefits involved by the the use of IFRS as reporting standards (Gârbină et al. 2012) [20];
- the influence of IFRS application on the cost of capital (Ionaşcu et. al, 2010 [21]; Munteanu et al., 2011) [22];
- the application of IFRS in the banking sector (KPMG Romania, 2010 [23] and 2011 [24]). They underlined the differences between the requirements of the national accounting regulations applicable to credit institutions and those of the IFRS and measured their impact on banks equity and income;
- the regulations issued by the National Bank in the context of IFRS use as accounting basis starting 1st January 2012, (Ştefan & Muşat, 2011) [25];
- the challenges of IFRS implementation in Romanian banks from the perspective of managers and auditors (Grecu, 2011) [26];
- the impact of IFRS application on prudential regulations (Răducănescu & Dima, 2011) [27];
- the manner in which the banking independent auditors' mission could be influenced by the IFRS adoption (Socol, 2012) [28].

4. THE EVOLUTION OF THE BANKING SYSTEM IN ROMANIA AFTER THE IFRS IMPLEMENTATION

Starting with January 2012, the implementation process of IFRS, has represented a complex process that had a major impact on the accounting reporting process, having a major impact on the financial data. This process required, amongst others, the re-structuring of the informational systems as well as staff training, both generating in extra expenses for banks.

From the data collected by NBR (Annual Report 2012 – Prudential Monitoring of the Financial Institutions) the Romanian banking system can be characterized by an adequate capitalization for the year 2012, as opposed to the assets and the risk level that needed to be undertaken. The social/ endowment capital has risen in nominal terms with 36,9% and in real terms with 33,6%. The factors that helped contribute to the maintaining of the adequate level of self-owned-funds focus on: shareholder capital input, annual net profit allocation, credit transformations subordinated in social capital and last but not least – the positive amendments of the social/ endowment capital as a follow up of the technical effect of the IFRS implementation; implementation that can be seen mainly through consumption price index for the period in which the Romanian economy has been characterized by hyperinflation (for the capital established before the 1-st of January 2004).

At the same time, in order to maintain the quality of self-owned-funds and in order to consolidate the registered capital levels before switching to IFRS, the central bank had asserted the use of some prudential filters representing the sums obtained from provisions issued starting with January 2012.

The development of the banking activity for the year 2012 was a mild one, the total net assets producing a 3,3 % growth (nominal terms), from 353.910,9 million lei dated 31.12.2011 to 365.618,1 million lei dated 31.12.2012. The net growth expressed in Euro was of only 0,8% (from 81.929,5 million euro to 82.556,5 million euro).

In comparison to the year 2011, the deposits made by non-bank clients have gone up with 5,2% (nominal variation).

This growth of the total net assets and deposits made by non-bank clients are partially due to the new demands imposed by IFRS.

A series of indicators, during the year 2012, have resulted in an unpleasant development:

- the risk rate has gone up from 23,3 % at the end of December 2011 to 29,9% at the end of December 2012
- the rate of non-performing credits (assessment indicator of credit portfolio quality from the prudential point of view) has gone up from 14,3% (31.12.2011) to 18,2% (31.12.2012)

On the one hand, the cause of growth of these factors may just as well refer to the new approach imposed by IFRS by recognizing within the balance sheet of the previous registered debts for accounts outside the balance sheet and through the implementation of new specific regulation based on which future money flow has been calculated and on the other hand the financial situation of the clients has worsen due to the economic crises.

In order to counter this development, the banks have calculated, starting with January 2012, the level of provisions for the awaited losses both based on prudent provisions (prudential amendments of value) but also based on IFRS regulations (amendments of depreciation). Starting with the same date (January 2012) within their accounting operations, the banks have registered only amendments for the depreciation.

In the same content as above, of IFRS implementation, the central bank had a prudent approach to it, by asserting the use of positive difference between the total value of prudential amendments and the total amendments of depreciation, as a filter for the count of self-owned-funds and that of bank prudent indicators.

The main analysis factors of the banking system for the 2011-2012 period are shown in the table below (table no. 1), as foreseen by NBR:

Table 1: Percentage

Name of the Indicator	***2011***	***2012***
Capital Adequacy		
Solvency Indicator	14,87	14,94
Leverage (level 1 self-owned-funds / total medium value assets)	8,07	8,02
Assets Quality		
Loans awarded to clients (gross value)/ Total Assets (gross value)	59,24	60,78
Investments and Interbank Loans (gross value)/ Total Assets (gross value)	16,90	14,74
Impaired receivables of the non-bank clients (net value)/ Total credit portfolio of the client (net value)	----	12,00
Impaired receivables of the non-bank clients (net value)/ Total Assets (net value)	----	7,05
Impaired receivables of the non-bank clients (net value)/ Total Debt	----	7,87
Credit Risk Rate	23,28	29,91
Rate of nonperforming loans	14,33	18,24
Profitability		
(Net Profit/ total medium value assets)	-0,23	-0,64
(Net Profit/ Ownership Equity at medium value)	-2,56	-5,92
Liquidity		
Immediate Liquidity	37,17	35,88
Liquidity Indicator (effective liquidity/necessary liquidity)		
D ≤ 1 month	1,47	1,57
1 month < D ≤ 3 months	3,54	3,98
3 months < D ≤ 6 months	5,94	5,11
6 months < D ≤ 12 months	5,67	5,68
12 months < D	2,13	2,35

Starting with January 2012, given the shift to the new regulatory framework, namely the implementation of **International Financial Reporting Standards (IFRS)**, the **"Past-due and doubtful claims/Total assets", "Past-due and doubtful loans/Total loan portfolio", "Past-due and doubtful claims/Total liabilities",** indicators that were a part of the set of indicators usually used to inform the public, could no longer be calculated. Under these circumstances, ***assets quality assessment*** was performed using new analysis indicators that during 2012 underwent a process of testing and calibration of the calculation formulas:

- Impaired loans granted to non-bank clients (net value)/ Total non-banking loan portfolio (net value);
- Impaired loans granted to non-bank clients (net value)/ Total assets (net value)
- Impaired loans granted to non-bank clients (net value)/ Total liabilities.

The main methodological differences result from the dissimilarities that exist between the regulations based on the European directives and the regulations based on IFRS as follows:

- the different grouping of assets and liabilities;
- the restructuring of past-due and doubtful claims accounts into past due but not impaired loans and impaired loans;
- the mandatory introduction of the effective interest rate method in the implementation of IFRS (previously optional, along with the linear method) for amortising the amounts

relative to the effective yield of the financial instrument, impacting the asset value;

- the introduction of some new accounts representing „amounts to be amortised" for the recognition of the amounts, other than interests, that are taken into account when computing the effective interest rate (e.g. collected commissions);
- the recognition in the balance sheet, in the context of the shift to IFRS, of the items „Receivables written off from assets, but still followed up" and „ Debtors resulting from claimed penalties" previously recorded off the balance sheet (making the necessary adjustments for impairment losses and keeping them in the balance sheet until they do not generate future benefits any more).

The IFRS presentation requirements imposed the restructuring of **past-due and doubtful claims** into **past due but not impaired loans and impaired loans**. Thus, while "past-due claims" included, according to the prior accounting regulations, only overdue instalments, the remainder of the loan being recognized in the current accounts, in compliance with IFRS rules, the full amount of the loan to be repaid shall be disclosed as overdue (principal, interests, amounts to be amortized).

"Doubtful claims" included only disputed claims, while, according to IFRS, the item "impaired loans" was introduced, consisting of assets for which there is an evidence of impairment (loss-generating events, such as an increase in unemployment rate in the geographic area of the debtors, decline in prices of mortgaged property in the relevant fields, observable data that indicate a quantifiable decline in future estimated cash flows) and which include loans that are not yet overdue and claims that are not disputed.

The impact was limited, in what concerns the liquidity of the banking sector, during the year 2012, although the Romanian Banks had faced with the negative perception of some depositors (on the background of some events that have taken place in the county of the mother-bank) and with the risk of non-prolongation at maturity date of the short term deposits from local sources. The liquidity factor (established according to the NBR provisions – NBR Oder No. 22/2011 and NBR Regulation No. 25/2011) calculated for the total amount of operations equivalent in lei, on maturity buckets (up to 1 month, between 1 month and 3 months, between 3 months and 6 months, between 6 month and 12 months and over 12 months) has registered an adequate level above the normal one (1).

The immediate liquidity has registered a drop of 1,3 percentages contrary to the one in 2011 as a follow up of debt growth (with 1,5 %) and that of decline of 2,1 % from the total value adherent to liquid assets, bank accounts, non-collateral government bonds, denominated bonds in euros/dollars (issued by Romania for the external markets) and denominated bonds in lei (issued by the international financial institutions).

Taking into consideration a unpredictable external environment and that of the modest evolution of the national economy, the Romanian banking system has awarded a special attention to maintaining the level of performance through a drastic monitoring process over the cost/profit indicator, a harsher management of the risks within a volatile environment and by paying a closer attention to the needs of the clients. Although, at the end of the year 2012, the Romanian banking system has registered a loss of 2,3 billion lei, as a follow up of the depreciation of the financial assets and that of the effect brought upon by the re-assessment of the credit guarantees. The profit indicators: Return on Equity (ROE) and Return on Assets (ROA) have registered a negative value (-5,92 and -0,64 dated 31.12.2012).

Although the banks have taken up measures to adjust the territorial networks (closing down 232 units) and adjustments within the personnel staff (the number of workers had been reduced with approx. 4000 employees) the deterioration of the operating profit has led to the deterioration of the cost/profit indicator. This factor has had an unpleasant evolution from 51,2% dated 31.12.2012 to 58,7% dated 31.12.2012. Comparison with the year 2011 cannot be made, due to the amendments undertaken within the profit and operating expenses count methodology.

5. CONCLUSIONS

The IFRS implementation within the financial reports made for the Romanian banking sector is without a doubt an advantage for supplying comparative, important information data, credible within the globalization context. It is clear that the process was a difficult one that required considerable efforts from all the parties involved (banks, NBR, Ministry of Public Finance, ARB, accounting authorities). To be appreciated is the fact that, the Romanian banking system is constantly subject to alignment of the fiscal regulations to the financial ones (in connection to this topic there are several other correlations to be made). On the other hand, the international financial reporting process is constantly developing and as a result the banks must operate in accordance to these developments (the banks must adapt their annual financial situations to the amendments of the provisions that foresee future operations – 2014, 2015).

Until now, the Romanian banking system has significantly improved provisioning rate with the transition to international financial reporting system, freeing up about one third of the provisions made by the Romanian accounting system (RAS), according to data provided by commercial banks. It is important to note that switching to IFRS does not create unhealthy premises an extension of credit, because the central bank rules, in agreement with the banking community were established prudential filters that will not cause an artificial increase of the index solvency of banks.

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Analysis of stock markets volatility comovements using wavelet transformation: example from Central European stock market

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Abstract

This paper deals with testing the comovements of stock markets volatility using wavelet analysis during different time periods. The aim of this paper is to provide empirical wavelet analysis which is able to identify key periods and frequencies at which two time series of stock market indices show high level of coherence. Therefore, the data set must be adjusted so that the observations match. We focus on Central European stock markets represented by the Czech Republic and Poland, and compare them with the U.S. stock market which is considered as benchmark. Wavelet coherence analysis was applied on daily volatility approximated by squared returns of mentioned stock markets in the period of 2004-2012 years with a special emphasis on the period of recent financial crisis of 2008-2009 years. The results of our analysis indicate that each of the tested stock markets reacted differently especially in the period of recent global financial crisis. In the pre-crisis and post-crisis periods the results of wavelet coherence differs quite significantly.

Key words

coherence, global financial crisis, stock market, volatility, wavelet analysis.

JEL Classification: C49, C58, C65, C87, G15, G17

1. Úvod

Waveletová analýza představuje univerzální a také velice účinný nástroj pro analýzu časových řad ze dvou hledisek či perspektiv současně. Jednak z hlediska frekvence, ale také z hlediska časového. Jinými slovy waveletová analýza rozšiřuje časové řady do časově frekvenčního prostoru a je proto schopna zachytit dílčí intermitentní intervaly. Obecně existují dva základní druhy waveletové neboli vlnové transformace: jednak spojitá, označovaná jako CWT a také diskrétní, označovaná jako DWT.

V tomto příspěvku se budeme zabývat pouze spojitou verzí waveletové transformace, jelikož naším cílem bude extrahovat a identifikovat vlastnosti časových řad z hlediska časově-frekvenčního. Navíc v teorii waveletové analýzy existují dvě další rozšíření CWT analýzy, které umožňují provést analýzu dvou řad současně. Pomocí první z nich, XWT analýzy, lze vysvětlit oblasti společné síly dvou časových řad, zatímco druhá, WTC analýza, identifikuje oblasti s významnou koherencí obou řad na základě informací získaných z XWT analýzy. Hovoříme o tzv. waveletové koherenci, a právě tato metoda bude v tomto příspěvku využita.

Teorie waveletové analýzy je založena na výzkumné práci Mallata (1989) a Daubechiese (1990). Základní informace o waveletové analýze je možné nalézt také v článku Lau a Weng (1995). Základy testování statistické významnosti v oblasti waveletové analýzy byly poprvé popsány v publikaci Wang a Wang (1996). Od té doby byla waveletová analýza aplikována v

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mnoha vědních oborech. Zpočátku se jednalo o přírodní vědy jako geofyzika, klimatologie či meteorologie. V posledním desetiletí, byla waveletová analýza použitá také v ekonomické analýze. A to především k analýze hospodářských cyklů nebo úrovní integrace zemí do eurozóny, viz Crowley a Lee (2005) a Crowley et al. (2006). Aplikaci waveletové analýzy v oblasti akciových trhů lze nalézt např. v Rua a Nunes (2009), kteří se zabývají společnými pohyby indexů kapitálového trhu v Německu, USA, Velké Británii a Japonsku. Dospěli k závěru, že existuje významný dlouhodobý společný pohyb trhů v USA, Velké Británii a Německu. Užitím wavelet analýzy se zabývali také Vácha a Vošvrda (2007).

S ohledem na předchozí výzkum v této oblasti je cílem tohoto příspěvku využití waveletové analýzy pro analýzu společného pohybu čtverců výnosů, které představují aproximaci volatility, na akciových trzích v České republice, Polsku a USA, a to s cílem identifikovat společný pohyb volatility těchto trhů ve vymezených časových periodách v období let 2004-2012.

V prvním části tohoto příspěvku budou popsána teoretická východiska waveletové analýzy a waveletové transformace. Dále budou objasněna rozšíření této transformace XWT a WTC, následně budou tyto postupy aplikovány na volatilitu zvolených akciových trhů v České republice, Polsku a USA.

2. Waveletová transformace CWT a waveletová koherence WTC

Spojitá waveletová transformace CWT rozděluje původní časovou řadu do tzv. vlnek $\Psi_{T,S}(t)$, které se nazývají dceřinými vlnkami. Vlnky si lze představit jako vlny, jejichž velikost závisí na časovém období při dané frekvenci. Tyto vlnky jsou produktem mateřské vlny $\Psi(t)$, která je závislá na časové pozici T, což je překladový parametr, a frekvenci s, který představuje škálový parametr. Vlnky lze definovat následujícím způsobem:

$$\Psi_{T,S}(t) = \frac{1}{\sqrt{s}} \Psi\left(\frac{t-\tau}{s}\right), \tag{1}$$

kde $\frac{1}{\sqrt{s}}$ znamená normalizační faktor, který zajišťuje srovnatelnost vlnek napříč časovými frekvencemi. Mateřská vlna $\Psi(t)$ musí splnit následující tři podmínky. Její střední hodnota musí být rovna 0:

$$\int_{-\infty}^{+\infty} \Psi(t)\,dt = 0. \tag{2}$$

Dále pak její rozptyl musí být roven jedné:

$$\int_{-\infty}^{+\infty} \Psi^2(t)\,dt = 1. \tag{3}$$

Nakonec musí být splněna také tzv. podmínka postačující, aby původní časová řada $x(t)$ mohla být získána ze spojitých vlnkových transformací. Musí tedy platit:

$$0 < C_{\Psi} = \int_{0}^{+\infty} \frac{\left|\hat{\Psi}(\omega)\right|^2}{\omega} d\omega < +\infty, \tag{4}$$

kde $\hat{\Psi}(\omega)$ je Fourierova transformace $\Psi(\omega)$.

Spojitá vlnková transformace časové řady $x(t)$ s ohledem na $\Psi(\omega)$ je definována následujícím způsobem:

$$W_x(\tau,s)=\int_{-\infty}^{+\infty} x(t)\Psi^*_{\tau,s}(t)\,dt=\frac{1}{\sqrt{s}}\int_{-\infty}^{+\infty} x(t)\Psi^*\left(\frac{t-\tau}{s}\right)dt, \tag{5}$$

kde * znamená komplexní konjugaci. Waveletová síla je pak definována jako $\left|W_x(\tau,s)\right|^2$ a její hodnoty se pak objevují v časově frekvenčním prostoru CWT.

Vlnkovou transformaci lze chápat jako množinu pásmových filtrů aplikovaných na časové řady po sobě jdoucích s waveletovým měřítkem lineárně závislým na charakteristické periodě příslušného filtru. Nicméně CWT není kompletně lokalizována v čase, a to z důvodu rostoucí délky pásma, pro který je waveletová síla počítána. Proto se používá tzv. kužel vlivu (COI), u kterého klesla waveletová síla na hodnotu e^{-2} hodnoty na kraji kuželu.

Křížová waveletová transformace XWT dvou časových řad $x(t)$a $y(t)$ je pak definována jako $W_{xy}(\tau,s)=W_x(\tau,s)W_y^*(\tau,s)$, kde * znamená komplexní konjugaci. Křížová waveletová síla je pak definována jako $\left|W_x(\tau,s)\right|$. Křížová waveletová transformace XWT poskytuje informaci, jak se dvě časové řady chovají společně v čase, a také s ohledem na jejich frekvenci. Rozhodujícím měřítkem je přitom křížová waveletová síla.

Waveletová koherence WTC indikuje stupeň koherence mezi dvěma časovými řadami, přičemž využívá informace z křížové waveletové transformace. Waveletová koherence je definována jako:

$$R_n^2(n)=\frac{\left|S\left(s^{-1}W_{xy}(s)\right)\right|^2}{S\left(s^{-1}\left|W_x(s)\right|^2\right)S\left(s^{-1}\left|W_y(s)\right|^2\right)}, \tag{6}$$

kde S je operátor vyhlazení. Je zřejmé, že definice $R_n^2(n)$ je blízká definici korelačního koeficientu. Intuitivně lze považovat waveletovou koherenci za jakýsi lokalizovaný koeficient korelace v rámci časově-frekvenčního prostoru.

Stejně jako v případě koeficientu korelace, pohybují se hodnoty waveletové koherence v intervalu od 0 do 1, přičemž hodnota blízká 1 indikuje velice silný společný pohyb. Abychom změřili významnost waveletové koherence, používá se obvykle simulace Monte Carlo. Nicméně empirické výsledky ukazují, že velmi významnou roli hrají hodnoty operátorů vyhlazení.

3. Aproximace volatility

Vzhledem k deklarovanému cíli tohoto příspěvku je nutné v dalším kroku definovat pojem volatilita a také způsoby jejího měření. Nejčastěji je volatilita definována jako veličina vyjadřující míru kolísání hodnoty určitého finančního aktiva během určitého časového období. Volatilita nám udává rychlost změny a amplitudu neboli variabilitu finančních časových řad. Na trzích, které vykazují vysokou volatilitu, lze dosáhnout za kratší časový okamžik, ale také se dá na takovémto trhu více prostředků prodělat. Můžeme tedy konstatovat, že volatilita vyjadřuje nejistotu, s níž je činěno finanční rozhodnutí, a také riziko investice do finančního aktiva.

První metodou, která se zdá být přirozená, je samozřejmě použití čtverce výnosů. Matematicky lze volatilitu zapsat jako △ , přičemž r_t je výnos aktiva v čase *t*. Denní výnos r_t v čase *t* je pro účely tohoto textu definován jako logaritmus rozdílů uzavíracích kurzů:

$$r_t = \log\left(p_t - p_{t-1}\right), \tag{7}$$

kde p_t je cena aktiva v čase *t*.

Jelikož je volatilita vyjádřena jako druhá mocnina změny výnosu aktiva, potom dojde-li k vysoké změně výnosu aktiva vyjádřeného jako r_t, a to jak kladné, tak i záporné, dojde také k vysoké změně volatility △ . Na druhou stranu při stabilním vývoji na finančních trzích, kdy bude docházet jen k nepatrným změnám ve výnosu aktiva, bude i volatilita nízká.

Předpokládejme obecně používanou rovnici pro výnosy:

$$r_t = \mu_t + e_t, \tag{8}$$

$$e_t = \varepsilon_t + \sigma_t, \tag{9}$$

kde r_t je výnos aktiva v čase t a μ_t je vhodně modelovaná střední hodnota výnosů. Přirozené se zdá použití e_t^2 jako veličinu pro použití místo volatility σ_t^2. Toto však není vhodné. Podle Lopez (2001) platí, že pokud pro ε_t předpokládáme normální rozdělení pravděpodobnosti, tj. $\varepsilon_t \sim N\left(0,1\right)$, pak druhá mocnina $\varepsilon_t^2 \sim \chi^2\left(1\right)$ pochází z chí-kvadrát rozdělení e_t^2.

To ale znamená, že v 75 procentech případů je e_t^2 větší nebo naopak menší než σ_t^2 alespoň o polovinu. Tato aproximace se nezdá příliš vhodná a lze dle Poon (2005) využít jiné metody. Pokud máme dostatek finančních dat naměřených s větší časovou frekvencí, než je frekvence volatility, můžeme pro volatilitu v každém časovém okamžiku s použít vzorec výběrové směrodatné odchylky:

$$\hat{\sigma}_t = \sqrt{\frac{1}{S-1}\sum_{s=1}^{S}\left(r_S - \mu\right)^2}, \tag{10}$$

kde S je počet měření. Podle Tsay (2005) má tato metoda také své nevýhody. Pokud použijeme tato data, nesmíme zapomenout, že se s finančními aktivy neobchoduje neustále, burzy se na noc zavírají. Volatilita se skládá ze dvou částí: denní a noční, přičemž noční můžeme vnímat jako vliv pozitivních či negativních zpráv na kurz v době, kdy se neobchoduje, nebo vliv obchodování v jiných částech světa. Data, která máme k dispozici, dokážou popsat a vysvětlit pouze denní volatilitu.

4. Popis dat

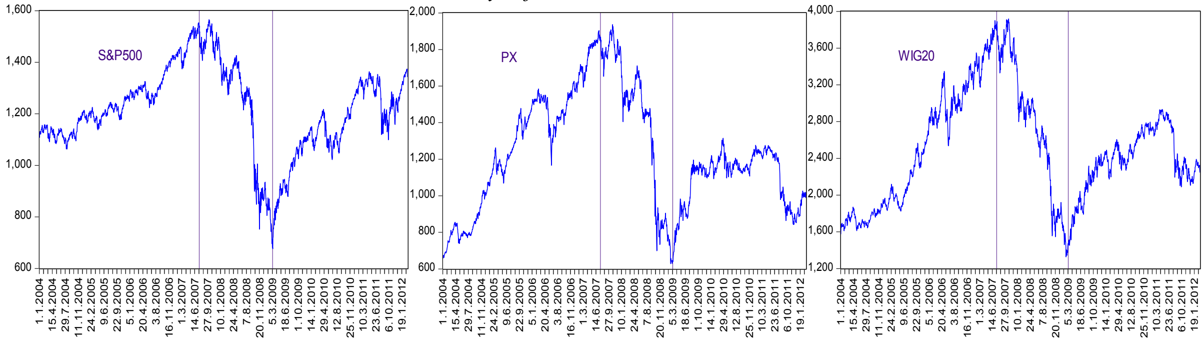
Empirická analýza bude provedena na denních datech vybraných vyspělých i rozvíjejících se akciových indexů v období od ledna 2004 do března 2012, což znamená více než 2200 denních pozorování. K dispozici máme více než 9 let dlouhé časové řady otevíracích a uzavíracích kurzů, které byly získány především z veřejně dostupných zdrojů.

Pro účely tohoto příspěvku byly analyzovány jak vyspělé, tak rozvíjející se akciové trhy. Rozvíjející trhy jsou zastoupeny českým a polským trhem (indexy PX a WIG20), vyspělé trhy pak trhem americkým (index S&P500). Základní testovací období bylo zvoleno záměrně, a to s cílem analyzovat volatilitu v čase s důrazem na její chování v období před, během a po období globální finanční krize v letech 2008-2009.

4.1 Vývoj akciových indexů a jejich volatility

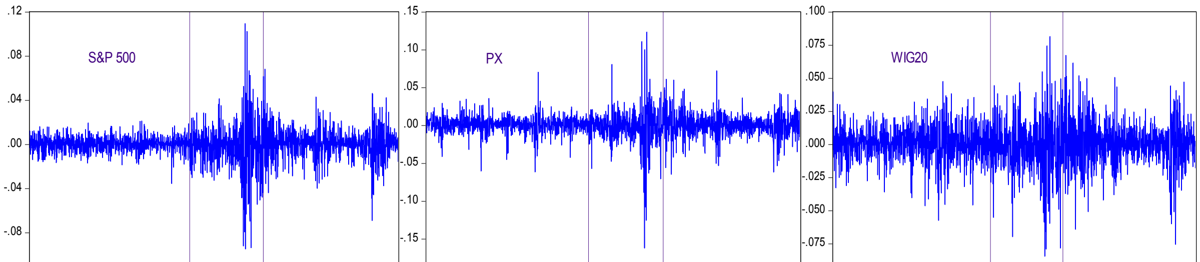
Empiricky bylo potvrzeno, že finanční krize se netýkají pouze vyspělých trhů (USA, Velká Británie, Německo, Japonsko, Hong-Kong atd.), ale nevyhýbají se ani trhům rozvíjejícím (Česká republika, Polsko atd.). V návaznosti na rozšíření negativních zpráv z amerického akciového trhu, které vyústily v globální finanční krizi, akciové trhy reagovaly poklesem také v Evropě v roce 2008. Vývoj uzavíracích kurzů všech analyzovaných indexů je uveden na Obrázku 1. Zaznamenány byly poklesy akciových trhů ve výši cca 60%. K tomu došlo především díky odchodu zahraničních portfoliových investorů v období od září do prosince 2008 a také díky psychologickém dopadu na národní investory.

Obrázek 1: Vývoj indexů S&P500, PX a WIG20



Z Obrázku 2 je zřejmé, že výnosy se pohybují kolem nulové střední hodnoty. Volatilita je v některých obdobích nízká a v jiných obdobích naopak vysoká. Pohyby volatility jsou jak kladné, tak záporné, a je zřejmá tendence shlukování volatility v některých obdobích či naopak období relativně nízkých hodnot volatility. Na Obrázku 2 je vidět shlukování volatility, kdy vysoké výnosy jsou následovány nižšími výnosy, což vede k obdobím relativní stability. Shlukování volatility indikuje silnou autokorelaci čtverců výnosů.

Obrázek 2: Volatilita indexů S&P500, PX a WIG20



Protože volatilita byla nejvyšší v roce 2008, kdy hodnoty většiny indexů dosáhly minimálních hodnot ve sledovaném období, bylo základní testovací období rozděleno na tři dílčí období. První období bylo definováno od roku 2004 do poloviny roku 2007, kdy indexy dosahovaly maximálních hodnot, druhé období zahrnuje období globální finanční krize a končí březnem 2009, kdy trhy dosáhly svých minimálních hodnot, zatímco poslední období je zakončeno březnem 2012 a zahrnuje tedy období pozvolného růstu sledovaných trhů.

4.2 Empirické vlastnosti výnosů

Deskriptivní statistiky používáme zejména kvůli větší přehlednosti analyzovaných údajů. Při výpočtu deskriptivních statistik jsou vypočítány také čtvrté momenty sledovaných údajů, tedy špičatosti, mediánu, střední hodnoty a směrodatné odchylky. Navíc byl proveden také J-B test normality. Výsledky popisných statistik všech analyzovaných indexů ve všech dílčích obdobích jsou uvedeny v Tabulce 1.

Table 1: Popisné statistiky výnosů indexů S&P500, PX a WIG20

	Předkr. období	Období krize	Pokrizové období	Předkr. období	Období krize	Pokrizové období	Předkr. období	Období krize	Pokrizové období
		*S&P*500			*PX*			WIG20	
Střední hodnota	0,0004	-0,0019	0,0009	0,0011	-0,0025	0,0006	0,0009	-0,0022	0,0006
Median	0,0006	-0,0001	0,0009	0,0016	-0,0012	0,0001	0,0007	-0,0005	0,0001
Směrodatná odchylka	0,0066	0,0223	0,0131	0,0107	0,0251	0,0152	0,0127	0,0218	0,0158
Špičatost	4,2019	7,5169	6,4942	8,6038	12,1045	5,7086	4,5116	4,7066	5,4143
J-B statistika	63,19	365,51	399,64	1254,09	1492,78	239,91	103,87	55,48	190,48
Pravděpod.	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000

U střední hodnoty a směrodatné odchylky je možné si všimnout poměrně velkých rozdílů u jednotlivých období. Zatímco v předkrizovém a pokrizovém období je střední hodnota u všech akciových indexů kladná, což znamená, že v těchto obdobích byl průměrný denní výnos kladný a tedy docházelo v průměru ke zhodnocování vložených prostředků. Naopak v období globální finanční krize je střední hodnota u všech sledovaných indexů výrazněji záporná a to znamená, že v tomto období docházelo častěji k záporným denním výnosům, než ke kladným. Při pohledu na velikost směrodatné odchylky je jasně patrné, že největší směrodatná odchylka byla zjištěna u všech indexů v období globální finanční krize, což znamená, že toto období můžeme označit za nejrizikovější pro investory. Nižší hodnota byla zjištěna v pokrizovém období a nejnižší hodnota byla dosažena v předkrizovém období, což naznačuje skutečnost, že první období bude ze všech sledovaných období neklidnější, bez výrazných šoků.

Ani v jednom z devíti případů není špičatost menší nebo rovna číslu 3, což potvrzuje hypotézu, že finanční časové řady mají špičatější rozdělení pravděpodobnosti, než je tomu u normálního rozdělení, což znamená, že se hodnoty výnosů, které téměř odpovídají střední hodnotě, vyskytují častěji, než je tomu u normálního rozdělení. Ač všechny výše uvedené skutečnosti nasvědčují tomu, že se žádná časová řada indexu nechová dle normálního rozdělení, je přesto nutné toto tvrzení potvrdit pomocí J-B testu normality.

5. Empirická waveletová analýza

Jak bylo uvedeno v úvodní kapitole, cílem empirické waveletové koherenční analýzy je identifikovat klíčová období a frekvence, při kterých dva indexy akciových trhů ukazují vysokou míru soudržnosti neboli koherence. Proto je nutné upravit data tak, aby jednotlivá pozorování byla v souladu, tj. pro každý den musí být známa hodnota všech zkoumaných indexů. Pokud tato podmínka není splněna, vybrané datum do analýzy nezahrneme. Výsledky jsou získané s použitím kódu ve výpočetním prostředí Matlab. Podrobnosti lze nalézt např. v Grinsted et al. (2004).

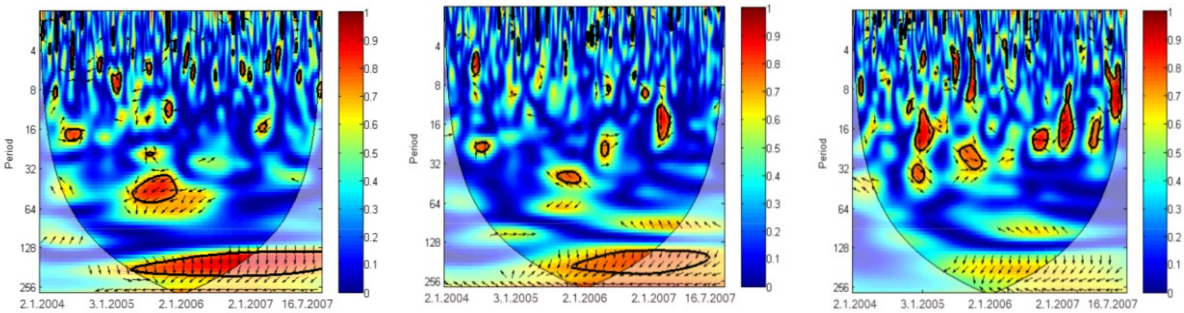
Waveletovou koherenci lze graficky zobrazit pomocí barevného grafu, který zahrnuje cekem tři základní dimenze. Na horizontální ose je zobrazeno příslušné časové období. V našem případě se jedná o tři dílčí období v rozmezí let 2004-2012. Na vertikální ose je zobrazena frekvence ve dnech a barvy reprezentují stupeň společného pohybu, přičemž modrá barva znamená nejnižší stupeň koherence a červená naopak stupeň nejvyšší. Oblasti, které jsou statisticky významné na 5% hladině významnosti, jsou ohraničeny tlustou černou čarou, zatímco tenká černá čára indikuje kužel vlivu COI.

Pokud jde o následnou interpretaci výsledků, je důležité rozlišit mezi červenými oblastmi v dolní (horní) části, které indikují společné pohyby napříč celým obdobím při nízké (vysoké) frekvenci, a červenými oblastmi na levé (pravé) straně, které indikují společné pohyby dvou řad napříč frekvencemi, ale pouze na začátku (konci) příslušného časového období.

5.1 Předkrizové období let 2004-2007

Jako první byla waveletová koherence kvantifikována a graficky zobrazena pro všechny tři dvojice analyzovaných indexů pro data za období let 2004-2007. Jedná se tedy o období stabilního růstu všech tří trhů. Výsledky jsou znázorněny na Obrázku 3.

Obrázek 3: Waveletová koherence indexů PX a WIG20, PX a S&P500, WIG20 a S&P500 v předkrizovém období



Pokud se jedná o koherenci volatility indexů PX a WIG20, na Obrázku 3 vlevo jsou vidět celkem dvě významné oblasti koherence. V prvním případě se jedná o frekvenci od 35 do 55 dní a období druhé poloviny roku 2005. Druhá, mnohem významnější oblast, se objevuje při frekvenci 130 dnů a výše a zahrnuje období od druhé poloviny roku 2005 do konce roku 2007. Šipky na obrázcích indikují vztah mezi oběma indexy. Ve statisticky významných obdobích není ale podle směru šipek zřejmé, zda se volatilita obou sledovaných trhů se vyvíjí stejným směrem, tedy roste nebo klesá, neboli také, že volatilita jednoho trhu ovlivňuje volatilitu druhého trhu.

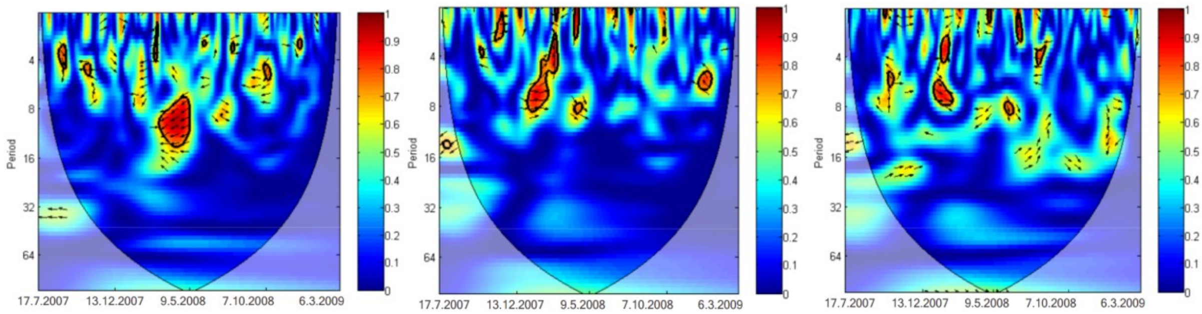
V případě koherence volatility indexů PX a S&P500, viz Obrázek 3 uprostřed, byla zaznamenána pouze jedna významná oblast koherence. Její velikost dosahuje pouze hodnoty 70-80% a zahrnuje období od roku 2006 do poloviny roku 2007 při frekvenci 130 až 230 dnů. Podle směru šipek lze soudit, že pohyb volatility na obou trzích byl spíše protisměrný. Jinými slovy, když roste volatilita na českém trhu, tak na americkém trhu naopak klesá.

Poslední analyzovaný vztah mezi volatilitou indexů WIG20 a S&P500 je z pohledu waveletové koherence poměrně překvapivý, viz Obrázek 3 vpravo. Nebyla totiž zaznamenána statisticky významná koherence až na několik malých oblastí, kdy se jednalo vždy o krátkodobou záležitost, a to napříč celým analyzovaným obdobím.

5.2 Období globální finanční krize let 2008-2009

V další fázi výpočtů byla analyzována a graficky znázorněna waveletová koherence pro data z období let 2008-2009, které tedy zahrnuje období globální finanční krize, kdy hodnoty všech analyzovaných indexů prudce klesaly. Výsledky jsou uvedeny na Obrázku 4.

Obrázek 4: Waveletová koherence indexů PX a WIG20, PX a S&P500, WIG20 a S&P500 v období globální finanční krize

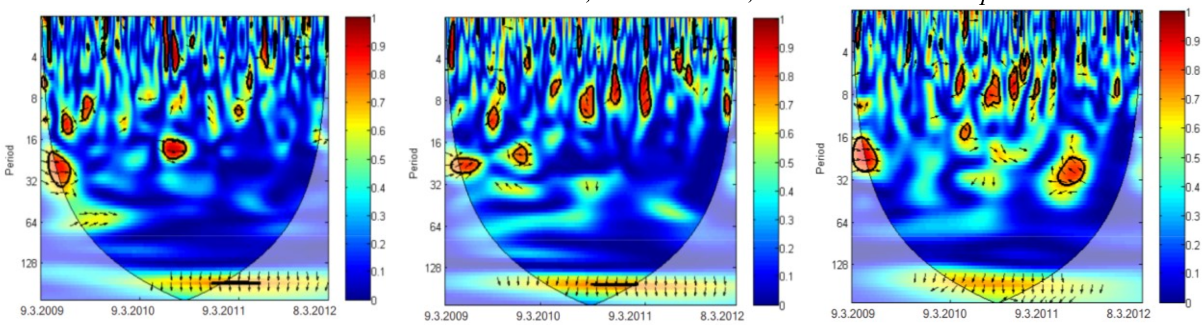


V období globální finanční krize jsou výsledky waveletové koherence zcela odlišné ve srovnání s předchozím předkrizovým obdobím. V případě koherence volatility všech dvojic indexů PX, WIG20 a S&P500 převažují modré oblasti, které indikují téměř nulovou hodnotu koherence. Zajímavých je pouze několik oblastí signifikantní koherence, které pokrývají období několika dnů a dosahují síly 80-90%. Jedná se zejména o vztah mezi indexy PX a WIG20 v období od dubna do května 2008, viz Obrázek 4 vlevo. Významná systematická závislost tedy indikována nebyla. Podle směru šipek nelze většinou jednoznačně usoudit, zda se volatilita vyvíjí stejnosměrně či protisměrně.

5.3 Pokrizové období let 2010-2012

Nakonec byla waveletová koherence kvantifikována také pro období let 2010-2012, kdy opět dochází k pozvolnému růstu analyzovaných indexů a také k poklesu volatility. Grafické znázornění waveletové koherence je uvedeno na Obrázku 5.

Obrázek 5: Waveletová koherence indexů PX a WIG20, PX a S&P500, WIG20 a S&P500 v pokrizovém období



Pokud se jedná o pokrizové období, výsledky waveletové koherence ukazují, že volatilita sledovaných trhů se v jistých krátkých obdobích v řádu jednotek měsíců při frekvencích od 5 do 35 dnů vyvíjí buďto stejnosměrně nebo protisměrně. Statisticky významná koherence byla zaznamenána u všech dvojic trhů. Nebyly ale identifikovány žádné dlouhodobější nebo trvalejší závislosti ve vývoji volatility mezi sledovanými trhy. Nicméně chování trhů v pokrizovém období se opět začíná přibližovat svým charakterem období předkrizovému.

6. Závěr

Wavelet transformace se ukázala být užitečným nástrojem pro analýzu významných společných pohybů volatility dvou časových řad. Její aplikace na denní hodnoty volatility aproximované jako čtverce výnosů za použití dat z českého, polského a amerického trhu ukazují, že volatilita se vyvíjí v různých obdobích odlišným způsobem.

V předkrizovém období let 2004-2007 byly zaznamenány oblasti statisticky významné koherence v případě všech dvojic indexů zejména při vyšších frekvencích zejména v první polovině roku 2006. V období globální finanční krize nebyly oblasti statisticky významné koherence volatility mezi indexy, až na výjimky v první polovině roku 2008, indikovány. V pokrizovém období byla statisticky významná koherence identifikována u všech dvojic trhů. Nebyly avšak identifikovány žádné závislosti dlouhodobého charakteru.

V předkrizovém období stability byly tedy identifikovány oblasti významné koherence, které v období turbulencí představovaném globální finanční krizí zmizely. Otázkou je, jak by se výsledky změnily při použití jiné frekvence dat, například při využití intradenních údajů. Jiným kritériem, který výsledky může také významně ovlivňovat, je způsob modelování a aproximace volatility.

Výsledky waveletové analýzy mohou mít významné implikace pro risk management, a to především z hlediska vývoje velikosti volatility při investování prostředků na více trzích současně.

Poznámka
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Immovable Cultural Heritage

Martina Sieber [1]

Abstract

The term Cultural Heritage appears frequently in many contexts. There is protection and sustainability of cultural heritage anchored in the Czech legal framework. Nevertheless one academic question is still relevant. Is the society still willing to pay for the cultural heritage protection and sustainability under full rationality of decision making axiom holding? The article is focused on the analysis of current legal framework treatment with particular cultural heritage issues within the context of economic rationality and actual stay of the society.

Key words

Culture Heritage, Value, Welfare.

JEL Classification: D 60

1. Definice kulturního dědictví

Byť Česká republika není z daleka zemí s nejvyššími počty nemovitého kulturního dědictví na obyvatele (byť se tomu tak někdy může zdát), není jejich počet jistě z hlediska vynakládaných zdrojů na jejich zachování a udržování zanedbatelný. Nicméně otázkou je, zda přístup ke kulturnímu dědictví jako k nedotknutelnému statku s nekonečnou hodnotou je správný? Metrikou správnosti tohoto přístupu by měl být společenský blahobyt, pokud hledáme nějaký uchopitelný numerický rámec. Onu zmíněnou nedotknutelnost z velké části determinuje zákon na ochranu kulturního dědictví. Tento text si neklade za cíl rozbít představu o významu kulturního dědictví mimo jiné pro udržení národní svébytnosti. Cílem je upozornění, že současný přístup nemusí být nutně ten nejšťastnější. Současně množství vynakládaných zdrojů velmi pravděpodobně neodpovídá vnímanému dopadu na blahobyt.

Otázkou je, zda stávající regulace kulturního dědictví je přiměřená či zaměřena na vhodné objekty. Začít bychom měli definováním základního pojmu a tím je kulturní dědictví. Co je to tedy kulturní dědictví?

Kulturní dědictví je podmnožinou pojmu kultura. Nicméně zatímco kulturu lze popsat jako současné, žijící a v čase se stále měnící výsledky lidské činnosti, kulturní dědictví má svoji historii, jedná se o tu část kultury, kterou společnost má zájem zachovávat v podobě, v jaké ji získala. Otázkou je proč? Kulturní dědictví má svoji estetickou funkci, ale lze najít i jiný účel jeho bytí? Prostřednictvím kulturního dědictví se jedinec identifikuje s národem, se společností či s lidstvím jako takovým (v určitém slova smyslu lze toto říci i o kultuře, ale pro kulturní dědictví je to poměrně významná charakteristika).

Jako kulturní dědictví můžeme vnímat historické budovy, vědecké sbírky, sbírky knih, audiovizuální materiály, obrazy, nejrůznější sbírky, ale i tradice, zvyky, specifické dovednosti (např. řemeslníků a umělců) či další hmotná a nehmotná aktiva s historickou, uměleckou či etnografickou hodnotou. Nicméně tento text má ambice se věnovat pouze nemovitému

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kulturního dědictví, mezi něž řadíme např. historické obytné domy (z hlediska zastoupení na seznamu chráněných památek majoritní skupiny), hrady a zámky.

Skutečnost, že určitý statek je považován určitou skupinou společnosti, či celou společností za kulturní dědictví znamená, že má nenulovou hodnotu, nicméně nezakládá to nutnosti jej rekonstruovat, restaurovat či udržovat při životě v daný moment a na daném místě. Hodnota je věcí relativní a při existenci rozpočtového omezení je nutné si uvědomit, že za předpokladu, že společnost bude považovat jiné statky za hodnotnější, je možné připustit, že nezachováme jakýkoliv statek kulturního dědictví, a to vč. takových objektů jako je Karlštejn (jakkoliv je obecně vnímán za kulturní dědictví českého národa, pokud by existoval statek jako např. zdravotnictví či školství, jehož hodnota je v daný moment, při daném rozpočtovém omezení, vyšší, není možné investovat do jeho zachování). Toto je ovšem teze, která je v přímém rozporu se současnou legislativou.

K tomu abychom se rozhodli, které kulturní dědictví stojí za záchranu a které nikoliv je právě nutné stanovení hodnoty daného statku a statků, které si s nimi konkurují o prostředky v prostředí rozpočtových omezení a omezených vzácných zdrojů.

Toto je obecné ekonomické vymezení respektující teorii ekonomie blahobytu, realita v České republice je ale jiná. Zde není prostor pro diskusi, zda energické, lidské, finanční či jiné zdroje jsou či nejsou vynakládány efektivně. Bez ohledu na okolí zde je definováno, že historické objekty se chrání. Tento postoj nicméně velmi nahrává korupci a najednou si nejsou před zákonem všichni rovni. Výše zdrojů obětovaných na zachování kulturního dědictví je mnohdy tak vysoká, že není v silách vlastníků památek jeho zachování. Cesta k řešení jje potom korupční jednání, jehož finanční náklady se jeví jako nižší než cena zachování kulturního dědictví.

Statky kulturního dědictví jsou statky ekonomickými, nicméně nemusí vždy mít explicitně stanovenu tržní cenu, resp. velmi často tržní cenu vůbec nemají. A i v situaci, kdy cena takového statku existuje, neznamená to, že reflektuje jeho hodnotu a že je aplikovatelná pro rozhodování o zachování daného statku. Jedná se většinou spíše o cenu na trhu se vyskytující než, že bychom o ní mohli hovořit jako o ceně tržní. Příkladem takové ceny je vstupné do hradu či zámku. Jedná se o určitý regulační poplatek. Nicméně ať na trhu se cena vyskytující (tedy cena, která neodpovídá rovnováze nabídky a poptávky na trhu daného statku) či příp. i tržní cena (pokud by skutečně existovala), obě by nám ukazovaly, pouze kolik skutečně lidé zaplatili či zaplatí za užití daného statku, nicméně skutečná ochota zaplatit za užití může být významně vyšší (v závislosti na pozici a tvaru poptávkové křivky po daném statku a dané tržní ceně). Na druhou stranu i v případě subjektu, jehož ochota zaplatit za užití daného statku je shodná s tržní cenou, nám daná tržní cena ukazuje pouze hodnotu přímého užití. Nevypovídá nic o hodnotě opční, bequst či altruistické, která je v případě statků kulturního dědictví poměrně významná.

Statky kulturního dědictví jsou statky nenahraditelné[2] a jako u takových je často v jejich souvislosti diskutována specifická kulturní hodnota statků odlišná od hodnoty ekonomické. Hodnotu ekonomickou stanovujeme na základě preferencí celé společnosti, resp. reprezentativního vzorku celé společnosti. Diskutuje se, zda by hodnotu kulturního dědictví nebylo možné definovat pouze na základě názorů expertů v dané oblasti, ve které se daný statek kulturního dědictví vyskytuje. Příčinou připuštění diktatury vybrané privilegované skupiny je ona zmíněná nenahraditelnost. Je otázkou, jak by se měly dané pohledy na hodnotu

[2] Nenahraditelností je míněna ta vlastnost statků kulturního dědictví, která spočívá ve skutečnosti, že tyto statky není možné nahradit v čase či v prostoru v plné kvalitě a se srovnatelnou hodnotou. Jinými slovy pokud nyní připustíme, že se daného statku vzdáme, je toto rozhodnutí konečné a není možné nikdy v budoucnosti je zvrátit.

ovlivňovat, zda experti mají tvořit poradní sbor při stanovení hodnoty ekonomické, či zda mají tvořit určitou část vzorku respondentů při stanovování hodnoty statků. Odpověď na tuto otázku je obecnou ekonomickou otázkou na princip rozhodování. Dnes je stav takový, že sice rozhodování o rozdělení rozpočtu státu je sice prostřednictvím voleb v rukách celé společnosti, ale rozhodování o památkách samotných by bylo z velké části v pravomoci jmenovaných expertů památkové péče. Na druhou stranu je toto obrazem současného stavu světa. Je otázkou, zda by to tak mělo být trvale.

2. Zákonná úprava ochrany památek

Když pohlédneme do §2 zákona č. 20/1987 Sb., o státní památkové péči, najdeme definici podobnou výše uvedené, byť ne zcela shodnou. Ovšem nalezené odlišnosti nejsou zanedbatelné. [3]Proč se ovšem domníváme, že znění zákona není zcela v souladu s tezí, že „cílem hry" je maximalizace blahobytu? Text zákona sice vymezuje byť velmi obecně, co vnímat pod pojmem kulturní památka, ale nevěnuje se vůbec společenským preferencím v oblasti kulturního dědictví. Jinými slovy není řešeno, co by si společnost přála, je pouze řečeno, co si přeje stát. Nicméně státní orgány by měli řídit stát nikoliv navzdory přání společnosti, ale v jeho zájmu (otázkou je, zda má být respektována vůle společnosti, byť je v rozporu s názory expertů), a to především vzhledem k výše uvedené „nenahraditelnosti" kulturního dědictví. Jak již bylo řečeno – v obecné rovině je vůle chránit památky bohulibý. Problémem je, že zákon tak, jak dopadá na majetek společnosti, přenáší preference vztahů ke kulturnímu dědictví z minulosti do současnosti, neboť historie památkové péče ukazuje, že legislativa v této oblasti, ale i její provedení v praxi vznikla v jiné době, v jiném ovzduší a jiném hodnotovém prostředí a pouze se přenáší v čase.

Začátek památkové péče v oblasti nemovitého kulturního dědictví sahá do poloviny předminulého století, konkrétně do roku 1850, kdy byla v tehdejším Rakousko-Uhersku zřízena tzv. Ústřední komise pro zajištění a zachování stavebních památek (smyslem komise bylo vyhledávání a zachovávání kulturního dědictví). Prvopočátky strukturované památkové péče tedy byť se zaštiťovali zájmy lidu, byly spíše ve znaku monarchy a monarchie. Po vzniku první republiky byla překlopena zákonná a formální ochrana kulturního dědictví mezi právní normy republiky (konkrétně se tak stalo 29.10.1918). Zákon byl následně inovován v roce 1958 a 1987. Poslední jmenovaný platí s několika úpravami dodnes, i přestože obsahuje některé přežitky (např. výroky typu pro blaho lidu), ale především je historicky odvozen od normy vzniklé v Rakousko-Uhersku. Bohužel poslední vláda vzešlá z voleb (známá jako Nečasova vláda) měla v programu předložení nové verze tohoto zákona, ale bohužel se tak nestalo. Argumentem pro nutnost schválení nového zákona je několik nalezených nesrovnalostí s dnešní dobou a dnešním životním stylem. Jednu podobnost mezi původní právní a nynější právní úpravou lze nalézt, a to zájem, ve kterém se památková péče dělá. Byť z původního úhlu pohledu nelze považovat preferování zájmu monarchy za irelevantní, dnešní zájem úzké skupiny expertů, resp. není ze zákona patrný zájem celé společnosti (minimálně není zřejmý zájem vlastníků památek).

Pohlédneme-li do zákona 20/1987 (část „z judikatury") nalezneme řadu rozhodnutí soudních institucí (mezi nimi i Ústavního soudu), které uvádějí, že prohlášení nemovitosti kulturní památkou neznamená jednostranné omezení vlastnických práv, jelikož vlastník

[33] §2 zákona 20/1987 říká, že: „za kulturní památky podle tohoto zákona prohlašuje ministerstvo kultury ČR nemovité a movité věci, popř. jejich soubory, které

a) které jsou významnými doklady historického vývoje, životního způsobu a prostředí společnosti od nejstarších dob do současnosti…
b) které mají přímý vztah k významným osobnostem a historickým událostem."

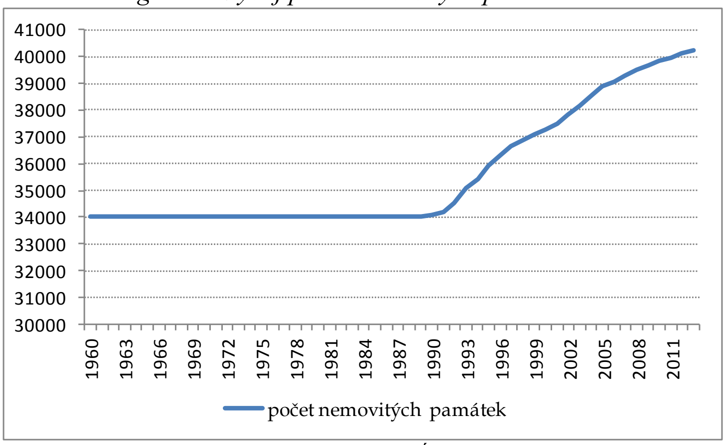
dotčené nemovitosti tímto rozhodnutím neztrácí na plnosti svých práv bez náhrady. Náhradou mu jest na jedné straně možnost získat dotační prostředky na rekonstrukci a údržby, dále na provoz, který může být v případě kulturních památek mnohdy vyšší (např. není možné provést některé rekonstrukce ke snížení energetické náročnosti) a současně mají k dispozici Národní památkový ústav jako poradní orgán, který vlastníkům radí, jak památky udržovat a rekonstruovat. Když si uvědomíme, že na jednu nemovitou památku připadá dotační podpora (poskytovaná Ministerstvem kultury a kraji) ve výši cca 23 tis. Kč za rok (kalkulováno na základě informací Ministerstva kultury za období 2005 – 2010), nelze předpokládat, že finanční podpora státu by pokryla újmu na vlastnických právech. Pokud kriticky pohlédneme na poradní funkci Národního památkového ústavu, uvidíme, že jeho reálný smysl je kontrola vlastníků nikoli pomoc.

Největším problémem zákona i prováděcích předpisů od něj odvozených je přílišná obecnost a šíře působení. Bez analýzy společenských preferencí nelze jednoznačně obhájit zájem společnosti na zachování kulturního dědictví, resp. rozsah zachování kulturního dědictví. Pokud má kulturní dědictví pouze estetickou funkci, je možné připustit „řecký model“ přístupu ke kulturnímu dědictví, a tedy nechat vlastníky zacházet s kulturním dědictvím dle svého uvážení za předpokladu zachování veřejného vzhledu objektů totožného původnímu stavu (tedy připustit výrobu replik, resp. nahrazovat část památek replikami.) Zákon nerozlišuje rozdíly ve významu jednotlivých památek (tedy mezi obytnými domy a hrady a zámky).

3. Vývoj počet nemovitých památek

S postupem času dochází k postupnému stárnutí objektů, což je jeden z důvodů pro postupné zvyšování počtu nemovitého kulturního dědictví. Nicméně čas není jediným parametrem, který stojí za meziročními změnami. Otázkou ovšem zůstává, co všechno vyvolává potřebu památkové péče zvyšovat každoročně počet chráněných objektů.

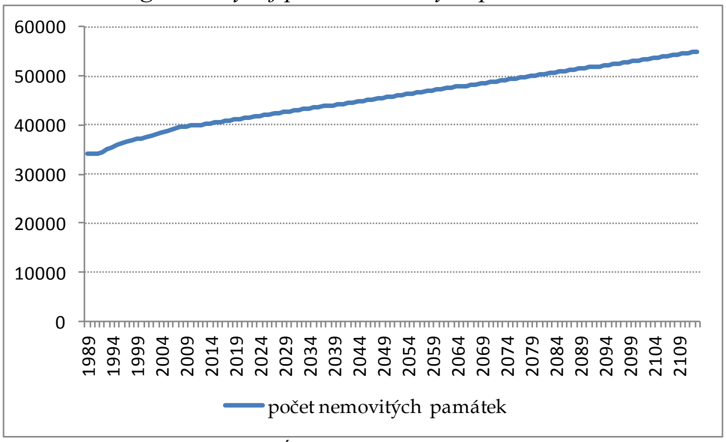
Figure 1: Vývoj počtu nemovitých památek - 1



Zdroj: NPÚ

Při pohledu na křivku vývoje počtu nemovitých kulturních památek stojí za vyzdvižení dvě zajímavá zjištění, a to že mezi rokem 1958 a 1988 nedošlo de facto k žádné početní změně v počtu nemovitých kulturních památek a dále že od roku 1989 dochází k poměrně velkému každoročnímu nárůstu v počtu nemovitých kulturních památek. Kdyby byl udržen trend posledních pěti let, znamenalo by to, že v roce 2113 bude na našem území cca 55 tis. nemovitých kulturních památek. Za předpokladu platnosti zákona zachování hmoty, budou pokrývat čím dál tím větší území a tím pokrývat čím dál větší plochu a vytlačovat novou zástavbu, která by mohla být po stránce estetické stejně hodnotná, ale z hlediska environmentálního významně efektivnější.

Figure2: Vývoj počtu nemovitých památek - 2



Zdroj: NPÚ, vlastní extrapolační odhad

Opět narážíme na konflikt zájmů. Na jedné straně zákon na ochranu památek a na druhé straně vzácný zdroj v podobě půdy (ale i mnohé další). To bychom za chvíli neměli, kde stavět nové nemovitosti. Má smysl skutečně zachovávat vše, co definuje zákon. Stopou doby jsou i paneláková sídliště a máme zájem je zachovávat, když budou dostatečně staré? Jsou znakem pro určitou dobu? Ano. Jsou specifickou stavbou? Taky. A přesto není zřejmé, že budeme mít zájem je zachovávat. Jinými slovy, stojí proti sobě dva zájmy. Prostor je omezený, a tudíž specielně v městských aglomeracích je nezbytné s ním zacházet velmi obezřetně. A současně je zákonem explicitně bez ohledu na cokoliv jiného deklarována nutnost památky chránit a zachovávat bez ohledu na dopady.

4. Hodnotový paradox

Zákon definuje, že je v zájmu lidu památky chránit bez ohledu na příp. negativní dopady vyplývající z této ochrany. Staré objekty jsou energeticky méně efektivní než budovy novější. Zachování nemovitostí na sebe váže velké množství vzácných zdrojů. Dochází tak ke vzniku zajímavého paradoxu. Společnost obecně deklaruje zájem šetřit vzácné zdroje. Současně zákon 20/1987 vymezuje nutnost chránit kulturní památky. Dochází tak ke vzniku hodnotového paradoxu. Připustíme-li předpoklad, že společnost má zájem chránit pouze ty statky, které pro ni mají hodnotu, dochází zde ke střetu hodnot. Ochranou památek získáváme hodnotu ve velikosti našeho užitku z nich plynoucího, ale současně ztrácíme zdroje plynoucí na jejich zachování, dále materiálové, energetické zdroje na jejich zachování a další a další zdroje na údržbu (rekonstrukce a údržba historických objektů je násobně finančně náročnější než rekonstrukce a údržba objektů nových). Pokud bychom respektovali zákon společenské racionality, museli bychom vyhodnocovat, která ze zmíněných hodnot je vyšší. Skutečnost je ale taková, že zmíněný zákon bez ohledu na dopady preferuje zachování kulturního dědictví.

Podstatné je vyzdvižení skutečnosti, že není ničím podloženo, zda společnost skutečně stojí o zachování kulturního dědictví. S tím souvisí otázka, zda je pro nás přijatelný diktát expertů, kteří mohou mít z dlouhodobého horizontu pravdu, pokud tvrdí, že máme památky chránit. Je nezpochybnitelné, že nemovité památky mají významnou estetickou roli, ale mají ještě nějakou další hodnotu? Zmínili jsme, že rekonstrukce historických objektů je nákladná. Výstavba repliky bude ve většině případů levnější než rekonstrukce stávajícího, a to na jednu stranu novostavbu můžeme v interiéru uzpůsobit plně současným nárokům a na druhou bude vždy energeticky efektivnější. Významná je ovšem odpověď, zda pokud postavíme věrnou repliku historického objektu, bude pro společnost méně hodnotná než originál nebo ne. Jinými slovy, zda společnost lpí na památkách, protože jsou krásné, anebo má i jiné důvody, jako že si společnost skutečně cenní stáří objektu. Upozorníme zde, že nejde o to bourat Karlštejn, diskuse je spíše o množství obytných domů, které činí Prahu a jiná města krásnými, ale efektivita jejich zachování je sporná.

5. Závěr

Smyslem textu není polemika o smysluplnosti ochrany kulturního dědictví, nýbrž upozornění na skutečnost, že byť můžeme určitou aktivitu považovat za nezbytnou (jako například ochranu kulturního dědictví) je nezbytné si racionalitu jejího konání vždy verifikovat. Nemovité kulturní památky generují hodnotový paradox, který ovšem není racionálně vyhodnocován. Do budoucna by bylo vhodné provést analýzu velikosti jednotlivých složek hodnoty kulturního dědictví (mimo již zmíněnou estetickou funkci, opční hodnotu, altruistickou hodnotu a další) a na základě zjištěných výsledků přizpůsobit formu památkové péče a především strukturovat památkový fond.

Je bezesporné, že určitá skupina památek má svoji historickou hodnotu a v jejich případě je v zájmu široké veřejnosti jejich zachování v maximálně nezměněné podobě (příkladem je např. Karlův most, Karlštejn) vždy za předpokladu, že jejich hodnota je vyšší než hodnota oportunitních statků. Jedná se o objekty, u nichž oceňujeme skutečnost, že mají svoje stáří, že se jich dotklo množství generací před námi.

Na druhém konci spektra památek bychom nalezli takové, u nichž převládá právě ona zmíněná estetická funkce a potom je dostatečné zachování vzhledu, ale není nezbytné zachování původního. U těchto typů objektů by bylo možná dostatečné respektování původního vzhledu, ale je možné rekonstrukce řešit pomocí výstavby replik, příp. udržování nezměněného vnějšího vzhledu budov.

Závěrem je možné pouze shrnout základní sdělení textu, jakýkoliv projekt, či intervence bez ohledu jaké oblasti se týká, by měla být vždy vyhodnocována z hlediska dopadu na blahobyt společnosti. Nikdy bychom neměli spadnout do zkratkovitého rozhodování na základě pocitu, že se tak koná, protože se to sluší. Zvláště pokud ono pocitové vnímání společenských preferencí je postaveno na zvykových hodnotových rámcích (ty se totiž mohou v čase velmi významně měnit).

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Financial Derivatives Market

Juraj Sipko [1]

Abstract

The paper describes the development of the financial derivatives market. Based on official data the paper describes how the financial derivatives market has significantly increased its volume of trading, mainly after the abolishment of the Glass-Steagall Act. The growing volume of the financial derivatives market also significantly contributed to the global financial crisis. This paper also analyses different types of the financial derivatives in comparison with the commodities derivatives. Based on data analysis, the paper came to the conclusion that it is critical to implement all necessary measures in order to eliminate non-transparent transactions with certain financial derivatives products. Therefore, in line with process of the financial globalization it is necessary to adopt all necessary measures recommended by G 20 countries. These measures should be implemented in a timely manner and they are imperative to put the global economy on a sustainable, solid and balanced economic growth path.

Key words

credit default swap, derivatives, derivatives market, over-the counter market.

JEL Classification: G1, G18, G 28

1. Introduction

The mortgage crisis in the USA brought about the global financial crisis. Academia, research and policy-makers still discuss who is responsible for the present financial turmoil. In line with the officially published document by the Financial Crisis Inquiry Report, there is a clear that behind the present global financial crisis are very many factors that have significantly contributed to historically unprecedented very deep turbulence in the global financial market.[2.]

The comprehensiveness of this crisis is much deeper than of the Great Depression during the 30's in the last century. However, the present global financial crisis has one specific phenomenon which significantly contributed to the global financial crisis – financial engineering, i.e., financial derivatives[3.]

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2 The mortgage crisis in the USA is connected with the following negative factors, which have significantly contributed to the global financial crisis: expansionary monetary policy (2003-2005), underestimated risks in markets, failure of corporate governance, and failure of both supervision and regulatory of banking industry, failure of both rating and auditing companies and growing income disparity. In addition, a strong support was providing by mass media, which have played a critical role in investing in real estate even in the time when participants of the market, research, academia, and policy-makers recognized the existence of the real estate bubble.

3 Derivatives is the collective name used for a broad class of financial instruments that derive their value from other financial instruments (known as the underlying), events or conditions. So, derivatives are financial instruments whose characteristics and value depend upon the value of an underlie, typically a commodity, bond, equity or currency. Examples of derivatives include futures and options. Advanced investors sometimes purchase or sell derivatives to manage the risk associated

Therefore the main aim of this paper is to create a clear picture of the development of the financial derivatives market, mainly at the beginning of the last decade of this century. In addition, this paper will focus on history, the latest development of derivatives and a comparison of this development with the world real economic growth.

2. History of derivatives

Since the breakdown of the fixed exchange rate system that brought about a new international monetary system known as Kingston international monetary system create a huge space for financial derivatives market.

Since the breakdown of Bretton Woods system, there has been a significant increase in the trading volume of derivatives, i.e., mainly financial derivatives. The size of growth of financial derivatives has had an unprecedented trend, mainly during the last decade, in particular due to the abolishment of the main regulatory reform that has been put in place since 1933.

Ever since this period of financial derivatives are bought and sold in two ways. Contracts with standardized terms are traded on exchanges. Tailored varieties are bought "over the counter" (OTC) from big "dealer" banks. These banks support the OTC market by hedging their clients' risks with each other or on an exchange.

Based on available literature, both financial and commodities derivatives have existed for many centuries. Historically, there are two periods, when we registered a significant increase of volume of derivatives.

The first period was after the shutdown of the Bretton Woods system. According to the official data published by the Bank for International Settlements (BIS) from the beginning of 70's in the last century the volume of financial derivatives has significantly increased .

The second period was after the elimination of the Glass-Steagall Act . During the period of existence of this Act a relatively low volume of derivatives was traded in comparison with the last decade. However, due to strong lobbing from the (financial industry), Wall Street was interested in abandoning this legislation. Finally, at the end of the second term of Mr. Clinton's presidency, was finally successfully cancelled the Glass-Steagall Act.

3. Development of derivatives after the cancelation of Glass-Steagall Act

Since this period the volume of financial derivatives has enormously increased (see Table 1 above). The table describes three types of derivatives (credit, interest rate, and equity) for three periods (first half of 2001, end 2007 and first half of 2008). On the one hand, the table clearly describes a big movement in different types of derivatives e.g., interest rates since the first half of 2001 to the end of 2008 from \$57.305 trillion in the first half of 2001 to \$464.7 trillion at the end of 2008[4].

with the underlying security, to protect against fluctuations in value, or to profit from periods of inactivity or decline. These techniques can be quite complicated and quite risky.

[4] According to the data publish by the BIS.

Table 1: The World of Derivatives

Type of Derivative	H1 2008	End 2007	H1 2001
Interest Rate	$464.7 trillion	$382.3 trillion	$57.305 trillion
Credit	$54.6 trillion	$62.2 trillion	$631.497 billion
Equity	$11.9 trillion	$10 trillion	

Source: BIS data, author's calculations

On the other hand, credit derivatives significantly reduced in volume from $631.497 trillion in the first half of 2001 to $54.6 trillion in at the end of 2008. Paradoxically, the volume of derivatives had significantly increased between 2007 and at the end of 2008. This was a period when there was an evident lack of liquidity in the banking industry and Freddy Mac and Fenny Mae came under big pressure in terms of market value of mortgages of both of these institutions. This was a first-time development and many market it as a moral hazard, because the majority of CEOs stimulate further investment operations through various new derivatives products.

In addition, after canceling the historical Glass-Steagall Act there has been tremendous change in terms of growth of GDP and the volume of financial derivatives as is discussed subsequently.

3.1 The volume of financial derivatives and real GDP growth

In order to better understand the increase of both financial derivatives after the breakdown of the Bretton-Woods system, it is necessary to analyze their structure.

Generally, derivatives are qualified as follows: credit derivatives, over-the-counter derivatives, interest rate derivatives, credit default swaps, foreign exchange derivatives, commodity derivatives and equity-linked derivatives.

According to the Bank for International Settlements unallocated derivatives at the end of 2007 were at about USD 71 trillion[5]. The graph clearly shows that a dominant position in the financial derivatives market belongs to OTC derivatives.

Although the latest development of financial derivatives is significant, so far there haven't been many articles comparing the growth of derivatives and the growth of the real economy. Therefore, it is important to compare the growth of financial derivatives with the growth of the real economy to be able to explain the increased systemic risk of the financial system.

A completely different situation arises when comparing derivatives with interest rates. After the breakdown of the Bretton Wood system there has been a gradual increase in currency and interest rates.

In order to better understand the real economic growth for the last 50 years, it is necessary to compare nominal and real world GDP. According to official data publish in the WEO there is a historical development of both world nominal and world real GDP. The development of both nominal and real GDP is correlated since the beginning of the 60s until the beginning of the last decade. At the end of 2000, world nominal GDP counted for USD 31.8 trillion. For the same period of time, world real GDP was counted for USD 32.5 trillion. However, since the beginning of 2001, there has been a significant growth in world nominal GDP. One explanation of this might be that the world nominal GDP is growing faster due to the huge

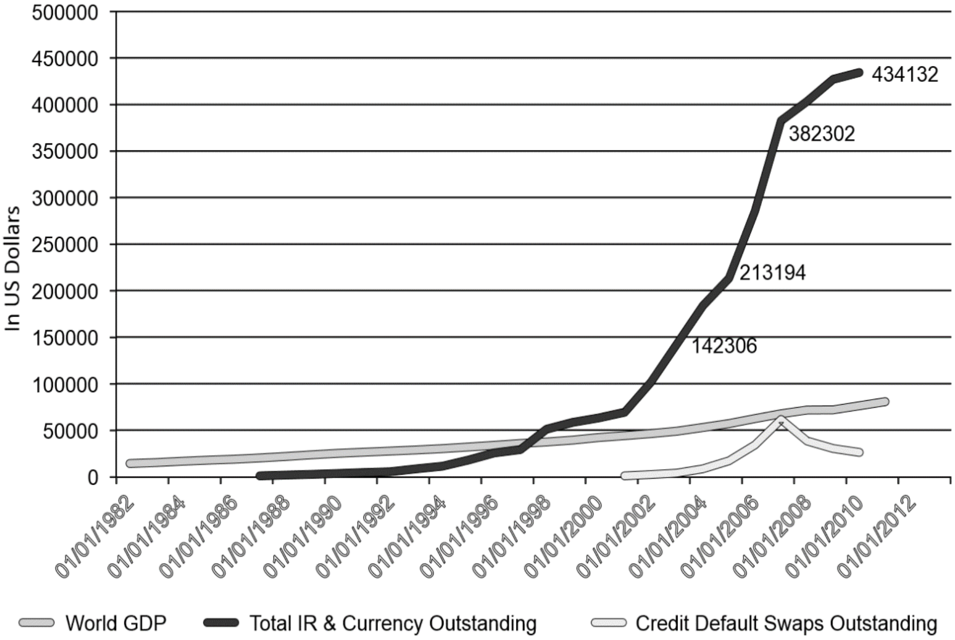
[5] At the end of 2007, according to the BIS the total volume of the derivatives market accounted for USD 1,147 trillion. The biggest size of derivatives market was over-the-counter derivatives[5] which accounted for USD 596 trillion, then listed credit derivatives USD 548 trillion, interest rate derivatives USD 333 trillion, credit default swaps USD 58 trillion, foreign exchange derivatives USD 56 trillion and only USD 9 trillion was counted for commodities and USD 8.54 trillion for equity-linked derivatives.

increase of financial derivatives markets. Nonetheless, the increasing size of financial derivatives markets is not part of the real economy.[6]

In reality, based on comparison between the global real economic growth and the OTC derivatives market in terms of volume, it brings us to the conclusion that the global derivatives market is growing much faster than the global real GDP. Although there is no clear distinction about how big the volume of this speculation is, one thing is clear, nowadays, financial derivatives have started to dominate instead of the real economy.

Graph 1 shows that interest rate derivatives started to grow since the second half of the 90's. However, extraordinarily fast growth of interest rate derivatives continued since the abolishment of the Glass-Steagall Act. The steep curve clearly shows a huge increase of derivatives from USD 50 trillion in 2000 to USD 434 132 trillion in 2013.

Figure 1: Financial derivatives and real GDP growth and Credit default swaps



Source: based on BIS data, graph set up by the author

In reality, credit default swaps at the end of 2007 have the same volume as the global gross national product. That means that this kind of derivatives, which are non-transparent, reached the same volume as the annual global gross domestic product. However, since the end of 2007, there was a decline of credit default swaps and at the beginning of 2013 reduced to approximately to USD 28 trillion at the beginning of 2013. The most important is to assess the dynamic of financial derivatives.

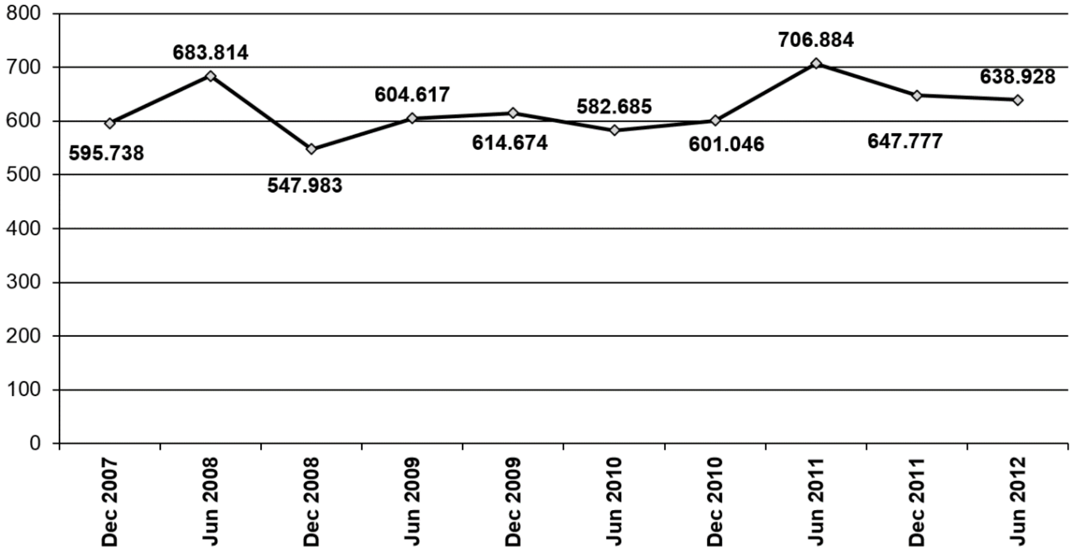
3.2 The dynamics of financial derivatives

In order to better understand the entire volume of all financial derivatives, i.e., both financial and commodity derivatives, it is necessary to understand the main structure. At the end of 2007, the overall volume of over- the-counter financial derivatives has been increased since 2008 (see graph 2).

[6] As was mentioned before, the abolishment of the Glass-Steagall Act created unparalleled conditions for fast-growing derivatives markets, including those which are less or non-transparent. The notional amount of OTC derivatives outstanding globally at the end of 2000 was approximately USD 95 trillion. Between the end of 2000 and the end of 2008, the volume of outstanding OTC derivatives outstanding was increased more than 7-fold to the total volume of USD 672 trillion.

Interesting thing here it is that this type of financial derivatives were growing even during the outbreak of the global financial crisis i.e., in 2008. Although has been reduced the overall size of financial derivatives at the end of 2008, still the volume of the financial derivatives is higher than it was at the beginning of the global financial crisis and have reached at the end of 2012 value of USD 638 928.

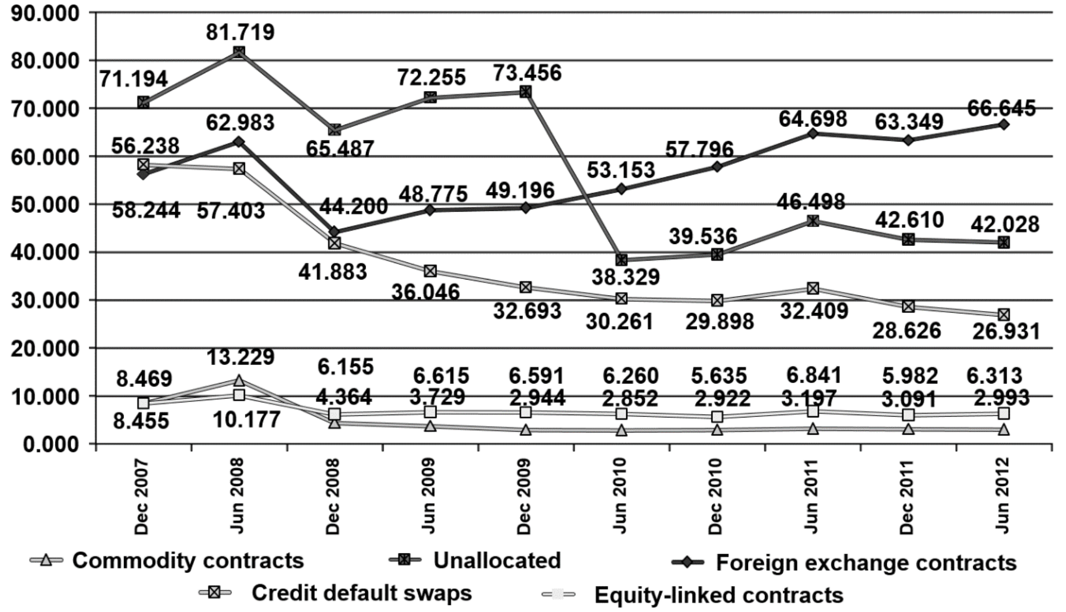
Figure 2: Outstanding OTC financial derivatives



Source: based on BIS data, graph set up by the author

Some types of derivatives played a dominant role in OTC derivatives markets. Among those foreign exchange contracts are predominantly in notional amounts outstanding OTC derivatives. Graph 3 below provides of notional amounts outstanding of OTC derivatives.

Figure 3: Notional amounts outstanding of OTC financial derivatives



Source: based on BIS data, graph set up by the author

Graph shows how big a proportion there is various types of financial derivatives to the total size of OTC derivatives. On one hand, some kinds of derivatives such as commodities derivatives have gradually reduced their volume in comparison with the some OTC financial derivatives. Since 2008 the size of commodities derivatives have significantly gradually reduced. On the other hand, foreign exchange contracts have been growing since 2008.

Due to the role which the financial derivatives market has played in the emerging of the global financial crisis, the G 20 was led to revaluate the present legal framework and transparency of the existing derivatives markets. Therefore, after the outbreak of the global financial crisis member countries of Group 20 decided to prepare an agenda for avoiding a potential financial crisis in the future. In line with the recommendation of G 20 important steps have been adopted by the European Commission. One of the critical documents related to the improving the overall supervision of the financial sector, including the derivatives market was prepared Report under auspices of de Larosière.

3.3 The de Larosière Report

In February 2009, a Report prepared by the de Larosière group on financial supervision in the European Union was issued. This Report made a series of proposals for establishment of new pan-European supervisory bodies. In March 2009, the European Commission recommended European leaders to endorse the main proposal of the de Larosière Report. In September 2009, the European Commission adopted a set of legislative proposals aimed at strengthening financial sector supervision, which was presented at the G20 summit on the 24th-25th of September in Pittsburgh.

The de Larosière Report proposed the establishment of a European System of Financial Supervisors (ESFS). ESFS will be a decentralized network of the three new European financial supervisors charged with carrying out the micro prudential supervision of banks, insurance companies and markets. The proposal provides for these authorities to have binding powers as opposed to the three committees they will be replacing, which will play an advisory role (Committee of European Banking Supervisors (CEBS) for banks, Committee of European Insurance and Occupational Pensions Supervisors (CEIOPS) for insurance companies and Committee of European Securities Regulators (CESR) for markets). The ESFS will develop and vote by qualified majority on technical standards that will be applied throughout Europe. The standards will only become binding law after formal enforcement by the European Commission. The recent financial crisis revealed deep weaknesses in the global financial system. Therefore, this calls for substantial changes to the regulatory framework.

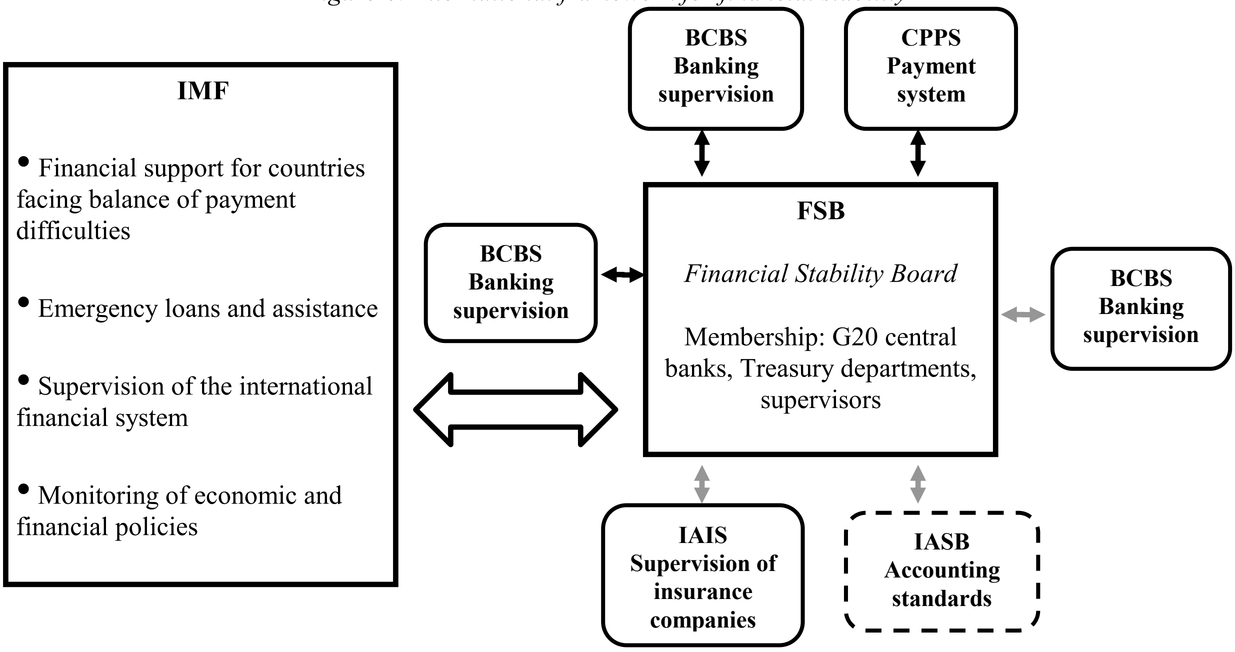
3.4 International Cooperation

In order to increase the credibility and consistency of the management of systemic risks creation, an institutional framework for international cooperation is needed. The process of financial globalization in the recent decades demonstrates that systemic risks have developed an increasingly cross-border nature. Therefore, it is almost impossible to control this risk by national authorities. The question is: how to manage the so called side effects of this risk? If the development of integrating financial markets is increasing, then it is called on to create international cooperation. In this regard, the global financial crisis is a wake-up call for the European Commission. For this purpose, a new advisory body – European Systemic Risk Board (ESRB)[7], was established.

[7] The European Systemic Board Risk (ESBR), located in the European Central Bank, will conduct macroprudential supervision by assessing the potential threats to financial stability in the European Union. The ESBR will be composed of the ECB General Council members, the future European supervisory authorities, the European Commission and the president of the Economic and Financial Committee.

In order to eliminate systemic risk, international cooperation is critical. In this regard, two main bodies for international cooperation, e.g., Financial Stability Board (FSB) and the International Monetary Fund (IMF), have been institutionally established. The latter historically concentrated mainly on macroeconomic issues; in particular, on providing financial facilities in financing external dis-equilibrium current account deficit. However, in line with financial globalization and financial interconnectedness, the G20 decided to delegate the responsibility to the IMF as a global monetary and financial institution.

Figure 4: International framework for financial stability



Source: EC, ECB (2009)

The main goal of the IMF in supporting the global financial stability is not only to provide financial needs for current account difficulties and loans and technical assistance for more vulnerable countries, but also to supervise the international financial system, including monitoring of economic and financial policies of its member countries. The IMF altogether in cooperation with the FSB, which includes G20 and national central banks, ministries of finance and national supervisory authorities[8].

3.5 Main regulatory reform proposals

Based on London's G20 declaration, member countries agreed on a set of reforms to strengthen the financial system. Regulatory reforms will focus primarily on improving the resilience of individual institutions and the financial sector. Regarding the banking sector, the Basel Committee on Banking and Supervision (BCBS) provided guidelines and recommendations to improve the resilience of individual banks[9]. The recent proposals of BCBS on capital standards represent a substantial improvement in the quantity and quality of capital in comparison with the price-crisis level (Table 2).

[8] The national supervisory authorities will cover the overall financial sector, including the payment system and accounting standards.

[9] The crucial components of the BCBS proposals are: higher and better quality capital (mostly common equity, with better loss absorption features), better risk recognition for market and counterparty risks, a non-risk based leverage ratio as a backstop measure, tighter liquidity standards, including a liquid asset buffer for short-term liquidity coverage and a long-term stable funding requirement to limit maturity mismatches and the capital conservation buffer.

Table 2: BCBS capital and liquidity standards

	2011	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*
Leverage ratio	Supervisory monitoring		Parallel run 2013-17 Disclosure starts January 1, 2015					Migration to Pillar I	
Minimum common equity capital ratio			3.5	4.0	4.5	4.5	4.5	4.5	4.5
Capital conversation buffer						0.625	1.25	1.875	2.50
Minimum common equity plus capital conservation buffer			3.5	4.0	4.5	5.125	5.75	6.375	7.0
Phase-in deductions from CETI (including amounts exceeding the limit for DTAs, MSRs, and financials)				20	40	60	80	100	100
Minimum Tier 1 capital			4.5	5.5	6.0	6.0	6.0	6.0	6.0
Minimum total capital			8.0	8.0	8.0	8.0	8.0	8.0	8.0
Minimum total capitals plus conservation buffer			8.0	8.0	8.0	8.625	9.25	9.875	10.5
Capital instruments that no longer quality as noncore Tier 1 capital or Tier 2 capital			Phased out over 10-year horizon beginning 2013						
Liquidity capital ratio (LCR)	Observation period begins				Introduce minimum standard				
Net stable Funding Ratio (NSFR)		Observation period begins						Introduce minimum standard	

(in percent, all dates are as of 1/1/2011)
Source: BCBS, Press Release, September 12, 2010

The main improvement of new standards is the following: common equity will represent a higher proportion of capital, in particular, it will increase from 2 percent to 4.5 percent. The amount of intangible and qualified assets will be limited to 15 percent. The implementation period starts in 2013, with gradual introduction of the deductions from 2014 to reach a common equity target of 7 percent by 2019. Banks are expected to comply with revised requirements for trading exposures, counterparty credit risk and exposures to other financial institutions[10]

[10] See the Basel Committee on Banking and Supervision (July 2009).

The leverage ratio will be introduced with current regulations on a trial basis, starting with implementation and migration to Pillar 1 by 2018. The Liquidity Coverage Ratio will be implemented in January 2015 after an observation period beginning in 2011. Net Stable Funding Ratio (NSFR) is designed to promote longer-term funding of assets. It will become a minimum standard by January 2018.

4. Conclusion

Financial derivatives have significantly contributed to the mortgage crisis in the USA and the later spillover to the global financial crisis. Although there are some similarities of the present financial crisis with the Great Depression, the one specific feature of the present global financial crisis is that it was strongly influenced by financial derivatives. There is clear evidence that some of the financial derivatives such as credit default swaps were not, or less transparent.

The elimination of the Glass-Steagall Act was a step in the wrong direction. An unprecedented increase of the financial derivatives led to worsening of the financial position in the banking industry in both commercial and investment banks. Despite the fact that the competent international monetary and financial institutions recognized that regulatory and supervisory bodies failed to deal with the transparent management of the financial derivatives so far this agenda is still pending.

Before the Great Depression the financial derivatives did not play a critical role in the financial crisis. The present problem is the unprecedented development in terms of volume of financial derivatives in comparison with real GDP growth. From the analysis by using official data published by the International Bank for Settlements it brings to the conclusion that financial derivatives market is growing much faster than the real economy.

Without adoption of all the necessary measures to regulate financial derivatives in a non-transparent market it will be difficult to stabilize the real economic growth for medium and long term perspectives. Therefore, rigorous efforts on the international level connected with fruitful cooperation in improving the functioning of the derivatives market is critical.

Research, academia and policymaker, after analyzing the main causes of the global financial crisis, came to the conclusion that the derivatives market significantly contributed to the global financial turmoil. Therefore, G-20, in order to avoid potential crises, discussed regulatory framework for the financial sector, including the financial derivatives market.

The main goal of the financial sector reform in terms of financial derivatives market is follow the four broad-based objectives: 1) preventing activities in OTC derivatives from posing risk to the global financial system, 2) promoting efficiency and transparency of those markets, 3) preventing market manipulation, fraud and other market abuses and finally, 4) ensuring that OTC derivatives are not marketed inappropriately to unsophisticated parties.

G-20 adopted an agenda for improving the legal framework for the financial derivatives market. The main goal of this agenda is to specify the relation between securities markets and security-related OTC derivatives. Based on this agenda, the regulatory framework for OTC derivatives is very important to recognize the relationship between regulated securities market and the unregulated markets for securities related to OTC derivatives. Although has been done a lot of still remain to accomplish the overall the regulatory agenda, however, at present stage it is necessary to solve some open issues between the USA and EU in area of financial derivatives.

The creation of the European Systemic Board Risk as part of the macroprudential policy in the European Union is a step in the right direction. By analysing the risks arising from both macroeconomic trends and from developments within the financial system, the European

Systemic Board Risk will be able to identify both endogenous and exogenous threats to financial stability. Still, there are some open questions regarding the interaction between ESBR and national authorities. There are expectations that ESBR might cooperate effectively with national authorities. Here, again, there are some open questions regarding direct authority and concerning whether implementation relies on cooperation by national supervisors.

Finally, the banking sector and other financial institutions should continue with the new reform. There is hope that a vigilant implementation of the reforms in the financial sector will have some impact on the economy. However, the economic costs will have limited impact in comparison to long-term benefits in terms of eliminating potential damage from future financial sector crises.

The only way to accomplish this task is adopt the correct rules of game which will support transparency in the financial derivatives market and support, but not undermine, the still three speed and uneven economic growth, which is imperative to increase the standard of living of all populations around the globe.

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Selected current problems of subordinated insurance intermediaries

Ilja Skaunic, Rostislav Šárek [1]

Abstract

This article deals with current issues in insurance brokerage activities on the Czech insurance market. From the wide range of intermediary position focuses on practical aspects and principles of current subordinated insurance intermediaries. Due to upcoming changes in the regulation of these entities the article makes an effort to answer selected impacts associated with the cancellation of subordinated status of insurance intermediaries and creating a tied agent category.

Key words

brokerage activities, insurance, independent agent, tied agent

JEL Classification: G22, G28

1 Úvod

Pojištění rizik je naprosto přirozenou součástí života všech subjektů na trhu – ať jde o domácnosti, nebo o velké firmy. V minulosti bylo při jeho zřizování nutno navštívit některou ze společností, které se touto činností zabývaly – tedy jednu z pojišťoven. V současnosti je možné mimo výše uvedený způsob volit cestu, která by měla být jednodušší – využít služeb některého ze subjektů, které zprostředkovávají služby samotných pojišťoven. Subjekt, který službu uzavření pojištění požaduje, tak nemusí navštívit přímo pojišťovnu, ale může využít služeb podnikatele, který se v dané problematice orientuje, je schopen jednat s klientem přímo v jeho domácím prostředí nebo sídle a měl by být schopen navrhnout pojistný produkt přímo na míru.

Potenciální zájemce o pojistný produkt obvykle sám aktivně vyhledá, případně je osloven zástupcem určité zprostředkovatelské společnosti nebo fyzické osoby – zprostředkovatele. Společnost jedná prostřednictvím svých zaměstnanců, jednatelů nebo dalších externích spolupracovníků, kteří vyvíjejí svou činnost na základě smluvního vztahu se společností. Tento příspěvek není zaměřen na činnost zaměstnanců a jednatelů společností – právnických osob. Zaměřuje se na činnost nejpočetnější skupiny registrovaných zprostředkovatelů, kterými jsou podřízení pojišťovací zprostředkovatelé. Současná situace ovšem přináší pro žadatele o pojistné služby řadu rizik, které nebyly původně při tvorbě regulace této formy podnikatelské činnosti předpokládány. O některých z nich pojednává tento příspěvek

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2 Charakteristika českého trhu zprostředkování pojištění

Pojišťovací zprostředkovatelé mohou v České republice podnikat podle Zákona č. 38/2004 Sb., o pojišťovacích zprostředkovatelích a samostatných likvidátorech pojistných událostí ze dne 17. prosince 2003. Podle tohoto zákona může zprostředkovatelskou činnost v pojišťovnictví provozovat na území České republiky právnická nebo fyzická osoba jako vázaný pojišťovací zprostředkovatel (VPA), podřízený pojišťovací zprostředkovatel (PPZ), pojišťovací agent (PA), výhradní pojišťovací agent (VPA), pojišťovací makléř (PM) nebo pojišťovací zprostředkovatel, jehož domovským členským státem není Česká republika. Registrací výše uvedených subjektů a jejich kontrolou je pověřena Česká národní banka.

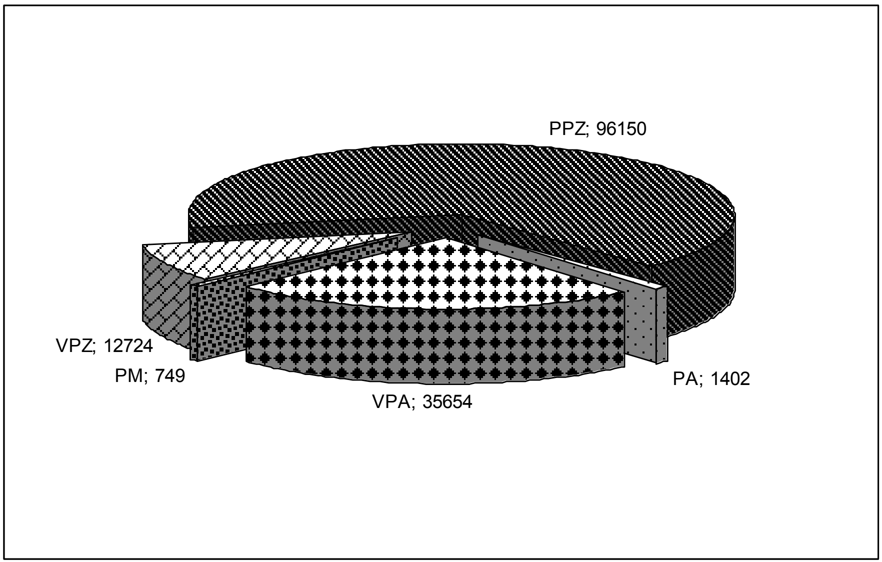
Jednotlivé typy zprostředkovatelů se liší způsobem jejich činnosti a jsou přesně popsány ve výše uvedeném zákoně, v němž jsou také přesně stanoveny kvalifikační požadavky a způsob činnosti včetně forem odměňování za provedené služby. Zjednodušeně je možné říci, že nejkomplexnější služby poskytuje pojišťovací makléř, který poskytuje prakticky komplexní služby v oblasti pojištění na základě smlouvy s pojišťovnami. Pojišťovací agent a výhradní pojišťovací agent vykonává zprostředkovatelskou činnost pro více či jednu (v případě výhradního agenta) pojišťovny jejich jménem a na jejich účet. Podřízený pojišťovací zprostředkovatel spolupracuje s pojišťovacími makléři, pojišťovacími agenty a výhradními pojišťovacími agenty, na rozdíl od nich není oprávněn inkasovat pojistné a zprostředkovávat plnění z pojistných smluv. Vázaný pojišťovací zprostředkovatel vykonává zprostředkovatelskou činnost jménem a na účet jedné nebo více pojišťoven za obdobných podmínek, za jakých podniká podřízený pojišťovací zprostředkovatel pro své smluvní partnery.

Významnost tohoto podnikatelského segmentu co do počtu subjektů zapojených do této činnosti je patrná z údajů registru České národní banky. Ke dni 13. 8. 2013 Česká národní banka v registru pojišťovacích zprostředkovatelů evidovala 137.683 záznamů registrovaných subjektů v jedné z forem zprostředkování popsaných v předchozím odstavci. Dalším, již také zmíněným způsobem provozování zprostředkovatelské činnosti v pojišťovnictví je pojišťovací zprostředkovatel, jehož domovským členským státem není Česká republika. Takových subjektů bylo ke dni 13. 8. 2013 dle údajů registru České národní banky 5.433.

Výše uvedený počet záznamů odpovídá počtu subjektů dle seznamu obchodních jmen u právnických osob a seznamu příjmení a jména u fyzických osob. Faktem ale je, že právnická osoba může být držitelem několika forem pojišťovacího zprostředkovatele a tudíž může vystupovat při jednání se zájemci o pojištění ve více formách. Současná právní úprava výslovně nezakazuje, aby pojišťovací zprostředkovatelé disponovali registracemi v různých formách. Proto je pochopitelné, že celkový počet evidovaných pojišťovacích zprostředkovatelů v registru České národní banky dosahuje k výše uvedenému datu 146.679 záznamů. Z toho vyplývá, že 8.966 subjektů (tj. cca 6 % všech pojišťovacích zprostředkovatelů) bylo oprávněno na základě registrace vystupovat při jednání s klienty minimálně v jedné další roli. Toto číslo však v sobě zahrnuje pouze oficiální registrované role, nikoliv reálné vazby mezi subjekty, jak ukáže příklad v kapitole 2.1.

Z údajů registru České národní banky je zřejmé, že na českém zprostředkovatelském trhu pojištění má možnost působit vysoký počet zprostředkovatelů. Porovnání statistik je možné konstatovat, že jde o jednu z nejvyšších hodnot v přepočtu na jednoho obyvatele v rámci zemí Evropské unie. Významným problémem registru je ovšem ten fakt, že obsahuje také registrace subjektů, kteří již opustili aktivní výkon zprostředkovatelské činnosti v pojišťovnictví. Reálný přehled o aktivní účasti v tomto odvětví je tak pouze předmětem častých spekulací a odhadů. Expertní odhady hovoří o 30 tisících skutečně aktivních, tedy pravidelnou činnost vykazujících, pojišťovacích zprostředkovatelích. To by znamenalo, že aktivně činnost v České republice vykonává jeden pojišťovací zprostředkovatel na cca 340 obyvatel. Problematika spojená s velkou administrativní zátěží dozorujícího orgánu, efektivitou dohledu a případné řešení tohoto stavu však přesahují obsahové zaměření tohoto příspěvku.

Obrázek č. 1 – počet platných registrací PZ v ČR dle rolí k 13. 8. 2013



Zdroj: údaje registru ČNB

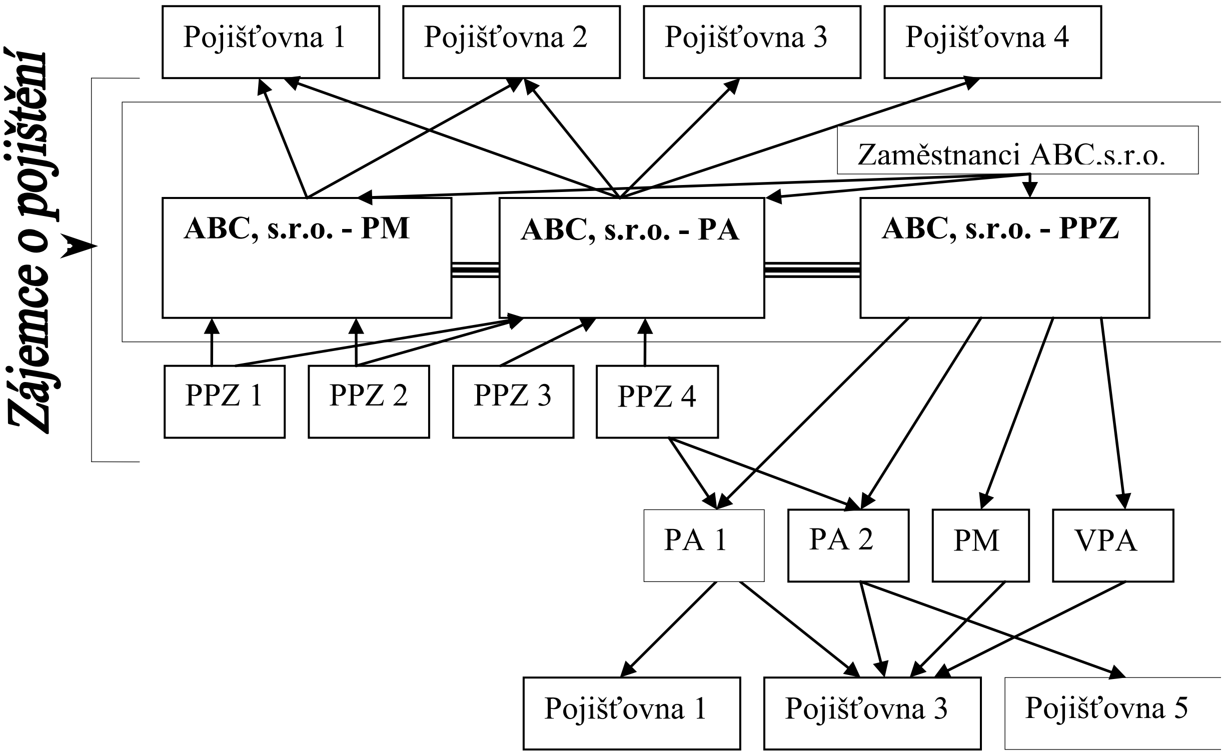
Z obrázku č. 1vyplývá, že nejvyšší počet rolí (66 % z celkového počtu registrací) připadá na podřízené pojišťovací zprostředkovatele. Druhou nejvýznamnější skupinou jsou výhradní pojišťovací agenti (24 %). Jen tyto dvě kategorie tvoří co do počtu registrovaných subjektů 90 % trhu tuzemských pojišťovacích zprostředkovatelů. Pojišťovací agenti a pojišťovací makléři, jejichž registrace náleží především právnickým osobám, představují dohromady pouhé 2 % z počtu registrovaných subjektů.

2.1 Ukázka komplikovanosti vazeb

Na českém zprostředkovatelském trhu pojištění poměrně často dochází k situacím, že právnická osoba je současným držitelem registrací pojišťovacího makléře, pojišťovacího agenta a podřízeného pojišťovacího zprostředkovatele. Obrázek č. 2 názorně ukazuje možné vazby fiktivní zprostředkovatelské společnosti ABC, s.r.o., která v tomto případě disponuje registracemi pojišťovacího makléře (PM), pojišťovacího agenta (PA) a podřízeného pojišťovacího zprostředkovatele (PPZ). Jako pojišťovací agent tato fiktivní společnost navázala obchodní vztahy se čtyřmi pojišťovnami. Ačkoliv jako pojišťovací makléř by měla být společnost vázána obsahem smlouvy uzavřené se zájemcem o pojištění, je i v těchto vztazích běžné, že společnost disponuje písemnou smlouvou, na základě které je oprávněna při poskytování služeb svým klientům oslovovat tyto (v uvedeném případě dvě) pojišťovny s žádostí o vypracování nabídky pojistné smlouvy.

Vazba společnosti ABC, s.r.o. jako podřízeného pojišťovacího zprostředkovatele na pojišťovny je vedena přes možnou spolupráci s jiným pojišťovacím agentem, pojišťovacím makléřem nebo výhradním pojišťovacím agentem. Je však možné disponovat hned všemi těmito vazbami na různé subjekty v uvedených rolích, což dále značně ztěžuje orientaci v celém systému vztahů.

Obrázek č. 2 – ukázka možných vazeb mezi jednotlivými rolemi zprostředkovatelů



Zdroj: vlastní

Z pohledu zákazníka je podstatná skutečnost, že pokud bude zájemce o pojistný produkt jednat se společností ABC, s.r.o. a požadovat konkrétní pojistný produkt Pojišťovny 5, bude s ním společnost muset jednat jako podřízený pojišťovací zprostředkovatel s vazbou na pojišťovacího agenta (konkrétně PA 2), jehož pokyny se bude muset společnost ABC, s.r.o. řídit. Zájemce o pojištění musí být srozuměn s tím, že společnost ABC, s.r.o., kterou oslovil za účelem sjednání pojistného produktu, jedná jménem a na účet zcela jiné společnosti, kterou naopak mohl zájemce o pojištění záměrně na základě dřívějších zkušeností nebo doporučení z rozhodování vyřadit. Důležité je také uvést, že pokud by zájemce o pojistný produkt od Pojišťovny 5 oslovil s tímto konkrétní požadavkem podřízeného pojišťovacího zprostředkovatele společnosti ABC, s.r.o. (konkrétně PPZ 1 až PPZ 3), nebude mu moci přímo tento PPZ vybraný produkt zprostředkovat. Důvodem je nemožnost řetězení vazeb několika podřízených pojišťovacích zprostředkovatelů. Jedinou výjimku by v tomto ukázkovém příkladě představoval PPZ 4, který na základě nevýhradní spolupráce zabezpečuje činnost ještě pro jiného pojišťovacího agenta (PA 2), v jehož portfoliu spolupracujících subjektů se vybraná pojišťovna nachází.

Cílem výše uvedeného schématu je ukázat, že trh zprostředkovatelů pojištění může mít značně komplikované vazby mezi subjekty. Uvedený příklad však mezi právnickými osobami nepředstavuje na českém zprostředkovatelském trhu žádnou výjimku a naopak se jedná spíše o značné zjednodušení těchto a dalších možných vazeb.

2.2 Aktuální problémy činnosti PPZ v současném systému.

Úkolem pojišťovacích zprostředkovatelů je poskytovat zájemci o pojištění veškeré služby spojené především s prodejem pojistného produktu pojišťovny. V oblasti zprostředkovatelské činnosti v pojišťovnictví je dominantně dlouhodobě uplatněn provizní systém, kdy hodnota provizních plateb je odvozována od hodnoty klientem skutečně placeného pojistného.[2] Silně konkurenční prostředí zprostředkovatelů vede k tlaku na provizní sazby, které jsou dále dle naznačených vazeb rozdělovány participujícím subjektům. S ohledem na systém odměňování je nutné počítat se skutečností, že v příkladu uvedený PPZ 4 při zprostředkování produktu Pojišťovny 3 má ve skutečnosti na základě smluvních vztahů tři možnosti, jakým způsobem tento produkt zájemci o pojištění obstarat. Může vybrat zprostředkování prostřednictvím společnosti ABC, s.r.o., nebo prostřednictvím jednoho z cizích pojišťovacích agentů (PA 1 nebo PA 2), neboť všechny tyto subjekty disponují smluvními vztahy na vybranou pojišťovnu. Je vysoce pravděpodobné, že významným kritériem výběru distribuční cesty tohoto produktu k zájemci o pojištění bude představovat hodnota provize, kterou bude mít tento zprostředkovatel smluvně přislíbenu.[3] Umožnění četnosti vazeb ve svém důsledku přináší významnou netransparentnost celého systému.

Jednotliví podřízení pojišťovací zprostředkovatelé mají možnost jednat jménem a na účet několika svých nadřízených subjektů. Je tomu tak z toho důvodu, že současná právní úprava hovoří o spolupráci podřízeného pojišťovacího zprostředkovatele s pojišťovacím agentem nebo výhradním pojišťovacím agentem nebo pojišťovacím makléřem.[4] Nebylo však stanoveno, aby tento podřízený subjekt byl vázán pouze na jeden nadřízený subjekt, jehož pokyny by byl při své činnosti vázán.

2.3 Reakce státní správy na problémy PPZ

Potřebu vytvoření přehledného systému, který by byl srozumitelný pro spotřebitele a zároveň umožnil efektivní výkon dohledu, zmiňuje mimo jiné také dokument s názvem *Doporučení pracovní skupiny k regulaci distribuce na finančním trhu*, vypracovaný ministerstvem financí v roce 2010.[5]. Jako východisko současného stavu bylo navrženo sjednocení struktury subjektů s podnikatelským oprávněním k distribuci na finančním trhu. Toto sjednocení několika současných rolí do jedné by mělo mimo jiné také přispět k jednoznačnému stanovení odpovědnosti za výkon distribuční činnosti. Na základě tohoto principu má dojít k vytvoření pouze dvou základních rolí zprostředkovatelů na finančním trhu. Těmito rolemi jsou samostatný zprostředkovatel a vázaný zástupce. Zásadním doporučením je pak skutečnost, že v rámci podnikatelského oprávnění bude vázaný zástupce disponovat smluvním vztahem o poskytování těchto distribučních služeb pouze s jedním nadřízeným subjektem. Myšlenky z tohoto dokumentu vedly k vypracování novely zákona č. 38/2004 Sb.

Důvodová zpráva k návrhu novely zákona o pojišťovacích zprostředkovatelích obdobně uvádí, že současný stav uměle vytvořených rolí pojišťovacích zprostředkovatelů je z pohledu regulace nevyhovující. Z hlediska spotřebitelů je obsah současných zprostředkovatelských

[2] Již tato skutečnost představuje ve své podstatě významný střet zájmů. Pojišťovací zprostředkovatel je odměňován pojišťovnou, jejímž jménem a na jejíž účet jedná. Doporučení pojišťovacího zprostředkovatele při volbě pojistného produktu, výše pojistného nebo doby pojištění představují základní kritéria pro stanovení provizní odměny vyplácené pojišťovnou pojišťovacímu zprostředkovateli.

[3] Nelze však jednoznačně tvrdit, že hodnota smluvní provize bude jediným kritériem pro výběr distribuční cesty ke zprostředkování produktu. Podstatnou roli mohou hrát například také osobní vazby těchto osob nebo dřívější zkušenosti v rámci vzájemné spolupráce.

[4] Viz ustanovení § 6 odst. 1 zákona č. 38/2004 Sb., o pojišťovacích zprostředkovatelích a samostatných likvidátorech pojistných událostí a o změně živnostenského zákona.

[5] Doporučení pracovní skupiny k regulaci distribuce na finančním trhu (2010)

pozic obtížně intuitivně rozpoznatelný, až vysloveně matoucí.[6] Aktuálně projednávaný návrh novely zákona o pojišťovacích zprostředkovatelích[7] přijal výše uvedenou koncepci, která byla navržena pracovní skupinou pro distribuci. Počítá tak pouze se dvěma rolemi pojišťovacích zprostředkovatelů, tedy samostatnými zprostředkovateli (SZ) a vázanými zástupci (VZ). Předlohou tohoto konceptu se stala distribuce v oblasti investičních produktů dle zákona o podnikání na kapitálovém trhu, kde nadřízené subjekty mohou využít výhradní spolupráce se svými vázanými zástupci. Další text příspěvku vychází z předpokladu, že novela zákona o pojišťovacích zprostředkovatelích vstoupí v účinnost ve znění známém v současné době.

2.4 Novela zákona a jeho důsledky ve sledované problematice

Z pohledu budoucích vázaných zástupců v oblasti pojišťovnictví by tak obdobně jako v jiných odvětvích zprostředkování na finančním trhu měl být klíčový výběr nadřízeného subjektu, neboť produktové portfolio vázaného zástupce bude vázáno na aktuálně účinné smluvní vztahy nadřízeného subjektu. U těch podřízených pojišťovacích zprostředkovatelů, kteří v současné době disponují jednou aktivní vazbou na nadřízený subjekt v roli pojišťovacího agenta či pojišťovacího makléře, by situace neměla být z hlediska rozhodovacích procesů komplikovaná. Současné role pojišťovacích agentů a makléřů by se měly přeměnit na pozici samostatného zprostředkovatele. S vysokou pravděpodobností lze předpokládat, že současní podřízení pojišťovací zprostředkovatelé s jednou aktivní vazbou na tyto subjekty zůstanou registrováni s vazbou na totožný subjekt.

Současní podřízení pojišťovací zprostředkovatelé však mohou dle aktuálně účinné zákonné úpravy spolupracovat také s výhradními pojišťovacími agenty. Výhradní pojišťovací agenti ale budou dle novely zařazeni do kategorie vázaných zástupců (jako vázaný zástupce pojišťovny), čímž dojde ke znemožnění navázání dalšího vázaného zástupce na tento subjekt. Výhradní pojišťovací agenti, kteří k výkonu činnosti využívali služeb svých podřízených pojišťovacích zprostředkovatelů, tedy buď budou odstřiženi od těchto vazeb (čímž by mohli přijít o část zprostředkované produkce a odměny za ně), nebo je čeká proces „osamostatnění" od výhradní vazby na pojišťovnu a registrace do pozice samostatného zprostředkovatele.

3 PPZ na území města Ostravy

V kapitole 2 bylo uvedeno, že registr pojišťovacích zprostředkovatelů uvádí data, která nejsou vždy zcela aktuální, resp. jsou velmi často neaktuální s ohledem na nedisciplinovanost subjektů v něm registrovaných. V následující části příspěvku bude tato skutečnost ověřena na na vybraném vzorku registrovaných podřízených pojišťovacích zprostředkovatelů, kteří měli adresu sídla či adresu bydliště na území statutárního města Ostravy. Na základě analýzy těchto dat budou provedena zobecnění některých zjištění.

Dle údajů registru ČNB ke dni 13. 8. 2013 se aktuálně na území města Ostravy nacházelo 2.614 podřízených pojišťovacích zprostředkovatelů s platnou registrací k činnosti. Z tohoto počtu bylo 2.509 podřízených pojišťovacích zprostředkovatelů (tj. 96 %) fyzickými osobami a 105 subjektů bylo osobami právnickými. Hlavním cílem při sledování dat bylo zjistit, zda se v tomto vybraném vzorku potvrdí dříve uvedené hodnoty expertních odhadů ohledně počtu neaktivních subjektů. Dále bylo ověřováno, kolika zprostředkovatelů se bude v budoucnu

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[6] Důvodová zpráva k návrhu zákona, kterým se mění zákon č. 38/2004 Sb., o pojišťovacích zprostředkovatelích
a samostatných likvidátorech pojistných událostí a o změně živnostenského zákona.

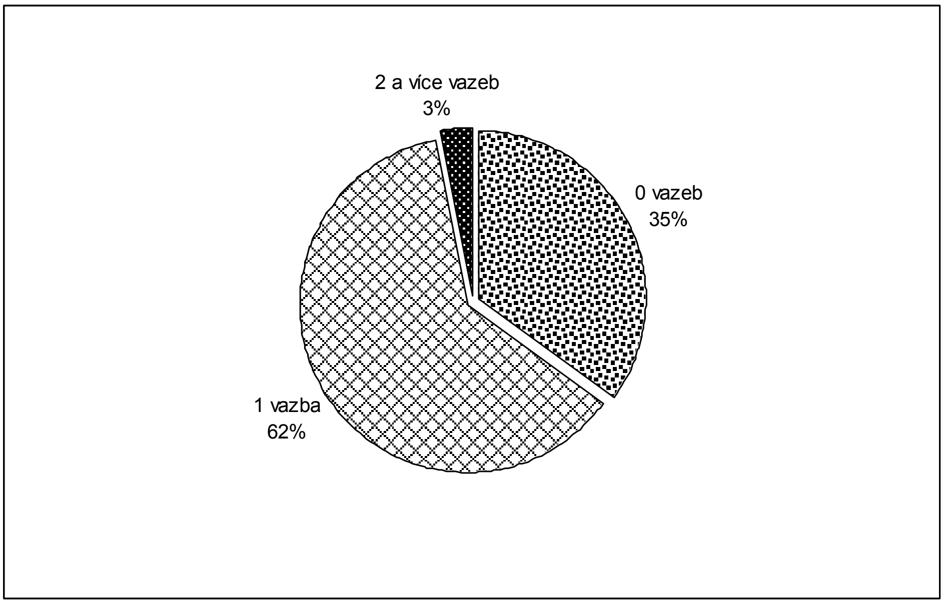
[7] Usnesením ze dne 6. února 2013 Poslanecká sněmovna přikázala projednání tohoto návrhu zákona rozpočtovému výboru. V rámci probíhajícího legislativního procesu tak lze očekávat změny předmětného zákona.

týkat problematika nutnosti výběru jednoho nadřízeného subjektu a/nebo případná transformace do jedné z nově vznikajících rolí (SZ nebo VZ) u těch subjektů, které disponují více platnými registracemi (PPZ a zároveň VPA nebo VPZ). Vzhledem k rozsáhlému objemu dat byla podrobena detailní analýze pouze náhodně vybraná část dostupných údajů. Konkrétně bylo vybráno 785 podřízených pojišťovacích zprostředkovatelů tak, aby poměr zastoupení fyzických a právnických osob zůstal zachován. Vybraná část dat odpovídá 30% zastoupení subjektů z území statutárního města Ostravy, což podle názorů autorů představuje dostatečně velkou základnu

3.1 Neaktivní subjekty na území města Ostravy

Jako základní předpoklad pro ověřování počtu zcela neaktivních subjektů byla zvolena podmínka aktuálně nulových vazeb podřízeného pojišťovacího zprostředkovatele na jeden z možných nadřízených subjektů (tedy PA, PM nebo VPA). Pokud registr České národní banky v současné době tuto vazbu neeviduje, je vysoce pravděpodobné, že k tomuto okamžiku zprostředkovatel činnost vůbec nevykonával. Je však důležité také upozornit, že ani aktuálně kladný počet aktivních vazeb nemusí vypovídat o skutečnosti, že podřízený pojišťovací zprostředkovatel činnost skutečně aktivně vykonává. Na základě kontrolní činnosti České národní banky bylo zjištěno, že pojišťovací zprostředkovatelé často nevěnují dostatečnou pozornost aktualizaci těchto údajů v registru.[8]

Obrázek č. 3 – počty vazeb PPZ s adresou sídla/bydliště na území města Ostravy na nadřízené subjekty



Zdroj: údaje registru ČNB

Ve sledovaném vzorku 785 podřízených pojišťovacích zprostředkovatelů s adresou sídla nebo adresou bydliště na území statutárního města Ostravy bylo zjištěno, že 275 subjektů aktuálně nedisponovalo žádnou vazbou na jakýkoliv nadřízený subjekt. Na základě tohoto údaje autoři dovozují, že až 35 % registrovaných podřízených pojišťovacích zprostředkovatelů tuto činnost aktivně nevykonává.

[8] Konkrétně v případě uvádění a aktualizace vazeb podřízených pojišťovacích zprostředkovatelů na své nadřízené subjekty vstupuje do problematiky nejednoznačné určení, který z dotčených subjektů by tento úkon vůči registru České národní banky měl vykonávat.

3.2 Novelou dotčené subjekty

Většina subjektů mělo v registru uvedenu jednu aktivní vazbuna nadřízený subjekt. U této skupiny zprostředkovatelů lze očekávat, že přechod do nových pozic vázaných zástupců pro ně nebude představovat žádnou významnou komplikaci v rámci rozhodovacího procesu. U pouhých 3 % z celkového počtu zkoumaných registrovaných osob byla zjištěna vazba na dva nebo více nadřízených subjektů, což představuje poměrně nevýznamný podíl.

Chystaná změna přechodu na role vázaných zástupců s povolenou vazbou na jeden nadřízený subjekt se tak bude konkrétně na území statutárního města Ostravy týkat pouze marginálního počtu osob. Pro úplnost dodejme, že pokud bychom ze sledovaných hodnot údajů odstranili osoby s nulovou vazbou na jakýkoliv nadřízený subjekt, představuje podíl skupiny aktivních osob, které budou muset podstoupit rozhodovací proces výběru svého nadřízeného subjektu, hodnoty 5 %. Lze odhadovat, že údaje pro celou Českou republiku mohou dosahovat obdobných hodnot.

Statutární město Ostrava evidovalo k trvalému pobytu ke dni 1.7.2013 celkem 295.424 obyvatel. V případě tohoto města tak dle odhadu připadá pouze 174 obyvatel na jednoho aktivního podřízeného pojišťovacího zprostředkovatele[9] - tato hodnota se významně odlišuje od dříve uvedených expertních odhadů průměru za celou Českou republiku.

Autoři článku si dále na vybraném vzorku podřízených pojišťovacích zprostředkovatelů všímali, zda tyto osoby disponují také jinými registracemi rolí v oblasti zprostředkovatelské činnosti v pojišťovnictví. Typicky se jednalo o případy, kdy podřízený pojišťovací zprostředkovatel byl zároveň držitelem registrace pro činnost výhradního pojišťovacího agenta nebo vázaného pojišťovacího zprostředkovatele. Ve sledovaném vzorku bylo identifikováno 65 takových osob (podíl cca 8 %), kdy většina (přesně 59 osob) disponovala jednou další registrací. Tento 8% podíl v podstatě odpovídá dříve uvedeným údajům v článku a potvrzuje tak, že ani zprostředkovatelé pojištění v Ostravě nejsou v počtu zaregistrovaných rolí na jeden subjekt žádnou výjimkou.

4 Závěr

Na základě vybraných údajů o pojišťovacích zprostředkovatelích s adresou sídla nebo adresou bydliště na území statutárního města Ostravy je možno odhadnout, že rozhodovací proces výběru svého nadřízeného subjektu (tj. samostatného zprostředkovatele) bude muset realizovat zhruba 5 % všech podřízených pojišťovacích zprostředkovatelů.

Dále bylo zjištěno, že 8 % podřízených pojišťovacích zprostředkovatelů disponovalo další registrací pojišťovacího zprostředkovatele. Tato hodnota vypovídá o podílu zprostředkovatelů, kteří po nabytí účinnosti novely zákona o pojišťovacích zprostředkovatelích budou zvažovat transformaci do jedné z možných rolí, tedy samostatného zprostředkovatele či vázaného zástupce. Takto lokálně zjištěné údaje lze aplikovat také na ostatní území České republiky.

Pokud k těmto změnám jako důsledek změn v legislativním procesu v České republice dojde, lze předpokládat, že klienti pojišťoven budou mít možnost kvalitnějšího výběru zprostředkovatelských služeb, nezatížených dnešními složitými a neprůhlednými vztahy mezi jednotlivým zprostředkovatelskými subjekty.

[9] Dle zvoleného předpokladu (alespoň 1 evidovaná vazba na nadřízený subjekt v registru ČNB) je aktivních 65 % z celkového počtu registrovaných PPZ.

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An alternative method of characterization of extreme value distributions[1]

Valéria Skřivánková, Matej Juhás [2]

Abstract

The paper deals with alternative method of characterization of general classes of distributions using suitable trasformation of records. Extreme value distributions are considered as special cases of general distributions. The new methodology of identification distributions is verified on simulated data and it seems to be suitable for insurance data analysis. At the end, the results of known goodness of fit tests and result of Hoeffding´s test of independence are compared.

Key words

Extreme values, characterization of distributions, records, simulation, Hoeffding´s test

JEL Classification: C13, C16, G22

1. Introduction

Extreme value models are widely used in many areas of real life including financial, enviromental, meteorological, hydrological and climate changes problems (see e.g. [3], [4], [6], [11]). Our interest is in modelling extremes in insurance data.

The statistical modelling is based on analysis of observed extremes, estimation of their distribution, including the testing of equality between theoretical and empirical distributions and on the prediction of further extremal events. The problem is that, the sampling distributions are generally unavailable in exact form and are approximated either in terms of the asymptotic distributions, or their correction using expansions, or by using transformations.

The basic theorem in extreme value theory, the Fisher-Tippett theorem says that, the only three limit distributions of extreme value distributions are the Gumbel, Fréchet and Weibull distribution (see [6]). These distributions are special cases of general distribution of extreme values (GEV). There exist some graphical and analytical methods for identification of the type of extreme value distribution. The graphical analysis includes time series representation, histogram, Kernel density, probability plots (PP-plot) and quantile graphs (QQ-plot), but all of them have except of advantages also some disadvantages (see [4],[7],[8],[11],[13], [14], [15]).

In this paper, we will present a new analytical method of characterization extreme value distributions using the independence property of some suitable transformation of record values. Its applicability for statistical analysis will be demonstrated on simulated data. We compare the result of Hoeffding´s test of independence needed in our methodology with the results of well-known goodness of fit tests as Kolmogorov-Smirnov test and Anderson-Darling tests are.

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2. Basic terms and known results

Consider a sequence $\{X_n,\ n \geq 1\}$ of independent identically distributed (iid) random variables with common absolutely continuous distribution function $F(x)$ and probability density function $f(x)$. Random variable X_n is an upper record, if $X_n > \max\{X_1, X_2, \ldots, X_{n-1}\}$ and lower record if $X_n < \min\{X_1, X_2, \ldots, X_{n-1}\}$. By convention X_1 is an upper and lower record. Let $\{T_n, n \geq 1\}$ be the record times at which record values occur. We define $T_1 = 1$ and

$$T_n = \min\left\{k; k > T_{n-1}, X_k > X_{T_{n-1}}, n \geq 1\right\}, \text{ for upper records,}$$

$$T_n = \min\left\{k; k > T_{n-1}, X_k < X_{T_{n-1}}, n \geq 1\right\}, \text{ for lower records.}$$

Denote as $\{R_n, n \geq 1\} = \{X_{T_n}, n \geq 1\}$ the sequence of upper record values and $\{L_n, n \geq 1\} = \{X_{T_n}, n \geq 1\}$ the sequence of lower record values. The distributions of record values R_n and L_n are given in terms of hazard function and hazard rate (see [3]).

The function $H(x)$ defined as $H(x) = -\ln(1-F(x))$ is called hazard function for upper records and function $H(x) = -\ln F(x)$ is called hazard function for lower records. The derivative of hazard function is called hazard rate and is denoted by $h(x)$.

If $F_n(x)$ is the distribution function of the nth record (of random variable R_n or L_n), $f_n(x)$ is the density function and $H(x)$ the corresponding hazard function, then

$$F_n(x) = \int_{-\infty}^{x} \frac{H^{n-1}(y)}{(n-1)!} dF(y), \tag{1}$$

and

$$f_n(x) = \frac{H^{n-1}(x)}{(n-1)!} f(x). \tag{2}$$

The joint density function of k records (upper or lower) is given by formula

$$f_{1,2,\ldots k}(x_1, x_2, \ldots, x_k) = h(x_1) \cdot h(x_2) \cdots h(x_{k-1}) \cdot f(x_k), \tag{3}$$

where $h(x)$ is hazard rate for upper record if $x_1 < x_2, < \ldots < x_k$ and for lower record if $x_1 > x_2 > \ldots > x_k$. The marginal density function of two records R_i, R_j (or L_i, L_j) we derived in the form

$$f_{i,j}(x_i, x_j) = \frac{(H(x_i))^{i-1}}{(i-1)!} h(x_i) \frac{(H(x_j) - H(x_i))^{j-i-1}}{(j-i-1)!} f(x_j), \tag{4}$$

for $-\infty < x_i < x_j < \infty$ in case of upper records (for $-\infty < x_j < x_i < \infty$ in case of lower records). Relation (4) we will need in the proof of out main theory.

3. Characterization of probability distributions by records

The problem of characterization of probability distributions by some properties of record values was opened by Ahsanullah in 1982 when he characterized the exponential distribution ([2]). In 2005 Ahsanullah in monograph [3] presented the recent developements of classical records (records in a sequence of independent identically distributed random variables). Korean mathematician Chang, Lee and Lim dealt with the problem of characterization of Pareto and Weibull distribution using upper records in [5] and [10] . We solved the problem of characterization of Gumbel, Fréchet and Weibull (for extreme values) distributions by transformation of lower records (see [12]). In this paper, we will present some characterization of general classes of probability distributions, where extreme value distributions are considered as special cases. We formulate here necessary and sufficient conditions using the independent property of suitable transformation of lower records. Similar theorems for upper records were discussed in detail in our earlier paper [9].

Theorem 1.
Let $\{X_n,\ n \geq 1\}$ be a sequence of independent identically distributed random variables with absolutely continuous distribution function $F(x)$, $x \in (a,b) \subseteq R$, $F(a) = 0$ and $F(b) = 1$. Let function $g : (a,b) \to (0,\infty)$ with properties : g is differentiable function, $g'(x) < 0$ for all $x \in (a,b)$, $\lim_{x \to a_+} g(x) = \infty$, $\lim_{x \to b_-} g(x) = 0$. Then the distribution function of $X_1, X_2, \ldots$ *is* of the form $F(x) = e^{-cg(x)}, x \in (a,b)$, $c > 0$ if and only if random variables $g(L_n)$ and $g(L_{n+1}) - g(L_n)$ are independent.
Proof. We give the sketch of the proof in two steps:

First we prove the necessary condition. Let $F(x) = e^{-cg(x)}, x \in (a,b)$, $c > 0$. Then the hazard function for lower records is $H(x) = -\ln(F(x)) = cg(x)$ and for the density of L_n, L_{n+1} by (4) holds

$$f_{n,n+1}(x,y) = \frac{(cg(x))^{n-1}}{(n-1)!} \cdot cg'(x) \cdot cg'(y) \cdot e^{-cg(y)}, \tag{5}$$

Consider the transformation

$$t : \begin{pmatrix} L_n \\ L_{n+1} \end{pmatrix} \to \begin{pmatrix} g(L_n) \\ g(L_{n+1}) - g(L_n) \end{pmatrix} = \begin{pmatrix} U \\ V \end{pmatrix} ; \quad \tau : \begin{pmatrix} U \\ V \end{pmatrix} \to \begin{pmatrix} g^{-1}(U) \\ g^{-1}(U+V) \end{pmatrix} \tag{6}$$

The determinant of the transformation is $D_\tau = (g^{-1})'(u)\ (g^{-1})'(u+v)$, so the density of U,V we get in the form

$$f_{U,V}(u,v) = \frac{(cu)^{n-1}}{(n-1)!} e^{-c(u+v)} cc, \quad u > 0,\ v > 0,\ c > 0. \tag{7}$$

According to (2) for the probability density of $U = g(L_n)$ holds

$$f_U(u) = \frac{(cu)^{n-1}}{(n-1)!} ce^{-cu}, \ c > 0,\ u > 0. \tag{8}$$

We obtain the density of V by integration of $f_{U,V}(u,v)$ according to du. Now it is easy to show that the joint density of U,V can be expressed in the form of product of marginal densities, i.e. $f_{U,V}(u,v) = f_U(u)\, f_V(v)$ what means that $U = g(L_n)$ and $V = g(L_{n+1}) - g(L_n)$ are independent random variables.

To prove the sufficient condition, we suppose that U,V are independent. Consider again the transformation (6) and derive the density $f_{U,V}(u,v)$ in general form for U=$g(L_n)$ by relation (4)

$$f_{U,V}(u,v) = \frac{\left(H\left(g^{-1}(u)\right)\right)^{n-1}}{(n-1)!} h\left(g^{-1}(u)\right) f\left(g^{-1}(u+v)\right) \left|\left(g^{-1}\right)'(u) \left(g^{-1}\right)'(u+v)\right| \tag{9}$$

and $f_U(u)$ using (2) in form

$$f_U(u) = \frac{\left(H\left(g^{-1}(u)\right)\right)^{n-1}}{(n-1)!} f\left(g^{-1}(u)\right) \left|g^{-1}(u)\right|. \tag{10}$$

The marginal density $f_V(v)$ then we get from the condition of independence of U,V in form

$$f_V(v) = -\frac{1}{F\left(g^{-1}(u)\right)} f\left(g^{-1}(u+v)\right) \left(g^{-1}\right)'(u+v). \tag{11}$$

After integration of (9) on $(0,v_1)$ and substituting $F_1(x) = F(g^{-1}(x))$, $x > 0$, we can derive functional equation of Cauchy type $F_1(v_1)F_1(u) = F_1(u+v_1)$. Its nontrivial solution is (see [1]) $F_1(x) = e^{cx}$, where c is an arbitrary constant, so $F(x) = e^{cg(x)}$. More exactly, because $F(x)$ is distribution function, we have $F(x) = e^{-cg(x)}$, $c > 0$, $x \in (a$,b). These complet the poof. □

The theoretical importance of this theorem consists in the fact that some suitable choice of the function $g(x)$ and of the interval (a,b) leads to various types of distribution functions, including extreme value distributions as we can see in the following example.

- *Gumbel distribution* with $F(x)=e^{-e^{-x}}$, $x \in R$, we get for

$$g(x)=\frac{1}{c}e^{-x}, x \in (a,b)=R, c>0,$$

- *Fréchet distribution* with $F(x)=e^{-\left(\frac{\beta}{x}\right)^{\alpha}}$, $\alpha>0, \beta>0, x>0$, we get for

$$g(x)=\frac{1}{c}\left(\frac{\beta}{x}\right)^{\alpha}, x \in (a,b)=(0,\infty), c>0, \alpha>0, \beta>0,$$

- *Weibull distribution* with $F(x)=e^{-(-x)^{-\alpha}}$, $x<0$, $\alpha<0$, we get for

$$g(x)=\frac{1}{c}(-x)^{-\alpha}, c>0, \alpha<0, x \in (a,b)=(-\infty,0).$$

On the other side, the practical importance of Theorem 1 consists in the fact that we can use it for approximation of the distribution of real data with extreme values. In the next section we will apply the theoretical results to simulated data and verify our theory using Hoeffding´s test of independence.

4. Application to simulated data

First we present the Hoeffding´s test of independence of two random variables with continuous distribution function. Hoeffding´s test is a non-parametric rank test which is consistent against all bivariate dependence alternatives. The hypotheses are in the form

H_0 : X, Y are independent,
H_1 : X,Y are dependent.

The test statistic is

$$\begin{aligned} D_n &= \frac{Q-2(n-2)Z+(n-2)(n-3)S}{n(n-1)(n-2)(n-3)(n-4)}, \text{ where} \\ Q &= \sum_{i=1}^{n}(Z_i-1)(Z_i-2)(S_i-1)(S_i-2), \\ Z &= \sum_{i=1}^{n}(Z_i-2)(S_i-2)C_i, \\ S &= \sum_{i=1}^{n}C_i(C_i-1). \end{aligned} \tag{12}$$

Z_i and S_i being the respective ranks of X_i among the X´s and Y_i among the Y´s, and C_i is the number of bivariate observations (X_j, Y_j) for which $X_j \le X_i$, and $Y_j \le Y_i$. The null hypothesis is rejected at level α, if $D_n > d_{n,\alpha}$ where $d_{n,\alpha}$ is the critical value of Hoeffding´s test (see [16]). For large values of n we can use approximation of test statistic (12) in form

$$\begin{aligned} T &= \frac{1}{2}\pi^4 n B_n, \text{ where} \\ B_n &= n^{-5}\sum_{i=1}^{n}\left(N_1(i)N_4(i)-N_2(i)N_3(i)\right)^2 \end{aligned} \tag{13}$$

and $N_j(i)$, j = 1, 2, 3, 4 are the numbers of points (x,y) lying in the four quadrants determined by the vertical and horizontal lines through the points (x_i,y_i).

To compare our results with standard goodness of fit tests, we will use the Kolmogorov-Smirnov (K-S) test and Anderson-Darling (A-D) test. Both of them test the hypotheses

$$H_0 : F_n(x) = F(x) \quad \text{againts} \quad H_1: F_n(x) \neq F(x),$$

where $F_n(x)$ is the empirical and $F(x)$ the continuous theoretical distribution function. The test statistics for K-S test is

$$K_n = \sup_x \left| F_n(x) - F(x) \right|, \tag{14}$$

and for A-D test

$$A_n = -n - \frac{1}{n} \sum_{k=1}^{n} (2k-1) \left[\ln F(x_{k:n}) + \ln(1 - F_{n+1-k:n}) \right], \tag{15}$$

where $x_{1:n} \leq x_{2:n} \leq \ldots \leq x_{n:n}$. The null hypothesis is rejected at level α , if the test statistic is bigger than the corresponding critical value.

Simulation study

- Consider independent identically distributed random variables $X_1, X_2, \ldots, X_{500}$.
- Each random variable X_i get values $X_{i,1}, X_{i,2}, \ldots, X_{i,1000}$ for i= 1,2,…,500, which are generated from Fréchet distribution with parameters $\alpha = 3, \sigma = 2$.
- Estimate the parameters of Fréchet, Weibull, exponential and Burr distribution based on observations $X_{1,1}, X_{1,2}, \ldots, X_{1,1000}$.
- In data $X_{1,j}, X_{2,j}, \ldots, X_{500,j}$, j=1, 2, …, 1000 find the realization of records L_1, L_2.
- Use Hoeffding´s test and the considered transformation of Theorem 1 to test equality of sampling and theoretical distributions.
- Compare the results with goodness of fit tests (K-S and A-D).

We estimated the unknown parameters of considered distributions using the maximum likelihood method and the results are in Table 1. The corresponding probability density functions of estimated distributions we can see on the Figure 1 and Figure 2.

Table 1: Estimation of unknown parameters

Distribution	λ	α	σ	k	t
Exponential	0.37	–	–	–	–
Fréchet	–	3.2	2.01	–	–
Weibull	–	2.9	2.93	–	–
Burr	–	0.33	–	93.24	8.05

Figure 1: Exponential and Weibull density functions

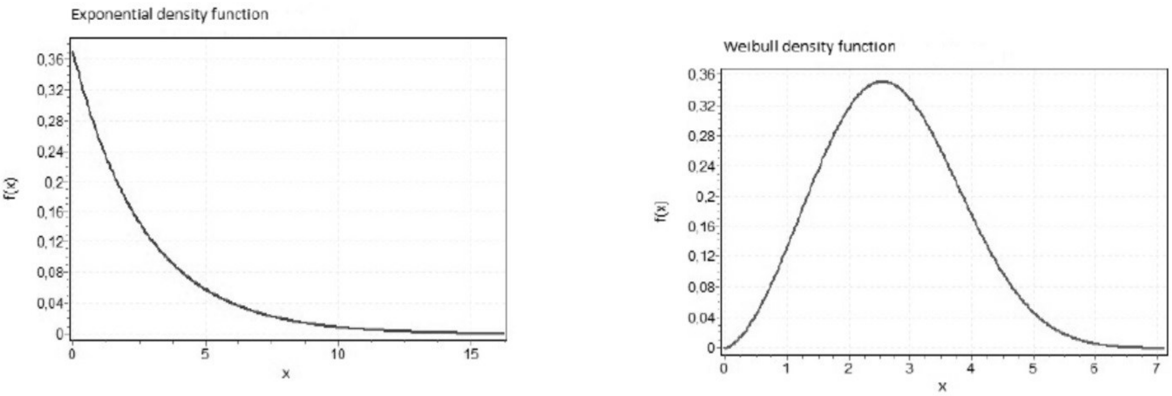
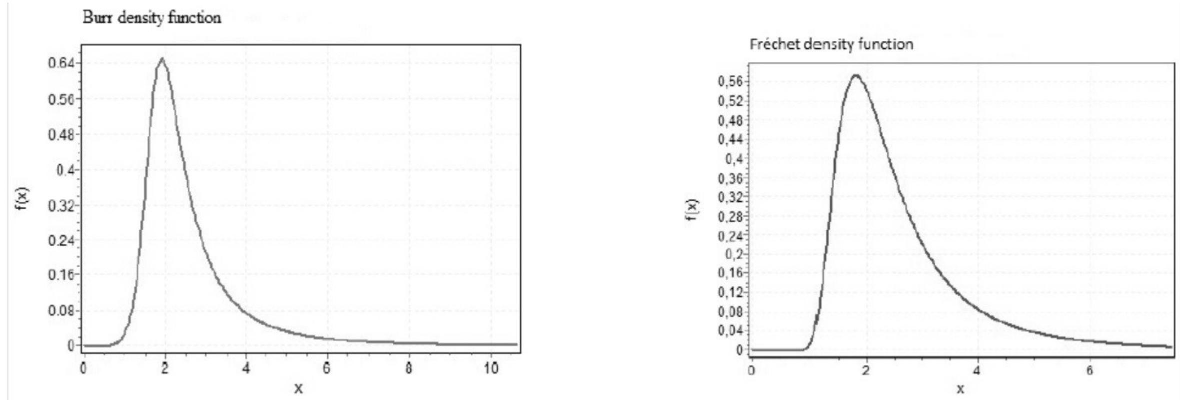


Figure 2: Burr and Fréchet density functions



The following table gives a brief outline about the results of testing the above presented hypotheses. We will consider the highest p-Value of tests as a criterion of optimality for our decisions.

Exponential distribution

	K-S test	A-D test	Hoeffding test
Statistics	0.3673	176.344	0.1941
p-Value	0	$6e^{-7}$	0.0006

Fréchet distribution

	K-S test	A-D test	Hoeffding test
Statistics	0.0189	0.4596	0.0254
p-Value	0.8664	0.7882	0.4415

Weibull distribution

	K-S test	A-D test	Hoeffding test
Statistics	0.1407	52.217	1.7679
p-Value	0	$6e^{-7}$	0

Burr distribution

	K-S test	A-D test	Hoeffding test
Statistics	0.0310	1.1973	0.1242
p-Value	0.2926	0.2686	0.0032

Decisions whether we reject hypothesis H_0 or not, are based on p-Values. We establish that according to all of tests only Fréchet distribution with estimated parameters is suitable model for generated data. According to test results we can deduce that Hoeffding´s test with Theorem 1 gives similar results as another two goodness of fit tests for exponential, Fréchet and Weibull distribution.

It seems, that the densities of Fréchet and Burr distribution are approximately equal (see Figure 2) but Hoeffding´s test reject the null hypothesis at all chosen significance levels.

The same simulation can be realized also using another distribution by choosing proper function *g*. Also data can be generated from other distribution we chose.

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Stakeholder analysis in the bank sector

Marie Slabá [1]

Abstract

Stakeholder analysis is nowadays considered as an important part of management of all institutions. For all organisations it is necessary to analysed in detail all individuals or groups that can affect or are affected by the organisations' activities. This article deals with the detailed stakeholder analysis and identification in the bank sector. In the first part of this article there are generally defined stakeholders and the basis of stakeholder approach. The second part focuses on results of the author's pilot research of stakeholders in bank sector. The analysis of stakeholders is carried out on the basis of Stakeholder Circle Methodology. The emphasis is on the identification and prioritisation of key stakeholders of bank institutions. The main objective of this article is verification of application possibilities of the stakeholder analysis and the Stakeholder Circle Methodology in the bank sector and detail identification and prioritisation of key stakeholder groups of bank institutions.

Key words

Stakeholder, stakeholder identification, stakeholder prioritisation, Stakeholder Index, Stakeholder Circle Methodology

JEL Classification: G20, M10

1. Úvod

Oblast stakeholder managementu a zejména pak analýzy a identifikace stakeholderů jsou považovány za jedny z moderních technik, které v současné době stále více nabývají na významu pro všechny typy komerčních i nekomerčních subjektů. Přesto však je nutné podotknout, že první koncept zaměřující se na oblast stakeholderů se objevil v literatuře již ve třicátých letech dvacátého století, ale větší popularity získal až díky dílům Freemana, jenž vytvořil komplexní pojetí stakeholder managementu. Freeman navázal na prvotní práce Stanford Research Institute, který se začal zabývat oblastí stakeholder managementu již v polovině šedesátých let (Hit, Freeman, Harrison 2004).

Rostoucí popularita přístupů k oblasti analýzy, identifikace a prioritizace stakeholderů v kontextu rozhodovacích procesů jsou reflektovány v dílech celé řady autorů, jako jsou například Brugha a Varvasovszky (2000) či Bryson (2004). Techniky, které jsou prostředky analýzy stakeholderů, pomáhají organizacím identifikovat a naplňovat jejich poslání i vytvářet vyšší hodnotu pro zákazníky a uspokojovat všechny požadavky cílových trhů (Bryson 2004). S ohledem na fakt, že stakeholder management, jehož důležitou a nedílnou součástí je právě analýza stakeholderů je obvykle zahrnován do oblasti strategického řízení (Freeman 2010, Freeman et al. 2010), je nutné brát v úvahu výsledky analýzy stakeholderů na všech úrovních managementu i úrovni vrcholové.

A kdo vlastně představuje samotného stakeholdera? Obecně je za stakeholdera považován kdokoliv, kdo ovlivňuje organizaci a její aktivity, nebo je naopak sám jimi ovlivněn. V užším slova smyslu jsou stakeholdery ti, bez nichž organizace nemůže v podnikatelském prostředí přežít, v širším slova smyslu se jedná o skupiny nebo jednotlivce, kteří mohou ovlivnit organizaci (Freeman 2010). Analýza stakeholderů pak představuje způsob identifikace,

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pochopení, ohodnocení, prioritizace, či mapování stakeholderů z pohledu organizace, či určení jejich relevance a vztahu k organizaci (Brugha, Varvasovszky 2000).

V současné literatuře nalezneme obrovské množství autorů, kteří se věnují analýze stakeholderů v oblasti komerčních institucí, kde je tato oblast rozpracována nejvíce. Analýze stakeholderů podnikatelských subjektů se věnují například Freeman (2010), Johnson, Scholes a Whittington (2008) a mnozí další. Celá řada autorů se také věnuje analýze stakeholderů v oblasti vzdělávání - například Mainardes, Alves and Raposo (2010), Kanji and Tambi (1999), atd. či v oblasti zdravotnictví v dílech Marsteina (2003) či Brughy and Varvasovszkyho (2000).

O potřebě analýzy stakeholderů v oblasti bankovnictví se začalo hovořit zejména v souvislosti s finanční krizí, která bankovní sektor velice ovlivnila. Dle Gunbara a Clunie je pro banky velice důležité zjistit, jak investoři a další stakeholdeři, které banky ovlivňují, o bankách smýšlejí. Bankovní sektor pracuje s celou řadou interních i externích skupin stakeholderů, mezi něž patří zákazníci, orgány státní správy a samosprávy, investoři, management, zaměstnanci a mnozí další (Dunbar, Clunie 2013).

V soudobé domácí i zahraniční literatuře, výzkumných zprávách a dalších zdrojích však nenajdeme komplexní analýzy, či výzkumy stakeholderů finančních institucí, přestože se ale mnohé zahraniční finanční instituce postupně i na oblast stakeholder managementu zaměřují – např. Standard Chartered Bank, či NIBC Bank. Většina bankovních institucí využívá analýzu stakeholderů zejména s ohledem na corporate responsibility a také oblast sociálních a environmentálních problémů.

Cílem tohoto článku je proto provést aplikaci tradiční analýzy stakeholderů v oblasti finančních institucí. Na základě pilotního výzkumu autorky bude provedena identifikace a prioritizace základních skupin stakeholderů v oblasti bankovního sektoru v České republice. V oblasti analýzy stakeholderů a jejich prioritizace je využívána celá řada různých přístupů. V rámci tohoto příspěvku je využita pro provedení důkladné analýzy stakeholderů Metodika Stakeholder Circle, která je podpořena také stejnojmenným softwarem Stakeholder Circle, který pracuje online. Tento software umožňuje nejen identifikaci a prioritizaci stakeholderů, ale také jejich mapování pomocí vizuálních map a dalších nástrojů a komunikaci s jednotlivými skupinami stakeholderů a tak značně usnadňuje zpracování jednotlivých kroků metodiky, jež budou popsány v následující kapitole.

2. Analýza stakeholderů českých bankovních institucí

V této kapitole budou prezentovány výsledky pilotního výzkumu autorky, jejž se zúčastnilo 25 manažerů vybraných poboček bank v České republice. Z důvodu, že data týkající se stakeholderů nejen bankovních, ale i ostatních organizací jsou považována za data velmi citlivá, dotazník byl naprosto anonymní a zúčastněné instituce nebudou v článku prezentovány.

2.1 Materiál a metody

Jak již bylo výše v textu uvedeno v oblasti finančních institucí, potažmo bankovního sektoru prozatím nenalezneme žádné výzkumy, které by byly zaměřeny na analýzu stakeholderů. Na základě pilotního průzkumu, který byl proveden u 25 vybraných poboček bank působících na území České republiky, bude provedena analýza stakeholderů. Veškeré bankovní instituce jsou ovlivněny celou řadou skupin s přímým, či nepřímým vlivem na její konání. Cílem tohoto výzkumu je identifikovat nejdůležitější skupiny stakeholderů bankovních institucí a stanovit priority pro 15 nejvýznamnějších skupin stakeholderů.

Na základě analýzy sekundární zdrojů byl stanoven následující základní seznam skupin stakeholderů pro bankovní instituce v České republice:

- akcionáři, Česká národní banka (dále jen ČNB), dodavatelé, dopravci, investoři, konkurence, management, média, Mezinárodní měnový fond (dále jen MMF), ministerstvo financí, místní komunita, orgány místní samosprávy, orgány státní správy, sponzoři, Světová banka, vzdělávací instituce, zákazníci (klienti), zaměstnanci.

Jelikož existuje celá řada dalších skupin, jak z oblasti orgánů státní správy, či nadnárodních institucí a mnohých dalších, byla respondentům ponechána otevřená volba Jiné, kde mohli doplnit jakoukoliv další skupinu stakeholderů, jež považují za významnou v oblasti bankovních služeb.

Vlastní analýza stakeholderů bude provedena na základě Metodiky Stakeholder Circle, která se skládá z následujících pěti kroků (Walker, Bourne, Rowlinson 2008):

1. identifikace stakeholderů,
2. prioritizace stakeholderů,
3. vizualizace stakeholderů,
4. strategie zapojení a komunikace,
5. monitoring.

V rámci tohoto článku budou řešeny první dva kroky Metodiky Stakeholder Circle, které jsou klíčové pro stanovení nejdůležitějších skupin stakeholderů bankovních institucí. Metodika Stakeholder Circle klade velký důraz na detailní identifikaci a popis jednotlivých skupin stakeholderů, což vede k dokonalému poznání nejdůležitějších skupin stakeholderů dané organizace a správnému způsobu práce s těmito skupinami. V průběhu identifikace je v rámci této metodiky nutné stanovit, zda se jedná o interní či externí skupinu stakeholderů. Dále se pro bližší analýzu určuje i směr působení stakeholderů na organizaci, jež nabývá čtyř základních hodnot – sidewards, upwards, outwards a downwards. Směr působení upwards je směrem působení od kontrolních skupin, pracovníků, či managementu a jeho opakem je působení downwards od běžných zaměstnanců instituce. Sidewards je spojováno zejména způsobením obdobných a konkurenčních organizací. Nejčastěji jsou skupiny označovány jako působící směrem outwards, kdy se jedná o skupiny stakeholderů, které se nachází mimo organizaci a nejsou organizacemi obdobnými, působícími jako její konkurence.

Pro budoucí targeting stanovených klíčových skupin stakeholderů je také důležité stanovit požadavky stakeholderů od organizace, na něž může pak organizace reagovat ve své cílené marketingové komunikaci vůči těmto skupinám stakeholderů. V rámci Metodiky Stakeholder Circle jsou přesně definovány požadavky, které jsou jednotlivým skupinám stakeholderů přiřazovány. Tyto požadavky jsou následující:

- žádné,
- zvýšení reputace,
- kariérní vzestup,
- zvýšení vlivu v rámci organizace,
- více pracovních příležitostí (větší příjem),
- benefity vyplývající z úspěšně dokončené práce,
- uspokojení zákazníků,
- dosažení benefitů z obchodního případu.

Nepovinnou položkou identifikace je také určení důležitosti a významu stakeholdera pro instituci. V rámci těchto bodů se určuje, zda stakeholder disponuje významnými znalostmi, které jsou pro organizaci důležité, zda může organizaci, její prostředí a výstupy přímo ovlivnit, nebo naopak zda těmito aspekty je sám ovlivněn, zda disponuje silou ovlivnit úspěch či neúspěch instituce, má zájem na jejích aktivitách, schopnost ovlivnit organizaci, vlastní práva, či je zdrojem financí, či jiných zdrojů, apod.

Po důkladném popisu jednotlivých skupin stakeholderů dochází k prioritizaci stakeholderů. Při využití Metodiky Stakeholder Circle se priorita, jež je přidělena jednotlivým skupinám stakeholderů, odvozuje od Stakeholder Indexu, který vyjadřuje důležitost dané skupiny stakeholderů pro organizaci a je vypočítán následovně

$$Stakeholder\ index = (\sum Power, Proximity, Urgency\ )$$

kde Power představuje sílu vlivu stakeholdera na zkoumanou instituci, Proximity zapojení stakeholdera do aktivit organizace a hodnota Urgency představuje potřebu aktivit v rámci komunikace směřující k dané skupině stakeholderů, která je počítána z hodnoty Action – tedy aktivity stakeholderů a jejich podílu (Value) na činnostech bankovní instituce. Veškerá hodnocení jsou vyjádřena slovně a každému tvrzení je přiřazena numerická hodnota. Veličiny Power a Proximity nabývají hodnot od 1 do 4 a veličiny Action a Value nabývají hodnot od 1 do 5. Ukázka slovního vyjádření jednotlivých hodnot je uvedena v následující tabulce (případ veličiny Proximity – zapojení stakeholdera).

Tab. 1: Hodnoty veličiny Proximity (zapojení stakeholdera)

Verbální vyjádření	Numerická hodnota
Bez přímého zapojení do aktivity	1
Pravidelný kontakt	2
Zapojení na částečný pracovní úvazek	3
Plné zapojení	4

Zdroj: vlastní výzkum

Jak již bylo výše naznačeno cílem tohoto článku je provést podrobnou identifikaci klíčových skupin stakeholderů bankovních institucí. Dále bude provedena jejich prioritizace. Ke stanovení priorit dojde na dvou úrovních – dle profesionálního úsudku respondentů a dle pravidel Metodiky Stakeholder Circle. Tyto přiřazené priority budou vzájemně porovnány.

Jak bylo výše uvedeno v rámci Metodiky Stakeholder Circle se přidělená priorita odvozuje od Stakeholder Indexu. Vztah mezi prioritou přiřazenou softwarem Stakeholder Circle a Stakeholder Indexem bude prověřen prostřednictvím regresní analýzy a výpočtu korelačního koeficientu, jehož vzorec je následující (Hindls et al. 2006)

$$r_{yx} = \frac{s_{xy}}{\sqrt{s_{x^2} s_{y^2}}}$$

2.2 Identifikace základních skupin stakeholderů

Celkový seznam vytipovaných skupin stakeholderů byl předložen manažerům vybraných bankovních poboček, kteří měli označit skupiny stakeholderů, na něž se jejich pobočky zaměřují. Jednotlivé skupiny stakeholderů byly rozděleny na interní a externí skupiny a dále pak dle požadavků Metodiky Stakeholder Circle dle směru jejich působení na organizaci.

Tab. 2: Základní skupiny stakeholderů

Skupina stakeholderů	Absolutní/Relativní četnost (v %)	Interní skupina	Externí skupina	Směr působení			
				upwards	downwards	sidewards	outwards
Akcionáři	18/72	✓		✓			
ČNB	24/96		✓				✓
Dodavatelé	4/16		✓				✓
Dopravci	3/12		✓				✓
Investoři	15/60		✓	✓			
Konkurence	25/100		✓			✓	
Management	20/80	✓		✓			
Média	25/100		✓				✓
MMF	3/12		✓				✓
Ministerstvo financí	12/48		✓				✓
Místní komunita	14/56		✓				✓
Orgány místní samosprávy	9/36		✓				✓
Orgány státní správy	19/76		✓				✓
Sponzoři	18/72		✓	✓			
Světová banka	17/68		✓				✓
Vzdělávací instituce	9/36		✓				✓
Zákazníci (klienti)	25/100		✓				✓
Zaměstnanci	25/100	✓			✓		
Další	0/0						

Zdroj: vlastní výzkum

Jak je vidět z výše uvedené tabulky všichni oslovení respondenti se zaměřují na zákazníky, zaměstnance, konkurenci a stejně tak jsou pro ně důležitá média, jež disponují silou ovlivnit veřejné mínění, a proto je nutné jim věnovat náležitou pozornost. Pouze jediný respondent neuvedl ve svých odpovědích ČNB. Velkou roli pro bankovní instituce také hraje také management, jejž uvedlo 80% dotázaných, a orgány státní správy (76% dotázaných respondentů). Dále pak 72% všech respondentů označilo jako důležité skupiny akcionáře a sponzory. Na druhé straně jako nejméně důležité skupiny byly označeny MMF a dopravci. Dodavatele uvedlo pouze 16% dotazovaných, což v porovnání s podnikatelskými subjekty, jejichž výzkum byl autorkou také prováděn na území České republiky, je pouze nepatrný zlomek, jelikož dodavatele jako důležité stakeholderů uvedlo 64% všech dotazovaných podnikatelských subjektů. Rozdíl v těchto odpovědích s největší pravděpodobností vyplývá z odlišného zaměření zkoumaných subjektů.

Jak již bylo výše uvedeno, směr vlivu stakeholderů nabývá čtyř základních podob – upwards, downwards, sidewards a outwards. Směr upwards je spojen v tomto případě s akcionáři a manažery bank, kteří představují tzv. kontrolní skupiny, ale také investoři, popř. sponzoři, kteří jsou pro bankovní instituci významní. Skupiny stakeholderů se směrem působení upwards mají tzv. sílu „kill the project“ (Bourne 2006), a proto je těmto skupinám nutné věnovat dostatečnou pozornost. Směr downwards reprezentují zaměstnanci. Pouze 1 skupina je skupinou se směrem působení sidewards a to je konkurence a všechny ostatní skupiny je možné zahrnout do směru působení outwards. Pouze 3 skupiny vytypovaných a ověřených stakeholderů jsou skupinami interními (akcionáři, management a zaměstnanci), ostatní skupiny jsou zahrnuty do stakeholderů externích stojících mimo organizaci.

V níže uvedeném diagramu jsou jednotlivé skupiny stakeholderů podrobněji rozděleny na primární, které byly na základě výzkumu identifikovány jako nejdůležitější, a sekundární skupiny stakeholderů. Primární skupiny představují ty, bez nichž by instituce nemohla fungovat, sekundární skupiny jsou pak skupinami, které více, či méně instituci ovlivňují, nebo jsou jejím konáním ovlivněny (Chinyio 2010). Primární skupiny se nachází blíže ke středu diagramu a sekundární skupiny se nachází ve vzdálenější vrstvě diagramu. Dělení stakeholderů na primární a sekundární je dalším nástrojem pro jejich podrobnější analýzu a identifikaci, jež využívá například Freeman (2010).

Obr. 1: Primární a sekundární skupiny stakeholderů bankovních institucí

Zdroj: vlastní výzkum

Zejména s ohledem na targeting cílových trhů, marketingovou komunikaci a přípravu komunikovaného sdělení, je v rámci identifikace klíčových skupin stakeholderů také nutné stanovit požadavky stakeholderů od samotné instituce. Na tyto požadavky je pak třeba reagovat vhodně zvoleným marketingovým sdělením.

Tab. 3: Podrobnější analýza klientů bankovních institucí

Požadavek	Skupiny stakeholderů
Žádné	ČNB, Světová banka, média, ministerstvo financí, konkurence, orgány státní samosprávy, orgány místní samosprávy, MMF, dodavatelé, místní komunita, vzdělávací instituce
Zvýšení reputace	Sponzoři
Kariérní vzestup	Zaměstnanci
Zvýšení vlivu v rámci organizace	Management, akcionáři
Více pracovních příležitostí (větší příjem)	Zaměstnanci
Benefity vyplývající z úspěšně dokončené práce	Akcionáři, investoři
Uspokojení zákazníků	Zákazníci, management
Dosažení benefitů z obchodního případu	Akcionáři, investoři

Zdroj: vlastní výzkum

Jelikož bankovní instituce jsou velmi specifickými subjekty, na něž působí celá řada orgánů státní správy a samosprávy a také různých typů organizací (ČNB, MMF, atd.) bylo by dobré pro tyto subjekty přidat do softwaru možnost požadavku na informace, jež tyto organizace od bankovních institucí vyžadují. Stejně tak informace vyžadují média, popř. konkurence, či místní komunita a vzdělávací instituce, dodavatelé a dopravci. Jedná se o všechny skupiny, u nichž bylo vhodné v rámci softwaru uvést požadavky žádné. V případě dodavatelů či dopravců je možné uvažovat i o zvýšení vlastní reputace, pokud považují služby poskytované bance za prestižní.

Jako nepovinné aspekty identifikace stakeholderů se určují důležitost a význam stakeholdera pro organizaci. Význam jednotlivých vytipovaných skupin stakeholderů pro bankovní instituce je shrnut v následující tabulce.

Tab. 4: Důležitost a význam stakeholderů pro bankovní instituce

Aspekt	Skupiny stakeholderů
Znalosti	Management, ČNB, zaměstnanci, Světová banka, ministerstvo financí, MMF
Práva (legální, či morální) vůči organizaci	Akcionáři, sponzoři, investoři
Přímý vliv na výsledky, či prostředí organizace	Investoři, management, ČNB, Světová banka
Zájem na aktivitách organizace	Zákazníci, investoři, média, sponzoři, konkurence, místní komunita, vzdělávací instituce
Schopnost ovlivnit výsledky aktivit organizace	Zákazníci, management, zaměstnanci, akcionáři, investoři, sponzoři, orgány státní správy, orgány místní samosprávy, MMF
Stakeholder je ovlivněn výsledky organizace	Zákazníci, konkurence, místní komunita
Stakeholder je důležitým zdrojem finančních zdrojů	Investoři, akcionáři
Vlastnická práva	akcionáři
Stakeholder přispívá k dosažení výsledků organizace	Zaměstnanci, management, dodavatelé, dopravci
Stakeholder je důležitým zdrojem jiných než finančních zdrojů	Dodavatelé
Stakeholder může ovlivnit úspěch či neúspěch organizace	ČNB, zaměstnanci, management, Světová banka, ministerstvo financí, orgány státní správy, MMF
Stakeholder může ovlivnit vnější pohled na organizaci	Média, místní komunita
Stakeholder disponuje specifickými schopnostmi důležitými pro organizaci	Management
Stakeholder je členem řídícího orgánu	Management, akcionáři

Zdroj: vlastní výzkum

2.3 Prioritizace základních skupin stakeholderů

Prioritizace klíčových skupin stakeholderů byla provedena na dvou úrovních. Nejprve po identifikaci základních skupin stakeholderů byli respondenti požádáni, aby na základě svého profesionálního úsudku přiřadili priority jednotlivým skupinám stakeholderů. Jelikož do této oblasti je vždy vnesen prvek subjektivity, byla v druhé fázi provedena prioritizace na základě Metodiky Stakeholder Circle. Jak již bylo výše uvedeno, priority jsou přiřazovány automaticky softwarem Stakeholder Circle, jenž je odvozuje od hodnoty Stakeholder Indexu.

Tab. 5: Přiřazené priority

Skupina stakeholderů	Priorita dle profesionálního úsudku respondentů	Stakeholder Index	Priorita dle Metodiky Stakeholder Circle
Akcionáři	7	51,3	4
ČNB	6	50,8	5
Dodavatelé	17	20,5	15
Dopravci	18	14,9	18
Investoři	3	56,8	2
Konkurence	4	35,7	10
Management	8	55,7	3
Média	5	36,8	8
MMF	14	30,8	12
Ministerstvo financí	11	35,9	9
Místní komunita	10	20,1	16
Orgány místní samosprávy	16	25,6	14
Orgány státní správy	13	35,5	11
Sponzoři	12	30,4	13
Světová banka	9	45,8	7
Vzdělávací instituce	15	15,0	17
Zákazníci (klienti)	1	59,7	1
Zaměstnanci	2	49,4	6

Zdroj: vlastní výzkum

Jak je vidět z výše uvedené tabulky priorita, kterou přiřadili respondenti na základě svého vlastního profesionálního úsudku se, ve všech případech kromě nejdůležitější skupiny – zákazníků, kterým byla přiřazena priorita 1, a nejméně důležité skupiny – dopravců, kterým byla přiřazena priorita 18, liší. V některých případech došlo pouze k mírné odchylce o 1 nebo 2 stupně (případ ČNB, dodavatelů, investorů, MMF, ministerstva financí, orgánů státní správy a místní samosprávy, sponzorů, Světové banky a vzdělávacích institucí). V ostatních případech došlo k odchylkám výraznějším. Například konkurenci vnímají respondenti jako čtvrtou nejdůležitější skupinu stakeholderů, zatímco na základě Metodiky Stakeholder Circle jí byla přiřazena až 10. priorita. Stejným případem s rozdílem o šest bodů na žebříčku priorit je místní komunita, kdy opět je chápána respondenty jako výrazně významnější, než jaká jí byla ve skutečnosti přiřazena priorita na základě Metodiky Stakeholder Circle.

Zjevným důvodem těchto rozdílů jsou parametry, které jsou nutné pro vlastní výpočet Stakeholder Indexu, od nějž je priorita odvozena. Mezi těmito parametry je síla (Power), s kterou stakeholder, či skupina může působit na aktivity organizace, či zapojení (Proximity) stakeholdera do aktivit organizace, které v případě konkurence a místní komunity jsou nízké, a proto i celková priorita stakeholdera je nižší, než dle profesionálního úsudku respondentů.

Vzájemný vztah mezi vypočteným Stakeholder Indexem a prioritou přiřazenou na základě Metodiky Stakeholder Circle byl prověřen prostřednictvím regresní analýzy. Nejspolehlivějším modelem pro prověření vzájemného vztahu je lineární regresní model s následujícím odhadem regresní funkce

$$Priorita\ dle\ MSC = 22{,}996 - 0{,}362201 * Stakeholder\ Index$$

Legenda:

MSC……………………………..Metodika Stakeholder Circle

Hodnota odpovídajícího t-testu je nižší než 0,01. Bylo tedy prokázáno, že směrnice přímky β_1 je záporná, a je tedy možné konstatovat, že čím vyšší je Stakeholder Index, tím vyšší je priorita přiřazená skupině stakeholderů (což představuje nižší hodnotu – jelikož hodnota 1 znamená nejvyšší prioritu a hodnota 18 prioritu nejvyšší). Toto tvrzení také koresponduje s velikostí a znaménkem vypočteného korelačního koeficientu r= - 0,991325 a hodnotou koeficient R^2 = 98,28 %). Na základě provedené regresní analýzy je tedy možné konstatovat, že mezi vypočteným Stakeholder Indexem a přiřazenou prioritou je signifikantní závislost, která byla ověřena na hladině významnosti 99 %.

3. Závěr

Cílem tohoto článku bylo provést analýzu stakeholderů bankovních institucí a jejich podrobný popis, identifikaci a prioritizaci klíčových skupin stakeholderů na základě Metodiky Stakeholder Circle. V prvním kroku došlo k identifikaci 18 základních skupin stakeholderů bankovních institucí, které byly rozděleny na interní, externí, primární a sekundární skupiny stakeholderů. Z výše uvedených 18 skupin stakeholderů jsou interními skupinami pouze 3 – a to akcionáři, management a zaměstnanci, ostatní skupiny tvoří skupiny externí. Jako primární skupiny, které mají největší vliv na organizaci, byly na základě provedeného výzkumu určeny zákazníci, investoři, sponzoři, management, zaměstnanci, akcionáři a ČNB. Vliv ostatních skupin není pro bankovní instituce natolik klíčový, aby bankovní instituce ohrožovaly. Dále byl dle Metodiky Stakeholder Circle určen směr působení stakeholderů na bankovní instituce. Většina skupin stakeholderů se vyznačuje působení outwards, což také koresponduje s faktem, že většina skupin stakeholderů jsou skupiny externí s nepřímým vlivem na organizaci.

Pro komunikaci s cílovými trhy, targeting a přípravu sdělení, je důležité identifikovat požadavky jednotlivých skupin stakeholderů od bankovní instituce. Těmito požadavky může být kariérní postup zaměstnanců, uspokojení zákazníků a mnohé další. Při identifikaci požadavků stakeholderů od organizace bylo zjištěno, že pro celou řadu stakeholderů bankovních institucí jsou důležité informace, které tito stakeholdeři od bankovní instituce získávají. Tuto možnost však software Stakeholder Circle nenabízí, a proto by bylo vhodné tuto možnost do zpracování prostřednictvím softwaru doplnit.

Prioritizace skupin stakeholderů proběhla na dvou úrovních, nejprve byly respondenti požádání o přiřazení proirity dle svého vlastního profesionálního úsudku, dále pak byla určena priorita dle Metodiky Stakeholder Circle. Při porovnání těchto priorit bylo zjištěno, že pouze v případě nejdůležitější skupiny (klienti) a nejméně důležité skupiny (dopravci) se přidělené priority shodují. Zjevným důvodem těchto rozdílů jsou parametry pro výpočet Stakeholder Indexu, od nějž je priorita v rámci Metodiky Stakeholder Circle odvozena.

V rámci dalšího zkoumání skupin stakeholderů bankovních institucí bude provedena vizualizace a mapování těchto skupin prostřednictvím multidimenzionálních map a dalších prostředků. Vizualizace představuje třetí krok Metodiky Stakeholder Circle. Pro tvorbu multidimenzionálních map je nutný počet 15 skupin stakeholderů. Těchto 15 skupin, které budou použity pro další výzkum, jsou následující skupiny stakeholderů, jimž byly na základě Metodiky Stakeholder Circle přiřazeny nejvyšší priority a jsou z toho důvodu považovány za nejdůležitější klíčové skupiny stakeholderů (seřazeno od nejvýznamnější (priorita 1) po nejméně významnou (priorita 15):

- zákazníci (klienti), investoři, management, akcionáři, ČNB, zaměstnanci, Světová banka, média, ministerstvo financí, konkurence, orgány státní správy, MMF, sponzoři, orgány místní samosprávy a dodavatelé.

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Are Money Growth and Inflation Related?

Lenka Spáčilová [1]

Abstract

In recent years, some countries have increased the amount of money to support their economies in the current crisis. According to the quantity theory of money an increase in money growth causes inflation in the long run. In this study we tested the long-run relationship between average money growth and average rate of inflation on the sample of countries in four five-year periods from 1993 to 2012. We used the graphical analysis and correlation. The correlation between money growth and inflation is strong or very strong across all time frames except the period of 2008-2012, the period of financial crises. For this period we found strong relationship between money growth and growth of real GDP.
The paper's outline is as follows. In Section 1, we begin with some reflections on the body of thought known as the quantity theory of money. Section 2 is concerned with empirical regularities relating to money growth and inflation.

Key words

Correlation, inflation, monetary aggregate, money growth, quantity theory of money, long run.

JEL Classification: E52

1. Introduction

Six years ago, the global financial and economic crisis started. Financial and political chaos that followed the collapse of Lehman Brothers, led to the greatest economic disaster in the postwar era.

The 1990s was a period of disinflation. Thanks to the effort of achieving low and stable inflation, nominal interest rates fell to very low levels. At the beginning of the crisis, central banks sought to support economic activity by lowering interest rates. Gradually nominal interest rates fell to zero (see Table 1). Never in recent economic history have interest rates been so low for so long.

Once interest rates get close to zero the central bank has no room to support the economy when economic collapse comes. This form of monetary policy is no longer effective because nominal interest rates cannot be lowered below zero. In order to stimulate the economy other policies must be implemented. There are three monetary policy alternatives at the zero bound: (1) using communications policies to shape public expectations about the future course of interest rates; (2) increasing the size of the central bank's balance sheet (quantitative easing); and (3) changing the composition of the central bank's balance sheet (credit easing).

Six years after the outbreak of the financial crisis the economic situation in the world is far from back to normal. Unemployment is high in many countries, growth is expected to return only gradually. In this situation, some central banks continue to use the policy of quantitative easing, in policy of printing money to buy assets.

One worry with quantitative easing is that the increase in the supply of money might lead to inflation.

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Table 1: Key interest rates

	Eurozone	USA	Great Britain	Czech Republic	Japan	Sweden	New Zealand
Key interest rates 03/2008	4 %	3 %	5.25 %	3.75 %	0.1%	4.25 %	8.25 %
Key interest rates 03/2009	1.5 %	0-0.25 %	0.5 %	1.75 %	0.1 %	1 %	3.5 %
Key interest rates 03/2013	0.5 %	0-0.25 %	0,5 %	0.05 %	0.1 %	1 %	2,5 %

Source: www.cnb.cz, www.boj.or.jp

2. Quantity theory of money

An economic theory called the quantity theory of money indicates that excess money creation is the underlying cause of inflation. The quantity theory has a long and distinguished history. The 18th century Scottish philosopher David Hume was one of the first to formulate a version of the quantity theory of money. The most important formulations of the modern quantity theory were written in the late of nineteenth and early of twentieth centuries, the main contributions being by Knut Wicksell in Sweden, Irving Fisher in America and Alfred Marshall in England. A more recent proponent was monetarist Milton Friedman.

In its simplest form, the quantity theory of money says that changes in money supply growth are followed by equal changes in the inflation rate.

Irving Fisher, in the *Purchasing Power of Money* (1911), laid out the quantity theory in terms of the famous quantity equation

$$MV = PT \tag{1}$$

where M is the stock of hard or metallic money consisting of gold coin and convertible bank notes[2], V is the turnover velocity of circulation of that stock, P is the price level, and T is the total value of transactions or trade.

The development of national accounting has stressed income transactions rather than gross transactions. We can rewrite the quantity equation in income form as

$$MV = PY \tag{2}$$

where M represent, as before, the stock of money, V is the average number of times per unit time that the money stock is used in making income transactions (that is, payments for final productive services or, alternatively, for final goods and services), P is the price index and Y is real product.

The same theory can be reinterpreted in terms of the inflation rate:

$$m + v = p + y \tag{3}$$

where lower case characters represent the rate of growth of upper case characters (i.e. m is the rate of growth of money M).

[2] In fact, the later writers have had in mind quantities of fiat (paper) money whereas the earlier ones were discussing quantities of metallic money.

Irving Fisher as well as other proponents of the quantity theory of money concluded that changes in the stock of money lead to proportional changes in the price level and do not affect output.

According to Milton Friedman (1970), inflation is always and everywhere a monetary phenomenon in the sense that it is and can be produced only by a more rapid increase in the quantity of money than in output. Friedman's version of the quantity theory is based on the postulate that there is a stable demand for real money balances. He assumes that in the long run the level of money demand depends on economic fundamentals such as real income, the interest rate, and the nature of the technology for conducting transactions. Under this assumption, changes in the nominal supply of money have no long-run impact on the real demand for money and lead to changes in the price level.

3. Empirical Analysis of Long-run Relationship between Money Growth and Inflation

In the following section we will examine the long-run relationship between money growth and inflation.

3.1 Data

To explore the relationship between money growth and inflation, we chose the largest available sample of developed and developing countries from OECD Statistics covering the years 1993-2012.[3] Like Dwyer and Hafer (1988, 1999)[4], we used five-year averages. To determine whether there are differences between time periods, we considered four sub-samples 1993-1997, 1998-2002, 2003-2007 and 2008-2012. These periods should be long enough to identify long-run relations. The data set covers 17 countries from 1993 to 1997, 22 countries from 1998 to 2002, 26 countries from 2003 to 2007 and 26 countries from 2008 to 2012. These samples reflect the availability of the necessary data.

The quantity theory of money does not specify which definition of money supply should be used in empirical tests of the theory. We tested the quantity theory using monetary aggregate M1. Inflation is measured as percentage increase in the consumer price index.

3.2 Results

In the first step, we analysed the relationship between average growth rate of monetary aggregate M1 and the average rate of inflation graphically by scatter plots for each sub-sample. Each point in the figures shows the average growth rate of monetary aggregate M1 and the average rate of inflation measured by CPI for a specific country. The visual evidence in figures indicates that the points cluster around positive linear line.

Monetary theory predicts a strong long-run correlation between money growth and inflation. For this assertion we examined the correlation between average money growth and average inflation for all sub-samples. All the correlations estimated in this paper are long-run. They do not establish any direction of causality between money and inflation even in the long-run. Calculated across a range of countries this correlations will be independent of various country specific effects and policies (e. g. the way in which monetary policy is implemented).

[3] In a full sample, there are following countries: Australia, Brazil, Canada, Chile, China, Czech Republic, Euro area, Denmark, Hungary, Iceland, India, Indonesia, Israel, Japan, Korea, Mexico, New Zealand, Norway, Poland, Russian Federation, South Africa, Sweden, Switzerland, Turkey, United Kingdom and United States.

[4] These authors (Dwyer, Hafer, 1999) compare the relation between average money growth and average inflation rate in two periods, 1987-1992 and 1993-1997.

1.1.1 1993-1997

Figure 1: Average Money Growth and Inflation across Countries, 1993-1997

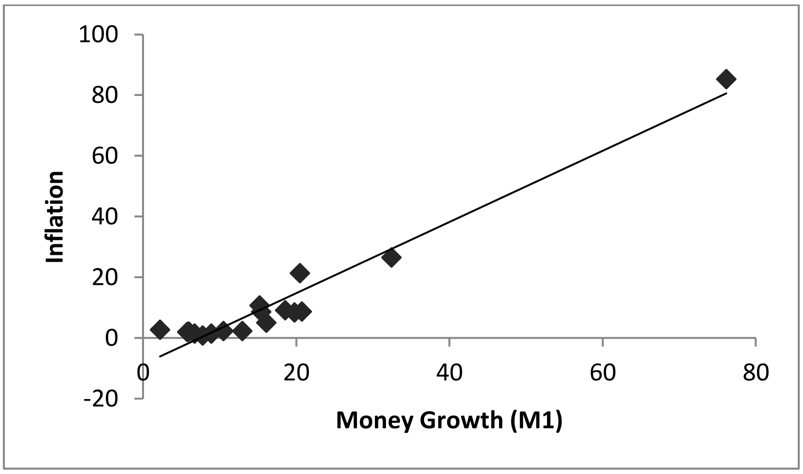


Table 2: Correlation coefficient, 1993-1997

Correlations[a]

		M1	Inflation
M1	Pearson Correlation	1	,969**
	Sig. (1-tailed)		,000
	N	19	19
Inflation	Pearson Correlation	,969**	1
	Sig. (1-tailed)	,000	
	N	19	19

**. Correlation is significant at the 0.01 level (1-tailed).

a. Year = 1993-1997

In this sub-sample, we can see that the relationship is almost exactly as the theory predicts and the correlation coefficient between money growth and inflation is 0.969. The high correlation between money growth and inflation suggests that the relationship between these two variables is very close to linear. It means, there is a relationship between money growth and inflation in the long run, as the quantity theory of money claims. However, according to the quantity theory of money is the relationship between money and inflation proportional. It means one-to-one. One-percent change in the quantity of money causes a one-percent change in inflation. This would mean that the points in the figure had to lie near the line of 45 degrees. However, we can see in Figure 1 – 4, the points are below 45º line. Long-run inflation is caused not only by increase in the amount of money, but also by other factors, such as long-run growth rate of the economy and changes in velocity.

Perhaps is there a high correlation affected by the presence of high-inflation countries in the sample (see Figure 1). Therefore, we excluded the high-inflation country (Turkey) from the sample. The correlation remains strong (0.867) even if high-inflation country is removed from the sample.

1.1.2 1998-2002

Figure 2: Average Money Growth and Inflation across Countries, 1998-2002

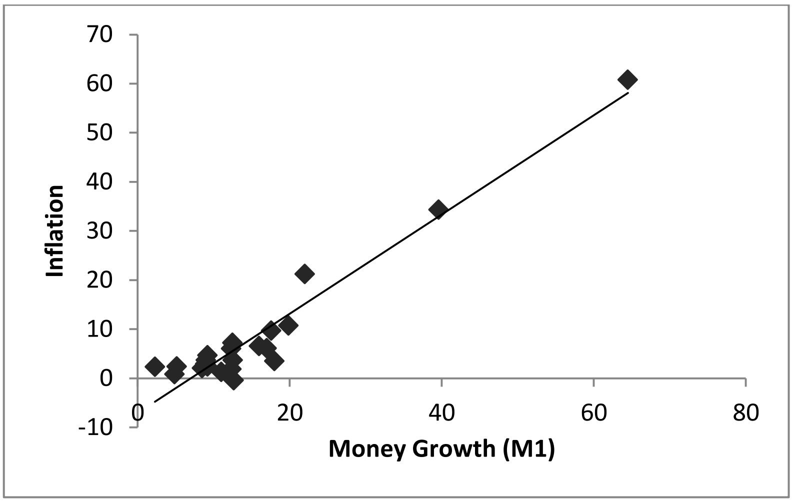


Table 3: Correlation coefficient, 1998-2002

Correlations[a]

		M1	Inflation
M1	Pearson Correlation	1	,965**
	Sig. (1-tailed)		,000
	N	22	22
Inflation	Pearson Correlation	,965**	1
	Sig. (1-tailed)	,000	
	N	22	22

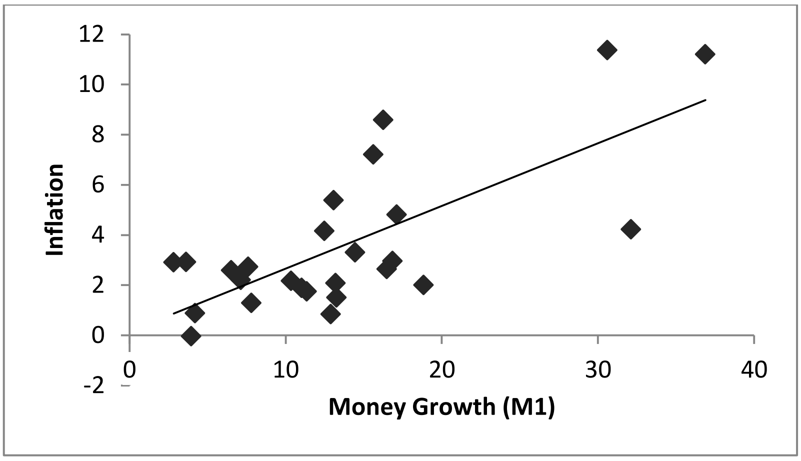
**. Correlation is significant at the 0.01 level (1-tailed).

a. Year = 1998-2002

Also, this sample shows a high correlation coefficient (0.965). As in the preceding five-year period, higher rates of money growth are associated with higher inflation rates. However, there are also two countries (Russian Federation and Turkey) with extremely high inflation (see Figure 2). With excluding these countries from the sample, the correlation is 0.717. It means, also in this period there is a high correlation between the rate of growth of the money and the rate of inflation in the long run.

1.1.3 2003-2007

Figure 3: Average Money Growth and Inflation across Countries, 2003-2007



As we can see in the Figure 3, in this period there are any countries with extremely high inflation. The rate of inflation of countries in the sample is not greater than 12 percent. But if the money supply is growing faster in the long run even low inflation countries will experience greater inflation.

In this period, the correlation coefficient is lower (0.722), but still significant.

Table 4: Correlation coefficient, 2003-2007

Correlations[a]

		M1	Inflation
M1	Pearson Correlation	1	,722**
	Sig. (1-tailed)		,000
	N	26	26
Inflation	Pearson Correlation	,722**	1
	Sig. (1-tailed)	,000	
	N	26	26

**. Correlation is significant at the 0.01 level (1-tailed).

a. Year = 2003-2007

1.1.4 2008-2012

In comparison with previous periods, the results for this period are different. The relationship between money growth and inflation is still positive, but weak (see Table 5).

According to the quantity theory of money, the money growth does not affect economic activity in the long run. However, this theory usually analyse economy with fully employed sources or close to this situation. The period 2008-2012 is period of financial and economic crisis with central banks using some unconventional forms of monetary policy. What is the relationship between growth of narrow money and growth of real GDP in this period? Is monetary policy more effective in crisis than in normal times?

When we compared the relationship between average growth of monetary aggregate M1 and average GDP growth in periods 1993-1997 and 1998-2002, the correlation between these variables was not found. However, the results for following two periods (2002-2007 and 2008-2012) are somewhat different.

Figure 4: Average Money Growth and Inflation across Countries, 2008-2012

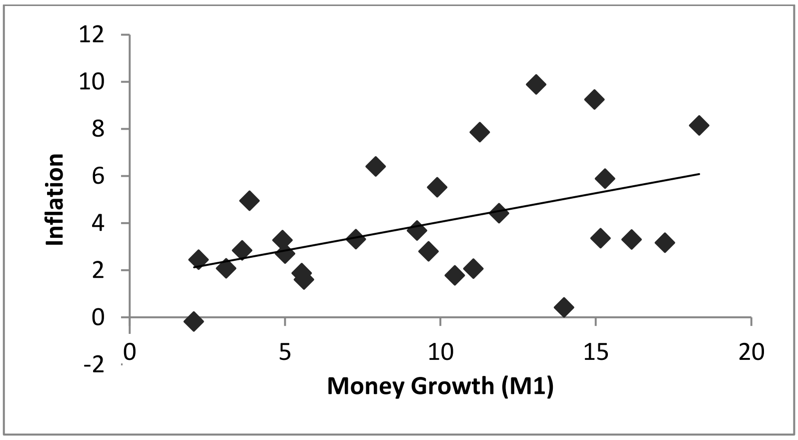


Table 5: Correlation coefficient, 2008-2012

Correlations[a]

		M1	Inflation
M1	Pearson Correlation	1	,465**
	Sig. (1-tailed)		,008
	N	26	26
Inflation	Pearson Correlation	,465**	1
	Sig. (1-tailed)	,008	
	N	26	26

**. Correlation is significant at the 0.01 level (1-tailed).

a. Year = 2008-2012

Figure 5: Average Money Growth and Growth of real GDP across Countries, 2008-2012

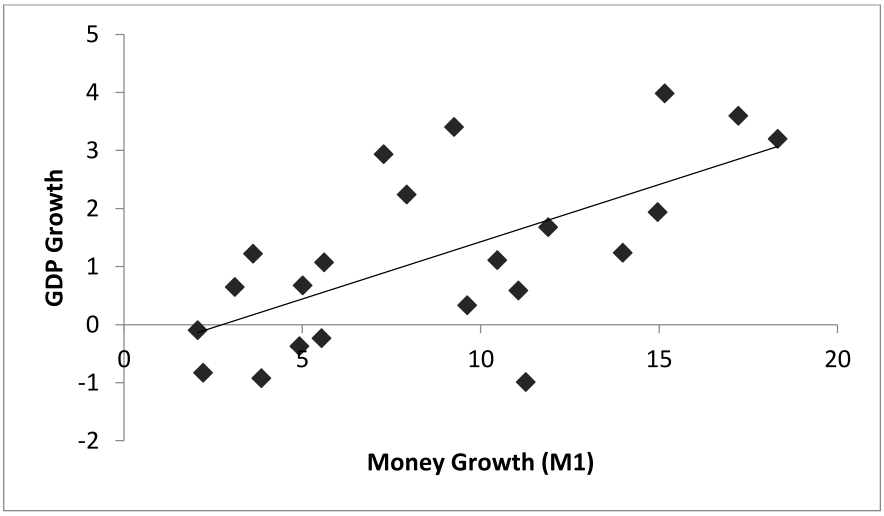


Table 6: Correlation coefficient, 2008-2012

Correlations

		M1	GDP
M1	Pearson Correlation	1	,642**
	Sig. (1-tailed)		,001
	N	22	22
GDP	Pearson Correlation	,642**	1
	Sig. (1-tailed)	,001	
	N	22	22

**. Correlation is significant at the 0.01 level (1-tailed).

As we can see in Figure 5, there is a linear relationship between average growth of monetary aggregate M1 and average growth of real GDP. Also, the correlation coefficient shows strong relationship between growth of narrow money and growth of real GDP in this period (see Table 6). Similar value (0.62) of correlation coefficient for correlation between M1 and GDP growth was found also for the period 2002-2007. These results are far from conclusions of the quantity theory of money.

It is possible that monetary policy is more potent during financial crises due to aggressive monetary policy of quantitative easing.

Efficiency of monetary policy will depend in part on how close the economy is to full employment. When the economy is near full employment, the increase in spending is likely to be transferred into higher inflation more quickly. When the economy is far below full employment inflationary pressures are more likely to be lowered. Current economy is below its potential product for a long time and it is possible, that monetary expansion affects economic activity not only in the short run, but also in the long run. It is possible that we have to rethink conclusions about efficiency of monetary policy in the long run with experience of current crisis. This question will probably have to be discussed further.

4. Conclusions

The quantity theory of money is one of the oldest economic theories. According this theory, monetary policy is neutral in the long run. The neutrality of money means that a permanent increase in the growth rate of money leaves output and velocity of money unaffected in the long run. If there is a positive effect of money growth on output, it only holds in the short run.

The validity of the quantity theory of money has been tested in the past by different methodologies. The first methodology uses time series techniques to test the long-run relationship between the price level and money for one or a few countries. We use this methodology in Spáčilová (2011) for sample of countries with quantitative easing. Another branch of studies used cross-section data on a large number of countries. Regardless of the methodology the most studies concluded that between the rate of money growth and the rate of inflation is strong or very strong correlation.

Relationships among monetary aggregates and other macroeconomic variables are studied in order to describe and to forecast changes in economic activity, interest rates and inflation for economic policy purposes.

In this study we tested the long-run relationship between average money growth and average rate of inflation on the sample of countries in four five-year periods from 1993 to 2012. We used the graphical analysis and correlation.

The first three periods (1993-1997, 1998-2002 and 2003-2007) show strong linear relationship between average rate of monetary aggregate M1 and average inflation. Correlation coefficients between money growth and inflation for these periods are in the range from 0.72 to 0.97. Summing up, the evidence in favour of a positive long-run relation between money growth and inflation is strong. In the period 2008-2012 we found weak relation between money and inflation. Therefore, we tried to test this relationship for money growth and growth of real GDP. We found a positive strong correlation.

According to Keynes, monetary policy is ineffective in liquidity trap that can arise if interest rates reach a level so low that further expansion of the money supply cannot drive them lower. But it is possible that monetary expansion can increase aggregate demand even under such circumstances when the central bank uses unconventional forms of monetary policy such as quantitative easing. Developments in financial markets, including financial deregulation and innovation, and major tax and interest rate changes, have altered the demand for money (and credit) and thus affected linkages to other economic variables such as income, employment and prices.

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Possibility to hedge against Exchange rate risk through Financial Derivatives

Erika Spuchľáková [1]

Abstract

One of the possibilities of the risk management is to hedge, where there is a minimizing or completely prevent any impact of possible changes of any risk factor. The main cause of formation of the financial derivatives was hedging against adverse price movements of the underlying asset. Derivatives serve for the purpose of ensuring the future cash flows. This means that in addition to ensuring resp. hedge current assets held against their values change in the spot market, there is possible to ensure the assets that the investor does not own at the moment, but he expected to receive in the future.
This paper points to the individual methods of hedging the exchange rate risk through financial derivatives, i.e. through forwards, futures, swaps and options.

Key words

Exchange rate risk, hedging, forwards, futures, swaps and options

JEL Classification: F31, G15

1. Úvod

Makroekonomický vývoj krajín a globalizácia sveta spôsobili zvýšenie pohybu kapitálu a taktiež vyššiu intenzitu jeho využívania. Každý racionálne uvažujúci podnikateľský subjekt sa snaží maximálne využiť svoj kapitál, jednotlivé tržné príležitosti a v neposlednom rade svoje konkurenčné výhody. To pochopiteľne vedie k rozvoju medzinárodného obchodu, hospodárskych väzieb a celkovej previazanosti ekonomického sveta.

S rozšírením medzinárodného obchodu na Slovensku prišlo nielen k otvoreniu trhu a rozšíreniu podnikateľských príležitostí, ale aj k zvýšeniu konkurencie a k otvoreniu nových rizík. Medzi takéto riziká patrí aj kurzové riziko, resp. transakčné menové riziká. Týmto rizikám je vystavený každý podnikateľský subjekt, ktorý realizuje finančné transakcie presahujúce hranice štátu, alebo ktorý svoju nákupnú alebo predajnú cenu v eurách odvodzuje od kurzu voči inej zahraničnej mene.

Avšak aj voči kurzovému riziku sa dá určitými spôsobmi zaistiť. Medzi spôsoby zaistenia sa voči kurzovému riziku patrí okamžitá platba, prirodzený hedging a zaistenie pomocou finančných derivátov.

2. Kurzové riziko

Kurzové riziko sa dá definovať ako možnosť vzniku straty (ale aj zisku) z dôvodu zmeny menového, resp. devízového kurzu. Kurzové riziko vzniká spravidla dvoma spôsobmi. Prvý spôsob vychádza z priebehu samotného obchodu. Keďže spravidla medzi uzatvorením obchodu a samotnou úhradou kúpnej ceny vzniká časový nesúlad.

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Slovenská republika patrí medzi krajiny s pomerne vysokou ekonomickou otvorenosťou. Dosahuje vysoké obchodné previazanosti najmä s krajinami Európskej únie. Aj keď zavedenie eura na Slovensku eliminovalo kurzové riziko, teritoriálna štruktúra zahraničného obchodu Slovenskej republiky za rok 2012 poukazuje, že Česká republika je v rámci dovozu aj vývozu Slovenskej republiky na druhom mieste[2].

Keďže pri vzájomnom obchode podnikateľských subjektov z Českej a Slovenskej republiky je dohodnutá mena kontraktu pre jedného z účastníkov domáca, pre druhého cudzia, jeden z partnerov je vždy vystavený kurzovému riziku.[3] Na obrázku 1 je znázornený vývoj devízového kurzu CZK/EUR v období od septembra 2012 po august 2013. Z daného obrázku vyplýva, že euro v priebehu daného roku posilnilo oproti českej korune o 2,28%, tzn. volatilita kurzu CZK/EUR bola v sledovanom období okolo 2,28%, (vyjadrená pomocou smerodajnej odchýlky[4]).

Obr. 1 Vývoj devízového kurzu CZK/EUR počas obdobia september 2012 – august 2013

Zdroj: NBS, http://www.nbs.sk/sk/statisticke-udaje/kurzovy-listok/grafy-kurzov

3. Metódy zaistenia sa voči kurzovému riziku

Najjednoduchšou formou, ako eliminovať kurzové riziko, je úplne sa mu vyhnúť. To je možné dosiahnuť len vtedy, ak sú platby aj úhrady realizované v tej istej mene. V praxi sa to však nedá dosiahnuť so 100 %-ným úspechom, pretože málo podnikateľských subjektov pôsobiacich na trhu má príjmy aj výdavky len v jednej mene. V takomto prípade je riešením tzv. ***netting***, čo znamená vzájomné vyrovnávanie dlhých a krátkych pozícií v tej istej mene, (ak má podnikateľský subjekt zo Slovenska významné príjmy v českej korune, tak významné výdavky by mal mať tiež splatné v českých korunách).

Ďalšou možnosťou hedgingu sú ***finančné deriváty***. „Pod pojmom derivát označujeme nárok (právo) v určenom budúcom termíne kúpiť, či predať isté aktívum alebo získať peňažné plnenia odvodené od pohybu hodnoty daného aktíva." (Kralovič, Vlachynský, 2006, s.283)

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[2] Informácie dostupné na: http://www.economy.gov.sk/zahranicny-obchod-2012/136128s

[3] Partneri kontraktu sa môžu dohodnúť aj na mene tretej krajiny, v tom prípade nesú riziko zmeny kurzu obidvaja. Dobrým príkladom je trh s ropou, ktorá je obchodovaná prakticky na všetkých svetových trhoch v USD.

[4] Volatilita kurzu je daná vzťahom: $\sigma = \sqrt{\frac{\sum\left(\bar{X} - X_i\right)^2}{n-1}} * \sqrt{t_s}$ kde $\bar{X} = \frac{\sum_{i=1}^{n} X_i}{n}$ a $X_i = \ln\frac{C_t}{C_{t-1}}$

Deriváty sú ďalšou z možností ako si môže podnik zabezpečiť svoje pohľadávky či záväzky voči kurzovému riziku, t.j. pomáhajú k riadeniu podnikových aktív a pasív. Predstavujú aktívne uzatváranie nových zmlúv, ktoré umožňujú ovplyvňovanie rizika. Môže ísť buď o pevné termínované kontrakty (forwardy, futurity, swapy) alebo podmienené termínové kontrakty (opcie). V príspevku sa budem ďalej zaoberať najmä hedgingom pomocou menových forwardov a menových opcií, stručne budú spomenuté aj zaistenia pomocou futures kontraktov a swapov.

V prípade, že sa chce podnik zabezpečiť proti nárastu hodnoty výmenného kurzu v budúcnosti v porovnaní s aktuálnym (spotovým) kurzom, zabezpečenie sa najčastejšie uskutočňuje prostredníctvom nákupu forwardovej operácie alebo nákupu opcie. Typickým príkladom subjektov, ktoré využívajú toto zabezpečenie, sú importéri, pre ktorých oslabenie domácej meny oproti cudzej mene zvyšuje hodnotu záväzkov za importovaný tovar a služby, vyjadrenú v jednotkách domácej meny.

V opačnom prípade, ak sa chce podnik zabezpečiť proti poklesu hodnoty výmenného kurzu v budúcnosti v porovnaní s aktuálnym kurzom, zabezpečenie sa najčastejšie uskutočňuje prostredníctvom predaja forwardovej operácie alebo nákupom opcie. Typickým príkladom subjektov, ktoré využívajú toto zabezpečenie, sú domáci exportéri, pre ktorých posilnenie domácej meny oproti cudzej mene znižuje hodnotu pohľadávok za exportovaný tovar a služby, vyjadrenú v jednotkách domácej meny.

3.1 Zaistenie pomocou forwardovej operácie

Menový forward je dohoda o výmene pevnej čiastky v jednej mene za pevnú čiastku v inej mene k určitému dátumu v budúcnosti. Z tohto obchodu plynie u jednej strany záväzok dodať, prípadne odobrať určité množstvo meny a pre druhú stranu plynie záväzok opačný, tzn. menu odobrať prípadne dodať. (Králik, 2004, s.143) Forwardový kontrakt prebieha pri vopred stanovených podmienkach.

Na rôznych forwardových trhoch sa obchody uzavierajú väčšinou na tie meny, na ktorých sú realizované promptné obchody s veľkou frekvenciou. Forwardový obchod je však možné uzavrieť na každú menu.

Každý forwardový obchod musí spĺňať určité náležitosti. Patrí medzi ne hlavne dohoda o výške forwardového kurzu, lehota splatnosti, alebo expiračný deň, a ostatné špecifiká, ako sú miesto, bankové účty či mená predávajúceho a kupujúcu zahraničnú menu.

Hodnota forwardového kurzu zohľadňuje hodnotu súčasného spotového kurzu a diferenciál úrokových mier medzi danými menami. Rozdiel medzi úrokovými mierami môže byť pozitívny alebo negatívny, z čoho vyplýva, že forwardový kurz bude ako prémia alebo diskont voči spotovému kurzu. Vždy platí, že rozdiel medzi forwardovým kurzom a kurzom spotovým v okamihu vysporiadania znamená automaticky zisk resp. stratu pre oboch účastníkov. Obchod je teda symetrický.

V praxi to znamená, že pokiaľ sa podnikateľský subjekt dohodne na výmene napr. 1 000 000 CZK za 38 767,20 EUR (t.j. kurzom 25,795 CZK/EUR[5]) a v momente vysporiadania kontraktu, t.j. v expiračný deň (napr. o 3 mesiace) bude kotácia daného devízové kurzu 25,678 CZK/EUR, potom podnikateľský subjekt dosiahol stratu vo výške 176,64 EUR. Protistrana pochopiteľne rovnakú čiastku získala.

Pri uzatváraní forwardového kontraktu sa používa forwardový kurz. Forwardový kurz predstavuje hodnotu domácej meny voči zahraničnej mene v budúcnosti, naproti tomu spotový kurz vyjadruje súčasnú hodnotu meny na devízovom trhu. forwardový kurz sa väčšinou od spotového kurzu odlišuje. Závisí najmä od vývoja dopytu a ponuky po danej

[5] Kurz určený na základe kurzového lístku ECB zo dňa 30.5.2013

mene. Prevažne však odchýlka forwardového kurzu od spotového zodpovedá rozdielu v úrokových sadzbách obchodovaných mien.

Pre stanovenie forwardového kurzu použijeme označenie:

$TK^{N}_{A/B}$	nákupný termínový kurz domácej meny A voči zahraničnej mene B
$TK^{P}_{A/B}$	predajný termínový kurz domácej meny A voči zahraničnej mene B
$SK^{N}_{A/B}$	nákupný spotový kurz domácej meny A voči zahraničnej mene B
$SK^{P}_{A/B}$	predajný spotový kurz domácej meny A voči zahraničnej mene B
i^{V}	úroková miera pre vklad (prijatie depozít bankou) v danej mene
$i^{Ú}$	úroková miera pre úver (poskytnutie depozít bankou) v danej mene
t	súčasný dátum, dátum uzatvorenia kontraktu
T	dátum splatnosti forwardu

Vzorec pre výpočet nákupného termínového kurzu:

$$TK^{N}_{A/B} = SK^{N}_{A/B} * \frac{1 + i^{V}_{A} * \frac{T-t}{360}}{1 + i^{Ú}_{B} * \frac{T-t}{360}}$$

3.2 Zaistenie pomocou futures kontraktu

Futures je štandardizovaný forward, s ktorým sa obchoduje na špecializovanej burze. Každá burza určuje, na ktoré komodity či finančné aktíva sa na nej obchoduje. Burza taktiež určuje štandardné podmienky kontraktov, minimálny objem či životnosť kontraktu. Vstupuje do vzťahu predávajúci – kupujúci ako sprostredkovateľ, pričom preberá na seba záruky za serióznosť kontraktu a za jeho plnenie. Preto požaduje od oboch partnerov zloženie istej peňažnej sumy – kolaterálu.

3.3 Zaistenie pomocou swapov

Swap, spoločne s forwardmi a futures, patri k pevným termínovým kontraktom, kde medzi dvoma resp. viacerými subjektmi nastáva dohoda o výmene série platieb v určitých intervaloch v budúcnosti. Swap je ekvivalentom série forwardových kontraktov. Ďalším špecifikom swapov je, že väčšinou majú dve podkladové aktíva, t.j. aj zahraničnú menu aj úrokovú mieru. Aj pomocou swapov sa dá zaistiť proti kurzovému riziku.

3.4 Zaistenie pomocou opčného kontraktu

Aj menové opcie môžu byť užitočným nástrojom zaistenia sa proti kurzovému riziku. Nákup opcie umožňuje podnikateľskému subjektu zredukovať riziko nepriaznivého pohybu menového kurzu pri zachovaní si schopnosti profitovať z priaznivého vývoja výmenných kurzov. Vyplýva to z vlastnosti opcií, ktoré ako jediné z finančných derivátov patria medzi podmienené finančné deriváty.

Menová opcia je dohoda medzi držiteľom opcie a jej vypisovateľom. Držiteľ opcie má právo, ale nie povinnosť, nakúpiť resp. predať jednu menu pri výmene za inú pri danej realizačnej cene. Toto právo je však kompenzované platbou – opčnou prémiou, ktorú predstavuje nenávratnú finančnú čiastku, ktorú zaplatí držiteľ opcie vypisovateľovi za možnosť kúpiť/predať podkladové aktívum (menu) v budúcom termíne za vopred dohodnutú cenu. V typických prípadoch predstavuje aj maximálne možnú stratu pre držiteľa opcie, (v prípade forwardového kontraktu je výška straty neobmedzená). Pre vypisovateľa opcie je výška opčnej prémie obvykle maximálne možný zisk, stratu však vypisovateľ môže dosiahnuť v neobmedzenej výške.

Výška opčnej prémie závisí od nasledujúcich faktorov: vzťah medzi realizačnou cenou a spotovým kurzom v čase uzavretia obchodu, vplyv lehoty splatnosti, rizikovosť meny a vplyv úrokového diferenciálu bezrizikových úrokových sadzieb.

Ak môže majiteľ opcie uplatniť svoje právo iba v deň splatnosti, hovoríme o opciách európskeho typu, na rozdiel od opcií amerického typu, kedy je možné uplatniť právo kedykoľvek počas životnosti opčného kontraktu (expiračnej doby).

V praxi to znamená, že pokiaľ sa podnikateľský subjekt dohodne na výmene napr. 1 000 000 CZK za EUR o tri mesiace, pri opčnom kurze napr. 25,00 CZK/EUR a opčnej prémii 0,50 CZK/EUR, znamená to že o 3 mesiace dostane 39 215,70 EUR. Ak bude spotový kurz v expiračný deň vyšší ako 25,50 CZK/EUR podnikateľský subjekt dosiahne zisk. Ak bude spotový kurz v expiračný deň nižší ako 25,00 CZK/EUR, podnikateľský subjekt dosiahne stratu vo výške opčnej prémie.

Predchádzajúci príklad je veľmi zjednodušený. Na oceňovanie opcií sa používa množstvo štatistických a ekonomických modelov. Medzi najpoužívanejšie pri opciách na menu patrí Garmanov-Kohlhagenovmodel, ktorý je modifikáciou známejšieho modelu – Black-Scholesov. Teoretické hodnoty vypočítané podľa tohto modelu sú zhodné s reálnymi cenami opcií dosahovanými na reálnych trhoch.

Vzorec pre cenu európskej kúpnej opcie je nasledovný:

$$P^c = Pe^{r_f T} * N(d_1) - Xe^{r_d T} * N(d_2)$$

kde:

P^c – cena európskej kúpnej opcie

P – okamžitý kurz domáca / zahraničná mena

N(x) – hodnota distribučnej funkcie N(0,1)

X – realizačná cena opcie

r_d – domáca bezriziková úroková sadzba

r_f – zahraničná bezriziková úrokková sadzba

δ – volatilita

T – doba splatnosti opcie v rokoch.

$$d_1 = \frac{\ln \frac{P}{X} + (r_d - r_f)T}{\delta\sqrt{T}} + \frac{1}{2}\delta\sqrt{T} \qquad d_2 = d_1 - \delta\sqrt{T}$$

4. Záver

Cieľom príspevku bolo poukázať na možnosti, ktoré poskytujú menové opcie, menové forwardy, futures či swapy a taktiež iné nástroje pri riadení kurzového rizika podnikateľských subjektov pôsobiacich na medzinárodných trhoch. Aj keď sa jednoduchšími spôsobmi javí okamžitá platba a prirodzený hedging, vhodnejšími spôsobmi na zabezpečenie sa proti kurzovému riziku je použitie finančných derivát, najmä kvôli tomu, že časový nesúlad medzi uzatvorením obchodu a samotnou úhradou je v podnikateľskej praxi bežný.

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Convergence between Global Financial Reporting Standards: Some Light at the End of the Tunnel?

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Abstract

The paper presents a qualitative research through content analysis of several reports concerning the roadmap for convergence of globally recognized financial reporting practices (US GAAP, IFRS). Firstly, we developed a conceptual framework for the evolution of standards' convergence and further there is discussed the level of standards harmonization and convergence between US GAAP and IFRS as to October 2012. As a major conclusion there might be pointed out that most topics did not follow the expected progress. Furthermore there are still some differences in the long-term project that are in process to be completed and other that were reassessed as a lower priority projects.

Key words

convergence, financial reporting practices, IFRS, US GAAP, Norwalk Agreement, accounting harmonization

JEL Classification: M41, G30

1. Introduction

Recently each country developed and followed its own unique system of accounting standards. There were vast differences in accounting measurement and reporting procedures of different countries, making it impossible to compare and evaluate financial information of companies from different countries (Yallapragada, 2012; Albu et al., 2013; Strouhal, 2007). In this way, literature and also the international accounting reality notes the existence and manifestation of a process of bringing the national accounting systems to a common direction and establishing a uniform system of financial reporting. This process was named harmonization, and its primary purpose is the existence of a universal financial accounting language in a global economy.

Harmonization has morphed into convergence along with the comparison between US GAAP and IFRS; nowadays the both boards used the concept of „convergence", the same as the literature (Evans and Nobes, 1998; Aisbitt, 2002; Tarca, 2004, Schipper, 2005; Erchinger and Melcher, 2007; Baker and Barbu, 2007; Armstrong et al., 2010; Haskin, D. and Haskin, T., 2012; Yallapragada, 2012; Strouhal, 2012; Albu et al., 2013). Harmonization and convergence have been used to describe efforts done by the United States and European countries to move towards a global financial accounting infrastructure.

The first step towards harmonization of US GAAP and IFRS was made in October 2002 when the FASB (Financial Accounting Standards Board – US GAAP setter) and the IASB

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(International Accounting Standards Board – IFRS setter) issued joint-agreement, widely known as the "Norwalk Agreement", which formally recognize convergence as an avowed goal of these two standard-setting bodies (Hopkins et al., 2008; Yallapragada et al., 2013). This paper aims to present the major differences between IFRS and US GAAP today and is focuses on those we consider to be the most significant and are encountered more frequently in practice.

As a research methodology tool there is used a qualitative research of the financial reports and statements presented by the two major professional organizations the IASB and the FASB. Namely there are used the following methods: observation ➔ comparison ➔ investigation.

Initially we did focused on the boards history convergence, and then we made a comparative analysis between US GAAP and IFRS in the evolution of accounting standards from 2002 to 2012 to critically analyse whether the proposed elements over the ten years were standardized or harmonized. In 2012 there were still some differences at the long-term project that are in process to be completed and other that were reassessed as a lower priority project. The obtained results indicate that most topics do not respect the progress expected to be achieved and there could be said that one of the obstacle is the financial crisis whose impact is analyzed in a significant number of areas (Bonaci et al., 2011).

2. A Brief Insight to Trade Literature

International convergence of accounting standards is not a new idea. The concept of convergence firstly arose in the late 1950s in response to post World War II economic integration and related increases in cross-border capital flows. Initial efforts focused on harmonization—reducing differences among the accounting principles used in major capital markets around the world. By the 1990s, the notion of harmonization was replaced by the concept of convergence—the development of a single set of high-quality, international accounting standards that would be used in at least all major capital markets.

In 1973 was created the "International Accounting Standards Committee" (IASC), a private body whose members included accounting professionals from many countries, including the US. Yallapragada (2012, p. 284) specifies that Ruder et al. (2005) consider the IASC founded as a vehicle for harmonizing accounting practices throughout the world. The International Accounting Standards Board (IASB) was formed in 2001 to replace the IASC, with a mandate to develop and approve pronouncements known as International Financial Reporting Standards (IFRS) (Yallapragada, 2012, p. 284). The IASB began to produce comprehensive and consistent accounting standards, mostly in conjunction with the FASB (United States).

In the United States of America (US), all the accounting procedures and guidelines for measurement and reporting by business firms are governed by a body of principles and concepts known as "Generally Accepted Accounting Principles (GAAP)." These GAAP are presently issued by the Financial Accounting Standards Board (FASB) with the authority delegated by the Securities and Exchange Commission (SEC) (Yallapragada, 2012, p. 283). The International Accounting Standard Board (IASB) and the US Financial Accounting Standards Board (FASB) are collaborating since 2002 when they set up the Memorandum of Understanding (MoU), known as the „Norwalk Agreement", to achieve compatibility and remove differences between International Financial Reporting Standards (IFRS, which include International Accounting Standards, IAS) and U.S. GAAP. Over the time these two professional organisms published process reports and updates of the common set of high quality global standards that remains a priority of both the IASB and the FASB. The Norwalk Agreement was further strengthened in 2006 and updated in 2008.

The Group of 20 Leaders (G20) called for standard-setters to re-double their efforts to complete convergence in global accounting standards. Following this request, in 2009 the IASB and the FASB published a progress report describing an intensification of their work program. In April 2012 the IASB and FASB published a joint progress report in which they describe the progress made on financial instruments, including a joint expected loss impairment ('provisioning') approach and a more converged approach to classification and measurement. We can say that the SEC has set a timetable for achieving convergence of US GAAP and IFRS, by issuing a road map and a work plan to achieve full adoption of IFRS by US companies before the end of 2016 (Yallapragada, 2012, p. 287).

Over time, a number of researchers compared IFRS with U.S. GAAP and specified the harmonization problems. In the paper named „Trends in research on international accounting harmonization" (2007), Baker and Barbu present some studies done by researchers. In one of those studies, Grove and Bazley (1993) compared IAS 20 with their American equivalents. They also recommended certain accounting treatments which they believed would improve the efficiency of global capital markets. In addition, they estimated the costs and benefits of their recommendations.

Street and Shaughnessy's (1998) research described the evolution of accounting standards during the period 1973–1997; they discussed similarities and differences in financial reporting practices stated by the IASC and the national accounting standards setting bodies of the United States, England, Canada and Australia. Nobes (1990) examined the effects of IFRS on financial reporting of American companies listed in the US capital markets. Because US GAAP are more detailed than IFRS "for a US company that is obeying GAAP, it is very difficult not to comply with IASB standards" (Nobes, 1990, p. 42). Nobes also compared US GAAP and IFRS and concluded that differences between IFRS and US GAAP have little impact on the financial reporting practices of American listed companies (Baker and Barbu, 2007, p. 285-286).

Another study made by Yallapragada (2012) presents the background and development of the movement of IFRS, timeline for the change in US and the implications involved in the adoption of IFRS in the US. Haskin D. and Haskin T. investigate in the paper named „Hierarchy of GAAP vs. IFRS- The case of bankrupcy accounting", whether companies in countries which use IFRS are influenced by the guidance of ASC 852 (Reorganizations) when confronted with bankruptcy. Bonaci et al. (2012) also contribute to the literature on accounting standard setting in the international arena by performing an analysis aimed at facilitating the assessment of further developments of the convergence project.

3. Qualitative Analysis and Its Results

We make a comparison in the evolution of accounting standards from 2006 to 2012 to critically analyse whether the proposed elements over the six years were standardized; which ones are still in the process of convergence and which ones have been removed from the agenda. We look at the Norwalk Agreement and we identified two types of projects: short-term and long-term projects that would bring a significant improvement to IFRS and US GAAP. These types of projects shows how much the IASB and the FASB focus on certain topics and how they have worked in order to make all differences to disappear, to flatten to create unique accounting standardized throughout the world. We can see by taking a „snapshot" of the first Roadmap for Convergence the initial topics that are focused on the major areas expected to be met by 2008. These are presented in the following table (Tab. 1).

Table 1: Issues for Short-Term Convergence

To be examined by the FASB	To be examined by the IASB
Fair value option*	Borrowing costs
Impairment (jointly with the IASB)	Impairment (jointly with the FASB)
Income tax (jointly with the IASB)	Income tax (jointly with the FASB)
Investment properties**	Government grants
Research and development	Joint ventures
Subsequent events	Segment reporting
FASB Note: *On the active agenda at 1 July 2005 ** To be considered by the FASB as part of the fair value option project	IASB Note: Topics are part of or to be added to the IASB's short-term convergence project, which is already on the agenda.

Source: Roadmap for Convergence

In "September 2008 progress report and timetable for completion" the FASB issued new or amended standards that introduced into US GAAP the fair value option (SFAS 159 in 2007) and adopted the IFRS approach to accounting for research and development assets acquired in a business combination (SFAS 141R). The IASB published new standards on borrowing costs (IAS 23 revised in 2007) and segment reporting (IFRS 8). In the second half of 2008 IASB decide to undertake projects that would eliminate differences in the accounting for taxes (IAS 12 revised), investment properties (IAS 40), and research and development (IAS 38-Intangible Assets) by adopting the relevant IFRS. US GAAP amended for acquired research and development, as part of business combinations, in 2008. The FASB issued a proposal to require investment property entities to measure their investment properties at fair value from the year 2012; however this is still an ongoing convergence process.

At the beginning of 2009, the IASB wanted to publish a proposed standard on income taxes that would have improved IAS 12 Income Taxes, but at this date the boards agreed that the project should not proceed in its current form. In November 2009 the IASB reconsidered whether it should address any aspects of IAS 12 as part of a limited scope project of improvements. In 2012 this topic was considered to be reassessed as a lower priority project with no immediate action.

Only in 2009, IASB expected to publish a standard that should improve the financial reporting for joint arrangements, including joint ventures and remove the option of proportionately consolidated joint ventures, thereby providing a more representative portrayal of the assets the reporting entity controls. In June 2010 plans to finalize these new requirements were presented in the 2010 report. IFRS 11 Joint Arrangements, issued in May 2011, established principles for the financial reporting by parties to a joint arrangement.

If we refer to the business combinations, this area is converged to a large extent. However, there are still some differences in certain areas, such as the measurement of noncontrolling interests, the recognition of contingent assets and liabilities, and the subsequent accounting for certain acquired assets and liabilities. But, IFRS 10, issued in May 2011, introduced a new definition of control that focuses on whether an investor controls the decisions that affect an investee's level of returns.

In May 2011, within the accordance with the fair value measurement, the IASB issued IFRS 13 and the FASB issued ASU 2011-04. As a result, IFRS and U.S. GAAP guidance on the definition of fair value, the framework for measuring fair value, and disclosure requirements for fair value measurements are substantially converged. IFRS 13 is effective as of January 1, 2013.

Even if the IASB and the FASB issued proposed guidance for "Revenue from Contracts with Customers" in June 2010 as part of a joint project to develop and would supersede the guidance in IAS 18 and IAS 11, and most existing guidance in ASC 605, is not expected to be effective before 2015.

In 2012 there were still some differences at the long-term project that are in process to be completed and other that were reassessed as a lower priority project. In the following table (Tab. 2) we observed the status of the projects.

Table 2: Status of the Convergence Projects in 2012

Project		**Status**
Short term process	***Long term process***	Completed process
Share-based payments Segment reporting Non-monetary assets Inventory accounting Accounting changes Fair value option Borrowing costs Research and development Non-controlling interests Joint ventures	Business combinations Derecognition Consolidated financial statements Fair value measurement Post-employment benefits Financial statement presentation—OCI	
Income tax Financial instruments with the characteristics of equity		Reassessed as a lower priority project. No immediate action
Investment property entities Leases Revenue recognition Financial instruments Insurance contracts		In process
Investment entities		IASB and FASB published proposals in August and October 2011, respectively

Source: authors‘ projection based on the Joint Update Note from the IASB and FASB on Accounting Convergence (2012)

Many convergence projects have already been successfully completed such as the projects on share-based payments, business combinations and fair value measurement, but the boards were working together on four long-term priority projects like financial instruments, revenue recognition, insurance and leases. The work is proceeding very slowly. Other projects involved either the IASB converging with US GAAP, such as operating segments and borrowing cost, or the FASB converging with IFRS, such as acquired research and development and the fair value option.

The convergence efforts of the IASB and the FASB have helped bring IFRS and US GAAP closer together. However, even after decade-long convergence efforts, there still remain some differences between these two sets of global reputed accounting standards. The fundamental differences between IFRS and US GAAP as identified by SEC in 2012 were following:

(a) the non-financial asset impairment requirements (in particular, that IFRS permits the reversal of impairments, which could make earnings reported in accordance with IFRS more volatile than US GAAP) and the recognition of non-financial liabilities earlier than they would be recognised under US GAAP;

(b) the ability to revaluate PPE (property, plant and equipment) and investment properties at fair value, which is permitted by IFRS but not by US GAAP;
(c) the possibility for US companies to use an inventory measurement method called LIFO (Last In First Out), which is not permitted by IFRS;
(d) the requirement in IFRS for development expenditure to be capitalised, whereas US GAAP requires all development expenditure to be recognised as an expense as incurred;
(e) specific requirements in US GAAP relating to uncertain taxation positions, whereas IFRS has a more general contingency model; and
(f) a requirement in IFRS to depreciate components of an item of PPE in certain circumstances, which is not a requirement in US GAAP.

4. Conclusion

Convergence of global accounting standards has received a great deal of attention and after September 2002 has been an important research area all over the world. We can say that the "era" of the formal convergence efforts of the FASB and the IASB is nearing an end. The Boards continue to make new accounting standards that should eliminate most, if not all, of the existing differences in the accounting standards. Still, there exists certain differences between discussed standards, most of these shall be resolved within the long-term project and the substantial workload for IASB and FASB is still ahead. Convergence between IFRS and US GAAP helps investors to have more opportunities for cross-border investments.

SEC staff compared IFRS with US GAAP and note that, as a result of more than ten years of joint work with the FASB to improve IFRS and US GAAP and bring about their convergence, the differences that the US will have to bridge are significantly smaller in scope than the differences faced by other major countries that have already adopted IFRS. Finally there shall be concluded by the finding of Ohlgart and Ernst (2011) who observed that the process of incorporation of IFRS into the US GAAP is much slower and is estimated to take, at the very least, five or seven years.

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Investment location from the perspective of urban and regional activities in the Czech Republic

Jan Sucháček[1]

Abstract

This paper deals with location factors that are offered by large towns and NUTS III self-governing regions in the Czech Republic. Country's economic landscape is formed on the basis of an interplay between individual location decisions and spatially differentiated qualities offered to enterprises. The whole issue will be examined primarily from qualitative perspective.

Key words

investments, location factors, towns, regions

JEL Classification: P25, R10, R11, R59

1. Úvodem

Při lokalizaci investic je jedním z nejdůležitějších hledisek to prostorové. Lokalizační rozhodování významným způsobem spoluurčuje nejen současnou, ale také budoucí hospodářsko-sociální podobu jednotlivých území. U lokalizačního rozhodování rozeznáváme stranu poptávky reprezentovanou především podniky a investory; tyto subjekty vyžadují určité charakteristiky a kvality území, do nichž směřují své aktivity. Lokalizační podmínky a kvality jednotlivých měst a regionů zase představují specifickou stranu nabídky (Van Dijk, Pellenbarg, 1999, Markusen, 1985 či Suchacek, Seda, 2011).

Lokalizační rozhodování je v praxi ztížené především závislostí na konkrétním časoprostorovém kontextu. Jakékoliv větší generalizace nejsou u tohoto procesu příliš žádoucí s ohledem na rozdílnost využívaných metod, rozdílnou kvalitu datových základen, rozdílné charakteristiky jednotlivých ekonomických odvětví a další (Vanhove, Klaasen, 1987, Gregory et al, 2009 nebo Maier, Tödtling, 1997).

Pozornost teoretiků i praktiků bývá obvykle upřena na poptávkovou stranu lokalizačního rozhodování (Dunning, Lundan, 2008 nebo Suchacek, Baranek, 2011). Nabídková strana, která sehrává u lokalizace kardinální roli, je však dosud nedoceněna (Maier, Tödtling, 1997 nebo Suchacek, 2013). Cílem našeho článku je proto analýza a interpretace vybraných aspektů kvality území a to ve vazbě na lokalizaci investic. Článek se bude zabývat touto specifickou teritoriální nabídkou a sice ze strany velkých měst a NUTS III regionů v České republice. Budou zde identifikovány společné a rozdílné rysy nabídkové strany lokalizačního procesu a to u velkých měst a samosprávných regionů.

2. K vybraným aspektům lokalizace

Žádná firma ani instituce nesídlí „ve vzduchoprázdnu“. Naopak je lokalizována v konkrétním místě, území a obklopena celou řadou více či méně složitých vazeb a vztahů se

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svým okolím. Patří mezi ně dodavatelé, odběratelé, místní i státní instituce, zákazníci, právní systém, životní prostředí a mnoho dalších.

Pro vztahy podniku s okolím je důležitá skutečnost, že z hlediska zásobovacícho trhu je přístup k inputovým faktorům (půda, práce, kapitál, přírodní zdroje, vstupy a meziprodukty od jiných podniků, know-how a technologie) prostorově diferencován. Stejně tak z hlediska odbytového trhu, na outputové straně je přístup k trhům či odběratelům silně rozrůzněn a v zásadě odpovídá existujícímu systému osídlení. Existují pochopitelně faktory, které nacházejí uplatnění na straně vstupu i výstupu. Typickými příklady jsou infrastruktura anebo aglomerační efekty.

Koncepcí lokalizační analýzy je celá řada, Maier s Tödlingem (1997) rozlišují neoklasickou, behavioristickou a strukturní. Neoklasická koncepce lokalizace bývá často označována jako normativní, protože ukazuje, jakým způsobem by se podnik měl chovat, aby se lokalizoval na optimálním místě. Dalším charakteristickým rysem této koncepce je deduktivní postup. Závěry jsou vyvozovány z axiomatických předpokladů a teoreticky vypracovaných zákonitostí. Nevýhodou této koncepce je skutečnost, že jen stěží může zachytit reálné lokalizační chování podniků.

Oproti předchozí koncepci je behavioristický přístup k lokalizaci induktivního charakteru. Tento přístup se zaměřuje na to, jak se reálně lokalizují jednotlivé subjekty. Při tomto způsobu lokalizace se v praxi nevyužívá složitých či sofistikovaných metod, ale tzv. heuristických, rutinních a náklady šetřících postupů.

Lokalizační rozhodování se obecně vyznačují vysokou mírou nejistoty, jsou vysoce komplexní a kvazi-ireverzibilní a je složité určit optimální lokalizační rozhodnutí. Optimalizační výpočty jsou obvykle natolik nákladné, že je pro podnik výhodnější hledat takové metody, které sice nezaručují optimální lokalizační rozhodnutí, ale náklady s nimi spojené jsou daleko nižší a kompenzují ztrátu vzniklou odchylkou od optima. Heuristické metody zdůrazňují zkušenosti manažerů, které značně napomáhají lokalizační rozhodování uspíšit. Nejde o nalezení lokality s minimálními, ale s obhájitelnými náklady. Jedná se o různé zjednodušené nebo rutinní postupy a to od stupňovitého lokalizačního rozhodování až po napodobování.

Závěrečná, strukturní koncepce lokalizace je z chronologického hlediska nejmladší. Oproti neoklasickým a behavioristickým koncepcím se tento přístup opírá především o posuzování pozice a chodu podniku v rámci širších národohospodářských a celospolečenských procesů. Předchozí koncepce jsou kritizovány kvůli přílišnému zaměření na podnik samotný a zanedbávání či ignoranci širších souvislostí. Behavioristická koncepce je kritizována pro přílišné zohledňování manažerského pohledu a nedostatečné uvědomění si významu lokalizace podniku pro regionální či celkový územní rozvoj. U neoklasické koncepce pak strukturní přístup vedle obvyklých kritik ještě zpochybňuje její víru ve vývoj tendující k ekonomicko-prostorové rovnováze.

Strukturní koncepce vychází z předpokladu, že hospodářství ve světě prochází fázemi, ve kterých dominují určité rámcové podmínky a výrobní koncepty, které zase zpětnovazebně ovlivňují podnikové technologické, organizační, ale také lokalizační struktury a pravidla. Mnozí autoři upozorňují, jak velký význam má z hlediska lokalizace podniku v dané době převládající fáze světového hospodářství. Zatímco pro klasický konkurenční kapitalismus byly typické malé a střední podniky, slabý stát a sektorová územní specializace, fordismus již může být charakterizován stabilní poptávkou, intervencionistickou hospodářskou politikou, velkovýrobou a velkopodniky. Z prostorového hlediska pak lze hovořit o místní koncentraci a vnitropodnikové dělbě práce.

Velká pozornost byla věnována postfordismu a zejména pro současnost aktuální globalizaci. Po ropné krizi v sedmdesátých letech minulého století se poptávka stává silně diferencovanou, nastupuje liberální hospodářská politika, technologie a podnikové strategie začínají mít flexibilní charakter a narůstá význam podnikových sítí. Ropná krize a následná ekonomická recese rozhodujícím způsobem přispěly k vytvoření tlaku na snižování firemních nákladů ve všech vyspělých zemích. Přesun produkce do zahraničí napomohl úspěšné adaptaci firem na nové podmínky. Tento proces, o jehož dopadech na vyspělé země se hovoří jako o deindustrializaci, nastartoval změny v mezinárodní dělbě práce. Zatímco pro vyspělé země se stala charakteristickou koncentrace řídicích funkcí, do periferních oblastí se přesunula výroba.

Abychom snadněji konceptualizovali hierarchii lokalizačního rozhodování, je užitečné vymezení lokalizačních faktorů na jednotlivých prostorových úrovních.

Tabulka 1: Lokalizační faktory podle prostorových úrovní rozhodování

Prostorová rovina	**Kritéria – lokalizační faktory**
národní	politická a hospodářská stabilita, daňový systém, odbory, inflace, hospodářský růst, státní podpora na úrovni regionů
regionální	charakteristika pracovních sil, mzdy, odborové organizace, přístup k trhu, rozloha, hospodářská struktura, dodavatelé, služby, regionální podpory
místní	dopravní přístup (letecky, automobilem, vlakem), kvalita a kvantita pracovních sil, specifická infrastruktura (univerzity, výzkumná zařízení), místní hospodářská politika a podpory, životní úroveň
pozemek	infrastrukturní propojení, velikost a cena, stav životního prostředí

Zdroj: upraveno podle Maier, Tödtling, 1997

Specificky pro podmínky České republiky ještě nutno zmínit systém investičních pobídek, který vytváří širší rámec pro lokalizaci investic ve městech a samosprávných regionech. Nejen investoři zavádějící výrobu nebo rozšiřující produkci ve zpracovatelském průmyslu, ale také technologická centra a centra strategických služeb mohou nově čerpat investiční pobídky. Je to zásluhou novely zákona č. 72/2000 Sb., o investičních pobídkách, která nabyla účinnost 12. července 2012.

Formy investičních pobídek v České republice zůstávají v zásadě nezměněny, novinkou je, že investor z oblasti zpracovatelského průmyslu, strategických služeb a technologických center, nově příchozí i stávající, může získat slevu na dani z příjmů po dobu 10 let místo stávajících 5 let. Zůstává zde také možnost čerpat hmotnou podporu na vytváření pracovních míst, školení a rekvalifikaci a investiční pobídka ve formě převodu pozemků a související infrastruktury za zvýhodněnou cenu.

Úplnou novinkou pak je zavedení institutu strategické investiční akce. To znamená, že kromě standardních investičních pobídek mohou takto označené projekty získat hmotnou podporu na kapitálovou investici až do výše 5 % nákladů. Tato podpora se týká zpracovatelského průmyslu a technologických center. O podpoře jednotlivých projektů, které splní podmínky, bude rozhodovat Vláda České republiky (Czechinvest, 2013).

3. Metodický postup

Cílem výzkumu bylo zjistit, jaké kvality a aktivity ovlivňují investiční atraktivitu na úrovni měst a jaké na úrovni NUTS III regionů v České republice. Výzkum byl tedy zaměřen na nabídkovou stranu lokalizačního procesu.

Realizovaný výzkum byl kvalitativního charakteru, sběr dat probíhal formou elektronického, resp. telefonického dotazování. K jednotlivým městům a regionům byl vyhledán e-mailový a telefonický kontakt na osobu ve významném postavení. Ve většině případů však byli pověřeni zodpovězením dotazníků podřízení pracovníci. Nejprve byl dotazník rozeslán na e-mailové adresy, s ohledem na nízkou návratnost pak muselo být uskutečněno druhé kolo obesílání a nakonec i telefonické dotazování.

Celkem bylo osloveno 200 největších měst v zemi a 13 samosprávných krajů. Hlavní město Praha bylo s ohledem na svůj charakter řazeno mezi města. Protože se dohromady vrátilo 88 dotazníků, dosažená míra návratnosti činila přes 41%.

Samotný výzkum, který proběhl v roce 2011, byl realizován prostřednictvím strukturovaného dotazníku. Likertova škála v rozmezí od -3 do +3 se ukázala jako vhodná pro naše potřeby. Výsledky jednotlivých odpovědí byly posléze převedeny na procenta.

4. Výsledky a diskuse

Před vyhodnocením výzkumu nutno upozornit na specifika, kterými se vyznačují města a kterými regiony. Města představují entity ztělesňující na relativně malých územích charakteristiky podstatně rozsáhlejších teritorií. Městské managementy se zabývají dosti konkrétními problémy a obvykle bývají při prosazování svých zájmů jednotnější, nežli diferencovanější a heterogennější regiony. Na rozdíl od územně koncentrovaných měst hledají regiony své „společné jmenovatele“ podstatně nesnadněji.

Za povšimnutí také stojí poměrně intenzivní diferenciace, která panuje v rámci sídelní hierarchie 200 největších měst v České republice. Také na úrovni regionů NUTS III se projevuje určitá diferenciace, která ale není z hlediska populačního tak hluboká, jako je tomu v případě 200 největších měst v zemi.

Při hodnocení lokalizačních faktorů nabízených největšími městy a samosprávnými kraji je patrné, že kraje dosáhly o poznání vyšších hodnot. Tato skutečnost může být připsána jejich větší rozloze, počtu obyvatel, rozsáhlejší infrastruktuře apod. Z tohoto důvodu dosáhly faktory jako dobrá geografická poloha či infrastruktura podstatně vyšších hodnot u krajů, nežli u měst.

Zatímco města nehodnotila nízké mzdové požadavky vlastních obyvatel jako zvláštní výhodu, u krajů se tento faktor naopak umístil dosti vysoko. Na území krajů se kromě měst nacházejí také ostatní typy teritorií, jako např. rurální a s tím souvisí také zdůrazňování výhod nízkých mzdových požadavků právě na rozsáhlejších územích krajů. Jen v nepatrně menší míře se tento rozdíl u obou zkoumaných typů území projevil u faktoru dostupnost, resp. množství pracovních sil.

Poměrné shody dosáhla města a kraje při hodnocení celostátních politik a podpory státu při usídlování nových investorů. Samotná státní pomoc při lokalizaci nových investic v konkrétním území není hodnocena nijak zvlášť příznivě (více viz např. Suchacek, 2013).

Tabulka 2: Faktory nabízené 200 největšími městy v České republice a samosprávnými kraji ve vztahu k investorům

Průměrné procentuální hodnocení/pořadí důležitosti lokalizačního faktoru nabízeného městy investorům		**Lokalizační faktor**	**Průměrné procentuální hodnocení/pořadí důležitosti lokalizačního faktoru nabízeného kraji investorům**	
1.	70,8	**Dobrá geografická poloha**	91,7	1.
	70,8	**Možnosti sportovního vyžití**	65,0	10.
2.	70,1	**Infrastruktura**	81,7	4.
3.	67,3	**Dostupnost/množství pracovních sil**	88,3	2.
4.	66,9	**Možnosti kulturního vyžití**	68,3	8.
5.	66,7	**Kvalita pracovních sil**	81,7	4.
6.	64,9	**Systém veřejné správy**	75,0	7.
	64,9	**Kvalita životního prostředí**	61,7	12.
7.	64,5	**Prestiž/pověst území**	76,7	6.
8.	60,9	**Kvalita podnikatelského prostředí**	66,7	9.
9.	60,7	**Nízké mzdové požadavky**	83,3	3.
10.	60,1	**Cena pozemků**	61,7	12.
11.	55,9	**Blízkost decizních orgánů**	58,3	14.
12.	55,5	**Blízkost odběratelů**	78,3	5.
13.	53,9	**Blízkost dodavatelů**	66,7	9.
14.	53,7	**Blízkost/koncentrace příbuzných oborů**	56,7	15.
15.	51,8	**Aglomerační výhody**	63,0	11.
16.	47,8	**Celostátní politiky**	46,3	17.
17.	44,5	**Dostupnost surovin**	55,0	16.
18.	39,6	**Investiční pobídky**	60,0	13.

Zdroj: vlastní výzkum

Tabulka 3: Způsoby, jakými o sobě dávají investorům vědět města a samosprávné kraje

	Města (v %)	**Samosprávné kraje (v %)**
Úzká spolupráce s profesionálními sdruženími	53,3	90,9
Vlastní aktivity	48,0	81,8
Spolupráce se subjekty jako Czechinvest, agentury pro regionální rozvoj atd.	45,3	63,6
Ostatní	21,3	18,2

Zdroj: vlastní výzkum

Tabulka 3 pak přináší přehled způsobů, kterými o sobě dávají vůči investorům vědět města a kterými kraje. Kraje se u těchto aktivit jeví samostatněji a aktivněji, nežli města, což souvisí s jejich širším personálním a materiálně-technickým zázemím. Byť se prezentované skutečnosti mohou jevit dosti příznivě, výzkum také poukázal na závažný problém, kterým je častá absence systémového ošetření jak se zachovat v případě, že se na danou územní jednotku obrátí potenciální investor. Města nemají takovýto algoritmus stanoven v 31,9 % případů a regiony pak v 18,2 %. Neexistence plánu pro případ oslovení investorem může pochopitelně vést ke ztrátě zájmu o město či region. Nutno připomenout, že samosprávný manévrovací prostor obcí a regionů je v zemi poměrně limitován a to jak s ohledem na kompetence tak také na dostupné finanční prostředky, což dále podvazuje možnosti ofenzivního postupu měst a krajů vůči investorům.

Z realizovaného výzkumu také vyplynulo, že města jsou spokojenější se situací na trhu práce, nežli kraje. Průměrná hodnota spokojenosti se situací na trhu práce udávaná městy byla 37,2 %, průměrná hodnota u samosprávných regionů pak činila 28,8 %. Tato skutečnost je vysvětlitelná tím, že bylo dotazováno 200 největších měst v zemi, u nichž je trh práce přeci jen v lepší situaci, nežli u menších obcí a ve venkovských oblastech. Samosprávné regiony disponují teritoriálně širším pohledem na trh práce a vedle měst se v nich nacházejí také rurální, hospodářsky slabá či jinak problematická území. Z tohoto důvodu je jejich hodnocení situace na trhu práce o poznání pesimističtější.

5. Závěrem

Teorie i praxe lokalizace se obvykle zaměřují na poptávkovou stranu tohoto procesu. Straně nabídky, která je neméně důležitá, dosud nebyla věnována adekvátní pozornost. Článek ukázal, jaké jsou základní shody a rozdíly v nabídce lokalizačních faktorů ze strany 200 největších měst a samosprávných regionů v České republice. Lze konstatovat, že kraje hodnotí nabídku těchto faktorů ze své strany podstatně příznivěji a to ve vazbě na větší územní, populační a další potenciál, kterým disponují. Situace na trhu práce byla naopak hodnocena lépe-a nikoliv překvapivě-městy, která využívají výhody územní koncentrace. Investiční atraktivita měst a krajů je nepříznivě ovlivněna skutečností, že je prostor územních samospráv z hlediska kompetenčního a finančního dosti omezen. Kromě toho nemají v mnoha případech města a regiony stanoven ani postup svého jednání vůči investorům, což dále snižuje jejich potenciál pro přilákání investic.

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Evaluation of bank efficiency in selected countries in EU

Zuzana Svitálková[1]

Abstract

The aim of this paper is to measure and compare the efficiency of bank system in selected countries in the EU (Czech Republic, Slovakia, Austria, Poland, Hungary, Slovenia). It is important to know the real state of the bank system and whether there is a place for improvement, or whether banks are already on the production possibility frontier. Detailed knowledge about financial conditions and the economic situation of banks helps to prevent ineffective state-aid allocation and unnecessary cost, and thereby enable better decision making for responsible persons to strengthen the financial system. In this article are used DEA models with undesirable outputs and the result are expressed as a percentage of inefficiency in one indicator (compared in a group of estimated banks).

Keywords

efficiency, indicator, DEA

JEL Classification: G21

1. Introduction

Each country should try to build the most advanced banking system, because the better bank system the state has, the better competitive the state is. 2 Banks play a crucial role in financing the economy and settling payments. They also perform another important function, by providing products that allow other entities to manage their financial risk. Therefore, special emphasis is put on the analysis and assessment of banking system stability. The analysis of the financial system stability also constitutes a necessary element of an efficient regulatory and supervisory policy, in the development of which the NBP plays an important role and which, together with the monetary policy contributes to maintaining sustainable economic growth.

Central banks, commercial banks, management, government and other institution not always manage the financial system well. Because of mistakes of reliable persons could sometimes in the economy occur recession or crisis. In current strong competitive financial environment it is necessary to work as efficient as possible and do not have unnecessary extra costs. Measuring the level of efficiency of the banking system can help to identify the performance of measured units and if there is some way for the eventual improvement. These measurements may provide valuable information to market regulators and also bank managers for their decision making.

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[2] According to the study Berger, Hassan, Klapper 2004 (An International Analysis of Community Banking and Economic Performance). In this study was found an important relationship between the efficiency of bank system and GDP growth (tested in 49 lands). This result confirms also the paper from King and Levine (1993). There were examined 80 states in 1960-1989. According them the well functioning banking system enables better allocation of resources and investments. This opinion also validates Wachtel (2003), Kohler a Cecchetti (2009).

Inefficient banks with lower capital structure have, in accordance to the article from Fioderlisi, Marques-Ibanez and Molyneux (2010), the tendency to make risky steps, which are dangerous for the entire financial system. Furthermore, the authors found, that banks, reaching the good productivity, operate with lower costs and do not tend to do operations that border on moral hazard. After that the bank has a good capital structure, can afford to make business with higher risk, in which is possible to increase revenues (or has enough capital to cover losses from bad transactions).

Of course it exist a lot of typical performance indicators, for example ROA (Return of asset), ROE (Return of equity), ROI (Return of investment) and other finance analysis indicators. All these indicators have a big disadvantage by evaluation of bank efficiency is necessary to compare a lot of results.

It exists two ways for efficiency estimation – parametric (econometric) and nonparametric (mathematical programming). In both cases is the measured efficiency compared with the 'best practice frontier' in the group of investigated DMUs (Decision making units, in this study is one DMU one bank).

The most used parametric method is SFA (Stochastic Frontier Analysis). This method has a big disadvantage, that the model must be exactly defined. The DEA (Data Envelopment Analysis) model is a nonparametric method which allows quantification of the efficiency in one number and is formed as a piecewise linear combination of best - practice observations. Nonparametric approach is more suitable for bank efficiency ranking (Kamcka, Apergis 2011, Holod a Lewis 2010, Halická, Ševčovič, Brunovský 2001, Leibstein 1966). Advantage is that the technique works without the need for standardisation. Classical DEA models, described in Charnes, Cooper, Rhodes (1978) rely on assumption that inputs have to be minimized and outputs maximized (or conversely minimisation of outputs and maximization of inputs in the models oriented of inputs). A lot of authors applied this methodology in their articles. Casu, Molyneux (2000) researched the bank efficiency in EU after joining in the EU. Fioderlisy Marques (2010) examined the bank risk and efficiency. Ševčovič, Halická, Brunovský investigated the level of performance of bank branches in Slovakia, Stavárek, Řepková (2011) estimated the efficiency of Czech banking industry. All these works used the simply DEA CCR (constant returns to scale) and BCR (variable returns to scale) model. But the production process may also create undesirable outputs (for example air pollution in growing industry locations). As an undesirable output is in bank accounting considered 'loan loss provision'. It is the money a bank sets aside to cover potential losses on loans. Because the changes in bank risk may temporary precede a decline in cost efficiency related to higher costs of dealing with non-performing loans. (Fioderlisi 2010)

There are three categories of efficiency: productive (production of outputs given some inputs), cost (measured is the ability of bank to minimise the cost) and profit efficiency (ability to maximize profits). (Apergis 2011)

The term input- and output-oriented relates to the way in which inefficient DMUs are projected onto the efficient frontier. There are three possibilities: input-oriented models try to reduce the input amounts by as much as possible without reducing present output levels. Output-oriented models maximize output levels without increasing input consumption. The choice of an input-oriented model implies that banks cannot set their outputs at will and rather faces the given level of demand for their products. They can also not set the price of their outputs freely: many legislators in the region set strict upper/lower bounds for pricing bank products, particularly those offered to consumers. In the model banks cannot also completely decide the price of inputs at will. (Kamecka 2010)

2. Explored states

In the article are explored 6 states of European Union: Czech Republic, Slovakia, Hungary, Poland, Slovenia and Austria. These states are historically and economical close connected and cooperate together in a lot of fields (culture, trade, internal security, defence, science and education, strengthening the region).

These chosen CEE counties had similar problems due to communist past: inherited ban loans from this time, lack of experience in commercial banking, rapidly growing number of banks, privatization of state-owned banks, entry of foreign banks, freeing of interest rates, changes in legislation, establishing of prudential legislation and supervision. (Pančurová, Lyocsa 2013). Despite of these difficulties have in this time rather developed universal banking system. In Austria exist a lot of small banks and Austria has one of the densest bank networks in the world. This fact lead Austrian banks in the last years to the establishment the bank branches and subsidiaries in other states, especially in CEE countries so the bank systems in CEE countries and Austria are very close connected. The main joining is made by Erste Group, Raiffeisen Bank and Bank Austria. Austrian banks business strategies concentrate on a sustainable business model in Central and Eastern Europe with the overall goal to create value for shareholders. (Winkler, Haiss 2011)

Short description of bank systems in selected states:

Czech Republic

The Czech economy is for various reasons (tradition, under-development of the capital market, political hesitation with pension reform, etc.) dependent on bank financing much more than in Western Europe. The banking sector in the Czech Republic is largely foreign-owned (more than 95 % of all assets are controlled by parent banks in developed countries, in particular in the EU). The bank system is created of 44 commercial banks, 5 building societies (with a specialised banking licence) and twenty one branches of foreign banks. In general, the structure of the banking sector is relatively stable from a long-term perspective. Four 'large banks' manage approximately 57,5% of all assets. Their market share, however, is slowly declining due to relatively strong competition from small and medium-sized banks. The number of employees in Czech banks is over 40 000.

Slovakia

The Slovak banking system allows that commercial banks may engage in investment banking and brokerage activities, as well as traditional commercial transactions and lending. Branches may handle any transactions authorized by the parent bank. Foreign banks must agree to take over the assets and liabilities, effectively guaranteeing the financial health of the branch. In the present are 27 financial companies with banking licence on the Slovak market. Most of banks are members of the international banking groups (Erste, Intesa, Sanpaolo, KBC, RZB UniCredit, etc.). Foreign capital own more than 90% of Slovak banking assets.

Hungary

Legislation in Hungary allows universal banking entitling and licensed banks can provide a full range of securities transactions, including trade in stocks and publicly placed corporate bonds. Foreign financial institutions can open and operate branch offices in Hungary (65%). The banking sector is also consolidating, with larger banks acquiring or merging with smaller ones. As the Hungarian banking system continues to develop, new types of credit and financial institutions are entering the market, including mortgage banks and home-savings institutions.

Poland
Poland has the largest banking industry out of the countries from V4. Growing economy, with rising credit demand, makes Poland a favourable destination for investment in the banking sector. The banking system is focused on domestic business and plays an important role in financing private households, SMEs, big infrastructure projects and project financing. Polish banking sector is dominated by foreign-owned institutions (70%). Low penetration of banking services makes Poland an attractive destination to capture the market with standard or customised. The Polish banking system is showing resilience and has avoided serious problems during financial crisis.

Slovenia
The banking sector in Slovenia remains fairly rudimentary. Slovenian banks have rather strong capital bases and robust loan portfolios. In many cases, however, banks are limited to a narrow range of traditional activities and have yet to engage in new consumer services, investment banking, and management of more complex financial instruments. Nevertheless, the financial statements of Slovenian banks are in compliance with international standards and audited by international auditors. Because of the relative immaturity of the banking sector, identifying financing for domestic projects can be problematic. Banks typically seek 100% collateral in most cases. Slovenia has taken some important steps to liberalize its financial markets.

Austria
Austria has a highly developed banking sector. The banking sector can be divided into 7 subsectors (joint stock banks and private banks, savings banks, state mortgage banks, Raiffeisen credit cooperatives, Volksbanken credit cooperatives, building and loan associations and special purpose banks). The biggest sectors are the joint stock banks and private banks, the Raiffeisen credit cooperatives and the savings banks. The Austrian banks have a lot of branches and subsidiaries in Central and Eastern Europe (CEE), they Austrian banks are facing there only relatively small risks. The Austrian Banking Sector generally displays solid numbers regarding regulatory capital, the cost-to-income ratio, the return on equity, as well as profits before taxes. The costs to pay for the effects of the crisis are € 500 million. [3]

On the pictures below are mentioned some bank system characteristics and macroeconomic and bank sector indicators of estimated states. On the first view is visible that the structure of bank sector is not the same. In Poland and Austria are a lot of credit institutions and number of branches and in other states exist only a few credit institutions. In the article were selected 8-12 banks of the state in all estimated years according to the sum of assets, so it are estimated only the biggest institutions which cover usually 80% of the market. In all states, accept Hungary, is a good loan to deposit ratio.
On the second picture are depict six macroeconomic indicators. The values are approximately similar, only Hungary has problems with net lending / borrowing and unemployment. The biggest unemployment has Slovakia.
These lands had the similar history and starting position after the communist times. They made till now a lot of steps and improvements for betterment the bank system. In this article would be estimated, how efficient are the states in 2004 – 2011, and where is the efficiency gap.

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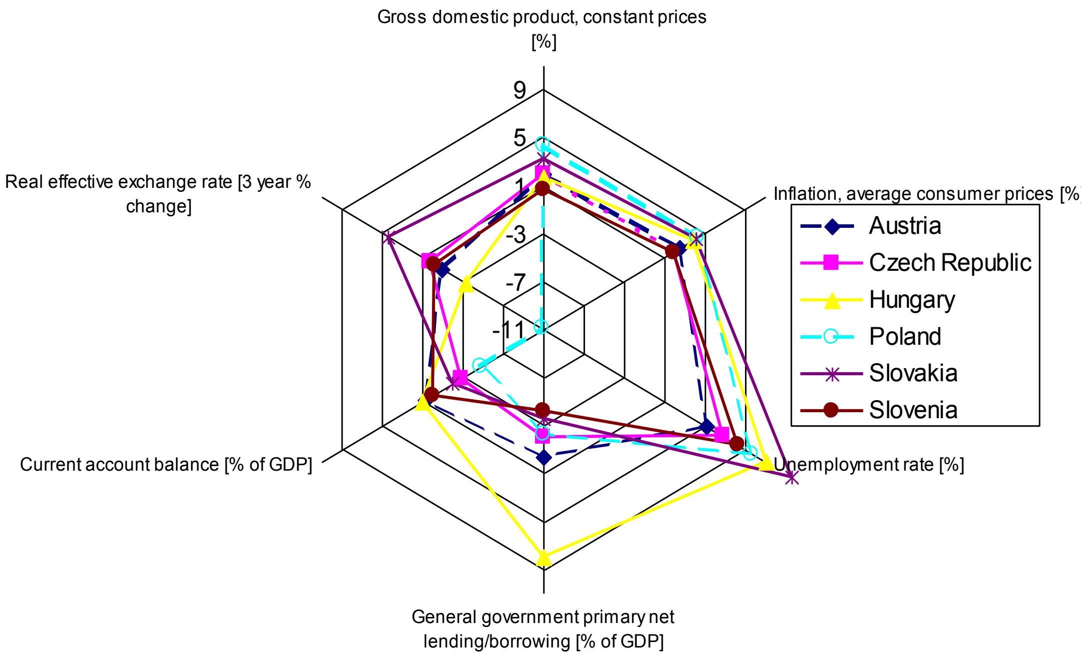
[3] Source: European Banking Federation, Knowyourcountry

Table 1: Key banking sector indicators [European Banking Federation]

2011	Poland	Czech Republic	Austria	Slovakia	Slovenia	Hungary
Number of credit institutions	700	58	766	31	25	189
Number of branches	14 611	2 070	4 461	1 051	690	3 460
Number of bank staff	186 331	39 461	78 085	18 452	11 813	41 305
Total Assets (mil.€)	309 803	180 395	1 010 385	58 025	52 350	114 924
Total loans (mil.€)	217 025	106 739	609 754	38 388	38 361	74 143
Total deposits (mil.€)	190 180	122 308	545 905	42 161	37 938	56 762
Capital and reserves (mil.€)	40 686	19 711	89 051	7 863	4 111	8 859
Loan to deposit ratio, %	121,9	92,4	118,6	93,1	154,67	161,77
ROE (%)	12,3	13,7	1,5	11,1	-11,1	-7,9
Population	38 200 037	10 532 770	8 404 252	5 435 273	2 050 189	9 985 722

Figure 1: Macroeconomic indicators 2011[Source: European Central Bank]



Only few authors analysed the efficiency of V4 Countries and Slovenia and Austria. The authors analysed usually only V4 Countries or CEEC countries or developed countries in EU. Stavárek, Řepková 2011 analysed V4 Countries and found that despite similar history of these states the bank systems differ and still exists a gap between bank efficiency in developed countries and V4. Pančurová, Lyocsa, 2013 researched CEEC countries with the DEA analysis. They detected the higher cost efficiency in foreign owned banks than domestic banks suggesting different banking behaviours between foreign banks (less risky, more cost focused). DEA analysis was used also in these studies Stavárek, Polouček 2004; Staněk 2010 measured the efficiency in Austria, Matoušek, Taci 2005; Taci, Zampieri 1998). All these authors used the parametric or nonparametric techniques without including risk (undesirable outputs). Contrary to previous studies is used in this article the model with undesirable output as the risk factor included. It is represented by loan loss provision (LLP) and it would be proved the impact of economical crisis on bank performance.

3. Methods and Resources

In traditional DEA models (CCR, BCR) is the main effort to maximize outputs or inputs (depends on type of the model). In the case of output maximization and input minimization appears the problem that not all outputs are for the estimated unit beneficial. The simply models ignore the undesirable outputs. But it is necessary to decrease these 'bad outputs' and increase the desirable outputs to improve the performance of DMU. It exist different ways, how to incorporate undesirable outputs into the DEA model. Indirect approaches transform the values of the undesirable output variables by a monotone decreasing function so that they can be included in the model along with the desirable outputs in the technology set T and are maximized. In this way, by maximizing the transformed values, the original undesirable output values are minimized. Direct approaches on the other hand include the undesirable output data directly into the DEA model but instead modify the assumptions of the model in order to consider the undesirable outputs appropriately. (Triantis, Hoopes, Koelling, 2002)
In model, there are n DMUs (banks) which are evaluated, indexed by $j = 1,\ldots,n$
The input and output vectors of DMU_j is $X_j = (x_{1j}, \ldots, x_{ij})$ and $Y_j = (y_{1j}, \ldots, y_{ij})$
In this article is used the indirect approach, it means the transformation of undesirable outputs (we set as variable d_i the constant for recalculating the undesirable outputs to plus sign values: $d_i = \max_j(y_{ij}) + 1$).

$$\psi_{ij} = -y_{ij} + d_i, i \in UO \qquad (1)$$

ψ_{ij}…transformed undesirable outputs; UO….undesirable outputs, DO…desirable outputs, I…inputs
The undesirable outputs are positive now, we can consider them as normal outputs and it is possible to maximize them.

$$T = \left\{ (X,Y) \middle| X \geq \sum_{j=1}^{n} \lambda_j X_j, Y \leq \sum_{j=1}^{n} \lambda_j Y_j,\ \lambda_j \geq 0, j = 1,\ldots,n \right\} \qquad (2)$$

$$\text{Max} \quad g = \theta_q - \varepsilon\left(\sum\nolimits_{i\in I} s_i^{-} + \sum\nolimits_{i\in DO} s_i^{+} + \sum\nolimits_{i\in UO} s_i^{+}\right) \qquad (3)$$

λ = intensity variables that form linear combinations of observed inputs and outputs with variable return to scale imposed by the constant: $\sum_j \lambda_j = 1$;

θ_q …degree of efficiency of virtual unit (the system looks for the combination of virtual inputs and outputs which are better or worse than the inputs and outputs of estimated Unit); s_i^+, s_i^- …slacks (distance from production possibility frontier) ; ε…infinitesimal constant which ensures inclusion of all inputs and outputs to the model at least in this value, it is usually 10^{-8}
The DMU is efficient if (x,y) ϵ T. In this situation no less or any more input can produce the same output or if the same input can produce no more any single outputs. (Fukuyama, Weber 2009)
Constrain:

$$\sum_{j=1}^{n} \lambda_j x_{ij} + s_i^{-} = x_{iq}, i \in I \qquad (4)$$

$$\sum_{j=1}^{n} \lambda_j y_{ij} - s_i^{+} = \theta_q y_{iq}, i \in DO \qquad (5)$$

$$\sum_{j=1}^{n} \lambda_j \psi_{ij} - s_i^{+} = \phi_q \psi_{iq}, i \in UO \qquad (6)$$

$$\lambda_j \geq 0, s_i^{+} \geq 0, s_i^{-} \geq 0 \qquad (7)$$

$$VRS: \sum_{j=1}^{n} \lambda_j = 1 \qquad (8)$$

$$CRS : \sum_{j=1}^{n} \lambda_j - free \qquad (9)$$

Efficient units have the efficiency = 1. The units with higher level of measured efficiency are not effective and have to improve the inputs, desirable outputs and undesirable outputs in this way:

$$x'_{ij} = x_{ij} - s_i^{*+}, i \in I; \qquad (10)$$

$$y'_{iq} = \Phi_q^* y_{iq} + s_i^{*+}, i \in DO \qquad (11)$$

$$y'_{iq} = d_i - (\Phi_q^* \Psi_{iq} + s_i^{*+}), i \in UO \qquad (12)$$

All symbols with * are the vectors of optimal values of the models.

The paper focuses only on commercial banks other specialized banks (central banks, investment banks, securities houses, multilateral government banks, non-banking credit institutions, specialized financial institutions…) were in the study not covered. The dataset was obtained from Bankscope - Bureau van Dijk database. As inputs were selected: personnel costs, deposits, fixed assets and as outputs net interest revenue, loans and as an undesirable output loan loss provision. All dates were used from unconsolidated financial statements, annual periodicity.

All dates were adjusted for inflation (2005 = 100%) and for foreign currencies was used the exchange rate from 31.12.20XX. By data selection took a lot of time to analyze the dates from mergers and acquisitions. A lot of banks were renamed or did not exist or the dates were not complete. Selected period was 2004-2011. From both states were selected 9-12 biggest banks according to total assets. Estimated file comprises approximately 75-80% of the whole market.

4. Results and discussion

Comparison between the bank system of V4, Slovenia and Austria is displayed in Fig.2. The efficient units have the score 100%. The further is the distance between achieved efficiency level and 100% border, the more inefficient the system is. On the first view is visible, that in the year 2008 with entrance the financial crisis decreased the bank performance sometimes also of 20% (CCR model). The sharpest decline in global economic activity was recorded in the first quarter of 2009. Several countries sought to revive their economies by taking extensive fiscal and monetary stimulus measures. The principal aim of the fiscal stimuli was to boost domestic demand and sustain domestic economic activity, while the level and form of these stimuli varied from one country to another. Whereas in advanced countries the stimulus measures were largely directed at maintaining domestic demand, in emerging economies they focused mainly on infrastructure projects.

The pressures on *Czech* bank had in 2004 the efficiency only 40% according to the model CRS, the performance of bank grew up till 2008 system when the financial market turbulence turned into a global financial crisis, causing an economic slowdown. Although the Czech banking system was not directly affected by the crisis thanks to its sound balance sheet structure and capitalization, liquidity declined in some financial market segments as a result of a general lack of market confidence. A sharp slowdown in economic growth abroad and a related decline in net export growth, weakening domestic economic activity and a subsequent worsening of the financial sector's performance had been identified as the main risks and the bank performance descended on the 40% level The escalation of the European debt crisis, slower growth abroad and continuing domestic fiscal consolidation were the most important factors that affected the Czech economy and the bank efficiency has gone down also in the following years. Despite some losses the Czech banking sector as a whole remains highly profitable.

The *Slovakia* had very similar economical reasons for decline as the Czech Republic. In 2008 the economic growth reached 6,4%, with its dynamics weakening gradually from 9.3% in the first quarter to 2.5% in the fourth quarter. Parallel with the slowdown in foreign demand, the efficiency decreased from 52% in 2008 to 40% in 2011. The growth in the investment component of domestic demand also slowed, when non-financial corporations restricted their investment activities.

The *Hungarian bank* system had to prevent the series of cost and supply of increase in inflation in 2008. Removal of the exchange rate band in February 2008 expanded the room for maneouvre in terms of monetary policy and strengthened the credibility of the anti-inflationary commitment. Drastic deterioration in growth prospects and the significant correction in commodity prices put the Hungarian economy on track for rapid disinflation. The crisis had strong impacts on the financial markets and the banking sector in Hungary. An adverse environment, including a heavy tax burden and rising NPLs have increased bank losses and contributed to sharp external and domestic deleveraging. Hungary´s economy has not yet recovered to pre-crisis levels. Continued weakness in private consumption and investment, compounded by a sizable fiscal consolidation, contributed to the downturn. From the very good starting position of 55% efficiency was the performance of Hungarian bank only about 32% in 2011. Net exports, buoyed by the expansion of the car industry, were a key source of growth.

Poland had the lowest bank efficiency in all estimated years, only about 30-36%. The main reason is the loan quality and not a developed payment system in beginning of measured years. The high level of current earnings meant that companies had no need to take out new loans, being able to fund investment and ongoing operations internally. One of the reasons of bank inefficiency are nominal wages, their growth was limited due to the maintenance of high unemployment. In Poland, there is a high demand for bank loans. The bulk of credit was granted to households: 56% of total loans, of which 59% comprised lending for house purchase. Loan-to-deposit ratio was quite stable, at around 112%. The Polish banking sector may still be considered as a promising growth market. Most Polish banks entered the financial crisis with relatively healthy fundamentals.

The performance of *Slovenian* bank system is approximately in the middle of estimated states. In 2005 – 2008 during the times of economic growth used Slovenian banks borrowing in the rest in the world to secure the additional funding to cover the sharply increasing demand for loans. The funding drew up in financial turmoil in 2008, but the banks made in first ten month the next repayment 3,3 billion € from foreign lenders. After that, banks had to change the financial strategy. They became some sum from government, they obtained additional funding from Eurosystem and they increased interest to attract household deposits which was a high risk. Banks tightened credit standards, placed heavy burden on construction companies with high leverage which lead to price pressures on real estate market. Credit risk increased very quickly, the proportion of loans more than 90 days doubled in one year. In spite of all these problems, Slovenia had the capital adequacy 11,6%. In 2011, after five years is Slovenia again in recession because of over-leveraging in the private sector and because of weakness of banking system in funding of banks and corporates and the dependence on international funding markets. The sector ended in 2011 with the largest loss since the outbreak of financial crisis. This situation is visible on the Fig.2, model VRS below.

Austria had the best bank efficiency in 2004 which decreased every year and in 2011 was the performance according to the model CCR the second worse of all states in this study. After the entrance of Austrian bank to CEE sector, their profitability increased rapidly. The weakening of Austrian exports has mainly had a negative impact on value added in manufacturing. Investment growth also slowed, but in relative terms it remained fairly robust. Consumer spending continued to show a very moderate development due to high inflation.

Since 2007, new issues on the Austrian stock market have decreased drastically, and a number of previously announced issues were canceled. During the crisis CESEE operations were key profit driver of Austrian banks, even though the higher profitability of those transactions is linked with higher risks. Due to a still weak macroeconomic environment, credit quality continued to decrease. The aggregate loan loss provision ratio of Austrian banks CESEE subsidiaries stood at around 7.6% at the end of 2012.[4]

It exist smaller and larger banks on market, which differently influence the whole banking sector because of its different market strength. Because of that was used SAE. It recalculates the data set according to the formula:

$$SAE = \sum_{i=1}^{n} w_i g_i * \qquad (13)$$

where w_i are weights according to the asset ratio in the estimated file All values in all years had deteriorated. These results show that mainly the biggest banks, which have the highest market power, are more inefficient than smaller banks. Bigger banks have very often higher costs for company governance and operation costs.

[4] Source: Annual Reports of National Banks, European Bankiny Federation, IMF

Figure 2: Bank system efficiency in selected EU countries in 2004-2011[Source: Author´s calculation]

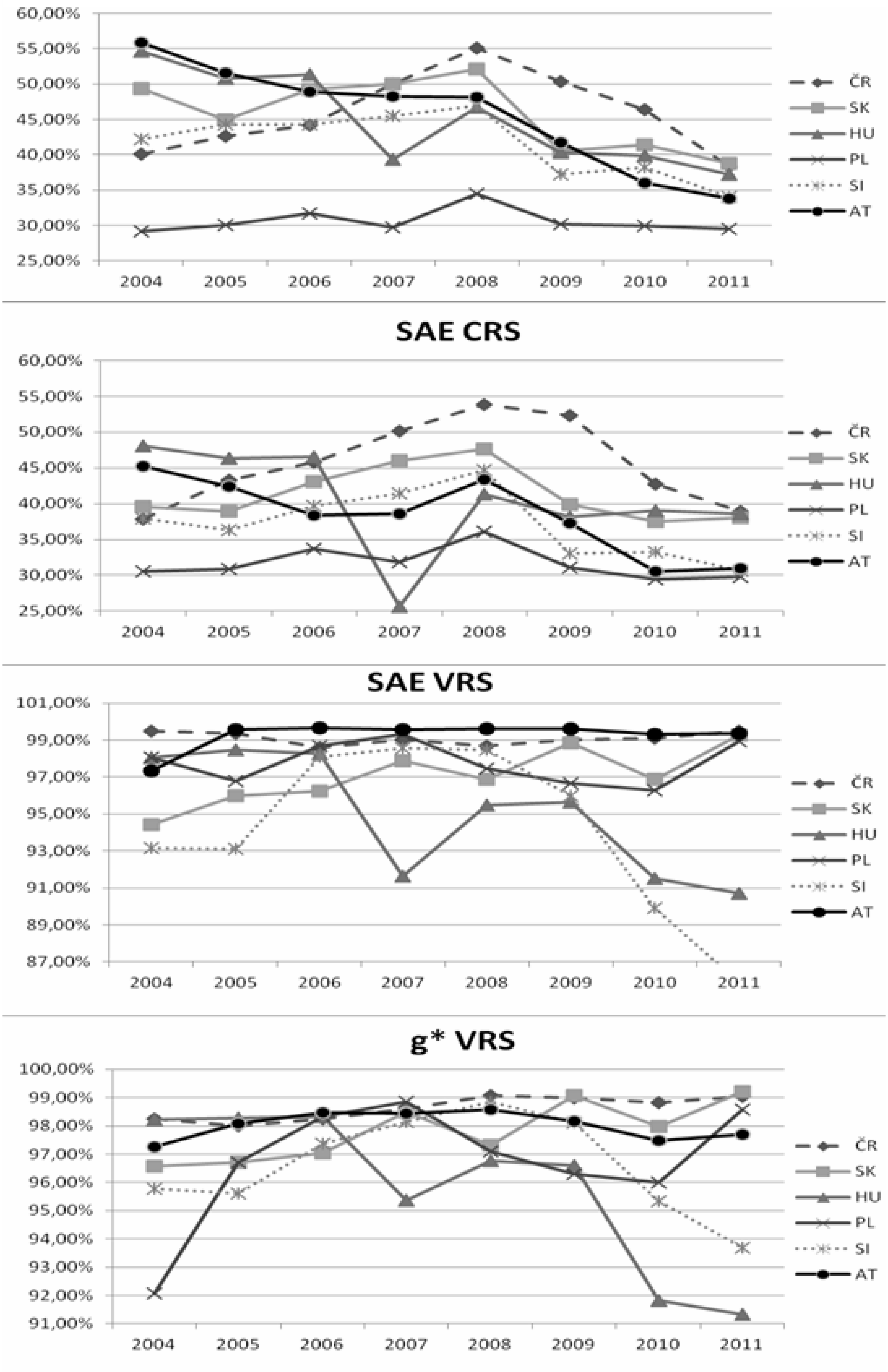


Fig.2 shows that bank systems in measured countries in the year 2004 did not have the same level of efficiency. In both used models (CRS and VRS) were big differences between estimated states. According the model CRS, Austria was the best performed state and Poland the worse. Subsequently the performance of the banking sector in all states increased, accept Austria and Hungary. In 2008 began a drop of efficiency in all bank systems the efficiency significantly decreased in the next years. In 2011 were the differences between best and worse states only 10%, although the gap in 2004 was about 28%. After SAE recalculation is visible, that the biggest banks in the systems have lower efficiency, because the performance after recalculation reduced in all states, apart from Poland. Poland had in model CRS no efficient unit during the whole period. Slovenia had only 1 efficient unit, Austria and Czech Republic had both 8 efficient units and Hungary 18 efficient units in the measured period. Although the politician claim, that the financial crisis has gone, the results of measuring efficiency proved, that the balance sheets of banks still contain a lot of souvenirs from last financial crisis.

According to the model VRS (variable return to scale) had Czech Republic and Austria the most efficient bank system of all compared states. Surprisingly, the performance of Poland banks was much higher as in the model CRS and the worse system is Hungarian. The main sources of inefficiency were in all states the fixed assets. Particularly bigger banks hold mostly not always fully utilized buildings and other significant items of tangible assets. These big banks also offer a wide range of products and that brings much more costs as to offer some specialized examined profitable product. The other sources of inefficiency are personnel cost, especially in Hungary were the personnel costs higher than in other states.

If we compare the CCR and BCC models and divide these values, we find that this value is more than 1. This result reveals that banks do not operate at their optimum size. This value does not tell us whether the bank is too small or too large. To determine it, it is necessary to calculate the value NDRS (non-decreasing return to scale) to the NIRS (non-increasing return to scale). After the calculation was found, that banks are generally too large and therefore inefficient.

5. Summary

The aim of this paper was to estimate the level of bank efficiency in the Czech Republic, Slovakia, Austria, Poland, Hungary, Slovenia and Austria in the period 2004 - 2011 and to compare them. For the survey were used two models: CCR and BCC with undesirable outputs. As an undesirable output was chosen the indicator ‘loan loss provision’. As inputs were selected personnel costs, deposits and fixed assets, as outputs loans, net interest revenue. In the survey were covered every year about 60 banks, which account for about 75% of the whole market in estimated states. According to both models the performance of bank systems was very different in 2004, till 2008 increased the efficiency of bank system in mostly in all countries. After the year 2008 decreased the efficiency considerably because of the impact of financial crisis. The efficiency declined rapidly till 2010 and in 2011 was the reduction not so large. The best performance had the Czech, Slovak and Austrian bank system. The biggest source of inefficiency was in all states a huge amount of not fully utilized fixed assets. Other finding is that banks do not operate on the ideal size and are too big. Measuring the efficiency of small and medium banks could be a subject for future studies.

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Structure of commodity indexes – an actual analysis

Martin Svoboda, Věra Jančurová[1]

Abstract

This article focuses on analyses of structure, calculation and performance of commodity indexes. First index was constructed 130 years ago to measure the market performance. Since then many different indexes appeared which makes up the question what index is really a good measure for the market. Commodity indexes are a special group of indexes that are established to measure the commodity market, whose importance has been growing during the last years. This is especially caused by the fact, that commodities became investable also for small investors. This paper focuses on describing and comparing the structure of chosen commodity indexes.

Key words

Financial commodities, indexes, agricultural commodities, structure.

JEL Classification: G11, G15, G23

1. Introduction

First indexes were constructed in the second half of the nineteenth century to represent market in the United States. First market indexes were calculated in 1884, when the journalist Charles Henry Dow looked for representative American economy companies. Dow found nine railway companies and two industrial companies which closing courses he followed. He started with a simple methodology Dow added the closing courses and then deleted them by eleven.[2] And the first index was calculated. Over the years there were created many different indexes constructed by different methodologies and for different market segments. Now a day new indexes are established, however, the main idea stays the same over the years, indexes should represent given market/market segment and are estimated to be indicators of stock exchange market.[3] Indexes can be used on one side as benchmarks on the other one as underlying for structured products. Because of that it is very important to know exact structure of particular index, inclusive its updates and the whole process of calculation. Commodity indexes are index group that was constructed to measure and also represent the commodity market.

This article is going to discuss chosen commodity indexes, which are used by particular issuer for emission of structured products. We focus on identification of their structure and show that there are significant differences in their structure and calculation. The goal of this paper is to analyze structure of some commodity indexes and compare it. And further show that it is important to study the structure of indexes before using it as benchmark or underlying.

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[2] Finanznachrichten lesen-verstehen-nutzen, Schäffler, Poeschel; page 123

[3] Investování na finančních trzích, Veselá; page 177

To understand indexes we start with a brief introduction of their possible types; the literature distinguishes among price indexes and performance indexes. Price indexes are influenced only by price changes. On the other hand performances indexes take into consideration not only rate changes but also dividend payments or gains of selling the rights.[4] The different access to the calculation leads to distinction in the results and information power of the index. Some experts prefer using performance indexes, because they are considered to be more realistic.[5] However most of the currently calculated indexes are price indexes.

Indexes can be also classified according to the field which they represent. We can find international and national market indexes, as well as market segment indexes as for example: shares indexes, energy indexes, commodity indexes at cetera. In the next part there will be analyzed structure of chosen commodity indexes inclusive their importance and representativeness for realistic display of commodity market or its segments.

2. Commodity indexes

In this part there are analyzed three commodity indexes that were constructed to represent the commodity market. There is introduced Thomson Reuters/Jefferies CRB index, than S&P GSCI and last Rogers International Commodity Index. These indexes are broadly recognized and issuers often use them for emission of different kinds of structured products. The introduction is followed by comparison of these indexes.

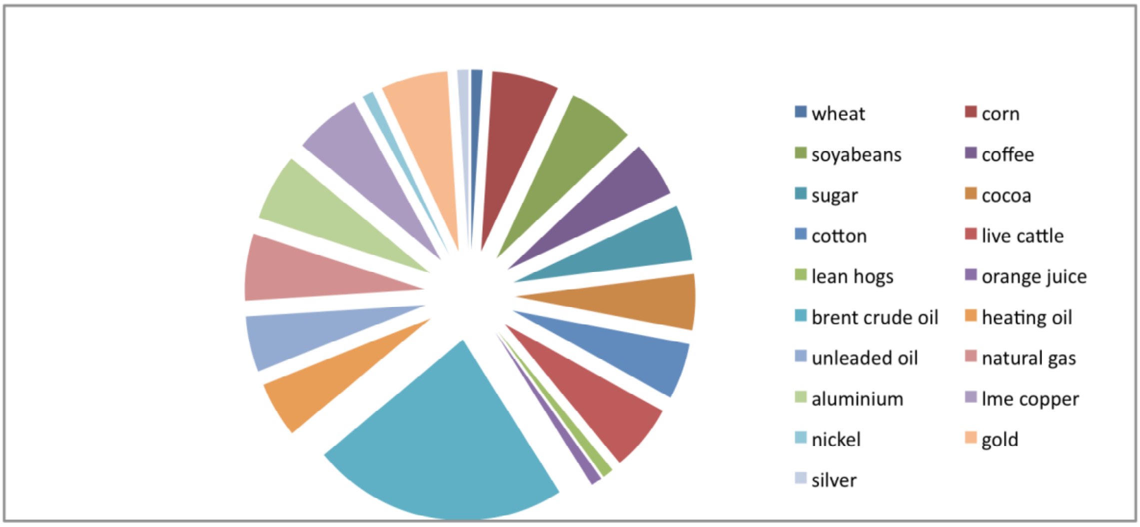
2.1. Thomson Reuters/Jefferies CRB (TRJ-CRB)

Thomson Reuters/Jefferies CRB (TRJ-CRB) is the first commodity index. This index was constructed by Commodity Research Bureau and is calculated since 1957. This first index, originally called Thomson Reuters Equal Weight Continuous Commodity Index; nowadays called Thomson Reuters/Jefferies CRB is still calculated in its original way as well as in the updated form. Even if there were done many changes in the calculation of Thomson Reuters Equal Weight Continuous Commodity Index during the years; the index is still calculated according to spot courses and accounts all commodities with the same weight regardless of their market liquidity. This makes the emission of structured products impossible. Because of this was constructed new index, called Thomson Reuters/Jefferies CRB, which differs a lot from the previous one. “This leading commodity futures benchmark is designed to provide timely and accurate representation of a long-only, broadly diversified investment in commodities through a transparent and disciplined calculation methodology.”

The new Thomson Reuters/Jefferies CRB constructed in 2005 consists of 19 commodities. Unlike the original Thomson Reuters Equal Weight Continuous Commodity Index are all commodities involved in Thomson Reuters/Jefferies CRB weighted according to their market importance. The commodities and their weights are checked quarterly and their currently weights are showed in the following graph. Special by TRJ-CRB is that it distinguishes between agricultural goods and soft commodities. Which can be seen as interesting is, that “Softs” as cacao, coffee and sugar are very strong covered by this index. Further the weight of live cattle is higher than by other indexes (7%).

[4] Finanznachrichten lesen-verstehen-nutzen, Schäffler, Poeschel; page 125
[5] Finanznachrichten lesen-verstehen-nutzen, Schäffler, Poeschel; page 126

Figure 1: Structure of Thomson Reuters/Jefferies CRB



Source: Own calculation based on Bloomberg (2013).

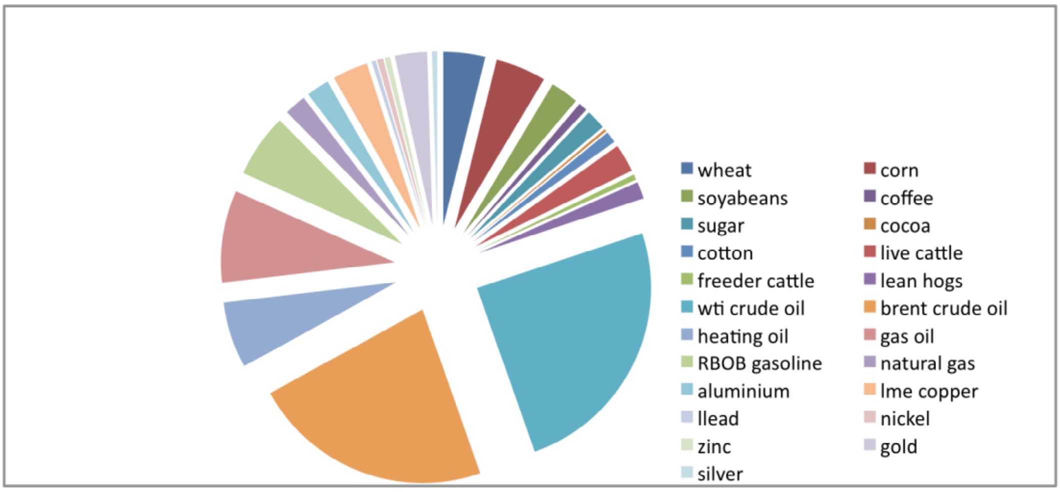
Well diversify the index. The commodities chosen for the original index were not often changed as well as their significance which could cause that the index did not really represent the market.[6] However new TRJ-CRB changes the weights of involved commodities regularly and can be seen as interesting investment opportunity. Another possible disadvantage can be seen in the coincidence which is involved in this index and omitted by some other indexes. This coincidence is caused on one side by choosing the commodities on the beginning and not changing them during the time and on the other hand by the fact that it still uses light oil for the calculation instead of the Brent Oil which has been implemented in all big indexes.. All these details make the index different from the other indexes calculated for commodity market. TRJ-CRB can be seen as an interesting investment possibility, especially as diversification to shares and savings because of the small significance of industry metals.

2.2. Goldman Sachs Commodity Index (S&P GSCI)

Goldman Sachs Commodity Index (S&P GSCI) is currently the most known commodity index was constructed by Goldman Sachs in 1991 and then sold to Standard & Poor in 2007. S&P GSCI shows official closing level on the daily basis.[7] S&P GSCI is an international commodity index that captures the whole commodity market. “The S&P GSCI is designed to be a “tradable” index, providing investors with a reliable and publicly available benchmark for investment performance in the commodity markets. The index comprises the principal physical commodities that are traded in active, liquid futures markets.“[8] .Commodities are chosen for S&P GSCI according to their importance for world production. Each commodity included in the index is given by average production of that commodity during the last five years. Because of that involves S&P GSCI mostly energies (currently about 70 %).

[6] Thomson Reuters/Jefferies CRB
[7] Bloomberg: http://www.bloomberg.com/quote/SPGCCI:IND
[8] http://eu.spindices.com/performance-overview/commodities/sp-gsci?indexId=spgscirg--usd----sp------

Figure 2: Structure of S&P GSCI



Source: Own calculation based on Bloomberg (2013).

The weighting of individual kinds of raw materials is determined by the average quantity of production in the last five years. Thus it is no surprise that the index is largely dominated by the energy sector. Oil, petrol and natural gas are after all the primary driving force of every industrialized society and thus are entitled to more than 70 per cent share in the value of the index. The structure of the index is keen on energies and cannot be seen as well diversified. But there are included also industrial metals, precious metals, agricultural fabrics and cattle.[9] The commodities chosen for the index are regularly (every year) changed as well as their significance which should make the index representative for the market. S&P GSCI as well as TRJ-CRB include little industrial metals and can be also seen as interesting investment possibility, especially as diversification to shares. Future contracts are limited by their maturity, while GSCI Index is without such a time limitation and its price is calculated continuously from 1991 and was retro calculated to 1970. The price for the new futures contract is usually not exactly the same as for the futures rolled forward. It is usually quoted at a price higher (contango) or Loir (backwardation) than the original one. Therefore, GSCI Excess Return Index does not simply reflect only the development of prices of individual commodity futures, but also the development of the roll-over process, which comes out negative with contango and positive with backwardation. The S&P GSCI is calculated as Total Return, Excess Return and as well in the Spot Variant.

Every part (sector) of S&P GSCI is represented by a subindex, like S&P GSCI Agricultural, S&P GSCI industrial et cetera. S&P GSCI index group is added also by indexes that reduce the importance of energy. The investors can find within the index group well diversified indexes as well as close-fitting ones.

2.3. Rogers International Commodity Index (RICI)

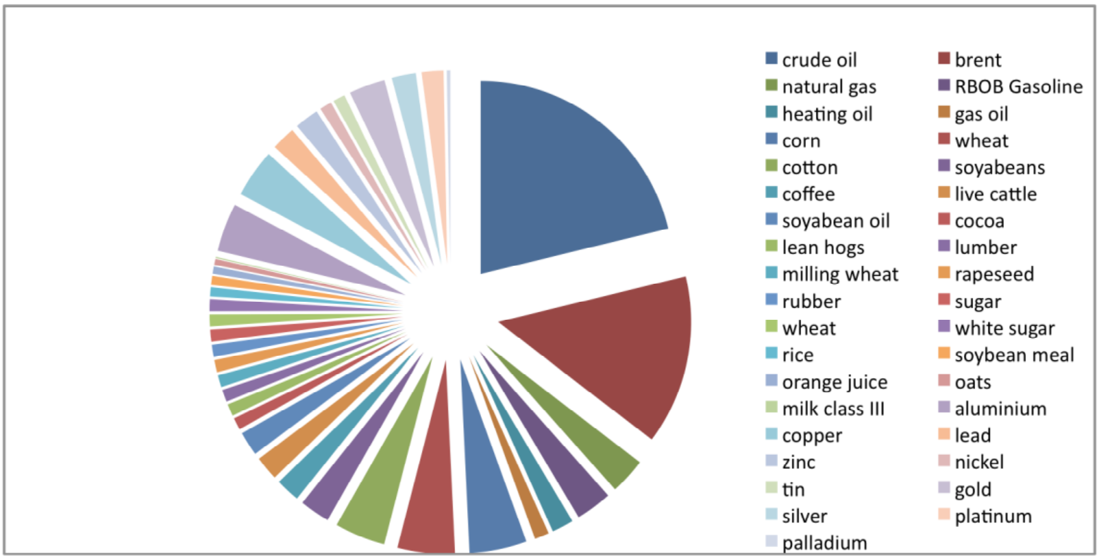
Rogers International Commodity Index (RICI) was constructed in the late 1990s by Jim Rogers and is constructed as total return index (performance index). "RICI® aims to be an effective measure of the price action of raw materials not just in the United States but also around the world."[10] According to Rogers, the index is intended to reflect everyday cost of living. The purpose of this index is to meet the needs for consistent investing and was created as the measure for international commodity markets.[11] The structure of RICI corresponds to

[9] For more details see the table in section comparison.
[10] http://beelandinterests.com/PDF/RICI%20Hndbk_Jan2013FINAL.pdf
[11] http://www.rogersrawmaterials.com/

this purpose; commodities are involved according to their use and importance for global markets. RICI involves currently 37 commodities and is one of the most complex indexes at the market.

RICI is managed actively by Jim Rogers. Every December, Rogers checks the composition of the index and reviews the weighting of individual components.

Figure 3: Structure of RICI



Source: Own calculation based on Bloomberg (2013).

RICI can be seen as one of the most diversified indexes. "It represents the value of a basket of commodities consumed in the global economy, ranging from agricultural to energy to metals products."[12] Changes of included commodities and their weights are decided by a committee. [13] This should guarantee the efficiency every time. RICI can be also seen as good diversification for share market because of low consideration of industrial metals. Rogers is convinced that there are long years of commodity boom ahead of us, namely until 2022. Agricultural products in particular are believed to promise a huge potential.

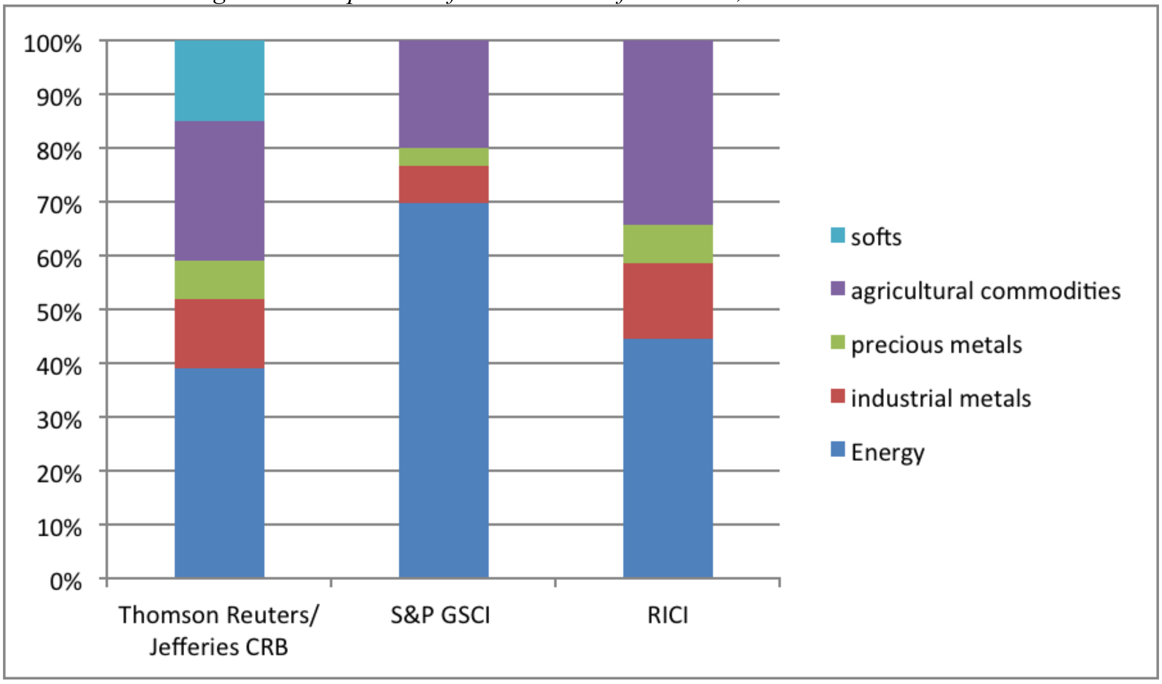
2.4. Comparison of indexes

The following table shows the structure of chosen commodity indexes. As we can see S&P GSCI is the most influenced index by energy but contains least precious and industrial metals. On the other side the biggest percentage of agriculture commodities is captured by TRJ-CRB (we have to account "softs" as well).

[12] http://beelandinterests.com/PDF/RICI%20Hndbk_Jan2013FINAL.pdf

[13] In the Handbook is the commitee and metodology of index creating described: The Rogers International Commodity Indexes are maintained by their owner, Beeland Interests, Inc., who is advised by members of the Rogers International Commodity Index® Committee: a group of "wise people" just as are the people who determine the Dow Jones Averages and other major indexes. The RICI® Committee formulates and enacts all business assessments and decisions regarding the calculation, composition and management of the index.

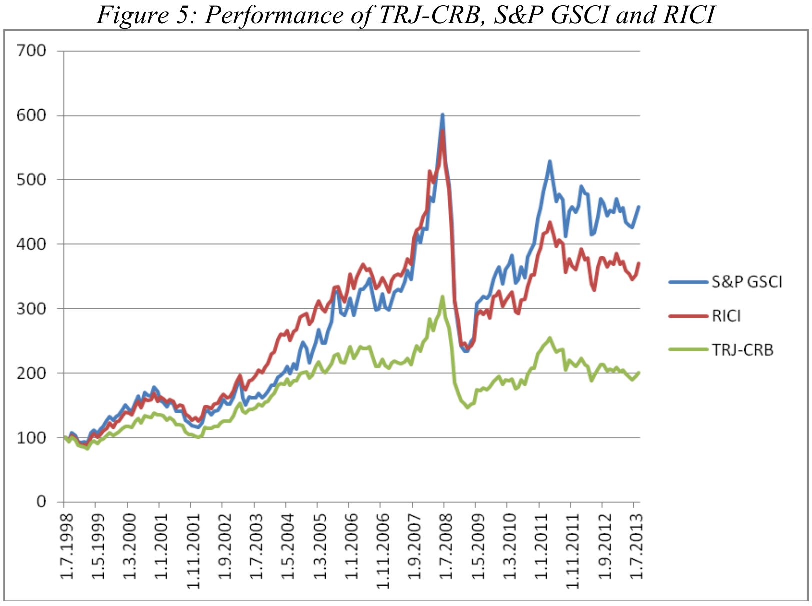
Figure 4: Comparison of the structure of TRJ-CRB, S&P GSCI and RICI



Source: Own calculation based on Bloomberg (2013).

As we can see from the previous comparison of index structure, the structure of TRJ-CRB, S&P GSCI and RICI is quite similar but not the same, which causes differences in the performance.

Figure 5: Performance of TRJ-CRB, S&P GSCI and RICI



Source: Own calculation based on Bloomberg (2013).

The comparison of the performance of the three indexes discussed till now shows that RICI and S&P GSCI seem to perform very similarly. But TRJ-CRB Index seem to be less volatile, it performs better in the time when the market prices are low and then when the market grows it does not grow as fast as S&P GSCI and RICI.[14] In our mind CRB Index can be suitable investment for risk averse investors.

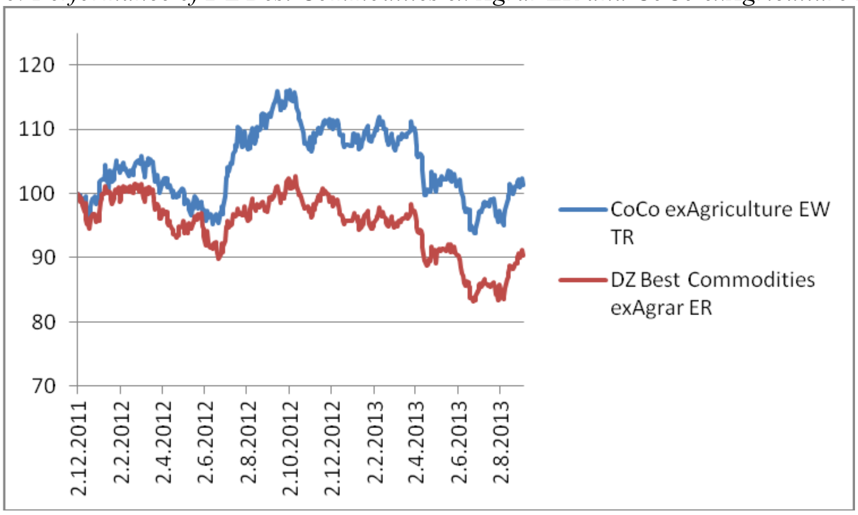
3. Commodity indexes without agricultural goods

Subindexes are also very popular; they enable investors to invest into different commodity segments. One type of subindexes are “ex- indexes” that allow investors to track a diversified basket of commodity futures while excluding single classes of commodities like precious metals, grains, livestock, energy, “softs”, agricultural commodities et cetera. Investors can have different reasons for excluding some commodities from their portfolio. Agricultural commodities are sometimes excluded as well; for some investors they can be seen as unpredictable, because of its dependence on weather and consumption. There can be many reasons for excluding agricultural commodities from the index, one of the most known for example is, that agricultural commodities are usually subject of high volatility.[15] This can motivate investors to exclude agricultural commodities from their portfolio. In the following part there are analyzed two commodity indexes that exclude agricultural commodities. As previous analyzed indexes also DZ Best Commodities ex Agrar ER and CoCo exAgriculture EW TR can be used as underlying for emission of different kinds of structured products. .

3.1. DZ Best Commodities ex Agrar ER

DZ Best Commodities ex Agrar ER was constructed by DZ Bank[16] after the bank decided not to produce any further indexes that are influenced by agricultural commodities. DZ Best Commodities ex Agrar ER excludes all agricultural commodities; it includes only six commodities from area energy, industry metals and precious metals. Unlike TRJ-CRB omit DZ Best Commodities exAgrar ER the WTI Oil (it is one of less indexes that doesn´t include light American oil at all). This index can be seen as a special case because of the strong consideration of the six included commodities. There is not another index that would considerate gold, silver or copper that much. It is not a representative index for the whole commodity market. It can be seen as an interesting mixture of a few commodities.

Figure 6: Performance of DZ Best Commodities ex Agrar ER and CoCo exAgriculture EW TR



Source: Own calculation based on Bloomberg (2013).

[14] See attachment 2 to see the performance of the particular indexes in separates graphs.
[15] Higher volatility can be caused for example by high dependence on nature (weather).
[16] DZ Bank is german bank that offers a bright range of products. DZ Bank i sone of the biggest emitents of structured products.

3.2. CoCo exAgriculture EW TR

CoCo exAgriculture EW TR was constructed by Commerzbank and as some other new indexes is not a representative index for the commodity market.[17] For the calculation of this index there are used twelve commodities with the same significance. This access leads to representative power problems. The smaller part of the market ("small" metals) as zinc or palladium is overestimated and bigger part of the market (energy) as oil seems to be underestimated.

CoCO ex Agriculture is a mixture of the previous mentioned indexes. It excludes agricultural commodities but calculates more commodities than DZ Best Commodities ex Agrar ER. According to our mind (našeho mínění) this makes the index more complex than the DZ Best Commodities ex Agrar ER. However the same significance of each commodity cause less realistic picture of the market. And if we compare CoCO ex Agriculture to TRJ-CRB, S&P GSCI and RICI there are still less commodities included and the exclusion of agricultural commodities makes its representative power weaker.

4. Comparison of analyzed indexes

In the previous parts there were introduced five commodity indexes, three of them represent whole commodity market and two other exclude agricultural goods.

The following table analyses the structure of commodity indexes mentioned above. Some of these indexes exclude agricultural commodities and thus can be watched as a special group of commodity indexes.

Table 1: Percentage structure of analyzed indexes

	Thomson Reuters/Jefferies CRB	S&P GSCI[18]	Rogers International Commodity Index (RICI)		DZ Best Commodities exAgrar ER	CoCo exAgriculture EW TR
Energy	39	52,6	44		46	33,33
Industrial metal	13	10,6	12		34	33,33
Precious metals	7	5,5	7,1		20	33,33
Agricultural fabric	34	23,7	32,9			
Cattle	7	7,6	3			

Source: Own calculation based on Bloomberg (2013).

The previous table shows, that the index that TRJ-CRB, S&P GSCI, RICI and DZ BC ex Agrar are most impacted by energy. By nearly all of these indexes builds energy almost half of the index component. By TRJ-CRB, S&P GSCI and RICI are the second most important component agricultural commodities; they built up to 40% of these indexes. Industrial and precious metals are included less by TRJ-CRB, S&P GSCI and RICI. However DZ BC ex Agrar and CoCo ex Agricultural involve more of industrial and precious metals, which can cause their high dependence on market cycle and thus high volatility.

As the structure of the commodity indexes varies, the performance of them differs as well. Following table shows the differences in the performance of given indexes in years 2011 and 2013 as well as their performance in year 2013.

[17] Investmentcheck 1/2013
[18] http://www.spindices.com/documents/factsheets/fs-sp-gsci-ltr.pdf

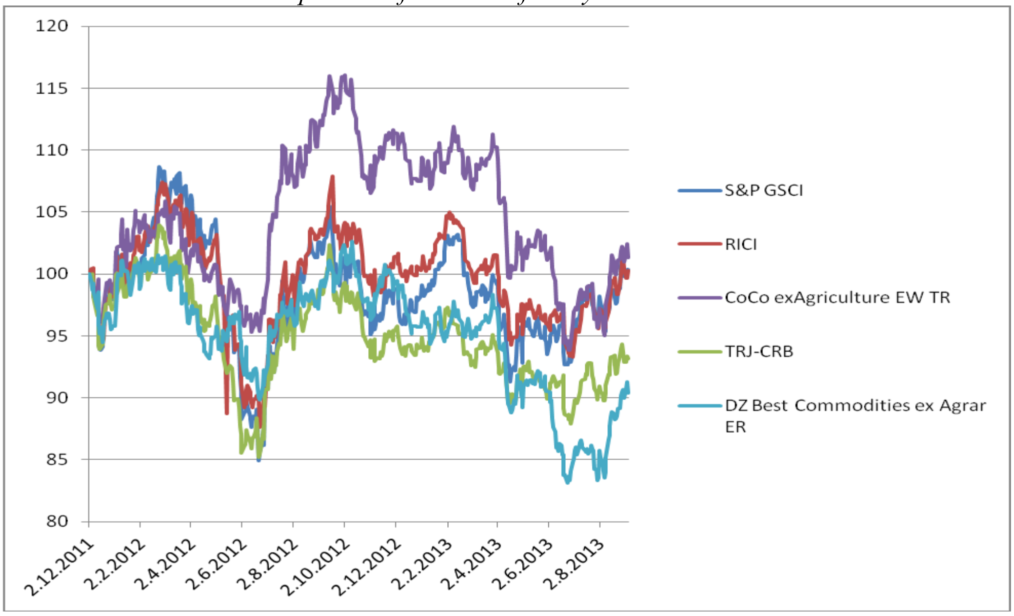
Table 2: Performance comparison of analyzed indexes

	Rate 12.2.2013	Rate 12.4.2013	Rate 6.6.2013	Performance in 2011	Performance in 2012
DZ Best commodity ex Agrar	72,18	69,53	66,76	-	-0,3
CoCo ex Agriculture EW TR	113,66	105,76	103,11	-12,4	9,5
Thomson Reuters/Jefferies CRB	21,1	20,86	20,54	-6,8	-5,4
S&P GSCI	36,10	33,75	33,59	0,4	-3,0
Rogers Inter. Comm. Index (RICI)	121,89	117,02	114,52	-6,0	-1,1

Source: Own calculation based on Bloomberg (2013).

As expected the volatility DZ BC ex Agrar and CoCo ex Agricultural seem to be higher than the volatility of whole commodity market indexes. This shows also following graph (graph 4) which compares the historical progress of all discussed indexes.

Graph 7: Performance of analyzed indexes



Source: Own calculation based on Bloomberg (2013).

The most volatile seem to show CoCo ex Agriculture, the less volatility shows CRB Index. All of the indexes perform in the same direction; they vary only in the power. As we can see the figure shows high volatility by all analyzed indexes; within one and half year the indexes moved up and down by about 10%. These movements can bring investors interesting investing possibilities by choosing the right strategy and structured product.

According to the graph ex-agricultural indexes seem to be more volatile that indexes in the previous part. This needn´t be necessary caused by exclusion of the agricultural commodities. As mentioned before DZ Best Commodities ex Agrar ER and CoCO ex Agriculture are constructed only with few commodities, which seem to me as a more probable reason for the high volatility. While RICI is calculated with 37 commodities, S&P GSCI with 23 and TRJ-CRB with 19 commodities, CoCO ex Agriculture is calculated by only 12 commodities and DZ Best Commodities ex Agrar ER even only with 6 commodities.

5. Conclusion and discussion

Indexes tend to be more important from day to day. In the growing market they enable investors to see the market movements. However, as discussed in the paper, not all indexes are really good indicators, an index should meet many requirements/tasks to be representative and indicative for a market. Good index represents a wide enough market, its construction is clear and the index is easy to calculate. If the index will be accepted by the market, depends on its transparence and continuity. Before using an index as underlying or benchmark it is necessary to see the structure of that index. All indexes are constructed for some reasons; it is not possible to say which index is the best or the worst; there are just some better indexes for given purpose. Each index represents different part of the commodity market. Our study shows that all studied indexes move nearly in the same direction, but they differ in the power of that movement. The most volatility show the indexes that exclude agricultural commodities, however this needn´t be caused by exclusion of agricultural commodities. More complex and thus more representative for the market are TRJ-CRB, S&P GSCI and RICI. These indexes can be seen as an interesting alternative for investment, especially as diversification for other kinds of assets for example shares.

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Bank Management and Financial Literacy

Martin Svoboda, Jan Krajíček, Bohuslava Doláková[1]

Abstract

The paper focuses on the analysis of the relationship between the financial literacy and the risk management in banks. To increase the financial literacy is the interest not only for government organizations, notably the Ministry of Finance and the Ministry of Labor and Social Affairs, but also for banks. Increasing of the financial literacy will be reflected in improving of the portfolio on the one hand and on the other hand there can be expected lower profit.

Key words

Financial Literacy, Management, Bank, Profit, Risk.

JEL Classification: G23, G21, I21, I22

1. Introduction

Question of the financial literacy in general becomes very frequent, both in commerce, media, as well as the academic field. Academics and government workers want financial literacy measure and analyze general population it wants to increase and traders of which want to make a profit.

The government sector works on detection the real level of financial literacy of the population of the Czech Republic. There weres several series of projects that mapped the area, such as exclusive research of the Ministry of Finance and the Czech National Bank, which was done in 2010, and the results of government are based on the creation of his other projects. These projects are created in collaboration with commercial entities such as Citibank and Citi Foundation - which works with the Ministry of Finance in the new project "Increasing Financial Literacy of Socially Weak Citizens of the Czech Republic“, focused on those most in need of financial education. Similar character of help have the projects specialized on children's homes (2010).

European Union puts strong emphasis on financial literacy. EU financially supports a large number of projects, especially projects of the European Social Fund or European Commission.

Commercial entities also seek the way to increase the financial literacy of the population. There are various courses which are free of charge and open to the public, but there can also be some hidden advertisement for specific financial products.

On the other hand, there are banks that take many risks in their business activities. The environment in which they operate is characterized by uncertainty. The main and most

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significant risk in the banking business is a credit risk. Generally, credit risk is the risk of loss of the bank if the other side fails to meet its obligations.

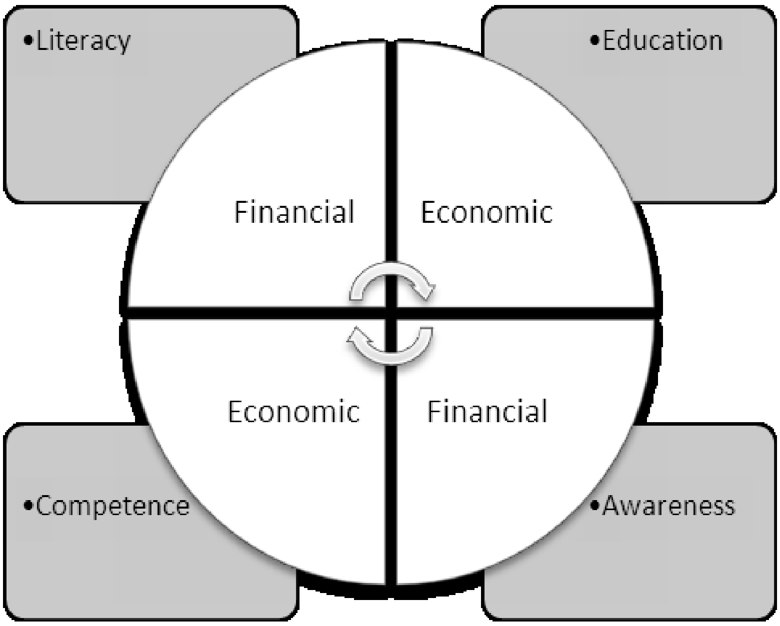
The aim of this paper is to analyze the impact of financial literacy on the banks.

2. Goal of the Financial Literacy

2.1 Financial Literacy

Financial Literacy (FG) is defined inconsistently, often, the individual subjects that are concerned with, they have different definitions. Also across the Anglo-American world is no uniform approach to the FL, the United States used the term "financial literacy," i.e. financial literacy (2009), while in the UK are more likely to encounter the phrase "financial capability", or rather financial competence (2005). Both terms are translated into Czech the same way, but their meaning is slightly different, the financial competence of financial literacy are closely linked, but cannot be used as interchangeable terms. Financial literacy refers in particular to the knowledge, financial skills refers rather to the ability of adequately usage of these acquired skills and knowledge. The concepts (including the previously mentioned financial literacy and competence) are interconnected, as it is evident in the Figure 1.

Figure 1: Interpenetration of the concepts related with Financial Literacy (2013)

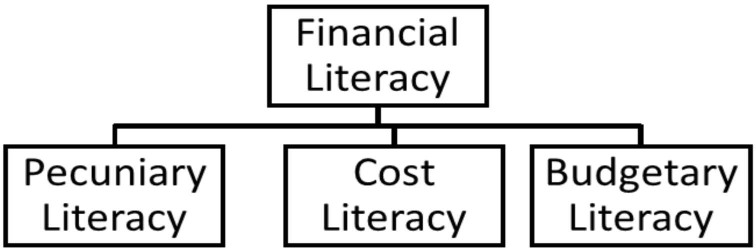


Issues of the financial education and financial literacy in the Czech Republic are in the framework of consumer protection in the financial market. The Ministry of Finance began to deal with these issues and defined financial literacy in the "National Strategy for Financial Education" (2007, updated 2010), which became the central document for financial education in the Czech Republic. *"Financial literacy is a set of knowledge, skills and abilities that are necessary for the citizen to financially secure him/herself and his/her family in contemporary society and can be active in the market of financial products and services. Citizen financially literate in the issue of money and prices is able to responsibly manage personal and family budget, including the management of financial assets and financial liabilities with respect to the changing situation." (2010)*

As the main motto financial literacy Ministry states: *"Citizens are not financial experts, but they should be able to consider what is offered to them - the final solution is their responsibility."*

Financial Literacy Ministry structured into three components:
- Financial literacy,
- Cost literacy,
- Budgetary literacy.

Figure 2: The basic scheme of Financial Literacy (2013)

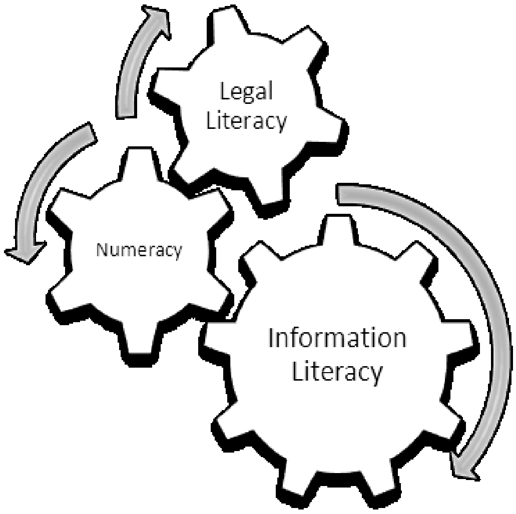


Where:
- *Pecuniary literacy skills are required to manage cash and non-cash money and transactions with them as well as management tools for this purpose (e.g. current account, payment instruments, etc.).*
- *Cost literacy skills are essential for understanding of the price mechanisms and inflation.*
- *Budget literacy skills are required to manage personal / family budget (e.g., the ability to manage a budget, set financial goals and make decisions about the allocation of financial resources), and includes the ability to manage different situations in life from a financial point of view. Budget literacy includes not only the above-described general components also two specialized components: the management of financial assets (e.g. deposits, investments and insurance) and the management of financial liabilities (such as credits or leases).*

An integral part of the financial literacy is the macroeconomic policy, i.e. focusing on the fundamental relationships between different sectors of the economy along with understanding of the basic macroeconomic indicators (such as inflation, GDP and interest rates). Necessary are also a basic awareness of the tax system and the role of taxation in society, so the basic knowledge in the field of taxation.

The financial literacy is associated with the numeracy, which is the ability to obtain, use and interpret mathematical information and ideas in order to cope actively with the mathematical demands that the life of an adult present. It is the ability to handle numerical financial operations in the context of real life and work with numbers, graphs, tables, etc. Very important is also the information literacy - the ability to look, understand, use and evaluate relevant information in the context. Also important is the legal literacy - the orientation in the legal system knowledge of rights, obligations and opportunities. Complementarity of the three additional literacies is illustrated in the Figure 3.

Figure 3: Continuity of additional literacy (2013)



2.2 Manifestations of Financial Literacy

Modernization Theory (authors Blau, Duncan) argues that with advancing industrialization there is a declining influence of social origin on education. The main causes of this state are increasing educational opportunities and changes in principle of the allocation of education. Great attention sparked the "Theory of the Bell Curve", authored by Murray and Hernstein. It lies in the fact that intelligence is not distributed evenly in the population and those ones who have more intelligence, become elites and stay in this position. (1994)

The Theory of Cultural Capital, designed by Pierre Bourdieu, argues that children from higher status groups have over others access to specific "cultural capital", which denotes familiarity and orientation in the dominant cultural codes and practices (such as a way of speaking, aesthetic preferences, modes of social interaction)(1998). This capital is positively sanctioned by majority of social institutions for the selection of individuals (school, employment system). In childhood, during early socialization, acquired cultural capital is a permanent advantage, which cannot be gain by those who did not keep it at the beginning of their educational careers. Children, who enter the educational process with cultural capital, are able to gain another one much faster and easier and there is created barrier between children from different social backgrounds. Early cultural socialization is thus the result of the accumulation of cultural capital. It thus contributes to intergenerational continuity status (reproduces it) legitimizes power and also gives it the appearance of meritocracy. These input differences are not really eliminated, but they are even more increased.

Similar recourse is in The *Theory of Educational Reproduction*, which assumes that educational inequalities remain stable over time, reproduced from generation to generation.(2011) A more radical approach to this theory, the term "maximally maintained inequality" (authors Raftery and Hout) working with the thesis that the privileged ones have the potential, through which they retain access to tertiary education. Only in the case of saturation of demand of these groups there are given opportunities for the groups with lower status. His analysis confirmed that the expansion of educational opportunities gives a better chance of learning for disadvantaged social groups.

Latest attempt to explain existing class inequalities of opportunity to achieve higher education is a *Theory of Rational Behavior* (authors Breen and Goldthorpe). It is based on "the concept of rationality" - social actors have goals and alternative means to achieve them. A selection from them is determined by the costs, risks and benefits of various options. The theory distinguishes between "primary" factors (skills, school performance) and "secondary" effects (operating phase branching education system). With the higher levels of education weakens the effect of the primary factors (performance selectivity decreases with each other transitions). Differences between classes to achieve increasingly ambitious goals remain.

3. Management of Bank Risk

The banking business has been and will remain an integral part of the overall business environment. This kind of business activity significantly affects the allocation of capital. For the banking business, in comparison to other business activities it is characteristic that the foundation of this business is the management of the property, which is owned by the bank. The banking business is able to significantly influence both business and the public sector. Core business of banks is accepting deposits and lending. Originally, the profits of banks consist mainly of those operations. At present, however, resources of the bank profits are much wider. The main sources are currently fees for bank transactions. The great advantage of banks is that the current payment system in a developed market economy is mostly noncash, conducting of charged bank transactions (2005).

Banks operate with funds received as primary deposits, and these resources are assigned to banks only temporarily. For this reason it is very important for the banks, when creating its assets (in this case, in particular credit, even if the bank debts may have originated from the guarantees, etc.) act the way that the quality of these assets is the greatest. The peculiarity of the banking business generated social demand for the control of risks associated with the asset quality of banks. This regulation is done by the special subjects, mostly by the central banks of each country. One can certainly argue that for common business subject is equally important that its receivables will be paid or not. From the point of view of any business entity without distinction it is obvious that the quality of receivables is important to the company's ability to continue to operate and develop the business. Non-bank entrepreneurs are willingly in business with a certain degree of risk. Therefore, if they enter into business relations, these relations must also calculate with the risk that counterparty fails to meet its obligations and the quality of the resulting contract will not be as the quality that was expected. On the other hand, the majority of bank customers entrusted their funds to banks rather than as part of their business activities, but mostly as a decision about the safe storage of excess funds. Sure, I can already hear the objections that anyone who decides to impose their available funds to the bank must base take into account also the business risk, because the funds are placed in a bank depositor according to the yield from the bank for temporary provision of free funds available offers. There are proceedings created for the safe operation of the bank sector and particularly for the regulation of the bad loans. These proceedings are significant to one side for the average client, who reduces the risk of loss of funds provided by the bank, and on the other hand, they have a direct impact on the management of the bank mainly due to the creation adjustments and provisions for receivables. In this regard, the bank is inconvenienced compared to conventional businesses, where making adjustments to receivables is not the subject to such strict regulations and thus directly affect the financial results of the subject, which does not mean that these bad debts do not cause problems, especially in the area of Cash Flow.

4. Inclusion Financial Literacy in Bank Risk

The goal must be to apprize the public with the mechanism of the bank management, especially their risks. However, it is imperative to realize that the loans do not provide only banks but also non-bank institutions (leasing and various non-banking companies providing loans - Home Credit, Cetelem, Provident Financial, etc.) and credit practices are very general and in particular individuals and even corporation loan, so their financial literacy to enable them proper access to loans is simply necessary.(2004)

The basis is the lending process, which can be decomposed into several successive operations:

- initial communication with the client and applying for a loan,
- interview with the client and collecting information from different areas,
- evaluation of the client and the credit application (credit analysis),
- determine the detailed conditions of the loan proposal,
- approval and signature of the loan agreement,
- drawing on the loan,
- tracking and monitoring of credit,
- the adoption of certain measures in case that the situation changed or problems were originated.

Loan process officially begins applying for a loan, which must precede the analysis of the client (regardless of whether they are natural or legal persons):

- need a loan,
- what is necessary loan amount,
- I am able to pay it off,
- what can I offer to the bank as collateral as it may require,
- what will follow if they cannot repay the loan.

The loan process will discuss the client with the bank's expectations and requirements of the loan, especially its amount, an idea of the amount of payment or the time of repayment, the purpose of the loan, the currency of the loan, etc.

For individuals there are especially basic personal information and other data about the household and employers.

For legal persons there is relevant information such as information about the company, the key persons in the company, etc. They are also required basic financial statements for the past several years. Bank checks and searches provided additional information from other sources. These sources can be internet, credit registers and other client information[2], credit ratings, previous experience with client banks themselves, or information from the media and from third parties.

After obtaining the necessary data and information the bank employee assesses the situation and determines the client's level of credibility and client´s creditworthiness. This assessment is based on the bank assembled evaluation models containing both quantitative and qualitative criteria, which are the assessment of the employee. The output of the model is in most cases creditworthiness, determining the probability of default during the term of the contract. In addition, a bank employee assesses the application for a loan from the bank's viewpoint, its policies, and its credit limits, etc. The assessment may also contribute more bank employees that have a function to verify the accuracy of evaluation and assess of the client as objectively as possible. If the result is negative assessment, employee of the bank rejects the loan application. In the case of a negative result due to the credit application bank

[2] In particular, it is a business record, criminal record, bank and non-bank register client information CBCB - Czech Banking Credit Bureau (information about individuals citizens) LLCB - Leasing and Loan Credit Bureau), the Central Credit Register (data on legal persons and natural persons entrepreneur), etc.

employee may propose a change to the client credit application and start the whole process again.

If the process of client assessment is positive, the results of the credit proposal, subject to approval, which sets out all the necessary conditions:

- Information on the contracting parties,
- the type of loan product,
- the amount of the loan,
- price terms (interest and other charges),
- the method of disbursement.
- security and insurance,
- monitoring of credit,
- the amount and timing of payments,
- the procedure for the recovery of claims for the client in the event of default.

5. Conclusion and discussion

Financial literacy is the sum of pecuniary, cost and budget literacies. Their knowledge is reflected in the general public's knowledge and subsequently into an approach of the institutions providing loans and borrowings. Increasing financial literacy has the impact on the business of the institutions that provide them. With increasing financial literacy there can be expected the impact on the credit demands.

Reduction of applications for loans due to higher financial literacy of applicants will be reflected in the banks' balance sheets in two ways. On the one hand, there will be the decline in total loans and associated decrease in total assets and profits. On the other hand, there will be a decrease in provisions and write-off of bad debts and the associated increase in profit.

As a final result of the increase of the financial literacy, it can be expected the increase of the profit for banks - it is also one of the reasons that led the banks to focus on increasing of the financial literacy.

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The impact of financing on the prosperity and competitiveness of agricultural holdings in the Slovak Republic

Ľuboslav Szabo, Miroslav Grznár, Nadežda Jankelová [1]

Abstract

Article is dedicated to the financing of agriculture and agricultural enterprises in the context of the financing of the agricultural sector in the EU. Assessing the impact of support mechanisms in the EU countries on the performance of agriculture and agricultural enterprises. Analyzing the financial position of enterprises in the production conditions of the Slovak republic, and examines the impact of equipment assets, fixed assets and activity of the financial management on the competitiveness and prosperity of the business.

Key words

Finance of agriculture, financial management, property, asset, profit and loss enterprise

JEL Classification: Q 12, Q 15, Q 17

1. Úvod

V každom výrobnom odvetví sa výsledky podnikov medziročne značne odlišujú. Niekoľko podnikov je lídrami odvetvia čo sa prejavuje výškou ich výkonov, nízkymi nákladmi a dosahovaným výsledkom hospodárenia. Ďalšie podniky sa umiestňujú v pozícii odvetvového priemeru a niektoré na konci rebríčka z pozícii výkonov a efektívnosti hospodárenia. Príčinou značnej diferencovanosti výsledkov hospodárenia podnikov sú najčastejšie vplyvy podnikateľského prostredia, ktorým sa nie každý podnik dokáže dostatočne prispôsobiť, ďalej kompetentnosť manažérov, záujmy majiteľov o prosperitu a rozvoj podniku, schopnosť podniku využiť poznatky vedecko-technického rozvoja, pôsobiace konkurenčné sily v odvetví a ďalšie.

Takýto obraz nachádzame aj v odvetví poľnohospodárstva, kde sa pod prosperitu podnikov okrem uvedeného podpisuje neraz aj riziko podnikania, najmä vývoj prírodno-klimatických podmienok a volatilita cenového vývoja, ale aj vplyv financií a kompetentnosť finančného manažmentu.

V súčasnom turbulentnom trhovom prostredí, musia aj agrárne podniky flexibilne reagovať na signály trhu a udržovať si ekonomickú rovnováhu, pričom hrá významnú úlohu finančný manažment. V odvetví však popri štandardných faktoroch trhu hrá významnú úlohu regulácia spoločnou poľnohospodárskou politikou EÚ (SPP) a usmerňujúcich nástrojov odvetvového riadenia, v SR je ním Ministerstvo pôdohospodárstva a rozvoja vidieka.

Finančný manažment poľnohospodárskych podnikov musí nielen ex post vyhodnocovať ako podnik dopadol v minulom období, ale konať aj ex ante, teda pripravovať finančnú stratégiu pre budúcnosť a zabezpečiť nielen financovanie rozvojových potrieb, ale i bežné

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financovanie prevádzky. Môže si pritom pomôcť niektorými podpornými nástrojmi zo zdrojov EÚ i zdrojov domácich, ktoré iné odvetvia nepoznajú.

Silná podmienenosť poľnohospodárskej výroby prírodným podmienkam vnáša do hospodárenia typické črty rizika a neistoty, ktorých dopady sa prejavujú medziročným kolísaním produkcie, cenovými pohybmi a nezriedka i záporným hospodárskym výsledkom, ktorý možno často pokryť iba externými podporami a rezervami. K tomu treba pridať aj všeobecne nízku výnosnosť kapitálu alokovaného do poľnohospodárstva.

Cieľom nášho príspevku je analyzovať finančné nástroje regulovania poľnohospodárstva v SR a ich vplyv na konkurenčnú schopnosť slovenského poľnohospodárstva a finančné pozície slovenských agrárnych podnikov v súčasnosti v kontexte krajín EÚ. Príspevok je čiastkovým výstupom riešenia projektu VEGA č. 1/0026/12 „Stratégia rozvoja agropotravinárstva a konkurenčná schopnosť poľnohospodárskych podnikov".

1.1 Konceptuálny rámec

Financovanie poľnohospodárstva je kľúčovým problémom rozpočtového programovania v EÚ, keďže výdaje do poľnohospodárstva predstavujú až 40 % celkového rozpočtu únie. V súčasnosti končí programovacie obdobie na roky 2007-2013 a pripravujú sa rozpočty na roky 2014-2020. Ich súčasťou sú aj zmeny vo financovaní poľnohospodárstva, ktoré sú v súčasnosti diskutované v orgánoch únie i v členských štátoch.

Do tejto diskusie vstupuje aj akademická sféra. Napríklad Dos Santos, M. (2010) a i., analyzujú postoje portugalských farmárov k Spoločnej poľnohospodárskej politike EÚ, Střeleček, F. a i. (2009), porovnávajú dotácie v ČR a vybraných krajinách EÚ. Disparity dotácii v EÚ hodnotíme aj v našom príspevku (Grznár, M. a i., 2009). Koráb, B. a i. (2008)a Kráľovič (2010) zvýrazňujú význam finančného plánu pre prosperitu podniku. El Beni et al. (2012) sa venujú skúmaniu reforiem v agrárnej politike v období rokov 1990 – 2009 a ich dopadu na dôchodky fariem a ich diferenciáciu vo Švajčiarsku. Hodnotia ako prechod od podpory cien na priame platby sa odrazil v dôchodkoch fariem a ich rozdelení. Štolbová, M.-Míčová, M. (2012) analyzujú ekonomiku veľkých a malých fariem v podmienkach LFA v ČR, keď podpory sú rozdeľované len podľa výmery pôdy a neprizerajú na veľkosť podniku. Prichádzajú k záveru, že by bolo vhodnejšie znížiť platby LFA vo vzťahu k veľkosti fariem.

Financovaniu poľnohospodárskych a potravinárskych podnikov sa venujú ďalej Vukoje, V. a Dobrenov, I. (2011) v Srbsku, rozvojové finančné zdroje v čínskom poľnohospodárstve posudzuje Lin He a i. (2011) a ďalší. Finančným analýzam v slovenskom poľnohospodárstve sa systematicky venujú výskumníci z VÚEPP v Bratislave (Uhrinčaťová, E., 2011).

1.2 Metodický postup

Analýzu zakladáme na báze dostupných sekundárnych i primárnych štatistických údajov o slovenskom i európskom poľnohospodárstve. Pre medzinárodné komparácie využívame údajovú základňu EÚ FADN EÚ (Farm Accountancy Data Network EU) za rok 2008.

Pre identifikáciu súčasnej ekonomickej situácie slovenských poľnohospodárskych podnikoch využívame ako primárne údaje databázu MPRV SR založenú na Informačných listoch za roky 2010 - 2011, prevádzkovanú VÚEPP v Bratislave, ktorá obsahuje údaje za viac ako 1 400 poľnohospodárskych podnikov v SR typu právnických osôb.

Pri analýzach využívame štandardné metódy výskumnej práce ako sú analýza a syntéza, komparácie, triedenie súborov podnikov, deskriptívna štatistika a grafické znázorňovanie.

2. Vlastná práca

2.1 Odvetvové finančné ukazovatele v poľnohospodárstve SR a EÚ

Financovanie poľnohospodárstva a potravinárstva sa v žiadnej krajine neobíde bez zdrojov zo štátneho rozpočtu. Pri jeho tvorbe sú vždy požiadavky odvetvových riadiacich orgánov vyššie ako prístupné zdroje, čo sa prirodzene odráža aj na tempách rozvoja odvetvia. Jednotlivé krajiny venujú svojmu poľnohospodárstvu rozdielne čiastky, čo prispieva k diferencovanej výkonnosti a efektívnosti odvetvia výroby potravín v rozdielnych krajinách.

Slovensko po vstupe do EÚ prijalo Spoločnú poľnohospodársku politiku (SPP), ktorá realizuje značné transfery finančných prostriedkov medzi krajinami spoločenstva. Vzhľadom na nižšiu úroveň svojho ekonomického rozvoja patrí SR ku krajinám, kde príjem prostriedkov z EÚ je väčší ako príspevok krajiny do rozpočtu spoločenstva. Značná časť tohto finančného transferu smeruje do poľnohospodárstva a je významným zdrojom k vytváraniu jeho ekonomickej i finančnej rovnováhy.

Financovanie slovenského poľnohospodárstva v súčasnosti teda zabezpečujú dva hlavné zdroje, štátny rozpočet SR a zdroje z fondov EÚ. K ďalším zdrojom možno prirátať priame zahraničné investície a ďalšie súkromné investície, ktoré vstupujú do poľnohospodárskych a potravinárskych podnikov.

V tab. 1 uvádzame pohľad na celkové výdavky do poľnohospodárstva v poslednom období. Z údajov možno pozorovať stagnáciu vo výške príjmov poľnohospodárskeho sektora a skutočnosť, že najväčší dôraz nástrojov finančnej politiky smeroval do programu rozvoja vidieka a nie na podporu rastu výkonnosti odvetvia, ktoré stagnuje už po viac rokov. Prostriedky na rozvoj vidieka sa v súčasnom programovacom období EÚ podieľajú na celkových výdavkov až 50,7 %. Súvisí to s politikou rozvoja vidieka, ktorú EÚ dlhodobo podporuje a má zabezpečiť zachovanie osídlenia na vidieku, rozvoj tradičných výrobných činností a diverzifikovaného podnikania.

Tab. 1 Transfer financií do slovenského poľnohospodárstva v mil. €

Ukazovateľ	2009			2010		
	EÚ	SR	Spolu	EÚ	SR	Spolu
Trhovo orientované výdavky	37,6	2,2	39,8	10,9	2,7	13,6
Priame platby	270,0	137,1	364,1	243,7	93,9	337,6
Rozvoj vidieka	331,8	101,6	433,5	369,3	113,8	483,1
Štátna pomoc a ostatné výdaje	-	108,8	108,8	-	117,5	117,5
Spolu	596,4	325,5	946,8	623,9	326,9	950,8

Prameň: Správa o poľnohospodárstva a potravinárstve SR, MPRV SR, 2011, upravené

Druhý najväčší objem predstavujú priame platby, ktoré slúžia k stabilizácii dôchodkov producentov a majú vplyv aj na rast výkonnosti poľnohospodárstva. Trhovo orientované výdaje klesajú, čo súvisí s posilňovaním signálov trhu pre orientáciu výrobcov. Štátna pomoc je financovaná len zdrojmi rozpočtovými a rieši skôr krízové situácie.

Pre porovnanie SR s niektorými vybranými krajinami EÚ o výške poskytovaných transferov do poľnohospodárstve uvádzame v tab. 2 údaje za rok 2010 z prameňov EÚ.

Tab. 2 Výdaje vybraných krajín EÚ do poľnohospodárstva v roku 2010 v mil. €

Ukazovateľ	DE	FR	BE	UK	SK	CZ	HU	PL
Trhové výdaje	251,9	829,8	103,3	76,1	28,4	45,2	137,3	211,6
Priama pomoc	5 446,1	8 087,4	576,0	3 306,8	245,8	563,4	817,4	1 847,1
Výdaje celkom	5 725,0	8 926,5	683,4	3 398,2	277,6	608,6	965,2	2 066,3

Prameň: Správa z EK pre EP a Radu – podľa Správy o poľnohospodárstve a potravinárstve SR, 2011

Tabuľka obsahuje len absolútne údaje, ktoré nie je možné celkom porovnávať, ale hovorí o pomerne rozsiahlych finančných transferoch v jednotlivých uvádzaných krajinách do poľnohospodárstva. Nové členské krajiny V 4, až na Poľsko, disponujú v porovnaní s vyspelými krajinami únie značne obmedzenými zdrojmi pre svoje poľnohospodárstvo.

Eurostat v roku 2011 publikoval porovnanie hodnoty produkcie a podpory na 1 hektár využívanej poľnohospodárskej pôdy za štáty EÚ 27. V ďalšej tabuľke sme vybrali niektoré pôvodné vyspelé krajiny a krajiny V 4 a porovnávame rozdiely v týchto ukazovateľoch. Údaje vyjadrujú priemer príslušných ukazovateľov za obdobie 2008-2009.

Tab. 3 Produkcia a podpora v EÚ v €·ha-1

Krajina	Produkcia	Podpora	Produkcia /podpora
EU 27	1 873	297	6,31
EU 15	2 227	353	6,31
Španielsko	1 624	304	5,35
Nemecko	2 513	388	6,48
Francúzsko	2 136	333	6,41
Rakúsko	1 929	528	3,65
Maďarsko	1 017	201	5,06
Poľsko	1 117	200	5,59
Slovensko	963	264	3,65
Česko	1 042	346	3,01

Prameň: Eurostat, Agricultural statistics, 2011,vlastná úprava

Pôvodné vyspelé krajiny únie i krajiny EÚ 15 výškou hodnoty svojej produkcie na jednotku plochy výrazne prevyšujú krajiny V 4. Podobne je to však aj výškou získanej podpory, vari s výnimkou Českej republiky.

V tabuľke vyčíslujeme aj vzťah produkcie ku podpore, ktorý vyjadruje hodnotu produkcie, ktorá pripadá na 1€ podpory. Efektívnejšie využívajú získané podpory pôvodné krajiny únie. Nové krajiny zhodnocujú získané podporné prostriedky horšie. Jednou z príčin môže byť skutočnosť, že v týchto krajinách sú poskytnuté podpory marginálne a preto neumožňujú dosiahnuť intenzitu výroby vyspelých krajín či ich priemeru.

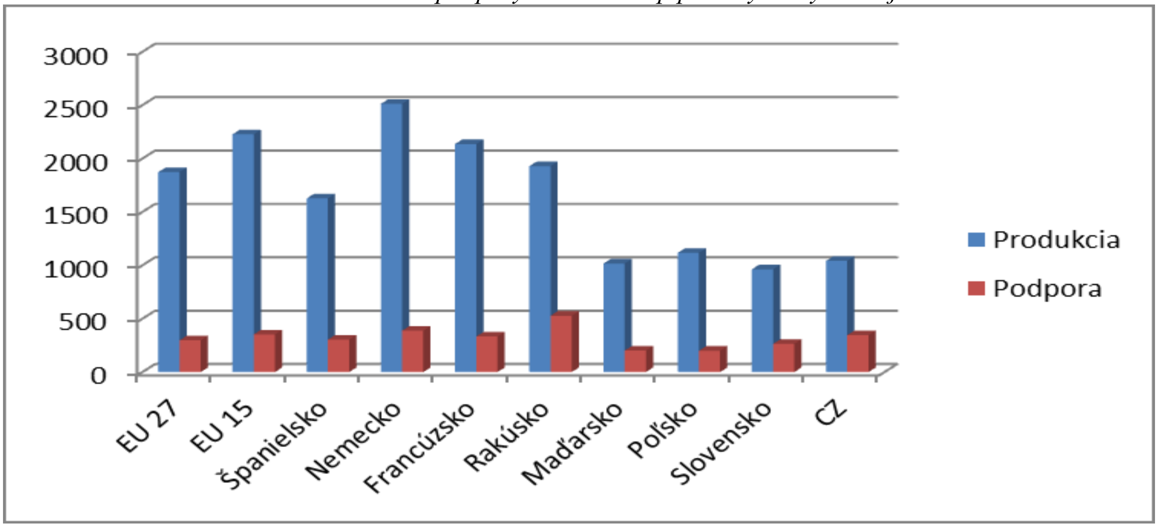
V obrázku 1 ilustrujeme vzťah medzi intenzitou výroby a poskytnutými podporami aj graficky.

Okrem podporných prostriedkov a štátnej pomoci k zdrojom financovania poľnohospodárstva ako odvetvia patria aj priame zahraničné investície. Ich vstup do poľnohospodárstva nie je u nás príliš výrazný. V roku 2010 predstavovalo obstaranie investícii financované zo zahraničných zdrojov čiastku asi 3 860 tis. € a smerovali najmä do nákupu strojov a zariadení a obnovy budov.

Komparácie finančných pozícii slovenských poľnohospodárskych podnikov v EÚ vykonáme s využitím údajovej základne, ktorú publikoval FADN EÚ (Farm Accountancy Data Network EU) za rok 2008. Z databázy vyberáme ukazovatele, ktoré na jednej strane vyjadrujú výšku vybraných finančných ukazovateľov na jednotku plochy priemerného podniku každej krajiny a na druhej strane aj ukazovatele výkonnosti podnikateľských subjektov. Pre porovnávanie sme vybrali krajiny V 4 a niektoré poľnohospodársky vyspelé krajiny EÚ.

V záujme lepšej porovnateľnosti prepočítame používané ukazovatele na 1 ha p. p. priemerného podniku v jednotlivých krajinách. Výsledky uvádza tab. 4.

Obr. 1 Produkcia a podpory v € na 1 ha p.p. vo vybraných krajinách EÚ



Prameň: Tab. 3, vlastná úprava

Tab. 4 Finančné ukazovatele agrárnych podnikov vybraných krajín EÚ v €·ha^{-1}

Ukazovateľ	DE	FR	UK	SK	CZ	PL	HU	EU-27
Výmera ha	82,6	77,8	160,0	579,3	227,8	18,3	54,3	29,8
CHP na ha	3 757	1 910	1 428	922	1 326	1 553	1 514	1 942
Aktíva na ha	9 276	4 733	7 925	1 378	945	5 376	3 090	8 254
Vlastný kapitál	10 102	3 930	2 020	1 280	219	4 406	2 439	3 586
Obežné aktíva	3 489	1 849	963	650	810	934	1 215	1 552
Stále aktíva	7 671	4 733	6 962	728	864	4 442	3 090	6 735
Záväzky	1 679	1 728	836	237	751	565	921	1 114
Krátk. záväz.	1 046	631	415	117	298	173	483	290
Podpory	407	360	275	257	284	279	268	326
Podpory inv.	2	15	5	24	2	12	14	14

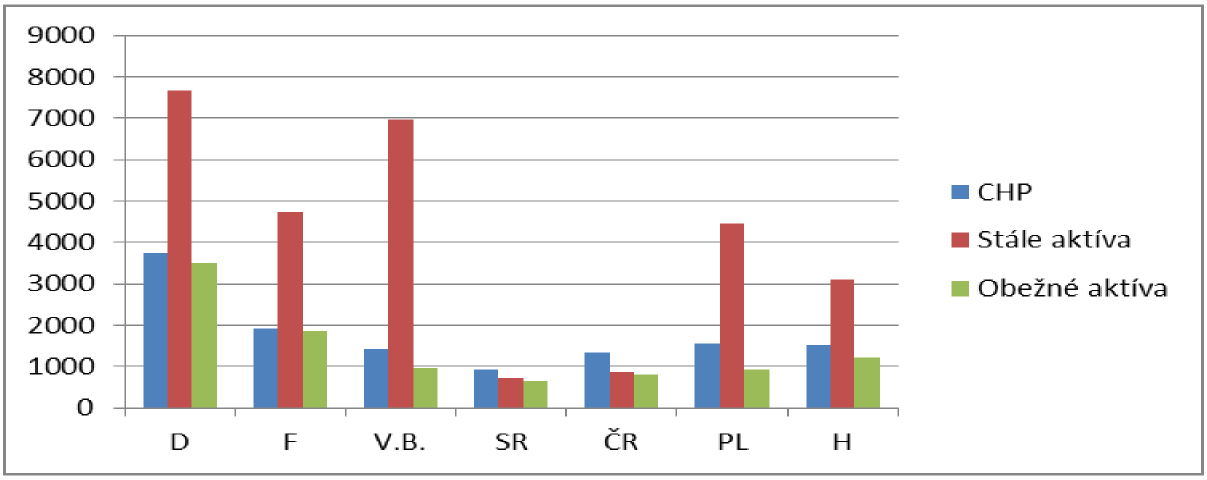
Prameň: Štandardné výsledky ISPU 2008 v členských krajinách EÚ – 27. In: Ekonomika poľnohospodárstva, XI., 2011, č. 2, s. 61-63, vlastné spracovanie. (CHP – celková hrubá produkcia)

Z porovnania finančných ukazovateľov agrárnych podnikov v tab. 4 vyplýva, že podniky vo vyspelých krajinách EÚ disponujú nepomerne vyššími aktívami, veľkosťou vlastného kapitálu i stálych aktív na jednotku plochy ako krajiny V 4 s výnimkou Poľska. Podobne je to aj u obežných aktív a bežných podpôr.

O niečo menšie rozdiely sú vo výške záväzkov a krátkodobých záväzkov, ktoré zjavne korelujú s výškou celkovej hrubej produkcie (CHP). Nové krajiny únie sú úspešnejšie len v získaní o niečo vyšších investičných podpôr, ktorých získanie je spojené s predložením príslušných projektov.

Dispozícia finančných zdrojov nepochybne priaznivo ovplyvňuje výkonnosť podnikov, ak ju meriame výškou celkovej hrubej produkcie, ako naznačuje aj obrázok. 2.

Obr. 2 Produkcia a finančné zdroje vo vybraných krajinách EÚ, 2008, v €·ha^{-1}



Prameň: Tab. 5, vlastná úprava

Poľsko a Maďarsko sa svojim kapitálovým vybavením približujú Veľkej Británii, zatiaľ čo SR a ČR značne zaostávajú. Vo výkonnosti podnikov meranej celkovou hrubou produkciou je zaostávanie týchto krajín výraznejšie.

2.2 Finančné pozície poľnohospodárskych podnikov v SR

Pre identifikáciu finančnej situácie v slovenských poľnohospodárskych podnikoch v posledných rokoch využívame databázu MPRV SR založenú na Informačných listoch za roky 2010 a 2011, ktorá obsahuje údaje za viac ako 1 200 poľnohospodárskych podnikov – právnických osôb v SR. V našich analýzach sa sústredíme len na podniky hospodáriace v produkčných podmienkach SR, ktoré sú trhovo orientované a mali by usilovať o konkurenčné presadenie sa na trhu. Tieto podniky budeme triediť na dve skupiny. Prvou skupinou budú poľnohospodárske podniky prosperujúce, ktoré vykazujú pozitívny hospodársky výsledok. Druhou skupinou budú podniky, ktoré v hodnotenom období vykazovali záporný hospodársky výsledok. Nasledujúca tabuľka 5 uvádza výsledky podnikov a zodpovedajúce finančné zdroje.

V súboroch prezentovaných podnikov v uvádzaných rokoch nejde vždy o totožné podniky, napriek tomu možno vyvodiť z údajov niektoré zovšeobecnenia. Medziročne klesol počet stratových podnikov, čo je pozitívny jav. Ziskové podniky zaznamenali síce pokles výnosov, ale i pokles nákladov a zvýšili hospodársky výsledok. Zatiaľ čo u stratových podnikov sa prejavil výrazný vzostup výnosov pri neúmernom raste nákladov, čo malo za následok rast straty v prepočet na jednotku pôdy. Jedným zo zdrojov rastu nákladov u stratových podnikov môže byť väčšia investičná aktivita, keď ich hodnota DHM na 1 ha vzrástla dvojnásobne. čo nepochybne vyvolalo rast odpisov. Výraze vzrástla u stratových podnikov aj hodnota majetku i obežného majetku, zatiaľ čo u ziskových podnikov tieto hodnoty poklesli. Výška vlastného imania je v oboch súboroch podnikov vyrovnaná.

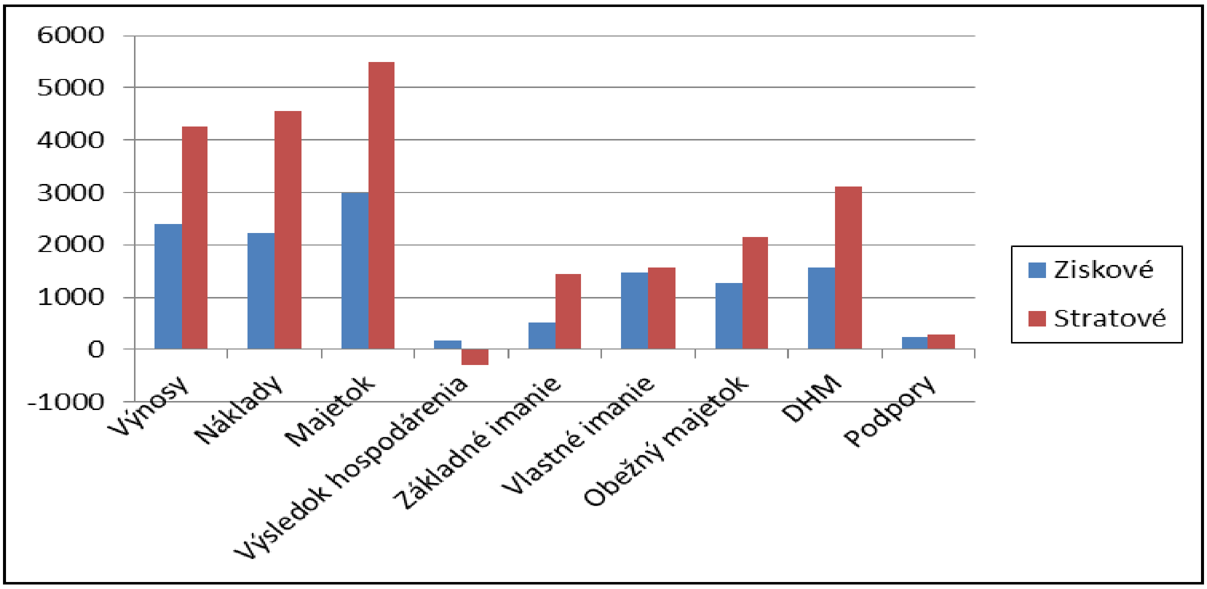
Tab. 5 Vybrané finančné zdroje a výsledky podnikov v priaznivých podmienkach v rokoch 2010-2011 v €·ha⁻¹

Ukazovateľ	Ziskové podniky		Stratové podniky	
	2010	2011	2010	2011
Počet podnikov	332	457	175	111
Výnosy	2 643	2 408	2 368	4 263
Náklady	2 528	2 220	2 623	4 566
VH	99	161	- 252	- 303
Vlastné imanie	1 631	1 461	1 370	1 557
Majetok	3 209	2 919	3 864	5 476
DHM	1 886	1 575	1 443	3 108
Obežný majetok	1 350	1 281	1 344	2 149
Bežné podpory	248	248	284	284

Prameň: CD MPRV SR, VÚEPP v Bratislave, 2010, 2011, vlastné prepočty (VH – výsledok hospodárenia, DHM – dlhodobý hmotný majetok)

Výška bežných podpôr v uvádzaných rokoch stagnovala pričom o niečo vyššie podpory získali stratové podniky. Pravda súčasný stav alokácie podporných prostriedkov neberie do úvahy prosperitu podniku. Obrázok 3 graficky ilustruje disparitu vybraných finančných ukazovateľov medzi ziskovými a stratovými podnikmi.

Obr. 3 Disparita vybraných finančných ukazovateľov podnikov v roku 2011



Prameň: Tab. 5, vlastné zobrazenie

Tab. 6 naznačuje nedostatky v oblasti vlastného finančného manažmentu, ktoré môžu byť príčinou neuspokojivých výsledkov značného počtu stratových podnikov. Uvedené ukazovatele záväzkov sú nepomerne vyššie v podnikoch stratových v porovnaní so ziskovými, pričom sa medziročne zhoršili. Stratové podniky čerpali aj viac bankových úverov. Týmto podnikom sa zrejme nedarí manažovať finančné toky podniku, čo sa potom odráža na hospodárskom výsledku. Pravda záväzky sú vyššie ako pohľadávky u všetkých podnikov v súbore.

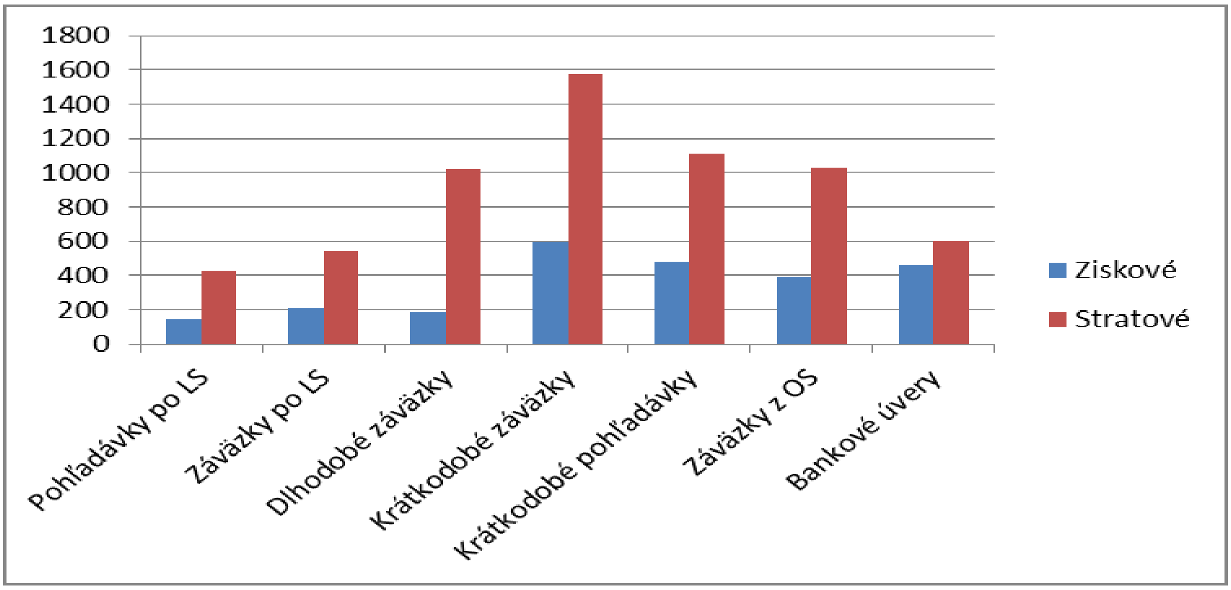
Tab. 6 Pohľadávky a záväzky podnikov v produkčných podmienkach v rokoch 2010, 2011 v €·ha^{-1}

Ukazovateľ	Ziskové podniky		Stratové podniky	
	2010	2011	2010	2011
Počet podnikov	332	457	175	111
Pohľadávky po LS	159	147	234	432
Záväzky po LS	202	210	524	594
Dlhodobé záväzky	197	189	333	1 020
Krátkodobé záväz.	654	596	988	1 575
Krátkodobé pohľ.	487	482	530	1 114
Záväzky z OS	409	390	651	1 032
Bankové úvery	413	456	767	601

Prameň: CD MPRV SR, VÚEPP v Bratislave, 2010, 2011, vlastné prepočty (OS – obchodný styk, LS – lehota splatnosti)

V obrázku 4 graficky ilustrujeme značné disparity v ukazovateľoch pohľadávok a záväzkov medzi ziskovými a stratovými podnikmi.

Obr. 4 Pohľadávky a záväzky podnikov v roku 2011



Prameň: Tab. 6, vlastné zobrazenie

3. Záver

Komparácia slovenského poľnohospodárstva a poľnohospodárskych podnikov s vyspelými krajinami EÚ naznačuje nízke kapitálové vybavenie podnikov a nižší objem podporných finančných prostriedkov alokovaných do poľnohospodárstva nás. To je hlavnou príčinou slabších konkurenčných pozícii slovenských výrobcov nielen na trhoch EÚ, ale i na trhu domácom, čomu nasvedčuje znižovanie miery sebestačnosti a rast dovozu agrárnych komodít a potravín.

Analýza vývoja hospodárskeho výsledku a finančných ukazovateľov podnikov hospodáriacich v produkčných podmienkach v rokoch 2010 a 2011 naznačila síce medziročné zníženie počtu stratových podnikov, ale napriek tomu ich zostáva temer pätina. Príčinou stratovosti nie je ani tak vybavenie podnikov finančnými zdrojmi, ktorých majú tieto viac ako podniky ziskové. ale skôr nezvládnutý finančný manažment pri ich využívaní.

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Personnel audit in financial institutions in Slovak Republic

Miroslava Szarková, Martin Andrejčák[1]

Abstract

This article discusses the ongoing external audit of human resources in financial institutions in the Slovak Republic (banks and insurance companies) This article informs about the specifics that are typical for the personnel audit in financial institutions, that subsidiaries of the multinational financial corporations engaged in the business environment of Slovak Republic, which has a surplus of labour force in financial services. It further informs about the second specific of human resource audit of subsidiaries operating in Slovakia, which is the fact the the audit is carried out by the recruitment agencies working overseas, that are able to use a wide spectrum of methods and procedures. This article was created within the VEGA 1/0053/2012 project.

Key words

External audit of human resrouces, financial institutions, multinational financial institutions, labor surplus

JEL Classification: A10, M12, M54

1. Úvod

Personálny audit v súčasnosti predstavuje súhrn jednotlivých typov auditu ľudských zdrojov a ich riadenia, ktoré disponujú metodologickými postupmi, metódami a technikami, ktoré umožňujú odhaľovať rezervy a nedostatky tak v oblasti tvorby a rozvoja ľudských zdrojov podniku z pohľadu ich súčasnej a budúcej kvality a kvantity vo vzťahu k cieľom a zámerom podniku ako aj v oblasti ich riadenia v súlade s komplexným cieľom podniku: skvalitniť procesy riadenia podniku a podporiť a zvýšiť tak jeho konkurencieschopnosť na trhu. Tento cieľ však nemožno dosiahnuť bez kvalitných zamestnancov a manažérov, ktorí tvoria intelektuálny kapitál každého podniku. Ten pozostáva z troch zložiek: ľudského kapitálu, spoločenského kapitálu a štrukturálneho kapitálu a v celosti predstavuje zásobu a toky znalostí, zručností a schopností, ktoré má konkrétny podnik v danom čase k dispozícii2 na uskutočnenie svojich podnikateľských cieľov a úloh. Zistenie úrovne intelektuálneho kapitálu podniku a jeho potenciálu z hľadiska budúcich potrieb podniku tvorí východisko stanovovania jeho podnikateľských cieľov a strategických krokov na trhu. Dôkladná analýza intelektuálneho kapitálu podniku vo všetkých troch jeho zložkách a zistenie a deskripcia existujúcich odchýlok v jeho štruktúre z hľadiska stanovených kritérií, medzi ktoré patria vek, vzdelanie, pohlavie, prax, zručnosti a osobnostný potenciál zamestnancov a manažérov

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2 KOUBEK, J.: Řízení lidských zdroju: základy moderní personalistiky. Praha: Management Press, 2007, s. 27. ISBN 978-807-2611-683.

má veľký význam hlavne pre finančné inštitúcie. Vo finančných inštitúciach sa vzhľadom na predmet činnosti, počet zamestnancov a stupňovitosť organizačnej štruktúry jednotlivé činnosti prelínajú, čo v podstate vyžaduje kvalitných zamestnancov, ktorí sú odborne vzdelaní, skúsení, zruční a schopní profesionálne flexibilne reagovať na potreby podniku, ktorý sa musí flexibilne prispôsobovať požiadavkám trhu. Z tohoto hľadiska je potrebné, aby personálny audit zameraný na hodnotenie intelektuálneho kapitálu podniku finančnej inštitúcie prebiehal pravidelne a tiež aby bol dobre pripravený a to tak v ekonomickej, metodologickej, psychologickej ako aj komunikačnej a etickej rovine. Táto požiadavka však úzko súvisí s postojom podnikových manažmentov, ktoré rozhodujú o uvoľnení finančných prostriedkov na realizáciu personálneho auditu. Preto jedným z parciálnych cieľov výskumu bolo zistiť, aké možnosti a postoje majú manažmenty finančných inštitúcii, ktoré sú dcérskymi spoločnosťami nadnárodných finančných korporácii a pôsobia v podnikateľskom prostredí Slovenskej republiky k finančným požiadavkám spojeným s realizáciou personálneho auditu, či finančné náklady spojené s realizáciou personálneho auditu netvoria základnú prekážku jeho výkonu.

Úlohou auditu riadenia ľudských zdrojov je získať informácie o fungovaní procesov riadenia ľudských zdrojov v podniku. Svojou podstatou sa zaraďuje medzi súbor kontrolných mechanizmov, ktoré monitorujú podmienky, v ktorých procesy riadenia ľudských zdrojov prebiehajú, aké náklady na seba viažu, aké investície sú do týchto procesov vkladané a aká je ich návratnosť v podobe hmotných ako aj nehmotných aktív. Predstavuje systém revízie a kontroly účinnosti a spoľahlivosti programu riadenia ľudských zdrojov. Vzhľadom na rastúci trend delegovania veľkej časti personálnej práce na každého riadiaceho zamestnanca, narastá význam a miesto auditu ľudských zdrojov v každom podniku3 a to v troch základných oblastiach: v oblasti získavania vhodných zamestnancov do podniku, v oblasti optimalizácie pracovných miest a v oblasti tvorby ľudského kapitálu podniku.

2. Špecifiká personálneho auditu vo finančných inštitúciach v SR

Vývoj na finančných trhoch, ktorý je vľmi nevyspytateľný a plný rýchlych zmien, a ktorý ovplyvňuje a ostatné trhy, núti podniky rýchlo sa prispôsobovať zmenám ako aj špecifickým požiadavkám, ktoré mnohokrát môžu podniky splniť len za predpokladu, že majú kvalitné a vysoko adaptabilné ľudské zdroje. V kvalite ľudských zdrojov , ich viacprofesnosti a schopnosti rýchlo sa učiť nové veci, tkvie adaptabilita každého podniku. Prax ukazuje, že adaptabilita podniku – schopnosť prispôsobovať sa vonkajším podmienkam trhu, súvisí tiež s jeho veľkosťou a charakter jeho vlastníckej štruktúry. Potvrdzuje sa, že čím má podnik viac zahraničnú majetkovú štruktúru, tým je menej schopný zaoberať sa vlastnou personálnou činnosťou, ktorú zväčša vykonávajú zahraničné personálne agentúry, ktoré súschopné využívať širšií diapozón metód a postup spojených z efektívnejším a kvalitnejším proces vykonania personálneho auditu. Preto jedným z cieľov výskumu bolo zistiť, kto vykonáva personálny audit vo finančných inštitúciach na Slovensku.

Vzorku tvorili finančné inštitúcie v Slovenskej Republike (banky a poisťovne s výnimkou nebankových subjektov). Bola použitá dotazníková metóda, metóda štruktúrovaného rozhovoru a postojové škály. Dotazník bol distribuovaný elektronicky. Výsledky boli vyhodnotené pomocou základných matematicko-štatistických metód.

Výsledky ukázali, že väčšina finančných inštitúcii si nevykonáva audit sama, ale vykonáva to ich materská spoločnosť outsourcingom. Na otázku, čo považujú za najdôležitejšiu

[3] CHOCHOLOUŠ, I. 2005. Audit – strašák i pomocník. In: Hospodářské noviny. ISSN 0862-9587, 2005, roč. 49, 26.9.2005.

prekážku realizácie personálneho auditu, až 73 % uviedlo finančné náklady. Zvyšných 27%, že ho vykonávať sami nemôžu, nakoľko to nie je v ich kompetenciach. uviedlo Výsledky tiež ukázali, že vo finančných inštitúciach sa personálny audit vykonával pravidelne. Manažmenty, ktorý o realizácii personálneho auditu rozhodovali, vychádzali z predstavy, že vo finančných inštitúciach je nutné zabezpečovať stabilitu vyývoja organizácie a nakoľko je v Slovenskej republike prebytok pracovnej sily v oblasti finančných služieb, rôzne nedostatky v rámci organizácie sa dajú veľmi jednoducho odstrániť.

Výsledky monitoringu okrem iného ukázali, že finančné inštitúcie v Slovenskej republike vo veľkej miere využívajú personálny audit a to nielen ako zdroj informácií o stave a riadení personálu ale aj ako nástroj riadenia podniku. Väčšina respondentov týchto inštitúcii uviedla, že v ich podniku už bol vykonaný personálny audit a tento sa aj v pravidelných intervaloch opakuje.

Dôvody, ktoré sme uviedli, boli zistené metódou pološtruktúrovaných rozhovorov s majiteľmi a manažmentmi skúmaných inštitúcii a budú ďalej predmetom hlbšej analýzy. Dosiahnuté výsledky majú informačný charakter a ilustrujú len jednu (vybranú) stránku celej problematiky.

3. Záver

Personálny audit je jedným z dôležitých zdrojom informácií, poznatkov a vedomostí o stave a kvalite zamestnancov a manažérov vo finančných inštitúciach. Informácie, ktoré ponúka, môže však využiť len schopný manažment, ktorý disponuje racionálnymi a kladnými postojmi k implementácii sofisitkovaných postupov do personálnych procesov podniku a ktorý sa nebojí investovať finančné prostriedky do skvalitňovania ľudského kapitálu podniku. Ako ukázali získané výsledky, personálny audit manažmenty finančných inštitúcii ktoré sú dcérskymi spoločnosťami nadnárodných finančných korporácii a pôsobia v podnikateľskom prostredí Slovenskej republiky vykonávajú pravidelne, chápu ho v rovine nástroja riadenia podniku a aj v rovine nástroja skvalitňovania ľudského kapitálu podniku. V rámci monitoringu bolo tiež zistené, že v väčšine finančných inštitúcii, v ktorých sa uskutočnil externý audit vykonaný zahraničnou personálnou agentúrou za nemalé finančné prostriedky, výsledky a zistenia personálneho auditu boli vôbec použité nielen na účely skvalitnenia stavu personálu ale aj na účely zefektívnenia riadenia ľudských zdrojov v podniku.

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Progressive trends in budgeting

Slavka Šagátová [1]

Abstract

Due to constantly changing market conditions, traditional approaches in financial planning and budgeting have become rigid and inefficient. On the other hand, trends including elements of constant streamlining and optimization (especially in costs management) become more and more preferred. Beyond budgeting, kaizen budgeting, balanced score card and other modern approaches opened wider perception of budgeting, which has been already considered for obsolete and ineffective by many companies. Traditional approaches, as well as newer trends have their advantages and disadvantages. Knowing the possibility of individual budgeting techniques will allow their efficient usage in the company management processes.

Key words

Traditional Budgeting, Zero based Budgeting, Rolling Budgeteng, Kaizen Budgeting, Activity Based Budgeting, Balance Scorecard Budgeting, Beyond Budgeting.

JEL Classification: M10, M40

Úvod

Turbulentné zmeny v ekonomike kladú zvýšené nároky na procesy riadenia. Problematika využívania finančného plánovania a rozpočtovania ako nástrojov riadenia je v súčasnosti konfrontovaná s rýchlym zastarávaním informácií. V mnohých podnikoch preto prevládajú názory, že tieto nástroje sú zastarané a pre moderné podnikanie nepotrebné. Kľúčovým problémov je v prípade rozpočtovania vymedzenie cieľa, ktorý by mal rozpočet napĺňať v oblasti riadenia. Je jeho hlavným poslaním, aby zamestnanci splnili cieľ stanovený na určité obdobie, alebo má byť motivačným faktorom pre kreatívnu a tvorivú prácu všetkých zainteresovaných?

1 Nevýhody tradičného rozpočtovania

Rozpočty sú chápané ako kvantitatívne vyjadrenie dosiahnutia plánovaných hodnôt, na základe ktorých je možné riadiť, koordinovať a kontrolovať jednotlivé činnosti podniku. Vzhľadom na fixnú ročnú platnosť rozpočtu vzniká otázka, či predstavuje v dobe rýchlo sa meniacich podmienok v podnikateľskom prostredí, dostatočne efektívny nástroj riadenia. Medzi najzávažnejšie negatíva vyčítané tradičnému rozpočtovaniu možno zaradiť:

- Nepružnosť – rozpočet neumožňuje flexibilne reagovať na nové udalosti. V rozpočtoch sú stanovené cieľové hodnoty rozpočtovaných veličín, ktoré v priebehu určitého časového obdobia nie je možné meniť.
- Neefektívnosť – rozpočtovanie predstavuje byrokratický systém, ktorého realizácia je prácna a časovo náročná, pri dosiahnutí málo dôveryhodných výsledkov. Dochádza tiež k nedostatočnej previazanosti jednotlivých čiastkových rozpočtov.

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- Orientácia na minulosť – rozpočty vychádzajú prevažne z údajov z minulosti, pri prepočítavaní týchto údajov na podmienky budúcnosti často dochádza k prenášaniu minulých chýb, pričom nie sú zohľadnené prípadné nové skutočnosti.
- Chýbajúca väzba na stratégiu – rozpočtovanie sa sústreďuje predovšetkým na operatívne riadenie, ucelenej podnikovej stratégii je pritom venovaná len malá pozornosť.
- Potláčanie iniciatívy a inovácií – rozpočty podporujú autoritatívny systém riadenia, nemotivujú ľudí k optimalizácii rozpočtovaných hodnôt, ale udržiavajú ich vo vymedzených intenciách.
- Zameranie na vstupy – rozpočty sú orientované spravidla na alokáciu vstupov a nie na ich príspevok k vytváraniu hodnoty.
- Podnecujú iracionálne až neetické správanie – odmeňovanie na základe stanoveného rozpočtu môže podnecovať ľudí k dosiahnutiu rozpočtovaných hodnôt za každú cenu. Pri tvorbe rozpočtu môžu byť rozpočtované parametre zámerne vyčíslené tak, aby ich dosahovanie bolo jednoduchšie.

Uvedené nedostatky sú podnetom k hľadaniu možných vylepšení tradičného systému rozpočtovania, respektíve jeho častí, ktoré by obstáli ako riadiaci nástroj v dnešnej dobe. Aj keď sa objavilo niekoľko manažérskych konceptov, ktoré ponúkajú alternatívne riešenia pre problematiku plánovania a rozpočtovania, žiadny z nich nepredstavuje univerzálne riešenie bez určitých negatív. Ponúkajú však možnosť ako vylepšiť existujúci systém v konkrétnych podmienkach. Rozhodnutie pre radikálnu zmenu existujúceho systému si však vyžaduje dokonalé poznanie možných alternatív s ich výhodami aj nevýhodami.

2 Kĺzavé rozpočtovanie (Rolling Budgeting)

Kĺzavé rozpočtovanie ponúka isté východisko zo strnulosti tradičných rozpočtov, ktoré mení rozpočet na nepretržitý cyklus, v ktorom sú prognózy neustále aktualizované a rozširované. Rozpočet tak nepredstavuje prognózu na statické, väčšinou na ročné obdobie, ale neustále aktualizovaný systém prognózovaných dát. Pôvodné časové obdobie je pri aktualizácii posunuté, pridaním údajov pre ďalší časový úsek. Rozpočtový výhľad tak nekončí na konci roka, ale neustále ponúka prehľad údajov na isté časové obdobie vopred. Za výrazné negatívum tohto systému je považovaná časová náročnosť na prípravu rozpočtov, ktorá pri neustálej snahe aktualizovať východiskové dáta a zostavovať z nich nový rozpočet zvyšuje zaťaženosť zodpovedných pracovníkov, a tým aj nákladnosť celého systému. Nevýhodou tohto systému je tiež, že napriek akejkoľvek snahe o kvalitnú prognózu môžu byť dáta o budúcnosti potrebné k rozhodovaniu v určitom okamihu zastarané.

3 Rozpočtovanie z nulového základu (Zero based Budgeting)

Ako už bolo spomenuté tradičnému systému rozpočtovania je vyčítané, že pri tvorbe rozpočtu vychádza z historických údajov. Tento postup spôsobuje prenášanie chýb a neefektívnych postupov z minulosti do budúceho rozpočtu. Rozpočtovanie od nuly (ZBB) nezohľadňuje žiadne minulé údaje a rozpočet sa zostavuje tak, ako by podnik práve vznikol. Každá rozpočtovaná hodnota je analyzovaná vzhľadom na podmienky budúceho obdobia. Tento prístup na jednej strane umožňuje podrobne analyzovať budúce činnosti podniku prehodnocovať ich väzby, prínosy a efektívnosť. Môže tiež pôsobiť motivačne pri napĺňaní cieľov, ak manažéri uplatnia pri tvorbe rozpočtu svoje nápady. Na druhej strane je však ich zostavenie veľmi náročné na východiskové údaje, ktoré by mali vychádzať z analýz trendov. Celý proces sa tak stáva časovo aj kapacitne náročným. Rozpočty sú tvorené zdola, čo umožňuje manažérom nastaviť rozpočtované hodnoty menej ambiciózne, aby ich dokázali splniť. Pri komplikovanejších rozpočtoch potom vrcholoví manažéri nedokážu rozpočet kompetentne skorigovať.

4 Kaizen rozpočtovanie (Kaizen Budgeting)

Kaizen predstavuje japonskú stratégiu neustáleho zlepšovania. V podnikovom ponímaní to znamená neustále zlepšovanie vo všetkých oblastiach fungovania podniku, ktoré sa prejaví najmä v oblasti znižovania nákladov. Pri zostavovaní rozpočtu sa preto tieto zmeny musia prejaviť v rozpočtovaných hodnotách. Kaizen rozpočtovanie možno definovať ako prístup k rozpočtovaniu, ktorý sa snaží zohľadniť náklady na zlepšenie výrobku. Jeho pozornosť sa nesústreďuje len na prognózu nákladov v existujúcich výrobných podmienkach, rozpočet zahŕňa aj náklady na plánované zmeny zamerané na zníženie skutočných nákladov v porovnaní so štandardom. Pri zostavovaní kaizen rozpočtu je preto potrebné vnímať dva aspekty:

- rozpočet bude obsahovať náklady súvisiace s procesmi zabezpečujúcimi zefektívnenie činností podniku – takzvané nové náklady,
- existujúce položky nákladov budú optimalizované s cieľom znížiť skutočné náklady na úroveň štandardných nákladov.

Kaizen vyžaduje aplikáciu kreatívnych prístupov a zbavenie sa rutinných praktík. Nové riešenia by mali viesť ku kvalitnejším procesom a lepším výstupom. Práve rozpočet môže už pri úvahách o zjednodušení úloh či odstránení nepodstatných činností ukázať konečné efekty týchto opatrení. Kaizen rozpočtovanie tak bude znamenať transformovanie nápadov do finančnej podoby. Nápady na zlepšenie, sa prostredníctvom rozpočtu stanú súčasťou finančného plánu a finančnej stratégie, ktorá bude podkladom pre riadenie v duchu zlepšovania. V rozpočte kaizen bude prognózovaná výška nákladov v súlade s výslednou výškou nákladov, ktorá by mala byť dosiahnutá po implementácii zlepšení. Nedosiahnutie týchto výsledkov sa prejaví ako prekročenie rozpočtu. Rozpočtový systém na princípe kaizen teda zabezpečí aj kontrolu dosiahnutia cieľových nákladov. Aby bola aplikácia tohto prístupu čo najefektívnejšia mal by vychádzať z týchto myšlienok (Mansour, Tanaka, 1994):

- Vrcholové vedenie má konečnú zodpovednosť za dosiahnutie zisku a za správu rozpočtu.
- Medzi nákladovými strediskami nie je nutné transferové oceňovanie, ktoré eliminuje neobjektívne vyhodnotenie výkonu.
- Ciele stanovené z hľadiska kaizen majú tendenciu motivovať zamestnancov, pretože kaizen je jednoduchý a zrozumiteľný všetkým.
- Rovnaké štandardy sú platné pre všetky procesy bez ohľadu na to čo robí jednotlivec.

Tento systém by mal motivovať zamestnancov k dosiahnutiu jednotnej a vysokej kvality v rámci celej organizácie. Kaizen sa opiera o štíhlu výrobu, ktorá vyžaduje dokonalé plánovanie a rozpočtovanie. Pri tvorbe rozpočtu je potrebné si uvedomiť, že príliš strohé alebo naopak podrobné a rozsiahle informácie môžu viesť k zlyhaniu celého systému, alebo jeho neprimeranému predraženiu. Rozpočet by mal byť zostavený tak, aby nepredstavoval plytvanie a bol vypracovaný vtedy, keď je to naozaj nutné, v rozsahu časového rámca, ktorý umožní zohľadniť všetky dopady. Dôvodom nekvalitne vypracovaného rozpočtu môže byť aj nedostatočné identifikovanie dôsledkov navrhovaných opatrení. Pri hľadaní možností zlepšenia je potrebné realizovať opatrenia nielen na identifikáciu možných vylepšení, ale aj na vymedzenie oblastí, na ktoré bude mať uvedený návrh dopad. Dôležité je, aby boli zachytené všetky náklady, ktoré budú so zavedením uvedeného opatrenia a jeho dlhodobou aplikáciou súvisieť. Pamätať treba aj na tvrdenia kritikov kaizen, ktorí poukazujú predovšetkým na rastúci stres personálu pri dosahovaní nastavenej cieľovej výkonnosti. Niektoré organizácie preto dávajú prednosť zníženiu stupňa cieľovej výkonnosti, aby predišli možným stratám spojeným s nadmerným napätím na pracovisku (napríklad zvýšená chybovosť výroby, rast práceneschopnosti zamestnancov, a pod.).

5 Rozpočtovanie podľa aktivít (Activity Based Budgetint)

Rozpočtovanie podľa aktivít (ABB) je súčasťou procesného riadenia nákladov Aktivity Based Managemet (ABM). Je základom pre vypracovanie kalkulácií podľa aktivít (ABC) a rovnako ako tieto kalkulácie, vychádza z myšlienky vzniku nákladov na konkrétne činnosti, ktoré sú spotrebovávané pri realizácii výkonov. (Tóth, 2004, s. 66 - 68) Celý proces rozpočtovania pritom pozostáva z niekoľkých krokov. (Popesko, 2009, s. 206 - 208) Počiatočným krokom je analýza stratégie a identifikovanie kritických faktorov úspechu, ktoré je potrebné merať a riadiť. V ďalšom kroku je potrebné využiť závery z analýzy hodnotového reťazca, ktorá je súčasťou celého systému Aktivity based managementu. Na základe tejto analýzy sú identifikované procesy a aktivity, ktoré budú po ďalšom preskúmaní obsiahnuté v rozpočte. Pre tieto aktivity sa v nasledujúcich krokoch identifikujú potrebné investície, ktoré ovplyvnia ich výšku, realizuje sa ich klasifikácia a stanoví sa miera ich výkonu. Pre rozpočtovanie podľa aktivít je rovnako ako pre tradičný rozpočet, potrebné vypracovať plánovaciu smernicu, ktorá obsahuje informácie o očakávanom vývoji makro- a mikroekonimických ukazovateľov potrebných pre rozpočtovanie. Medzi základné odlišnosti tohto systému od tradičného rozpočtovania patrí predpoveď pracovného zaťaženia pracovníkov, jednotlivých aktivít a procesov, ktorá umožní na základe objemu výstupov konkrétnych aktivít a analyzovať mieru ich využitia.

Rozpočtovanie podľa aktivít teda vychádza zo znalostí procesov podniku, ktoré budú v podniku realizované. Rozpočet sa zostavuje na základe plánovaných aktivít a k nim prislúchajúcim zdrojom. Takýto adresný prístup napomáha identifikovať a optimalizovať úzke miesta procesov a tiež umožňuje sumarizovať hodnotu dosahovanú jednotlivými procesmi. Za pozitívum celého systému možno tiež považovať, že rozpočet nevychádza z odhadov, ale poznatkov o vzájomných väzbách medzi procesmi, aktivitami, zdrojmi a nákladmi, čo umožňuje sprehľadnenie nákladov spoločnosti. Množstvo väzieb medzi procesmi, aktivitami, zdrojmi a nákladmi však na druhej strane zapríčiňuje komplikovanosť, nákladnosť a časovú náročnosť tvorby takéhoto rozpočtového systému.

6 Balanced Scorecard Budgeting

Balanced Scorecard predstavuje nástroj na presadzovanie podnikovej stratégie do všetkých jeho činností. Je považovaný za vhodný spôsob na riadenie stratégie „zhora nadol“. Celý proces tvorby a implementácie stratégie je teda v rukách vrcholových manažérov. Štruktúra systému je tvorená štyrmi základnými perspektívami pre, ktoré sú určené trendy vývoja pomocou cieľov vyjadrených konkrétnymi ukazovateľmi. Pre každú perspektívu sú tiež vymedzené opatrenia, ktoré je potrebné realizovať pre dosiahnutie stanovených cieľových hodnôt. Tradičné scorecard sú zamerané na oblasti: finančného výhľadu, interných podnikových procesov, učenia sa a rastu, pohľadu zákazníkov prípadne môžu byť doplnené o samostatnú perspektívu zameranú na ľudské zdroje. Balanced Scorecard Budgeting predstavuje prístup, ktorý zabezpečí previazanie rozpočtu na konkrétne obdobie s cieľmi podniku.

Z hľadiska implementácie Balance Scorecard do procesu rozpočtovania je možné rozoznávať 4 úrovne činností:(Condon, 2010)

- Informačnú – pri ktorej dochádza k zhromažďovaniu všetkých údajov potrebných pre rozpočet. Zhromažďovanie informácií je cielené z presne identifikovaných oblastí.
- Plánovaciu – ktorá odhaľuje slabé stránky a hrozby podniku. Zároveň núti vedenie prehodnotiť predchádzajúce opatrenia alebo navrhuje nové opatrenia, ktoré pomôžu pri dosahovaní cieľov.
- Prípravnú – ktorá zabezpečí previazanie rozpočtových požiadaviek s meraním scorecard.
- Kontrolnú – ktorá porovnáva skutočne dosiahnuté cieľové hodnoty s prognózovanými v rámci jednotlivých oblastí scorecards. Pri dobrom zostavení rozpočtu je kontrola jednoduchá.

Problémy tejto metodiky nastávajú v prípade, že podnik nemá zadefinovanú podnikovú stratégiu. Využívanie Balanced Scorecard tiež vyžaduje, aby v operatívnom a taktickom riadení podniku existovala fungujúca základná procesná a informačná infraštruktúra.

7 Beyond Budgeting

Beyond Budgeting (BB) predstavuje adaptívny model riadenia, ktorý presahuje hranice tradičného rozpočtovanie. Zameriava sa na pružné meranie výkonnosti, sledujúce dosahovanie strategických cieľov, vymedzených pomocou ukazovateľov výkonnosti (KPI – key performance indicators). Ciele pritom nie sú stanovené absolútne, ale vychádzajú z relatívneho vyjadrenia napríklad vo vzťahu k externej alebo internej konkurencii. Kontrola dosahovaných výsledkov je postavená na jasných princípoch. Celý systém je zostavený v duchu klzavého plánovania a riadenie výkonnosti. Dôležité je tiež otvorené a etické uvádzanie informácií o skutočnom stave.

Realizácia jednotlivých činností prebieha prostredníctvom samostatných podnikateľských tímov pracujúcich v sieťovom modeli. Namiesto tradičného princípu príkazov ukladaných hierarchicky vyššie postavenými útvarmi dochádza k decentralizácii právomocí a zodpovednosti medzi vnútropodnikovými jednotkami, ktoré pracujú na báze obojstrannej spokojnosti. Vychádza sa z predpokladu, že tím vykoná najlepšie možné rozhodnutia, ak nie je nútený k plneniu fixného rozpočtu. Tímy zvyšujú svoju výkonnosť na základe vlastnej motivácie. Pracovníci sú odmeňovaní za trvalé zvyšovanie výkonnosti tímu. Pre zabezpečenie pružnosti celého systému je potrebné vytvoriť veľa malých tímov, ktoré budú môcť pružne reagovať na vzniknuté situácie. Očakáva sa od nich väčšia inovatívnosť v rozhodovaní a zodpovednejší prístup. Jednotlivé činnosti pritom podliehajú samokontrole tímu. Vedenie podniku zasahuje len v prípadoch ak sa kľúčové ukazovatele výkonnosti vymykajú stanoveným mantinelom. V konečnom dôsledku by malé tímy mali znamenať menej riadenia s nižšími nákladmi na túto činnosť. Teória Beyond Budgeting rozoznáva štyri druhy tímov. Možno pritom hovoriť o dočasných tímoch a stálych tímoch. Dočasným tímom je projektový tím. Tím vedenia spoločnosti zodpovedný za stanovenie cieľov a strategického smerovania podniku zamerané na dosiahnutie maximálneho výkonu. Podporné tímy zamerané na činnosti v oblasti financií, ľudských zdrojov, marketingu, logistiky, informačných technológií. Hodnotové tímy sú zodpovedné za realizáciu stratégie, investovanie kapitálu a vytváranie hodnôt (alebo zisku). Zámerom rozpočtovania je minimalizovať počet a veľkosť tímov podporných služieb a dosiahnuť tak zníženie nepriamych nákladov na neproduktívne činnosti.

Problematikou Beyond Budgetingu sa podrobne zaoberá výskumný tým BBRT. Eviduje a analyzuje viac ako 20 spoločností po celom svete, ktoré úspešne pracujú na princípoch BB. Nosnou myšlienkou systémov riadenia týchto spoločností je dôraz na sústavné zvyšovanie výkonnosti a uspokojovanie potrieb zákazníkov. Pri dôkladnejšej analýze týchto spoločností je vidieť, že nie všetky implementovali BB naraz, ale postupne preberajú najmä prvky kĺzavého rozpočtovania a prognózovania, ktoré im umožnia pružnejšie reagovať na zmeny v podnikaní.

Podstatu fungovania Beyond Budgetingu je možné zhrnúť do dvanástich oblastí. (BBRT, 2013) Prvých šesť predstavuje rámec pre prenesenie zodpovednosti na jednotlivé tímy, čím vytvára predpoklady pre ich rýchlu reakciu na vzniknuté situácie v duchu princípov neustáleho zlepšovania. Druhá šestica obsahuje princípy podporujúce adaptáciu systémov riadenie výkonnosti. Umožňujú tímom lepšie reagovať na konkurenčné prostredie a potreby zákazníkov. Princípy Beynod budgetingu (BBRT, 2013; Popesko, 2009, s. 215):

Riadenie a transparentnosť

1. Hodnoty – systém pracuje s jasne a zrozumiteľne vymedzenými hodnotami a cieľmi. Neobsahuje však celopodnikový rozpočet a nemá vymedzené žiadne detailné úlohy ani finančné rozpočty.
2. Riadenie – vychádza zo snahy naplnenia prijatých hodnôt a samostatnej práce tímov nie rešpektovania podrobných pravidiel. Každý zamestnanec by mal byť zodpovedný za spokojnosť zákazníkov.
3. Transparentnosť – informačný systém by mal byť otvorený a vyvážený a zobrazovať pravdivý skutočný stav organizácie a jej okolia. Prístup k informáciám by nemal byť obmedzený podľa hierarchických úrovní.

Tímová zodpovednosť

4. Tímy – tvoria štíhle siete malých zodpovedných tímov, bez centralizovaných princípov organizácie ich práce.
5. Dôvera – tímy disponujú voľnosťou pri svojej práci a jednaní, zamestnanci by nemali byť obmedzovaní.
6. Zodpovednosť – každý zamestnanec by mal myslieť ako podnikateľ a neslúžiť žiadnemu pevnému plánu.

Ciele a odmeny

7. Ciele – sú stanovené s ohľadom na maximalizovanie výkonnostného potenciálu. Sú orientované na dosiahnutie strednodobých výsledkov. Nie sú vymedzené fixne.
8. Odmeny – odmeny vychádzajú z viacerých kľúčových ukazovateľov v súlade s cieľmi a stratégiou. Výkonnosť je pri odmeňovaní posudzovaná relatívne bez porovnávania s fixnými cieľmi.

Plánovanie a kontrola

9. Plánovanie – plánovanie by malo prebiehať ako nepretržitý proces, bez pevných rozpočtov konkrétnych čísel pre vymedzený časový úsek.
10. Koordinácia – všetky aktivity je potrebné koordinovať dynamicky, bez použitia ročných plánovacích cyklov.
11. Zdroje – zdroje by mali byť dostupné podľa potreby v súlade so systémom just-in-time, nie prostredníctvom ročných rozpočtov.
12. Kontrola – je orientovaná na relatívne indikátory výkonnosti a trendy, porovnávané s konkurentmi alebo externými kritériami. Poskytuje rýchlu spätnú väzbu.

Za hlavnú výhodu celého systému možno považovať pružnosť reakcií na novovznikajúce situácie v rámci jasných strategických hraníc. Prenesenie zodpovednosti za rozhodnutia na výkonné tímy zas prispieva k zlepšeniam v oblasti nákladov a kvality požadovanej zákazníkom. Hlavnou nevýhodou celého systému však je, že napriek množstvu návrhov a odporúčaní nemožno BB považovať za univerzálny návod, ako sa zbaviť nevhodných techník tradičného rozpočtovania a stať sa úspešným podnikom. Celý koncept možno vnímať len ako istú víziu, ktorá sa snaží ukázať podnikom smer, ktorým by si mohli vydať pri hľadaní najefektívnejších plánovacích a rozpočtových postupov. Medzi nevýhody možno zaradiť aj náročnosť implementácie komplexného modelu BB, ktorá vyžaduje zmenu povahy celej organizácie. Výsledok takejto zmeny je pritom neistý. V neposlednej rade sa predpokladá, že implementácia iba časťi uvedeného modelu, môže znamenať návrat k tradičným postupom rozpočtovania vychádzajúcich z princípov príkaz - kontrola.

Záver

Napriek všetkým uvedeným problémom a nevýhodám tradičného rozpočtovania nie je možné jednoznačne odpovedať na otázku, či príde k ich úplnému zániku. Aj nové postupy prinášajú so sebou množstvo nevýhod a problémov, nedostatočných informácií, náročných implementácií a nereálnych požiadaviek. Je na zvážení každého podniku v akom rozsahu budú zmeny v rozpočtovaní preň potrebné a aké techniky si na ich vylepšenie zvolí.

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Determinants of Stocks' Choice in Portfolio Competitions

Martin Šmíd, [1] Aleš Antonín Kuběna [2] [3]

Abstract

We study investment competitions in which the players invest a virtual amount of money into financial asset and those with highest returns, measured by the actual prices, are rewarded by fixed prizes. We show that the competition, seen as a game, lacks a pure equilibrium and that the "max-min" solution of the game lies in the extremal point of the feasible set having maximal probability of victory. We show further that if a mixed equilibrium exists then its atoms lie exactly in the extremal points with a non-zero probability of victory and its weights are close to corresponding probabilities of victory.
We analyse empirically a portfolio competition held recently by the Czech portal "lidovky.cz"; we find that the majority of people do not behave according to the game-theoretic conclusions. Consequently, searching for factors influencing a choice of particular stocks, we find that the participants' choice may be explained by several stock traits to a certain extent. We also show that participants tend to choose negatively diversified portfolios.

Keywords

portfolio competition, game theory, behavioural finance, discrete choice

JEL Classification: C7, D03

1. Introduction

The subject of our study is a portfolio competition if which their participants divide a virtual amount of money into several (real-life) financial assets; after a specified time, gains of the players are evaluated and several (usually three) best players are rewarded by monetary prizes. If more than one participant achieve the same gain, the prize is divided equally.

As we show below, the strategies in those competitions differ dramatically from a real-life investment: while only the actual return, regardless on the results of the other "players", matters in real life, so the "player" may afford to reduce her risk by a diversification diversify (see [1]), only the best returns among all the players bring positive gains in the competition which, as shown in Section 2. of the present paper, makes even a risk-averse participant to take the most risky positions. In particular, the only portfolios getting a positive max-min gain are those lying in extremal points of the feasible set. Moreover, we show that if an equilibrium of the game exists then it has to be mixed one with atoms lying in the extremal points.

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An analysis of a particular portfolio competition by Czech internet portal "lidovky.cz", made in Section 3., however shows that people do not behave according to game-theoretic conclusions; in particular, only 17.6% of participants chose portfolios lying in extremal points.

In Section 4., we propose a method of an explanation of the player's behaviour. In particular, we use multinomial logit - one of the discrete choice models - to determine possible factors driving the participants' choice. It is also shown how the multinomial logit model may emulate the possible game-theoretic behaviour of the participants.

In Section 5., the method is applied to the "lidovky.cz" competition. The analysis is carried out separately for supposedly rational participants (i.e. those who place their portfolios into the extremal points) and the remaining ones. In both the cases, a hierarchy of models is proposed and subsequently estimated.

The paper is concluded by Section 6..

2. Game Theoretic Approach

Let $R \in \mathbb{R}^n$ be a random vector of asset returns, possibly discounted by a deterministic risk free rate r_0, with an absolutely continuous joint distribution such that

$$\operatorname{supp}(R) = (-1, \infty)^n.$$

and let the set of feasible actions of the players be defined as

$$S = \{\pi \in \mathbb{R}^n : \gamma \leq 1'\pi \leq 1, 0 \leq \pi_i \leq \alpha, 1 \leq i \leq n\}$$

where α and γ are some constants; the points π of S stand for a vector fractions of the initial sum invested into the individual assets.

Let the competitors be risk averse first, the i-th one having a strictly increasing utility function u_i. For simplicity, we assume that (the participants act as if) there is only single prize. Then the utility of the i-th player is

$$v_i = \mathbb{E}(u_i(Z_i))$$

where Z_i is a gain of the player given by

$$Z_i = Z_i(\pi_1, \dots, \pi_m) = \begin{cases} \frac{1}{k_i} & \text{if } R \in \Gamma_i \\ 0 & \text{otherwise} \end{cases}$$

Here

- $\Gamma_i = \Gamma_i(\pi_1, \dots, \pi_m) := \{r : \pi_i' r > \pi_j' r, j \notin K_i\}$
- $K_i = \{1 \leq j \leq m : \pi_j' R = \pi_i' R\}$,
- $k_i = |K_i|$
- $\pi_1, \pi_2, \dots, \pi_m$ are the strategies (portfolios) of individual players.

The following result says that the best max-min strategy is to take the most "advantageous" corner of S; however, no equilibrium in pure strategies exists given that there do not exist a group of stocks strongly outperforming the rest.

Theorem 1. *Denote $E = (e_1, \dots, e_r)$ the set of extremal points of S and put*

$$\sigma_i = \mathbb{P}(\rho \in N_S(e_i))$$

where

$$N_S(e) = \{r : r'(\pi - e) \leq 0 \text{ for all } \pi \in S\}$$

is a normal cone.
(i) If $m \geq n+2$ then

$$\max_{\pi_i} \min_{\pi_j, j \neq i} v_i = 0$$

whenever $\pi_i \notin E$.
(ii)

$$\max_{\pi_i} \min_{\pi_j, j \neq i} v_i \geq u_i(\frac{1}{m})\sigma_i$$

whenever $\pi_i \in E$.
(iii) Denote $I = \lfloor \frac{1}{\alpha} \rfloor$. If there is a player, say the i-th one, such for each $j \geq 1$ there exist $j_1, j_2, \ldots, j_{I+1}$, differing from j fulfilling

$$\mathbb{P}(R_{j_k} \geq R_j) > \frac{u_i(\frac{1}{m})}{u_i(1)}, \qquad 1 \leq k \leq I+1 \tag{1}$$

then there exists no symmetric equilibrium in pure strategies.

Proof. See [4] □

Note that the RHS of (1) goes to zero with the growing number of participants.

The following result deals with possible mixed equilibria given a risk neutrality of the players. Even though it does not guarantee an existence of a mixed equilibrium, it says that if a symmetric equilibrium exists then it is very close to the mixed strategy with atoms coinciding with the extremal points of S and with weights equal to the victory probabilities σ_i corresponding to the points.

Theorem 2. *If u_i are linear and if $m \geq m_0$ where*

$$m_0 \geq \frac{1}{\sigma_{min}}, \qquad \sigma_{min} = \min\{\sigma_i : 1 \leq i \leq |E|\}$$

and

$$\ln(n+1) + (m_0 - 1)[\ln(1 - \sigma_{min}) + \ln m_0 - \ln m_0 - 1] + \ln m_0 \leq 0$$

then each symmetric equilibrium in mixed strategies $\Pi = (\theta_i, q_i)_{i \leq r}$ consists exactly from all the extremal points of S and

$$q_i \geq \sigma_i - \frac{1 - \sigma_i}{m-1} \geq \sigma_{min} - \frac{1 - \sigma_{min}}{m-1}$$

Moreover, $q_i \to \sigma_i$ as $m \to \infty$.

Proof. See [5]. □

Summarizing: if one wants to be sure with a positive expected gain and uses only pure strategies then he has to choose one of the extremal points as his strategy. However, under quite realistic conditions, no symmetric equilibrium in pure strategies exists; hence, if a symmetric equilibrium exists, then it has to be a mixed strategy; however, if such a strategy exists than it has to be a mixture of extremal points with their victory probabilities as weights.

Code	Name	p	a
AAA	AAA Auto Group N.V.	0.17	3.0
CETV	CE Media Enterprises Ltd.	0.15	3.2
ÄŚEZ	ÄŚEZ, a.s.	0.50	12.2
EFORU	E4U a.s.	0.04	0.7
ENCHE	ENERGOCHEMICA SE	0.06	0.9
ENRGA	Energoaqua, a.s.	0.08	1.3
ERSTE	Erste Group Bank AG	0.42	8.2
FOREG	Fortuna Entertainment Group N.V.	0.37	7.5
JIP	VET ASSETS a.s.	0.04	0.7
KB	KomerÄŤnĂ banka, a.s.	0.43	8.3
LAZJA	JĂˇchymov Property Management, a.s.	0.03	0.4
NWR	New World Resources Plc	0.22	4.7
OCELH	OCEL HOLDING SE	0.09	1.5
ORCO	Orco Property Group S.A.	0.18	3.7
PEGAS	PEGAS NONWOVENS SA	0.26	5.2
PM ÄŚR	Philip Morris ÄŚR a.s.	0.43	9.2
PRSLU	PraĹľskĂ© sluĹľby, a.s.	0.05	0.9
PVT	RMS Mezzanine, a.s.	0.03	0.6
SCHHV	SPOLEK PRO CHEM.A HUT.VĂťR.,a.s	0.00	0.0
SMPLY	SeveromoravskĂˇ plynĂˇrenskĂˇ, a.s.	0.12	2.0
TEL. O2	TelefĂłnica Czech Republic, a.s.	0.35	6.9
TMR	Tatry mountain resort, a.s.	0.16	3.3
TOMA	TOMA, a.s.	0.08	1.2
UNI	UNIPETROL, a.s.	0.26	4.7
VCPLY	VĂ˝chodoÄŤeskĂˇ plynĂˇrenskĂˇ,a.s.	0.09	1.6
VGP	VGP NV	0.02	0.4
VIG	VIENNA INSURANCE GROUP	0.23	4.1

Table 1: Menu of stocks: p - frequency of choice, a - average weight (in %)

3. Data

In the present Section we analyse a particular portfolio competition, namely the one held by Czech news internet portal "lidovky.cz" this year. The competition started in April and ended in July. According to the rules, its participants could split a virtual million Czech crowns among 27 stocks listed in Table 1, and a (fictitious) bank account yielding 0.4% p.a. The three participants with the highest value of their virtual portfolios, measured on July 9, were promised to obtain 30.000, 20.000, and 10.000 Czech crowns, respectively. If there were more participants with the highest value of their portfolios then the prize would be divided equally.[4] The upper limit α of an investment asset is 40% for stocks, 50% for the bank account, respectively. The rules also said that at least 10% could be invested into a single stock if it is invested into it which, however, was violated by 6 portfolios for unknown reasons.[5]

The data we used come from the internet site of the competition `http://portfolio.lidovky.cz`

[4]It is, however, not said int the rules what would happen in case of equality on the second and/or the third place.

[5]We neglect these lower bounds in our theoretical analysis in Section 2. as they bring non-convexity of the feasible set which consequently complicates the treatment.

and a subsequent preprocessing by a software written by us in `C++` and by a free OCR program `gocr`. As the text recognition appeared to be inaccurate, several consistency checks were performed and, subsequently, manual corrections were made; nevertheless, it is still possible that there are minor errors left in data caused by an inaccurate OCR recognition, which may be, however, regarded as noise if the data is analysed statistically .

There was as much as 2699 portfolios competing in the game. Even if it is highly probable that some players created multiple identities to increase their chances, we neglect this suspicion as we have no means to identify those cases.

There is 9828 extremal points of a feasible set in total,[6] 365 of which were occupied by portfolios of 477 (17.68%) participants (the most popular being portfolio CETV 40%, NWR 40%, ORCO 20% which was used 8 times). In other words, no more than 17.68% of players behaved "rationally" in the sense of Theorem 1. Out of remaining (non-extremal) portfolios, 975 (36.1 %) was dominated (i.e. there were enclosed into a convex hull established by other portfolios), having no chance for the first prize given the configuration of the other portfolios. We used Iredundancy problem algorithm to determine which portfolios were dominated (see [3], Chp. 19 for details).

Figure 1 shows average weights of individual stocks in the participants' portfolios; differences among the stocks are visible at the first look, and, even if the differences between participants who chose extreme portfolios (we call them "extremists" in the rest of the paper) and the others could not be proved solely from the numbers displayed in the graph (the standard deviation of the difference is up to 0.015), a more detailed statistical analysis (the goodness-of-fit test of distributions of two most weighted stocks in portfolios of extremists and the others) shows this difference to be significant, too. Therefore we decided to analyse the two groups separately.

4. Methodology

In econometrics, situations when K subjects choose between J alternatives is usually treated by means of discrete choice models, the multinomial logit model especially. We use this approach, too.

The multinomial logit model assumes the k-th subject to choose the alternative j_0 if and only if

$$j_0 = \text{argmax}_j u_{k,j}, \qquad u_{k,j} = \beta'_{k,j} X_{k,j} + \epsilon_{k,j}, \quad k \le K, j \le J,$$

where $\beta_{j,k} \in \mathbb{R}^q$ are deterministic vectors, $X_{j,k} \in \mathbb{R}^q$ are explanatory variables and $\epsilon_{j,k}$ are mutually independent random variables each with the standard type 1 extreme value distribution (for more details, see [6]).

After some calculation, the probability that subject k chooses alternative j_0 comes out as

$$p_{k,j_0} = \frac{\exp\{\beta'_{k,j_0} X_{k,j_0}\}}{\sum_{j=1}^{J} \exp\{\beta'_{k,j} X_{k,j}\}}. \tag{2}$$

Parameters β may be easily estimated by an application of standard maximum likelihood to (2). To test hypotheses about the parameters either t-tests associated with the ML estimation or likelihood ratio tests may be used.

As a measure of explanation brought by a model in comparison with

$$H_0 : p_{k,1} = p_{k_2} = \cdots = p_{k,j},$$

the quantity

$$\rho = 1 - \frac{\text{LL}}{\text{LL}_0}$$

[6] Note that this number depends only on the number of stocks

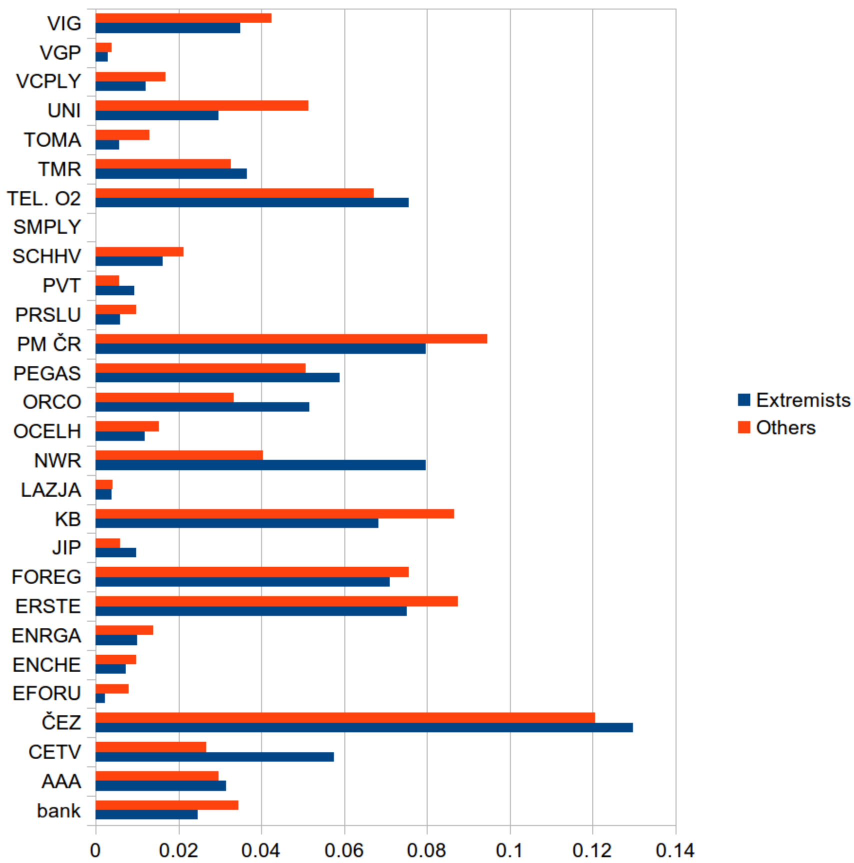

Figure 1: Relative frequencies of stocks' choice.

is often used, where LL and LL_0 are the log likelihoods given the model, given H_0, respectively - note that $\rho = 0$ given H_0 and that $\max \rho = 1$ hence ρ may be interpreted as a percentage improvement with respect to H_0.

Even if the assumptions of the multinomial logit model, implicitly including the irrelevant alternatives assumption among others, are rather limiting, the tractability, the estimability and the relative simplicity of the model speak in favour of using it at least as a useful starting point.

An additional reason for the application of the model to our problem is that it is able to describe the behaviour of participants acting according to game theory - in particular, if we assume the alternatives of the choice to be exactly the extremal portfolios and if

$$H_{mm}: \qquad \text{the participants act the min-max way}$$

then, by putting put $X_{k,j} = \sigma_j$ and $\beta_{j,k} = \beta \to \infty$. we get

$$p_{k,j} \to \begin{cases} 1 & \text{if } j = \arg\max_\iota \sigma_\iota \\ 0 & \text{otherwise} \end{cases}$$

ie, the min-max solution. The case when β is finite naturally models the situation in which the participants are uncertain regarding the value of σ_j, see the next Section.

Similarly, the case when

$$H_{me}: \qquad \text{the participants apply a mixed strategy } (\sigma_1, \sigma_2, \ldots, \sigma_J).$$

may be emulated by assuming $X_{k,j} = \log(\sigma_j)$ and $\beta_{j,k} = 1$ in which case $p_{k,j} = \sigma_j$; therefore, estimates of $\beta_{k,j}$ may serve as a statistic possibly falsifying H_{me}.

5. Empirical Evidence

5.1 Extremists

In the present Subsection we deal with the 477 participants who chose extremal portfolios.

Say first that probabilities $\sigma_\bullet$ are known only up to an additive error $e_\bullet$ with common variance v and that H_{mm} holds true. Then

$$u_{k,j} = \sigma_j + e_{k,j}$$

which, standardized for the variance of the extreme value distribution (being $v_e = \frac{\pi^2}{6}$) gives

$$\tilde{u}_{k,j} = \beta\sigma_j + \epsilon_{k,j}, \qquad \beta = \sqrt{v_e/v}. \tag{3}$$

Testing H_{mm} against H_0 thus reduces to testing whether $\beta = 0$.

The probabilities of victory σ_j we used in the test were computed by means of simulation: in particular, $4,000,000$ simulated asset returns were drawn from multivariate normal distribution with mean and variance matrix estimated from the daily returns of the assets (with a silent assumption that the daily returns are independent in time). The victory probabilities were then evaluated by counting victories of individual extremal points.[7]

The results of the test of H_{mm} against H_0 are as follows:

[7] If the moments were exact and the distribution was indeed normal time-independent then the victory probabilities would be estimated with standard error less than 0.00005 by our computation. Due to the impreciseness of the estimates, however, our σ's are imprecise, too, and, because the form of dependence of σ's on the moments is complicated (its exact evaluation would require multidimensional numerical integration), we even are not able to determine the estimation error. We thus, in fact, silently assume that the participants count with the estimated distribution.

	Coefficient	Std. Error	t-ratio
PWIN	451.208	67.8915	6.64603***
ρ	0.00557393	observations	477
likelihood ratio	48.2814	d.f	1

Even if the test came out significant, the result is practically useless because, by (3), the standard error of e is $\sqrt{v} = \pi^2/(6\beta) \doteq 0.02$ which is far more than the highest estimates of σ's, being less that 0.01. Thus, the only conclusion we may make here is that the choice probabilities somehow, very weakly, reflect the estimated victory probabilities.

Similarly we may test H_{me}: assuming multiplicative errors $f_\bullet$ this time, we get

$$u_{k,j} = \log(\sigma_j f_{k,j}) \doteq \log(\sigma_j) + \epsilon_{k,j}$$

(because only the differences matter in discrete choice, the constant term resulting from the non-linear transformation of f may be neglected). Here, however, we face the problem that about 90 estimates of σ's are zero which would lead to covariates equal to minus infinity.[8] Therefore, when tried to overcome this by an approximation of the logarithm by a quadratic function (making our new model sup-model of the previous one). The results are as follows:

	Coefficient	Std. Error	t-ratio
PWIN	1293.9	135.179	9.57177***
PWIN2	−217748	26444.6	8.23414***
ρ	0.00917296	observations	477
likelihood ratio	79.4561	d.f	2

Even though the quadratic term is negative so the function has the "right" concave shape, still the explanation power of such a model is poor.

Another hypothesis could be, that

H_r : people "seek risk", measured by the variance, in order to win the competition.

In order to examine this hypothesis in greater detail, we split the variance into the diagonal and the covariance parts, i.e. we assume

$$u_{k,j} = \beta_1 v_j^d + \beta_2 v_j^c + \epsilon_{k,j}, \qquad v_j^d = \sum_{i=1}^{n} \pi_i^2 \mathrm{var}(R_{i,i}), \qquad v_j^c = \mathrm{var}(\pi_i' R) - v_j^d.$$

The results are following:

	Coefficient	Std. Error	t-ratio
NAIVEVAR	−0.892095	0.178622	4.99431***
DIVEFFECT	13.7508	0.742238	18.5262***
ρ	0.0444239	observations	477
likelihood ratio	384.799	d.f	2

Contrary to the previous two models whose ρ's were less than 1%, the ρ here is as great as 4%. Even more interestingly, if we omit the "naive" part, the ρ would not decrease too much:

	Coefficient	Std. Error	t-ratio
DIVEFFECT	12.2192	0.644341	18.9639***
ρ	0.0414165	observations	477
likelihood ratio	358.75	d.f	1

[8] This is partially due to the fact that the distribution of four stocks - LAJZA, OCELH, SCHHV and VGP - is Dirac at zero, their returns are thus dominated by the bank account which implies that no portfolio including some of these stocks and with less that 50% of the bank has chance to win.

Because the explanatory power is still low and the differences between the individual stocks are still unexplained, the next step was to seek stock traits which would be able to explain the participants' choices in addition to the diversification effect. To this end, we assume that

H_t : a participant gets utility from certain traits of the stocks

i.e.

$$u_{k,j} = \beta v_j^d + \sum_i \gamma_i t_{i,j} + \epsilon_{k,j} \qquad t_{i,j} = \sum_\nu \pi_{j,\nu} \tau_{\nu,i}$$

where $\tau_{\nu,i}$ is the i-th trait of the ν-th stock. The traits we take into account include the information about individual stocks provided by the Prague stock exchange on their website plus several additional traits which are deducible from historical data being available on the website in a graphical form:

LOGMK logarithm of market capitalisation, measuring the size of the firm

PE price earning ratio

PEMISSING a dummy being one in case that the PE is not available on the website

MAJORITY a stake of a major owner

DIVIDENDRET dividend return in the previous year

TRADEABILITY equal to one, if the stock belongs to more liquid stocks (displayed as "selected stocks" on the website)

TREND6M trend from the last half year

TRENDLONG long trend, measured by the relative position of the current price to the average of the highest and the lowest prices from the last year

TRADEFREQ percentage of days in which the price changed

ZEROTRADES equal to one if the variance of the stock is zero (see above)

VOLATILITY volatility of the stock

All the traits had been standardized, the results of the estimation are following:

	Coefficient	Std. Error	t-ratio
LOGMK	0.569593	0.183298	3.10748**
PE	−0.395217	0.271275	1.45689
PEMISSING	0.142912	0.140483	1.01729
MAJORITY	0.0341098	0.537776	0.0634276
DIVIDENDRET	−0.00561123	0.717448	0.0078211
TRADEABILITY	0.895469	0.154135	5.80963***
TREND6M	2.08681	0.165754	12.5898***
TRENDLONG	0.225133	0.138736	1.62275
TRADEFREQ	−0.502935	0.126327	3.98122***
ZEROTRADES	−0.763352	0.772684	0.987922
VOLATILITY	−30.0713	16.1025	1.86749
DIVEFFECT	9.14242	1.09444	8.35354***

ρ	0.121835	observations	477
likelihood ratio	1055.33	d.f	12

It is obvious that this model brings much better explanation then the "risk" one.

The last in the chain of models we studied was the one assuming

H_c : a participant get a constant utility for each stock

i.e.

$$u_{k,j} = \beta v_j^d + \sum_{\nu} \pi_{j,\nu}\eta_\nu + \epsilon_{k,j}$$

where η_ν is the utility from the stock ν, whose results are

	Coefficient	Std. Error	t-ratio
AAA	0.530561	0.658	0.806324
CETV	0.160249	0.725612	0.220847
ÄŚEZ	4.74244	0.543707	8.72241***
EFORU	−8.03221	2.1953	3.65882***
ENCHE	−3.59581	1.16197	3.09457**
ENRGA	−2.50735	0.943191	2.65837**
ERSTE	1.23782	0.666734	1.85655
FOREG	2.47644	0.574739	4.3088***
JIP	−3.10638	1.01899	3.04849**
KB	1.84364	0.628468	2.93355**
LAZJA	−5.74459	1.49506	3.84238***
NWR	2.03821	0.629318	3.23876**
OCELH	−1.9931	0.909482	2.19146*
ORCO	1.51898	0.612075	2.48169*
PEGAS	2.60494	0.601844	4.32827***
PM ÄŚR	3.42789	0.588588	5.82393***
PRSLU	−4.28001	1.15181	3.71589***
PVT	−2.94068	0.944044	3.11499**
SMPLY	−1.01016	0.859054	1.1759
TEL. O2	3.10432	0.583214	5.32277***
TMR	1.6007	0.638862	2.50556*
TOMA	−4.35303	1.22469	3.55439***
UNI	0.681223	0.684628	0.995027
VCPLY	−1.88229	0.915875	2.05518*
VGP	−6.63777	1.53987	4.31061***
VIG	0.35951	0.651651	0.55169
DIVEFFECT	8.71744	1.31269	6.6409***
ρ	0.137125	observations	477
likelihood ratio	1187.77	d.f	27

Here we see that the explanatory power did not increase much in comparison with the previous model, so we may admit that H_t is able to explain the participants' choices to some extent, taking the significant coefficients as possible factors explaining the participants' behaviour.[9]

5.2 Remaining Participants

The behaviour of the participants not choosing extremal portfolios may be analysed similar way. However, additional question arises: what is the set of alternatives here? From the matter of fact,

[9]One may object here that *any* vector standing for traits could come out significantly. However, if we take random numbers instead of the traits, the resulting ρ is 0.076 on average with a standard error 0.015 which proves the objection false.

the set is infinite, in which case the discrete choice models could not be applied. Therefore, we made an additional assumption that only portfolios with weights taking values in a certain finite subset of $[0, 1]$ are the alternatives. Even given this simplification, however, the set of alternatives turns out to be extremely huge. Therefore, we decided to approximate the denomitator of (2) by an integral, which we consequently evaluated by means of Monte Carlo.[10]

Because the probability of victory is zero for all the non-extremal portfolios, we omit the first two models from the previous Subsection, and the chain of the model will be as follows:

H_r without naive part:

	Coefficient	Std. Error	t-ratio
DIVEFFECT	24.2769	0.43612	55.6658***

ρ	0.0507012	observations	2222
likelihood ratio	2599	d.f	1

H_t (including the diversification effect):

	Coefficient	Std. Error	t-ratio
LOGMK	−0.0333417	0.117292	0.284261
PE	−2.9273	0.170304	17.1887***
PEMISSING	0.97319	0.085496	11.3829***
MAJORITY	−0.158435	0.29394	0.539004
DIVIDENDRET	0.767688	0.387857	1.97931*
TRADEABILITY	−0.00332881	0.0818279	0.0406806
TREND6M	3.17522	0.0958563	33.1248***
TRENDLONG	−0.80461	0.101747	7.90792***
TRADEFREQ	0.538875	0.0844264	6.38278***
ZEROTRADES	−16.7061	0.41519	40.2373***
VOLATILITY	−169.245	9.91285	17.0733***
DIVEFFECT	1.39461	0.834849	1.67049

ρ	0.208218	observations	2222
likelihood ratio	10673.5	d.f	12

H_c (including the diversification effect):

[10] In the present preliminary paper we allowed the portfolios in the set to have more than 10 positive weights, even if it was not allowed by the rules of the competition. We regard the accommodation of this fact as the necessary next step in our research.

	Coefficient	Std. Error	t-ratio
AAA	−0.699784	0.370038	1.89111
CETV	−0.61192	0.491754	1.24436
ÄŚEZ	1.01176	0.275866	3.66759***
EFORU	−13.0467	0.607241	21.4853***
ENCHE	−7.84003	0.550969	14.2295***
ENRGA	−2.45436	0.477254	5.14266***
ERSTE	0.69641	0.389015	1.79019
FOREG	0.809344	0.309536	2.6147**
JIP	−23.3353	0.726183	32.1342***
KB	0.374025	0.357288	1.04685
LAZJA	−44.0061	0.894984	49.1698***
NWR	0.0260313	0.395202	0.0658684
OCELH	−2.70495	0.474067	5.70583***
ORCO	−0.0864965	0.355688	0.243181
PEGAS	−0.0400821	0.304455	0.131652
PM ÄŚR	0.867288	0.279767	3.10004**
PRSLU	−8.80391	0.545008	16.1537***
PVT	−24.7978	0.694069	35.7281***
SMPLY	−0.774537	0.428156	1.80901
TEL. O2	0.315307	0.301567	1.04556
TMR	0.11573	0.344331	0.3361
TOMA	−4.43616	0.504323	8.79627***
UNI	0.740131	0.314619	2.35247*
VCPLY	−2.21295	0.463615	4.77324***
VGP	−46.8473	0.901979	51.9384***
VIG	0.22218	0.351757	0.631629
DIVEFFECT	−0.361743	1.02811	0.351852

ρ	0.235593	observations	2222
likelihood ratio	12076.8	d.f	27

At the first look, the results are similar to the "extremists" case, with the important exception that, contrary to extremists, the diversification effect is insignificant here suggesting less degree of the "risk to win" approach in comparison to the extremists. However, it is also possible that this difference is caused solely by the fact that the portfolios here consist of more stocks here - to solve this problem seems to be the one of the next steps of our research.

6. Conclusion

We analysed a rather general case of a portfolio competition. As the behaviour of players in an actual game of this type is apparently inconsistent from the game-theoretical point of view, we applied a discrete choice model in order to explain the participant's choices by certain stock traits, several of which we found significant.

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The financial symptoms of forthcoming business failure in the construction industry

Jindřich Špička[1]

Abstract

The paper aims to discover the financial symptoms of the forthcoming bankruptcy in the Czech construction industry. The basic year for the comparison is 2010 – the starting point of the crisis in the construction industry. The paper compares the financial ratios of the sample of construction companies before they went bankrupt with the similar sample of the construction companies with a relatively good credit risk rating. The Propensity Score Matching method (PSM) and Mann-Whitney test of differences between two independent samples are the key statistical methods. The results point out an inappropriate enterprise financial management. The business failure is caused by combination of poor debt management and long-term loss. The construction companies before bankruptcy do not create enough own funds to overcome a crisis. The analysis reveals statistically significant differences in key financial indicators between two samples.

Key words

Business failure, construction industry, insolvency, financial ratios

JEL Classification: M21, L74

1. Introduction

The construction industry is relatively important sector of the economy, not only in the GDP (6.8 % in 2011) and employment (8.8 % in 2011) but also as the industry that improves the transport infrastructure. Currently, it is one of the sectors most threatened by the economic recession. A decline of production in the construction industry has been since 2010 due to a lack of particularly large contracts that were previously funded from public sources.

The most frequent sources of insolvency with respect to the firms' financial decision-making are the debt-equity ratio, lack of own financial reserves, problems with enforceability of claims and financial inflexibility in response to the decline in sales (Stehlíková, 2013). Moreover, the credit risk management of banks adversely affected the number of bankruptcy petition. The willingness of banks to lend money in the recession decreases, which can be labelled as a cyclical financial distress (Kislingerová, 2012). A growing number of insolvency in the region directly and indirectly helps to increase unemployment rate.

Záthurecký and Marinič (2013) conclude that the companies oriented on commerce transactions between businesses (B2B – Business to Business) perceive the current crisis and economic outlook in the construction industry better than B2C and B2G companies. Kislingerová (2013) predicts ongoing dynamic growth of insolvency petition as well as of the number of declared bankruptcies in the period 2013 and 2016. A higher number of insolvency proceedings will result in a significant burden on the courts.

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Through the financial statement analysis Richter (2013) concludes that the situation of SMEs essentially reflect the situation in the Czech construction industry as a whole. However, the large construction companies show specific features, mainly in the capital structure. When the crisis started, large companies promptly decided to get rid of the debt to reduce the debt service risk. However, the different strategy of debt management did not lead to significantly better financial performance of the large companies relative to the SMEs.

The forthcoming bankruptcy can be predicted through the bankruptcy models. Kuběnka and Králová (2013) used the bankruptcy model Z" Score. Based on the analysis of 473 companies they statistically confirmed that 20 % of businesses in the construction industry had symptoms of bankruptcy in 2010. Nevertheless, they proved that the situation in the construction industry is better than the national economy as a whole.

The aim of the paper is to discover the symptoms of the oncoming bankruptcy in the Czech construction industry. The paper compares the financial performance of two groups of construction companies: 1) the companies before bankruptcy and 2) the companies with relatively good solvency rating. The analysis compares similar groups by the company's size and NACE code structure. This approach reduces the misinterpretation of the results.

2. Material and Methods

The Commercial Register provides the financial statements of the companies in the construction industry. The construction industry is defined as the group of businesses under the "F code" of the NACE rev. 2 classification. It includes 3 divisions:

- Construction of buildings (NACE 41),
- Civil engineering (NACE 42) and
- Specialized construction activities (NACE 43).

The paper compares two groups of the construction companies. Group A includes companies before bankruptcy. Although the economic recession has fully appeared since 2009, the sharp drop of the construction industry delayed one year because of long-term production cycle. The basic year for the comparison is 2010 because all companies in the group A were at the starting point of the crisis period. In the subsequent years the number of available financial statements considerably dropped because many companies stop publishing financial statements when they expect financial difficulties. The construction companies in the group A went bankrupt between January 2011 and May 2013.

The construction companies in the group B have had a relatively good financial condition because of their above-average solvency index estimated by Bisnode Company. The companies haven't experienced the bankruptcy.

Because the results can be biased by the structure of specialization (NACE) as well as by the company's size (total assets), the similar groups are picked out. The Propensity score matching (PSM) is used to create treatment-control matches based on propensity scores and/or observed covariate variables (Khandker et al, 2010). Greedy data matching is used for propensity score data matching procedure in this paper. Mahalanobis distance within propensity score calipers (no matches outside calipers) is used in this paper as the distance calculation method (Gu, Rosenbaum, 1993).

The Mann-Whitney U test compares the below mentioned financial indicators between group A and group B. The null and alternative hypotheses are: H_0: Median A = Median B, H_A: Median A $\neq$ Median B. A normal approximation method is used for the distribution of the sum of ranks which corrects for ties and does have the correction factor for continuity. The null hypothesis is tested at the significance level of 0.05.

The financial statement analysis consists of the following indicators.

A) Indicators of profitability:
- Return on Assets (ROA) = EBIT/Total Assets
- Long-term Profitability = (Retained Earnings + Reserve Funds + Net Income After Tax)/Total Assets

B) Indicators of the capital structure
- Debt Ratio = Total Debt/Total Assets
- Short-term Debt Ratio = (Short-term Liabilities + Short-term Bank Loans & Overdrafts)/Total Assets
- Long-term Debt Ratio = (Long-term Liabilities + Long-term Bank Loans & Overdrafts)/Total Assets
- Credit Debt Ratio = Bank Loans & Overdrafts/Total Assets

C) Indicators of liquidity:
- Current Ratio (L3) = Current Assets/Current Liabilities
- Cash Ratio (L1) = Short-term Financial Assets/Current Liabilities

D) Turnover indicators
- Total Assets Turnover = (Production + Revenue from Goods Sold)/Total Assets
- Liability Turnover = (Production + Revenue from Goods Sold)/(Total Payables + Short-term Bank Loans & Overdrafts)
- Accounts Receivable Turnover = (Production + Revenue from Goods Sold)/Total Accounts Receivable

The sample of 81 companies in each group with available full accounting data in 2010 is the base for the analysis.

3. Results and discussion

Table 1 provides information about profitability indicators and capital structure of the construction companies.

Table 1: The differences in profitability and capital structure

Indicator	Unit	Group A (median)	Group B (median)	Mann-Whitney Z	p-value
ROA	%	-5.09	1.98	4.5155	<0.0001
Long-term Profitability	%	-14.90	25.82	6.6894	<0.0001
Debt Ratio	%	102.67	59.47	-7.2020	<0.0001
Short-term Debt Ratio	%	97.27	52.94	-6.7229	<0.0001
Long-term Debt Ratio	%	0.44	1.58	0.5670	0.5707
Credit Debt Ratio	%	7.82	0.00	-3.8395	0.0001

Source: Author

Table 1 clearly shows the bad financial condition of the companies shortly before bankruptcy. The bankrupt companies (group A) have not only the negative return on assets shortly before the failure, but they also record financial losses over a long period. The median long-term profitability is deeply negative that indicates the long-term cumulative loss. The median value denotes that one half of the sample A has the long-term profitability below -14.9 % which is alarming. The long-term profitability indicators of the group B indicates retained earnings and financial reserves which enable them to survive the bad years. Mann-Whitney test confirms the statistically significant differences of profitability ratios at $\alpha = 0.05$.

The median debt ratio of the group B indicates that one half of the construction companies had more than 59.47% share of debt in total liabilities in 2010. However, it is significantly lower than in the group A where the debt of more than one half companies reaches more than

100% of the total assets. Such companies have negative equity and have not enough assets available to pay off all debts. The business failure of the construction companies is caused by short-term insolvency. The share of bank credits and loans is also significantly higher in the sample of companies before bankruptcy. Alternatively, the long-term debt ratio of the group A does not significantly differ from the group B. Generally, the combination of a high level of short-term debts including credits and loans together with a long-term cumulative loss causes the serious problems with settlement of the debt service costs in the sample A. During a crisis, holding of own resources is the best way to keep the company's financial stability (Kislingerová, 2010).

The table 2 contains ratio indicators of liquidity and turnover. It attempts to measure the differences of the business activity and short-term liquidity between two groups of construction companies. Acid-test ratio (liquidity L2) is not calculated because construction companies do not have much inventory and L2 is roughly the same as L3.

Table 2: The differences in liquidity and turnover indicators

Indicator	**Unit**	**Group A (median)**	**Group B (median)**	**Mann-Whitney Z**	**p-value**
Current Ratio (L3)	x	0.80	1.29	5.7381	<0.0001
Cash Ratio (L1)	x	0.02	0.25	6.9241	<0.0001
Total Assets Turnover	x	1.70	1.80	0.3986	0.6902
Liability Turnover	x	1.60	3.80	5.2828	<0.0001
Accounts Rec. Turnover	x	3.09	5.27	3.8155	0.0001

Source: Author

The liquidity indicators are significantly lower in companies before bankruptcy than in other companies. One half of the companies in the group A covers the short-term liabilities by the current assets less than 0.80 times. The median cash ratio is only 0.02 in the group A. It means the construction companies before bankruptcy have insufficient cash liquidity which indicates grave problems with cash flow.

The total assets turnover does not significantly differ between two groups of companies. Both the companies before bankruptcy and other companies generate revenues in the crisis period. But the companies which expect failure often sell their long-term tangible assets either to bridge the gap in the production or to offload the useless assets after reduction of production.

The liability turnover and accounts receivable turnover are significantly lower in the companies before bankruptcy. The median liability turnover is lower than the median accounts receivable turnover in both groups. It means that the construction companies often use the commercial credit by their suppliers.

4. Conclusion

The aim of the paper is to discover the symptoms of the forthcoming bankruptcy in the Czech construction industry. Based on the statistical hypotheses testing, the symptoms of the business failure are found.

The construction companies went bankrupt due to the extremely high debt ratio (often higher than 100 %) and deep long-long term losses. This combination does not enable them to generate enough sources to cover the costs on debt service. The short-term liabilities are the key problem. However, they can be reduced more promptly than the long-term liabilities if the financial management properly works.

The current and cash liquidity of the construction companies before bankruptcy is significantly lower than in other companies. There is high share of accounts receivables of which mainly irrecoverable claims are the most dangerous. Moreover, the construction companies often use the commercial credit by their suppliers. When the construction companies get into problems with solvency, the suppliers do not receive money and can fall in financial difficulties. So, the crisis quickly shifts to other branches.

Finally, it can be concluded that an inappropriate financial management is one of the main sources of business failure in the construction industry. The companies should manage the debts more carefully in relation to their profitability. They should also create own financial reserves to overcome a crisis.

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New skill requirements of financial managers

Ľubica Štefániková, Gabriela Masárová [1]

Abstract

Due to continuing market instability in addition to the main financial activities of each enterprise managers put increasing emphasis on identifying, analysing and sharing information on innovations, customers, competitors, government activities and other aspects of the external environment in order to maximize market opportunities for minimizing risks. Obviously, financial managers and professionals continue to deal with a wide range of financial processes, transactions and analyses. Strengthening of these long-established predominantly transactional activity remains a necessity of today, but survey results, referred to in this paper, shows that new strategic skills and knowledge of competitive intelligence are required from financial managers in decision making.

Key words

Financial skill, competitive intelligence, return on investments

JEL Classification: D21, M31

1. Úvod

Tradičné finančné zručnosti vrátane znalosti finančných technológií, poznatkov o podávaní požadovaných správ a odborných vedomostí v oblasti daní i štátnej finančnej správy strácajú na význame. Z časti to môžeme považovať ako výsledok meniacej sa roly finančných riaditeľov v organizáciách, teda zmeny od ich tradičných funkcií k vykonávaniu úloh, ktoré vyžadujú analýzy pre rozhodovanie. Je to tiež odrazom aktuálnych priorít v reakcii na vonkajšie prostredie. Na konkurenčnom trhu úspech podniku stále viac závisí na získavaní dobrých znalostí o konkurenčných aktivitách a ich zmysluplné využitie pre odlíšenie svojho produktu. Zvyšujúci počet podnikov si stanovuje takýto cieľ a pre jeho dosiahnutie investujú do konkurenčného spravodajstva.

Bouthillier a Shearer (2003) sumarizujú veľký počet nepríliš odlišných definícií konkurenčného spravodajstva. Definície hodnotia ako zriedkakedy kompletné, spravidla vágne hovoriace o konkurencieschopnosti, etike a legálnosti konkurenčných činností. Na všeobecnej definícii konkurenčného spravodajstva, v praxi často neprekladaného termínu, a to Competitive Intelligence (CI), sa teoretici ani praktici nezhodujú. V nasledujúcich príkladoch definícií CI je v niektorých aspektoch zrejmý konsenzus ako aj rozpory. Lesáková (1994) sa stotožňuje s charakteristikou CI, ktorá tvrdí, že konkurenčné spravodajstvo je vytvorenie efektívneho informačného systému konkurencie, čo je základom kvality procesu analýzy konkurencie. Spoločnosť Competitive Intelligence Professional (SCIP), ktorú možno považovať za autoritu v problematike konkurenčného spravodajstva, ho v roku 2003 definovala ako systematický a etický programu zberu, analýzy a riadenia externých informácií, ktoré môžu ovplyvniť plány, rozhodnutia a operácie spoločnosti. Bill Weber,

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bývalý prezident SCIP, ako uvádza Kopec (2003), charakterizuje CI ako dynamickú podnikateľskú disciplínu na zbieranie, analyzovanie, komunikovanie a manažovanie znalostí konkurenčného podnikateľského prostredia a zahrnutie tohto spravodajstva do podnikovej stratégie tak, aby zabezpečila a udržala konkurenčnú výhodu". Podľa Fleishera (2003) je konkurenčné spravodajstvo proces, pri ktorom organizácia zhromažďuje užitočné informácie o konkurencii a konkurenčnom prostredie a ideálne ich použije na rozhodovanie a plánovanie s cieľom zlepšiť výkonnosť podniku. Konkurenčné spravodajstvo je cross-disciplína, ktorá sa snaží dosiahnuť konkurenčné výhody prostredníctvom cieleného zberu a analýzy čiastkových informácií o trhu a konkurencii (Tomek, Vávrová, 2007). Jednou z kľúčových tém konkurenčného spravodajstva je nájdenie tzv. slepých škvŕn, ktoré vedú k nedorozumeniam ohľadom fungovania trhov, konkurenčných aktivít, požiadaviek zákazníkov a smerovania do budúcnosti (Gilad, Gordon a Sudit, 2003).

Definície sú v podstate totožné vo vnímaní konkurenčného spravodajstva ako procesu, v ktorom spoločnosť sleduje, zhromažďuje, analyzuje a vyhodnocuje informácie o svojich konkurentoch a prostredí, v ktorom pôsobia. Získané výsledky z analýzy a syntézy daných informácií sú aplikované s cieľom udržať alebo získať novú konkurenčnú výhodu. Inými slovami, konkurenčné spravodajstvo je proces zvyšovania konkurencieschopnosti prostredníctvom vyčerpávajúceho ale etického analyzovania konkurencia a konkurenčného prostredia. Ide o legálny zber a analýzu informácií o možnostiach, zraniteľnosti a zámeroch konkurentov pomocou databáz a iných verejne dostupných zdrojov informácií.

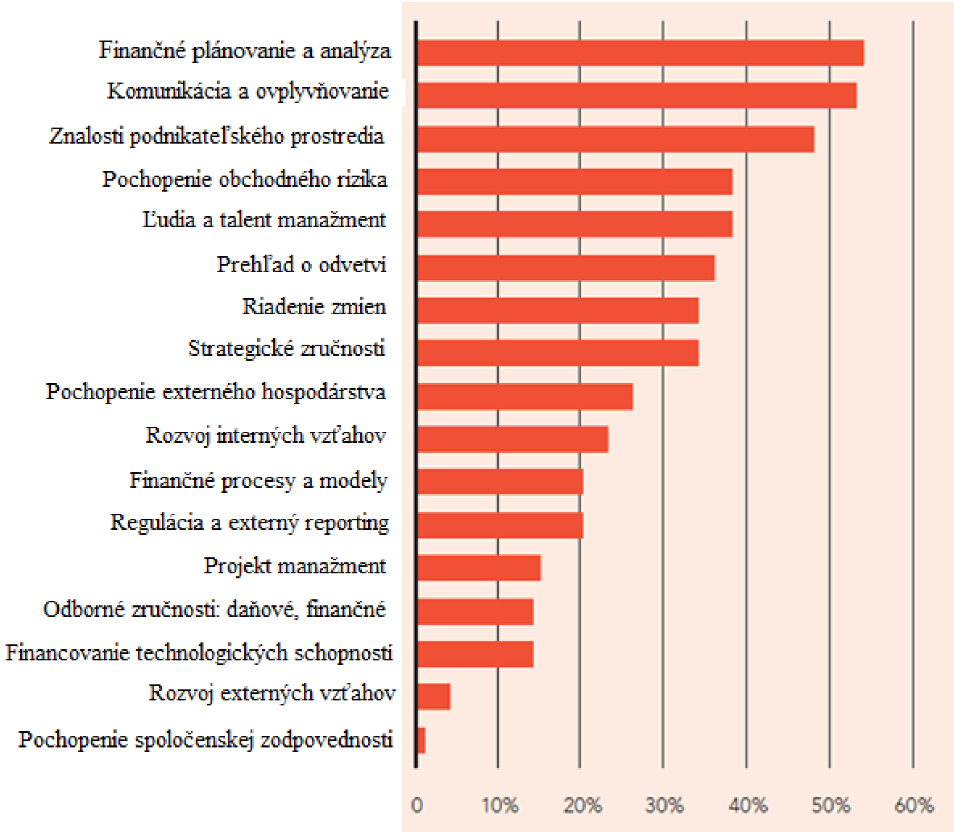
Okrem budovania konkurenčného spravodajstva mnoho finančných manažérov a profesionálov sa snaží prevziať väčšiu zodpovednosť za pre podnik kľúčové analýzy a podávanie správ. Samozrejme si taktiež musia zlepšovať svoje finančné aktivity pre riadenie výkonu pri súčasnom zlepšovaní efektívnosti a účinnosti širokej škály finančných procesov, transakcií a analýz, ktoré sú neustále kvalifikované ako nevyhnutné finančné činnosti, napriek tomu, že rôzne výsledky prieskumov nám dokazujú potrebu strategickejšej práce vo finančných oddeleniach. Medzi dané prieskumy patrí aj výskum realizovaný v októbri 2012 spoločne spoločnosťami ACCA (Association of Chartered Certified Accountants) a IMA (Institute of Management Accountants). ACCA je medzinárodne známa asociácia certifikovaných účtovníkov a IMA je združenie pre účtovných a finančných odborníkov v oblasti obchodu. Je jedným z najväčších a najrešpektovanejších združení zameraných výhradne na pokrok v oblasti vedenia účtovníctva. Prieskumu sa zúčastnilo 361 finančných lídrov vrátane generálnych riaditeľov, finančných riaditeľov, viceprezidentov a finančných kontrolórov zo 46 krajín. Výskum sa zameriaval okrem iného aj na identifikáciu a význam rôznych finančných zručností.

2. Význam nových finančných zručností

Finanční manažéri a odborníci sa samozrejme naďalej zaoberajú širokou škálou finančných procesov, transakcií a analýz. Posilnenie týchto dlhodobo zavedených prevažne transakčných aktivít ostáva naďalej nutnosťou súčasnej doby. Toto potvrdzujú aj výsledky vyššie spomínaného prieskumu, zobrazeného na obrázku 1. Finančnému plánovaniu a schopnosti analýzy bola priradená najvyššia priorita medzi zručnosťami finančného lídra podniku. Tieto vedomosti boli nasledované schopnosťou komunikácie a ovplyvňovania, pomocou ktorých sa finanční lídri snažia rozšíriť povesť a úlohu finančného oddelenia v podnikaní.

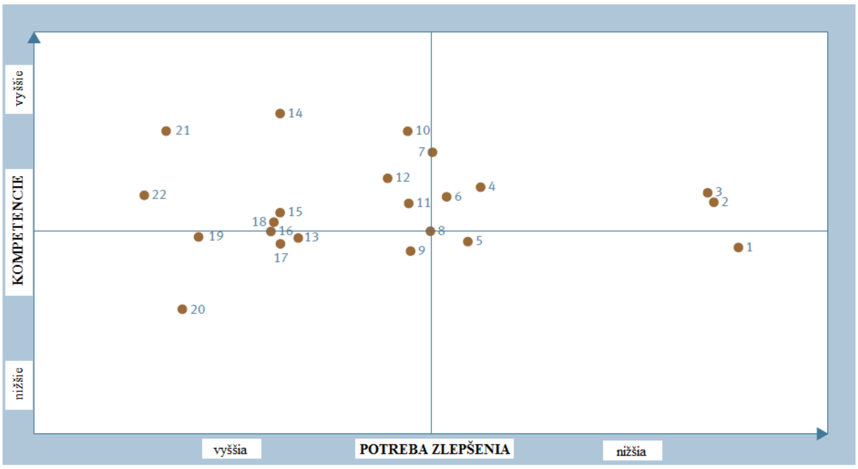
Výsledky sú v súlade so závermi rokovaní finančných riaditeľov organizovanými inštitúciami ACCA a IMA, kde komunikačné zručnosti boli uvádzané ako veľmi dôležité a taktiež vysoko hodnotená schopnosť vyžadujúca od finančných lídrov bola schopnosť „hovoriť rovnakou rečou". Finanční lídri sú si vedomí potreby znalosti podnikateľského prostredia, čo jasne vyplýva z nestabilného trhu a tlaku na finančné funkcie s cieľom pomáhať vedeniu podnikov v rozhodovaní. Faktory preniknutie do podstaty odvetvia podniku ako aj pochopenie obchodného rizika boli v prieskume identifikované ako dôležité. To posilňuje myšlienku, že finanční lídri potrebujú k zvyšovaniu hodnoty podniku pochopiť podnikanie ako také ako aj podnikateľské prostredie. Z tohto dôvodu si podniky začínajú uvedomovať význam tvorby konkurenčného spravodajstva.

Obrázok 1: Význam rôznych finančných zručností



Ďalším prieskum, ktorý sa zaoberal okrem iného aj identifikovaním hlavných priorít a kľúčových oblastí finančných činností, uskutočnila v roku 2012 organizácia Protiviti, globálna konzultačná spoločnosť v oblasti financií, technológií, prevádzky, riadenia, rizika a interného auditu. Prieskumu sa zúčastnili finanční úradníci, viceprezidenti, finanční riaditelia a kontrolóri, ktorí predstavovali vzorku všetkých priemyselných odvetví. Respondenti boli požiadaní, aby posúdili na stupnici od jednej do piatich ich kompetencie v 22 oblastiach procesných možností so zameraním na finančnú analýzu, pričom jedna je najnižšia úroveň kompetencie a päť najvyššia. Dopytovaní boli požiadaní, aby uviedli, či majú dostatočné spôsobilosti alebo je ich potrebné zlepšiť s prihliadnutím na ich podnik a odvetvie. Obrázok 2 znázorňuje mapu porovnávajúcu hodnoty veličín “potreba zlepšenia” a “kompetencie” finančných činností.

Obrázok 2: Percepčná mapa finančných procesných možností

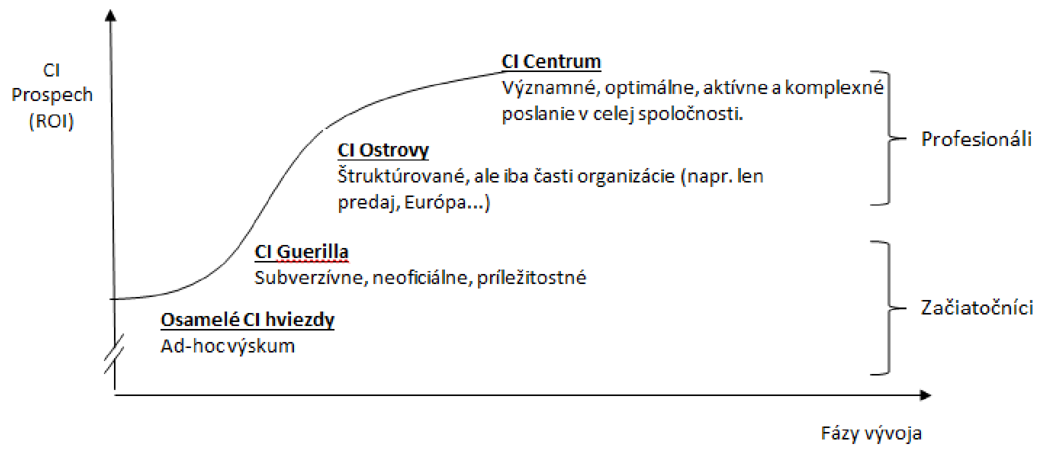


Číslo	Procesné možnosti	Číslo	Procesné možnosti
1	Competitive intelligence	12	Viacročný rozpočet
2	Business intelligence	13	Cenový manažment
3	Manažérsky informačný systém	14	Ročný rozpočet
4	Analýza rentability (produkt, zákazníci, distrubučný kanál...)	15	Ad hoc nefinančný reporting
5	Reporting o rentabilite - zákazník	16	Reporting kontroly
6	Strategické plánovanie	17	Iný štatistický reporting
7	Manažment výkonnosti	18	Reporting o rentabilite - segment
8	Reporting o rentabilite - produkt	19	Projekt manažment
9	Reporting o rentabilite - distribučný kanál	20	Štruktúra manažmentu rizika podniku (COSO ERM)
10	Periodické prognózy	21	Finančný reporting vedenia podniku
11	Ad hoc reporting	22	Externý reporting

Respondenti prieskumu, hlavne finanční manažéri, uviedli ako najvýznamnejšiu oblasť, ktorú treba posilniť práve konkurenčné spravodajstvo. Celopodnikové konkurenčné spravodajstvo umožňuje spoločnostiam preskúmanie vonkajšieho prostredia, ktoré manažéri potrebujú na identifikáciu nových príležitostí rastu a minimalizáciu alebo zrušenie rizika. Konkurenčné spravodajstvo musíme chápať ako komplexný proces, ktorý sa stáva účinnejším, ak je skupina ľudí, ktorí sú zakomponovaní do tohto procesu väčšia a rozmanitejšia, existuje medzi nimi kooperácia a výsledok ich činností sa dá kvantifikovať.

Mnoho organizácií sa snaží merať úspech konkurenčného spravodajstva. Ako uvádza Işık et al. (2013), niektoré podniky sa snažia kvantifikovať hmatateľné výhody a používať explicitné kritéria, ako je napríklad návratnosť investícií (ROI). Podľa viacerých autorov (Wu, 2000, Groh 2004, De Silva, 2005) sa práve tento ukazovateľ obvykle používa na meranie výkonnosti projektov konkurenčného spravodajstva. ROI je jedným z najčastejšie používaných metód pre posudzovanie ekonomickej návratnosti vzhľadom k investovaného kapitálu, a to ako pre jednotlivé investície, rovnako ako aj v celých projektoch alebo podnikoch. Helinsky (2011) uvádza, že návratnosť investície je metóda, ktorá meria pomer získaných peňazí k investovaným a ukazuje výnos (v percentách) použitej čiastky. Účelom je zistiť mieru návratnosti prostriedkov investovaných do podniku za určité obdobie a poskytnúť prehľad o ziskovosti a ekonomickej efektívnosti. Dôkazy o ziskovosti je často nutné pre pridelenie dodatočnej finančnej podpory účtovnej jednotke. Podľa Michaeli (2008) najväčší prínos pre podnik meraným prostredníctvom ukazovateľa ROI má centrum konkurenčného spravodajstva, ktoré zahŕňa niekoľko osôb, ktoré tvoria sieť konkurenčného spravodajstva. Táto sieť zastúpená vo všetkých činnostiach firmy, finančné oddelenie nevynímajúc, má väčšiu šancu zachytiť presnejšie a aktuálnejšie signály a tiež presnejšie spracovať získané informácie ako jednotlivci. Obrázok 3 ukazuje zvýšenie návratnosti investícií dosiahnuté rozvojom komplexnosti konkurenčného spravodajstva v podniku.

Obrázok 3: Fázy vývoja konkurenčného spravodajstva



3. Záver

V dôsledku pokračujúcej trhovej nestabilite sa popri hlavných finančných činnostiach každého podniku kladie čoraz väčší dôraz na identifikáciu, analýzu a zdielanie informácií o inováciách, zákazníkoch, konkurentoch, vládnych činnostiach a iných aspektoch externého prostredia s cieľom maximalizovať príležitosti na trhu pri minimalizácií rizika. Samozrejme, finanční manažéri a odborníci sa naďalej zaoberajú širokou škálou finančných procesov, transakcií a analýz. Posilnenie týchto dlhodobo zavedených prevažne transakčných aktivít ostáva naďalej nutnosťou súčasnej doby, no do popredia stále viac preniká potreba zavedenia komplexného konkurenčného spravodajstva, a to na základe jeho najvýznamnejších preukázaných prínosov pre podnik, ako sú zvýšená kvalita informácií, zrýchlené rozhodovanie, systematické zlepšenie organizačných postupov, zlepšenie organizačnej efektivity, zníženie nákladov, skvalitnenie šírenia informácií, urýchlenie identifikácie hrozieb a príležitostí, úspora času.

Výskumný projekt

Križanová, A. a kol.: Vega č. 1/0473/12 Integrovaný model budovania hodnoty značky ako nástroja marketingového mixu podniku

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Corporate financing strategies

Jaromír Štůsek[1]

Abstract

The contribution point out the issue of strategic management optimization finance the further development of the company. This paper summarizes some of the findings of the financial analysis and its impact on the strategic management of the company in terms of financing from its own or external resources. Financial analyzes were carried out in small and medium-sized enterprises (type: family firm) of the wood industry. Financial analysis was performed using the standard basic ratio and multi-factor indicators. Results of the analysis showed that many family businesses apply a conservative approach to financing its development. Economic Results, stability and prospects of companies surveyed are favorable. The selected financial strategy is successful in the circumstances. Award equity and liabilities should be analyzed in all specific cases. Financial policy decisions must be thoroughly prepared with regard to complex effect on the price of resources, not only the standard financial indicators.

Key words

Strategic, financial analysis, finance, financial sources,enterprice.

JEL Classification: G3

1. Úvod

Organickou součásti podnikového řízení je funkcionální oblast finančního řízení. Kromě toho, představuje finanční řízení integrační propojení s dalšími součásti speciálních managementů tj. strategické řízení, projektové řízení, marketingové řízení apod. S pojmem finanční řízení se setkáváme u řady autoru kteří zdůrazňují především obsah finančního řízení zejména finanční analýzy bez kontextu na podnikovou strategii např. Kalouda,Valach apod. Kalouda definuje pojem finanční řízení jako „Podmnožinu firemních financí, která je využívána jako rozhodující nástroj podnikových financí“. (Kalouda,2011,s12). Dále autor zdůrazňuje základní funkce finančního řízení. Dluhošová zdůrazňuje strategické aspekty finančního řízení, které definuje „Finanční řízení a rozhodování má dynamické aspekty, což znamená, že je nutné řídit a usměrňovat jak strategické, taktické, tak operativní dimenze a variabilitu v čase“.(Dluhošová, 2006,s.11)

Charakteristickým znakem znalostní ekonomiky je větší propojenost a adaptace jednotlivých podnikových procesů které odrážejí celkovou strategii podniku. To se týká i realizace finančních procesů které jsou významným syntetizujícím faktorem řízení podniku. To vyžaduje od manažerů hlubší strategické myšlení odrážející interdisciplinární znalosti a dovednosti které využívájí v řízení podnikových procesů. Z tohoto pohledu autor článku chápe proces finančního řízení jako umění a soubor znalostí a dovedností, které využívají manažeři při přípravě a realizaci finančních procesů s cílem zvýšit efektivnost vynakládaných finančních prostředků a tím zlepšit konkurenční postavení na trhu a naplnit základní cíle podnikové strategii. Stejně jako ve všech oblastech řízení, tak i ve finančním řízení hraje důležitou složku rozhodovací proces. Finanční rozhodování je vymezeno tří dimenzionálním

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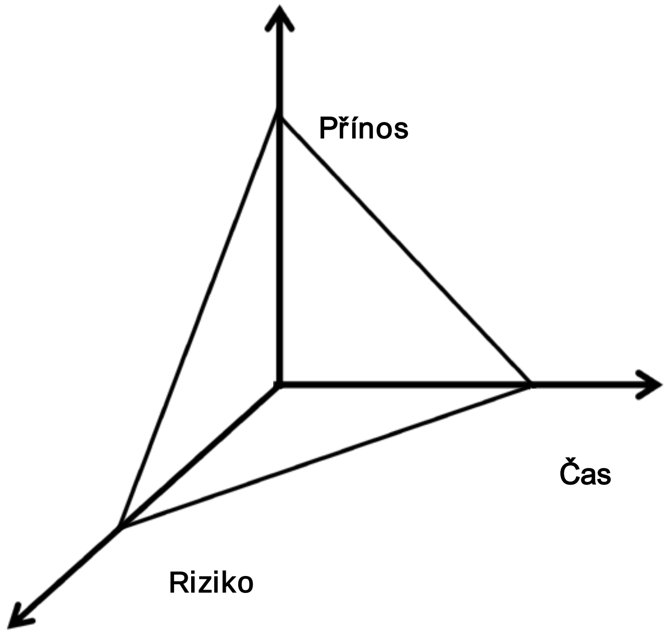
vektorovým prostorem. Vlastní prostor finančního rozhodování je limitován vektorem přínosů, vektorem rizika a vektorem času.

Schéma 1: Vektor finančního rozhodování



Finanční rozhodování je zaměřeno na optimalizaci vazeb mezi těmito třemi faktory, kdy tato optimalizace zajišťuje udržení konkurenční výhody resp. růst hodnoty podniku.

Hlavním úkolem finančního řízení je naplnění podnikové strategie při řízení finančních procesů:

- Financování - zaměřené na získávání finančních zdrojů.
- Alokace resp. investování - zaměřené na investování do různých forem hmotného i nehmotného majetku.
- Ekonomické řízení výkonnosti podnikových procesů.

Jedním z důležitých oblastí finančního řízení je získávání finančních prostředků. Pro další rozvoj podniku musí podnik získat finanční zdroje ve formě peněžních prostředků nebo investičních prostředků tzn. zdroje které rozšiřují pasivní i aktivní stránku rozvahy. Problematika optimalizace financování podniků je neustále diskutovaný problém jak ve finanční teorii tak v praxi. V této souvislosti je nutno se zmínit, že existuje řada teorií které rozebírají problematiku optimalizace finanční struktury podniku. Jedná se například o klasickou teorii optimalizace finanční struktury, která považuje za základní kriterium minimalizace průměrných nákladů kapitálů. Ostatní teorie respektují více kritérií pro rozhodování. Například teorie Brealeyho- Myerse uvádí čtyři dimenze (daně, riziko, typ aktiv a finanční volnost) kapitálové struktury podniku. Tito autoři dále zdůrazňují, že „firmy s odvětví s podstatnou převahou hmotných aktiv, nižším rizikem a stabilními zisky se více zadlužují než firmy s převahou nehmotných aktiv či firmy s větší flexibilitou a možností volných investičních příležitostí“ (Valach, 2006.s.304). Výše zmíněná tvrzení jsou založena především na zkoumání podnikových ukazatelů při respektování vnějších determinantů. Tyto determinanty autoři více nezkoumají. Autor článku na základě praktických a teoretických zkušenosti je přesvědčen, že vliv vnějších faktoru, zejména pak charakter odvětví, ve kterém firma podniká ovlivňuje až z 50% finanční strukturu podniku.

V praxi této oblasti není věnována taková pozornost zejména u malých a středních podnikatelských subjektů. Důvodem může být skutečnost, že tyto podniky řeší více provozních každodenních problémů a optimalizace financování podniku nepřikládají takový význam. V rámci standardizovaných rozhovorů jsme se setkali s názorem „Tyto ukazatele nejsou pro nás důležité – když firma funguje, tvoří zisk a máme peníze".Rovněž si neuvědomují, že finanční rozhodování má vliv na hodnotu podniku a tudíž na postavení firmy na trhu. Každý podnik musí sledovat a vyhodnocovat zdroje podnikového kapitálů neb každý kapitál představuje pro podnik určitý finanční náklad.

V rámci podnikové praxe se setkáváme se strategií využití vlastního či cizího kapitálu. Využití záleží vždy na okolnostech. Vlastní kapitál je vhodné investovat např. pro financování investic s vysokou mírou rizikovosti. Při použití vlastního kapitálů by měly náklady odrážet konkrétní odvětví podnikání a konkrétní situaci podniku. Obecně je možné říci, že náklady na vlastní kapitál se pohybují mezi 10-25%. Výhody financování vlastním kapitálem je skutečnost, že nemusíte brát zřetel na povinné pravidelné platby.

Obecně je levnější financování cizím kapitálem. Většinou náklady cizího kapitálu jsou levnější než vlastního kapitálu. Náklady cizích zdrojů, které představují úroky jsou pro podniky většinou daňově uznatelnými náklady. V současnosti lze vysledovat trend, že banky běžně poskytují dluh do výše maximálně 60% co se týče poměru zapojení vlastního a cizího kapitálu.

2. Cíl a metody

Příspěvek je zpracován na základě výzkumu financování malých a středních podniku. Výzkum je zaměřen především na vliv vnějších determinantů zejména charakteru odvětví ve kterém podniky fungují na finanční strukturu podniku v kontextu vlastních finančních ukazatelů. V teorii je málo popsaná vazba mezi finančními ukazateli odvětví a fungováním odvětví.

V příspěvku jsou prezentované některé výsledky finanční analýzy a strategie zkoumaného souboru podniků z oblasti dřevozpracujícího průmyslu. Cílem článku je posouzení problematiky finanční struktury zkoumaných podniku ve vazbě na zvolenou strategii financování. Při zpracování uvedeného tématu byly využity metody finanční analýzy, Altmanův index (Altman Z-score), standardní rozhovory.

V tomto příspěvku se zaměřuji především na problematiku finančního analýzy podniku. Finanční analýza je nástrojem posouzení komplexní finanční situace podniku tj. podchycení základních prvků finančního systému:

- Finanční situace podniku tj. na základě kvantifikovatelných ukazatelů posoudit finanční zdraví podniku.
- Posouzení finančních ukazatelů, jedná se o poměrové ukazatele, které tvoří základ představy o finanční situaci podniku.

Vedle poměrových ukazatelů se využívá i kombinace primárních ukazatelů které hodnotí situaci podniku více synteticky tzn. spojují poměrové ukazatele s dalšími hodnotícími kritérii s využitím metod vícefaktorového hodnocení. Např. Altmanův vzorec a další.

K základním poměrovým ukazatelům patří:

1. Ukazatele rentability jakožto ukazatel tvorby míry zisku.
2. Ukazatele aktivity reprezentující relativní vázanost kapitálů v jednotlivých formách aktiv např. doba obratu zásob, pohledávek, hotových výrobků.
3. Ukazatele likvidity – cílem těchto ukazatelů je podat informace o potenciální schopnosti podniku hradit dluhy.

4. Ukazatele zadluženosti se zaměřují na hodnocení finanční struktury podniku.
5. Ukazatele kapitálové situace podniku na trhu.

Jako vstupní údaje pro finanční analýzu byly využity: rozvaha, výkaz zisku a ztrát, údaje z účetnictví. Dále byla využita některá data z manažerského účetnictví vybraných subjektů a výsledky standardizovaných rozhovorů s vlastníky podniku.

4. Výsledky a diskuse

V rámci výzkumného úkolu zaměřeného na optimalizaci strategického řízení financování malých a středních podniků v ČR byly vybrány rodinné podniky z oblasti dřevozpracujícího průmyslu. Dřevozpracující průmysl je zařazen dle klasifikace NACE 16 kde řadíme: zpracování dřeva, výroba dřevařských, korkových, proutěných a slaměných výrobků s výjimkou výroby nábytku. Podíl dřevozpracujícího průmyslu představuje přibližně18-20% celkového zpracovatelského průmyslu v ČR. Dřevozpracující průmysl se řadí mezi tradiční odvětví výroby v České republice. Je to dáno především vysokou plochou lesní půdy. Trendy v tomto odvětví předpokládají další investice do tohoto odvětví což bude zdrojem růstu produktivity práce a povede k dalšímu snižování počtu pracovníků. Celkové tržby v tomto odvětví s výjimkou výroby nábytku se pohybují mezi 2-3mld.korun ročně. Většinu podniku v tomto odvětví tvoří podniky ve vlastnictví českých majitelů, a to 98%. To představuje vysokou příležitost pro zaměstnávání českých občanů. Nejvíce zastoupena skupina pracovníků je ve věku 30 – 39 let a skupina pracovníků nad 50 let.

Celkem bylo do výzkumu vybráno 12 podniků s výrobním programem jak uvádí tabulka č. 1.

Při výběru objektu zkoumání byly zvoleny tato kritéria:

1. Rodinný podnik.
2. Výrobní program je zaměřen do oblasti dřevozpracujícího průmyslu.
3. Velikost reprezentuje malý a střední typ podniku.
4. Podniky uplatňují stejnou strategie financování z vlastních zdrojů.

Tabulka 1: Základní charakteristika zvoleného souboru zkoumání

Skupina podniků podle výrobního programu	**Počet podniků**	**Průměrný počet zaměstnanců**	**Průměrné tržby v tis.Kč**	**Pozn.**
1. Výroba násad	2	45	53262	
2. Výroba stavebního řeziva	3	12	35375	
3. Výroba truhlářského řeziva	4	13	23363	
4. Výroba palivového dřeva	3	10	13631	

3.1 Finanční analýza

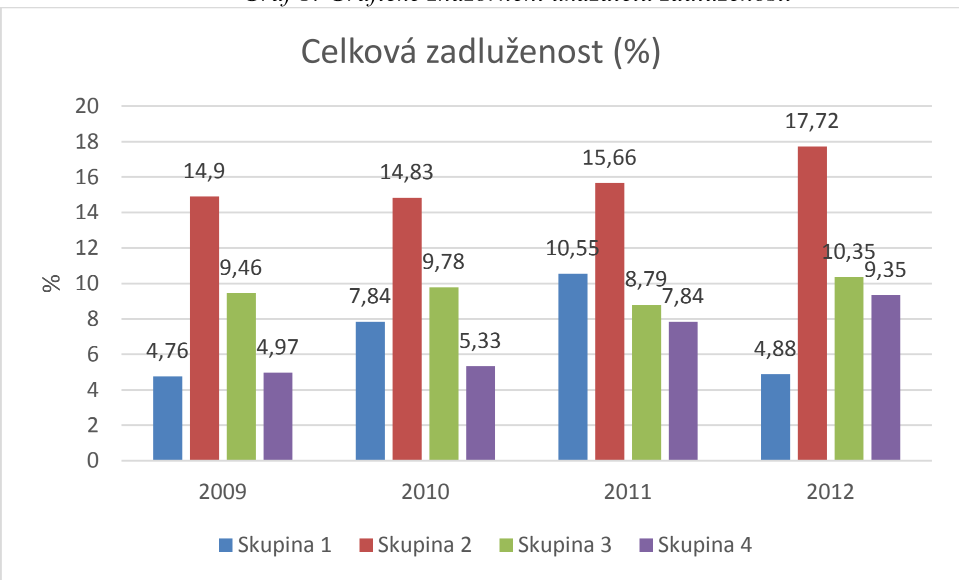
Finanční analýza jako jeden z manažerských informačních modelů je zaměřen na analýzu vybraných skupin podniků. V další části finanční analýzy jsou uvedeny agregované výsledky poměrových ukazatelů. V tabulce č. 2 jsou uvedeny ukazatelé zadluženosti.

Tabulka 2: Ukazatelé zadluženosti sledovaného souboru podniků

Sledovaná skupina podniku	Celková zadluženost v %				Vlastní kapitál v %				Zadluženost vlastního kapitálů v %			
	2009	**2010**	**2011**	**2012**	**2009**	**2010**	**2011**	**2012**	**2009**	**2010**	**2011**	**2012**
Skupina 1	4,76	7,84	10,55	4,88	95,24	92,16	89,45	95,12	5,00	8,5	11,8	5,1
Skupina 2	14,9	14,83	15,66	17,72	85,1	85,17	84,34	82,28	17,5	17,47	18,6	51,5
Skupina 3	9,46	9,78	8,79	10,35	90,54	90,22	91,21	89,65	10,45	10,84	9,64	11,55
Skupina 4	4,97	5,33	7,84	9,35	95,03	94,67	92,16	90,65	5,23	5,64	8,51	10,31

Z výsledků výzkumu vyplynulo, že rodinné firmy vykazují velmi nízkou zadluženost. Svědčí to o konzervativním přístupu k řešení finanční struktury podniku a z malé analýzy charakteru odvětví. Většinu podnikatelských aktivit financují z vlastních zdrojů. Částečně jiná situace je u podniku vyrábějící stavební řezivo kde celková zadluženost je v průměru o 6% vyšší než u ostatních skupin podniku. Důvodem je silné konkurenční prostředí a z toho vychází nutnost zvyšovat produktivitu práce nákupem moderní technologie. Samozřejmě, odráží se tam i vliv stagnace resp. poklesu stavební výroby. Tyto firmy dodávají své výrobky na trh v rámci české republiky tak i část produkce do zahraničí. Z tabulky č 2 je patrné, že firmy investují i v období ekonomických problému a možno říct, že právě firmy vyrábějící stavební řezivo získávají cizí zdroje na investování a to z důvodu, že tyto finanční prostředky jsou levnější nebo nemají dostatek vlastních finančních prostředků. Výsledky tabulky č. 1 dokresluje graf č.1

Graf 1: Grafické znázornění ukazatelů zadluženosti



Ukazatelé rentability

Jedním ze základních ukazatelů hodnocení finančního stavu podniku jsou ukazatele rentability. V tabulce č 3 jsou uvedeny údaje rentability podle jednotlivých skupin podniků

Tabulka 3: Ukazatele rentability zkoumaného souboru podniků

Sledovaná skupina podniku	Rentabilita tržeb v %				Rentabilita celkového kapitálu ROA				Rentabilita vlastního kapitálu ROE				Rentabilita dlouhodobě invest. kapitálů ROCE			
	2009	2010	2011	2012	2009	2010	2011	2012	2009	2010	2011	2012	2009	2010	2011	2012
Skupina 1	4,02	4,99	8,65	7,37	4,56	5,82	12,46	9,58	3,56	5,19	9,83	9,21	3,49	5,01	8,82	8,73
Skupina 2	9,8	8,5	10,56	9,95	6,36	8,9	11,52	9,96	4,36	5,97	8,69	9,13	4,56	5,23	7,23	8,96
Skupina 3	5,06	5,54	9,68	9,73	5,9	6,31	14,28	13,25	6,35	7,32	9,56	9,4	6,98	8,35	10,25	8,93
Skupina 4	4,8	6,3	6,4	5,7	4,9	5,8	10,56	8,49	5,45	4,32	6,35	7,81	4,46	5,23	6,96	7,35

Ukazatelé rentability vyjadřují schopnost podniku generovat zisk z investovaného kapitálu. Z rozboru uvedené tabulky vyplývá, že sledované výrobní odvětví dosahuje podprůměrných výsledků rentability, zejména co se týká podniků vyrábějících násady.

Ukazatelé likvidity

Ukazatelé likvidity signalizují schopnost podniků splácet své závazky. V tabulce č. 4 jsou uvedeny výsledky sledování zkoumaného vzorku podniků.

Tabulka 4: Ukazatelé likvidity zkoumaného souboru podniků

Sledovaná skupina podniku	Běžná likvidita				Pohotová likvidita				Okamžitá likvidita			
	2009	2010	2011	2012	2009	2010	2011	2012	2009	2010	2011	2012
Skupina 1	16,93	11,76	10,12	8,46	9,01	7,65	7,78	5,83	7,10	6,39	6,33	5,12
Skupina 2	10,56	9,33	8,35	8,69	5,43	4,35	3,38	5,65	3,92	4,59	4,96	4,98
Skupina 3	8,95	9,36	7,23	9,16	4,93	3,38	5,69	7,16	4,1	4,73	5,23	4,68
Skupina 4	8,45	8,79	9,13	5,34	5,14	6,36	7,15	7,05	6,35	5,96	6,38	7,14

Ukazatelé likvidity vykazují u všech sledovaných subjektů pozitivní hodnoty. Je do dáno tím, že většinu položek oběžných aktiv představují krátkodobý finanční majetek. Relativně vysoká solventnost podniků znamená určitou konkurenční výhodu, v podobě schopnosti splácet své závazky.

Ukazatelé aktivity

Tyto ukazatelé jsou zaměřeny na posouzení efektivity hospodaření s aktivy resp. jak dlouho má firma v aktivech vázané finanční prostředky.

Tabulka 5: Ukazatele aktivity

Sledovaná skupina podniku	Obrat aktiv - rok				Doba obratu zásob - dny				Doba obratu pohledávek - dny			
	2009	2010	2011	2012	2009	2010	2011	2012	2009	2010	2011	2012
Skupina 1	0,97	1,03	1,04	0,85	140,42	95,96	63,25	104,81	41,30	33,29	36,35	31,29
Skupina 2	1,10	1,23	1,42	1,09	132,1	128,23	119,45	134,21	56,95	61,35	55,28	59,42
Skupina 3	0,86	1,05	1,10	0,96	95,84	86,23	89,26	94,38	46,51	48,63	52,79	61,38
Skupina 4	1,02	0,99	0,89	0,96	86,93	81,51	92,46	95,78	35,89	28,65	29,29	30,86

Ukazatele aktivity si udržují relativně stabilní hodnotu. V rámci jednotlivých let existují výkyvy, které jsou zapříčiněny hospodářskou situaci v jednotlivých odvětvích. V odvětví dřevozpracujícího průmyslu je nutné počítat s vyššími zásobami. Vyplývá to s těžební činnosti, která není u některých druhů dřevin rovnoměrně rozložená v průběhu roku. Jedná se například o listnaté dřeviny. Dále delší technologický proces zpracování dřevní hmoty tj. zejména umělé sušení.

3.2 Altmanuv – model Z –score

Uvedený model je založen na skupině pěti poměrových ukazatelů kterým jsou přiděleny koeficienty plnící funkci vah. Cílem modelu je stanovit finanční situaci firmy pomocí agregátní jediné hodnoty. Tato hodnota představuje s jakou pravděpodobností se může podnik dostat do bankrotního stavu ve střednědobém horizontu. Pravděpodobnost se získá zařazením výsledné hodnoty modelu do jednotlivých pásem, intervalů hodnot. Model využívají např. banky pro posouzení finančního zdraví podniku. Základní vztah uvedeného modelu je:

Z-skóre = $0{,}717 \times x_1 + 0{,}847 \times x_2 + 3{,}107 \times x_3 + 0{,}420 \times x_4 + 0{,}998 \times x_5$

Číselné údaje v Z-skóre představují váhy jednotlivých proměnlivých veličin, reprezentovaných jako „x“. Za „x“ se dosazují jednotlivé poměrové ukazatele.

Na základě výše uvedené rovnice můžeme vypočítat Z-scoré a výsledky zařadit do níže uvedeného hodnotícího intervalu(Marinič,2008,s.92).

- Z < 1,18 „Pásmo bankrotu“,
- 1,18 > Z < 2,99 ”Šedá zóna”,
- Z > 2,99 „Prosperující podnik“.

Podniky které nabývají hodnoty Z- score vyšší než 2,99 představují finančně zdravé podniky s velmi malým rizikem bankrotu. Opačnou skupinou jsou podniky zařazené do intervalu 1,18. Tyto podniky jsou pro věřitele velmi rizikové, potýkají se s finančními problémy a riziko bankrotu je veliké.

Podniky s hodnotou intervalu mezi 1,18 a 2,99 nejsou úplně rizikové, ale rozhodně k důvěryhodným nepatří. Nezlepší-li svoji finanční situaci, je pro ně ve střednědobém horizontu velice reálné riziko bankrotu.

Tabulka 6: Propočet Altmanova Z- score

Sledovaná skupina podniku	**Z - score**			
	2009	**2010**	**2011**	**2012**
Skupina 1	9,81	7,35	6,88	6,34
Skupina 2	3,34	2,99	2,35	2,86
Skupina 3	4,34	6,1	5,42	4,3
Skupina 4	8,35	7,21	6,39	5,98

Z tabulky č. 6 vyplývá, že Z – scoré u všech sledovaných podniků přesahuje doporučené hodnoty 2,99 což znamená, že skupinám podniků nehrozí bankrot. Uvedené podniky je možné označit za prosperující a důvěryhodné a finančně zdravé. Vyjímku tvoří podniky ve skupině 2 – výroba stavebního řeziva kde hodnoty v letech 2010 až 2012 se nacházejí v pásmu 1,18-2,99 což představuje šedou zonu a tudiž je potřeba věnovat hospodaření větší pozornost.

Struktura investování

Zkoumané podniky v průběhu sledovaného období neustále investovali do rozšíření majetkové struktury podniku. Průměrný přehled investic podle jednotlivých skupin podniku uvádí tabulka č. 7.

Tabulka 7: Průměrná hodnota investic podle sledovaných skupin

Sledovaná skupina podniku	Průměrná investice v mil.Kč			
	2009	2010	2011	2012
Skupina 1	2,0	1,14	4,2	3,2
Skupina 2	2,5	5,1	1,2	3,8
Skupina 3	1,5	2,7	0,9	0,6
Skupina 4	0,5	1,6	1,0	0,7

Analýzou bylo zjištěno, že zkoumané podniky investují v průměru ročně od 500 tis. do 5 mil Kč. Nižší investice jsou ve skupině podniku 4, které vyrábějí palivové dříví. Větší investice realizují firmy z oblasti výroby stavebního řeziva a výroby násad. Většina těchto investic byla pořízená z vlastních zdrojů. Ve skupině výroba stavebního řeziva byla jedna investice realizována z cizích zdrojů v celkové hodnotě kolem 10 mil.Kč. Investice většinou směřovaly do technologie výroby a manipulační techniky.

3.3 Závěry s finanční analýzy

Z finanční analýzy výsledků u zkoumaného vzorku vyplývá, že sledované podniky mají relativně stabilní finanční portfolio. Zvolená finanční strategie preference vlastního kapitálu před cizím se ukazuje jako oprávněná a robustní vůči turbulencím podnikatelského prostředí. Většina rodinných majitelů firem zamítá preferenci teoreticky správného doporučení, že cizí zdroje jsou levnější a vedou k vyšší efektivitě celého podniku. Zastává stanovisko – a také tak činí prakticky - že dosažený zisk je nutné vracet do výroby a tím snižovat požadavky na cizí zdroje. Jedinou výjimkou je skupina podniku vyrábějící stavební řezivo, kde zadluženost je vyšší než u ostatních skupin. Vyplývá to se zvláštností odvětví stavební výroby, které je silně konkurenční a proto je nutné zvyšovat produktivitu práce nákupem moderní techniky i s využitím cizích zdrojů. Kromě toho poptávka po řezivu má vysokou fluktuaci a dostupnost suroviny rovněž. Obě fluktuace jsou v různé fázi vlivem sezónnosti těžby, kampaňovitým odkupem surovin na vývoz aj. Nutnost tyto fluktuace sladit je vhodným případem využití krátkodobých cizích zdrojů.

Zvolená strategie financování s minimálním podílem cizích zdrojů se prosazuje a je obvykle i přiměřená v těch odvětvích, kde existují nízké bariery vstupu do odvětví a vysoce konkurenční prostředí. Podniky využívají jako cizí zdroje leasingu na nákup technologií a krátkodobých úvěrů především na předzásobení vstupní surovinou.

Důsledkem zvolené strategie je skutečnost, že většina zkoumaných podniků je překapitalizovaná, což je způsobeno vysokým podílem vlastního kapitálu, především krátkodobého finančního majetku. To se projevuje ve všech ukazatelích finanční analýzy. Vysoké hodnoty u těchto ukazatelů lze sledovat u podniků skupiny 1, 3, 4. Tyto hodnoty můžeme označit za extrémní v porovnání s doporučenými nebo s hodnotami dosaženými jinými podniky v odvětví.

Nadměrná kapitalizace signalizuje nevyužité možnosti a rezervy ve využití kapitálu. Bližším zkoumáním bylo zjištěno, že tento v podstatě negativní trend je ve skutečnosti tím menším zlem a je reakcí na podmínky na trhu. Finanční stabilita a finanční zdraví zkoumaných podniků není ve skutečnosti vykoupena nerealizováním lepšího uplatnění vlastního kapitálu, protože finanční trh v uplynulém období neposkytuje dostatek alternativních investičních možností, jejichž výnos, riziko a likvidita by výrazně konkuroval těmto parametrům u investice do vlastní firmy. Zde se potvrzuje správnost úvahy z teoretického rozboru o ceně cizích zdrojů a sice, že za daných poměrů není cena cizího kapitálu výrazně nižší než cena vlastního kapitálu a malý rozdíl není důvodem k podstupování vyššího rizika, snášení režie obsluhy manipulace s cizími zdroji a vystavení podniku řadě provozních problémů. Rovněž je třeba vzít v úvahu nevyčíslené hodnoty jako je renomé nezadluženého podniku u odběratelů, dodavatelů i potenciálních poskytovatelů cizích zdrojů do budoucna.

Na příkladu zkoumaných podniků je vidět, že navzdory omezené tvorby vlastních zdrojů dochází k jejich tvorbě, akumulaci a investování tam, kde má vlastník pod kontrolou riziko i výnosnost. Cenné je zejména to, že investice při takto zvolené strategii jsou plynulým procesem, který vede k zachování a stabilitě zaměstnanosti i produkce a k inovaci výroby. Teoretické teze, že cizí zdroje jsou zpravidla vždy levnější, je třeba vždy zkoumat v konkrétních podmínkách odvětví podnikání. V širších souvislostech je třeba poukazovat na to, že daleko větším problémem je zbytečné odčerpávání vlastních zdrojů z podniků jinými kanály. Přitom jen u zkoumaných podniků činil během let 2009-2012 investic i při omezených zdrojích více než 41 mil.Kč. s převahou investic do inovací, do úspor energií a do rozšíření výroby.

5. Závěr

Jak prokazuje výzkum v tomto příspěvku, pro úspěšné zvládnutí procesů strategického rozhodování o finanční struktuře podniku je nezbytné dle potřeby provádět v podniku řadu analýz dané vektorem finančního rozhodování. Jedná se především o analýzy času odrážející vývojové fáze podniku a vývojové fáze odvětví (trhu), analýzy rizika založené především na pravděpodobnostních propočtech (finanční veličiny jsou náhodné). Analýzy přínosu na základě finančních a ekonomických ukazatelů. S ohledem na potřebu podpory strategického finančního rozhodování je potřebné v dalším výzkumu připravit vhodný analytický nástroj – parametrizovatelný model pro what-if analýzu, který umožní jednoduché výpočty a porovnání cen vlastních a cizích zdrojů včetně zahrnutí kumulativních nákladů kapitálu a ocenění schopnost strategie na adaptability zvolené finanční strategie.

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Using the Finite Difference Method for Chooser Option Pricing

Lucia Švábová, Marek Ďurica [1]

Abstract

The paper deals with the determination of chooser option prices using one numerical method – Finite difference method. The basis for pricing of all derivative instruments is the Black – Scholes partial differential equation. In this article we show the way to use selected numerical method for Chooser options whose underlying asset is non dividend paying share. We also present the example of the application of explicit Finite difference method for the Chooser option with the selected parameters.

Key words

Finite difference method, Explicit method, Option pricing, Chooser option, Black – Scholes model.

JEL Classification: C02, G00

1. Úvod

Obchodovanie s finančnými derivátmi je dnes veľmi dôležitou súčasťou finančných trhov. Rôzne druhy finančných derivátov sú v súčasnosti viac či menej využívané a prax ukázala, že je nevyhnutné správne stanoviť cenu každého druhu finančného derivátu, aby sa predišlo špekuláciám alebo arbitrážnym príležitostiam, ktoré by mohli obchodníkom priniesť bezrizikový zisk.

Chooser opcie (niekedy označované ako *„as you like it“ opcie*) sú špeciálnym typom exotických opcií, pri ktorých má vlastník právo v určitom definovanom čase počas jej životnosti rozhodnúť sa, či daná opcia bude call (kúpna) alebo put (predajná). Cenu ázijskej opcie je možné numericky odhadnúť metódou konečných diferencií, ktorej základom je najpoužívanejší nástroj v oblasti oceňovania finančných derivátov, a to Blackov – Scholesov model. Metóda konečných diferencií spočíva jednak v zúžení oboru riešenia len na konečný počet bodov a tiež v nahradení parciálnych derivácií v Blackovom – Scholesovom modeli danými diferenciami. Týmto spôsobom dostaneme sústavu rovníc, odhad ceny opcie získame iteračnou metódou.

2. Základné pojmy

Finančný derivát je finančný nástroj, ktorého hodnota je odvodená od hodnoty iného finančného aktíva, ktoré sa nazýva podkladové aktívum (napr. akcie, burzový index, výmenný

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kurz a pod.). ***Opcia*** je finančný derivát, ktorej vlastníctvo prináša držiteľovi právo na kúpu alebo predaj daného podkladového aktíva (napr. akcie) v dohodnutom čase T v budúcnosti za dohodnutú realizačnú cenu X. Vyrovnanie opcie nemusí povinne prebehnúť, vlastník môže opciu nechať vypršať bez uplatnenia. ***Call opcia*** je typom kúpnej opcie, teda prináša jej vlastníkovi právo kúpiť dané podkladové aktívum (napr. akciu). ***Put opcia*** je typom predajnej opcie, teda prináša jej vlastníkovi právo na predaj daného aktíva. [4]

Vnútorná hodnota opcie v čase t je u call opcie daná

$$c = \max(S_t - X, 0),$$

u put opcie je daná

$$p = \max(X - S_t, 0).$$

Táto hodnota závisí od toho, či uplatnenie opcie v danom časovom okamihu by prinieslo majiteľovi opcie zisk (vo výške $S_t - X$ pri call opcii alebo $X - S_t$ pri put opcii), a teda držiteľ opcie ju uplatní, alebo by mu uplatnenie neprinieslo zisk, nakoľko by mohol v tomto okamihu kúpiť dané aktívum na trhu lacnejšie ako má dohodnuté v call opcii (alebo predať drahšie pri put opcii). Vtedy opciu držiteľ neuplatní a jeho zisk z nej je teda nulový.

Put – call parita je vzťah medzi cenou kúpnej a predajnej opcie viazanej na to isté podkladové aktívum (akciu) s cenou S:

$$c + Xe^{-rT} = p + S \tag{1}$$

pre bezdividendovú akciu, prípadne

$$c + Xe^{-rT} = p + Se^{-qT}, \tag{2}$$

ak podkladová akcia prináša spojitý dividendový výnos q % ročne.

Chooser opcia je takým druhom exotickej opcie, pri ktorej si jej vlastník môže v stanovenom čase počas doby jej životnosti vybrať, či táto opcia bude typu call alebo put, teda či ju využije na kúpu alebo na predaj dohodnutého podkladového aktíva. Tento čas voľby označíme T_1. V tomto čase je hodnota chooser opcie daná ako

$$v = \max(c, p),$$

kde c je hodnota zodpovedajúcej call opcie a p je hodnota zodpovedajúcej put opcie. [2]

V prípade, že obe opcie, call aj put, sú európskeho typu a majú rovnakú realizačnú cenu a rovnakú dobu životnosti T_2, môžeme na základe put – call parity stanoviť hodnotu chooser opcie v čase T_1 ako

$$\begin{aligned} v = \max(c, p) &= \max\left(c, c + X \cdot e^{-r(T_2 - T_1)} - S_1 \cdot e^{-q(T_2 - T_1)}\right) = \\ &= c + e^{-q(T_2 - T_1)} \cdot \max\left(0, X \cdot e^{-(r-q)(T_2 - T_1)} - S_1\right) \end{aligned}.$$

V takomto prípade teda môžeme chooser opciu považovať za package, ktorý sa skladá z dvoch častí: [2]

- call opcie s realizačnou cenou X a dobou do splatnosti T_2,
- $e^{-q(T_2 - T_1)}$ put opcií s realizačnou cenou $X \cdot e^{-(r-q)(T_2 - T_1)}$ a dobou do splatnosti T_1.

V prípade, že zodpovedajúca call a put opcia v chooser opcii nemajú rovnaké parametre, ako je doba realizácie alebo expiračná cena, nezodpovedá táto chooser opcia už package, ale skôr má vlastnosti podobné zloženej opcii (call na put a pod.). [2]

2.1 Blackov – Scholesov model oceňovania opcií

Blackov – Scholesov model je v súčasnosti najpoužívanejším modelom na ocenenie európskych opcií na bezdividendové akcie. Blackov – Scholesov model pre stanovenie výšky ceny opcie vychádza z niekoľkých predpokladov: [1]

1. Cena akcie sa dá popísať geometrickým Brownovým pohybom s konštantnými parametrami μ (očakávaná miera návratnosti akcie) a σ (miera neistoty alebo rizika, volatilita ceny akcie).
2. Akcie je možné predávať nakrátko s plným využitím výnosu, pričom pri krátkom predaji nie je potrebné žiadne krytie. Predaj akcie nakrátko znamená, že obchodník predá „požičanú“ akciu, ktorú v skutočnosti nevlastní, nakoľko predpokladá, že tento obchod mu prinesie zisk. Neskôr predmetnú akciu kúpi a „vráti“ majiteľovi. Pri takomto obchodovaní sa v praxi vyžaduje peňažné krytie ako záruka za pôžičku.
3. Transakčné náklady a dane, spojené s obchodovaním s cennými papiermi, sú nulové. Všetky cenné papiere sú ľubovoľne deliteľné, teda je možné obchodovať aj so zlomkom cenného papiera.
4. Podkladová akcia, na ktorú je viazaný derivát, neposkytuje počas životnosti derivátu žiadne dividendy.
5. Arbitrážne príležitosti sú vylúčené.
6. Obchodovanie s cennými papiermi prebieha v spojitom čase.
7. Bezriziková úroková miera r je konštantná a rovnaká pre všetky doby viazanosti. [6]

Pri splnení týchto predpokladov platí ***Blackova – Scholesova parciálna diferenciálna rovnica***

$$r f = \frac{\partial f}{\partial t} + r S \frac{\partial f}{\partial S} + \frac{1}{2}\sigma^2 S^2 \frac{\partial^2 f}{\partial S^2}.$$

Táto rovnica má nekonečne veľa riešení, ktoré závisia od zvolených začiatočných podmienok. Tieto podmienky udávajú hodnoty derivátu v okrajových hodnotách podkladovej akcie S a času t. Pre klasickú európsku call opciu sú okrajové podmienky dané

$$f\left(0,t\right)=0,$$

teda cena call opcie pre akciu s nulovou cenou je nulová; a tiež

$$f\left(S,t\right)\approx S$$

pre $S \to \infty$, teda cena call opcie s podkladovou akciou s teoreticky nekonečne veľkou cenou sa približne rovná cene tejto akcie. Avšak najdôležitejšia podmienka je daná payoff (výplatnou) funkciou, a to:

$$f = \max\left(S_T - X, 0\right) \tag{3}$$

pre call opciu a

$$f = \max\left(X - S_T, 0\right) \tag{4}$$

pre put opciu, pričom S_T je cena podkladovej akcie v čase exspirácie T a X je realizačná cena opcie.

Za platnosti spomenutých predpokladov, začiatočných a okrajových podmienok, je riešením Blackovej – Scholesovej rovnice pre cenu európskej opcie vzorec

$$c = S N\left(d_1\right) - X e^{-rT} N\left(d_2\right)$$

pre call opciu a

$$p = X e^{-rT} N\left(-d_2\right) - S N\left(-d_1\right)$$

pre put opciu. Pritom N(d_1) a N(d_2) sú hodnoty distribučnej funkcie rozdelenia pravdepodobnosti normovanej normálnej náhodnej premennej v d_1 a d_2, ktoré sú dané [2]

$$d_{1,2} = \frac{\ln\left(\frac{S}{X}\right) + \left(r \pm \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}.$$

2.1.1 Blackov – Scholesov – Mertonov model

Najdôležitejším problémom uvedeného Blackovho – Scholesovho modelu je predpoklad o bezdividendovom podkladovom aktíve, na ktoré je derivát viazaný. Tento model teda predpokladá, že podkladová akcia nevypláca počas doby životnosti derivátu žiadne dividendy, čo v reálnej praxi nastáva málokedy. S väčšinou akcií je spojená výplata dividendy, teda túto skutočnosť je treba do predpokladov modelu zapracovať. Týmto problémom sa zaoberal Robert Merton, ktorý do modelu zahrnul aj predpoklad o možnom dividendovom výnose z podkladového aktíva, na ktoré je derivát viazaný. ***Blackova – Scholesova – Mertonova diferenciálna rovnica*** má potom tvar

$$r f = \frac{\partial f}{\partial t} + (r - q) S \frac{\partial f}{\partial S} + \frac{1}{2}\sigma^2 S^2 \frac{\partial^2 f}{\partial S^2}.$$

Tento model spočíva v tom, že v pôvodnej verzii Blackovho – Scholesovho modelu nahradíme cenu akcie S cenou zníženou o dividendový výnos, teda akcia bude mať cenu $Se^{-q(T-t)}$. Potom Blackove – Scholesove – Mertonove vzorce pre stanovenie ceny európskej opcie na akciu s dividendovým výnosom vo výške q % p.a. sú

$$c = Se^{-qT} N(d_1) - Xe^{-rT} N(d_2),$$

$$p = Xe^{-rT} N(-d_2) - Se^{-qT} N(-d_1),$$

pričom

$$d_{1,2} = \frac{\ln \frac{S}{X} + \left(r - q \pm \frac{\sigma^2}{2} \right) T}{\sigma \sqrt{T}},$$

kde q je spojitý dividendový výnos vyplácaný v % z ceny akcie. [2]

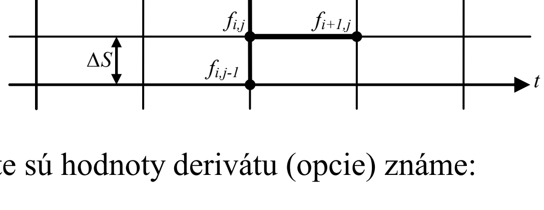
2.2 Oceňovanie opcií metódou konečných diferencií

Riešenie Blackovej – Scholesovej parciálnej diferenciálnej rovnice sa podstatne zjednoduší, ak definičný obor riešenia zúžime len na konečný počet bodov. Tento prístup je podstatou ***metódy konečných diferencií***. Tieto body riešenia zvolíme tak, že definujeme v súradnicovej sústave čiary rovnobežné s osami súradnicovej sústavy (osi súradnicovej sústavy sú tvorené časom a cenou podkladového aktíva – akcie). Definované čiary sa budú pretínať v uzloch siete, v ktorých budeme hľadať riešenie rovnice.

Hodnota derivátu v jednotlivých bodoch siete je vždy závislá od hodnôt v najbližších susedných uzloch siete v smere osi x (času) aj y (ceny akcie). Základom algoritmu stanovenia ceny derivátu pomocou metódy konečných diferencií je nahradenie parciálnych derivácií v Blackovej – Scholesovej diferenciálnej rovnici danými diferenciami.

Popisovaná sieť deliacich bodov je znázornená na nasledujúcom obrázku. [5]

Obrázok 1: Sieť deliacich bodov pre metódu konečných diferencií



V krajných bodoch siete sú hodnoty derivátu (opcie) známe:

- v čase $t = T$ bude hodnota call, resp. put opcie daná jej payoff funkciou (3) alebo (4) pre príslušnú cenu podkladovej akcie $S_j = j \cdot \Delta S,\ j = 0,1,\ldots, n$,
- pre akciu s nulovou cenou má opcia hodnotu 0, hodnota put opcie v týchto bodoch potom vyplýva z put – call parity (1) alebo (2),
- pre akciu s maximálnou cenou má zase put opcia nulovú hodnotu a call opcia má hodnotu vyplývajúcu z put – call parity (1) alebo (2),
- hodnoty opcie v ostatných bodoch závisia od hodnôt v susedných bodoch siete.

Pomocou daných aproximácií parciálnych derivácií v Blackovej – Scholesovej rovnici prevedieme túto diferenciálnu rovnicu na sústavu diferenčných rovníc. V sieti postupujeme smerom sprava doľava, teda od času exspirácie opcie až do času 0. V každom kroku využívame na výpočet hodnôt derivátu v danom čase známe hodnoty v okolitých bodoch siete. Ako riešenie dostaneme hodnoty ceny derivátu v čase 0.

Rozlišujeme dva základné spôsoby výpočtu pomocou metódy konečných diferencií, v závislosti od použitých daných aproximácií parciálnych derivácií, a to implicitnú a explicitnú metódu. ***Implicitná metóda*** konečných diferencií používa také aproximácie, ktoré po dosadení do Blackovej –Scholesovej diferenciálnej rovnice a úprave vedú na sústavu troch rovníc pre neznáme hodnoty derivátu v sieťových bodoch. Riešením sústavy postupne oceňujeme derivát v každom čase siete počas doby životnosti. Opakovaním postupu riešenia sústavy rovníc dostávame ceny opcie v čase 0. ***Explicitná metóda*** konečných diferencií používa také aproximácie parciálnych derivácií, po dosadení ktorých do Blackovej – Scholesovej diferenciálnej rovnice a úprave dostávame explicitný vzťah pre výpočet ceny derivátu v danom bode:

$$f_{i,j} = \frac{2(\Delta S)^2 f_{i+1,j} + \Delta t \Delta S r S_j \left(f_{i+1,j+1} - f_{i+1,j-1}\right)}{2r\Delta t(\Delta S)^2 + 2(\Delta S)^2} + \frac{\sigma^2 {S_j}^2 \Delta t\left(f_{i+1,j+1} + f_{i+1,j-1} - 2f_{i+1,j}\right)}{2r\Delta t(\Delta S)^2 + 2(\Delta S)^2}.$$

Pomocou tohto vzťahu počítame odhad ceny opcie vo vnútorných bodoch siete. Predpokladom je, že táto opcia je viazaná na bezdividendovú akciu. V prípade opcie na akciu so spojitým dividendovým výnosom dosadíme dané aproximácie do už spomínaného Blackovho – Scholesovho – Mertonovho modelu. Po úprave potom dostávame explicitný vzorec pre výpočet hodnoty opcie v každom vnútornom bode siete: [7]

$$f_{i,j} = \frac{2\Delta S^2 f_{i+1,j} + \Delta t \Delta S (r-q) S_j \left(f_{i+1,j+1} - f_{i+1,j-1}\right) + \sigma^2 {S_j}^2 \Delta t\left(f_{i+1,j+1} + f_{i+1,j-1} - 2f_{i+1,j}\right)}{2r\Delta t \Delta S^2 + 2\Delta S^2} \tag{5}$$

Pri stanovení ceny chooser opcie metódou konečných diferencií budeme postupovať ako obvykle v sieťových bodoch smerom „sprava doľava“, teda od konca časového intervalu životnosti opcie až k času 0. Nech T_1 je čas, v ktorom sa držiteľ môže rozhodovať o tom, akého typu bude jeho chooser opcia (call alebo put) a T_2 je čas exspirácie chooser opcie.

Potom vo všetkých tých bodoch siete, ktoré sú v časovom intervale $(T_1 ; T_2)$ budeme počítať cenu call opcie a aj cenu put opcie. V prvom kroku teda v pravých koncových bodoch siete použijeme na výpočet hodnôt opcií payoff funkcie call opcie aj put opcie (3) a (4). V ďalších krokoch smerom „sprava doľava“ až do času T_1 budeme podľa vzťahu (5) počítať hodnoty derivátu pre prípad call aj put opcie. Pritom netreba zabúdať na správne stanovenie hodnôt derivátu vo vrchných a spodných okrajových bodoch siete, nakoľko v prípade call opcie sú spodné hodnoty nulové a v prípade put opcie sú vrchné hodnoty nulové, ostatné hodnoty sa stanovia z put – call parity.

V čase T_1 potom v každom bode siete vyberieme z týchto dvoch hodnôt tú vyššiu podľa vzťahu $v = \max(c, p)$ uvedeného vyššie. Potom v ostatných krokoch pre body v časovom intervale $(0; T_1)$ postupujeme s týmito vybranými hodnotami podľa (5) ďalej až do času 0.

Hodnota v ľavom bode siete v čase 0 je odhadom ceny chooser opcie, stanoveným pomocou explicitnej metódy konečných diferencií.

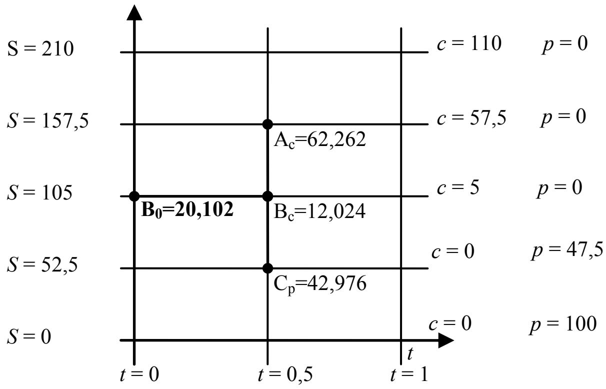
Vo výpočtoch, uvedených v časti 3 budeme používať explicitnú metódu, čiže cenu opcie so zvolenými parametrami v každom vnútornom bode siete počítame podľa vzťahu (5).

3. Príklad stanovenia ceny vybranej opcie

Majme chooser opciu, v ktorej majú obe zodpovedajúce opcie, call aj put, dobu životnosti 1 rok, realizačná cena pri oboch je rovnaká, a to $X = \$100$. Počiatočná cena podkladového aktíva je S_1 = \$105, bezriziková úroková miera je r = 10%. Podkladové aktívum neprináša počas doby životnosti opcie dividendový výnos, teda $q = 0$. Vlastník tejto opcie má právo sa v polovici jej životnosti, teda o pol roka rozhodnúť, či daná chooser opcia bude kúpna, alebo predajná. Teda $T_1 = 0{,}5$, pričom $T_2 = 1$.Nech maximálna cena podkladového aktíva, ktorú môže toto dosiahnuť počas doby životnosti derivátu je $S_{\max} = \$210$.

Nasledujúci obrázok znázorňuje výsledné ceny opcie v sieťových bodoch pri delení intervalu času na 2 časti a intervalu ceny akcie na 4 časti. Vo vrchnom sieťovom bode, v bode A a v bode B by si vlastník zvolil, aby jeho opcia bola typu call, v bode C a v spodnom bode siete by bolo preňho výhodnejšie zvoliť typ put. Cena v bode B$_0$ je vypočítaná z cien týchto vybraných variantov chooser opcie v čase 0,5 roka.

Obrázok 2: Ocenenie chooser opcie explicitnou metódou konečných diferencií



Pri takomto delení intervalu času a intervalu ceny akcie dostávame cenu chooser opcie so zvolenými parametrami $\boldsymbol{v}$ **= 20,102**.

Pre spresnenie výsledku použijeme hustejšiu sieť deliacich bodov. V nasledujúcej tabuľke uvádzame výsledné ceny danej chooser opcie v závislosti od jemnosti delenia časového intervalu. Hodnoty sú vypočítané explicitnou metódou, v prvom riadku je použité delenie intervalu ceny akcie na 4 časti, v druhom riadku na 10 častí a v treťom riadku tabuľky na 20 častí. Prvé dve hodnoty v treťom riadku nie sú touto metódou správne stanovené, tieto hodnoty vyšli záporné, čo je spôsobené zvolenými hodnotami vstupných parametrov.

Tabuľka 1: Ocenenie chooser opcie metódou konečných diferencií

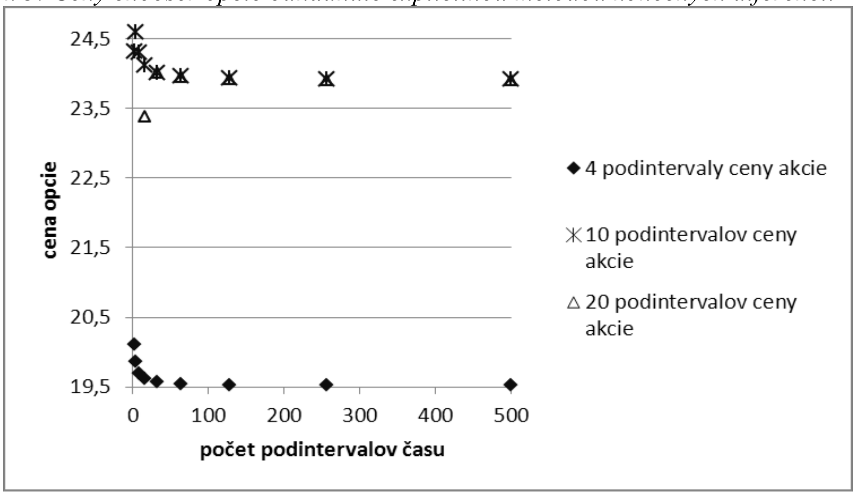
Počet podintervalov času	2	4	8	16	32	64	128	256	500
4 podintervaly ceny akcie	20,102	19,86	19,702	19,612	19,565	19,541	19,528	19,522	19,519
10 podintervalov ceny akcie	24,32	24,593	24,309	24,113	24,012	23,961	23,935	23,922	23,916
20 podintervalov ceny akcie	NA	NA	15,144	23,285	24,008	23,949	23,923	23,91	23,904

Pri hustejšej sieti deliacich bodov považujeme za odhad ceny tejto chooser opcie v požadovanom bode hodnotu $\boldsymbol{v}$ **= 23,9**.

Obrázok 3 znázorňuje vypočítané hodnoty ceny chooser opcie pomocou explicitnej metódy s rastúcim počtom podintervalov času.

Použitím explicitnej Metódy konečných diferencií na odhad ceny chooser opcie s realizačnou cenou \$100 pre call aj put opciu, s podkladovou akciou s hodnotou \$105, úrokovou mierou 10%, volatilitou 10%, a s dobou splatnosti 1 rok pre call aj put opciu sme stanovili cenu tejto opcie na \$23,9.

Obrázok 3: Ceny chooser opcie odhadnuté explicitnou metódou konečných diferencií



4. Záver

V predchádzajúcom texte sme uviedli možný spôsob numerického stanovenia ceny chooser opcie, ktoré prinášajú ich vlastníkovi oproti klasickým európskym opciám tú výhodu, že vlastník si môže vybrať, či opciu využije ako právo na kúpu alebo ako právo na predaj. Na ocenenie takýchto opcií sa dajú použiť rôzne numerické metódy, napríklad univerzálna metóda binomických stromov. V tomto článku sme uviedli spôsob stanovenia ceny takejto opcie pomocou Metódy konečných diferencií, čo je numerická metóda, ktorej princípom je zúženie definičného oboru riešenia a nahradenie parciálnych derivácií v Blackovej – Scholesovej – Mertonovej rovnici danými diferenciami.

V článku sme uviedli spôsob použitia tejto metódy pre stanovenie ceny chooser opcie. Na príklade sme ukázali ocenenie chooser opcie s danými parametrami a s rôznymi počtami deliacich bodov v sieti metódou konečných diferencií. Z výsledkov môžeme konštatovať, že je zrejmé, že čím viac časových krokov menšej dĺžky použijeme, tým budú výsledky presnejšie.

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Potential impact of mortality rate modeling on the solvency

Tomáš Tichý, Jana Koňuchová[1]

Abstract

Financial institutions are exposed to different classes of risk, some of them being specific to particular types of entities. For example, a specific risk factors of insurance companies are so called mortality and longevity. Their modelling even more challenging that modelling of market risks. In this paper, we describe the mortality evolution in the Czech Republic and apply the Lee-Carter model to estimate the trends for males and females. Finally, we show the potential impact of the random term on the VaR (capital) estimation.

Keywords

Life insurance, mortality, longevity, VaR, solvency.

JEL Classification: G22.

1. Introduction

Different kinds of financial institutions are exposed to different kinds of financial risks. Particular risk sources are related to the business activities of the financial institution and thus to the structure of assets and liabilities. For example, the assets of banks can consist either of loans and mortgages, both of them implying mainly the credit risk, or investments into various financial securities or even derivatives, whose market prices can change unexpectedly (ie. market risk arises). However, liabilities imply risk only in relation to possible mismatch with the structure of the assets as concerns the maturity (interest rate risk due to the need of reinvestment or refinancing) or currency (FX rate risk of naked positions).

By contrast, the risk management of insurance companies is focused especially on the risk of liability structure, while the market or credit risk implied by the asset structure is rather left aside. Obviously, the market or credit risk coming from particular investments cannot be regarded as insignificant, but it is mostly managed by conservative long-horizon investment strategies with strict limits on particular investment classes. On the other hand, the liabilities are created by selling of various insurance products that bring obligation to cover potential losses in the future.

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As concerns the insurance risk, there are two unknowns – the frequency of the loss and its severity, ie. what is the probability that the loss occur and if it occur what will be its magnitude. Clearly, the consequences slightly differ for the two basic categories of insurance products – the life and non-life insurance. While the latter is rather a short-horizon issue (mostly for a single year), the life insurance can require an analysis of even several dozen years. The non-life insurance products are mostly a single year contracts, though, there is often automatic renewal – notwithstanding, the price can be adjusted to the change of market conditions, including the expected frequency and severity.

By contrast, life insurance products are specific in the point that it is sure that a given person will die once in more or less distant future, although it is not sure *when* it happen. It also implies that the insurance company does not know, how many years a given client will pay the insurance premium and what will be the insurance payment for such client (or relevant beneficiary).

A specific part of life insurance is a longevity risk, ie. the risk that a given person will live long. The longevity risk is mostly calculated from mortality tables that provides past observations of mortality rates. In the past, mortality rate used for the risk estimation was assumed to be rather deterministic – for example, it might be obtained by regressing the past data and estimation of the trend. Currently, however, it is assumed that all risks of insurance companies, including the longevity risk, should be measured on Value at Risk basis.

Hence, recent research has been focused on stochastic mortality modeling. Original models, such as Lee and Carter (1992), focused basically on realized mortality modelling, which can be compared to *spot* models of financial securities. As an improvement, for example Plat (2011) suggested stochastic mortality trend model, which can be, in some way, compared to modeling of forward price of financial securities.

In this paper, we first describe the mortality behaviour in the Check Republic and after that, using estimated parameters of the Lee-Carter model and a stochastic variable, estimate potential impact of a given pool of insurance policies on the capital.

We proceed as follows. In the following section, some basic facts about the solvency of insurance companies and mortality modelling are reviewed. Next, the data set of mortality rates of males and females over 1920–2011 are described and trends as well as risk parameters are estimated assuming Lee-Carter model. Subsequently, a specific pool of insurance policies of the maturity of 20 and 30 years is assumed and its risk (95% VaR) is calculated.

2. Solvency and mortality modeling

Strictly speaking, the solvency means that a given entity is solvent, which is a binary variable – it either can meet all its obligation (ie. assets are higher than liabilities) or not (ie. it is insolvent). However, the life is not so easy and we are especially interested in the future. Thus, a solvency rule is followed if there is quite good chance that the entity will be able to meet all its obligation also in the future (going concern basis). Since the future is not known in advance, we often works with some probability level – say that we are sure with probability of 99% that the entity will be solvent over a given horizon.

Since insurance companies are an important part of financial markets, the regulators set the rules under which a given entity can be regarded as solvent from the future perspective. Mostly, it is some capital buffer to cover potential losses in the future due to adverse scenarios. Currently, two sort of capital are distinguished by the regulators

– the target level, which is called solvency capital requirement (SCR) and minimum capital requirement (MCR), $MCR < SCR$, which should never be broken, otherwise the insurance company is regarded as insolvent.

With transition of the regulatory requirements onto Solvency II, both solvency measures are to be calculated on VaR basis, ie. assuming stochastic scenarios of both, the assets and liabilities. As concerns life insurance, the capital to be put aside to ensure sufficient level of solvency is charged for several subrisks, in particular the *mortality*, *longevity*, *disability*, *lapse*, *expense*, *CAT* and *revision* risk, whereas the most important are the first two, and the total risk charge is obtained on the basis of a preset correlation matrix.

Notwithstanding, as concerns direct modelling of the mortality, most of the models are based on the assumptions of Lee and Carter (1992):

$$\ln(m_{x,t}) = a_x + b_x k_t + \epsilon_{x,t},$$

where m states (expected or central) mortality rate for age group x at time t, which gives initial rate of mortality,

$$q_{x,t} = 1 - \exp(-m_{x,t}),$$

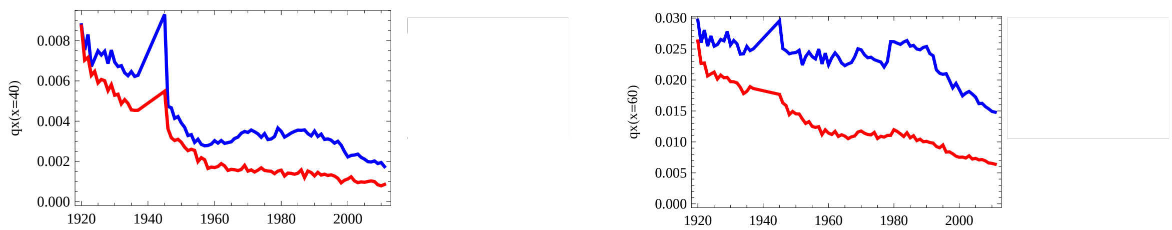
a_x is the mortality of age group x averaged over a given horizon, b_x can be interpreted as a relative velocity of the mortality change, k_t is the time-trend mortality index and ϵ states random error, whose mean should clearly be zero. It must also hold that sum of b for all considered age groups is 1, while k gives zero.

3. Data description

Within the analysis, the mortality data over 1920–2011 available at web pages of *Český statistický úřad* (www.czso.cz) are assumed, except the World War II (1938–1944). The data show mainly the probability of death at age x and clearly also the probability of survival $x + 1$. On this basis, we can obtain a 3D illustration of mortality in dependency on year and age for males as well as females, see Figure 4.

Observing particular charts, several aspects of the mortality evolution are apparent. First, high mortality of infants was regularly decreasing and almost disappeared in 50's. Second, there was a jump in mortality after WWII, which is, obviously, more evident for male data (see detail on the right). It also seems that mortality of senior males was more instable over the years.

Figure 1: Mortality of a specific age group over 1920–2011 (males always on the top)



In order to compare it, we provide two charts more, see Figure 1, depicting the mortality of males and females of a specific age, 40 and 60 in particular. Now, it is evident that the behaviour of the mortality curve over time is more smooth for females – despite a common believes that the mortality is always decreasing, or at least non-increasing, the case of 40 and 60 years old males in 70's shows the contrary, though there is no such observation for females.

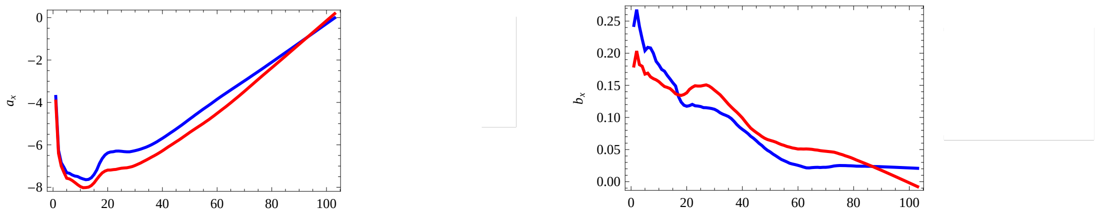
Especially the first observation of the trend reversal can have very serious impact on the assumed mortality and closely connected longevity as well as solvency of the insurance company.

4. Illustrative example

In this section we first estimate the parameters a and b of the Lee-Carter model that describe the average mortality and its deviation over whole horizon. These parameters will be later used in order to predict the future trend of the mortality and next also its riskiness.

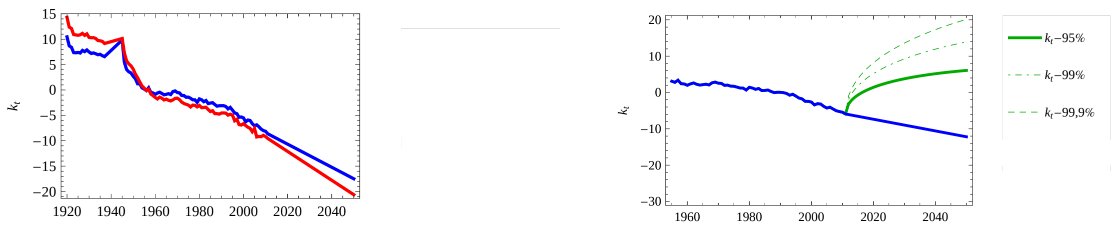
Parameter a describing the average mortality for various age groups is apparent from Figure 2. We can easily observe the J-shape of the curve given by high mortality of very young children. May be surprisingly, such character will remain even if we remove the observations before WWII. The second chart shows the error in the estimation and thus we can see that it is always higher for younger people.

Figure 2: Parameters a (left) and b (right) due to the Lee-Carter model over 1920–2011 (males always starts above females)



Now, we can easily extend the mortality curve into the future by estimating parameter k, see Figure 3. From the left part, we can see that the mortality of females should be decreasing much sharper than that of males; though, if we use only post-war data, the results will not be so much different – almost no impact on females, but k of males would decrease sharply.

Figure 3: Estimation of parameter k until 2050 with Lee-Carter model (left; males currently above females) and its quantile sensitivity for males



We already argued that there is some source of uncertainty in the trend; first, its slope can change substantially over time; second, it is just an average behaviour obtained by averaging over many years and thus, the real figures might be very different. In the left part of Figure 4 we show what might be the quantiles – may be quite surprisingly, with just a small diversion from the trend, we can easily reach values valid 50 years ago.

Finally, let us suppose an insurance company, which created a pool of several insurance policies covering death as well as survival of a given age with equal weights of 10 000 policies, each on 1 000 000 CZK as follows: male/female 30 years old insured for next 30 years with premium 28 495 / 27 998 ($r = 0.05$) or 29 852 / 29 332 ($r = 0.10$) and male/female 40 years old insured for next 20 years with premium 46 827 / 45 769 ($r = 0.05$) or 49 057 / 47 948 ($r = 0.10$), where r states risk premium. In fact, in both cases, the relevant age of survival is 60, although once it happen in 2022, the other time in 2032.

Thus, the insurance company is exposed to both main risk sources – the mortality risk (benefit is provided as soon as the insured person will die) combined with longevity risk (if death does not occur over given horizon, the benefit is payable anyway).

Clearly, the insurance premium is calculated in such a way that it allows to stay safe under normal circumstances. We can easily observe that in such a case the available capital rises up to year $t - 1$, where t stands for the maturity year of a given group of insurance policies and drops subsequently (2032, 2042). Anyway, the capital is still on the positive side for both risk premiums r considered.

The situation differs if the random term is considered as apparent from the last two columns of Table 1 – note that positive VaR means a shortage of capital. Thus, for first ten years or so the funds obtained from the policy holders are not sufficient to cover potential deviations in the life expectancy (mortality in this case), though the situation is improving year by year until the first group of polices matures.

Table 1: Available capital and estimated VaR at 5% level for a given pool of insurance policies

	Normal circumstances		$VaR(5\%)$	
Year	$r = 0.05$	$r = 0.10$	$r = 0.05$	$r = 0.10$
2013	869	1 743	2 152	660
2014	941	1 970	2 055	571
2031	9 255	10 701	−6663	−8483
2032	4 902	6 435	−2836	−4664
2041	8 790	10 646	−6755	−8881
2042	2 426	4 439	−1181	−3328

5. Conclusions

The unexpected changes in mortality and longevity can have substantial change on the solvency of an insurance company. In this short contribution, we have analyzed the evolution of mortality over 1920–2011 in the Czech Republic and on its basis we estimated the future trend. Subsequently, by adding random innovations potential impact on capital holdings with respect to a given pool of policies was estimated and compared to deterministic case.

It was shown that the impact of unexpected changes in the mortality can be serious; on a given set of data and with a given pool of policies, the severity was the highest during the first years.

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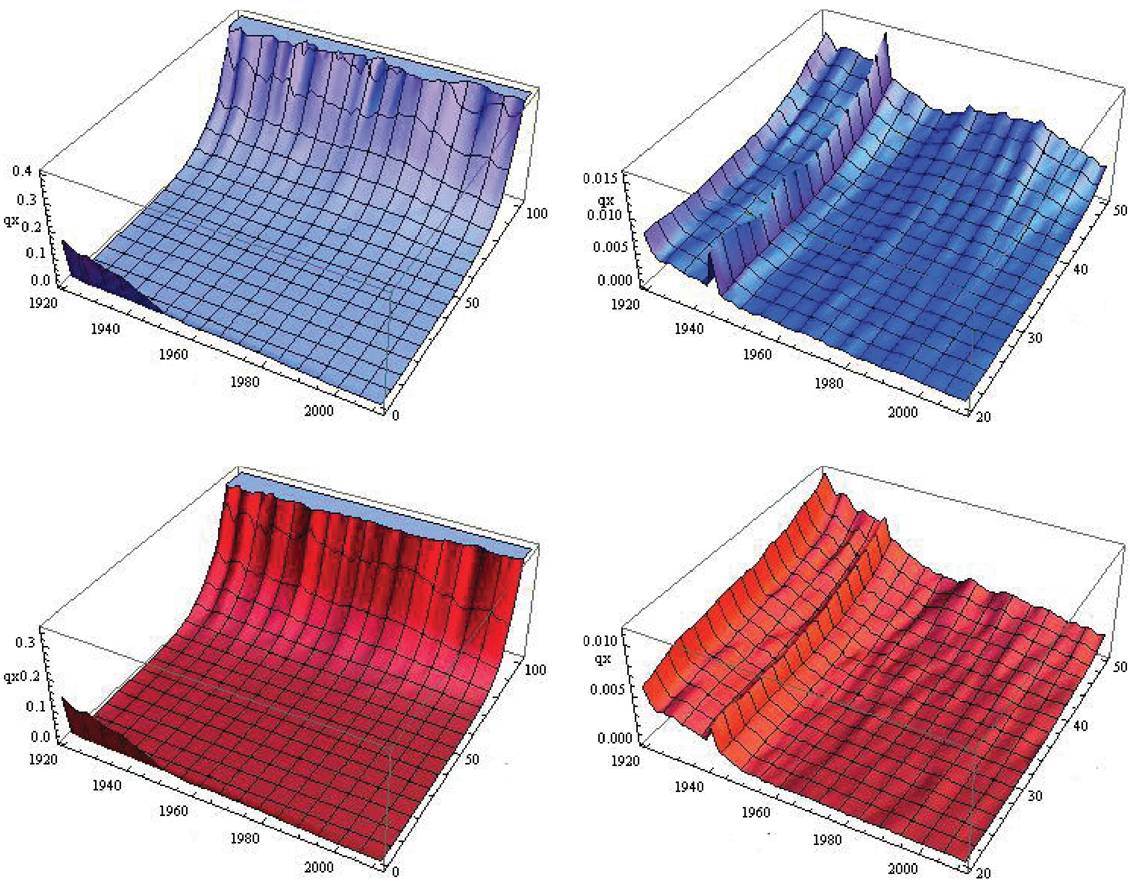
Figure 4: Mortality in dependency of years (x) and age (y) for man (top) and women (bottom) with detail on the right



Performance measures in DEA with an application for bank industry

Toloo Mehdi[1]

Abstract

Data envelopment analysis (DEA) is a mathematical approach for measuring the efficiency score of a set of homogeneous decision making units (DMUs) with multiple inputs and multiple outputs. In real applications of DEA, if the number of DMUs is less than the combined number of inputs and outputs (performance measures), then the majority of the DMUs will be identified as efficient and subsequently efficiency discrimination among DMUs is questionable. One approach to deal with this issue is to aggregate collected performance measures in order to reduce the number of inputs and outputs. In this paper, we utilize the aggregation method to reduce the number of performance measures in 20 branches of the largest private bank in Iran.

Key words

data envelopment analysis; assurance region; performance measures; bank industry

JEL Classification: G0

1. Introduction

Data envelopment analysis (DEA), originated by Charnes et al. (1978), deals with evaluating the relative efficiency of a set of similar decision making units (DMUs) with multiple inputs and multiple outputs. In original DEA model, the CCR model, relative efficiency of a DMU is equal to maximum value of the weighted sum of outputs over the weighted sum of inputs subject to the condition that this ratio must be less than or equal to one for all DMUs. Banker et al. (1984) extended the CCR model in order to accommodate variable returns to scale (VRS) assumption. DEA models partition all DMUs into two mutually exclusive groups: efficient and inefficient.

In performance measurement using DEA, if the number of performance measures is relatively large compared to the number of DMUs, then a large number of DMUs will be identified as efficient. To tackle this issue, we can select a small set of performance measures at the beginning and gradually enlarge the set to observe the effects of the added performance measures. Nevertheless, weight restrictions approach (such as the assurance region method, the cone ratio model and others) lead themselves to a sharper discrimination among DMUs. Beside these approaches, one method can be considered as aggregating performance measure to decrease the number of inputs and outputs.

As it is mentioned in Cooper et al. (2007), it is desirable that number of MDUs exceed the number of performance measures by several times. Let n, m and s be the number of DMUs, inputs and outputs, respectively. A rough rule of thumb in DEA is to choose n equal to or greater than $\max\{ms, 3(m+s)\}$; mathematically,

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$$n \geq \max\left\{ms, 3(m+s)\right\} \tag{1}$$

The selection of input and output items is critical for successful application of DEA.

In DEA approach the need for *a priori* knowledge or the need for recourse to assumptions which are *outside the data* are minimized. Nevertheless, in some cases, either additional information is available or DM likes to make some especial assumptions on weights of performance measures. To deal with these situations, there are two main approaches: *assurance region* and *cone-ratio*.

In this paper, we are going to measure the efficiency score of 20 branches of the largest privet bank in Iran with 12 performance measures (6 inputs and 6 outputs). Apparently, the rule of thumb (1) is not hold for this case study and, as a result, if one utilizes the DEA models, then a large number of branches will be determined as efficient which is a questionable outcome. As more information is available about the importance of performance measures, we apply the assurance region approach for the real data set and illustrate that the obtained result is acceptable and the approach can discriminate between efficient and inefficient DMUs.

2. Preliminary

Suppose, there are n DMUs, DMU$_j$ $j=1,...,n$, each one utilizes m inputs $\mathbf{x}_j = (x_{1m},\ldots$ R_+^m to produce s outputs $\mathbf{y}_j = (\mathrm{y}_{1s},\ldots$ R_+^s. The production technology is determined by production possibility set (PPS), $T = \left\{(\mathbf{x},\mathbf{y}) : \mathbf{x} \in R_+^m \text{ can produce } \mathbf{y} \in R_+^s\right\}$, which is the intersection of all sets $S \subseteq R_+^{m+s}$ that satisfy the principal axioms: feasibility, free disposability, convexity, and nonstant returns to scale (CRS). Under these axioms, the minimum extrapolation PPS can be explicitly stated as:

$$T = \left\{(\mathbf{x},\mathbf{y}) : \mathbf{x} \geq \sum\nolimits_{j=1}^{n} \lambda_j \mathbf{x}_j, \mathbf{y} \leq \sum\nolimits_{j=1}^{n} \lambda_j \mathbf{y}_j, \boldsymbol{\lambda} \geq \mathbf{0}_n \right\}$$

where $\boldsymbol{\lambda} = (\lambda_1,\ldots$ is a semi-positive vector and $\mathbf{0}_n$ is the origin in R^n. The following well-known LP model, which is called CCR, evaluates the performance of DMU$_o$ under evaluation:

$$\begin{aligned}
\max \theta = & \sum_{r=1}^{s} u_r y_{ro} \\
\text{s.t.} \quad & \sum_{i=1}^{m} v_i x_{io} = 1 \\
& \sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \leq 0 \quad j=1,...,n \\
& u_r, v_i \geq \varepsilon \quad \forall i,r
\end{aligned} \tag{2}$$

where v_i and u_r are the weights for i^{th} input and r^{th} output respectively, and $\varepsilon > 0$ is a non-Archimedean infinitesimal number. DMU$_o$ is efficient if and only if $\theta^* = 1$; otherwise it is inefficient. Hence, the efficiency score distinguishes between efficient and inefficient DMUs by establishing whether a DMU is located on the efficient frontier or not. This model involves some interesting properties: feasibility, having bounded optimal objective value, unit invariant and CRS. However, there are many computations efforts (and sometimes rounding errors) for determining the non-Archimedean epsilon. However, Amin and Toloo (2004) proposed a polynomial-time algorithm for finding a suitable value for the non-Archimedean epsilon.

Thompson et al. (1986) developed the assurance region approach to help in choosing a *best site* for the location of a high-energy physics laboratory. Charnes et al. (1990) developed the cone-ratio approach to evaluate bank performances when unknown allowances for risk and similar factors needed to be taken into account.

Assurance region approach imposes constraints on the relative magnitude of the weights for special performance measure. For example, the following constraint will be added on the ratio of weights for Input 1 and Input 2:

$$L_{1,2} \le \frac{v_2}{v_1} \le U_{1,2} \tag{3}$$

where $L_{1,2}$ and $U_{1,2}$ are lower and upper bounds that the ratio v_2/v_1 may assume. Indeed, the assurance region approach decreases the feasible region of the CCR model in a reasonable manner which leads to worsen efficiency score and a DMU previously characterized as efficient may subsequently be found to be inefficient after such constraints have been imposed.

More generally, we can add the following $(m+s-2)$ restricting input and output weights:

$$\begin{aligned} v_1 l_{1,i} \le v_i \le v_1 u_{1,i} \qquad & i = 2,\dots \\ u_1 L_{1,r} \le u_r \le u_1 U_{1,r} \qquad & r = 2,\dots \end{aligned} \tag{4}$$

It some restrictions are unavailable, we can delete them from the constraints. Hence, the following CCR-AR model can be utilized to measure the restricted optimal weights:

$$\begin{aligned} \max\ & \theta = \mathbf{u}\mathbf{y}_o \\ \text{s.t.}\quad & \mathbf{v}\mathbf{x}_o = 1 \\ & \mathbf{u}\mathbf{Y} - \mathbf{v}\mathbf{X} \le \mathbf{0}_n \\ & \mathbf{v}\mathbf{P} \le \mathbf{0}_{m-1} \\ & \mathbf{v}\mathbf{Q} \le \mathbf{0}_{m-1} \\ & \mathbf{v} \ge \mathbf{0}_m \\ & \mathbf{u} \ge \mathbf{0}_s \end{aligned} \tag{5}$$

where

$$\mathbf{P} = \begin{bmatrix} l_{12} & -u_{12} & l_{13} & -u_{13} & \cdots & \cdots & \cdots & \cdots \\ -1 & 1 & 0 & 0 & \cdots & \cdots & \cdots & \cdots \\ 0 & 0 & -1 & 1 & \cdots & \cdots & \cdots & \cdots \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \end{bmatrix} \quad {\scriptstyle 2(m-1)}$$

$$\mathbf{Q} = \begin{bmatrix} L_{12} & -U_{12} & L_{13} & -U_{13} & \cdots & \cdots & \cdots & \cdots \\ -1 & 1 & 0 & 0 & \cdots & \cdots & \cdots & \cdots \\ 0 & 0 & -1 & 1 & \cdots & \cdots & \cdots & \cdots \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \end{bmatrix} \quad {\scriptstyle :(s-1)}$$

3. Application

This section illustrates the assurance region approach through a real data set of the Saderat Bank (largest private bank in Iran). The bank has approximately 3150 branches in different cities in Iran with 127 branches in one of the northern provinces, Gilan. The data set, which is presented in Table 1, involves 20 branches of the capital of Gilan with 6 inputs and 6 outputs.

Table 1. Bank Data

	Inputs						**Outputs**						
DMUs	**Employees**	**No. of accounts**	**Assets**	**Space**	**Costs**	**Expenses**	**No. of transactions**	**Deposits**	**Loans**	**Check Card**	**Credit Card**	**OTP**	**Efficiency scores**
1	11	1250	1753	97	10020	3137	5214	72149	57537	5105	4839	25	1
2	17	5019	2604	150	11440	4406	5343	89781	51114	8646	8364	24	0.96
3	7	3217	1155	61	8427	2180	5145	42654	52485	2797	2697	5	1
4	12	1061	1899	105	11816	6477	3249	97812	67298	3373	3096	68	1
5	14	5219	2215	123	12426	3325	6706	77031	43487	8993	8787	58	1
6	14	1389	2357	123	9907	3757	6259	75923	41442	7604	7371	40	1
7	9	7166	1370	79	10365	2714	3652	47763	43262	3608	3497	9	0.68
8	5	1475	829	44	5283	2887	3913	45732	14237	3795	3500	32	1
9	6	1800	985	52	11061	2852	3566	55222	41062	3299	3182	15	0.93
10	6	1689	1023	52	5856	2606	4559	53323	37418	1858	1746	8	1
11	8	1780	1311	70	8745	4442	4441	69734	57883	3030	2882	23	1
12	9	2669	1536	79	7326	1989	5031	49153	47139	4811	4578	31	1
13	8	7175	1367	70	8326	3727	5053	92365	55543	6840	6588	45	1
14	7	2120	1193	61	6525	3473	4762	64235	22347	5382	5188	22	1
15	9	30618	1359	79	8158	3824	6876	89104	45717	7628	7292	105	1
16	7	1464	1111	61	11135	1524	4307	42012	73925	3187	2984	22	1
17	7	8924	1182	68	6920	3573	5331	69360	27246	3743	3524	24	1
18	7	2388	1069	61	5864	2523	4004	51438	26531	4360	4140	17	0.99
19	6	4714	992	52	5039	2398	2342	39948	20223	2688	2574	36	1
20	7	1866	1180	62	8378	3165	4238	154284	43928	4182	4008	18	1

As it can be seen from Table (1), 80% of all the branches are efficient which is questionable due to an inadequate number of performance measures. To have an acceptable result, we add the following constraints which are given by DM:

$$0.5v_1 \le v_i \le 10v_1 \quad r = 2,3$$
$$2v_1 \le v_i \le 5v_1 \qquad r = 4,5,6$$
$$0.5v_1 \le v_6 \le 10v_1$$
$$5u_1 \le u_r \le 10u_1 \qquad r = 2,3$$
$$0.5u_1 \le u_r \le 10u_1 \quad r = 4,5,6$$

which is equivalent to imposing the following P and Q matrixes in assurance region model (5)

4.

$$\mathbf{P}=\begin{bmatrix} 0.5 & -10 & 0.5 & -10 & 2 & -5 & 2 & -5 & 0.25 & -10 \\ -1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & 1 \end{bmatrix}$$

$$\mathbf{Q}=\begin{bmatrix} 5 & -10 & 5 & -10 & 0.5 & -10 & 0.5 & -10 & 0.5 & -10 \\ -1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & 1 \end{bmatrix}$$

The GAMS software code (see appendix) is utilized to solve the obtained model and the following table the result. As we expected, the assurance region method succeed in discriminating between efficient and inefficient units. Indeed, 10% of all branches are efficient and 70% of the branches that were CCR-efficient are now AR-inefficient.

Table 2. Assurance region results

DMUs	v_1^*	v_2^*	v_3^*	v_4^*	v_5^*	v_6^*	u_1^*	u_2^*	u_3^*	u_4^*	u_5^*	u_6^*	efficiency
1	2.91E-05	2.91E-04	1.45E-05	5.81E-05	5.81E-05	7.27E-06	8.30E-07	4.14E-06	8.28E-06	8.28E-06	8.28E-06	8.28E-06	0.861
2	9.49E-06	4.74E-06	4.74E-06	1.90E-05	4.74E-05	9.49E-05	5.50E-07	2.75E-06	5.50E-06	5.50E-06	5.50E-06	5.50E-06	0.625
3	2.41E-05	1.21E-05	1.21E-05	4.82E-05	4.97E-05	2.41E-04	9.40E-07	4.70E-06	9.40E-06	9.40E-06	9.40E-06	4.70E-07	0.750
4	2.70E-05	2.70E-04	1.35E-05	5.40E-05	5.40E-05	6.75E-06	8.20E-07	4.09E-06	8.18E-06	4.10E-07	4.10E-07	8.18E-06	0.956
5	1.61E-05	8.05E-06	8.05E-06	3.22E-05	3.22E-05	1.61E-04	6.30E-07	3.13E-06	6.14E-06	6.25E-06	6.25E-06	6.25E-06	0.624
6	2.77E-05	2.77E-04	1.39E-05	5.54E-05	5.54E-05	6.93E-06	7.90E-07	3.95E-06	7.89E-06	7.89E-06	7.89E-06	7.89E-06	0.750
7	1.89E-05	9.45E-06	9.45E-06	3.78E-05	3.89E-05	1.89E-04	7.40E-07	3.68E-06	7.37E-06	7.37E-06	7.37E-06	3.70E-07	0.550
8	3.52E-05	1.76E-05	1.76E-05	7.05E-05	1.76E-04	8.81E-06	1.45E-06	7.25E-06	7.25E-06	1.45E-05	1.45E-05	1.45E-05	0.547
9	1.27E-05	1.27E-04	1.27E-04	6.35E-05	2.54E-05	1.27E-04	7.80E-07	3.88E-06	7.75E-06	7.75E-06	7.75E-06	7.75E-06	0.585
10	3.19E-05	1.59E-05	1.59E-05	6.37E-05	1.59E-04	7.96E-06	1.16E-06	5.79E-06	1.16E-05	5.80E-07	5.80E-07	5.80E-07	0.750
11	2.69E-05	2.69E-04	1.34E-05	5.38E-05	5.38E-05	6.72E-06	8.20E-07	4.08E-06	8.17E-06	0.00E+00	0.00E+00	8.17E-06	0.761
12	2.69E-05	1.34E-05	1.34E-05	5.37E-05	5.53E-05	2.69E-04	1.05E-06	5.23E-06	1.05E-05	1.05E-05	1.05E-05	1.05E-05	0.854
13	2.13E-05	1.06E-05	1.06E-05	4.26E-05	1.06E-04	5.32E-06	7.30E-07	3.64E-06	7.28E-06	7.28E-06	7.28E-06	7.28E-06	0.842
14	2.84E-05	1.42E-05	1.42E-05	5.67E-05	1.42E-04	7.09E-06	9.70E-07	4.84E-06	9.69E-06	9.69E-06	9.69E-06	9.69E-06	0.635
15	9.25E-06	4.63E-06	9.25E-05	1.85E-05	4.63E-05	9.25E-05	6.20E-07	3.08E-06	6.16E-06	6.16E-06	6.16E-06	6.16E-06	0.653
16	2.57E-05	1.28E-05	1.28E-05	5.14E-05	5.14E-05	2.57E-04	1.04E-06	5.32E-06	1.04E-05	5.20E-07	5.20E-07	1.04E-05	1
17	2.46E-05	1.23E-05	1.23E-05	4.92E-05	1.23E-04	6.14E-06	8.40E-07	4.20E-06	8.40E-06	8.40E-06	8.40E-06	8.40E-06	0.586
18	3.14E-05	1.57E-05	1.57E-05	6.29E-05	1.57E-04	7.86E-06	1.07E-06	5.37E-06	1.08E-05	1.08E-05	1.08E-05	1.08E-05	0.657
19	3.48E-05	1.74E-05	1.74E-05	6.96E-05	1.74E-04	8.69E-06	1.19E-06	5.94E-06	1.19E-05	1.19E-05	1.19E-05	1.19E-05	0.544
20	5.21E-05	2.60E-05	2.60E-05	1.04E-04	1.04E-04	1.30E-05	1.00E-06	5.00E-06	5.00E-06	5.00E-07	5.00E-07	5.00E-07	1

Mostafa (2009) summarized the research conducted to evaluate bank efficiency using DEA. After studying the DEA research in banks we found out that large number of these studies *employee*, *assets* and *cost* are selected as input factors and also *the number of transactions*, *deposits* and *loan* are given as output factors. As an alternative approach, we considered these measures and ignored the rest of factors. Table (3) reports the optimal weights and the CCR-efficiency achieved by solving the CCR model (2).

Table 3. The data and CCR-efficiency

DMUs	v_1^*	v_2^*	v_3^*	u_1^*	u_2^*	u_3^*	efficiency
1	3.00E-06	3.00E-06	9.90E-05	3.00E-06	3.00E-06	8.00E-06	0.703
2	3.00E-06	3.00E-06	8.70E-05	3.20E-05	3.00E-06	3.00E-06	0.594
3	3.00E-06	8.44E-04	3.00E-06	1.01E-04	3.00E-06	3.00E-06	0.803
4	3.00E-06	3.00E-06	8.40E-05	3.00E-06	3.00E-06	5.00E-06	0.66
5	3.00E-06	3.00E-06	8.00E-05	1.90E-05	3.00E-06	3.00E-06	0.486
6	3.00E-06	3.00E-06	1.00E-04	5.90E-05	3.00E-06	3.00E-06	0.719
7	3.00E-06	7.07E-04	3.00E-06	3.00E-06	3.00E-06	9.00E-06	0.533
8	1.68E-01	3.00E-06	3.00E-05	1.97E-04	3.00E-06	3.00E-06	0.951
9	3.00E-06	9.82E-04	3.00E-06	7.60E-05	3.00E-06	9.00E-06	0.809
10	3.00E-06	3.00E-06	1.70E-04	6.50E-05	4.00E-06	1.40E-05	1
11	3.00E-06	3.00E-06	1.14E-04	3.00E-06	3.00E-06	1.10E-05	0.858
12	3.00E-06	3.00E-06	1.36E-04	5.60E-05	3.00E-06	1.00E-05	0.903
13	3.00E-06	3.00E-06	1.20E-04	3.00E-06	3.00E-06	1.20E-05	0.963
14	7.81E-02	3.00E-06	6.90E-05	1.26E-04	3.00E-06	3.00E-06	0.859
15	3.00E-06	3.00E-06	1.22E-04	8.70E-05	3.00E-06	3.00E-06	1
16	1.38E-01	3.00E-06	3.00E-06	3.00E-06	3.00E-06	1.20E-05	1
17	7.13E-02	3.00E-06	7.20E-05	1.20E-04	3.00E-06	3.00E-06	0.932
18	3.00E-06	3.00E-06	1.70E-04	1.43E-04	3.00E-06	3.00E-06	0.808
19	3.00E-06	3.00E-06	1.98E-04	7.60E-05	4.00E-06	1.60E-05	0.665
20	1.39E-01	3.00E-06	3.00E-06	3.00E-06	6.00E-06	3.00E-06	1

As can be extracted from the table, 20% of branches are efficient. It should be mentioned here that we have let $\varepsilon = 3\times10^{-6}$. Comparing these results we see that DMU16 and DMU20 are efficient in either of these two approaches.

5. Conclusions and further research

In this paper, we practically demonstrated that when the number of DMUs is less than the combined number performance measures the large number of the DMUs will be identified as efficient. The assurance region approach can be utilized in this case, if additional information is available or decision maker likes to make some especial assumptions on weights. Assurance region method by imposing some suitable constraints, restricts the feasible region of the model and increases the discriminating power of the model. As an alternative approach, we investigated some papers and selected the performance measures based to the under taken research. As a further research, a model can be formulated that selects the performance measures that are more appropriate for the efficiency score of DMUs.

Acknowledgments

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APPENDIX (GAMS CODE)

```
"Assurance Region model in GMAS"
$ONTEXT
This program is written by
Mehdi Toloo,
Faculty of Economics, Technical University of Ostrava,
Ostrava, Czech Republic
as a part of a paper entitle
''Performance measures in DEA with an application for bank industry''
in
9th international scientific conference on financial management of firms and financial institutions,
VSB-TU Ostrava, 9. - 10. 9. 2013
$OFFTEXT

SETS
  j  /01*20/
  i  /i1*i6/
  r  /o1*o6/
  pc  /pc1*pc10/
  qc  /qc1*qc10/

ALIAS(j,l);

PARAMETERS
xo
yo

TABLE     x(j,i)
        i1      i2        i3        i4      i5        i6
01      11      1250      1753      97      10020     3137
02      17      5019      2604      150     11440     4406
03      7       3217      1155      61      8427      2180
04      12      1061      1899      105     11816     6477
05      14      5219      2215      123     12426     3325
06      14      1389      2357      123     9907      3757
07      9       7166      1370      79      10365     2714
08      5       1475      829       44      5283      2887
09      6       1800      985       52      11061     2852
10      6       1689      1023      52      5856      2606
11      8       1780      1311      70      8745      4442
12      9       2669      1536      79      7326      1989
```

```
13   8   7175   1367   70   8326   3727
14   7   2120   1193   61   6525   3473
15   9   30618  1359   79   8158   3824
16   7   1464   1111   61   11135  1524
17   7   8924   1182   68   6920   3573
18   7   2388   1069   61   5864   2523
19   6   4714   992    52   5039   2398
20   7   1866   1180   62   8378   3165;

TABLE  y(j,r)
     o1      o2      o3      o4      o5      o6
01   5214    72149   57537   5105    4839    25
02   5343    89781   51114   8646    8364    24
03   5145    42654   52485   2797    2697    5
04   3249    97812   67298   3373    3096    68
05   6706    77031   43487   8993    8787    58
06   6259    75923   41442   7604    7371    40
07   3652    47763   43262   3608    3497    9
08   3913    45732   14237   3795    3500    32
09   3566    55222   41062   3299    3182    15
10   4559    53323   37418   1858    1746    8
11   4441    69734   57883   3030    2882    23
12   5031    49153   47139   4811    4578    31
13   5053    92365   55543   6840    6588    45
14   4762    64235   22347   5382    5188    22
15   6876    89104   45717   7628    7292    105
16   4307    42012   73925   3187    2984    22
17   5331    69360   27246   3743    3524    24
18   4004    51438   26531   4360    4140    17
19   2342    39948   20223   2688    2574    36
20   4238    154284  43928   4182    4008    18;

TABLE P(i,pc)
     pc1   pc2   pc3   pc4   pc5   pc6   pc7   pc8   pc9    pc10
i1   0.5   -10   0.5   -10   2     -5    2     -5    0.25   -10
i2   -1    1     0     0     0     0     0     0     0      0
i3   0     0     -1    1     0     0     0     0     0      0
i4   0     0     0     0     -1    1     0     0     0      0
i5   0     0     0     0     0     0     -1    1     0      0
i6   0     0     0     0     0     0     0     0     -1     1;

TABLE Q(r, qc)
     qc1   qc2   qc3   qc4   qc5   qc6   qc7   qc8   qc9    qc10
o1   5     -10   5     -10   0.5   -10   0.5   -10   0.5    -10
o2   -1    1     0     0     0     0     0     0     0      0
o3   0     0     -1    1     0     0     0     0     0      0
o4   0     0     0     0     -1    1     0     0     0      0
o5   0     0     0     0     0     0     -1    1     0      0
o6   0     0     0     0     0     0     0     0     -1     1;

FREE VARIABLE
        z;

POSITIVE VARIABLES
        u
        v

FILE Result/Toloo_2013a.txt/;

EQUATIONS
   obj
   con1
   con2
   con3
   con4;
```

```
obj..      z =E= SUM(r,u(r)*yo(r));
con1..     SUM(i,v(i)*xo(i)) =E= 1;
con2(j)..  SUM(r,u(r)*y(j,r))- SUM(i,v(i)*x(j,i)) =L= 0;
con3(pc).. sum(i, v(i)*P(i,pc)) =L= 0;
con4(qc).. sum(r, u(r)*Q(r,qc)) =L= 0;

MODEL CCR_AR /all/;
PUT result;
PUT 'DMU     Eff.    v1        v2       v3      v4        v5       v6        u1        u2       u3     u4        u5       u6'/;
PUT

LOOP(l,
    LOOP(i,xo(I)=x(l,i));
    LOOP(r,yo(r)=y(l,r));
    SOLVE CCR_AR USING LP maximizing z;
    PUT CCR_AR.modelstat:2 ' ';
    PUT L.TL:2  z.L:10:3;
    LOOP(i, PUT v.l(i):12:8);
    LOOP(r, PUT u.l(r):12:8);
    PUT/;
   );
```

A New Idea to Enhance the Quality of Consumer Price Index Estimates

Daniele Toninelli [1], Martin Beaulieu [2]

Abstract

Consumer Price Index (CPI) calculation proceeds in stages. In the first stage, elementary aggregates of homogeneous sets of products are estimated. These elementary indices are then aggregated to obtain higher-level indices using, as weights, the elementary expenditure aggregates. In compiling the CPI, in order to better represent the market shares of the various kind of stores selling same types of products, stratification by outlet type could be done. This raises questions as to what level would be more appropriate to define as the elementary aggregate. Our simulation study aims at assessing the impact on the index of the introduction of an additional intermediate level of weighted aggregation taking into account the stratification by type of outlet.

Key words

Price index, CPI, Laspeyres index, Lowe index, Jevons index, weighted aggregation.

JEL Classification: C43, C18.

1. Introduction

A price index is a measure of the proportionate change in a set of prices over time. In particular, in this paper the CPI (Consumer Price Index) is studied. The CPI is a measure of the monthly rate of change of the consumption prices of goods and services. To compile a CPI, a fixed basket of representative commodities is observed over time. The CPI basket is based on expenditures of a given target population (made of both families and individuals) living in private household in a certain reference period (for further details, see Statistics Canada, 1995, and Beaulieu, 2012). It is clear that it is necessary to synthesize the variation observed for single prices by means of a single measure of the change (based on the group of representative products/goods purchased by families and individuals). To summarize the data, a wide group of options is available. The choice of the best price index formula to be used is object of intensive study: see, among others, Armknecht and Silver (2012), Bishop (2013), and Dalén (1998); see also, for best practices, the ILO manual (2004).

In compiling a CPI, the aggregation process is applied starting, at the first step, with the price relative (*pr*) referred to a certain product *k* belonging to a stratum *h*:

$$pr_{hk}^{t,t-1} = \frac{p_{hk}^{t}}{p_{hk}^{t-1}};$$

this price relative simply measures the relative change of the price (*p*) of a certain good between the month *t*-1 and the month *t*. At a later stage, we need to compute an elementary

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aggregate measure of the change by means of the Jevons index, a geometric mean of price relatives referred to each stratum h:

$$I_h^{t,t-1} = \left[\prod_{k=1}^{n_h} \left(pr_{hk}^{t,t-1} \right) \right]^{1/n_h},$$

where n_h is the number of prices observed in the stratum h. Note that the stratum h is defined crossing the variables "elementary aggregate" and "geographic stratum". The following step is the computation of the index at the top level of aggregation. For this purpose, we use the Lowe index, that is a specific version of the Laspeyres formula in which weights come from a time $t = b$ rather than from the base time $t = 0$ (b is the reference time for weights, that is the time of the last available update); this choice is made because expenditure weights are updated every two years. This weighted average uses, as weights, the expenditures w_h^b observed at a previous time b for stratum h (N_h is the number of strata):

$$\hat{I}^{t,t-1} = \frac{\sum_{h=1}^{N_h} \left(w_h^b \cdot I_h^{t,t-1} \right)}{\sum_{h=1}^{N_h} w_h^b}.$$

Looking to the formula, we notice that the index is based, at the top level, on the computation of a weighted average, with weights given by the expenditures shares w_h^b. Interesting studies about the issue of weights in compiling the CPI can be found in Greenlees and Williams (2009) and Hansen (2006). Mehrhoff (2007) also studied the properties of the two-staged price indices and the correspondence between elementary and aggregate index formulas (Mehrhoff, 2010). Our research focuses on the study of issues related to the weighs used at the top level of aggregation and on their impact on price index estimates. More in particular, for the CPI, our main objective is to understand if a different (and more detailed) weighted aggregation structure of the index can improve the quality of the final index. In particular, we want to understand if considering the different type of outlets the quality of the index could be improved, and the estimate can better represent the real purchases of Canadians. In regard to this, we consider two kind of outlets: the Specialized stores and the Non-specialized, that will be referenced, in the following, as General stores.

2. Background, data and methodology

The objectives of our study were suggested by some evidences highlighted by a preliminary analysis. More in particular, the evidence originated from the indices computed for the General and Specialized stores categories. The final estimates for the two groups compared by major classes show that there can be big differences. The biggest difference is observed for the Health/Personal care major class: the Specialized stores index shows a bigger price variation (+3.42%) than the General stores index. The minimum difference is detected for the Alcoholic beverages/Tobacco major class (the Specialized stores index shows a slightly higher variation of prices: +0.1%). In other major classes (Food/Non-alcoholic beverages and Clothing/Footwear) the variation underlined by the General stores estimates is higher.

Taking this all into consideration, the research question referred to the CPI weights structure arises: can the introduction of an additional level of aggregation (taking into consideration weights specifically representing the General and Specialized stores categories) enhance the quality and/or the representativeness of the final estimates?

The CPI study simulated population is based on survey data collected monthly from January 2012 to January 2013. The dataset includes prices collected from a sample of products and services, representative of what Canadians consume. The sample design can be seen as a 3-stage sampling plan with non-probabilistic selection of representative items (for further details, see Beaulieu, 2012). The primary source for weights data (expenditure shares) is Statistics Canada's Survey of Household Spending (SHS). The classification by type of outlets, on the other hand, is based on the North American Industrial Classification System (NAICS), available on the Statistics Canada's Business Register (BR) and their sales (or market shares) are based on Statistics Canada's Quarterly Retail Commodity Survey (QRCS).

The simulated population of price relatives was generated starting from the study of the distribution by micro-cells, defined by elementary aggregate, geographical strata and reference month (the method of generation is similar to the one introduced in Toninelli, 2010). The target population is the sample of representative goods (basket) whose prices are collected by Statistics Canada. Only elementary aggregates for which prices are obtained via an alternative data source (e.g. administrative data) are excluded from the scope of this study.

The simulated study strategy is mainly focused on the evaluation of the effect obtained introducing an additional intermediate level of weighted aggregation (based on the type of store considered). Thus, the analysis compares different alternatives of estimates computed on the same dataset, listed hereunder:

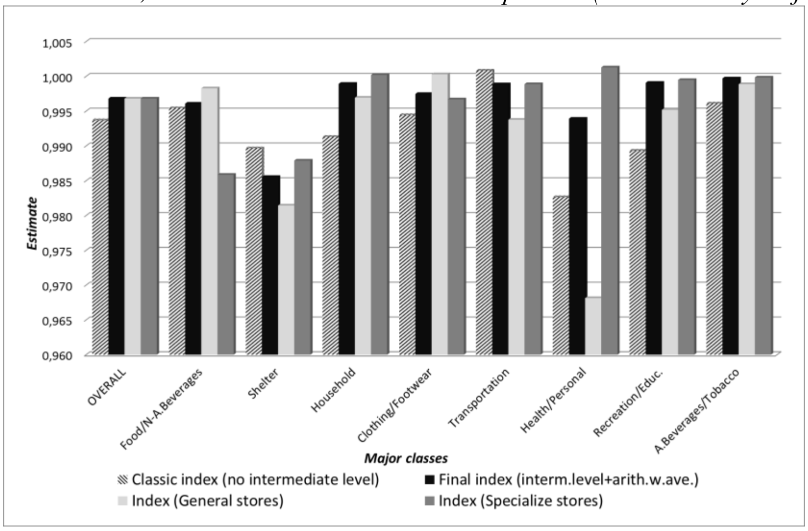
- *Classic Index* (*CI*): computed using the current methodology (Jevons index at the elementary aggregate level, Laspeyres/Lowe weighted formula to aggregate indices);
- *General sub-Index* (*GsI*): sub-index computed (with the "classic„ current methodology) on the General store group of outlets;
- *Specialized sub-Index* (*SsI*): sub-index computed with the current methodology on the group of Specialized stores;
- *Final Index* (*FI*): computed introducing the intermediate weighted level of aggregation; we obtain four versions of this index:
  - *Final Arithmetic* (*FA*): arithmetic weighted average of GsI and SsI, using, as weights, the type of store market shares;
  - *Final Geometric* (*FG*): geometric weighted average of GsI and SsI (weights: market shares);
  - *Final Arithmetic Low* (*FAL*): a first weighted aggregation is made at the low level (elementary aggregate level) by type of stores, using an arithmetic weighted formula (weights: market shares by type of store);
  - *Final Geometric Low* (*FGL*): the computation of the index introduces a geometric weighted average (weights: market shares by type of store) at the low level of aggregation (elementary aggregates).

3. Results

Graph 1 shows the comparison of four indices: the CI, the FA, and the two sub-indices (GsI and SsI). The comparison is made at a general level (whole frame population, first category on the left) and by major classes (from the second to the last classes on the *x*-axis). Overall (first class of the Graph 1), we notice that the FA and the sub-indices show very similar results; the Final index is also extremely coherent with the two boundaries represented by the General and Specialized stores indices. On the opposite side, the Classic index tends to measure a noticeably lower level of prices' movements. The behavior of the two sub-indices seem identical, at the overall level, but taking into consideration the different major classes, we notice big differences in the sub-indices' estimates. For all the categories (but for

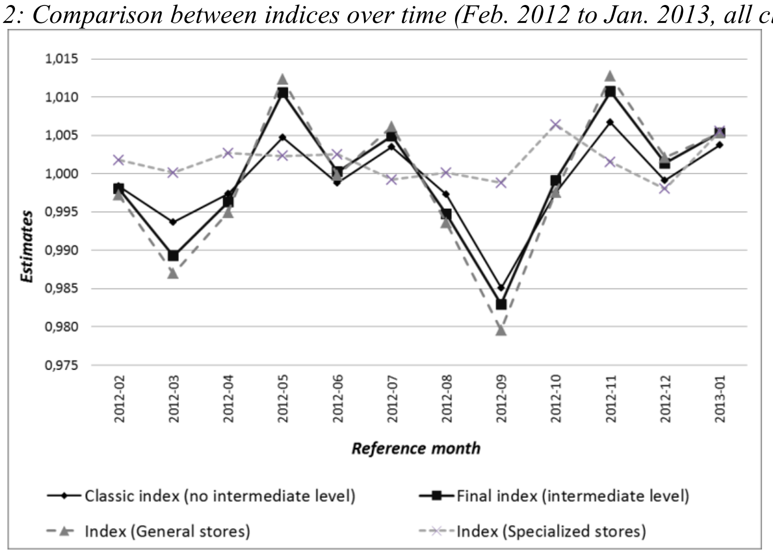
Clothing/Footwear) the GsI shows lower estimates, whereas the SsI shows higher values. The FA is always included in between the two sub-indices boundaries, as expected. But from this graph also emerge the fact that the CI is not coherent with the other indices, and mostly with the sub-indices. In several cases (6 out of 8 and at the overall level) the CI is out of the two sub-indices boundaries. In 2 cases (Shelter and Transportation) the CI gives bigger estimates than all other indices, in other 4 cases (Household, Clothing/Footwear, Recreation/Education, and Alcoholic beverages/Tobacco) it provides smaller values.

Graph 1: Classic index, Final index and sub-indices comparison (overall and by major classes)



Graph 1 only shows the FA index: the FG index is not shown because the differences between the estimates obtained with the geometric and the arithmetic formulas are not noticeable. Also the FAL and the FGL indices are not shown in the graph, but they confirm each other (the index obtained using the geometric formula is always slightly smaller than the index obtained with the arithmetic formula); moreover, they are substantially coherent with the results obtained with the FA and the FG aggregation structures, at the overall level: they only provide slightly smaller estimates of the price movements. But what is more important is that the FAL and the FGL estimates almost always fall within the sub-indices boundaries.

Graph 2: Comparison between indices over time (Feb. 2012 to Jan. 2013, all classes)



In Graph 2 the evolution of the indices over time is shown: the CI (thin black line) is directly compared to FA (black bold line), and to the sub-indices (GsI and SsI, the two grey broken lines); the FAL and the FGL indices are not shown in the graph (they mostly overlap with the FA index). Overall, we notice a high coherency in the estimates given by the Final Indices (at both the top and low level of aggregation, with no differences given, at the low level, by the kind of aggregation formula). All Final indices, moreover, are mostly influenced by the behaviour of the General stores index. The CI is, on the other hand, the aggregated index closer to the (more stable) behaviour of the Specialized sub-index.

Taking a more detailed look into two of the more interesting major classes (Food/Non-alcoholic beverages and Clothing/Footwear) we can better understand what should be the behaviour of our "desired" estimates. If we take into consideration the Food/Non-alcoholic beverages major class, we would expect a representative index proportionally more influenced by the behaviour of the General sub-index. The weighted Final indices, in fact, follow more the General than the Specialized one, whereas the CI is more a compromise with the more stable SsI. The Clothing/Footwear major class in terms of market shares is noticeably higher for Specialized stores. Thus, a price index that follows more closely the Specialized stores' index behaviour would be more representative; and this happens for the Final indices, whose strictly follow the SsI, whereas the CI is more influenced by the GsI, and, sometimes is also out of the sub-indices' boundaries.

4. Final remarks, recommendations and further research

The "weights" structure for CPI is of fundamental importance. In this paper we observed that the sub-indices obtained considering the type of outlets (General/Specialized) are clearly different. Thus, the introduction of an additional weighted level of aggregation between the low level (Jevons index) and the high level (Lowe/Laspeyres index), according to some preliminary findings of our research, push us to suspect that we could obtain more representative estimates, taking into account the different contribution (in terms of market shares) of the two kind of outlets.

In this paper we compare different methodologies to compile a new version of the aggregated indices (Final indices). We mainly compared the arithmetic and geometric formula to synthesize the sub-indices at the aggregate level, but no significant differences in the results were highlighted. Similar results were also observed comparing the FAL with the FGL scheme of aggregation. Our study also shows a high coherency of the four versions of the FIs (they mostly follow a common pattern of evolution) and a coherency with the two boundaries represented by the two sub-indices (referred to General and Specialized stores). Most of all, we found that the CI (compiled with the classical methodology) is not so coherent with the other versions of the indices (and most of the times it is also not consistent with the two sub-indices boundaries). The general conclusions seem to be confirmed by a study developed at the major classes level (considering, for example, two of the main ones: the Clothing and the Food/Non-alcoholic beverages).

We have to underline the current limits of our work: we cannot conclude, at this point, if the Final index aggregation structure (introducing the intermediate weighted level of aggregation) is better (or brings to more representative results) than the "classical" current methodology. We only discovered that there are noticeable differences in the results, using the two methods; we also obtained some indication (coherency and evolution over time) that seem to confirm that the current way of compiling a CPI could have some weaknesses in comparison to the new proposed methodology, especially when the sample distribution between General and Specialized stores does not reflect their respective market shares. Thus, further research is extremely needed to get a confirmation of our initial findings. A newer plan of study is already under development. Computing chained versions of the indices studied in this paper, we want to estimate the cumulative effect (over years) of the introduction of the intermediate level of aggregation on the final estimates. Moreover, in order to face some of the limitations of our study, we planned to compare the Classic and the Final Indices's estimates to a "superlative index" (e.g., using the Fisher or the Törnqvist formulas). The results obtained with the classical method and with the new proposed methodology could be then compared to a benchmark, considering a longer interval of years and, eventually, taking also into account the "change of the basket" effect and its impact on the reliability of the estimates.

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Disclaimer

The contents of this article reflect the views of the authors and not necessarily the official views or opinions of Statistics Canada.

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Intervention-Model-Based Analysis of Inflationary Pressures Induced by the Euro Area Expansion

Filip Tošenovský [1]

Abstract

The aim of the paper is to analyze whether the past eurozone expansion resulted in a statistically significant price increase in the countries adopting the european currency. The analysis will be carried out using intervention models which are a by-product of the time series theory. Different models of this kind are considered, and the statistical significance of the model parameters is tested within the framework of nonlinear models. Based on the results, a conclusion is made as to whether the Czech Republic might expect a price increase if it decides to adopt the european currency in the future.

Key words

Euro, eurozone expansion, price levels, intervention model

JEL Classification: C22

1. Introduction

Inflation, one of the most fundamental economic variables, has always drawn much attention as it undermines future returns of current investments, including those in the form of private bank savings, whereby it affects consumers' habits, and thus economy as a whole. It is for this reason that there has been a lot of talk about the benefits the eurozone continuing expansion may bring to a European citizen. Expanding eurozone means admitting countries which desire to adopt euro as their new currency, and the adoption may for some businesses serve as an excuse to round their market prices upwards, and fuel inflationary pressures. Some businesses may benefit from the eurozone expansion in this respect, other may not, relying on their large customer base. Individually, it doesn't really matter if the former or the latter applies. What matters is whether the overall business reaction to the euro expansion is such that it is reflected in an aggregate price level increase, measured by the consumer price index (CPI) in a given country. It is the CPI which is the most visible to everyone who cares about inflation, and may trigger a change in nationwide consumption habits.

The question whether the euro adoption by a country leads to a CPI increase in that country, and therefore very likely to a change in the consumer behaviour, is not straightforward to answer, and may be approached in more that one way. One such approach may be based on intervention model analysis (Wei, 1990). This approach models mathematically the time development of the CPI before and after the euro adoption, and subsequently tests statistical significance of the model parameters which describe a shift in the CPI stochastic behaviour incurred by the euro adoption. The variable *t* being used to express a point in time, as usual, the model that describes the time progress of CPI is written in the general form $CPI_t = X_t + Y_t$, $t = 0, \pm 1, \pm 2, ...$, where X_t is a stochastic process describing the

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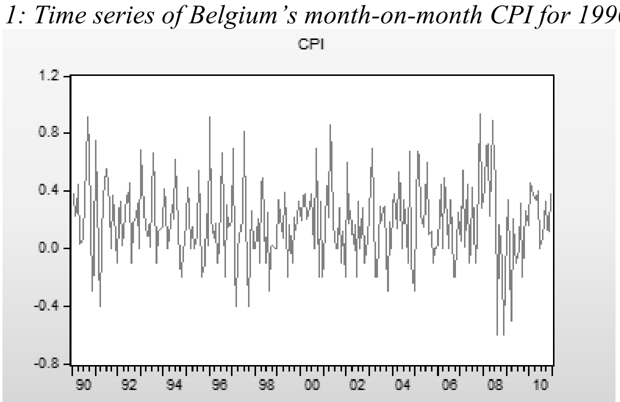
fundamental stochastic behaviour of CPI, and Y_t is a deterministic term such that $Y_t = 0$ for $t \neq t'$, t' being the time of euro adoption, and $Y_t = w$ for $t = t'$, where w is a real number. The deterministic term represents the effect of the euro adoption. If it turns out that the parameters defining Y_t are all equal to zero, i.e. they are statistically insignificant, then the euro adoption did not alter the fundamental stochastic behaviour of CPI.

The presented paper analyzes whether the euro adoption resulted in a statistically significant change in the time behaviour of CPI in a given eurozone country, using the model just outlined. The result of the analysis may be used to make a judgement on whether the future euro adoption in another country will give rise to an overall price increase in that country. To perform the analysis, historical data on 10 eurozone countries' CPI were used. Although there are currently 17 states in the eurozone, some of the countries have joined the euro area only recently, and thus, the time series data on their CPI's are not long enough for the intervention model to be reasonably reliable. Also, the CPI of two countries exhibited developments which did not fit the family of models we are going to use. Regarding the model $CPI_t = X_t + Y_t$ itself, a general enough model of the process X_t must be used so that it has the potential to capture the complexity of the time dynamics of the analyzed CPI. In this paper, SARIMA family of models is considered to describe X_t (Box, Jenkins and Reinsel, 2008), as ARIMA models have the power to describe a broad class of stochastic processes, and it is a known fact that inflation may be subject to seasonal factors, as well. To describe the term Y_t, an impulse function is used. The details on the model given in the next section.

2. The Data and the Model

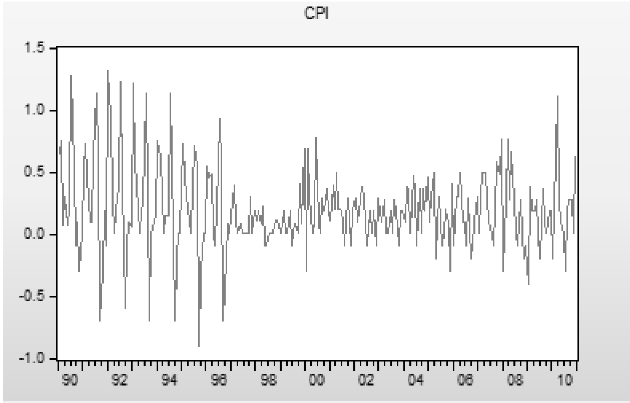
As was outlined, data on 10 eurozone countries' CPI is used in our analysis. The states to be examined are: Belgium, Austria, Finland, France, Germany, Greece, Italy, Netherlands, Portugal and Spain. Greece adopted the euro in January 2001. The other countries did so in January 1999. The states not included in the analysis are: Cyprus (admitted to eurozone in 2008), Estonia (admitted in 2011), Malta (admitted in 2008), Slovakia (admitted in 2009) and Slovenia (admitted in 2007), and also Luxembourg and Ireland whose CPI's follow a very difficult pattern to model mathematically. The monthly data on the ten countries span the period 1990-2010. The data set for each country represents a series of its CPI values, each of which describes a month-on-month price change in that country. Thus, each series contains 252 values, which is a long enough series. The data were taken from the official eurozone online source www.inflation.eu where they are published regularly. The per-country CPI series are depicted in the graphs 1-12.

Figure 1: Time series of Belgium's month-on-month CPI for 1990-2010



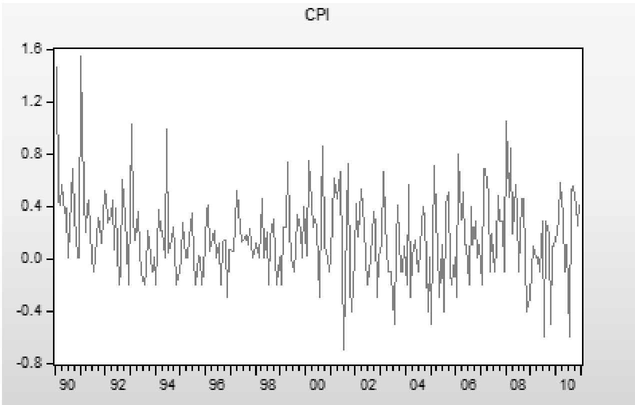
Time

Figure 2: Time series of Austria's month-on-month CPI for 1990-2010



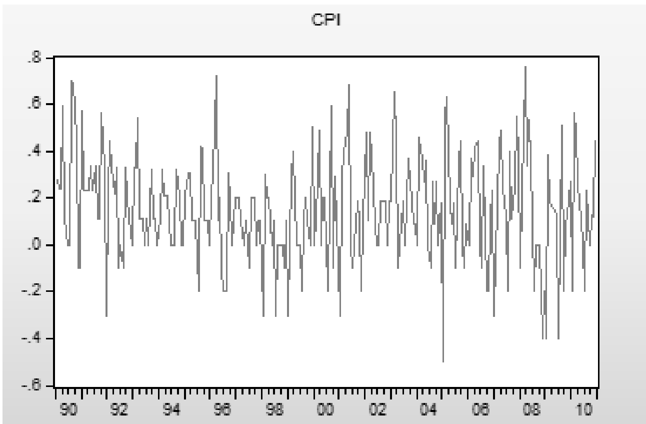
Time

Figure 3: Time series of Finland's month-on-month CPI for 1990-2010



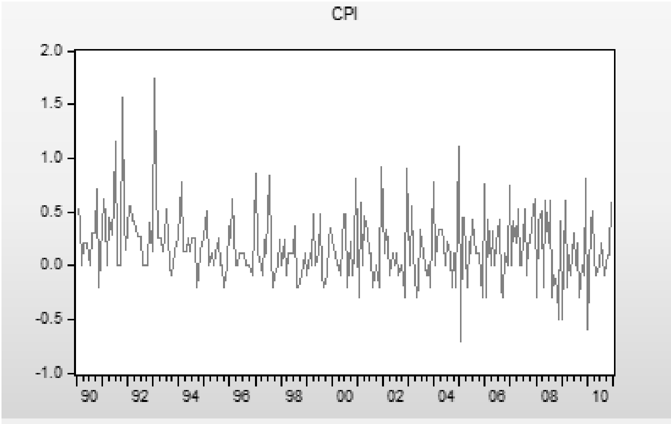
Time

Figure 4: Time series of France's month-on-month CPI for 1990-2010



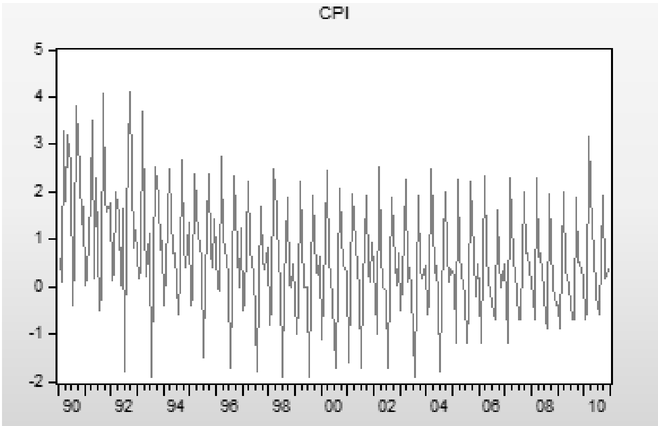
Time

Figure 5: Time series of Germany's month-on-month CPI for 1990-2010



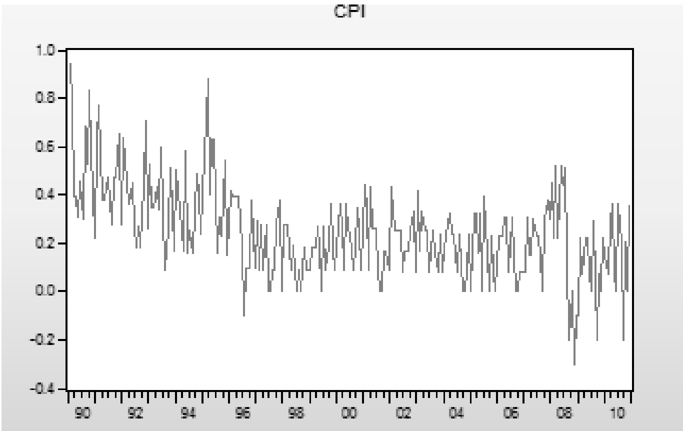
Time

Figure 6: Time series of Greece's month-on-month CPI for 1990-2010



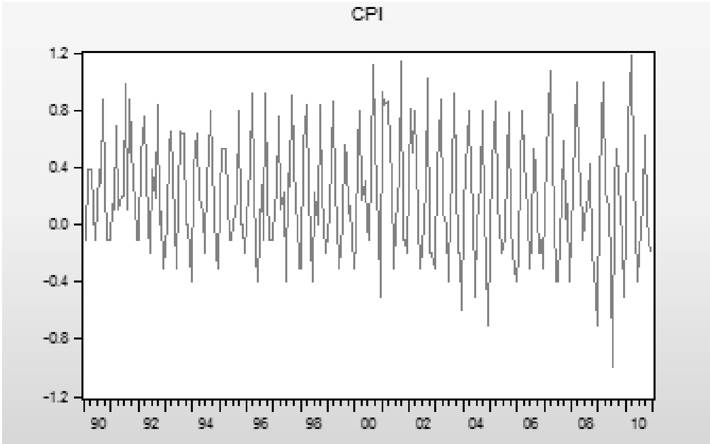
Time

Figure 7: Time series of Italy's month-on-month CPI for 1990-2010



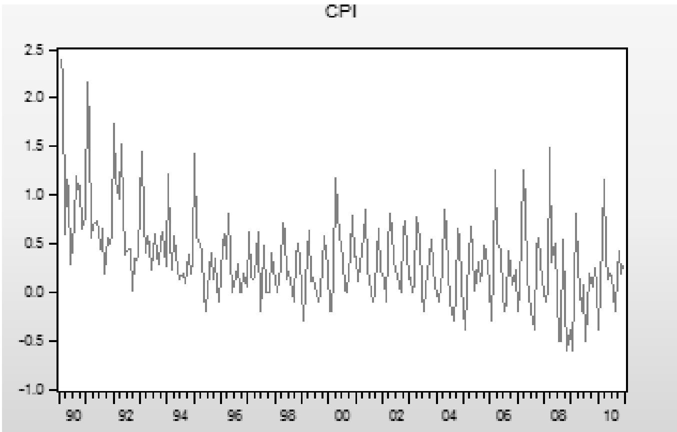
Time

Figure 8: Time series of Netherlands's month-on-month CPI for 1990-2010



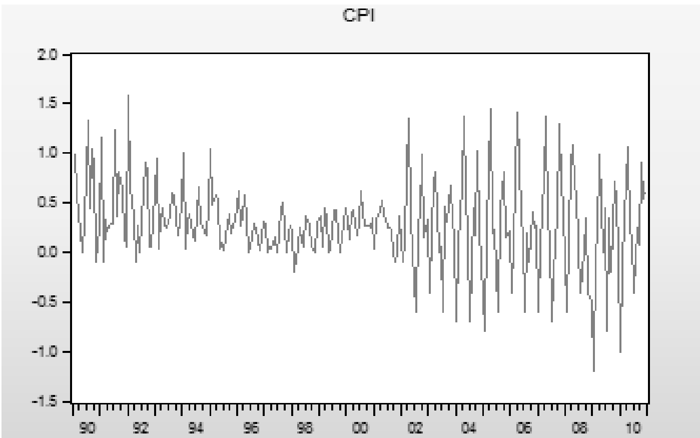
Time

Figure 9: Time series of Portugal's month-on-month CPI for 1990-2010



Time

Figure 10: Time series of Spain's month-on-month CPI for 1990-2010



Time

As for the model $CPI_t = X_t + Y_t,\ t = 0, \pm 1, \pm 2, \ldots$, the stochastic term X_t is assumed to satisfy the general $SARIMA(p,d,q) \times (P,D,Q)_s$ relation

$$\phi_p(B)\Phi_P(B^s)\Delta^d \Delta_s^D X_t = \theta_q(B)\Theta_Q(B^s)a_t, \tag{1}$$

or $\varphi^*(B)\Delta X_t = \theta^*(B)a_t$ in a simplified notation, where the polynomials in the lag operator B, defined as $B^k z_t = z_{t-k}$ for a time series $\{z_t\}$, take the usual forms

$$\phi_p(B) = 1 - \varphi_1 B - \varphi_2 B^2 - \ldots - \varphi_p B^p, \tag{2}$$

$$\Phi_P(B^s) = 1 - \quad , \tag{3}$$

$$\theta_q(B) = 1 + \vartheta_1 B + \vartheta_2 B^2 + \ldots + \vartheta_q B^q, \tag{4}$$

$$\Theta_Q(B^s) = 1 + \tag{5}$$

and have roots outside the unit circle. Also, $\Delta^d = (1-B)^d$ and $\Delta_s^D = (1-B^s)^D$ are differences of the d-th and D-th order, respectively, and a_t is a strong white noise process, which is to be verified statistically. Finally, s denotes the seasonal time period if there is any, and Δ_s^D then means the D-th order difference with the difference step s. Thus, if $CPI_t = X_t$ and X_t is a $SARIMA(1,2,0) \times (0,0,1)_{12}$, for instance, we deal with the model $\phi_1(B)\Delta^2 X_t = \Theta_1(B^{12})a_t$ or $Z_t = \varphi_1 Z_{t-1} + a_t + \quad$, where $Z_t = \Delta^2 X_t = X_t - 2X_{t-1} + X_{t-2}$.

Since $CPI_t = X_t$ is assumed to hold true prior to the euro adoption, the specific form of the SARIMA model is identified from the historical data falling to the time period before the euro adoption. It is further presumed that after the euro adoption, the identified SARIMA model keeps generating the CPI series but together with an added deterministic term Y_t which expresses the potential shift in the CPI time development caused by the euro adoption, or by an "intervention". For Y_t, we assume a model of the form

$$Y_t = wI_t,\ t = 0, \pm 1, \pm 2, \ldots\ . \tag{6}$$

Here, w is an unknown parameter to be estimated as well, and $I_t = 1$ for $t = t'$, $I_t = 0$ for other t. The relation describes an immediate effect of the euro adoption on Y_t, and therefore on the CPI. We assume that if there was any reaction to euro from businesses, it was immediate.

To summarize, after proper identification and diagnostic checking of the correctness of the (S)ARIMA model form of X_t, based on the data prior to the euro adoption, we shall eventually estimate the parameters of the following ARMAX model

$$\varphi^*(B)\Delta CPI_t = \theta^*(B)a_t + \varphi^*(B)w\Delta I_t. \tag{7}$$

Once the model is estimated, statistical significance of the parameter w relating to I_t is considered on the basis of standard deviations of the estimated parameters.

3. The Analysis

Since estimating parameters of an ARMAX model involves nonlinear numerical optimization, the models discussed will be found with Eviews 7 software package, where such model forms can be defined, estimated and tested. The procedure of finding the model is described in a greater detail for the first country under scrutiny - Belgium. For the other countries, only a summary of the results is published.

Taking data on Belgium's CPI prior to the euro adoption, we had Eviews drawn the autocorrelation and partial autocorrelation function for the data, whereby identifying a potential SARIMA model. Once the model was identified, we estimated its parameters, using Eviews again, and then calculated the residuals a_t from this model. If the autocorrelation function and partial autocorrelation function of the process $\{a_t\}$ didn't show any pattern, we considered it a white noise and tested in the next step whether we dealt with a weak or strong white noise. To do so, we used a so-called *test based on turning points* (Brockwell and Davis, 1991) which tests the hypothesis: *the series consists of independent variables having the same probability distribution*. If the hypothesis was accepted, we then drew a histogram to see if that identical distribution might be a normal distribution. If so, we concluded the process $\{a_t\}$ is a strong white noise – a Gaussian white noise. The process $\{a_t\}$ must be strong white noise for the models to work properly. This is exactly what happened in the case of Belgium as well as other states. Once the SARIMA model was identified, we took all the data on Belgium, i.e. not only those prior to the euro adoption but also those including the period after the adoption, and assumed the model $CPI_t = X_t + Y_t$. This model was estimated by Eviews and refined if the diagnostic-checking procedures required it (for instance, insignificant parameters were dropped from the model, and the model was reestimated). In case of Belgium, we arrived at the final model for $CPI_t = X_t + Y_t$ in the form

$$(1+0.18B)(1-B^6)CPI_t = (1-0.95B^6)a_t - 0.02(1-B^6)I_t, \tag{8}$$

where the estimate of the parameter *w*, which is mainly of interest here, is -0.02. We then decided, based on the data provided by Eviews, whether the parameter is statistically significant or not. The Eviews output for the Belgium's model was as follows:

Figure 11: Eviews output for the final model for Belgium's CPI

Dependent Variable: D6CPI
Method: Least Squares
Date: 08/31/13 Time: 12:29
Sample (adjusted): 8 252
Included observations: 245 after adjustments
Convergence achieved after 5 iterations
MA Backcast: 2 7

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D6I	-0.021716	0.257056	-0.084480	0.9327
AR(1)	0.186254	0.063458	2.935088	0.0037
MA(6)	-0.957372	0.013156	-72.77314	0.0000

R-squared	0.506413	Mean dependent var	-0.001265
Adjusted R-squared	0.502334	S.D. dependent var	0.371953
S.E. of regression	0.262396	Akaike info criterion	0.174244
Sum squared resid	16.66207	Schwarz criterion	0.217116
Log likelihood	-18.34485	Hannan-Quinn criter.	0.191508
Durbin-Watson stat	1.969638		

Inverted AR Roots	.19			
Inverted MA Roots	.99	.50+.86i	.50-.86i	-.50+.86i
	-.50-.86i	-.99		

The figure contains estimates (the second column) of the parameters of the variables (the first column) that appear in the final model, and also p-values for the significance of these estimates (the final column). When the p-value is greater than 0.05, one accepts the hypothesis that the corresponding parameter is insignificant, i.e. it is equal to zero. In the opposite case, the parameter is significant, i.e. different from zero. In the figure, *D6I* stands for the 6th-order difference of I and is the name of the variable $(1-B^6)I_t$ to which the parameter w is related. Therefore the parameter w seems to be zero in this case, thus the euro adoption very likely didn't have any effect on the CPI development of Belgium.

The same procedure was applied to all the other countries in question, and what follows are the final results for these countries. These results include the name of the country, the final model for its CPI and the p-value for the parameter w in the final model.

Table 1: Models for countries' CPI with p-value for parameter significance

Country	**Model**	**p**
Austria	$\Delta_{12}CPI_t = (1-0.54B^{12})a_t - 0.18\Delta_{12}I_t$	0.39
Finland	$\Delta_{12}CPI_t = (1-0.88B^{12})a_t - 0.41\Delta_{12}I_t$	0.12
Germany	$\Delta_6\, CPI_t = (1-1.04B^6 + 0.39B^{12} - 0.21B^{18})a_t - 0.25\Delta_6\, I_t$	0.19
Italy	$\Delta_{12}\Delta CPI_t = (1-0.79B)(1-0.7B^{12})a_t - 0.15\Delta_{12}\Delta I_t$	0.2
Holland	$\Delta_{12}CPI_t = (1-0.72B^{12})a_t - 0.07\Delta_{12}I_t$	0.7
Portugal	$(1-0.45B-0.39B^2-0.24B^3)\Delta_{12}\Delta_3\, \Delta CPI_t =$	
	$= (1-0.92B^3)(1-0.52B^{12})a_t - 0.46(1-0.45B-0.39B^2-0.24B^3)\Delta_{12}\Delta_3\, \Delta I_t$	**0.02**
Spain	$(1+0.35B)\Delta_{12}\Delta_6\, CPI_t = (1-0.78B^6)(1-0.66B^{12})a_t - 0.18(1+0.35B)\Delta_{12}\Delta_6\, I_t$	0.37
Greece	$\Delta_{12}\Delta_6\, CPI_t = (1-0.65B^6)(1-0.51B^{12})a_t - 0.88\Delta_{12}\Delta_6\, I_t$	**0.01**
France	$\Delta_6\, CPI_t = (1-0.9B^6)a_t - 0.25\Delta_6\, I_t$	0.19

4. Conclusion

As we can see in Table 1, eight out of ten countries did not show a reaction to the euro adoption, as far as their CPI time development is concerned, because the corresponding p-values are greater than 0.05. The only two countries that seem to have reacted to euro are Portugal and Greece with the p-value for the parameter w being smaller than 0.05 in their case. What is interesting, this reaction seems to be oriented downwards, as suggested by the final model in which w = -0.46 for Portugal and w = -0.88 for Greece, and not upwards as one might have expected. This means that in these two cases, the reaction seems to have lowered the price level a little, rather than the opposite. However, the general conclusion from this analysis is rather such that adopting euro doesn't seem to alter the price level in a country given the fact that an overwhelming majority of analyzed countries showed this kind of behaviour.

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Possibilities of Production Process Financial Assessment

Josef Tošenovský, Filip Tošenovský [1]

Abstract

Nowadays production process management is assessed almost exclusively with capability indices, or even only one of them – the Cpk index. The index can be used on condition that several prerequisites are met, which is often not the case. In such situations, other means of assessment, which are more universal and possess many other advantageous properties, may be exploited as well. The aim of this paper is to show some unconventional ways of process assessment. The presented subject has also been incorporated into university curriculum of econometrics.

Key words

Process capability, capability index, loss function, procedure optimization.

JEL Classification: C02

1. Úvod

Při hodnocení způsobilosti výrobního procesu pomocí indexu Cpk by měly být splněny minimálně tyto předpoklady: stabilita procesu, nezávislost dat, dostatečná velikost výběrového souboru, data nezatížená odlehlými hodnotami, normalita souboru a správně stanovená tolerance. Uvedené předpoklady je potřeba prověřit příslušným testem. Nesplnění některých znamená, že hodnocení procesu nelze provést, nesplnění jiných pak vyžaduje použití jiného indexu než Cpk. Alternativou k metodice hodnocení pomocí indexů způsobilosti je použití tzv. ztrátové funkce.

2. Index způsobilosti a ztrátová funkce

Připomeneme, že index Cpk se počítá pomocí vztahu

$$C_{pK} = \min(C_{pL}, C_{pU}), \qquad (1)$$

kde

$$C_{pU} = \frac{USL - \mu}{3\sigma}, C_{pL} = \frac{\mu - LSL}{3\sigma}, \qquad (2)$$

μ je střední hodnota a σ je směrodatná odchylka.

Základní a nejjednodušší varianta ztrátové funkce je vyjádřená rovnicí [2]

$$L(Y) = k(Y - T)^2, \qquad (3)$$

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kde T = cílová hodnota ukazatele kvality (předepsaná hodnota), Y = skutečně dosažená hodnota ukazatele kvality, k = konstanta, $L(Y)$ = *finanční* ztráta *odběratele*, způsobená nedodržením T.
S rostoucím $L(Y)$ klesá kvalita řízení, naopak hodnoty blízké nule svědčí o perfektním nastavení.
Konstanta k v rovnici (3) se počítá ze vztahu

$$k = \frac{A}{d^2}, \tag{4}$$

kde A = nákladová konstanta (obvykle ztráta, způsobená překročením tolerance), d = tolerance.
Užitečnější informace než ztráta u jednoho výrobku je *průměrná ztráta* za nedodržení T, která se vypočítá

$$EL(Y) = \frac{A}{d^2} s^2 = k \cdot s^2, \tag{5}$$

Přičemž s^2 = rozptyl ukazatele kvality a $EL(Y)$ = střední hodnota veličiny $L(Y)$. Jelikož stanovení konstanty A může být někdy problém, byla vytvořena *standardizovaná ztrátová funkce* SL(Y) [2], která má rovnici

$$SL(Y) = 4 \cdot \left(\frac{Y - T}{USL - LSL} \right)^2. \tag{6}$$

U $SL(Y)$ není potřeba hodnota A. Výsledky $SL(Y)$ jsou bezrozměrné. Čím menší je hodnota $SL(Y)$, tím větší je shoda s cílovou hodnotou a tedy lepší kvalita. Průměrná standardizovaná ztráta se vypočítá dle vztahu

$$ESL(Y) = \frac{4}{(USL - LSL)^2} s^2. \tag{7}$$

Příklad 1
Máme-li výsledky sledovaného ukazatele Y (viskozita pryskyřice): 53, 58, 59, 56, 64, 45, 65, 60, 59, 64, 53, 65, 65, 59, 62, toleranční hranice LSL = 33, USL = 81 a jsou-li základní charakteristiky $\bar{x} = 57.13$, s = 8, vychází Cpk = 0.97, což signalizuje nezpůsobilost procesu. Jelikož daný soubor ale nemá normální rozdělení, neměl by být Cpk použit. Místo něho lze použít např. univerzálnější indexy Cpp a CpT, které zde vycházejí Cpp = CpT = 1.09, tedy na hranici způsobilosti.
Pokud bychom chtěli vyjádřit průměrnou finanční ztrátu podle (5), způsobenou nedodržením předepsané hodnoty T, bude pro d = 24 a s^2 = 64 ztráta $EL(Y) = (A/24^2) \cdot 64$. Například pro A = 100 Kč/kg vychází $EL(Y)$ = 11,11 Kč/kg. Není-li A známo, vypočítá se průměrná standardizovaná ztráta $ESL(Y)$, která zde vychází $ESL(Y) = 4/(81-33)^2 \cdot 64 = 0{,}11$. Tento výsledek můžeme interpretovat jako 11% ztrátu způsobenou nedodržením T. Z výše uvedených předpokladů pro indexy způsobilosti zde sledujeme jen odlehlé hodnoty v souboru. Tento příklad ukazuje nejjednodušší variantu použití ztrátové funkce. Zajímavější je případ, kdy při použití ztrátové funkce vezmeme v úvahu také vstupy procesu, které ovlivňují sledovaný ukazatel kvality Y.

3. Vícerozměrná ztrátová funkce s uvážením vstupních parametrů

Jsou-li veličiny Y_i závislé na vektoru proměnných $\mathbf{x}$ = $(X_1,...,X_p)$, pak vícerozměrná ztrátová funkce má rovnici [2]

$$TSL(Y) = 4\sum_{i=1}^{i=p}\left(\frac{Y_i(x) - T_i}{USL_i - LSL_i}\right)^2 , \qquad (8)$$

kde $Y_i(\boldsymbol{x})$ je regresní funkce $Y_i = f(X_1,...,X_p)$, kterou je potřeba najít. Pak už je výpočet *TSL* jednoduchý. Ukážeme na dvou příkladech, jaké výsledky přináší ztrátová funkce. V příkladě 2 je sledován jeden znak na výstupy, který je ovlivňován třemi vstupními faktory X_1, X_2 a X_3.

Příklad 2 (data převzata z [1])
Při výrobě umělé pryskyřice je ukazatelem kvality *Y* její viskozita, vyjádřená molekulární vahou. Tu ovlivňují tři faktory: X_1 = teplota (°C), X_2= rychlost míchání (rpm), X_3= rychlost přidávání (min^{-1}). Vstupní hodnoty těchto parametrů a příslušné hodnoty *Y* jsou v tabulce 1. Hodnoty *Y* jsou tytéž, které byly použity v příkladě 1 při výpočtu indexů a nejjednodušší variantě ztrátové funkce.

Table 1: Vstupy a výstupy procesu

X_1	X_2	X_3	Y
150	5	20	53
200	5	20	58
150	10	20	59
200	10	20	56
150	7,5	15	64
200	7,5	15	45
150	7,5	25	35
200	7,5	25	60
175	5	15	59
175	10	15	64
175	5	25	53
175	10	25	65
175	7,5	20	65
175	7,5	20	59
175	7,5	20	62

Chceme-li užít vzorec (8), je třeba nalézt regresní funkci $Y(\boldsymbol{x})$ vyjadřující vztah *Y* a příslušných vstupů X_i. Tato rovnice má tvar

$Y(\boldsymbol{x})$ = -58,87 + 2,65X_1 -0,65X_2 -11,125X_3 -0,0118X_1^2 + +0,3X_2^2 - 0,145X_3^2 – 0,032X_1X_2 + +0,08X_1X_3 + 0,14X_2X_3.

Dále vymezíme regulační meze *LSL* a *USL* pro povolené hodnoty vstupů, toleranční interval pro výstup *Y* a ideální hodnotu výstupu *T* (u vstupů nemá smysl, tam se hledá optimum).

Table 2: Parametry procesu 2

	LSL	*USL*	*T*
X_1	150	200	
X_2	5	10	
X_3	15	25	
Y	65	75	70

Provedeme výpočet *TSL*(*Y*) dle (8) pro různá nastavení vstupů: nastavení na dolních a horních hranicích, na středních hodnotách a optimální nastavení. To je vypočítáno s programem Excel.

Table 3:TSL pro různá nastavení procesu 3

	Střední nastavení	Dolní nastavení	Horní nastavení	Optimální nastavení
X_1	175	150	200	**175,137**
X_2	7,5	5	10	**11,370**
X_3	20	15	25	**18,303**
TSL(y)	2,556	2,322	1,04	**$6{,}4\cdot10^{-24}$**

Při optimálním nastavení je tedy ztráta *TSL* nulová. Uvedený postup hodnocení umožňuje porovnat kvalitu různých nastavení vstupů a také vypočítat optimální hodnoty vstupů. Celý postup je možné zopakovat také pro více sledovaných výstupů, jak je vidět z příkladu 3.

Příklad 3 (data převzata z [1])
V daném chemickém procesu jsou sledovány tři výstupní ukazatele kvality: výtěžnost procesu Y_1, viskozita výrobku Y_2 a molekulární váha Y_3. Kvalita těchto ukazatelů je řízena prostřednictvím dvou vstupních veličin: času X_1 a teploty X_2. Hledá se optimální nastavení vstupů. Ukazatelem kvality nastavení je hodnota vícerozměrné ztrátové funkce *TSL*. Požadavky na proces jsou: maximální výnos, viskozita v mezích (62, 68) a molekulární váha pod hranicí 3400, respektive $\max Y_1, 62 \le Y_2 \le 68, Y_3 \le 3400$. Tyto údaje přepíšeme pro potřeby výpočtu ve tvaru konkrétních hodnot (tab. 4).

Table 4:Parametry procesu 3

	LSL	*USL*	*T*
X_1	80	90	
X_2	170	180	
Y_1	75	80	80
Y_2	62	68	65
Y_3	2900	3400	2900

Nyní posoudíme kvalitu nastavení pomocí *TSL* (tab.5).

Table 5:TSL pro různá nastavení procesu 3

	Dolní nastavení	Střední nastavení	Horní nastavení	Optimální nastavení	Teoretické nastavení
X_1	80	85	90	80	**61,12**
X_2	170	175	180	170	**178,60**
TSL(*Y*)	1512,44	2490,76	3630,07	**1512,44**	**1,26**

Optimální nastavení je zde shodné s nastavením dolním. Pokud by mohlo být X_1 nastaveno pod hranicí 80, je zdaleka nejmenší *TSL* pro X_1 = 61,12. Nastavení vstupů však musí respektovat reálné možnosti technologie.

4. Závěr

Při řízení technologických procesů je nezbytné nalézt vhodné kriterium kvality řízení. V současné době se téměř výhradně používají indexy způsobilosti. V tomto příspěvku jsme ukázali, že jsou i jiné možnosti, které jsou méně náročné na splnění výchozích předpokladů pro jejich použití, jsou použitelné pro libovolný počet hodnocených ukazatelů kvality na jednom produktu a navíc, vedle hodnocení procesu, umožňují výpočet jeho optimálního nastavení.

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Is there any relevance of business-related financial reporting in Slovakia

Miloš Tumpach, Zuzana Juhászová, Jitka Meluchová [1]

Abstract

There are several groups of external users of business information, whose needs are more often in mutual contradiction. As a result, in each country available data have to be standardized and provided within the financial reporting systems in the form of general financial statements. Since 1946 the accounting rules in Slovakia has been prescribed by the government in a very detailed way. Because the government itself is one of the parties interested in such information, we have been examining whether the current system of business financial reporting could be relevant also for those parties which have no such privileged status. Though the public availability of financial reporting data is limited, we have proven certain relevance for at least some type of decisions.

Key words

international accounting, financial reporting, accounting regulation in Slovakia

JEL Classification: M41

1. Úvod

V období ekonomickej krízy sa nielen v odbornej verejnosti či akademickej komunite zvýšil záujem o relevantnosť účtovných informácií, predovšetkým preto, že neindikovali jej príchod. Tento kritický pohľad na niektoré nedostatky účtovníctva nie ani v literatúre ojedinelý (Kothari, 2012), (Heaton, 2010), (Al Qudah, 2012), (Bignon, 2009) rovnako sa však vyskytujú názory (Laux, 2010), (Skálová a Mejzlík, 2012), (Andre, 2009), (Harris, 2010), (Badertscher, 2012), že účtovníctvo je iba neutrálnym nositeľom informácií ktorých rozsah, obsah a dostupnosť determinuje širšie prostredie, v ktorom účtovníctvo pôsobí. Viacerí autori (Nobes, 2010), (Aisbitt, 2002), (Doupnik, 1995), (Nair, 1980), (Nobes, 1998), (Roberts, 1995) využívajú práve tento predpoklad ako východisko pri klasifikácii účtovných systémov krajín alebo individuálnej krajiny (Mokošová, 2008) a to v závislostí od rôznych sociálnych, ekonomických, politických či kultúrnych faktorov. Vo všetkých krajinách pritom ako garant relevantnosti účtovných informácií pôsobí štát, hoci táto jeho úloha môže byť čiastočne realizovaná prostredníctvom nezávislých subjektov. Dokonca aj v tradične ekonomicky liberálnej krajine za akú môžeme USA považovať, je zvrchovaným tvorcom účtovných predpisov Kongres ako zákonodarný zbor, ktorý až následne deleguje časť svojich právomocí na nezávislú a nevládnu inštitúciu (Financial Accounting Standards Board).

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Naše úvahy sa však týkajú situácie v Slovenskej republike a predovšetkým toho, do akej miery môžu účtovné informácie poskytované národným podnikovým finančným výkazníctvom relevantne využívať aj tí (neprivilegovaní) používatelia ktorí majú inferiórne postavenie z hľadiska dostupnosti jeho informácií. Posúdenie relevantnosti informácií ktorých rozsah a obsah formuluje štát aj pre týchto používateľov je dôležité predovšetkým pre to, že účtovné informácie sa využívajú pre účely dokumentovania ekonomických účinkov konkrétnych transakcií, udalostí či okolností, určenie práv a povinností jednotlivých zainteresovaných strán, rozhodovanie na úrovni vnútropodnikového riadenia (Potkány, 2007) či simuláciu budúceho vývoja. Nedostatky v tejto oblasti môžu znehodnocovať či úplne znemožniť využitie týchto informácií pre prognózovanie ekonomického vývoja na mikro aj makro úrovni (Hindls, 2012) a zvýšiť neistotu možných obchodných partnerov vo vzťahu k ich oprávneným ekonomickým nárokom. Výsledkom môžu byť zvýšené transakčné náklady či neuskutočnenie obchodných transakcií v tých prípadoch, v ktorých sú si obchodní partneri vedomí rizika a majú k nemu averziu a naopak, hrozba druhotnej platobnej neschopnosti tam, kde toto riziko nie je známe či je úmyselne podceňované.

2. Formulácia hypotéz a postupy overovania ich platnosti

Relevantnosť účtovných informácií poskytovaných podnikovým finančným výkazníctvom je podmienená viacerými faktormi, ale predovšetkým ich včasnou dostupnosťou a schopnosťou znižovať neurčitosť používateľa vo vzťahu k budúcnosti. Vzhľadom na rozsah kapitálového trhu v SR nie je možné aplikovať niektorý z prístupov určujúcich relevantnosť na základe priamej odozvy investorov na obsah účtovných informácií poskytovaných podnikovým finančným výkazníctvom (Brown, 2012), (Ball, 2008), sme nútení použiť nepriame prístupy.

Prvým východiskom riešenia je predpoklad existencie neprivilegovaných používateľov z hľadiska dostupnosti informácií. V súlade s tým budeme v podmienkach SR overovať nulovú hypotézu H10, ktorá znie nasledovne: „dostupnosť informácií z podnikového finančného výkazníctva nie je pre tvorcu účtovných pravidiel vyššia, než ich dostupnosť pre iné skupiny externých používateľov“, pričom jej potvrdenie by viedlo k zamietnutiu predpokladu existencie neprivilegovaných používateľov. K tejto nulovej hypotéze preto existuje alternatívna hypotéza H11, podľa ktorej má tvorca účtovných pravidiel viac informácií než iní externí používatelia.

Za predpokladu, že sa existencia skupiny neprivilegovaných používateľov potvrdí, budeme ďalej uvažovať o tom, či informácie ktoré sú výsledkom noriem ustanovených tvorcom účtovných pravidiel, môžu byť týmito používateľmi využívané pri rozhodovaní. Hypotéza H20 teda bude znieť: informácie z podnikového finančného výkazníctva v SR nie sú relevantné pre žiadne rozhodovanie neprivilegovaných používateľov. Oproti tomu je alternatívna hypotéza H21 reprezentovaná tvrdením, že tieto informácie sú dôležité pre aspoň niektoré typy rozhodovania neprivilegovaných používateľov.

Pretože nemôžeme ex ante vylúčiť možné skreslenie v dôsledku toho, že štát má sám záujem na to, aby boli informácie (predovšetkým o dani z príjmo) ľahšie overiteľné, určíme hypotéza H30 bude preto znieť: účtovné pravidlá v SR nie sú skreslené požiadavkou na objektivizáciu základu dane z príjmov. Alternatívna hypotéza H31 bude znieť, že účtovné pravidlá v SR sú požiadavkou na objektivizáciu základu dane z príjmov skreslené. Hoci nižší vplyv štátu nemusí nutne viesť k vysokej relevantnosti účtovných informácií pre ostatné (alebo aspoň niektoré) zainteresované strany, dá sa predpokladať opak (Haller, 1992), (Noguchi, 2005), (Hoogendoorn, 1996), teda že silná orientácia iba na daňové potreby štátu môže naopak zužovať priestor pre poskytnutie verného a pravdivého obrazu o ekonomickej situácii podnikov.

3. Overovanie platnosti hypotéz

Overovanie platnosti hypotéz sa realizuje analýzou dostupných informácií z účtovných závierok, publikovaných v SR v obchodnom vestníku. Táto skutočnosť predstavuje sama o sebe inherentné obmedzenie skúmania, keďže zďaleka nie všetky subjekty majú povinnosť takéhoto zverejnenia. Na rozdiel od štátu teda neprivilegované subjekty nemajú k dispozícii informácie za všetky podniky a aj tie ktoré sú dostupné nie sú úplné (chýbajú poznámky, obsahujúce prehľady peňažných tokov, prehľady zmien vlastného imania a vysvetlenie metodických postupov na základe ktorých bola účtovná závierka zostavená). Okrem toho, pretože účtovné závierky môžu byť zostavené za rôzne subjekty, rôzne obdobia a s využitím rôznych metodík, obmedzili sme v záujme dosiahnutia všeobecných záverov východiskový zdroj údajov tak, aby obsahoval údaje z rovnakého typu účtovných závierok, týkal sa rovnakého obdobia, bol prezentovaný v tom istom ročníku obchodného vestníku. Takisto sme považovali za dôležite upraviť východiskovú bázu tak, aby neobsahovala údaje od subjektov, v ktorých záznamoch sa vyskytli identifikovateľné chyby či od subjektov, za ktoré by nebolo možné vypočítať relevantné údaje.

3.1 Overovanie platnosti hypotéz H10 a H11

Overenie platnosti hypotéz H10 a H11 je založené na hodnotení verejnej dostupnosti účtovných informácií v rámci podnikového finančného výkazníctva v SR pre neprivilegovaných používateľov. V tomto prípade vychádzame z údajov o celej populácii podnikov určených na základe údajov Štatistického úradu SR k ultimu roku 2011, pričom budeme hodnotiť, ktoré z nich sú verejne dostupné. Zákon o účtovníctve vyžaduje, aby sa zostavená individuálna účtovná závierka ukladala povinne v zbierke listín Obchodného zákona (§ 21, odsek 1 citovaného zákona), avšak iba v prípade obchodných spoločností, družstiev, štátnych podnikov a Exportno-importnej banky Slovenskej republiky. Hoci je toto uloženie možné považovať z istého pohľadu za zverejnenie, skutočná verejná dostupnosť sa do r. 2014 dosahuje iba zverejnením v Obchodnom vestníku. V ňom sa však uvádzajú iba niektoré súčasti účtovnej závierky (súvahu a výkaz ziskov a strát, nie však poznámky) a to iba za tie subjekty ktoré ukladajú účtovnú závierku do zbierky listín Obchodného registra, ktoré majú súčasne povinnosť overenia účtovnej závierky audítorom.

Porovnanie celkového počtu podnikov (153 881) s počtom subjektov, za ktoré sú dostupné použiteľné účtovné informácie aspoň na obmedzenej úrovni (3 889 subjektov postupujúcich výlučne podľa národných predpisov) naznačuje, že rozsah informácií dostupných pre neprivilegovaných používateľov je nedostatočný a teda platnosť hypotézy H10 je potvrdená.

3.2 Overovanie platnosti hypotéz H20 a H21

Vzhľadom na obmedzený rozsah obchodovania s cennými papiermi a skreslenie v dôsledku ekonomickej krízy nie je možné hodnotiť relevantnosť súčasných účtovných dát priamo, je však možné ju posúdiť aspoň z toho pohľadu, či existuje štatisticky významný vzťah medzi pozitívnymi účtovnými informáciami a rozhodnutiami používateľov. V našom prípade použijeme pre účely overovania platnosti hypotéz $H2_0$ a $H2_1$ nepriamy prístup, vychádzajúci zo z štúdie Lundtofta (2012) v ktorej sa hodnotila vzťah medzi kvalitou verejne dostupných informácií a závislosťou výšky úrokovej miery od doby splatnosti. Overovanie však bude v našom prípade založené na posúdení závislosti medzi obsahom vybraných informácií podnikového finančného výkazníctva a mediánu úrokovej miery skupiny 3 224 podnikov na ktorej sme platnosť hypotéz $H2_0$ a $H2_1$ overovali. Vybrané informácie sme zvolili na základe predchádzajúcich štúdií (Altman, 1968), (Zmijewski), (Beaver, 1966), (Edmister), (Zavgren, 1983), (Ohlson, 1980). Vychádzať sa bude z logistickej regresnej rovnice:

$$INCINT = \beta_0 + \beta_1 NEGEQ + \beta_2 ROA + \beta_3 LIQ2 + \beta_4 INDEB + \varepsilon,$$

kde *INCINT* je vysvetľovaná premenná, reprezentujúca vzťah úrokovej miery ktorými sú zaťažené cudzie zdroje daného podniku a mediánu úrokových mier za celý súbor podnikov (premenná bude nadobúdať hodnotu 1, ak je úroková miera daného podniku vyššia ako medián, 0 ak je úroková miera nižšia alebo rovná ako medián), vysvetľujúcimi premennými sú *NEGEQ* (ktorá bude nadobúdať hodnotu 1 v prípade ak je vlastné imanie podniku záporné a 0 ak je kladné či nulové), *ROA* (reprezentujúca podiel výsledku hospodárenia pred zohľadnením vplyvu úrokov a daní a celkovej hodnoty majetku, očistenej o oprávky a opravné položky; pretože *INCINT* zahŕňa úroky z roku 2011 a *ROA* úroky z roku 2010, nepovažovali sme prípadné skreslenie za významné), *LIQ2* (reprezentujúcu likviditu druhého stupňa, stanovenú ako pomer krátkodobého majetku a krátkodobých záväzkov) a *INDEB* (vyjadrujúcu zadĺženosť, ako pomer medzi celkovými záväzkami a majetkom). V nami uvažovanom prípade sú rozhodnutia používateľov reprezentované výškou úrokovej sadzby z poskytnutých zdrojov financovania. Informácie o úrokoch boli získané z riadku 39 Výkazu ziskov a strát za rok 2011 a údajov o výške záväzkov z titulu obchodných vzťahov, priebežného financovania a bankových úverov uvádzaných na riadkov 095, 098, 099, 102, 104, 107, 110, 111, 116 a 118 súvahy (tak isto zostavenej za rok 2011). Vysvetľujúce premenné zodpovedali roku 2010 (predpokladali sme, že údaje za rok 2011 ktoré sú dostupné v roku 2012 nemôže ovplyvniť výšku úrokov už v r. 2011) a boli vyčíslené z súvah takto: INDEB zodpovedá podielu hodnôt uvádzaných na riadkoch 88 a 1; NEGEQ zodpovedá 1 ak má súvahový riadok 67 v r. 2010 zápornú hodnotu a 0 ak má kladnú, LIQ2 zodpovedá podielu súčtu krátkodobých pohľadávok a finančných účtov (riadky 46 a 55) a súčtu krátkodobých záväzkov, krátkodobých finančných výpomocí a bežných bankových úverov (riadky 106, 117 a 120). V prípade ukazovateľa ROA ide o podiel výsledku hospodárenia za účtovné obdobie pred zdanením (riadok 59 výkazu ziskov a strát) a celkového majetku (riadok 1 súvahy) a to za rok 2010.

Obrázok 1

Efekt	INCINT - Odhady parametrů (LOGIT7) Rozdělení : BINOMICKÉ, Linkující funkce: LOGIT Modelovaná pravděpodobnost, že INCINT = 1					
	Odhad	Standard chyba	Wald. Stat.	Dolní LS 95, %	Horní LS 95, %	p
Abs.člen	-0,033950	0,142454	0,05680	-0,31316	0,245255	0,811631
"LIQ2"	-0,065962	0,014200	21,57891	-0,09379	-0,038131	0,000003
INDEB	0,207521	0,122132	2,88713	-0,03185	0,446895	0,089290
ROA	-0,912757	0,228013	16,02471	-1,35965	-0,465859	0,000063
NEGEQ	0,084955	0,089989	0,89125	-0,09142	0,261331	0,345139

Podkladové údaje sme spracovali s použitím štatistického softvéru STATISTICA spoločnosti Statsoft (Obrázok 1). Na základe Waldovej štatistiky a stanovenej hladiny významnosti na úrovni 0,05 vidíme, že za vysvetľujúce premenné LIQ2 a ROA majú dobré vysvetľujúce schopnosti, pričom existuje negatívna závislosť – teda s rastom hodnoty likvidity druhého stupňa a ukazovateľa ROA, klesá pravdepodobnosť, že miera úrokového zaťaženia bude vyššia ako medián tejto miery stanovený za celý súbor podnikov. Logické závery by sme získali aj pri pohľade na vzťah tejto pravdepodobnosti a premenných INDEB a NEGEQ (teda, s rastom ukazovateľa zadĺženosti a s existenciou záporného vlastného pravdepodobnosť miery úrokového zaťaženia vyššej ako medián rastie), avšak s ohľadom na ich spoľahlivosť ich nemôžeme prakticky použiť.

3.3 Overovanie platnosti hypotéz H30 a H31

Otvorenosť systému finančného vykazovania informácií o podnikoch je možné posudzovať rôzne (Nobes, 2006), (Feige, 1997), pri overovaní platnosti hypotéz $H3_0$ a $H3_1$ sa však budeme sústreďovať na mieru súladu účtovných a daňových predpisov. Hoci sa na rozdiel od iných krajín nezostavuje v Slovenskej republike tzv. daňová súvaha, používa sa koncept daňového ocenenia majetku a záväzkov pri vyčíslení odložených daní. Pretože rozdiely medzi účtovnými a daňovými hodnotami jednotlivých položiek majetku a záväzkov môžu mať aj prechodný charakter, bude overovanie hypotéz vychádzať iba z tzv. trvalých rozdielov. Využijeme pri tom vzťah: $\pi \times t - T_r - T_d = \gamma$, kde π výsledok hospodárenia pred zdanením daňou z príjmu, t sadzba dane z príjmov pre právnické osoby, T_r je reálna splatná daň, T_d reprezentuje odloženú daň (ktorá je výsledkom dočasných rozdielov medzi ocenením majetku resp. záväzkov podľa účtovných a daňových predpisov) a γ trvalé rozdiely. Aby bolo možné posúdiť celkový efekt týchto rozdielov na prezentovanú finančnú situáciu súboru podnikov v SR, transformujeme takto určený dosah trvalých rozdielov medzi hypotetickou daňou, ktorá by sa mala platiť ak by výsledok hospodárenia pre zdanením slúžil priamo ako základ dane z príjmov (táto hypotetická daň je rovná súčinu $\pi \times t$) a skutočnou daňou, na relatívne odchýlky v ocenení majetku resp. záväzkov. Miesto γ tak použijeme upravenú hodnotu $\hat{\gamma} = \frac{|\gamma|}{a \times t}$ (kde a je hodnota majetku podniku vykázaného v súvahe; jeho použitie v menovateli má umožniť porovnanie významnosti týchto odchýlok v rôzne veľkých podnikoch). Na validáciu nezávislosti účtovných pravidiel od daňových pravidiel stačí potvrdiť vysokú hodnotu $\hat{\gamma}$ aspoň v niektorých zo sledovaných podnikov. Aby sme sa vyhli skresleniu v dôsledku neštandardného postupu v prípade niektorého z podnikov, budeme posudzovať významnosť $\hat{\gamma}$ na úrovni 90. percentilu hodnôt $\hat{\gamma}$ zo všetkých podnikov. Vzhľadom k tomu, že sme pri zisťovaní pracovali s agregovanými údajmi, nie je možné z nízkych hodnôt uvedených výsledkov vyvodzovať závery o dokonalej zhode účtovného a daňového systému (pretože na úrovni účtovnej závierky sa mohli kladné a záporné odchýlky vzájomne eliminovať), avšak vysoké hodnoty indikujú významnú mieru odlišností.

Pri postupe sme vychádzali z účtovných výkazov – z riadku 048 ($r0_{48}$) *výkazu ziskov a strát* súvahy sme čerpali údaje o splatnej a odloženej dani z bežnej činnosti, z riadku 055 (r_{055}) uvedeného výkazu údaje o splatnej a odloženej dani z bežnej činnosti a z riadku 059 (r_{059}) údaje o výsledku hospodárenia za účtovné obdobie pred zdanením. Za každý podnik sme najprv vyčíslili vplyv trvalých rozdielov: $\gamma = \frac{r_{059} \times 19\ \%}{100\ \%} - r_{048} - r_{055}$

Následne sme hodnotu γ transformovali s využitím vzťahu: $\hat{\gamma} = \frac{|\gamma|}{a \times t}$ na relatívny teoretický rozdiel hodnoty majetku a záväzkov podľa účtovných a daňových predpisov (relatívnosť je vyjadrená vo vzťahu k celkovej hodnote majetku a). Inak povedané, zisťovali sme, aké by museli byť rozdiely vo vnímaní hodnoty majetku resp. záväzkov v účtovníctve a z pohľadu daňových predpisov aby γ zodpovedali reálne vyčísleným údajom, pričom skreslenie ktoré by mohlo vzniknúť v dôsledku uvádzania čísiel rôzne veľkých podnikov sme eliminovali vyjadrením uvedeného výsledku v pomere k majetku. K tomu, aby sme mohli skonštatovať rozdielnosť účtovných a daňových odpisov stačí, ak zistíme významné rozdiely (v našom prípade reprezentované $\hat{\gamma}$), ktoré nie sú dôsledkom extrémnych hodnôt v malom počte podnikov. Za hranicu významnosti sme preto zvolili 95. percentil zo súboru údajov za 3 224 podnikov. Na tejto úrovni má $\hat{\gamma}$ vyjadrujúci podiel a) rozdielu medzi uznaním ocenenia majetku a záväzku v účtovníctve a podľa daňových predpisov a b) celkovou sumou majetku, hodnotu 3,554 %. Hoci významnosť nemôžeme posúdiť absolútne, môžeme ju stanoviť aspoň relatívne. Postupom ktorý sme použili pri predbežnom testovaní (v úvode časti 2, testovanie sa týkalo významnosti jednotlivých položiek súvahy z hľadiska ich vzťahu k celkovej hodnote majetku) zisťujeme, že 95. percentil podielu vykazovaného zostatku k celkovej sume majetku je v prípade 80 riadkových položiek súvahy (zo 125) nižší než 3,554.

4. Interpretácia výsledkov a záver

Výsledky ktoré boli zistené pri overovaní hypotéz $H1_0$ až $H3_1$ môžeme interpretovať nasledujúcim spôsobom. Preukázaním platnosti hypotézy $H1_0$ môžeme dospieť k záveru, že bez ohľadu na to, aký je obsah účtovných informácií je jednou z hlavných prekážok systému podnikového finančného výkazníctva v SR ich všeobecná nedostupnosť. Tento nedostatok môže byť aj jedným z dôvodom vysokého rizika druhotnej platobnej neschopnosti – bez dostupnosti overených či aspoň overiteľných účtovných informácií totiž nemajú podniky žiaden nástroj na základe ktorého by mohli určiť riziko nezaplatenia. Tento stav sa však môže v súvislosti so zavedením registra účtovných závierok zmeniť. Pokiaľ sa zruší podmienka, podľa ktorej sa (v súčasnosti v obchodnom vestníku) zverejňujú iba účtovné závierky tých obchodných spoločností, ktoré sú predmetom auditu, vzrastie objem dostupných informácií viac ako 30 krát.

Dostupnosť informácií však ešte nemusí nutne znamenať, že bude možné ich využívať ako relevantný zdroj pre rozhodovanie zainteresovaných strán. Potvrdenie platnosti hypotézy $H2_1$ znamená, že niektoré informácie ktoré sú poskytované podnikovým finančným výkazníctvom majú pozitívnu koreláciu s mierou úrokového zaťaženia cudzích zdrojov nižšou ako je medián týchto mier. To síce môže byť interpretované aj ako dôsledok prechodu financovania od štandardných finančných inštitúcií, ktoré nie sú ochotné znášať riziko k iným subjektom (ktoré sú ochotné znášať riziko avšak s úrokovou mierou zvýšenou o zodpovedajúcu rizikovú prirážku) avšak aj v tomto prípade bude najpravdepodobnejším a vlastne jediným zdrojom informácii o riziku účtovná závierka (tvoriacu informačnú základňu podnikového finančného výkazníctva).

Overením platnosti hypotézy $H3_1$ sme zistili, že existujú rozdiely medzi účtovnými a daňovými predpismi z pohľadu vykázania majetku a záväzkov (a sekundárne aj nákladov a výnosov) sú relatívne významné. Relatívnosť v tomto prípade vyplýva z metodiky posudzovania významnosti – samotný fakt, že tieto rozdiely sú z pohľadu súvahy významnejšie, než 80 z predpísaných 125 riadkov ešte nemusí nutne znamenať, že informácie musia byť zákonite pre neprivilegovaných používateľov relevantnejšie. Znamená to len, že štát sám vytvára predpoklady pre to, aby sa v rámci podnikového finančného výkazníctva a poskytovali aj iné informácie než štát potrebuje na účely objektivizácie základu dane z príjmov.

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The Investment Decision-Making Process in Entrepreneurship: Advantages and Disadvantages of Selected Financial Methods Used in Projects Evaluation

Piotr Tworek [1]

Abstract

The knowledge of appropriate financial methods, which can be employed in investment activities carried out by companies is necessary in order to make right investment decisions. Due to their advantages, discount methods are particularly important and widely used in business practice all over the world. In addition to that, understanding the drawbacks of these methods may prevent investors from making wrong investment decisions. The main aim of the paper is to present these issues, focusing on the methods of Net Present Value (NPV) and Internal Rate of Return (IRR). The paper also deals with the creation of goodwill through investments.

Key words

corporate finance, capital budgeting, decision-making process, project evaluation, commercial investments, value creation, financial methods, NPV, IRR, risk, entrepreneurship

JEL Classification: G11, G31, G32, E22, L26

Introduction

Economic activities are inseparably related with investment decision-making.„(...) Decisions about the development of a company are the ones which result in projects that often last long"[1]. In addition, „(...) investing entails the disposal of substantial capital needed to fund the initial expenditure and any possible effects always come with a delay"[1]. As emphasized by R. Aggarwal „(...) the evaluation of new investments is an important part of process whereby firms create value, and thus it can have significant implications for the competitive position of firm"[2]. Therefore, in business practice understanding the right decision-making criteria, which should be followed by an investor when taking investment decisions, is of vital importance. These criteria include appropriate financial methods used in this respect. When looking at the benefits offered by the methods applied in the investment decision-making process, the effects of discount methods used by enterprises, such as Net Present Value (NPV), Internal Rate of Return (IRR), Modified Internal Rate of Return (MIRR) and Discounted Payback Period (DPP), should be taken into account. From among these methods, NPV is particularly important as it measures the growth in a company's goodwill effected by investments. What also matters is dependencies between the NPV result and the IRR result of an investments. In business practice, also other methods, such as static (simple) ones used in this respect, in form of a whole series of simple rates of return, e.g. ROE

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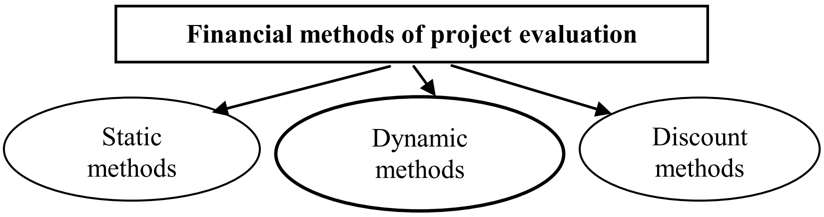
(Return on Equity), ROI (Return on Investment), ARR (Accounting Rate of Return) etc. should not be neglected. These issues are contemplated in the paper. Its main aim is to discuss the selected discount methods, focusing on their advantages and disadvantages. The paper also aims to draw attention to the creation of a company's goodwill through investments. The problems in question are presented in a synthetic way only. The discussions in the paper are of utilitarian value. All the formulas given in this paper are derived from: [1], [8], [9], [11], [12], [13], [17].

1. Some comments on the financial methods used by companies in investment decision-making processes

It's common knowledge that capital (money) changes its value over time. The same applies to investing as it's carried out in the time horizon, which is always accompanied by risk. As stressed by M. Hirschey and J. Nofsinger „(...) the value of a potential investment is dependent of the benefits to be received in the future"[3]. Hence, there is a need to revalue the future cash flow streams generated by a project. Therefore, discounting is the foundation for the division of methods used in financial evaluation of investments carried out by companies. This is strictly connected with the category of a discount rate as a rate used in projects evaluation. At the same time, in the theory of finance there are a variety of approaches to discount rate calculations and a group of discount-based methods are called discount methods (NPV, IRR, MIRR, DPP). Today, however, when referring to multiple projects carried out in business, we can no longer rely on the traditional division of capital budgeting methods, i.e. the division into static (not taking into account the changing value of money over time) and discount methods, but we should rather divide them into static (simple), dynamic and discount methods, as shown in Fig. 1.

Figure 1: Classification of financial methods of projects evaluation



Source: own elaboration.

The traditional methods used to measure effectiveness of investments, such as e.g. NPV or IRR, despite their numerous advantages, share a common drawback, i.e. they do not take into account the quantitative aspects of a number of various possible scenarios of returns on investments in the future. This disadvantage is referred to as investment inflexibility. Such methods are classified (Fig. 1) as discount methods, i.e. based on the discount concept, while methods that demonstrate flexibility are called dynamic methods which, in this case, refers to the methodology of real options including the use of appropriate simulation methods. This division is directly connected with a risk in the financial evaluation of projects carried out by companies. However, despite this disadvantage, discount methods are most popular and commonly used in Poland, along with being considered the best ones by practitioners. This is mainly due to the fact that real option methodology and simulation methods are quite difficult to use in practice and that the application of these methods requires specialised expert knowledge. Moreover, the practical use of e.g. real option methodology for various projects may be time-consuming and hard to do, while the outcome may not always be reliable. That is why in modern financial management of companies it's recommended that both static methods, which are often called primitive measures of projects evaluation by business practitioners (although commonly employed due to easy interpretation of results), and discount methods should be used complementarily. Only such an approach will provide decision-makers with comprehensive information about the investment potential and the substantive basis for making the right investment decisions. This should allow for the mitigation of a risk of making a wrong decision. Two important things ought to be kept in mind, however, firstly, the ability to interpret the results correctly as e.g. the Accounting Rate of Return (ARR) may be calculated using a number of different algorithms available in the theory of finance, secondly, the strengths and weaknesses of specific financial methods. Irrespective of the type and number of methods used in capital budgeting companies should invariably focus on the overriding aim, which is the creation of their value. That is why companies need to choose such investments that best maximize their value, which is reflected in an increase in a company's balance-sheet total, as shown in a simplified form in Table 1.

Table 1: A company's financial balance-sheet

ASSETS	LIABILITIES
• Completed investments (fixed assets) • Generated cash flows (on a day-to-day basis)	• Owners' equity (shareholders' funds)
• Expected value to be created by future investments (investments being already prepared)	• Accounts payable (creditors' funds)

Source: [4].

On the mathematical side, a rise in a company's value resulting from investments undertaken by this company can be illustrated by means of the following formula[4]:

$$NPV = \sum_{t=1}^{n} \frac{EVA_t}{(1+WACC)^t}$$

where: n – the analysed period; t – subsequent years of the period analysed; $WACC$ – Weighted Average Cost of Capital; EVA_t – Economic Value Added created by the project in year t.

In particular, the formula above shows the relationship between the NPV value of the project and the EVA value of the company carrying out the project, which means that the NPV value of the project equals the revalued EVA generated in the future or the EVA obtained in every year t (discounted) is a certain part of a specified whole – the total NPV[5]. Consequently, in practical terms an increase in the company's value may be effectively generated by carrying out financially viable investments, i.e. investments bringing a profit, i.e. when the return on investment is higher than the return required by the investor who puts in their capital[6]. The same NPV value of the project may be calculated by converting the main algorithm of this method in the following way:

$$NPV = \sum_{t=0}^{n} \frac{NCF_t}{(1+r)^t}$$

where: NCF_t – net cash flows in subsequent years analysed; r – discount rate.

The Economic Value Added EVA_t – in turn, is defined by the following formula[6]:

$$EVA_t = NOPAT_t - WACC_t \times IC_{t\,BEG}$$

where: $NOPAT_t$ – net operating profit after tax in period t; $IC_{t\,BEG}$ – capital invested in the company's assets (book value from the opening balance-sheet of period t).

The general mathematical formula to calculate WACC is as follows:

$$WACC = \sum_{i=1}^{Z} w_i c_i$$

where: z – number of capital sources; w_i – percentage of i-th source of capital for financing of the investment; c_i – cost of the capital derived from i-th (specific) source.

The WACC formula is very important in the theory of corporate finance, as it may be used to calculate the discount rate in the NPV method. In general, a company generates the value for the owners (shareholders, to put it simple), when $ROIC > WACC$, where: $ROIC$ – Return on Invested Capital is the obtained rate of return from the total invested capital (own and borrowed)[7]. This determines the effectiveness of an project, which means that ROIC should be higher than the percentage rate which reflects the cost of capital put into the financing of the investment. It should be noted, however, that in theory and in practice there are a variety of return rates available but investors generally tend to assume that investments are financial viable if $IRR > WACC$. Consequently, two essential criteria maybe distinguished in investment decision-making, namely:

- a criterion of absolute benefits or an increase in absolute benefits, measured by means of the present value (PV) or an increase in value (NPV),
- a criterion of relative benefits, measured by means of the Internal Rate of Return (IRR) [8].

In particular, these two decision-making criteria are the subject matter of the discussion which follows, first of all, because of mutual relationships and interdependencies between the results of the NPV and the IRR methods and secondly, because a discount rate is the basic parameter used in these two methods based on cash flows (*CF)*. The other financial methods used in investment decision-making, with the focus on their advantages and disadvantages, are listed in Table 2.

Table 2: Selected advantages and disadvantages of static and discount methods used in capital budgeting

Feature / **Method**	***Takes into account entire project lifecycle***	***Takes into account changeable time value of money***	***Takes into account company's objectives***	***Takes into account project risk***	***Determines net gains as net cash flows***	***Possibility of constructing an objective decision-making criterion***
ROI, ROE	Yes	No	No	No	No	No
PP (not discounted)	No	No	No	Yes	No	No
ARR	Yes	No	No	No	No	No
DPP (discounted)	No	Yes	No	Yes	Yes	No
NPV	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
MNPV (modified NPV)	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
IRR	Yes	Yes	No	Yes	Yes	Yes
MIRR (modified IRR)	Yes	Yes	No	Yes	Yes	Yes
PI	Yes	Yes	No	Yes	Yes	Yes
MPI (modified PI)	Yes	Yes	No	Yes	Yes	Yes

Source: [9].

„(...) As you can see in Table 2, NPV as the only one from among all the methods listed has only advantages. (...) This is an argument for the application of this method on a large scale"[10]. Table 2 also indicates the strengths and weaknesses of the Profitability Index (PI) as well as its modified form, i.e. MPI. At the same time, it presents the pros and cons of the modified methods of NPV and IRR, i.e. MNPV and MIRR.

2. Advantages and disadvantages of selected discounted methods used in projects evaluation – NPV & IRR

After all the deliberations it may be concluded that the NPV method has the advantages (Tab. 2) which make it, along with IRR, the most popular method used in business worldwide. First of all, the NPV result is easy to interpret, i.e. if NPV > 0, then an investment is financially viable and the investor should decide to go ahead with the project. Whereas if NPV < 0, then the investment is not financially viable and, as a consequence, should be rejected. The significance of this method in business practices also stems from the fact that it's used in the measurement of goodwill. Taking into account the deliberations above and assuming that all the investment expenditure is incurred by the company in year $t=0$, and the calculation (discount) rate has been established using the Weighted Average Cost of Capital (WACC), the mathematical formula for the NPV of an investment may be presented in the following form:

$$NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+WACC)^t} - CE_0$$

where: CF_t – net cash flows in subsequent years analysed; CE_0 – investment expenditure.

As shown in this mathematical notation, the NPV formula includes a discount coefficient. The NPV method takes into account all cash flows generated by the project and in case of multiple projects it allows for the summing up of individual NPV results, which is very important for the measurement of value of an entity which carries out a portfolio of projects. Therefore, the assumptions for the NPV methods are also used in valuation processes, as shown in Table 3.

Table 3: Test of NPV compliance with the description of a desirable measure of value created by investments

		NPV	
Test area	**Valuation of operations**	**Motivational measurement of results**	**Program**
Test result	+	–	–
Justification of the result	Estimation of NPV of the business requires prior valuation using the DCF method. NPV is a decision-making tool, strictly related to the value of the business.	**NPV is a 'resource' measure, which also describes budgeted and non-realized results.**	

Source: [5].

In business practice, apart from the NPV, also the Profitability Index PI (Tab. 2) is calculated, as it‘s equally sensitive to the choice of a discount rate, which may be displayed in the following formula:

$$PI = \frac{\sum_{t=0}^{n} \frac{CF_t}{(1+r)^t}}{\sum_{t=0}^{n} \frac{CE_t}{(1+r)^t}}$$

where: CE_t means investment expenditure incurred in subsequent years t.

Just like in case of NPV, the practical interpretation of the PI indicator is quite simple, i.e. if PI ≥ 1 it means that an investment is financially viable and in the above-mentioned formula 1 stands for a monetary unit of expenditure incurred for the project. That means the number of monetary units generated by the project as a result of incurring the unit of expenditure. In particular PI „(...) is useful for ranking projects in case of capital rationing, but misleading in the presence of interactions. (...) Cannot rank mutually exclusive projects“[11].

The second most important method is IRR, defined as a discount rate at which the NPV of the project equals 0, which may be illustrated by the following notation:

$$\sum_{t=1}^{n} \frac{CF_t}{(1+IRR)^t} - CE_0 = NPV = 0$$

where: IRR is a discount rate.

In order to calculate the IRR (assuming that this is a single return on investment), the formula needs to be converted in the following way:

$$IRR = \sqrt[t]{\frac{CF_t}{CE_0}} - 1$$

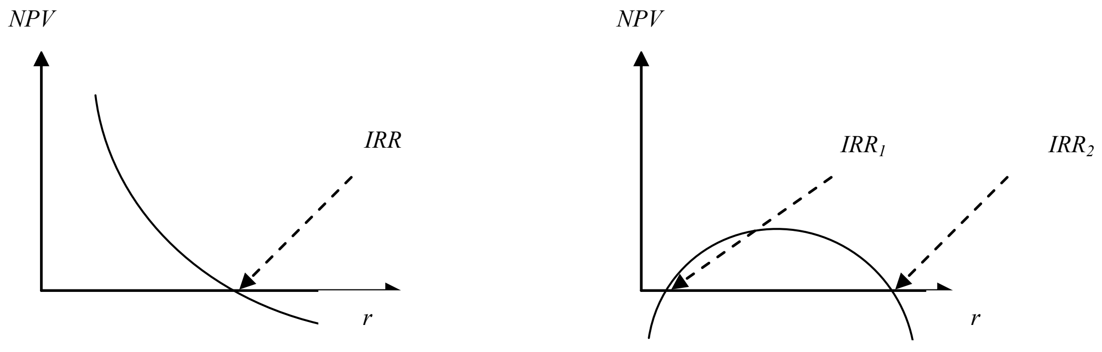
This approach, however, is more theoretical than practical, therefore in practice the IRR for a specific investment is calculated using the linear interpolation formula [12]:

$$IRR = r_0 + \frac{NPV_0}{NPV_0 - NPV_1}(r_1 - r_0)$$

where: r_0 – a lower discount rate accepted for the calculation; r_1 – a higher discount rate accepted for the calculation; NPV_0 – the NPV result calculated at a lower discount rate; NPV_1 – the NPV result calculated at a higher discount rate.

This formula is written into numerous computer programs used to measure the financial effectiveness of investments. It should be kept in mind, however, that there are also some projects which have a few IRRs and there might be some projects without any IRR at all. Such projects are called non-typical ones. The NPV profiles for various types of projects are shown in Fig. 2.

Figure 2: NPV profiles: relationship between NPV and IRR of the project



✓ **Typical projects** → we first incur investment expenditure and then generate infinite earnings - - - / + + +

✓ **Non-typical projects**, for example: → - - - / + + + / - - - (have two IRRs or even more)

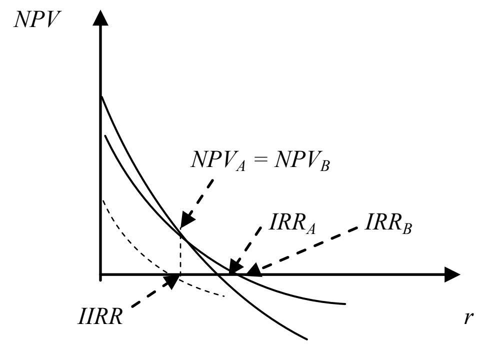
Source: developed on the basis of: [1], [10], [12].

As can be seen in Fig. 2, in order to calculate an IRR, the zero point of the function needs to be found. In addition, when looking at Fig. 2 attention should also be paid to the division into typical and non-typical projects, i.e. the ones which have conventional and unconventional cash flow *(CF)* streams. Therefore, the IRR method has a basic flaw, i.e. it's not reliable in case of projects with unconventional cash flow streams and in case of investments which differ in terms of size or lifetime period. That is why investors have a whole range of other rates of return to choose from, e.g. simple rates of return or they can use the MIRR rate (discount method), which is often called an 'a twin rate of the IRR' by business practitioners. One more dependency should be mentioned, namely [13]:

$$IRR = \frac{1}{\textit{Payback Period}}$$

The notation above can be interpreted in the following way: the higher the rate of return of the project, the sooner the investment expenditure incurred for the project is going to be paid back. Payback Period (PP) is the period during which the investment expenditure is paid back. „(...) When the payback period is used to make accept-reject decisions, the following decision criteria apply: 1) if the payback period is *less than* the maximum acceptable payback period, *accept* the project; 2) if the payback period is *greater than* the maximum acceptable payback period, *reject* the project“[14]. Additionally, one more problem should be pointed out here i.e. the situation when an investor has to deal with mutually exclusive projects. The graphic illustration of the problem is Fig 3.

Figure 3: Conflict of projects to be chosen



Source: [15].

As shown in Fig 3, „(...) the NPV curves of the analysed A and B projects cross when $r = IIRR$, where the IIRR stands for the Incremental Internal Rate of Return”[15], i.e. it’s such a discount rate (cost of capital) at which the NPVs of competitive projects are equal [15]. In the event the investor has to choose one out of the projects shown in Fig. 3, then „(...) if the cost of capital is higher than the IIRR, then project A should be chosen as it has a higher NPV and IRR. (...) If the cost of capital is lower than the IIRR, then project B should be selected as it has a lower IRR but a higher NPV (for this *r*)”[15]. In practical applications, however, NPV is a more important criterion for the selection than IRR, as this result ensures a higher increase in a company’s value. This is also due to the drawbacks of the IRR method, which are synthetically presented in Table 4.

Table 4: Advantages and disadvantages of the IRR method

Advantages	Disadvantages
• A net gain is expressed as a net cash flow • It's simple to interpret (the psychological effect connected with preference of profitability measures expressed as percentages) • Its evaluation of absolute return on investment includes net gains from the entire project lifecycle • Contains information about the level of the safety margin • Helps to determine the marginal cost of capital, which may be used to finance a given project • Enables the construction of an objective absolute decision-making criterion • May be used in the evaluation of absolute return on investment, also in the situation when a discount rate is not available yet	• Cannot be directly used for the evaluation of absolute return on investment of non-typical projects (does not meet the requirement of universality) • Assumes that the reinvestment rate of positive net cash flows equals the calculated internal rate of return • Does not fully take into account the changeable value of money over time (assumes that the value of money over time equals the internal rate of return of a given project) • Assumes a flat yield curve which makes it more difficult to formulate the absolute decision-making criterion for the model with a discount rate, which is changeable over time (more than one value of the marginal rate of return) • Does not meet the requirement of additivity: (IRR_A + IRR_B) differs from $IRR_{(A+B)}$

Source: [9].

No matter, however, which method is selected for the financial evaluation of projects, what should be in focus when making investment decisions is the yield requirement, according to which the inequality of IRR ≥ r, where r stands for the rate on the capital market, should be kept for the IRR. In addition, an investor may always compare the estimated IRR for a given project with another rate occurring on the capital market and decide whether to put their money into the project or invest it in any other financial instrument with a higher yield and a lower risk.

Conclusion

Investment decision-making in companies is a challenging task. Decision-makers bear a lot of responsibility related to that. Investment decisions often have irreparable consequences. In addition, investment decisions taken by companies invariably carry risks and cause uncertainty. Therefore, the right methodological background which may be drawn upon in this respect, with the focus on the understanding of advantages and disadvantages of specific financial methods used in investment yield calculations, is of such importance in business practice. However, before specific methods (NPV, IRR) can be used in the financial evaluation of investments, two important things should always be kept in mind, i.e. firstly, results obtained by means of discount methods depend on the correct estimation of a discount rate, secondly, the accuracy of this evaluation depends on the reliability of cash flow forecasts. As emphasised by J.C. Hartman „(...) estimation is generally considered the most difficult step of the decision-making process, as all of the cash flows are expected to occur in an uncertain future"[16]. It should also be noted that investment yield calculations should be based on cash flows, instead of a profit, and the evaluation of return on investment should be based on present values. Consequently, if any mistake is made when estimating cash flows for a project or a discount rate, all further calculations using the mathematical formulas referred to in the paper will be incorrect. Besides, it should be stressed that in order to eliminate the mistake of taking a wrong investment decision, the methods for investment yield calculations should be used complementarity with the methods for quantification of investment risks. As „(...)

rational investors will choose investment that fully compensate them for the risk involved. (...) The greater the risk, the greater the return required by investors"[17].

Summing up, all the discussion so far it should be concluded that „(...) if all investment decisions made in a company build the picture of an investment policy followed by this company, it may be assumed that the progress in the policy implementation can be measured using the NPV results of all the projects undertaken. (...) Therefore, the framework of the accepted investment policy carried out through projects (based on investment decisions made before) will indicate the maximum or minimum obtainable sum total of NPVs of all the projects conducted by the company. (...) As a consequence, NPV indicates the top and bottom limits for an increase in the company's value caused by the investments carried out by this company"[16]. In this context, the NPV method should be regarded as the most important of all the methods mentioned in the paper, taking into account primarily its application advantages.

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Risk allocation in contracts used in investment and construction processes in Poland – selected legal and economic problems

Piotr Tworek, Marcin Tomecki[1]

Abstract

Contracts used in the construction industry are a risk allocation instrument for participants of investment processes. Which contractual party bears a risk depends on the type of a contract and its specific provisions. There is a variety of contract forms used all over the world in investment and construction processes. The paper outlines the major economic and legal challenges in this area. The key aim of the paper is to present the solutions to such problems, which are applied in Poland.

Key words

risk management, risk allocation, construction contracts, investment process, cost management, insurance, construction industry

JEL Classification: D24, D86, G32, K12, L74

Introduction

In theory and practice alike, it's emphasised that an effective risk response in the construction industry is risk transfer by means of a variety of contracts applicable to investment and construction processes. This refers, in particular, to specific terms and conditions of contracts concluded between basic participants of investment and construction processes, and the most important thing here is the type of contract to be signed. It should be pointed out, first of all, that in the construction industry in Poland there is a free choice of final terms (provisions) of contracts, provided they satisfy the legal requirements, especially the ones stipulated in the construction law and the civil law. Secondly, in business practice the most important role is played by a construction works contract, as this contract determines how risk should be distributed among participants of an investment and construction process, i.e. an investor and a contractor. In Poland construction works contracts related to the direct execution of the construction project include: a general contractor agreement, a subcontractor agreement, a partial performance agreement and a turnkey contract. The provisions of such agreements (in the light of the effective law in Poland) are contemplated by the authors of this paper, who pay special attention to the related economic aspects. The paper also deals with the problems connected with the use of other contracts in the Polish construction industry, such as contracts for design work, contracts for investment supervision, contracts for investment substitution and insurance contracts. These contracts are directly connected with the project

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execution phase, i.e. the stage of an investment process at which contractors directly manage risks.

Therefore, the basic aim of the publication is to discuss the issues of risk allocation in agreements used in investment processes in Poland such as, in particular, construction contracts. This aim results from the very definition of risk in the construction industry, where risk, as an interdisciplinary category, should be examined in economic, legal and technical terms. The authors focus here on legal and economic issues only, due to their professional background. Sections (points) 1 and 2.1. of the paper are written by M. Tomecki (lawyer), while the introduction, conclusion and section (point) 2.2. are written by P. Tworek (economist). As a result, the paper is interdisciplinary in its character and it describes the problems in a synthetic way. To meet the aim of the publication, the authors reviewed (legal and economic) literature. The contents of the paper, to a large extent, are analysed from the contractor's perspective, as in the majority of contracts carried out in the construction industry in Poland, risk is mainly borne by contractors.

1. Contracts used in the construction industry in Poland – synthetic presentation

In the light of the Polish legal regulations, contracts used in the construction industry come in a variety of forms, due to their legal structure. Some of them find their normative basis in the civil code regulations. Others are innominate or mixed in their character, which means that their contents are based on the general principle of freedom in conclusion of contracts, as set forth in art. 353 of the civil code. Under the construction law regulations which are in force and effect in Poland, project documentation in most of construction projects needs to be drawn up in compliance with the legal requirements. As a general rule, this obligation should be borne by an investor – art. 647 of the civil code – and in such a case a contract for design work is concluded between an investor and an entity which provides design services. If construction processes involve a general contractor or an EPC contractor, these parties may have to incur that obligation. The legal character of such contracts is defined as *contractus innominatus*, as the civil code regulations do not contain any separate provisions governing a contract for design work. Contracts for design work are governed by the regulations applicable to specific work contracts (art. 627 – 646 of the civil code), as design documentation is a kind of intangible work expressed in form of documents (*corpus mechanicum*)[1].

The type of contract which is strictly connected with the construction project is a contract for investment supervision. The subject matter of the contract is technical supervision over a project. In the civil code, there are no separate provisions governing supervision. Unlike contracts for design work, this contract belongs to due diligence agreements, more than result-oriented agreements. Therefore, support here can be looked for in regulations governing mandate contracts, i.e. art. 750 of the civil code[1]. In such a contract parties decide about their mutual rights and obligations and agree upon, in particular, the subject matter and the scope of services to be performed, contract duration, remuneration, consequences of non-performance or improper performance.

In investment and construction processes, most risks related to a construction site are allocated in a construction works contract. This contract is an example of nominate contracts. The regulations are set forth in the provisions of art. 647 – 658 of the civil code. In some cases, the regulations governing a specific work contract are used respectively. It should be stressed that in business practice a number of construction works contract types, which meet the conditions of the legal definition under art. 647 of the civil code, have been devised, including:

- a general contractor agreement,
- a partial performance agreement,
- a subcontractor agreement,
- a turnkey contract[2].

In addition, prior to the conclusion of these agreements, preliminary contracts may be signed. In case of big construction projects, also agreements for investment substitution tend to be used. The subject of such an agreement is entrusting obligations related to the execution of the investment process, which are traditionally borne by the investor. The scope of services to be provided by a substitute investor depends on the contents of the agreement and may include also activities related to the preparation of the construction process, its organisation and work flow[3]. The civil code doesn't include any regulation devoted to investment substitution, therefore, due to the character of the contractual subject matter, i.e. rendering of services, the suitable provisions governing a due diligence agreement, such as a mandate contract, should be applicable – art. 750 of the civil code.

Insurance contracts are frequently used in construction processes as well. Such contracts allow participants of the construction project to shift the risks related to future events, which may occur and lead to a loss, onto an insurer. In the Polish legal system, there are a few types of insurance. When looking at the needs of the construction industry, the most useful type of insurance seems to be property insurance. The legislators provide for a normative model of an insurance contract in the civil code regulations (art. 805 – art. 834 of the civil code). Under art. 821 of the civil code, property insurance may cover: „(…) any property interest which is not unlawful and which may be assessed in money"[22]. Such a regulation offers a number of practical options when insuring against consequences of future unforeseeable events. Insurance contracts in a risk management process of a construction project may be employed to transfer selected risk categories none of the parties involved in the project is willing to bear to an insurance company. In business practice of Polish construction companies, such insurance comes in one of the following forms:

- construction and erection all risks – CEAR,
- property in transit insurance,
- third party liability insurance[4].

It should be added that in some cases, in order to protect its legitimate interests, an investor may demand in a construction works contract that a contractor should take out insurance to cover consequences of specific future events.

2. Risk distribution in contracts concluded between a contractorand other participants of an investment and construction process in Poland

2.1 Risk allocation in selected contracts used in investment and construction processes in the light of the Polish legal regulations

A construction works contract is an instrument for allocation of the majority of risks related to the construction process. Parties entering into such contract are free to arrange their mutual rights and obligations. However, it should be pointed out straight away that this freedom is not unlimited. In some cases the law prohibits certain arrangement of mutual relations by using legal norms which are absolutely binding – *ius cogens*[5]. To make sure that risk allocation in contracts is fully effective and feasible in the existing legal framework, prohibitions and limitations need to be explicitly defined. The general provisions of the civil law, such as art. 353, indicate the basic limitations, e.g. stating that the content or purpose of a contract cannot be contrary to the nature of the relationship, the law or the principles of community life. A legal act is invalid if it's contrary to the law or is designed to circumvent the law. The same applies in case when a legal act is contrary to the principles of community life (art. 58 of the civil code). Basically, the structure of a legal relationship, such as a construction works contract and its specific forms used in business practice, is based on an agreement between the parties and is supplemented by appropriate non-mandatory legal provisions (*ius dispositivum*). Consequently, the parties negotiating contractual provisions should take into consideration both mandatory and non-mandatory provisions as both of them affect the distribution of risk. After the general comments, it's time to move on to the analysis of the effective regulations and look at the distribution of most significant risk categories in construction works contracts. Contractor agreements which are most often used in the Polish construction industry include: a turnkey contract, a general contractor agreement, a partial performance agreement and a subcontractor agreement[6]. In principle, the structures of these agreements for construction works are similar. The main difference lies in the scope of obligations. The widest scope of obligations can be seen in a turnkey contract where the EPC contractor is obliged to prepare the investment process, deal with the technical design and coordinate the work. In case of general contractor agreements, the scope tends to be limited to the performance of construction works and their delivery. The other two types of construction works contracts cover certain defined works, therefore a risk to be borne by a partial contractor or a subcontractor is respectively lower. As investment expenditure related to the performance of construction works account for the most significant part of all the expenses, it may determine the financial success of the project. A cost overrun risk is a risk category, which is relatively well defined in contracts. The distribution of such a risk depends on the agreed method of calculation of remuneration. In accordance with the effective regulations, construction works contracts in Poland, unlike specific work contracts, do not contain any separate provision governing the calculation of remuneration. Therefore, the parties may agree to calculate the remuneration using one of the methods – a flat-rate fee, a cost estimate fee or a mixed fee.

In case of a flat-rate fee, a risk related to a possible rise in expenses is borne by a contractor as the fee is fixed. Exceptions are the cases when an investor orders the contractor to carry out some additional works which are not included in the technical documentation or if the investor orders alternative works[2]. It's assumed that if a contract does not explicitly provide for any possible changes in the remuneration, except for the cases described above, the remuneration cannot be changed on the contractor's demand. The reason is that the regulations governing construction works contracts do not contain any express reference to appropriate regulations governing the calculation of the flat-rate remuneration, i.e. art. 632 § 2 of the civil code. Taking into account the existing judicial practice – courts in some cases give an option of increasing the remuneration if certain circumstances (arising, e.g. out of the need to use an alternative technology or materials which are different from the originally planned ones) occur [2]. Certain exceptions from the fixed character of the remuneration are the reasons justifying the application of a *rebus sic stantibus* clause, which allows the contractor to demand an increase in the flat-rate fee from the court if the performance of the works put the contractor at a risk of a glaring loss.

The parties to a construction works contract may use a cost-estimate fee based on the specification of planned works and anticipated costs. Such a structure transfers risk to the investor, who is obliged to increase the remuneration in case of any price rises. In business practice also a mixed model may be used in which contractual provisions combine both methods of remuneration. It should be added that if a subcontractor agreement is concluded, both the party entering into a subcontractor agreement and the investor bear joint and several liability for payment of remuneration to the subcontractor under art. 647 § 5 of the civil code.

A construction project carries a risk that deadlines for completion of works might be missed. A construction works contract specifies a work performance deadline. Nevertheless delays quite often occur. There may be a number of reasons why works are performed past deadlines – sometimes they are a contractor's fault and sometimes not. In principle, a risk of delayed commissioning is borne by the contractor. There are, however, certain exceptions set forth in the law, such as delays:

- due to an ordering party's fault (e.g. a failure to deliver project documents on time or arrange a legal construction permit),
- due to a third party's fault (e.g. unlawful damage or blocking of access to a construction site),
- due to a *force majeure* events (e.g. disturbance of works as a consequence of a natural disaster).

If a deadline is not met because of such cases, a contractor is not liable for damage incurred due to that. When it comes to a commercial investments, such a loss may be lost profits – *lucrum cessans*. If a delay results from the contractor's fault, then the investor may demand that the damage is remedied under art. 477 of the civil code. Moreover, based on the reference made in art. 656 of the civil code, the provisions governing specific work contracts shall apply to the consequences of delays[6]. These provisions allow for the rescission of a contract – art. 644 in connection with art. 656 § 1 of the civil code. It should be emphasised that in order to protect the investor's interests, all types of construction works contracts may provide for liquidated damages in case of a delay, under art. 483 of the civil code. Such provisions, in the light of the effective regulations, are beneficial for the investor as they do not require that the size of damage is proven, which may turn out to be quite a difficult thing to do[7]. The size of stipulated liquidated damages the investor has the right to demand, if the contract is not performed or is not performed properly, basically does not depend on the size of incurred damage. The civil code regulations, however, contain certain clauses which mitigate stipulated liquidated damages. In two cases, the liquidated damages may be reduced. Firstly, in case when a greater part of the obligation has been performed. Secondly, the demand to have the stipulated liquidated damages reduced is permissible in case when the stipulated liquidated damages are grossly overstated, compared to the incurred loss, which is clearly indicated in art. 484 par. 2 of the civil code. An option which is often used in construction works contracts is staging of works and setting different deadlines for different tasks. The inclusion of such provisions into a contract is permissible under the Polish law and results in a much more disciplined behaviour of investment process participants[8]. It's particularly important in turnkey contracts under which a party performing a contract has a wider range of obligations. For instance, in order to make sure that technical documentation is provided in a timely manner, a specific deadline may be set and liquidate damages may be stipulated in case of any delay to meet this obligation.

Big construction projects involve a wide scope of construction works that are usually scheduled over a few construction seasons, which results in an inflation risk. Such a risk is frequently borne by the contractor. The allocation of this risk, however, largely depends on appropriate contractual provisions. Generally, the Polish civil law follows the principle of nominalism, formulated in art. 358 par. 1 of the civil code. This principle means that if the subject of an obligation is a specific sum of money, which happens specifically in the case of remuneration for construction works to be paid to the contractor, performance is made by paying the nominal sum[9]. However, like any principle, also the principle of nominalism allows for certain exceptions. The parties may transfer this risk to the investor by adjustment clauses, as set forth in art. 358 par. 1 and 2 of the civil code. The provisions, which stipulate that the payment may be adjusted, put the contractor in a much better position. Nevertheless investors are not always willing to make such concessions. This may be closely connected with the terms and conditions of credit agreements concluded for financing of projects. Banks which participate in the financing are not in favour of any open options in agreements for execution of works. In some legislations, the regulations state that a monetary performance may be adjusted by a court, especially in the event of a significant change in the purchasing power of money after the obligation arises, i.e. after the contract is concluded. Such adjustment is based on a court verdict. The legal regulations in Poland, however, allow for such adjustment ordered by the court in a limited personal scope. Under art. 358 par. 4 of the civil code, „(…) a party running an enterprise cannot demand a change in a monetary performance or a manner of making it if the performance is related to running the enterprise"[22]. That is why such adjustment by the court to the contractor's favour is not permitted in Poland. It should be stressed however that the civil code provides for a facility designed to protect a contractual party in the event of extraordinary changes in circumstances. The provision of art. 357 of the civil code provides a structure which is called in the doctrine a big clause of *rebus sic stantibus* [9]. The application of this clause is not easy as a number of conditions have to be met jointly, i.e. there has to be an extraordinary change in circumstances; due to this change a performance entails excessive difficulties or exposes one of the parties to a serious loss; the parties did not foresee this extraordinary change in circumstances when executing the contract.

Taking into account the court jurisprudence in this respect, when it comes to the inflation risk, a *rebus sic stantibus* clause may be cited only in case of hyperinflation or an economic crisis. Numerous construction entrepreneurs try to prove at a common court that these reasons have occurred but frequently in vain. If the court rules that reasons like these have occurred, it may specify, in its verdict, how the performance should be made, change (raise, reduce) its amount or terminate a contract. The *rebus sic stantibus* clause is also connected with the occurrence of force majeure events. A contract for construction works should specify the cases in which force majeure events may occur. Such events may bring about a number of consequences. Generally, the investor bears the risk. In the civil code there are regulations which directly refer to force majeure events, namely the aforementioned *rebus sic stantibus* clause and consequential performance impossibility. Furthermore, contractual parties may formulate their own force majeure clauses. In this case, a vital thing is to have force majeure precisely defined so that there are no doubts in case a specified event occurs. It should be added that a force majeure risk is most often dealt with in separate insurance agreements. This is connected with the severity of damage caused by force majeure events and a contractor's limited possibility to bear such a risk. If there is insurance against consequences of force majeure events, the related risk is transferred to an insurer, unless there are some limitations, in form of franchise, stipulated in the agreement[10]. If a construction works contract did not specify any consequences of force majeure events and the related risk was not insured, a contractor may refer to the *rebus sic stantibus* clause if the above-mentioned conditions set forth in the law were fully satisfied. Looking at rulings by Polish courts, an extraordinary change in circumstances may include such cases as e.g.: a war, a flood or a rapid change of a political system.

Because of the big scale of construction projects, an array of services need to be rendered by a variety of contracting parties. Such cooperation is often based on a subcontractor agreement, which is concluded between the general contractor (the EPC contractor) and a subcontractor. A subcontractor's risk is related to the right choice of a contracting party. Taking into consideration the respective regulations set forth in art. 647 par. 2 of the civil code „(…) the execution by the contractor of a construction works contract with a subcontractor requires the investor's consent"[22]. If no objections or stipulations are submitted by the investor, it's assumed that such a consent has been given. This solution protects the investor from the engagement of some unreliable subcontractors. In business practice, also agreements with further subcontractors are concluded. In order to be valid, however, they require the consent to be given both by the investor and by the contractor[11]. Attention should be drawn to the fact that the subcontractor and the general contractor bear joint and several liability for any damage suffered as a result of improper performance or non-performance of works by a subcontractor.

2.2 Risk allocation in selected contracts used in investment and construction processes – selected economic aspects (cost risk category)

Given the current economic crisis in Poland, the most important category of risk for contractors is the financing of construction projects. The economic risk in the construction industry should be analysed, to a large extent, by looking at increasing costs of a construction project, because actual project costs are almost invariably never likely to match the costs planned before construction works commence. As a consequence, there are cost deviations, which may be defined as a risk. Who should bear these additional and unpredicted costs of the construction project depends on a type of contract entered into by the parties. In Poland, apart from a traditional construction works agreements, FIDIC (Fédération Internationale Des Ingénieurs-Conseils) contracts may be used. For big scale construction projects, there are three forms of FIDIC contracts:

- The Construction Contract – for construction and engineering works designed by the ordering party,
- The Plant and Design/Build Contract – for electric and mechanical equipment for construction and engineering works designed by the contractor,
- The EPC/Turnkey Projects – for construction and engineering works designed by the ordering party[12].

In FIDIC contracts, the contractor has the highest risk to bear in case of EPC/turnkey projects[13]. Therefore, every participant of an investment and construction process should strive to conclude such a contract, which would be most advantageous for them in terms of risk. In particular, this is about specific provisions in contracts, which state who should bear additional and unplanned costs of the construction project if they occur. „(…) Under the Polish balance-sheet law, costs are defined as probable reductions in economic benefits during the reporting period, with a reliably measured value, which leads to a reduction in the value of assets or increase in the value of liabilities and provisions that will cause a reduction in equity or increase the deficit by other means than the withdrawal of funds by shareholders or owners"[14]. „(…) Based on this definition, the costs of a construction project may be defined as the value of resources, expressed in monetary terms, owned by an entity performing the project and external resources used directly or indirectly in connection with the preparation and execution of this project"[15]. „(…) In particular, costs of long-term contracts, under the Polish balance-sheet law, include costs which are directly related to a given contract and a reasonably and regularly allocated part of indirect costs of manufacture related to the activities resulting from the contract as well as other costs different from the costs of agreement (contract) execution costs"[14].

When it comes to the reimbursement of costs for completed additional scope of works, contracts used in the construction sector in Poland may be divided into two groups, i.e. contracts with fixed prices and contracts with 'cost plus' prices. The graphic illustration is given in Table 1.

Table 1: Classification and examples of long-term contracts in the light of the balance-sheet law in Poland

CONTRACTS IN THE CONSTRUCTION INDUSTRY IN POLAND	
CONTRACTS WITH FIXED PRICES	**CONTRACTS WITH 'COST PLUS' PRICES**
Contracts containing: a) fixed price with the possibility of its correction due to the changes in the price level indices, b) fixed price and the clause allowing for its re-negotiation if circumstances defined in the agreement occur, c) fixed price increased by the bonus granted periodically for timely and qualitative contract execution, d) fixed price that is subject to the condition of achieving the precisely defined indicators.	Contracts containing: a) reimbursement guarantee regarding the material or deemed as rational execution costs incurred by the contractor, b) condition of common cost incurrence by the client and the contractor, c) reimbursement guarantee regarding the material and deemed as rational execution costs incurred by the contractor and payment of additional motivational bonus in favour of the contractor, d) reimbursement guarantee regarding the material costs of its execution as well as the payment of periodical bonus in favour of the contractor, e) reimbursement guarantee regarding the material costs of its execution as well as the payment of profit in favour of the contractor in the amount determined, f) provisions anticipating the settlement of the execution costs in proportion to the time and materials used.

Source: prepared on the basis of: [16], [17], [18].

The data given in Table 1 shows that a risk in fixed price contracts is mostly borne by the contractor while in 'cost plus' contracts it's mostly incurred by the investor[13]. It should be added that special attention in business practice should always be paid to the correct calculation of the price to be quoted, taking into account any potential costs of project execution. „(…) In Poland a price of a construction contract is established by the contractor, taking into account the calculation given in their quotation and the project execution costs. (…) When calculating this price, the contractor looks at total and well-identified costs of construction of a given facility, a profit margin desired by the contractor and a risk related to the project execution"[18]. A thorough project cost analysis is the prerequisite for any efforts aimed at reducing construction costs[19]. Due to the specific character of construction and assembly production, special emphasis should be placed on such costs as machinery, buildings, electricity, equipment, materials, temporary workers, e.g. workers hired through an agency [20]. In business practice, the concept of Whole Life-Cycle Costing (WLCC) is well worth consideration. As stressed by A. Boussabaine and R. Kirkham „(…) combined with WLCC, risk assessment should form a major element in the strategic decision making process during project procurement and also value analysis, especially in today's highly uncertain business environment"[21].

Conclusion

Apart from strictly legal issues, which are connected with contracting of participants in investment and construction processes, every contractual party in business dealings focuses on the technical and economic risks they will have to face. Such an attitude results from the industry-specific risk profile and the character and the flow of investment and construction processes. In such processes carried out in Poland, many contractors have managed to protect themselves against bankruptcy by means of well-designed contracts. Therefore, it is not only construction engineers and economics who should be involved in every risk management process, but also lawyers. Such a cross-functional team (risk management team) should decide together about the risk carried by a given construction project, its size and possible ways of mitigating this risk. One of effective risk responses is the transfer of risk through construction contracts or insurance agreements. In addition, a vital issue here is the correct determination of the offer price by contractors, following the general formula: offer price = indirect costs + direct costs + profit + risk premium.

This approach may finally defend the contractor from a risk of business collapse. No matter which costing method is chosen to calculate the project costs, another important thing is always the right choice of a contract to be concluded between the parties, in which specific provisions should be thoroughly analysed as these may lead to the highest risk for the contractor. The risk management process in the construction industry, however, does not only require construction engineers, lawyers and economists, but also a variety of experts, depending on needs. Therefore, risk in the construction industry has to be analysed comprehensively and complementarily through a number of dimensions as only such an approach is likely to lead to successful risk management.

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Trend Component Estimation II

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Abstract

This paper deals with the problem of the trend component estimation (approximation) particularly for the economic time series. In the real life situations it may be used in many applications, especially in macroeconomic (Gross Domestic Product, Inflation, Unemployment etc.), microeconomic, statistics, stock markets etc. The trend estimation of time series has been discussed extensively in a literature and there will be presented extension of the method using orthonormal system generated by Gram-Schmidt orthonormalization process from some available linearly independent sequence of time series or functions in an inner product space. These results are then applied to the data collections of the balance of payments of the Czech Republic, particularly to its foreign trade part.

Key words

Trend component, time series, orthonormal system, inner product, Gramm-Schmidt orthonormalization process, index lines, Method of Least Squares

JEL Classification: C13, C51

1. Analýza a model odhadu trendové složky

Obsah tohoto článku je zaměřen na rozšíření dříve prezentovaného modelu k odhadu trendové složky časové řady opět ve specifických (makroekonomických) případech. Jak již bylo prezentováno v článku [5], trendová složka může být odhadována mnoha možnými způsoby a zde navrhovaný přístup je založen na vybrané metodě dekompozice časových řad do několika „hlavních“ komponent (tj. trend, sezónní, cyklická a náhodná složka). Jedna z těchto uvažovaných komponent je právě požadovaný a neznámý „trend“. Samotný pojem „trend“ lze označit za moderní výraz viditelný zejména v posledních letech, který je všude přítomný např. v makroekonomii, moderní mikroekonomii a ve všech aplikovaných podoblastí ekonomie, statistiky, sociologie, financí, obchodu. Pro účely tohoto článku ho lze zjednodušeně interpretovat jako „vhodnou“ vyhlazovací křivku naměřených reálných pozorování, respektive vyhlazující křivku reflektující dlouhodobé změny v pohybech získaných reálných hodnot. Zde se jedná zejména o odhad retrospektivní trendové složky a následné „krátkodobé“ predikce, tj. prediktivní trendové složky.

1.1 Model

Pro připomenutí je zde nejprve před odvozením samotného trendového modelu předpokládáno, že hlavní oblast zájmu je založena na základních znalostech makroekonomické „teorie“, která předpokládá dostupnost různých makroekonomických časových řad. Některé z makroekonomických peněžních časových řad mohou být popsány následujícím, složkovým, indexovým, modelem

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$$X(t) = X_0 \sum_{i=0}^{m} a_i (1 + r_i)^t + \varepsilon_t, \qquad t = 1, 2, \ldots, T, \qquad r_i > -1, \tag{1.1}$$

kde je pomocí faktoru $a_i(1 + r_i)^t$ označován konkrétní růst nebo pokles v některé složce, např. objemu, ceně, měnovém kurzu a ostatní změny počátečního objemu označovaného jako X_0 a pomocí indexu r_i jsou označovány meziroční přírůstky v případě, že $a_i > 0$ nebo roční ztráty (úbytky) či stagnace v případě, že $a_i \leq 0$. Dále je zde použit parametr t charakterizující čas a parametr m, který označuje počet dílčích složek.

Velikost části, která podléhá vlivu modelovaného indexu r_i je dána právě hodnotou parametru $|a_i|$ a poslední proměnná z tohoto vztahu je časová řada náhodné složky ε_t, kde požadavky na její vlastnosti jsou doplněny v odkazujícím se textu [5].

1.2 Formulace problému

Obecně jsou k dispozici „typové" posloupnosti časových řad (průběhů, funkcí, …) označované jako $f_i(t)$, kde:

1. $i = 1, \ldots, m$
2. $t = 1, \ldots, T$
3. $m \leq T - 1$
4. $\forall i \in \{0, 1, \ldots, m\} \exists t \in \{1, \ldots, T\}: f_i(t) \neq 0.$

Podstata modelů těchto časových řad je v jejich aplikační oblasti, ze které pocházejí případná řešení tohoto problému. Navíc bude o takové posloupnosti předpokládáno, že se jedná o lineárně nezávislou množinu. Proto je ve výše uvedených podmínkách napsáno, že jsou zde vyloučeny nulové časové řady nebo funkce.

Tj. je zde k dispozici lineárně nezávislý systém (nebo množina prvků) $f_i(t)$ pro $i = 0, \ldots, m$ a $t = 1, \ldots, T$, který může být používán k získání (vygenerování) požadovaného ortonormálního systému vzhledem ke skalárnímu součinu[2] za pomoci známého procesu (postupu), který je v literatuře označován jako tzv. Gram-Schmidtův ortonormalizační proces. Zde je předpokládáno, že metodika Gram-Schmidtova ortonormalizačního procesu je čtenáři známa včetně všech použitých proměnných (skalární součin, norma, projekce vektorů …) a zároveň lze nahlédnout do [5] pro informace o algoritmu pro počítačové výpočty (tj. zejména na modifikaci pro numerickou stabilizaci celého procesu z důvodu zpřesnění ortonormálních prvků uvažovaného systému).

Následuje výběr jedné (libovolné) vyhovující posloupnosti ke konstrukci ortonormálního rozvoje, protože tento výběr představuje první krok v dále uvedené metodě pro odhad neznámé trendové složky. Při výběru vhodného systému je k dispozici obecně velký počet možných zdrojových posloupností, ze kterých může být daný výběr proveden. Pro účely tohoto článku zde byly vybrány tzv. indexové čáry (někdy známé jako úrokové čáry), jejichž grafická interpretace je znázorněna v odkazovaném článku.

Samotná transformace zdrojových indexových čar (zdrojové soustavy) na ortonormální systém se může zdát jako samoúčelná nebo pouze motivována numerickými důvody, kde pro efektivní a numericky stabilní výpočty je vhodné mít k dispozici dobře podmíněnou bázi. Výhody vygenerovaného systému jsou ale v jeho vlastnostech při odvozování, které jsou důležité pro výpočty a dokazování zvoleného modelu (tj. je zde vytvořena ortonormální báze uvažovaného podprostoru).

Poznámka: Vygenerovaný ortonormální systém s použitím uvedené metody by měl být také lineárně nezávislý a splňující požadavky uvedené dále. Reálná simulace vybraného systému

[2] Předpokládá se konečně-rozměrný reálný prostor se skalárním součinem.

odhalila možné nedostatky numerického modelování, které nesouhlasily s teoretickým základem požadovaným na uvedená data.

1.3 Metoda nejmenších čtverců pomocí ortonormálního systému

Hlavní princip požadovaného odhadu je založen na skutečnosti, že zde bude nalezena „vhodná“ aproximace neznámé trendové křivky označované jako $X(t)$ pro získaný soubor diskrétních pozorování v čase $t = 1, \dots, T$. Jedna standardní a velmi známá metoda, která bývá velmi často používána pro získávání různých aproximačních řešení je tzv. metoda nejmenších čtverců. Vybraná metoda může být stručně popsána jako celkové řešení minimalizující součet čtverců chyb provedených v řešení každé rovnice. Detailnější popis, odvození a informace lze nalézt např. v [6].

Následná aproximace požadované trendové složky z původní řady $X(t)$, která bude nadále označována jako $X_m(t)$, může být chápána jako vytvořená lineární kombinace vyjádřená pomocí vztahu

$$X_m(t) = \sum_{i=0}^{m} a_i g_i(t), \quad t = 1, \dots, T, \quad m \leq T-1, \tag{1.2}$$

tak, že obecný přístup k řešení tohoto problému lineární úlohy pomocí metody nejmenších čtverců může být popsán pomocí následující rovnice

$$\|X_m(t) - X(t)\|^2 = \sum_{t=1}^{T} (X_m(t) - X(t))^2 \xrightarrow[a_0,\dots,a_m]{} min, \quad m \leq T-1, \tag{1.3}$$

kde zápis $\|\cdot\|$ označuje tzv. Euklidovskou normu[3]. Následný problém týkající se požadovaného odhadu lze zredukovat na skutečnost, kde je hlavním cílem najít takové neznámé ale předpokládané koeficienty a_i, které minimalizují součet kvadrátů chyb mezi modelem pro odhad neznámého trendu a získaným modelem ze souboru obsahujícího T pozorování.

Předmětem zájmu je tedy k-tý odhadovaný koeficient a_k, kdy je k dispozici vektor reálných (dopočítaných) koeficientů X a k-tý prvek z vygenerovaného ortonormálního systému g_k, jehož použité vlastnosti lze nalézt např. v [1]. Následný odhad neznámého koeficientu a_k může být vyjádřen na základě vztahu

$$a_k = \langle \mathrm{X}, g_k \rangle, \quad k = 0, \dots, m, \tag{1.4}$$

kde zápis $\langle \cdot \rangle$ označuje skalární součin a X, g_k jsou vektory obsahující celkem T hodnot. Postup k získání uvedeného výsledku je detailně popsán v [7].

Dále lze vyjádřit odhad trendové křivky $X_m(t)$ následujícím vztahem

$$X(t) = \sum_{i=0}^{m} \langle X, g_i \rangle g_i(t) + \varepsilon_t^m, \quad t = 1, \dots, T. \tag{1.5}$$

Nejedná se o nic jiného než o vyjádření reálných pozorovaných hodnot pomocí vztahu pro odhad trendové křivky a chyby daného odhadu. V této situaci je zde také předpokládáno, že máme k dispozici „specifický ortonormální systém“, který „obsahuje konstantu“ dále označovanou jako $g_0(t) = g_0 \in \mathbb{R}_1$ pro $t = 1, \dots, T$ a jejíž přesná hodnota je získána jako

$$1 = \langle g_0, g_0 \rangle = \sum_{t=1}^{T} g_0^2 = T g_0^2 \Rightarrow g_0 = \frac{1}{\sqrt{T}}. \tag{1.6}$$

[3] Reálná funkce na vektorovém prostoru definovaná v $\mathbb{R}^n$ jako odmocnina ze součtu druhých mocnin souřadnic vektoru.

1.4 Prediktivní trend

Predikce neznámé a předpokládané trendové křivky navazuje na vytvořený model k jejímu odhadu. Nechť je nadále předpokládáno, že jsou k dispozici jednotlivá pozorování $\{x(1), \dots, x(T)\}$ uvažované časové řady na diskrétním intervalu $1, \dots, T$ a vygenerovaný ortonormální systém vůči skalárnímu součinu na intervalu $1, 2, \dots, T, (T+1), \dots, (T+\tau)$. Vygenerovaný ortonormální systém je označován jako $g_0(t), g_1(t), \dots, g_m(t)$ a je potenciálně rozšiřitelný až na hodnoty $g_0(t), g_1(t), \dots, g_{T+\tau-1}(t)$, kde:

1. $t\epsilon\{1, 2, \dots T, (T+1), \dots, (T+\tau)\}$,
2. $0 < m < (T+\tau-1)$,
3. $g_0(t) = \frac{1}{\sqrt{T+\tau}}$.

Zde je vhodné připomenout, že první vygenerovaný prvek ortonormálního systému $g_0(t)$ je konstantní funkcí. Dále je předpokládáno, že je k dispozici „nějaké“ prodloužení (tím je myšlena možná předpověď, odhad, atd.) uvažované časové řady na intervalu $t\epsilon\{(T+1), \dots, (T+\tau)\}$, které bude označováno jako

$$z(t) = x(t) + \varepsilon_t, \tag{1.7}$$

pro $t\epsilon\{(T+1), \dots, (T+\tau)\}$, kde $x(t)$ je skutečná (budoucí a nedostupná) hodnota časové řady na uvažovaném intervalu a ε_t je chyba (náhodná složka) tohoto prodloužení. Tím je možné získat časovou řadu $\tilde{x}(t)$, pro kterou platí:

$$\begin{aligned} \tilde{x}(t) &= x(t), && t\epsilon\{1, 2, \dots T\}, \\ \tilde{x}(t) &= x(t) + \varepsilon(t), && t\epsilon\{(T+1), \dots, (T+\tau)\}. \end{aligned} \tag{1.8}$$

Nyní se lze zaměřit na množinu vybraných indexů, která je nadále označována jako I. Pro účely tohoto textu se jedná o blíže neurčenou (a subjektivně vybranou) množinu indexů vybraných ortonormálních složek $I \subseteq \{0, 1, \dots, m\}$, pomocí které bude odhadována neznámá trendová složka uvažované časové řady $\tilde{x}(t)$. Ta je nadále označována jako $\widetilde{X_I}(t)$ a lze ji vyjádřit vztahem

$$\widetilde{X_I}(t) = \sum_{i \in I} \tilde{a}_i g_i(t), \tag{1.9}$$

kde dosažitelný odhad neznámých koeficientů $\tilde{a}_i$ je možné rozepsat jako

$$\tilde{a}_i = \sum_{t=1}^{T+\tau} \tilde{x}(t) g_i(t) = \langle \tilde{x}, g_i \rangle = \sum_{t=1}^{T+\tau} x(t) g_i(t) + \sum_{t=T+1}^{T+\tau} \varepsilon_t g_i(t). \tag{1.10}$$

Pokud jsou vyjádřeny nedostupné a „skutečné“ koeficienty a_i jako

$$a_i = \sum_{t=1}^{T+\tau} x(t) g_i(t), \tag{1.11}$$

potom je získána vlivem „nedokonalé“ předpovědi $z(t)$ chyba odhadovaného koeficientu $\tilde{a}_i$ ve tvaru

$$(\tilde{a}_i - a_i) = \sum_{t=T+1}^{T+\tau} \varepsilon(t) g_i(t). \tag{1.12}$$

Potenciálně (ale jen potenciálně, ve skutečnosti je prakticky vždy nedostupná) je možné využít přesnou trendovou křivku časové řady $X_I(t)$, která je vyjádřena vztahem

$$X_I(t) = \sum_{i \in I} a_i g_i(t). \tag{1.13}$$

Zde je důležité zdůraznit, že koeficienty $\tilde{a}_i$ jsou potencionálně alespoň dostupné, ale koeficienty a_i nikoliv. Pokud je dále k dispozici pro časovou řadu $x(t)$ pro $t\epsilon\{(T+1), \dots, (T+\tau)\}$ nějaký vybraný jednoparametrický trendový odhad (nejen z aplikační oblasti) s označením $z(t,p)$ pro $t\epsilon\{(T+1), \dots, (T+\tau)\}$, může se hodnota neznámého parametru p odhadnout optimalizací „nějakého" zvoleného kritéria např. z aplikační oblasti. Pokud takové kritérium není k dispozici, pak lze zvolit např.

$$\max_{t=1,\dots,T} \left| x(t) - \sum_{i=0}^{m} \tilde{a}_i g_i(t) \right| \xrightarrow[p]{} min, \tag{1.14}$$

kde

$$\tilde{a}_i = \sum_{t=1}^{T+\tau} \tilde{x}(t) g_i(t) \tag{1.15}$$

a

$$\tilde{x}(t) = z(t,p), \qquad t\epsilon\{(T+1), \dots, (T+\tau)\}. \tag{1.16}$$

Zvolené kritérium obsahuje některé nedostatky, které se projevují zejména v návaznosti na „významně" odlehlá „pozorování" a mohou zkreslit požadovaný výsledek. Proto je někdy vhodnější volba jiného kritéria, např. Euklidovská norma

$$\left\| x(t) - \sum_{i=0}^{m} \tilde{a}_i g_i(t) \right\| \xrightarrow[p]{} min, \tag{1.17}$$

která se vyznačuje větší stabilitou vzhledem k popsaným vlastnostem normy pro $t = 1, \dots, T$. Uvedený přístup charakterizuje minimalizaci volatility reziduální složky. Celá optimalizace se provádí jen na množině $t\epsilon\{(T+1), \dots, (T+\tau)\}$ proto, aby hodnota parametru p byla „významně" ovlivněna (určena) již známým průběhem na $t\epsilon\{1, 2, \dots T\}$ a „minimálně" ovlivňovala $\tilde{a}_i$ (byla ovlivněna odhadem budoucnosti).

Pokud není (tvar) odhad trendu $z(t,p)$ k dispozici, je možné využít tzv. „prodloužení" přímkou vzhledem ke svým nesporným vlastnostem

$$z(t,p) = x(T) + p(t-T), \qquad t\epsilon\{(T+1), \dots, (T+\tau)\}. \tag{1.18}$$

Nebo lze použít i jiné „prodloužení", např. pro účely této práce je použito „prodloužení" ve tvaru

$$z(t,p) = x(T)p^{(t-T)}, \qquad t\epsilon\{(T+1), \dots, (T+\tau)\}, \tag{1.19}$$

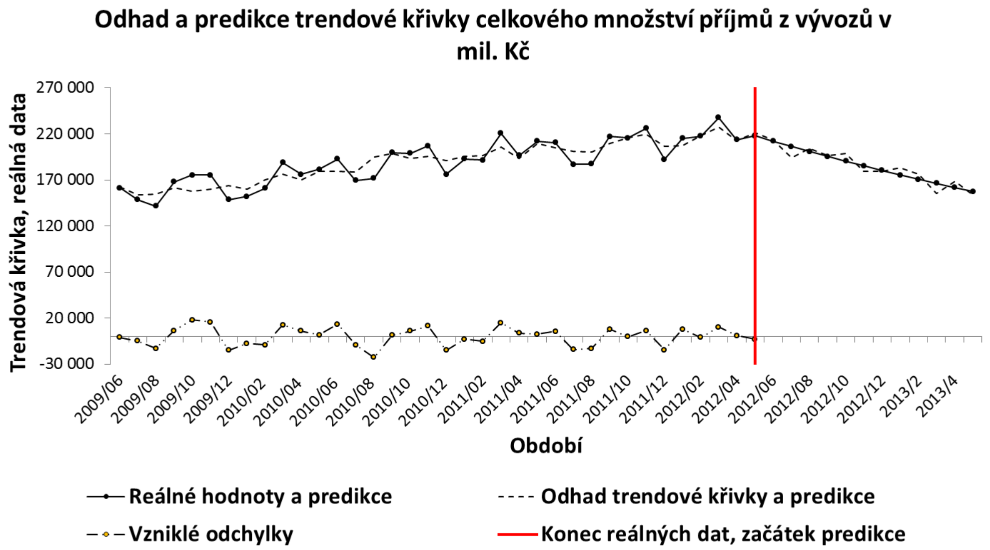
tj. vybraný indexový průběh, který je vhodný pro některé ekonomické řady. Takových prodloužení je samozřejmě více. Jejich typ a případně i parametr (parametry) by měl být podstatně ovlivněn aplikační oblastí, odkud pocházejí data.

2. Aplikace na reálná data

Verifikace odvozeného modelu pro odhad a predikci trendové složky včetně následných závěrů jsou postaveny na získaném souboru dat z platební bilance České republiky, zde z její části nazývané obchodní bilance. V platební bilanci dané země (též platební bilance zahraničního obchodu) je zachycen mezinárodní pohyb statků, služeb výrobních faktorů, pohledávek a závazků se zahraničím. Lze ji charakterizovat jako statistický výkaz, který systematicky zachycuje ekonomické transakce se zahraničím za určité časové období, zpravidla jeden rok [2]. Platební bilance má mnoho definic, např. z metodického listu ČNB [4] a samotná struktura je v různých zemích a institucích nejednotná. Získaný soubor dat je ze statistických výkazů České národní banky, která vychází z Příručky k sestavování platební bilance MMF (Balance of Payments Compilation Guide, 5. vydání, 1993), ve kterém lze platební bilanci rozdělit do horizontální nebo vertikální struktury a k účelu tohoto textu byly použity pozorování z horizontální struktury za uvažované období od 1. 1. 2003 do 31. 5. 2012. Samozřejmě se zde jedná o dílčí pohled. Hodnoty platební bilance jsou zveřejňovány v uvedeném členění v Kč, EUR[4], USD[5] od roku 1993 jako jednotlivá čtvrtletí nebo kumulovaná a vzhledem k požadavkům na co nejobsáhlejší soubor reálných dat byly zvoleny jednotlivá měsíční pozorování, které jsou zveřejňovány až od roku 2003 [3].

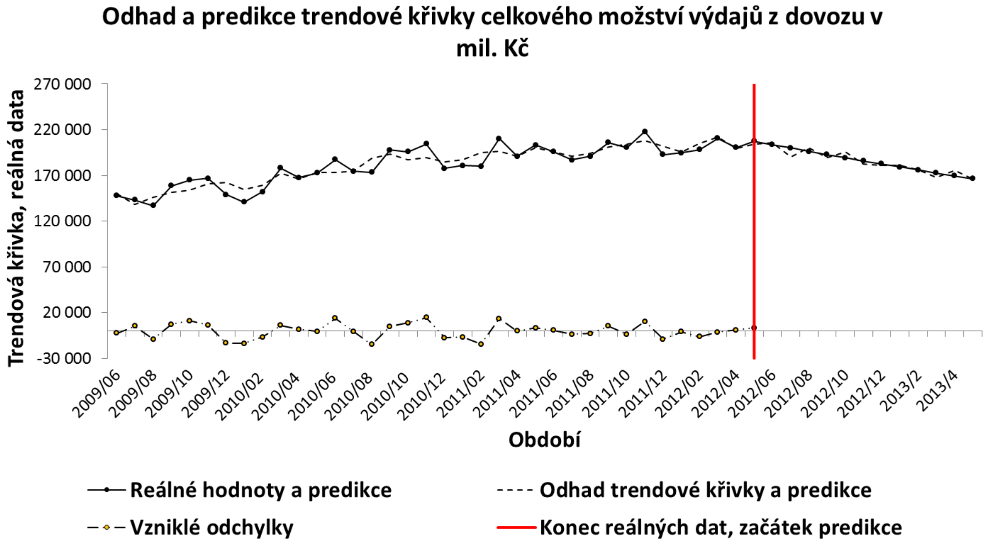
Uvažovaná trendová křivka je sama o sobě aproximací získaného souboru dat pomocí spojité křivky, která shrnuje, kde se získané hodnoty nacházely v minulosti, kde se tyto hodnoty nalézají nyní právě ve vztahu k minulosti a kde by se tyto hodnoty mohly vyskytovat v krátkém budoucím časovém intervalu po navrženém „prodloužení“ s využitím prediktivního modelu pro (možnou) predikci trendu v „krátkodobém“ časovém horizontu. Ten je zvolen počtem 12 měsíců v závislosti na předchozích datech, které jsou vzhledem k věrohodnému popisu (váze) změn v poslední době zvoleny za dobu 3 let, tedy posledních 36 měsíců včetně posledně získaného měření (5/2012). Shrnuto, základem odhadu trendové křivky je posledních 36 pozorování (měsíčních) s predikcí na 12 pozorování (měsíců). Volba delšího predikčního intervalu by již vzhledem k dynamicky se měnícímu prostředí ztrácela smysl. Analýze jsou podrobeny oba získané reálné soubory dat (vývoz, dovoz) na níže uvedených obrázcích, kde jsou odhady trendových křivek zobrazeny pomocí přerušované čáry.

Obrázek 1: Odhad trendové křivky (6/2009 – 5/2012) a 12měsíční predikce celkového množství příjmů z vývozu ČR, $n = 48$



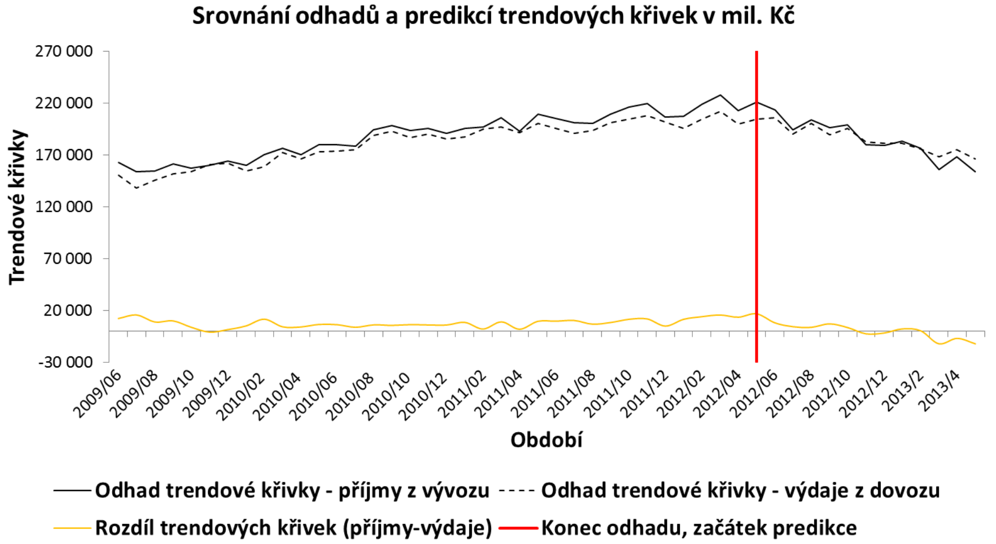
[4] EUR představuje zkratku pro měnu Evropské unie s názvem Euro.
[5] USD představuje zkratku pro měnu Spojených států americký s názvem americký dolar.

Obrázek 2: Odhad trendové křivky (6/2009 – 5/2012) a 12měsíční predikce celkového množství výdajů z dovozu ČR, $n = 48$



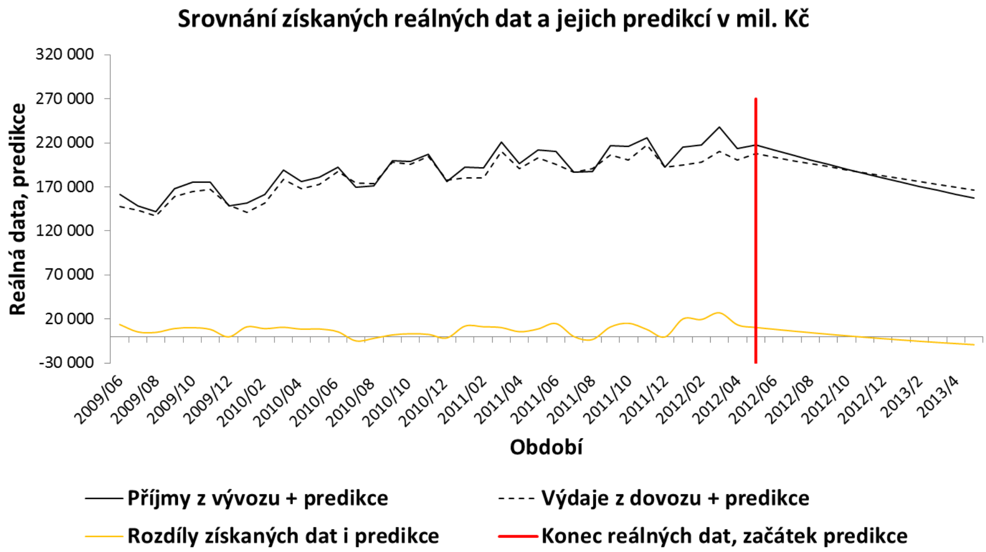
Srovnání vývojů (průběhů) trendových křivek je prezentováno na následujícím obrázku, kde za povšimnutí stojí „vyšší“ dynamika v odhadu trendové křivky pro příjmy z vývozu, než výdajů z dovozu a jejich záměna v predikovaném období.

Obrázek 3: Srovnání odhadnutých trendových křivek za 48 měsíců včetně 12měsíční predikce z celkové výše příjmů a výdajů ČR



Pro úplnost jsou zde zobrazeny získané soubory reálných dat (datových vektorů), respektive jejich vzájemné srovnání včetně predikčních odhadů na 12 měsíců.

Obrázek 4: Srovnání získaných souborů reálných dat z celkové výše příjmů a výdajů ČR za 36 měsíců a jejich 12měsíční predikce



Nyní lze stručně shrnout získané výsledky na obrázcích z ekonomického úhlu pohledu. O trendových křivkách na uvedených obrázcích charakterizovaných přerušovanou čárou lze vzhledem k získaným obrázkům tvrdit, že demonstrují růstový potenciál, což může být způsobeno růstem ekonomické aktivity ve vybrané zemi. Tím je zde myšlen růst ekonomické aktivity v celé České republice, který je reprezentován celkovou výší výdajů z dovozu (i příjmů z vývozu). Dále lze detailněji popsat směr obou trendových křivek, které mají od roku 2009 růstový charakter, který lze vysvětlit pomocí všeobecné rostoucí ekonomické aktivity. Tento směr je zachován až do 2012, kdy se na scénu vrátila původní celosvětová „krizová" nervozita a obě trendové křivky až do současnosti vykazují klesající tendenci. Zde stojí za povšimnutí skutečnost, že od roku 2009 až do konce 2011 nedocházelo v dovozních ani vývozních objemech k výraznému poklesu, dokonce je patrná neklesající tendence a zároveň Česká republika navyšuje po odeznění první vlny „finanční krize" své vývozy i dovozy.

Obě konkrétní aproximace neznámých trendových křivek (ve smyslu této práce) jsou dále užitečné i pro jejich vzájemné porovnání, zejména v dlouhodobém časovém horizontu. Vzniklá situace je znázorněna na výše uvedených obrázcích, kde přerušovaná křivka označuje trendovou křivku pro celkovou výši výdajů z dovozu a plná čára charakterizuje trendovou křivku pro celkovou výši příjmů z vývozu. Rozdíl mezi vykreslenými trendovými křivkami představuje kladnou nebo zápornou hodnotu (aktuálních odečtů) zahraničního obchodu platební bilance, tedy obchodní bilanci. Obecně zde může být řečeno, že jestliže se nachází plná čára nad přerušovanou, potom hodnota vzniklé „trendové bilance" je kladná a zahraniční obchod má znaky dobré kondice.

Obrázky pro vzájemné porovnání obsahují i třetí křivku, která reprezentuje vzniklé rozdíly mezi oběma odhady trendových křivek. Z obrázků je evidentní neklesající tendence směru až do začátku predikce, která znamená „rychlejší" růst celkové výše příjmů z vývozu než výdajů z dovozu. Stručně řečeno, ekonomická aktivita v České republice zvyšuje celkové příjmy z vývozu rychleji, než celkovou výši výdajů z dovozu v milionech Kč až do roku 2012(jistý vliv na to mohou mít i kurzové poměry, nejen), ale predikce dle navržených modelů již tak „optimistické" závěry nenaznačuje.

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Forecasting methods as an important tool of risk management

Marta Urbaníková [1]

Abstract

Companies operating in international goods, financial and commodity markets are exposed to various risks which affect their economic results. The important component of financial risks are currency risks. For successful management of these risks is necessary to forecast the movement in currency exchange rates properly. The aim of the article is to describe both traditional and modern methods of analysis and forecasting of financial time series. A neural network model is applied to the forecasting of the currency exchange rate EUR / USD.

Key words

Forecasting, time series, currency risks, currency exchange rates, neural network

JEL Classification: C32, C45, G17

1. Introduction

Businesses as a result of deepening globalization are becoming still more and more dependent on the external environment. Their economic results are influenced by the development in financial markets. For successful management of financial risks is necessary to predict the movement of financial time series properly. The significant component of financial risks are currency risks. The issue of forecasting of the exchange rates is actual since 1973, when the fixed foreign exchange rates were cancelled and a floating exchange rate system was established.

Forecasting of exchange rate is very complex. It is conditioned by volatile behavior which is the result of a complex market mechanism generating the data.

Attempt to predict asset value, however, does not cease due to economic profit. In this paper we will deal with technical analysis. It puts the emphasis only on using information from historical data and disregarded any economic factors. Financial time series are characterized by properties, making them difficult to predict. That are mainly non-stationary and nonlinearity. Conventional statistical methods are commonly used in technical analysis. For example, ARMA models (Autoregressive moving average model) have proved to be an effective tool for modeling some financial time series. However, these are only a linear models which are unable to read the data from the nonlinear relationships. Therefore, there is an increasing interest in nonlinear models which are able to capture nonlinear behavior of financial time series. The best known include ARV models (Autoregressive random variance model) and ARCH models (Autoregressive conditional heteroskedasticity model). The nonlinear models also include a neural network. Due to its non-parametric adaptive behavior and tolerance to noise they are able to describe the dynamics of non-stationary time series. They are very flexible therefore they can be used for technical and fundamental analysis.

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Neural networks have several properties that make them attractive for forecasting of financial time series. One of their main advantages, compared to the statistical methods, is that they do not need any assumptions about the models, they need only the input data. That is the reason why they are also suitable for tasks whose solution would with other methods require additional assumptions or model specification. In addition, they can cope with low-quality data. Another advantage is their ability to generalize. They are universal approximator, since they are able to approximate any function to any degree of accuracy.

Despite the good results achieved in forecasting of financial time series, they face criticism due to several shortcomings. The main problem of neural networks involves choosing the right architecture and the efficient training algorithm. Various algorithms of neural networks can with using the same data produce different results. Moreover, both weights and thresholds of neurons can be trained by multiple methods.

Previous researches have shown that neural networks can be a powerful tool used in finance. They are used in areas where semiparametric and nonparametric regression or classification of parameters are used, such as financial time series forecasting, risk assessment and scoring models. From the statistical point of view, neural networks are nonparametric nonlinear regression models. Math concept of neural networks is quite complex and not all of the theoretical aspects are brought to final form. A lot of knowledge about neural networks have been obtained using the heuristic approach applying them to real problems.

2. Traditional methods of financial time series forecasting

In general, we can divide considered models into two categories, namely the linear and non-linear. Since in this paper we deal with the analysis of exchange rates, we need models which are able to explain the stochastic behavior and high volatility.

2.1 Box-Jenkins methodology

In practice, we often encounter linear stochastic time series models, which are known as the Box-Jenkins methodology. There are three basic types of linear models: AR models (Autoregressive model), MA model (Moving average model) and ARMA models (Autoregressive moving average model).

A key concept of the Box-Jenkisovej methodology is stationarity of stochastic process. We say that a stochastic process is strictly stationary if its probability distribution is invariant to shifts in time. Because this feature is difficult to verify, the concept of weak stationarity of stochastic processes was introduced. Process is weakly stationary if its mean and dispersion are invariant to shifts in time. Any strongly stationary process with mean μ and dispersion σ^2 is also weakly stationary.

Most of the financial time series is nonstationary. Nonstationary time series, however, can be transformed into the stationary and therefore these models can also be used to analyze non-stationary data. There are several methods how to achieve it. In financial time series we are often faced with the transformation to the yields which enable good economic interpretation of the obtained results. To assess whether the process is stationary, the autocorrelation function and statistical tests of stationarity are used, for example Dickey-Fuller test.

Stationarity can be determined from the graph of autocorrelation function. If the value of the correlation coefficient exceeds range for confidence intervals only in a small number of delays, the series is stationary. Width of the 95% confidence intervals is approximately $\pm 2/\sqrt{N}$ where N is the dimension of the data.

2.1.1 ARMA models

General class of linear models used to predict the time series is a class of ARMA models. ARMA (*p, q*) model has the form

$$y_t = \gamma + \sum_{i=1}^{p} \varphi_i y_{t-i} + \sum_{j=1}^{q} \theta_j e_{t-j} + e_t$$

where φ_i are the autoregressive parameters and θ_j are the moving averages parameters. If the process y_t has zero mean, γ is equal to zero. Residues e_t are independent and uniformly distributed with properties

$$E(e_t) = 0, \quad E(e_t^2) = \rho_e^2 \quad Cov(e_t, e_s) = 0 \quad s \neq t$$

In the case of AR and MA processes, is the size of *p* respectively *q* determined by visual assessment of correlograms of autocorrelation and partial autocorrelation functions. But in ARMA process it is quite difficult. To estimate the parameters of ARMA model can be used several methods, for example Yule-Walker formula or Burg algorithm. According to the theory of forecasting optimal value of prediction is the one which minimizes the mean square error. The best estimate of y_t is conditional mean

$$\hat{y}_t = E(y_t | y_{t-1}, y_{t-2}, ...)$$

It has been shown in [2] that approximation of the optimal forecasts for ARMA (*p, q*) model is a recursive relationship

$$\hat{y}_t = \sum_{i=1}^{p} \varphi_i y_{t-i} + \sum_{j=1}^{q} \theta_j \hat{e}_{t-j}$$

2.2 ARCH and GARCH models

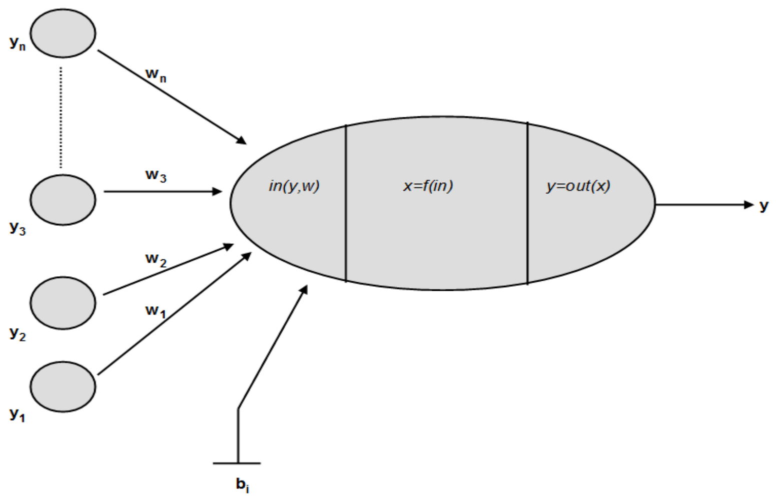
Analysis of financial time series, such as stock prices, interest rates or exchange rates, is quite complicated, because these variables have high volatility. In econometrics and finance are on the rise just those models which simulate returns using volatility. These models include the ARCH (Autoregressive conditional heteroscedasticity) and GARCH (Generalized autoregressive conditional heteroscedasticity). Key benefit of these models consist in the differentiation of conditional and unconditional volatility of residues process $\{\varepsilon_t\}$. The concept of conditional volatility reflects an explicit dependence on past observations, while the unconditional volatility is associated with long-term behavior of the time series.

In practice are usually occurred small values of the parameters *p* or *q*. The most often are occurred models GARCH (1,1), GARCH (2,1) or GARCH (1,2).

3. Neural network

Neural network is a massively parallel computing system, which has the ability to store information and allows their further processing while simulating the activity of the human brain in collecting of knowledge in the learning process (adaptability) and storing this knowledge using the connection between neurons (synaptic weights). If other parameters than connections between neurons, are used to store the data on the network (such as threshold parameters or coefficients of transition functions of neurons), we talk about adaptive networks. An essential element of the neural networks is neuron. In general, it has the number of inputs from other neurons or the environment, and one output. The operation, which transforms neurons inputs to the output is usually very simple. Figure 1 represents the neuron model which forms the basis of the artificial neural networks. Inputs enter the neuron and are multiplied by their respective synaptic weights. They are then summed and processed by an activation function. The most used activation functions are linear, logistic or sigmoid function.

Figure 1: Artificial neuron model



According to the direction that spreads signals in neural networks can be divided into feed-forward and recurrent. Feed-forward neural networks are those in which the signal is spread only from the input neurons (neurons, whose inputs are signals from the environment) through the hidden neurons to output neurons (neurons, which leads out into the environment). Recurrent neural networks are those in which the signal can also move from the outputs to the hidden parts or even to the inputs. It is clear that recurrent neural networks are more complex than feed-forward.

One of the basic properties of neural networks is the ability to learn. Depending on what principle is this ability in neural networks realized, we distinguish two types of learning: supervised and unsupervised. Supervised learning is based on the fact that during the learning the network has at its disposal a set of inputs and their desired outputs. In the process of learning the network parameters (i. e. weights) are modified to minimize the difference between the obtained network response to inputs and outputs required for these inputs. Unsupervised learning is the type, in which the network has only inputs available, outputs corresponding to them are generated by the network based on the properties of the input data themselves. These outputs are not known in advance.

Feed-forward neural networks with supervised learning is very often used for their easy implementability and versatility of use. They are used for data classification, function approximation, prediction and modeling and identification of unknown systems. The most commonly used type of feed-forward neural networks with controlled learning is a multilayer perceptron. The neurons are arranged in one input, one output and one or more hidden layers.

From the recurrent neural networks with controlled learning the Hopfield neural networks are necessary to mention. Method of neuronal connections (ie network topology) in this type neural networks is very special: each neuron is the input and output simultaneously (so-called dual neurons) and is associated with all other neurons. Networks of this type are used to memory realization. We should also mention the fact that Hopfield neural networks can also be used to solve the traveling salesman problem.

The feed-forward neural networks with uncontrolled learning include particularly the Kohonen self-organized maps. Topologically they are very simple: they contain only one input and one output layer of neurons and no hidden neurons. Self-organizing maps can be hierarchically organized and then they become very powerful tool for clustering the data division. Their utility may increase even more when they are combined with fuzzy sets.

The last type of neural networks are recurrent networks with uncontrolled learning. Topology of neuronal connections and way of learning of these networks is generally based on Adaptive Resonance Theory. This method of learning allows the network to learn the correct response to new designs without having to "forget" the knowledge learned in the past.

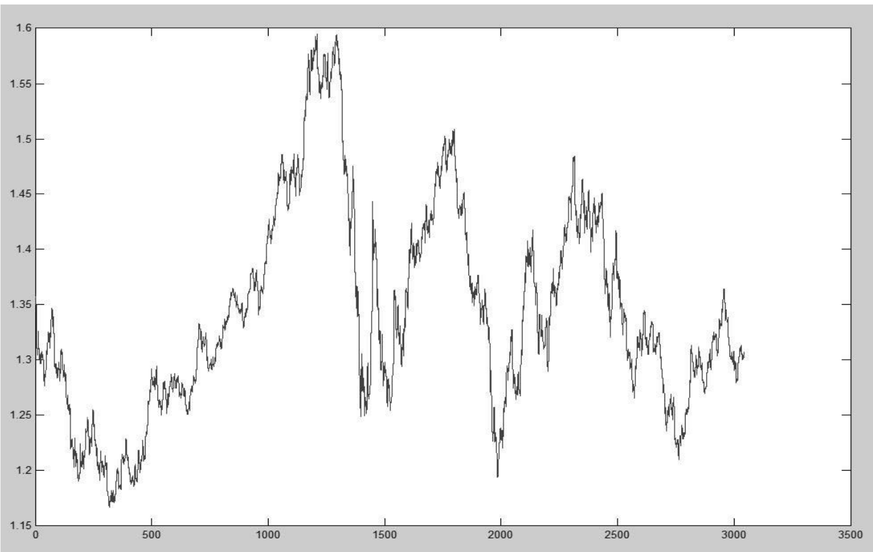
While creating the neural networks we have several options. Either programmed directly, mostly in C + + or Java, or use complex software, which enables to create neural networks directly in its environment, for example.: Math Works MATLAB, Wolfram Mathematica, STATISTICA, Neuro Solutions

In the MATLAB program we have to do the standard steps for designing neural networks to solve problems in four application areas: fiction fitting, pattern recognition, clustering, and time series analysis. The steps include: collect data, create the network, configure the network, initialize the weights and biases, train the network, validate the network, use the network.

4. Forecasting of currency exchange rates using neural networks

We applied the neural network method for forecasting of foreign exchange rate between EUR and USD. We used program packet MATLAB, Neural Network Toolbox. The data used in this study are the daily exchange rates of EUR/USD from 1.1.2005 to 30.4.2013. Source: http://www.oanda.com/currency/historical-rates/, which are displayed on figure 2.

Figure 2: Daily exchange rates EUR/USD, 1.1.2005-30.4.2013



To built a neural network forecasting model, historical data are divided into three portions: training, validation and testing sets. The training set contains 70% of the data, validation set contains 15% and the testing set contains 15% of the data. Six layers feed-forward back propagation neural network was used for prediction, five hidden layers and one output layer, see figure 3. In each layer was used sigmoid activation function. Figure 4 represents Mean Squared Error. Exchange rate EUR/USD prediction for next day is 1,314. Detail of comparision between predictions and actual values of exchange rate EUR/USD for next 14 days is on the figure 5.

Figure 3: Feedforward Neural Network

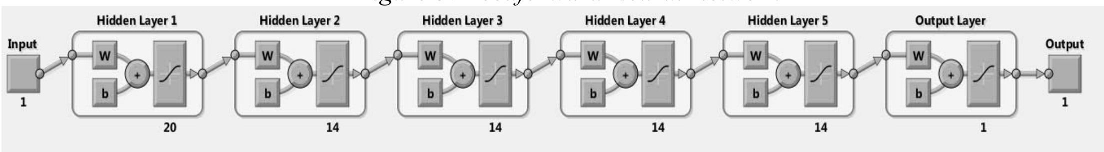


Figure 4: Mean Squared Error

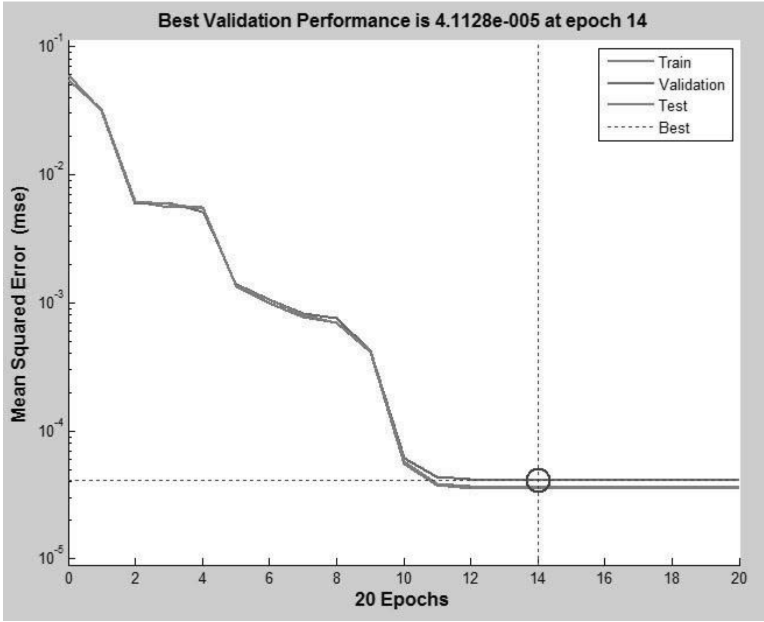
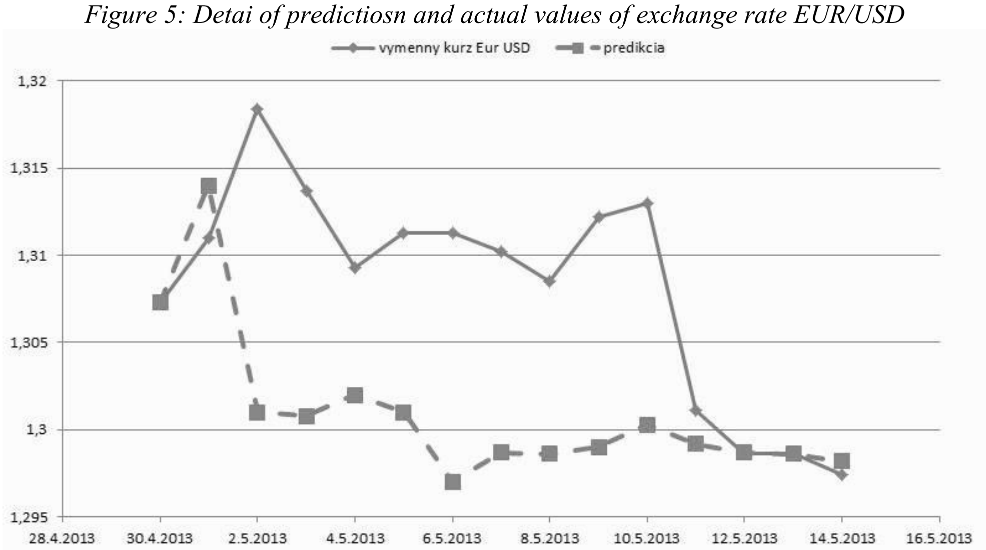


Figure 5: Detai of predictiosn and actual values of exchange rate EUR/USD



5. Conclusion

One of the primary goals of financial time series analysis is forecasting its future development. Because those data have stochastic behavior, their analysis is quite complicated. Several methods are used for their forecasting, the concept of neural networks is one of them. Previous researches have proved that neural networks can be quite successful. They are able to capture the features and anomalies in the data, while describing not only linear but also non-linear relationships between them. This ability is very important in modeling dynamic systems, for example financial time series.

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Application of fuzzy logic in practice

Katarína Valášková, Elena Gregová [1]

Abstract

The theory of fuzzy sets and fuzzy logic were developed to enable to process mathematically the linguistic terms. Fuzzy set theory and associated fuzzy logic have found widespread application in many disciplines. These applications are extensive in computer science, systems analysis, electrical and electronic engineering and related fields. The construction and application of expert systems has touched most aspects of modern life often without our knowledge. While the use of fuzzy sets and logic has been widespread in the physical sciences, the application of these tools in the social sciences appears to have been unlimited. The paper deals firstly with the theoretical background of fuzzy sets, secondly depicts the practical usage of fuzzy logic and lastly shows an example of fuzzy logic application in a sector of national policy.

Key words

Fuzzy set, fuzzy systems, fuzzy logic, fuzzy logic application

JEL Classification: C63, D11

1. Basic foundation of fuzzy logic

In general, fuzzy logic aims at modelling the imprecise models of reasoning that play an important role in the remarkable human ability to make rational decisions in an environment of uncertainty and imprecision (Zadeh, 1988, p.83).

During the last several years, fuzzy logic has found numerous specifications in fields ratings from finance to earthquake engineering. The basic idea underlying fuzzy logic control was suggested in notes published in 1968 and 1972 (Zadeh, 1968, p.95) and then described in details in 1973 (Zadeh, 1973, p.28). The first implementation was pioneered by Mamdani and Assilian in 1974 in connection with the regulation of steam engine.

The main features of fuzzy logic that differentiate it from traditional logical systems are the following. In two-valued logical systems, a proposition *p* is either true of false. In multivalued logical systems, a proposition may be true or false or have an intermediate truth value, which may be an element of a finite or infinite truth vale set T. In fuzzy logic the truth values are allowed to range over the fuzzy subsets of T. A fuzzy truth value may be viewed as an imprecise characterization of a numerical truth value.

The predicates in two-valued logic are constrained to be crisp in the sense that the denotation of a predicate must be a non-fuzzy subset of the universe of discourse.

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Two valued as well as multivalued logic allow only two quantifiers “all” and “some”. But fuzzy logic offers many others, such as “most”, “many”, “several”, “frequently” etc. those are so called fuzzy numbers that provide an imprecise characterization of the cardinality on one or more fuzzy or non-fuzzy sets.

Fuzzy logic provides a method for representing the meaning of both non-fuzzy and fuzzy predicate-modifiers. This leads to a system for computing with linguistic variables, that is, variables whose values are words or sentences in a natural or synthetic language.

In two-valued logical systems, a proposition *p* may be quantified easily but fuzzy logic has three core models of quantification; truth-qualification, probability-qualification, and possibility-qualification. (Zadeh, 1988).

Fuzzy logic is a mathematical discipline, introduced by Lotfi Zadeh in 1965 in his article "Fuzzy Sets - Information and Control", which disproves the traditional assumption that in the area of general consideration some ideas either belongs or does not to the consideration. It is a logic trying to be as close as possible to human thinking and perception. It is based on the assumption that people are not thinking in the exact variables (yes / no), but distinguish a range of "blurry" values (rather yes, much yes, maybe no, and yes and no). This means that it operates with cloudy concepts and blurred boundaries. The problems can be presented by some degree of truth and falsity. For example, the statement, it is sunny weather today, could be 100% true if there are no clouds in the sky, 80% true if there are few clouds, 50% true if it is cloudy and 0% true if it rains all day long. Fuzzy word is from English language and means "fuzzy, blurry, vague" (Hudec et al., 2005).

Fuzzy logic has proved to be applicable mostly in expert systems and other artificial intelligence applications. The theory of sets defines a set as a set of elements of certain properties. Then the element belongs to the set or not (taking the value of 0 or 1). L. Zadeh (founder of fuzzy logic) created the theory of fuzzy sets and fuzzy logic, where it is determined "how much" element belongs to the set or not (variable x and its set membership are defined as μ (x) in the range from 0 to 1, 0 means completely non-membership and 1 full membership in the set). It is mainly used as a form of decision making in conditions of uncertainty (Buckley, Eslami, 2006).

With fuzzy logic it is possible to find a solution for the particular case on the basis of the block of rules being set for similar cases. Methodology of fuzzy sets is a method that is used also in the field of business managing. In addition, it is possible to operate also with fuzzy logic combined systems, such as neural networks.

2. Mathematical and logical fuzzy operations

The set is generally known notion and it may be defined in several ways, for instance it is a set of elements that have to fulfil the set conditions or it is a function:

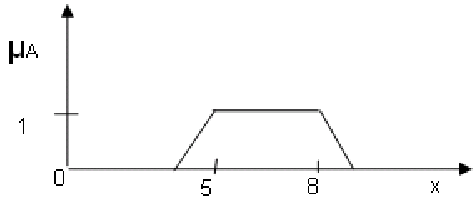
$$\mu_A : x \rightarrow \{0,1\} . \quad (1)$$

It means that the element x belongs to the set A only if $\mu_A(x) = 1$. If $\mu_A(x) = 0$ then the element does not belong to the set. Fuzzy set represents the generalization of the plane as it displays the plane in the range $\langle 0,1 \rangle$ Fuzzy sets is described by membership function:

$$\mu_A : x \rightarrow \langle 0,1 \rangle . \quad (2)$$

The fuzzy set cannot define exactly if the element is or is not an element of the set μ_A. The value $\mu_A(x)$, the degree of membership of x element, indicates the value of element membership in the set. Example of membership function entry is shown in Fig. 2 (Dostál, 2008, p.9).

Figure 1: Membership function



$\mu_A(x) = 0; x \in \{0,4\}$

$\mu_A(x) = kx + q; x \in (4,5)$

$\mu_A(x) = 1; x \in \{5,8\}$

$\mu_A(x) = -kx + q; x \in (8,9)$

$\mu_A(x) = 0; x \in \{9,\infty)$

Source: Dostál, 2008, p.9

Fuzzy logic is also specific in basic mathematics operation as it uses different procedures of addition, subtraction, multiplication, division.

$$[a,b]+[c,d]=[a+b,c+d]$$
$$[a,b]-[c,d]=[a-d,b-c]$$
$$[a,b].[c,d]=[\min(ac,ad,bc,bd),\max(ac,ad,bc,bd]$$
$$[a,b]/[c,d]=[\min(a/c,a/d,b/c,b/d),\max(a/c,a/d,b/c,b/d)]$$

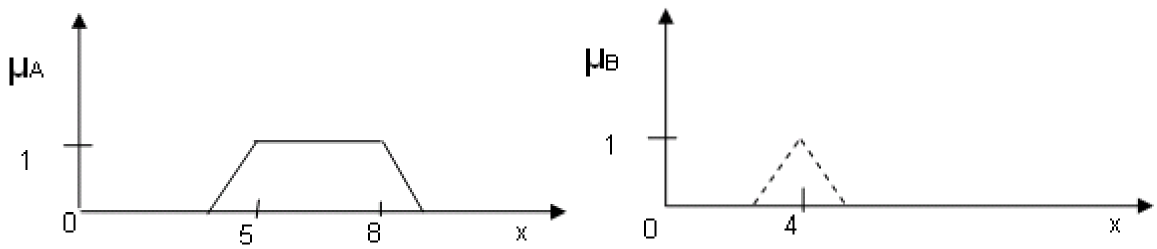
Table 1: Logical operations and fuzzy logic

Intersection (And)	$\mu(x \cap y) = MIN(\mu_x, \mu_y)$
Union (Or)	$\mu(x \cup y) = MAX(\mu_x, \mu_y)$
Complement (Dop)	$\mu(-x) = 1 - \mu(x)$

Source: Dostál, 2008, p. 10

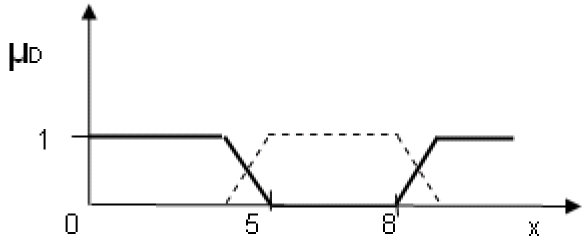
Even when evaluating the logical operations Union, Intersection and Complement fuzzy logic uses other procedures. There are the rules determined by conditional sentences < If, then>, shown in Table 1 (Dostál, 2008, p.10).

Figure 2: Fuzzy sets μA a μB



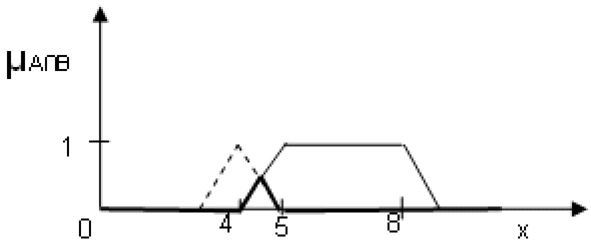
Source: Dostál, 2008, p.11

Figure 3: Fuzzy complement



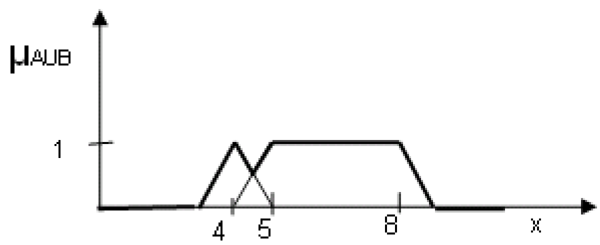
Source: Dostál, 2008, p. 11

Figure 4: Fuzzy intersection



Source: Dostál, 2008, p. 11

Figure 5: Fuzzy union



Source: Dostál, 2008, p.12

To illustrate the logic operation following examples of union, intersection and complement of fuzzy sets μ_A and μ_B are depicted.

The procedure of fuzzy processing is realized in several steps. In the first step variables, criteria and alternatives are identified - decision-making task is defined. In fuzzification process real variables are converted to linguistic ones. The user selects the variables that they want to incorporate into the knowledge base. For each indicator is firstly defined the universe (i.e. all possible values that the index can take). Subsequently, within the universe are determined fuzzy sets, their number and names. Defining of linguistic variables is based on the basic linguistic variable, e.g. when talking about variable reliability following attributes can be selected: absolute, very high, high, medium, low, very low, no or zero reliability. The more attributes (fuzzy sets), the more the variable is (the universe) described in details, but then it will be computationally difficult task. The degree of membership is expressed by mathematical function, so called membership function. The most common and easiest membership function is constructed on the basis of experimental estimates of one or more of those questioned, because it is basically a simulation of natural language words semantics. Validity of the procedure is also given by the fact that the basic words´ understanding is, into some range, the same for all people. There are many forms of the membership functions, however, in practice mostly used are standard membership functions, the types of functions Λ, π, Z and S.

The third step is to define the system's behaviour by the condition ⟨If, Then⟩, i.e. conditional sentences validating the state of particular variable are set. Except for ⟨If, Then⟩ in conditional sentence are also used mathematical operators yes, no and or. For example: If the net present value of the project exceeds 100 million € and the inflation rate is lower than 5% or the net present value of the project is min 120 million € and the inflation rate is not higher than 6%, then yes. In this step is also possible to use neuronal components to optimize existing rules. Each combination of variables, occurring in the condition ⟨If, Then⟩, represents one rule. Then the user sets the weight of particular rule by its subjective opinion. The weight of the rules can be changed during the optimization. The result of fuzzy system utilization, largely depends on the correct determination of the defined rules, is the language variable. The next step is to convert the fuzzy value of the output variable to represent the result of fuzzy computation verbally. It means that the process of defuzzification is needed to achieve numerical values. The last phase of fuzzy process is the implementation of optimal alternative in practice. Successful implementation should certainly help to improve the operation of the system with respect to the defined goal.

Fuzzy sets allow to describe vague concepts expressed in natural language. This description depends not only on the concept, but also on the context in which it is necessary to use it. Therefore, it is essential to determine the membership function properly, which is often a subjective matter of analyst dependent on their knowledge, skills and preferences.

3. Fuzzy logic in practice

Fuzzy logic is used in many applications. Most applications of fuzzy logic are nowadays related to the creation of fuzzy expert systems, which are widely used in many areas, such as management of linear and nonlinear systems, processing of images, financial systems, data analysis or forecasting.

The result of using fuzzy systems is not the data classification itself, but the setting of a tool that makes it possible. Each record in the database is defined by certain parameter which describes its properties. On this basis, these records are classified and their purpose is defined, e.g. classification of consumer behavior, density, unemployment etc. Fuzzy system is an alternative instrument to classical instrument of classification and sorting. Fuzzy systems can be used for creation of logical reasoning, support of processes based on rules ⟨If, Then⟩ and storage of understandable base of knowledge.

Fuzzy set theory is trying to solve one of the fundamental problems of science, i.e. the relationship between certainty and uncertainty. It is a discipline which during its more than forty years of existence has contributed to solution of many technical problems which in practice were not able to solve by other means. Since its foundation, it has been proven in several thousand applications for management, diagnosis, forecasting, etc. It is mathematically best treated part for artificial intelligence which makes it possible to simulate the vast majority of human thinking processes. Moreover, fuzzy logic can be used in various fields and levels of decision-making, particularly in the area of personnel, administrative, economic, financial and others. To declare a widespread utilization of this method are discussed following projects, for example.: evaluation of the bank's customers to obtain credit or loans, evaluating creditworthiness for credit or loans, insurance choice, savings, funds, real estate, property purchasing, land, rent, cars, mobile phones and other electrical appliances, weapons, computers, Internet service provider selection, employment, employee, supplier of material, but also the distribution of the premium, choice of school, search for talented students, the choice of foreign study, purchase of football player, horse, holidays, travel even the selection of suitable breeds of dog.

The utilization of fuzzy logic and its modeling can be a useful tool for economic decision-making simulation, because the uncertainty of model outputs is dependent on the “blurry" of the model input factors. The blurrier the input data, the more uncertain outcomes.

In application of fuzzy set theory, fuzzy logic and fuzzy measure theory, the field of engineering has undoubtedly been a leader. All engineering disciplines have been somehow affected by fuzzy sets and fuzzy measures. The utility of fuzzy set theory was recognized very early in civil engineering. Fuzzy set theory is also becoming important in computer engineering and knowledge engineering. The role of computering is mostly specialized in hardware for fuzzy logic. But as mentioned, fuzzy logic can be used in various economic fields.

One important category in civil engineering includes assessing or evaluating existing constructions. As typical examples can be depicted assessment of fatigue in metal structure, of quality of highway pavements, of damage in buildings after earthquakes.

The basic idea of fuzzy logic usage in mechanical engineering can be found in the whole design process. It allows designer to describe the designed artefact as approximately as desired at the early stages of the design process (Klir, Yuan, 1995).

In general, industrial engineering is concerned with the design, operation, and control of systems whose components are human beings, machines, material and money. Subject areas covered by industrial engineering include manufacturing, project management, control of industrial processes, organizational design, financial management, quality control, human factors, risk analysis, ergonomics, inventory control, safety engineering, etc.

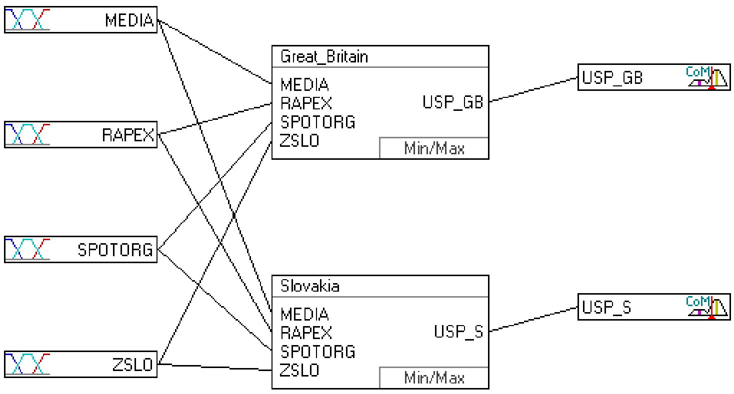
When the utility of fuzzy controllers became more visible, the need of computer hardware has been recognized. The principal reason for using the special fuzzy hardware is to increase operational speed via parallel processing. In general, fuzzy computer hardware allows all inference rules of a complex fuzzy inference engine to be processed in parallel. This increases the scope of applicability of fuzzy controllers and other fuzzy expert systems. Computer hardware for fuzzy logic is implemented in digital mode as well as in analogue mode. Digital fuzzy hardware is suitable for implementing complex schemes of multistage fuzzy inference. Analogue fuzzy hardware in characterized by high speed and good compatibility with sensors, it is thus particularly suitable for complex on-line fuzzy controllers.

The inventory of successful applications of fuzzy set theory has been growing steadily. There are many fields in which the utility of fuzzy logic or fuzzy set can be found. There areas include reliability theory, robotics, physics, chemistry, biology, ecology, political science, geology, meteorology, nuclear engineering. In medicine, for instance, the fuzzy set framework is used to determine the relation between symptoms and diseases (Klir, Yuan, 1995).

4. Fuzzy logic application in a sector of national policy

As an example of practical application of fuzzy systems in a sector of national policy, we have chosen the sector of consumer policy, with emphasis given to two European Union countries - United Kingdom and Slovakia. This selection is subjective and aimed to compare our country which adopts various measures to increase awareness of consumers and retailers and the UK, which has been considered to be the country with the highest level of consumer policy. Fuzzy system is applied and tested to determine the level of consumer policy in these countries on the basis of four chosen criteria. The program FuzzyTech 5.5 was used for the analysis. A universal set presents individual inputs which affect a single output, in this case it is the level of consumer policy in the country. Except for input values, the rule base (in this case two - one base for Slovakia and the other for the UK) and output variables (level of consumer policy in the UK and Slovakia) are determined. Each output is influenced by 4 inputs, so four universal input sets can be set (Fig. 6) [2]: number of RAPEX notification which poses a serious risk to the consumer (RAPEX), knowledge of consumer policy by retailers (ZSLO), changes of consumers´ mindset due to media (MEDIA) and customer trust in consumer organizations to protect their consumer rights (SPOTORG).

Fig. 6 : Fuzzy model scheme



Each universal set is constructed of fuzzy sets which may take various linguistic variables and values. In this practical example input linguistic variables (RAPEX, MEDIA, SPOTORG and ZSLO) can acquire the following linguistic values: low, medium and high while the output can be very low, low, medium, high and very high.

In the next step of fuzzy process, base of rules, it is necessary to set the rules and their weights between inputs and outputs. In the whole process this step is the most important, as it provides all the basic combinations necessary for the proper model functioning. Weighs may change during the program optimization. In this illustration four inputs were chosen, each of which can take three values, which in practice means that for each block of rules (for both the UK and Slovakia) $3^4 = 81$ combinations can be created. Short sample of rules with weights of block of rules of United Kingdom is demonstrated in Fig. 7. Similar procedure was used to set block of rules for Slovakia.

When creating fuzzy rules, it is necessary to take the weight of each entry criteria into account. The level of importance of each criterion is combined with real values that the factor takes. Subsequently, the linguistic values of particular variables are evaluated by using <IF; THEN> function, the output of which is determination of the output value for each combination. Therefore, when setting the rules both factors must be considered.

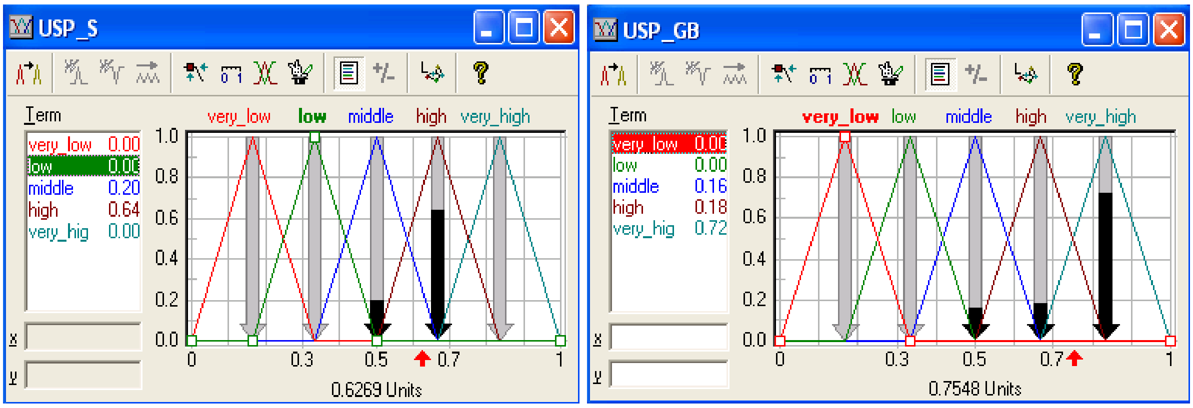
Fig. 7: Rule base of the United Kingdom

#	IF				THEN	
	MEDIA	RAPEX	SPOTORG	ZSLO	DoS	USP_GB
1	low	low	low	low	1.00	very_low
2	low	low	low	medium	0.90	very_low
3	low	low	low	high	0.80	low
4	low	low	medium	low	0.90	very_low

[2] All tables in this paper are the author's own processing and the output of the program FuzzyTech 5.5.

The last step is the process of defuzzification. Defuzzification is performed by the program itself when the input data is set properly. The overall result therefore shows that the level of consumer policy based on selected criteria is ranked as high in Slovakia, while in the UK as very high.

Fig. 8: Level of consumer policy in the Slovak republic and in the United Kingdom



a) Slovakia *b) Great Britain*

This fact is confirmed by the statistics issued by the European Commission, which evaluated (using CCI index) consumer policy in these two countries in 2011 as follows: CCI index for Slovakia recorded a slight increase of one point compared to 2010 and in 2011 it reached a value of 54. The prevalence of unfair commercial practices is a reason for concern. The United Kingdom had the second highest CCI index from all EU countries and with value of 73 in 2011. The United Kingdom has experienced a slight decrease in its Consumer Conditions Index, from 74 in 2010 to 73 in 2011. (Directorate-General for Health and Consumers, 2012).

5. Conclusion

Fuzzy set theory and associated fuzzy logic have found widespread application in many disciplines since the seminal contributions of Zadeh (1965, 1987) and his followers. These applications are extensive in computer science, systems analysis, electrical and electronic engineering and related fields. The construction and application of expert systems has touched most aspects of modern life often without our knowledge. While the use of fuzzy sets and logic has been widespread in the physical sciences, the application of these tools in the social science appears to have been limited mainly to psychology.

More specifically, the use of fuzzy sets in well-known in econometrics (Draeseke, Giles, 1999).

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Claim severity model for given motor hull insurance portfolio based on the individual rating factors

Jiří Valecký[1]

Abstract

Modelling of individual insured accident risk is important in terms of insurer's business policy and risk managing. Firstly, the insurance company may want to differentiate the insurance premium in order to determine fair insurance price and to gain new policyholders. Secondly, the insured accident probability is used in order to estimate the insurance risk capital requirement within the concept SOLVENCY II. In addition to that the GLM analysis of given insurance portfolio is in accordance with this concept, determining of the appropriate tariffs is closely related to modelling solvency capital requirements on non-life underwriting risk. The paper is devoted to empirical model for claim severity for given motor hull insurance portfolio over the years 2005-08 in the Czech Republic. Firstly the general exponential dispersion model is presented and then the GLM model under assumption of gamma distribution is derived. Finally, the estimated results are presented and relevant conclusions are drawn.

Keywords

Gamma regression, generalized linear model, exponential dispersion model, motor hull insurance, claim severity, Solvency II.

JEL Classification: C31, C58, G22

1 Introduction

The Solvency II directive will take effect in near future. This concept will have significant impact on insurance companies and governmental authorities carrying supervision over the financial market. This directive determines, among others, capital requirements of insurance companies with regard to their risk profiles which enables to insurers to develop own internal models for the purpose of modelling solvency capital requirements (SCR).

Except for that, the trend of differentiating premiums according to the undertaken risk has been observable in recent decades. The pure premium is usually determined in accordance with undertaken risk which implies that the annual premium paid should be determined in accordance with risk behaviour of given policyholder and other relevant rating factors. For this purpose, one can perform a tariff analysis based on the generalized linear model for claim frequency and claim severity separately (Brockman and Wright, 1992) or construct a tweedie model to model pure premium directly, see (Jorgensen and Souza, 1994) or (Smyth and Jorgensen, 2002). Generally, the former is preferred because the separated analysis gives more insight into how the rating factors affect the pure premium, see (Ohlsson and Johansson, 2010) for more details. This is in accordance with Solvency II concept because the GLM model is appropriate methodology for modelling insurance risk and consequently capital requirements on non-life underwriting risk.

The paper is devoted to the GLM analysis of motor-hull insurance portfolio generally but the main attention is paid to the claim severity analysis. The goal of the paper is to estimate an empirical model for claim frequency. In the second section, we describe GLM model

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generally and the GLM model based on gamma distribution which is intended for modelling of claim severity is derived in section 3. The next section is devoted to the estimation of empirical claim severity model for motor hull insurance portfolio over the year 2005-08 and appropriate conclusion are drawn. The last section concludes the paper.

2 GLM model

The key concept of all GLM model is the general exponential dispersion model with frequency function in the form of

$$f(y;\theta,\phi) = \exp\left[\frac{y\theta - b(\theta)}{a(\phi)} + c(y,\phi)\right], \tag{1}$$

where y is the response, θ is the canonical (natural) parameter or link function, $b(\theta)$ is the cumulant, ϕ is the dispersion parameter and $c(y,\phi)$ is normalization term guaranteeing that the probability function sums to unity. The choice of $b(\theta)$ and θ determines the actual probability function and GLM model. If the probability distribution of random variable can be expressed in the form of (1), we say that it is a member of exponential family. $b(\theta)$ is assumed twice continuously differentiable with invertible first derivative. The first and second derivative with respect to θ gives mean response μ and its variance, thus

$$E[y] = b'(\theta) = \mu, \tag{2}$$

$$V(y) = \phi b''(\theta) = \phi\frac{\partial b'(\theta)}{\partial\theta} = \phi\frac{\partial\mu}{\partial\theta} = \phi V(\mu), \tag{3}$$

where V is variance function, (1 for normal, μ for Poisson and μ^2 for gamma distribution for instance). Some authors specify dispersion parameter as ϕ/w if they use grouped data, where w is exposure (time). Then the frequency function becomes

$$f(y;\theta,\phi) = \exp\left[\frac{y\theta - b(\theta)}{\phi/w} + c(y,\phi,w)\right]. \tag{4}$$

Whereas we have only one parameter of interests in (1), θ (regardless to dispersion parameter), in GLM, we assume that each observation comes from the same type of distribution but with various mean response μ_i given by individual covariates (rating factors) and termed of systematic components η_i though the expression

$$\eta_i = \beta_0 + \beta_1 x_{i1} + \ldots \qquad = \mathbf{x}_i\boldsymbol{\beta} = g(\mu_i), \tag{5}$$

where x is a rating factor of i^{th} policyholder, β represents parameter estimates, $g(\cdot)$ is known link function and the inverse link function is mean function $\mu_i = g^{-1}(\eta_i)$. If the equality $g^{-1}(\eta_i) = b'(\theta_i)$ holds, the link function represents canonical link function and it follows that $\theta_i = \eta_i = \mathbf{x}_i\boldsymbol{\beta}$.

We now turn to the estimation of β-parameters in general under assumption of grouped data. Let the individual observations y_i follow the exponentially family distribution (1) and they are mutually independent, the log-likelihood function of $\boldsymbol{\beta}$-estimates is

$$\ell \qquad = \sum_{i=1}^{N}\frac{w_i\left(y_i\theta_i - b(\theta_i)\right)}{\phi} + \sum_{i=1}^{N}c(y_i,\phi,w_i). \tag{6}$$

The derivative of (6) with respect to β_j is, by the chain rule,

$$\frac{\partial \ell}{\partial \beta_j} \quad \sum_i \frac{\ell}{\partial \theta_i \, \partial \beta_j}, \tag{7}$$

where $\frac{\partial \ell}{\partial \theta_i} \quad \frac{-b'(\theta_i))}{\phi} = \frac{w_i(y_i - \mu_i)}{\phi}$, $\frac{\partial \theta_i}{\partial \beta_j} = \frac{\partial \theta_i}{\partial \eta_i}\frac{\partial \eta_i}{\partial \beta_j} = \frac{\partial \theta_i}{\partial \eta_i} x_{ij}$. Inserting these derivatives into (7), we obtain

$$\frac{1}{\phi}\sum_i \frac{\partial \theta_i}{\partial \eta_i} w_i (y_i - \mu_i) x_{ij}, \tag{8}$$

where $\frac{\partial \theta_i}{\partial \eta_i} = \left(\frac{\partial \eta_i}{\partial \theta_i}\right)^{-1} = \left(\frac{\partial \eta_i}{\partial \mu_i}\frac{\partial \mu_i}{\partial \theta_i}\right)^{-1} = \frac{1}{g'(\mu_i)V(\mu_i)}$. Thus we get the general first order condition in the form of

$$\frac{\partial \ell}{\partial \beta_j} \quad \phi \sum_i w_i \frac{(y_i - \mu_i)}{g'(\mu_i)V(\mu_i)} x_{ij} = 0. \tag{9}$$

To obtain parameter estimates, one may employ two estimator methods, iteratively re-weighted least squares (IRLS) based on Fisher scoring and maximum likelihood Newton-Raphson type algorithm. The dispersion parameter ϕ can be estimated by ML method solving $\partial \ell$ or by methods of moments on the basis of Pearson $\phi_x = X^2(N-r)^{-1}$ or deviance residuals $\phi_D = D(N-r)^{-1}$, where r is the number of parameters (including constant). (McCullagh and Nelder, 1989) or (Meng, 2004) made some numerical experiments, from which follows that the calculation based on Pearson residuals is more robust against model error and they recommend using ϕ_X.

Both estimator (Newton-Raphson and IRLS algorithm) gives the same results in the case of using canonical link function despite the former is based on observed information matrix (OIM) and the latter on expected information matrix (EIM). In the case of using non-canonical link, the IRLS algorithm must be amended to use OIM.

3 Model for Claim Severity

The models for claim severity are mostly based on heavy tail distributions, but we work with gamma distribution which is intended rather for modelling of light tail distributions. There are several reasons. Firstly, practical tariff analysis is made for small/medium claims and large claims separately and the gamma distributions should be appropriate. Secondly, within GLM theory, the gamma regression is simply derived, see (Hardin and Hilbe, 2007) for instance, and only one individual parameter is necessary to estimate (assuming constant scale parameter for all policyholders). On the contrary in the case of Pareto distribution for example, the parameter estimation is exacting because of expressing two parameters of this type of distribution. Lastly, there is a problem with estimation because of insufficient number of large claims for each policyholder which implies uncertain assumption of individual heavy tail distribution.

Let‘s suppose that total claim costs of policyholder over the given period follow gamma distribution $G(w\nu, \lambda)$ with density function

$$f_x(x) = \frac{\lambda^{w\nu}}{\Gamma(w\nu)} x^{w\nu - 1} e^{-\lambda x}; \; x > 0, \tag{10}$$

where w is number of claims, ν is the shape parameter and λ is rate parameter ($\lambda = \tau^{-1}$, where τ is the scale parameter).

Since $\mu = \nu/\lambda$ and $\nu = \phi^{-1}$, where ϕ is the dispersion parameter of exponential dispersion model (1), then we can reparametrize (10) though $\lambda = \nu\mu^{-1} = (\mu\phi)^{-1}$ into

$$f_x(x) = \frac{\mu\phi^{-w/\phi}}{\Gamma(w/\phi)} x^{w/\phi-1} e^{-x/(\mu\phi)}. \tag{11}$$

We are interested in claim severity rather than in total claim costs. Setting $x = wy$, where y is claim severity, and knowing that the sum of independent gamma distributions with the same rate parameter λ are gamma distributed, the total claim size is expressed $wf_x(x)$ and density function of claim severity is

$$\begin{aligned} f_y(y) &= wf_x(wy) \\ &= w\frac{(\mu\phi)^{-\frac{w}{\phi}}}{\Gamma(w/\phi)} w^{\frac{w}{\phi}-1} y^{\frac{w}{\phi}-1} e^{-\frac{wy}{\mu\phi}} \\ &= \frac{(\mu\phi)^{-\frac{w}{\phi}}}{\Gamma(w/\phi)} w^{\frac{w}{\phi}} y^{\frac{w}{\phi}-1} e^{-\frac{wy}{\mu\phi}} \\ &= \frac{(w/\mu\phi)^{\frac{w}{\phi}}}{\Gamma(w/\phi)} y^{\frac{w}{\phi}-1} e^{-\frac{wy}{\mu\phi}}, \end{aligned} \tag{12}$$

which can be expressed in exponential form

$$\exp\left[w\frac{y/\mu - (-\ln\mu)}{-\phi} + \frac{\ln w}{\phi} + \left(\frac{w-\phi}{\phi}\right)\ln y - \frac{w\ln\phi}{\phi} - \ln\Gamma(w/\phi) \right] \tag{13}$$

with log-likelihood function

$$\ell = w\sum\left\{ \frac{y/\mu - (-\ln\mu)}{-\phi} + \frac{\ln w}{\phi} + \left(\frac{w-\phi}{\phi}\right)\ln y - \frac{w\ln\phi}{\phi} - \Gamma\left(\frac{w}{\phi}\right) \right\}. \tag{14}$$

We can also derive the canonical link function here, thus $\theta_i = g(\mu_i) = -\mu^{-1} = \mathbf{x}_i\boldsymbol{\beta} = \eta_i$, but the beta restrictions are necessary to keep mu positive because $\mu > 0$ implies $\theta < 0$. Therefore, the non-canonical log-link function $\theta = \log(\mu) = \mathbf{x}_i\boldsymbol{\beta}$ is used. Inserting inverse non-canonical function expressed by the individual rating factors $\mu_i = \exp(\mathbf{x}_i\boldsymbol{\beta})$ into (14), we obtain log-likelihood function for beta estimates in the form of

$$\begin{aligned} \ell &= w_i(\mu, \phi; \mathrm{y}) \\ &= w_i\sum_i\left\{ \frac{y_i/\exp(\mathbf{x}_i\boldsymbol{\beta}) - (-\mathbf{x}_i\boldsymbol{\beta})}{-\phi} + \frac{\ln w_i}{\phi} + \left(\frac{w_i-\phi}{\phi}\right)\ln y_i - \frac{w_i\ln\phi}{\phi} - \Gamma\left(\frac{w_i}{\phi}\right) \right\}. \end{aligned} \tag{15}$$

4 Empirical model for claim severity

In this section, we present the estimated individual GLM claim severity model for given motor hull insurance portfolio. We used data sample encompassing characteristics of policies over the years **2005-2008** (11 524 observations). The dependent variable is a total loss of each policyholder over the period and the explanatory variables are following: vehicle age (*agecar*), engine volume (*volume*) and engine power (*kw*), owner's age (*ageman*), vehicle price (*price*), number of citizens in a region (*nocit*), company car (*company*), gender of policyholder (*gender*), type of fuel (*fuel*) and district area (*district*).

First of all, we performed the correlation analysis to avoid the problem of colinearity. Table 1 records the results.

Table 1 Correlation analysis of original rating factors

	agecar	*ageman*	*kw*	*volume*	*price*
agecar	1.000				
ageman	0.0442	1.000			
kw	-0.2157	-0.2642	1.000		
volume	-0.0795	-0.3184	0.8556	1.000	
price	-0.2397	-0.2363	0.7719	0.7356	1.000

It is obvious that the correlation between some variables is very high. Therefore we generated a new variable *kwvol* combining the *volume* and *kw* as follows *kwvol* = *kw* / *volume* · 1000. The correlations among original and amended variables are recorded in the next table.

Table 2 Correlation analysis of original and amended rating factors

	agecar	*ageman*	*kwvol*	*price*
agecar	1.000			
ageman	0.0442	1.000		
kwvol	-0.3146	-0.0995	1.000	
price	-0.2397	-0.2363	0.4056	1.000

In the next step, we estimated severity model. First and foremost, we evaluated large claims in the data set. Because of presumption of gamma distribution which is intended for light tailed distribution rather than heavy tailed, we were forced to truncate the individual losses. It is necessary to note here, that each claim must be truncated separately and then aggregated over each policyholder. Another reason supporting our procedure is that GLM theory is well described and relatively easy to employ for gamma distribution rather than for heavy tail distributions, see above, and secondly, the practical tariff analysis is also made for small/medium and large claims separately to obtain a good tariffs with lower volatility.

The core of the issue is to determine threshold level for truncation. We set it at level of 67,000 subjectively and we defined a new variable $AdjSev = \min\left(size, c\right)$, where c is the threshold value for truncation, *size* is the original claim and *AdjSev* is truncated claim. After that we estimated the GLM model under assumption of gamma distribution with the dependent variable *AdjSev* and explanatory rating factors explained above. Since we are interested in claim severity rather than total claims size, we set the claim count as the exposure. The next table records the estimation results.

Table 3 Parameters and relativities estimates of claim severity model

sevAdj	Rel.	Coef.	Std. Err.	z	P>z	95% Conf. Interval	
agecar	0.999877	-0.000120	0.002268	-0.05	0.957	-0.004570	0.004323
ageman	0.996583	-0.003420	0.000530	-6.46	0.000	-0.004460	-0.002380
kwvol	1.004541	0.004530	0.000764	5.93	0.000	0.003032	0.006028
fuel							
1	1.170333	0.157288	0.013303	11.82	0.000	0.131214	0.183363
2	0.508422	-0.676440	0.310907	-2.18	0.030	-1.285810	-0.067080
3	1.148477	0.138436	0.187593	0.74	0.461	-0.229240	0.506112
company	1.331400	0.286231	0.027936	10.25	0.000	0.231479	0.340984
district							
1	1.100432	0.095703	0.049814	1.92	0.055	-0.001930	0.193337
2	1.078419	0.075496	0.048922	1.54	0.123	-0.020390	0.171381
3	1.115160	0.108998	0.039878	2.73	0.006	0.030839	0.187157
4	0.953413	-0.047710	0.035993	-1.33	0.185	-0.118250	0.022838
5	1.178420	0.164175	0.041488	3.96	0.000	0.082859	0.245490
6	1.087753	0.084114	0.048530	1.73	0.083	-0.011000	0.179231
7	1.039338	0.038584	0.043231	0.89	0.372	-0.046150	0.123315
8	1.034484	0.033903	0.050304	0.67	0.500	-0.064690	0.132497
9	1.005789	0.005772	0.035337	0.16	0.870	-0.063490	0.075031
10	1.147512	0.137597	0.029834	4.61	0.000	0.079124	0.196070
11	1.018966	0.018789	0.046055	0.41	0.683	-0.071480	0.109054
12	0.983926	-0.016200	0.044127	-0.37	0.713	-0.102690	0.070282
13	1.160025	0.148442	0.032268	4.60	0.000	0.085197	0.211686
price	1.000000	7.02E-08	1.75E-08	4.01	0.000	3.58E-08	1.04E-07
gender	0.927905	-0.074830	0.015488	-4.83	0.000	-0.105180	-0.044470
_cons	23041.60	10.04506	0.046447	216.27	0.000	9.954022	10.13609
ln(*count*)	1	1	(exposure)				

The scale parameter estimate is 0.3859463 and was set to the Pearson chi-squared statistic divided by the residual degrees of freedom, which is recommended by (McCullagh and Nelder, 1989) as a good general choice for continuous distributions.

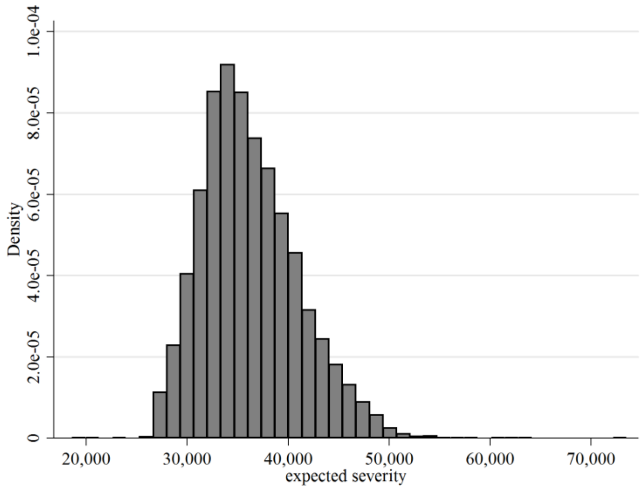
It is obvious from the table above that some covariates are not significant at the 5 % significance level, especially some categorical covariates. In spite of that, we kept all of them (*fuel* and *district*) in the model because testing the significance of whole categorical variable indicated statistical significance. In addition, we also included *agecar* in the model even though zero coefficient or unit relativity because this rating factor is used generally in claim frequency model and in spite of its insignificance, it is necessary to use it to obtain the multiplicative tariff. However, we

Finally, we summarized the statistical characteristics of predicted severity, i.e. considering count exposure to be 1 for all policies.

Table 4 General statistical characteristics of expected severity

Mean	Std. Dev.	Skewness	Kurtosis	Min	Max
36,003.08	4,967.75	0.5827022	3.483045	15,132.04	73,173.77

Figure 1 Histogram of expected severity



It is necessary to note here that this model is not appropriate for modelling of expected loss for each policy and is not suitable for making tariffs. It represents only one part, because the expected loss must be aggregated with expected claim frequency which generally decreases the expected loss (claim). Anyway, the model is good approximation of modelling claim severity and it can be used for further calculation and simulation studies.

5 Conclusion

The paper was devoted to the modelling of claim severity. Firstly, the general exponential dispersion model was described and consequently the GLM model based on gamma distributions was derived. Then, the empirical claim severity model based on individual rating factors was estimated.

The model was estimated on the data sample encompassing 11 524 observations over the years 2005-2008. Because of assumption of gamma distributions, it was necessary to truncate the individual claims at threshold level defined subjectively and then to aggregate the claims over each policy. After that, considering claim count as exposure, the empirical model was estimated. In spite of that some variables were statistically insignificant; we kept all of them because it concerns only some categories of categorical variables which was significant as a whole. The vehicle age was also included in the model with unity relativity due to its insignificance because this rating factor is generally use in claim frequency model and to obtain multiplicative tariff, this covariate must be included. The empirical estimated model could be appropriate for further calculation and simulation studies.

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The Potential of Alternative Financing of Industrial Companies by Means of Tolling

Šárka Vilamová, Kamila Janovská, Milan Stoch, Roman Kozel, Petr Besta [1]

Abstract

Industrial companies have to look for alternative financial sources in order to finance their current and future working capital needs. The tolling method represents one of the potential ways of alternative working capital financing. In the Czech Republic, this method is currently used mainly by medium-sized enterprises, especially in building and engineering sector. These are companies that are more prone to the occurrence of critical situations in the area of financial flow, and the tolling method can become an effective tool of solving these problems; however it is necessary to take into account the risks associated with inappropriate or poorly prepared application of tolling.

Key words

Financial Crisis, Tolling, Working Capital Financing, business venture support

JEL Classification: G01, G20

1. Introduction

The banking sector, which has continuously been tightening the interest and non-interest conditions in many segments of the credit market as a result of the financial crisis, thus reducing the tempo of granting credits, is a crucial source of financing for Czech industrial companies. Companies have to look for alternative financial resources in order to finance their current and future working capital needs, which can also include the tolling method.

In the Czech Republic, financing taking advantage of the tolling method is mainly realized on the basis of a private investor in small or medium-size companies whose lines of business include activities in the areas such as building and light engineering.

Tolling as a form of financing is a relatively little-known way of securing funds in our conditions. It is working capital financing using funds of another company. This form of financing was successfully used in the Czech Republic in the years 2000 - 2005 in VÍTKOVICE – OSINEK project that saved Vítkovice, a.s. company. Due to a large number of small and medium-size industrial companies that have recently found themselves in a financial crisis as a result of which they are not able to finance their working capital, tolling, after some adjustments, has been used more frequently, especially in the sector of small and medium-size companies.

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2. The basis of tolling financing

Tolling comes from the English word "toll", i.e. a charge. Tolling agreements are used for example in Australia, but tolling there is close to financing by risk capital, and also in Russia and Ukraine, where it rather resembles barter trade in the area of metallurgical production, with exchange of ore for a product. In the rest of Europe, these agreements are classified as non-traditional methods of company financing.

Generally, tolling can be defined as "*economic and business system of short-term assets financing in which the submitter has a finished product manufactured by a processor from its own raw materials at a charge*." [1]

This definition implies that tolling is a special business operation, which is used primarily to finance working capital. It is a certain alteration of the already familiar "Contract work".

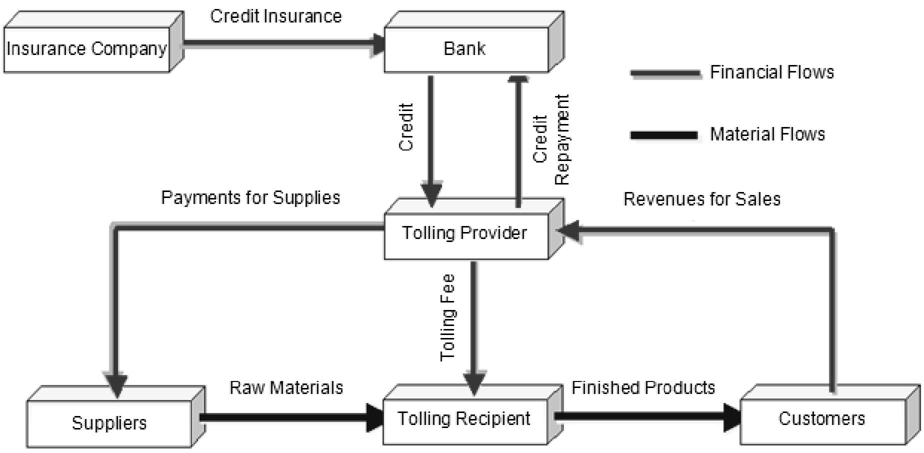
In a simplified concept, tolling can therefore be seen as certain modification of the commonly used "Contract work". Unlike conventional contract work, however, tolling is not generally a one-off affair, but it counts with medium-term up to long-term duration, i.e. considerable repetitiveness within the frame of the contractually defined system.

In the case of a tolling, a submitter does not have the products manufactured for their own consumption, but for the purpose of resale. The traditional contract work is largely used to expand the production capacity of the submitter, which is usually also the processor at the same time (a typical example is the heat treatment of metallurgical products, for which the submitter does not have any available production facilities).

On the contrary, tolling assumes complete processing of the supplied raw materials, semi-finished products and energies to finished products performed by the processor. The processor´s activities are, compared with the contract work system, much more complex - workers of the processor ensure the purchase of raw materials, materials and energies (on behalf of the submitter and on the account of the submitter), organize the sale of finished products (again, on the account of the submitter), according to a contract for a charge.

The following figure provides a closer look at the individual relationships, connections and flows arising within the scope of tolling, and nowadays, the box identified as "bank" can also contain another investor, who has the necessary financial resources. [3]

Figure 1: Tolling cooperation [1]



2.1 Contractual provisions of tolling cooperation

Due to the close mutual links of both tolling agreement parties, it is necessary to have their relations duly established by a contract. When entering into a tolling agreement, it is necessary to conclude the following contracts:

- **Framework contract (and a contract for work):** this contract includes general provisions, terms and mutual rights and obligations of the submitter and processor with respect to the production of products (work) for a given price. The framework agreement is further applied to the individual contracts, which are concluded separately for each product (order);
- **Consignment contracts:** determine the relationships between the commission agent (processor) responsible for the sale of products and the committer (submitter) in compliance with the principle of "on behalf of the processors, on the account of the submitter." [3];
- **Sales agency contracts:** these contracts define the conditions of purchase of production inputs, where the submitter grants the processor the right to act on behalf of the submitter according to the principle of "on behalf of the submitter, on the account of the submitter." [3]

In addition to the contracts between the submitter and the processor, it is also necessary to establish relationships with the suppliers, according to a concrete type of supplied raw material. [3]

2.2 The importance of tolling financing

The very purpose of tolling is to reduce negative consequences that may occur during the expansion of sales activities. The factors causing these negative impacts include mainly the lack of own resources to bridge the longer receivables maturity, while ensuring the purchase of inputs for production, insufficient knowledge of the exact requirements of customers with regard to the given products and, last but not least, a more difficult access to foreign capital in the form of bank loans.

The aim of tolling is:

- actively ensure the realization and subsequent management of the project;
- provide business financing of concrete sales/purchase contracts by ensuring the financial requirements of the suppliers and covering the longer receivables maturity of customers;
- provide financing of security instruments requiring the expenditure of funds in the period before or after the conclusion of the given business contract, i.e. sales/purchase contract or contract of work (e.g. tender funds, operation funds, etc.);
- provide financing of security instruments necessary for releasing the detained parts of customer payments after the execution of the business contracts in question – sales/purchase contracts or contracts for work (e.g. retaining lien during the warranty period), "[4]

The advantages and disadvantages of tolling result from its character. The advantages may include the possibility of continuous existence of the company, even with the lack of working capital funds, a higher probability of gradual payment of processor´s liabilities, which would not have been paid in the event of interruption or termination of business, and thanks to the processing commission, the processing company receives cash and may gradually extricate from the critical situation and continue to operate independently in the future.

The main disadvantage of tolling financing from the perspective of the processor is its close link with the submitter and the necessary mutual trust and cooperation. That is because the processor loses its independence to some extent. There is a risk for the submitter arising in case the submitter uses a loan to finance the activities of the processor and the processor does not reimburse its liabilities. In such a case, the bank can withdraw from the credit agreement, resulting in the inability of the submitter to continue to provide funds to the processor. There is also a risk of miscalculation in overestimating the sales orders volume or the profit from the sale of products, which means the processor will not be able to extricate from the critical situation even if tolling is used, as originally planned. [3]

2.3 Characteristics of tolling partners

Processing companies usually have the following characteristics:

- it is a manufacturing company whose products are competitive, but very insufficient to allow self-financing of its working capital;
- external resources of this company in the form of supply loans (e.g. liabilities from the supplies of materials, raw materials and energies), as well as its liabilities to employees until the maturity date are insufficient to cover the receivables and inventories as well as the necessary operational balance in bank accounts;
- other external resources in the form of bank loans are inaccessible or accessible only in a smaller scale, in many cases because of the concerns of bank due to possible insolvency risk with regard to the repayment of past debts of the company;
- on the other hand, the company is able to manufacture its products with certain profit margin or at least with a positive cash-flow and has a relatively good and stable sales potential, and has mastered the technology and know-how. [5]

Compared to the processor, the submitter usually has the following characteristics:

- the submitting company either has its own resources that may be available for tolling financing of the processor, or it is able to obtain bank sources through a bank loan (thanks to a credible status of the submitter at the bank);
- workforce of the submitter is sufficiently capable and qualified to facilitate the realization of all the necessary activities from the area of purchasing, sales, accounting, financial management, contracting, etc. for and on behalf of the processor - knowledge of the internal environment of the processor is an advantage in this respect;
- the submitter is a company that ensures, based on a set of trade agreements concluded between the company and the processor prior to the implementation of tolling, that each production input item controlled by the tolling financial company, regardless of whether it material, work in progress, semi-finished products, its own products or finished production, is owned by the submitter during the entire production process, in spite of the added value created by the processor, added costs allocated in the products or physical materials. [5]

2.4 Division of tolling

Tolling can be used in two different ways, namely as closed tolling or as tolling combined with project financing.

Closed tolling is mainly used in mass or batch production, where the processor is in a critical situation, or has other problems with working capital financing, it has a long-term nature and tolling is used to finance all inputs into the company, i.e. not only the material and energies used for production, but also the working stock purchased in small quantity. These problems may be found in a newly established company or a small or medium-size enterprise that has a project to realize, but works in the market only for a short time, and therefore does not have sufficient funds, or in a small or medium-size company, which has already been using many loans and the bank is reluctant to provide additional funds any more. [6]

In the case of a company in critical situation, which would like to and has the potential to continue with its activities in the market, tolling is one of the tools for restructuring of the company. A manufacturing company in crisis is facing a shortage of funds to finance its working capital, inability to meet its liabilities to its suppliers who may terminate their cooperation for that reason, and this client is not sufficiently creditworthy for a bank primarily due to the uncertain future existence of the company. There is a demand for the products of the company in the market and provided that it will bridge the critical period and lack of funding, there is a real chance of improvement of the situation. In this case, tolling would go hand in hand with restructuring of the company.

Tolling combined with project financing is used for custom and project production. Tolling is supplemented by bank loans or other bank financing options and it is used for specific projects, not for the entire production of the company, which is the main difference from the previously described closed tolling. Contract for work is concluded for one specific project, the submitter can purchase the necessary inputs by itself or can make a deposit in favour of the processors for the material, again, only for the given project or contract and after the completion of the contract, the processor receives a one-off processing fee equal to the difference between the costs and revenues from the project. This method is currently more commonly used compared to closed tolling. [6]

3. Implementation of tolling financing

The use of financing by means of tolling is usually preceded by problems of the company with working capital financing. The consequences of such a situation usually include late maturity of supplier invoices, as well as late payment of liabilities to the state (tax payments, social security and health insurance). The company therefore suffers from a lack of liquidity.

Tolling may be suitable, for example, for a manufacturing company before the crisis, or for a company that already finds itself in a critical situation, but has a real chance to extricate from this crisis just by strengthening its cash flow necessary for working capital financing. On the contrary, the implementation of tolling is not suitable in a company in bankruptcy or insolvency, when the tolling company faces a very unlikely return of their investment. [6]

Crisis management, whose objective is to analyse the risks, prevent losses, get the crisis under control and to minimize the damage, may be one of the prerequisites of the application of tolling. For the tolling (or financing) company, working capital financing of another company is a rather risky activity, which is why it is very important to first decide whether to implement tolling and then set the tolling conditions. The most important factors when setting the tolling conditions is determining whether it will be only a one-off cooperation on a specific project, or it will have a long-term character, and whether the financing company is primarily focused on providing tolling, or it is only its secondary activity along the main business activity of the company.

3.1 The evaluation of the consequences of implementation of tolling in comparison with other forms of financing

Like any other cooperation, this one has its positive and negative aspects as well and it depends on a concrete company and its situation, whether it is beneficial to use tolling at the moment or not. Generally, the following benefits or negative aspects of the utilization of tolling can be identified within the scope of the cooperation between the tolling companies and the firms from the sector of small and medium-size companies. [6]

From the perspective of a small or medium-size company, the most important positive aspects may include the possibility of reaching larger contracts than it would be possible without the funding partner. If we use an example of a medium-size building company, such a company often cannot accept an order, in which the investor requires a retaining lien, because even though it would be able to handle the job without the retaining lien, with the retaining lien, this company will not be able to finance the contract. Maintaining or improving the market position is another benefit, because acquiring a larger contract may help in the struggle with the competition, which has been continuously increasing in the area of small and medium-size companies, and even large building companies previously interested only in large contracts are now interested also in much smaller orders due to lack of demand. The advantages may also include the speed at which it is possible to conclude tolling agreement. There is no lengthy procedure, such as in case of allocation of grants and if everything is all right, the company can receive financial means fairly soon. Finally, the advantages may include the support of a large and financially strong partner in the form of the supplier that is able to arrange various guarantees and collaterals some investors require for large contracts, and which an independent small or medium-size company cannot reach.

The interventions in the management of the company represent the biggest drawback of tolling from the perspective of the processor. The top management of the company is familiar with the principles of tolling and because they understand the situation, usually, there are no significant problems at this level. In the case of tolling with project financing, the interventions in the management of the company are much smaller than in case of closed tolling system, where the employees of the tolling company are deployed in some of the key top management positions, or some of these positions are doubled. In project financing, the submitter tries to act more as a specific type of supplier in order to have control over the project it is funding, but on the other hand, the management employees throughout the company remain the same. The biggest changes occur at middle management level that may feel threatened by the loss of their competences.

The key factor is to reach an agreement, as for the form of cooperation, so that the employees of this level in the company realize that they are partners with the tolling company, not rivals or competitors, and so that they adopt measures that the tolling company implements on the basis of an agreement with the top management. Together with the introduction of tolling, there will be an obligation to provide regular reporting to the submitter on a monthly basis at least, which may again have a negative impact on the middle management. It is necessary to agree on the reporting form, so that the administrative burden is not excessively high, but the submitter has an overview of what is happening in the project and in the company. The above presented risks of communication within the processing company can be minimized by establishing the rules of communication at the beginning of the cooperation, so that both parties respect each other and know why they exist side by side. Lower profit for the building company represents another disadvantage, because tolling financing is more costly than e.g. financing using a bank loan. On the other hand, we are talking about a situation in which the company will not receive a bank loan in a sufficient amount; therefore it may be beneficial to use tolling even at a higher price.

From the perspective of the tolling company, the biggest advantage is making profit, because it is a business sector, the goal of which, like most other companies, is making profit.

The most important downside here is the risk of cooperation that must be secured in the best possible way. It is necessary to secure the risks that are similar to those in the banking sector, not only in case when the submitter draws a loan to finance the contract of the processors. The collateral can be in the form of a lien, a bill of exchange, collateral in the form of receivables related to other projects than the project funded by tolling, collateral as a business share and other collateral instruments. Even with the use of collateral instruments, the tolling company will always take a risk; however, the objective is to minimize it.

The biggest problems occurring within the frame of the tolling cooperation are communication barriers. The building company shows insufficient cooperation and the aforementioned middle management is hostile towards the submitter and does not want to provide details related to the contracts or delivery deadlines and so on. At the same time, the tolling cooperation can help, not only with the financing of a project, but because the cooperation may also include the provision of expert advice, thanks to tolling the building company can find and adopt a new way of company management and find ways of reducing the costs, which can also be used in the future activities of the company.

4. Conclusion

The aim of this article was to use the comparison of financing options in order to determine the advantages and disadvantages of project financing of small or medium-size companies through tolling in comparison with other forms of financing. However, tolling financing cannot be used to finance all companies in general, because for some companies, tolling would be inconvenient if the funds can be obtained by other means and, on the other hand, some companies are too risky from the point of view of the tolling company, which is why it is not suitable to apply tolling.

The advantage of this method of financing is also the fact that the form of tolling is not unchangeable, but there are options of modifying the individual concrete cases of its realization, of course, while respecting the fundamental economic, legal and also ethical rules. The indisputable advantage of this method is also the fact that when the processors is in danger of bankruptcy, the working capital funded by tolling is not part of the assets in bankruptcy and the processor can continue in production with simultaneous restructuring and implementation of other steps of company rescue.

Many small and medium-size building companies can use tolling as a form of help, for example, as it allows these companies to finance contracts with a retaining lien. Because there are many companies in a similar situation in the market today, we can reasonably assume that tolling financing will become more and more familiar and the use of this method will grow in the future.

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Liquidity risk sensitivity of Hungarian commercial banks

Pavla Vodová[1]

Abstract

The aim of this paper is to measure the liquidity risk sensitivity of banks in Hungary. Our sample includes significant part of the Hungarian banking sector in period 2000-2011. We use three stress scenarios: run on a bank, use of committed loans by counterparties and confidence crisis on the interbank market. We have found that the most severe scenario is run on a bank and the second most severe is the confidence crisis on the interbank market. There is no link between size of the bank and its vulnerability to liquidity shocks.

Key words

Liquidity risk, scenario analysis, Hungarian commercial banks

JEL Classification: G21, G01

1. Introduction

Many banks struggled to maintain adequate liquidity during global financial crisis (BIS, 2009). Unprecedented levels of liquidity support were required from central banks in order to sustain the financial system. Even with such extensive support, a number of banks failed, were forced into mergers or required resolution. Financial sector has gone through a dramatic re-appraisal of the liquidity risk. Stress testing plays very important role in liquidity risk management. It can show banks their potential vulnerability to liquidity shocks.

The aim of this paper is therefore to measure the liquidity risk sensitivity of Hungarian commercial banks and to find out the most severe scenario and the most vulnerable bank.

The paper is structured as follows. Next section gives theoretical background. Then we focus on methodology, data and results of liquidity scenario analysis of Hungarian banks. Last section captures concluding remarks.

2. Theoretical background

2.1 Liquidity risk and its measuring

Liquidity risk, e.g. the risk that a bank would not have enough liquidity, arises from the fundamental role of banks in the maturity transformation of short-term deposits into long-term loans. According to Nikolau (2009), the term liquidity risk includes central bank liquidity risk (which is highly unlikely as it is a risk that central bank would not be able to supply the liquidity needed to the financial system), funding liquidity risk (which captures the inability of a bank to service their liabilities as they come due) and market liquidity risk (which relates to the inability of trading at a fair price with immediacy). These types of liquidity risk are

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intensively interconnected. Liquidity risk can be measured by liquidity ratios. For the purpose of this paper we will use following six liquidity ratios:

The ratio *L1* is the share of liquid assets in total assets. A large enough buffer of liquid assets such as cash, balances with central banks and other banks, debt securities issued by governments and similar securities or reverse repo trades reduce the probability that liquidity demands threaten the viability of the bank. The higher this ratio, the higher the capacity to absorb liquidity shock is, given that market liquidity is the same for all banks in the sample.

The ratio *L2* is the share of liquid assets in deposits and short term borrowing. This ratio is focused on the bank's sensitivity to selected types of funding (deposits of households, enterprises, banks and other financial institutions and funds from debt securities issued by the bank) so it should therefore capture the bank's vulnerability related to these funding sources. The higher is the value of the ratio, the higher is the capacity to absorb liquidity shock.

The ratio *L3* is the share of liquid assets in deposits. It measures the liquidity of a bank assuming that the bank cannot borrow from other banks in case of liquidity need. The bank is able to meet its obligations in terms of funding if the value of this ratio is 100% or more. Lower value indicates a bank's increased sensitivity related to deposit withdrawals.

The ratio *L4*, which is the share of loans in total assets, indicates what percentage of the assets is tied up in illiquid loans. Therefore the higher this ratio the less liquid the bank is.

The higher the ratio *L5* (which is the share of loans in deposits) the less liquid the bank is. Lower values of this ratio also means that loans provide by the bank are financed by clients´ deposits.

The last ratio *L6* assesses activity of banks in interbank markets. It is the share of net interbank position (due from banks minus due to banks) in total assets. Positive values of this ratio signal that bank is a net lender; the value is negative for net borrowers.

2.2 Stress testing

Stress testing plays a complementary role in risk management practices of banks. BIS (2000) defines stress testing as a generic term describing various techniques used by financial institutions to gauge their potential vulnerability to exceptional, extreme or simply unexpected but plausible events. Especially during periods of financial distress, banks may be confronted with rapidly changing market situations. The concept of stress testing should answer the question of "What would happen if market conditions suddenly change?" Stress tests are usually divided into two categories. Sensitivity tests address the impact of shocks to single risk factors in each test. In scenario analysis, multiple risk factors change in a fashion which is intended to be internally consistent within a defined broader, underlying scenario (Swinburne, 2007). A sensitivity analysis employs a scenario that is restricted to the change of a single factor, ignoring possible interactions with other risk factors. In general, scenario analyses do not use sophisticated modeling but establish a straightforward link between the scenario and its impact (Boss et al., 2007).

Van den End (2008) introduced a stress-testing model for liquidity risk of banks which takes into account the first and second round effects of shocks, induced by reactions of heterogeneous banks, and reputation effects. Van den End (2008) applied his model on data of all Dutch banks in July 2007 and investigated impact of banking crisis scenario on bank liquidity. On average, the first round effect erased 8% of the initial liquidity buffer. Reactions of some banks mitigated the first round effect to around 7% on average. Smaller banks tended to react relatively more than large banks which signaled that an outflow of deposits would foremost bring small banks in a critical liquidity position. Due to the second round effects banks lost additionally 6% of their initial liquidity buffers on average. 30% of banks have a probability that would end up with a liquidity shortage. Mostly this was problem of small banks which confirmed that small banks are most vulnerable to a banking crisis scenario.

Komárková et al. (2011) described the model which is used by Czech National Bank (CNB) for stress testing of both market and funding liquidity risk. They applied the CNB´s model on data provided by banks operating in the Czech Republic in 2011 by the supervisory liquidity report. The liquidity shortfall is determined by deposit withdrawals on average to 11% of total deposits; drawdown of committed credit lines amounting to 10%; growth in the nominal stock of credit, liquidity dries up in the money market, as 50% of interbank claims are unavailable, 20% of other claims are unavailable; government bonds and other securities suffer a 40% loss in value; any asset liquidated prematurely suffers a 50% loss in value; 20% of assets previously eligible for central bank rediscounting become ineligible; no net additional intra-group funding is available; and no additional intra-bank funding or securities issuance is available. The results showed that the Czech banking sector as a whole seems to be stable and liquid enough. As the Czech banks stand more or less on a conservative business model and are not very active in the capital or money market, the impact of the first round shock was more significant than the second round. Most Czech banks have a sufficient liquidity buffer to be able to withstand a potential liquidity shock; however, a few banks were not able to cover a further liquidity needs.

Negrila (2010) tested how Romanian banks would react on the stress scenario which is characterized by following aspects: sudden drawing of 20% from deposits of individuals, 10% from deposits of corporate clients and 30% from interbank deposits; a lack of liquidity on the interbank market which would result in additional costs of financing; the decrease of 35% of the value of shares in bank trading portfolio; very low volume of treasury bills in banks´ portfolio and increase in minimum level of liquidity required by Central Bank. As a result of this scenario, liquidity ratio would decrease by more than 50%. In order to fulfill liquidity requirements, banks would have to face losses ensuring additional liquidity.

Other studies are less complex and focus on sensitivity analysis: they measure the impact of selected scenario (or several different scenarios) on bank liquidity. Boss et al. (2004) did liquidity risk stress tests for the whole Austrian banking sector, for the aggregated sectors (joint stock banks, savings banks, Raiffeisen cooperatives and others) and for the sample of systematically important banks (which included 15 largest banks). Liquidity ratios were shocked by four scenarios: market value of bonds decreased by 10%, market value of equities decreased by 20%, other banks withdraw 20% of interbank deposits and nonbank customers withdraw 20% of their deposits. Austrian banking system was well equipped with liquid assets in 2004.

Boss et al. (2007) continued in sensitivity analysis in 2007, when they conducted four scenarios (decrease of liquid bonds by 25%, decline in equity prices by 35%, withdrawal of 40% of all interbank short-term funding, and withdrawal of 50% of nonbank deposits) and investigated its impact on different liquidity ratios of the six largest Austrian banks. These scenarios were extreme and unprecedented in Austrian history. The impact on all ratios was substantial. However, all banks remained liquid which highlights their solid liquidity.

Jurča and Rychtárik (2006) investigated liquidity risk sensitivity for banks in Slovakia. They consider three scenarios: depreciation of government bonds by 10%, decline in client deposits by 20% and outflow of short-term capital from the banking sector for external reasons. They measured impact of these scenarios on different liquidity ratios. The size of the shock was assessed in regard to the average month-on-month fluctuations in these indicators in 2005. They came to conclusion that the depreciation of government bonds did not have a significant effect on banks. The scenario for a withdrawal of 20% of client deposits had the biggest effect on large and medium-sized banks, i.e. mainly on retail banks. The last scenario influenced mostly some medium-sized banks but also banks which are bound to their own financial groups.

Rychtárik (2009) measured the liquidity risk sensitivity of 32 banks active in Luxembourg banking sector. The study used four scenarios: run on a bank (simulated by a 20% withdrawal of clients´ deposits), use of 50% loan commitments by counterparties, netting of the positions with the parent financial group and changes in conditions of refinancing operations with the Eurosystem (simulated by the 5% decline of government bonds and 15% decline of all other debt securities). The impact of all scenarios was measured by relative changes of liquidity ratios. Half of the banks in the sample proved to be negatively exposed to the risk of bank run as their liquidity buffer could not counterbalance the withdrawals of clients´ deposits. One third of the banks were not able to refund a potential use of 50% of the committed credit lines. The impact of netting of the position with the parent financial group depended on the character of the activity with the parent undertaking. The last scenario had only minor impact.

3. Methodology and data

In contrast to authors of previously cited studies, who work in regulatory and supervision authorities and thus they can use internal bank data (e.g. from monthly reports on liquidity); we can use only publicly available data from annual reports of individual banks. This limitation strongly influence the methodology used.

3.1 Scenarios

Firstly, we will evaluate liquidity risk of each bank in the sample via six different liquidity ratios ($L1 - L6$) to obtain values for the baseline scenario. Then we will stress these ratios in different scenarios to calculate their stress value. Based on previously cited studies (and considering only publicly available data) we will use three different scenarios:

- run on a bank,
- confidence crisis on the interbank market,
- and use of committed loans by counterparties.

Scenario 1: Run on a Bank

First scenario is a simple simulation of the withdrawal of a certain volume of clients´ deposits. We simulate a 20% withdrawal of deposits; this haircut is applied on the total deposits not taking into account agreed maturities of different types of deposits.

To calculate the stressed value of liquidity ratios, we have to deduct the volume of withdrawn deposits, i.e. 20% of clients´ deposits, from liquid assets. Bank must use liquid assets to be able to repay deposits. At the same time, volume of total assets is also decreasing as a result of this operation. This is the way how we calculate stress value of liquidity ratios $L1 - L3$, i.e. $L1_{SC1} - L3_{SC1}$. The first scenario has not directly influence the volume of loans provided to nonbank clients so for the calculation of $L4_{SC1}$ and $L5_{SC1}$, we only change denominators. We are not able to calculate the stress value of the ratio L6 because we are not able to decide which type of liquid asset the bank will use to finance deposit withdrawal (cash, money obtained from government securities, funds from the interbank market or the combination of these possibilities). Therefore we cannot calculate the exact change of the net interbank position.

Scenario 2: Confidence Crisis on the Interbank Market

Second scenario models confidence crisis on the interbank market which is accompanied by withdrawal of 20% of interbank deposits. This means both the decrease of dues from banks and dues to banks. Although the decrease of dues from banks would not result to any change of the volume of liquid assets, the decrease of dues to banks has to be financed because these debts must be repaid. Calculating the stress values of liquidity ratios $L1 - L3$ (i.e. $L1_{SC2} - L3S_{C2}$), we have to deduct 20% of dues to banks from liquid assets, from total assets and from other short term borrowing. The second stress scenario will not directly influence the volume of nonbank deposits and loans. The value of $L5_{SC2}$ is therefore the same as the value of the ratio $L5$. When calculating $L4_{SC2}$, we only change the denominator (total assets). To obtain the stress value of the share of net interbank position in total assets ($L6_{SC2}$), we have to decrease both dues from banks and dues to banks by 20%. Also the volume of total assets is decreasing.

Scenario 3: Use of Committed Loans

The last scenario focus on the banks´ capacity to provide the loans they have committed in a previous period. Studies cited above most often modeled the use of 50% of committed loans. However, we do not have data about loan commitments for all banks in the sample. For this reason, we will simulate a 5% increase of loans provided to nonbank clients – we assume that this liquidity outflow is enough to cover use of loan commitments, larger bank overdrafts and greater use of credit cards by customers in case of any crisis period.

To calculate the stressed values of liquidity ratios, we simply increase loans by 5% and decrease liquid assets by 5% (we assume that liquid assets are used for providing more loans). This will change the calculation of ratios $L1 - L5$ (i.e. we obtain values of $L1_{SC3} - L5_{SC3}$). As in case of the first stress scenario, we are not able to expect the exact impact of the use of committed loans on the net interbank position so we assume that the value of $L6_{SC3}$ is equal to the baseline value of $L6$.

3.2 Impact of scenarios on bank liquidity

Stress values of ratios will be compared to the baseline values. We will identify the most severe scenario for the Hungarian banking sector and the most vulnerable banks under all scenarios via the magnitude of the relative changes between the baseline and the stressed value. Following the methodology of Rychtárik (2009), in order to find which scenario is the most severe and which banks are most sensitive in terms of liquidity risk we will calculate the change of the baseline value of each bank across all ratios in all scenarios (1):

$$R_i = \frac{(R_S - R_B)}{R_B} * 100(\%) \tag{1}$$

where R_i is a bank/ratio/scenario specific figure, R_S is the stress value and R_B is the baseline value of all ratios, in all scenarios for all banks in the sample.

3.3 Data

We used unconsolidated balance sheet data over the period from 2000 to 2011 which were obtained from annual reports of Hungarian banks. The panel is unbalanced as some of the banks do not report over the whole period of time. Table 1 shows more details about the sample. The sample includes significant part of Hungarian banking sector. We consider only commercial banks so we abstract from branches of foreign banks, mortgage banks, building societies and specialized banks like Magyar Fejlesztési Bank.

Table 1: Sample of banks

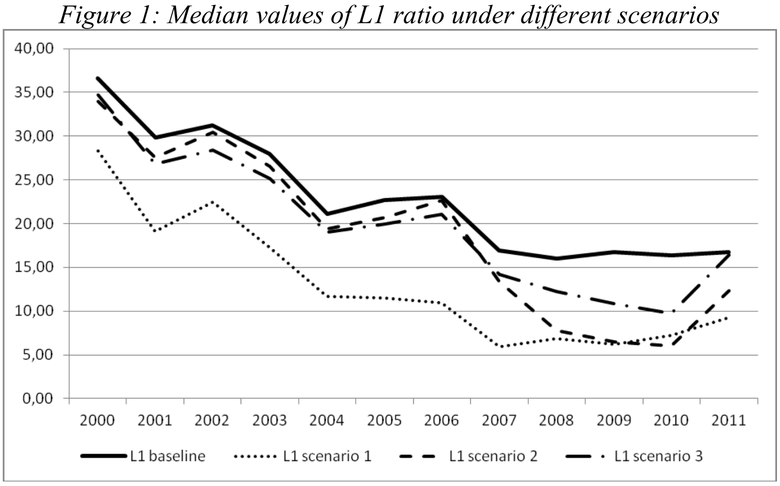
Indicator	00	01	02	03	04	05	06	07	08	09	10	11
Total number of banks	40	41	39	38	35	34	37	38	36	35	35	35
Number of observed banks	13	18	23	24	26	29	28	27	25	24	21	13
Share on total assets (%)	72	74	84	86	87	88	88	87	88	88	87	83

4. Results and discussion

4.1 Values of liquidity ratios for each scenarios

The median values of liquidity ratio *L1*, both for baseline scenario and for all three stress scenarios, are presented in Figure 1. As the detailed comments about the liquidity development can be find for example in Vodová (2012) and the extent of the paper is limited, we will focus only on impact of each scenario on bank liquidity. All three stress scenario would lower bank liquidity. It is evident that the worst impact on banks would have the first scenario, i.e. run on a bank. Median values of the ratio $L1_{SC1}$ is positive for the whole analyzed period which means that in spite of a substantial decrease of liquidity, Hungarian banks on average would be able to finance 20% withdrawal of the clients´ deposits. Of course, individual banks could have problems with such deposit withdrawals in some years (MagNet Hungarian Civic Bank, Budapest Bank in 2007-2010, CIB Bank in 2003-2004 and 2007-2011, Raiffeisen Bank in 2004-2011, KHB Bank in 2003, 2008 and 2009, Porsche bank in 2000, 2001 and 2009, and UniCredit Bank Hungary in 2010-2011).

Figure 1: Median values of L1 ratio under different scenarios

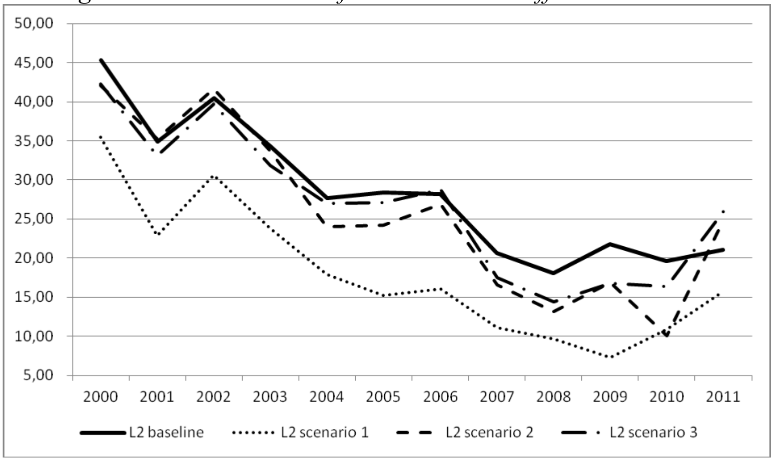


Scenario 3, i.e. the use of loan commitments and thus higher lending activity, would have the lowest impact on the liquidity of Hungarian banks. With the only exception of Banif Plus Banks, all other banks would remain liquid.

The crisis confidence on the interbank market (Scenario2) would lower bank liquidity quite substantially, especially in the second half of the analyzed period. Due to such crisis, Axa Bank, Banif Plus Bank, Magyar Cetelem Bank, Credigen Bank, Porsche Bank, CIB Bank (in 2008-2010) and Sopron Bank (in 2008-2010) would have serious liquidity problems (values of $L1_{SC2}$ for these banks are negative). The net interbank position of these banks is significantly negative therefore it would be impossible for them to repay suddenly 20% of their interbank liabilities.

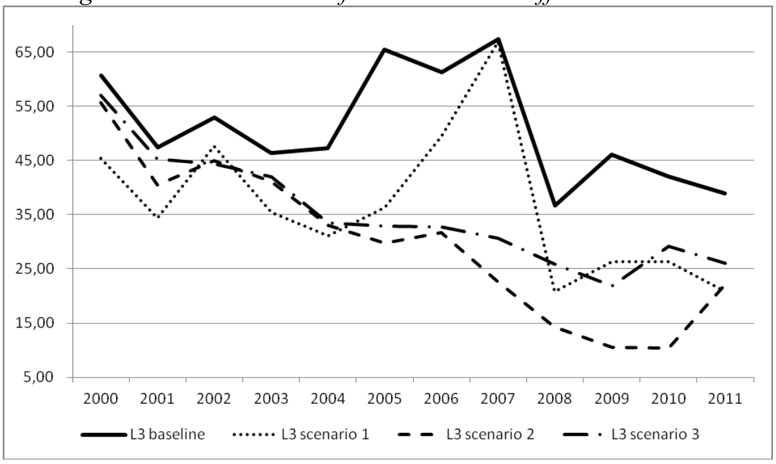
Although values of ratio *L2* (which is the share of liquid assets in deposits and short term financing) differ significantly from values of ratio *L1*, the trend and the impact of all stress scenarios are the same (Figure 2). Hungarian banks are most sensitive to run on a bank. The second most severe impact would have Scenario 2, i.e. confidence crisis on the interbank market. The use of committed loans would deteriorate bank liquidity only slightly.

Figure 2: Median values of L2 ratio under different scenarios



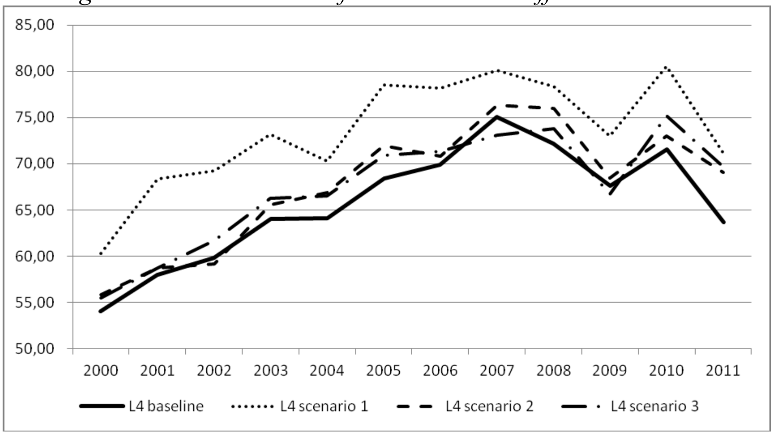
The Figure 3 shows that confidence crisis on the interbank market (Scenario 2) would have the most serious impact on the value of liquidity ratio *L3* in the second half of the analyzed period. This is not a surprising result: the Hungarian banking sector as a whole is a net borrower almost for the whole analyzed period. In 2008-2010, the net interbank position was significantly negative (see Figure 6). The confidence crisis on the interbank market would again have the worst effects on banks which are the most indebted in the interbank market. Scenario 3 (the use of committed loans) would be problem again only for Banif Plus Bank. Impact of run on a bank (Scenario 1), accompanied by 20% deposit withdrawal, is less severe because Hungarian banks are more dependent on other sources of funding (and thus less dependent on clients´ deposits).

Figure 3: Median values of L3 ratio under different scenarios



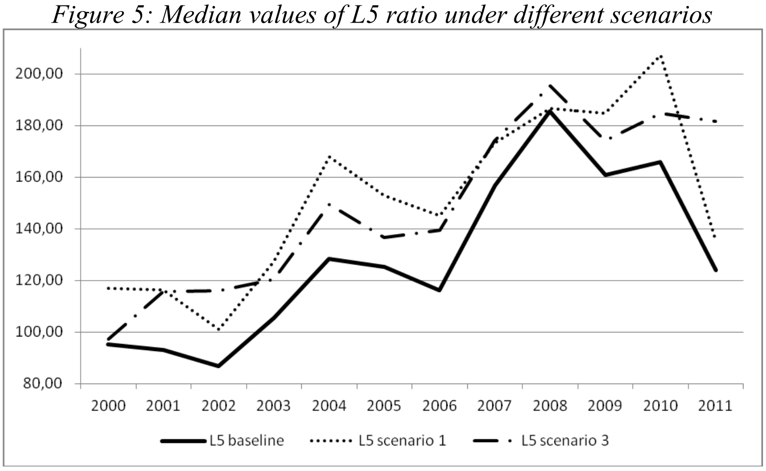
Values of liquidity ratio *L4* are presented in Figure 4. As this ratio measures the share of illiquid loans in total assets, high value of this ratio means low liquidity. The largest decline of bank liquidity would be again a result of run on banks (Scenario 1). Commerzbank in 2010, Banco Popolare in 2005 and Erste Bank Hungary in 2001-2004 have the value of $L4_{SC1}$ higher than 100%. This is a signal of the fact that after the withdrawal of 20% of clients´ deposits, these banks would not have enough funds to cover already provided loans. In fact, these banks would not be able to repay demanded 20% of deposits. The impact of crisis confidence on interbank market (Scenario 2) and the use of committed credit lines (Scenario 3) are very similar and again the same banks (as in case of ratios *L1 – L3*) would have problems with such development. The results also showed that banks which focus more on lending activity (Magyar Cetelem Bank, Credigen Bank and Banif Plus Bank) are more vulnerable to liquidity shocks.

Figure 4: Median values of L4 ratio under different scenarios



Results of the liquidity ratio *L5* can be found in Figure 5. Also in this case high value of this ratio means low liquidity. Scenario 2 has no direct impact on the value of the ratio *L5*. While in some years bank liquidity measured by the share of loans in deposits is more influenced by the run on a bank (Scenario 1), in other years the use of committed loans (Scenario 3) is more important. As average values of $L5_{SC1}$ and $L5_{SC3}$ are higher than 100% in all analyzed years, it is evident that both stress scenario lead to higher dependence of banks on other sources of financing.

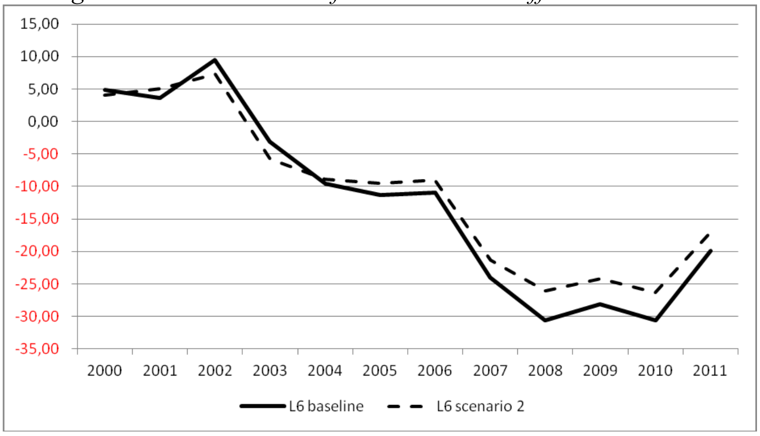
Figure 5: Median values of L5 ratio under different scenarios



The last liquidity ratio *L6* is calculated as a share of net interbank position in total assets. It assesses activity of banks in interbank markets: the value is positive for net lenders and negative for net borrowers. Banks who are net borrowers are more vulnerable: lenders may not provide them interbank loans in case of any doubts about their financial situation.

As it can be seen from Figure 6, as a result of the confidence crisis in the interbank market (Scenario 2), the share of the net interbank position on total assets would be rather better. In spite of this, the Hungarian banking sector as a whole would remain in the position of the net borrower. As we could see in previous figures (Figure 1 – 5), this stress scenario would be very difficult for Hungarian banks. The value of $L6_{SC2}$ would not actually ever have happened: many banks would not be able to repay 20% of their interbank liabilities because they do not have sufficient buffer of liquid assets. Respectively, their buffer of liquid assets is adequate for standard period but not for modeled liquidity shocks. This could potentially spill over the liquidity problems to other banks, especially to those that are lenders of these banks.

Figure 6: Median values of L6 ratio under different scenarios



4.2 Most severe scenario and most sensitive banks

To assess the most severe scenario, we have calculated all R_i values. Then, in each scenario separately, we have calculated the median value of R_i for all ratios, for all banks. We can see the results in Table 2.

Table 2: Severity of scenarios (median values of R_i)

Scenario	00	01	02	03	04	05	06	07	08	09	10	11
Scenario 1	-19	-22	-18	-22	-22	-17	-16	-14	-26	-23	-29	-18
Scenario 2	-7,5	-8,5	-5,5	-11	-12	-13	-13	-16	-18	-16	-18	-15
Scenario 3	-6,6	-7,5	-5,2	-5,7	-6,6	-6,3	-7,3	-7,8	-14	-11	-16	-14

It is evident that the first scenario – run on a bank – would have the most serious impact on liquidity of Hungarian banks. In normal times, almost all banks would be prepared to 20% of deposit withdrawals. However, it would be impossible for most banks to fund such withdrawals during financial crises. The second most severe is the Scenario 2 (crisis confidence on the interbank market). Although it would generate a liquidity outflow, it would be problem only for one bank to finance the use of committed loans (Scenario 3). The results also show that the severity of the impact worsens in periods of financial distress.

To identify the most sensitive banks, we have calculated the average R_i value for each bank across all ratios in all scenarios. Without any doubt, the most vulnerable bank is Magyar Cetelem Bank. Very vulnerable are also Raiffeisen Bank, CIB Bank, Credigen Bank, MagNet Hungarian Civic Bank, Porsche Bank, Sopron Bank Burgenland, UniCredit Bank Hungary or Volksbank Hungary. At these banks, the decline in liquidity due to the stress scenarios exceeded 30%, in many cases 50%.

We can find some common characteristics which make these banks so sensitive to liquidity shocks: they are strongly dependent on the funds obtained on the interbank market; they focus more on lending activity which lowers their liquidity. We could not find any relation between size of the bank and its vulnerability to liquidity shocks in Hungarian banking sector: these most sensitive banks belong to all groups of banks (small, medium sized and large banks).

5. Conclusion

The aim of this paper was to measure the liquidity risk sensitivity of Hungarian commercial banks and to find out the most severe scenario and the most vulnerable banks.

We have evaluated liquidity positions of Hungarian banks via six different liquidity ratios in the period from 2000 to 2011. Then we stressed these ratios in three different scenarios: run on a bank, confidence crisis on the interbank market, and use of committed loans by counterparties. The impact of modeled liquidity shocks differs among scenarios. The most serious liquidity problems would be caused by the first scenario – run on a bank. The confidence crisis on the interbank market is the second most severe scenario. An increase in lending activity by 5% would be a problem only for one bank.

We could not find any relation between size of the bank and its vulnerability to liquidity shocks in Hungarian banking sector: banks from all groups of banks (small, medium sized and large banks) belongs to most sensitive banks.

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Tax System Fragmentation in V4 Countries

Tomáš Wroblowský, Iveta Ratmanová[1]

Abstract

The complexity of a tax system in any country can be one of possible sources of so called tax illusion. If such illusion is present, the economic agents are not able to fully understand their tax liabilities. It is assumed that the more fragmented the tax system is, the more it is complex and more difficult for the agents to perceive the real value of taxation correctly.

Using the Herfindahl – Hirschman index, we analyze the development of tax systems fragmentation in V4 countries for 1995 – 2011 period. It is argued that the same years can be observed, when there were significant changes in systems' fragmentation happened. Those are especially 1999, when the significant changes in taxes or social security systems were realized, the 2004, when all countries joined the EU, and 2008, where there were more tax reforms and where the economic crisis also affected the results.

Key words:

Fiscal illusion, tax illusion, Herfindahl – Hirschman index, tax system fragmentation, tax system complexity, V4 countries

JEL Classification: H11, H21

1. Introduction

Many studies, both theoretical and empirical, show that tax subjects are not able to (or they do not want to) fully recognize their tax liabilities. Such wrong perception of taxation, usually called the „tax illusion“, can have several reasons. Let's mention the low level of economic literacy, high costs of information or complexity of the tax system.

This paper is focused on the complicatedness of tax systems in Visegrad group countries and its development in the 1995 – 2011 period. Using the Herfindahl – Hirschman index, the tax systems' fragmentation is examined. The structure is as follows. In the first part, the theory of the tax illusion and the measurement of tax system fragmentation will be discussed. Then, the development of tax systems structures and their fragmentation is presented. As a conclusion, some possible explanations of the development are discussed, as well as some expectations for the future.

2. Tax Illusion

Generally, the fiscal illusion is usually defined as a situation, where the economic subjects do not fully realize the real value of fiscal measures. However, the term fiscal illusion has been used in different meanings in the economic literature since 1903, when it was introduced by Amilcare Puviani in his Illusione Finanziaria. This paper is focused especially on the tax illusion as a part of fiscal illusion. For its purposes, we understand the tax illusion as a situation where the taxpayers do not fully realize their tax liabilities. There are several factors, which can influence the intensity of tax illusion. Theoretical explanation of those factors can

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be found for example in Mourão (2007), Fasora (2010) or Ratmanova and Wroblowsky (2012).

Tax system complexity is one of the main sources of tax illusion. The more complicated the tax system is, the more it is likely to be a source of tax illusion. The taxpayers are either unable or unwilling to fully understand the information contained in the tax system. If the system is too complicated, for some agents it is impossible to derive and understand all the necessary information about the average and marginal tax rates, the tax incidence, opportunities to avoid or minimize the tax duties etc. However, there can be also the situation that such information is available, but the costs connected with deriving and understanding it will overcome possible revenues. In that case, according to the theory of rational ignorance, people do not want to spend those costs and live in the illusion.

There are three main factors, which make the tax system more complicated (and less understandable for the taxpayers). These are the tax system fragmentation, visibility of taxes and the space for tax liability minimization.

As mentioned above, this paper focuses on the tax system fragmentation. The more it is fragmented (i.e. the more different taxes create the total tax liability) the less it is understandable for the taxpayers. Buchanan (1987, p. 135) says that *„To the extent that the total tax load on an individual can be fragmented so that he confronts numerous small levies rather than a few significant ones, illusory effects may be created. If, for example, all taxes paid by an individual are concentrated into a single levy on personal income, the individual would surely be more conscious of the sacrifice that he undergoes, presumably, in support of government services"*. The main problem is how to measure the degree of fragmentation. Wagner (1976) suggested to use the Herfindahl – Hirschman index (HHI), a variable which is usually used to measure the size of firms in relation to the whole market and as an indicator of the level of competition among those firms.

The HHI, adjusted for the measurement of tax system fragmentation, can be calculated as a sum of squares of particular tax to total tax revenues ratios.

$$HHI = \sum_{i=1}^{N} t_i^2, \qquad (1)$$

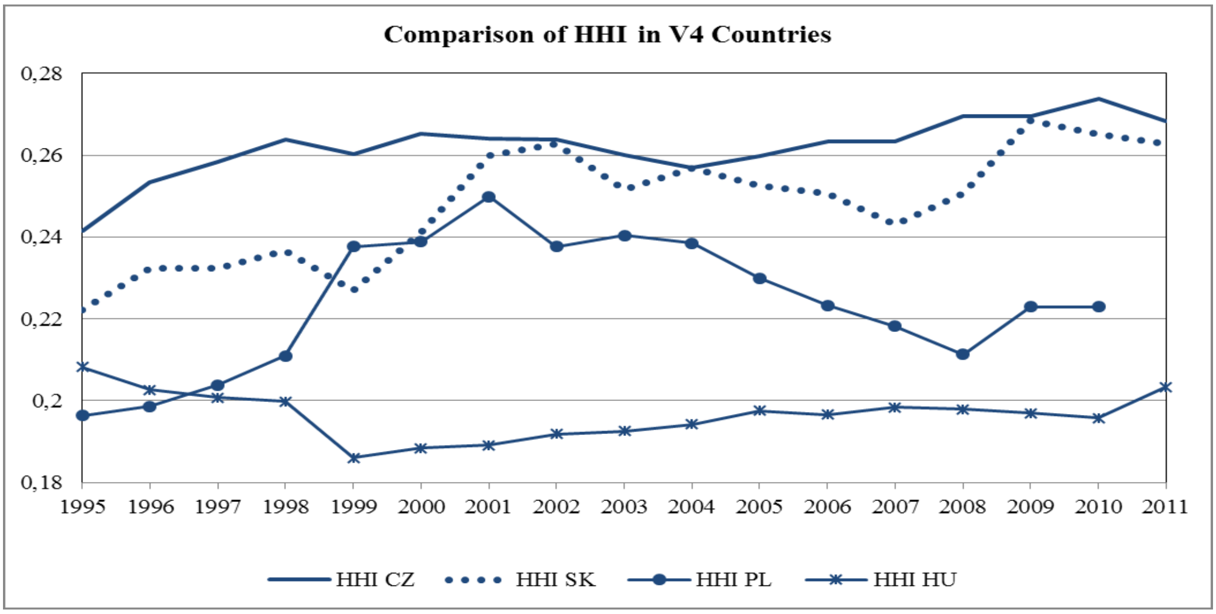
where the N in formula 1 denotes the number of taxes in the system and t_i represents the share of the tax i on the total tax revenues. It is clear that the index value must lie in interval <0;1>. The lower is the value of HHI, the higher is the degree of tax system fragmentation. The value of HHI is influenced by two factors – the number of taxes in the system and the differences in the shares of each tax to the total tax revenues. The more different taxes are present in the system and the lower is the difference among the shares of particular taxes on total tax revenues, the lower is the value of the HHI.

3. Herfindahl – Hirschman Index in V4 Countries

Using the previously presented equation 1, the values of HHI have been calculated for all four countries. As a source of data, the OECD tax database has been used. As mentioned in our previous paper (Ratmanova and Wroblowsky (2012)), using the OECD division of taxes has its advantages and disadvantages. It allows the researcher to compare the structure of taxes in different countries, as the approach is the same for all countries. However, it also assures that the number of taxes (or, more precisely, the number of tax groups) is the same in all countries. It means that some kind of loss of information, necessary for the examination of tax system fragmentation, can appear. Despite that, it still seems that this is the most suitable approach for calculating the HHI.

Following figure shows the values of Herfindahl – Hirschman index in Visegrad group countries for 1995-2011 period[2].

Figure 1: Development of Herfindahl – Hirschman index in V4 countries



Source: Own calculation based on OECD Tax Statistics data

It is obvious that the development of tax systems fragmentation in all examined countries is very similar, with Hungary being an exception. Before we start explaining the development of HHI both in each country and in the whole group, a brief description of tax systems in examined countries will be presented. Then, the results and their discussion will be provided.

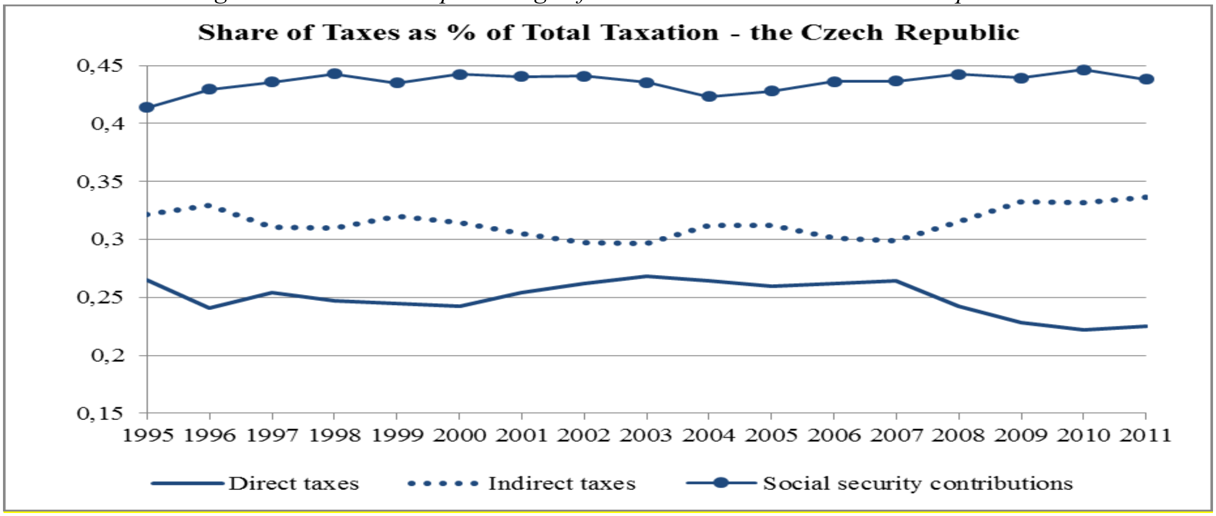
The Czech Republic

Czech tax system is characterized with the highest values of HHI, meaning that the system fragmentation is the weakest source of tax illusion, compared to other countries. The country also has one of the highest shares of social contributions (especially those paid by employers) on both total tax revenues and GDP in the EU. On the other hand, despite the gradual increase the share of indirect taxes remains still under the average of EU countries.

There were several important changes during examined period. The corporate income tax rate fell gradually from 41% in 1995 to 24% in 2006. The biggest drop was in 1999, when the tax rate declined from 35 to 31%. The progressive tax rate of personal income tax has remained from the start of the period until 2008, when it was replaced with linear rate of 15% and accompanied with the change of tax base (introducing the supergross wage). The share of property taxes is quite stable and very low, the most important are the real estate tax and the road tax. Although the energy taxes should have been introduced when the country joined the EU, their real appearance was in 2008. General insight to the development of Czech tax revenues structure is provided in figure 2.

[2] Poland is the only one exception, as the OECD database still does not contain the data for 2011.

Figure 2: Tax mix as a percentage of total tax revenues in the Czech Republic



Source: OECD Tax Statistics

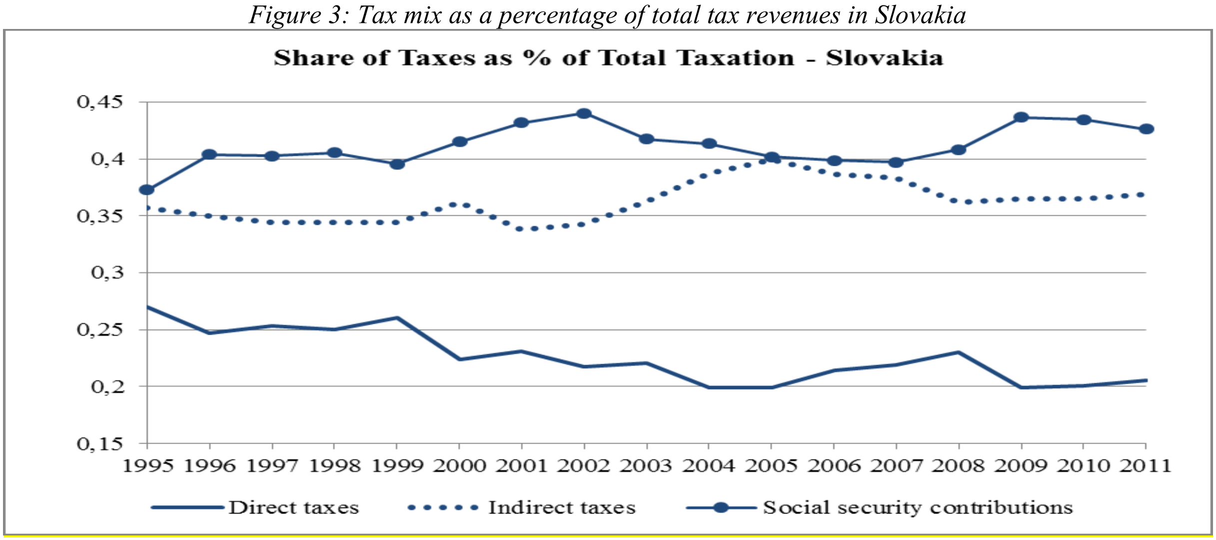
Slovakia

The values of the HHI through examined period are similar to the values of the Czech Republic, but it oscillates much more. One of possible explanations is the political cycle – governments in Slovakia were generally much stronger than in Czech and the changes in government were accompanied with important changes in tax or social security systems.

Slovakia has the lowest share of direct taxes on total taxation in the EU. On the other hand, the share of social security contributions is the second highest. The flat tax rate of personal income tax was introduced already in 2004 (the earliest introduction from V4 countries). The development of corporate tax was quite similar to the Czech one, the tax rate fell gradually from 41% in 1995 to 25% in 2002. There was a dramatic drop of the tax rate between 1999 and 2000, when it fell from 40 to 29%.

There was a tax reform in 2004, which affected several types of taxes. The gift tax and inheritance tax were cancelled, the tax rates of excises increased. Two tax rates of VAT were replaced with only one (later in 2006 it came back to two rates). As in all countries, the energy taxes appeared in 2008. The disappearance of some taxes from the system in 2004 can be one possible explanation of the break in HHI development. The development of Slovak tax structure during examined period can be found in figure below.

Figure 3: Tax mix as a percentage of total tax revenues in Slovakia



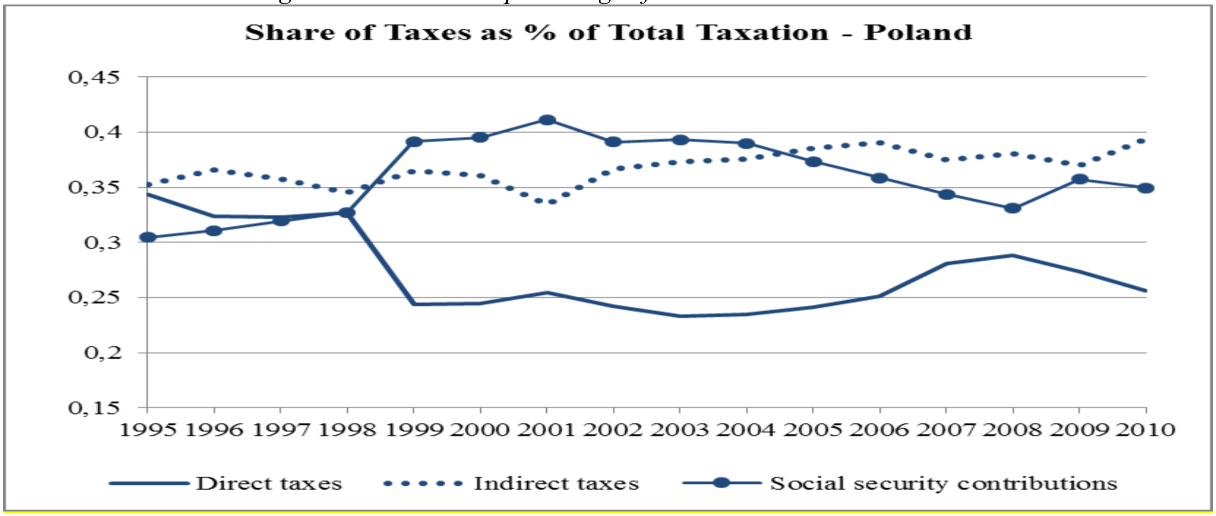
Source: OECD Tax Statistics

Poland

Poland started with the lowest values of HHI in 1995, meaning that in the mid 90's the tax system was the most fragmented of all four countries. However, there was quite sharp increase until 2001, then it started gradually decreasing.

There is a standard structure of taxes in Poland. It should be mentioned that Poland has much higher share of indirect taxes on total tax revenues than previous countries (7th highest in EU). The personal income tax rate has been progressive since the start of the examined period, but in 2009 the number of tax brackets was reduced to only two. The corporate tax rate fell from 40% in 1995 to 19% in 2004. A huge reform of social security was realized in 1999, when a significant part of direct taxation was replaced with social security contributions. Such a dramatic change heavily affected the structure of tax revenues, which can be a factor also influencing the degree of tax system fragmentation. The structure of indirect taxes is quite typical, i. e. the VAT and excises play the most important role. Three tax rates are now valid for the VAT. The energy taxes were introduced in 2008. The development of Polish tax revenues' structure is presented in following figure.

Figure 4: Tax mix as a percentage of total tax revenues in Poland



Source: OECD Tax Statistics

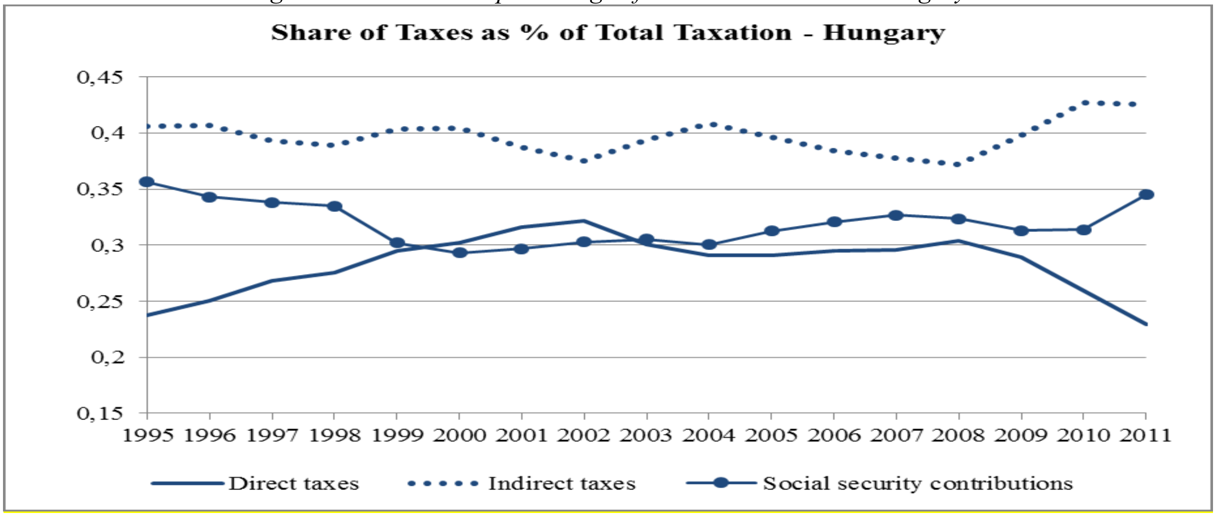
Hungary

Hungary shows the lowest values of HHI in comparison with V4 countries and the difference between Hungary and the rest is quite significant. This means that Hungarian tax system can be perceived as very complicated and/or fragmented.

Although most of the taxes have similar features as in the rest of Europe, some specifics can be found. The personal income tax rates have been progressive since the 1995, but it was replaced with a flat tax rate 16% of supergross wage in 2011. As in Poland, the country also underwent the social reform in 1999, but in different direction. The reform decreased the share of social security contributions and increased the direct taxation of income. What is more interesting, the corporate taxation was very low. The tax rates were below 20% already in the mid 90's (18% in 1995 precisely). This should have been an incentive for the foreign investors, who preferred other V4 countries for specific reasons in that time.

Figure 5 also shows that Hungary has the highest share of indirect taxes on total taxation. This is partly due to quite high tax rates of VAT and excises, partly due to the existence of some special kinds of taxes, which haven't been present in the rest of V4 countries. The vehicle registration tax or specific energy tax for suppliers can be mentioned among them. The higher number of tax types and generally the highest share of indirect taxes can be an explanation of such low values of HHI.

Figure 5: Tax mix as a percentage of total tax revenues in Hungary



Source: OECD Tax Statistics

4. Concluding Remarks

If we take the tax system fragmentation as one of possible sources of tax illusion, it can be concluded that there are differences among V4 countries. The values of Herfindahl – Hirschman index show that while the fragmentation of Czech and Slovakian tax systems is quite low, the values for Hungary are an evidence of presence of significant source of tax illusion. As it has been discussed above, especially the high share of indirect taxes on total taxation and the presence of special kinds of taxes can explain that phenomenon.

Although the countries have had different development of tax systems through the years, the common important years (according to the values of HHI and thus according to tax system fragmentation) can be found. First, the end of 90's and the new millennium can be mentioned. There was quite dramatic fall of HHI in all countries but Poland, but the increase of HHI from previous years stopped at that time. It was especially due to the tax reforms in all countries and the social security systems in Hungary and Poland. All these changes were (among others) motivated by fact that all countries obtained the status of candidate countries for joining EU.

The other breaking point was the year 2004, when the V4 countries joined EU. The pressures on tax systems harmonization (especially in indirect taxation) caused not only the changes in tax revenues structures of all countries, but also a reduction of the HHI gap among all four countries.

Last, but not least, we have to mention the 2007 and later period, where the financial and economic crisis played an important role. As the disposable incomes of households and profits of enterprises fell down and the unemployment increased, quite significant changes in tax revenues appeared. Although the revenues of income taxes and social contributions decreased, the property tax revenues did not change significantly. As the governments were looking for additional sources of revenues, the easiest way to get them was an increase of rates in indirect taxes. Thus, the share of indirect taxes on total revenues grew in all four countries after 2007, which was also one of the reasons why the Herfindahl – Hirschman index increased as well – more significantly in case of Poland and Slovakia, less visibly in case of Czech Republic and Hungary.

As there is still a need for stabilizing public finance of all countries, it can be expected that the share of indirect taxes will continue growing. This should increase the HHI in the future, meaning that the importance of the tax system fragmentation as a source of tax illusion will be reduced.

Acknowledgement

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Barriers to liquidity of small industrial enterprises in Poland – model approach

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Abstract

The aim of the study is to identify and evaluate factors that are barriers to liquidity of small industrial enterprises in Poland. This problem has been repeatedly undertaken in research [C.S. Kim, D. C. Mauer, A. E. Sherman 1998, M. Sierpińska, D. Wędzki 2008]. A model approach presented in the paper differs from those presented in the literature, since it is based on subjective opinions of small industrial enterprises' managers, which concerned the barriers to the ability of entities to fund their liabilities.

Key words

Liquidity, barriers, small industrial enterprises, model approach.

JEL Classification: G31, C20

1. Introduction

Liquidity in corporate finance represents the ability to meet financial commitments such as paying creditors and paying off loans on time. It is an important component of working capital management. Researchers have proved that the management of liquidity is usually more important than decisions about capital structure, concerning the enterprise's ability to function on the market.[2] The consequences of becoming illiquid can be bankruptcy or insolvency. So, it is very important to evaluate liquidity[3], using many measures in assessing companies' likelihood of failure and credit worthiness[4]. The business may become insufficiently profitable to generate adequate cash flows. In economics, liquidity means that an asset can be turned into cash quickly and without loss in other words whether it can be easily traded[5]. Many firms, particularly SMEs, hold cash as a buffer[6].

Industry small enterprises are a special group of entities. Firm size may partially determine the overall financial health of a company as well the company's basic financial characteristics. Furthermore, in industry companies fixed assets are a large proportion of total assets. It requires long-term or permanent financing. This brings into focus the fact, that small business should be concerned with working capital because of traditionally, small businesses have difficulty in obtaining long-term financing, so liquidity position of these entities is significant. Liquidity is a fundamental assumption of developing enterprise. The lack of adequate financing becomes a big problem in periods of growth[7]. Undercapitalization can leads to

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failure, reduces growth or becomes worse with rapid growth. Welsh and White (1981) maintain that sufficient liquidity is basic to survival for small firms. They point out that many business failures occur in a year with record sales, largely because of inadequate financing. This research focuses on the barriers for the liquidity of small industry enterprises. This problem has been repeatedly undertaken in research [C.S. Kim, D. C. Mauer, A. E. Sherman 1998, M. Sierpińska, D. Wędzki 2008]. A model approach presented in the paper differs from those presented in the literature, since it is based on subjective opinions of small industrial enetrprises managers, which concerned the barriers to the ability of entities to fund their liabilities.

2. Research objectives and source of data

Liquidity is a matter of enterprises' policy and it is determined by many factors. The questions that this paper sets out to answer is: which factors are the barriers for small industry enterprises' liquidity? The subjective data referring to the ability of small enterprises in Poland to settle current liabilities and to their financial situation comes from the *Badanie Koniunktury Gospodarczej [Study of Business Tendencies]* conducted by the Central Statistical Office (GUS).

The study of business tendencies in industry encompasses entities performing business activity in the processing industry classified in the Polish Classification of Activities (PKD 2007) in section C[8]. The observed enterprises employed 10 and more people and were divided into the following size classes: small, medium and big. The sample (3500 enterprises) is comprised of the whole group of big units and 10% of subjects from the small and medium group. The units are selected by the stratified sampling method, without replacement, proportionally, but there is an attempt to include in the sample all units which regularly partake in the study. The stratum is defined in terms of both the PKD section/division/class and the size class. The study does not include micro enterprises (up to 9 employed) due to the fact that they do not have a significant influence on business tendencies in the processing industry as a whole, generating less than 7% of revenues of the whole studied population. The study is conducted at a monthly frequency. In addition, follow-up data to the information gained on a monthly basis is gathered once a quarter, while data about investment activities of industrial enterprises is collected twice a year. Every month each of the selected subjects is obliged to answer opinion questions about the chosen factors affecting the present and future (in a three-month perspective) situation of the enterprise. The survey has two parts –

[8] The study of the business cycles tendencies has a qualitative nature and refers to the subjective evaluations of the management of industry enterprises. A typical question is formed in such a manner that a respondent has to indicate weather his/her situation in a particular respect improved, did not change or deteriorated in comparison with the subsequent period. The data is aggregated separately for each question, and the stages of this process provide data for the sections adopted in the study assumptions. In the case of a qualitative single choice question with three options, the first stage of the calculation consists in adding up the number of answers for each option – positive (situation improved), neutral (situation did not change) and negative (situation deteriorated) given by the subjects comprising a particular stratum (e.g. small enterprises manufacturing food products). The next stage consists in calculating the breakdown of the three responses, which add up to 100% (e.g. 50% positive responses, 30% neutral, 20% negative). This breakdown is the so-called business cycle tendency mirror. The simple business cycle tendency indicator for this type of question is calculated as the difference between the percentage of positive and negative responses, which creates the so-called balance of answers for a given question. It means that the balance of answers does not include the middle answer, i.e. the neutral answer[8].

diagnostic and prognostic[9]. Due to data availability, 42 quarterly observations (from the diagnostic part) of small enterprises from the first quarter 2003 to the second quarter 2013 were used in the study.

3. The Models and Variables

Linear econometric model was used to evaluate the liquidity of the small industrial enterprises:

$$Liquidity_t = c + \boldsymbol{\beta}\mathbf{x}_t + \varepsilon_t,$$

where the *Liquidity* is the dependent variable of the model. It results from averaging entrepreneurs' subjective responses to the question about "the ability to settle financial liabilities when due". Vector $\mathbf{x}$ is the vector of the independent variables described in Table 1, $\boldsymbol{\beta}$ is the vector of the variables' coefficients.

Table 1. Variables influencing the ability to settle liabilities when due in the opinion of the management of small industrial enterprises

Variable	**Variable description**
InsuffDem	Insufficient demand in the domestic market.
InsuffDemFor	Insufficient demand in the foreign market.
ShortSkillLab	Shortage of skilled labour.
ShortMaterials	Shortage of raw materials, materials and semi-finished products (not related to financial causes).
ShortEquipm	Lack of appropriate equipment.
HighBudget	High payments to state revenue.
CompImport	Competitive imports.
UnclearRegul	Unclear and inconsistent legal regulations.
UncertEcEnvir	Uncertainty of the general economic environment.
Other	Other barriers.

Source: own work.

Table 2 presents descriptive statistics of the variables.

[9] The diagnostic part includes questions concerning the evaluation of: the general economic situation of an enterprise, order portfolio including foreign orders, present production and in the past three months, level of stock of finished products, total financial situation, including financial liabilities, receivables and delayed payments. The prognostic part includes questions about predictions for the nearest months about: the general economic situation of an enterprise, order portfolio, including foreign orders, production, selling prices, employment, total financial situation, including financial liabilities. Questions in the quarterly survey concern the evaluation of: order portfolio in the past three months, an enterprise's manufacturing capacity, enterprise's manufacturing capacity utilization ratio, guaranteed period of production, barriers hindering economic activity, the position of the enterprise in comparison to the competitors in the domestic market, in the EU member states' markets and outside the EU.

Table 2. Descriptive statistics of the variables adopted in the model of liquidity barriers to small industrial enterprises

Variable	Mean	Median	Maximum	Minimum	Std. Dev.
SytFin	-16.93	-16.15	-2.3	-34.6	7.24
InsuffDem	59.67	60.7	77.3	40.6	8.99
InsuffDemFor	21.94	21.65	29.2	13.4	4.03
ShortSkillLab	15.96	14.25	31.0	7.9	5.78
ShortMaterials	5.06	4.8	8.0	2.0	1.64
ShortEquipm	9.90	9.8	16.2	5.0	2.10
HighBudget	59.25	61.3	74.7	46.0	8.89
CompImport	19.40	19.45	24.4	15.4	1.97
UnclearRegul	36.50	36.75	48.4	26.3	6.28
UncertEcEnvir	53.60	53.5	68.9	35.0	8.70
Other	6.10	5.9	10.1	2.7	1.65

Source: own work.

There is high correlation, both positive and negative, between some variables representing barriers to the enterprise's liquidity. Highest positive correlation coeficients are between *HighBudget* and *UnclearRegul* (0.939) and between *InsuffDem* and *UncertEcEnvir* (0.862), while highest negative – between *InsuffDem* and *ShortSkillLab* (-0,901). 22 out of 45 pairs of variables have significant coefficient of correlation at 5% significance level. 12 of thoose significant coefficients are negative.

Three variables, *InsuffDem*, *InsuffDemFor* and *UncertEcEnvir* have significant negative coefficients of correlation with *Liquidity*, while two variables, *ShortSkillLab* and *ShortMaterials* have significant positive coefficients of correlation with *Liquidity*.

4. Results and Discussion

Owing to the type of their operating activities, industrial enterprises are characterised by a higher percentage of fixed assets than current assets in the assets structure. In the structure of equity and liabilities, the share of equity is higher than liabilities. Liabilities structure shows higher value of long-term liabilities than short-term financing. It stems, above all, from the necessity to incur specific capital expenditure (higher than in other PKD sections). Additionally, it ought to be underscored that for security reasons manufacturing enterprises have to ensure more long-term financing than trade enterprises due to longer cash conversion[10].

Table 3 presents parameters' estimation results of the initial model of liquidity barriers to small industrial enterprises.

[10] Janeta A., (2009).

Table 3. Parameters' estimation results of the initial model of liquidity barriers to small industrial enterprises

Variable	Coefficient	Standard Error	t-Statistic	Probability
InsuffDem	-0.6604	0.3267	-2.0214	0.0519
InsuffDemFor	-0.8344	0.6213	-1.3431	0.1890
ShortSkillLab	-1.0220	0.3258	-3.1364	0.0037
ShortMaterials	0.0165	0.6813	0.0242	0.9809
ShortEquipm	-0.7393	0.4924	-1.5016	0.1433
HighBudget	0.8068	0.3355	2.4045	0.0224
CompImport	-0.6143	0.6088	-1.0091	0.3207
UnclearRegul	-0.9207	0.3753	-2.4530	0.0200
UncertEcEnvir	-0.2192	0.2243	-0.9772	0.3360
Other	0.0922	0.6931	0.1330	0.8950
C	73.2314	25.2244	2.9032	0.0067
R^2	0.7189		F-statistic	7.9296
Adjusted R^2	0.6283		Prob (F-statistic)	0.0000
DW Statistic	2.1070			

Source: own work.

Next, optimal set of regressors was determined using adjusted coefficient of determination $\overline{R^2}$ as criterion.[11] For this purpose, regressors with smallest value of absolute value of the t-ratio were consequently eliminated until all t-ratios became greater than 1 in absolute value. The result is presented in the Table 4.

Table 4. Parameters' estimation results of the final model of liquidity barriers to small industrial enterprises

Variable	Coefficient	Standard Error	t-Statistic	Probability
InsuffDem	-0.6713	0.2971	-2.2594	0.0306
InsuffDemFor	-0.8080	0.4967	-1.6268	0.1133
ShortSkillLab	-1.0290	0.3117	-3.3014	0.0023
ShortEquipm	-0.7313	0.4653	-1.5715	0.1256
HighBudget	0.8007	0.3082	2.5981	0.0139
CompImport	-0.5840	0.5245	-1.1135	0.2736
UnclearRegul	-0.9121	0.3583	-2.5460	0.0158
UncertEcEnvir	-0.2312	0.1906	-1.2126	0.2339
C	74.0818	17.7263	4.1792	0.0002
R^2	0.7188		F-statistic	10.5430
Adjusted R^2	0.6506		Prob (F-statistic)	0.0000
DW Statistic	2.0956			

Source: own work.

The estimation of the model of liquidity barriers to small industrial enterprises confirmed the statistical significance of four variables (at 10% level of significance). They are respectively: insufficient demand in the domestic market (*InsuffDem*), shortage of skilled labour (*ShortSkillLab*), high budgetary burdens (*HighBudget*) and unclear and inconsistent

[11] Greene W.H., (2000), p.306.

legal regulations (*UnclearRegul*). The influence of the variable *HighBudget* is positive. The tested model is statisticaly significant at 1% level (the value of F-statistic of 10.5430). The model describes about 72% of the total variation of the studied phenomenon. Durbin-Watson statistic lies in the inconclusive range[12], but it is much closer to its higher limit, which justifies with substantial reliability the application of the least squares method to estimate the model.

5. Conclusion

The research presented in the paper allowed the identification of economic barriers to the liquidity of small industrial enterprises in Poland. The data was provided by *Badanie koniunktury gospodarczej [Study of Business Tendencies]* conducted by the *Central Statistical Office (GUS)*. The evaluation of the identified barriers to liquidity was performed by means of statistical tools. The conducted studies allowed to formulate the following general conclusions:

1. As the liquidity barriers for small industrial enterprises should be treated those of statistically significant variables that have negative impact on the liquidity: insufficient demand in the domestic market (*InsuffDem*), shortage of skilled labour (*ShortSkillLab*) and unclear and inconsistent legal regulations (*UnclearRegul*).
2. Insufficient demand in the domestic market is a barrier to obtaining revenues supported by positive cash flows. Uncertainty is increased by the unclear and inconsistent legal regulations. The companies' liquidity is reduced also by the underinvestment on human resources (shortage of skilled labor).
3. Perception of high payments to state revenue as a barrier is concomitant with the improvement of the enterprises' liquidity.

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[12] The inconclusive range occurs when the test $d_l \le DW \le d_u$ or $4 - d_u \le DW \le 4 - d_l$ gives no answer as to the existence of autocorrelation. The critical values of Durbin-Watson's test are accepted: lower d_l and upper d_u of the distribution depending on the number of estimated parameters (k+1) and the size of the sample T. The critical values of Durbin – Watson's test for 42 observations and 8 explanatory variables amount to respectively d_L=1.096, d_U=1.980. In: Savin N.E. and White K.J. (1977).

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A model for the economic determinants of entrepreneurship – obstacles for small trade enterprises in Poland

Danuta Zawadzka, Roman Ardan [1]

Abstract

The aim of the presented research is to identify and evaluate external economic barriers to the functioning of small trade enterprises in Poland. The analyzed data are from *Badanie koniunktury gospodarczej [Study of Business Tendencies]* conducted by the *Central Statistical Office of Poland (GUS).* An econometric model is used to evaluate the influence of a range of factors on enterprises functioning.

Key words

Economic barriers, entrepreneurship, small trade enterprises, econometric model.

JEL Classification: G31, C20

1. Introduction

Economic theories have offered various descriptions of entrepreneurship, but it is derived from the economic schools of thought. Main trends in the study of entrepreneurship, which lay foundations for modern scientific deliberations, have their origins, among others, in the Austrian school, represented by L. von Mises, I. Kirzner and J. Schumpeter, the German school, represented by J. H. von Thunen among others, and the Chicago school, with its main representative – F.H. Knight. Kirzner believed that the relationship between entrepreneurship and economic growth is a good indicator to identify and make use of market opportunities. He proposed two approaches to defining entrepreneurship. On the one hand, he emphasized the necessity to adapt to the needs of the environment, while on the other, the process of discovering new opportunities, which guarantee development. According to Schumpeter, entrepreneurship is the source of all dynamic changes in the economy. An entrepreneur is someone who introduces innovations (new products, new technologies and new solutions). Knight, as a continuator of J.H. von Thünen, focused on risk and uncertainty resulting from entrepreneurship. Referring to the advances in economic theories, J.K. Tanas and D.B. Audretsch defined the following characteristics of an entrepreneur[2]: a) a person who accepts the risk associated with uncertainty; b) an innovator, who undertakes to introduce on a commercial basis new products, new productive techniques, or new forms of businesses (c) a decision maker, who sets the course of the business; d) an industrial leader; e) a manager or superintendent; f) an organiser or coordinator, g) a proprietor of an enterprise, h) an employer of factors of production, i) a contractor, j) an arbitrageur, k) a person who directs resources to alternative uses; l) a supplier of initial financial capital. Therefore, entrepreneurship can be identified with an entrepreneur – a person who possesses certain characteristics initiating

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actions, undertakes risk and is a creator of business activity (classic approach)[3]. However, in many current studies entrepreneurship is identified with small and medium-sized enterprises[4]. Entrepreneurship is determined by a number of factors. Some of them are subject oriented (internal), related to the characteristics of people undertaking business activity, others refer to the environment in which an enterprise functions (external factors) – they determine the functioning scope of an enterprise and the dynamics of its development. The determinants of entrepreneurship refer to the factors both influencing the development of enterprises and curbing their activity.

2. Literature Review

Economics literature offers many theories and explanations of the determinants of entrepreneurship. They can be grouped by the above suggested criterion into internal and external theories and empirical verifications. Scientific studies connected with the first group of determinants look for the characteristics that distinguish entrepreneurs from other people[5]. Many a scientist proved in their studies that characteristics such as age, gender, education, earnings, capital assets, professional experience, marital status, professional status of parents, and other factors are important drivers. Contemporary studies provide evidence that men are more likely to be engaged in the entrepreneurship process than women[6]. Increased age has generally a negative influence on entrepreneurship[7], but individuals between 25 and 45 years of age are most likely to be entrepreneurs[8]. The influence of education on entrepreneurship is under discussion in literature. Uhlaner and Thurik prove that higher education is related to a lower self-employment rate[9]. Davidsson and Honig, on the other hand, provide proofs of a positive relation between entrepreneurship and education[10]. Undoubtedly, entrepreneurship is influenced by risk aversion[11].

Another group of factors determining entrepreneurship refers to the environment. These factors influence both the process of establishing an enterprise and its further functioning. Yaghoobli, Salarzehi, Aramesh and Akbari provided a comprehensive list of environmental factors influencing entrepreneur activities at the start point. These factors include: bankers, competitors, customers, economy, social traditions, educational institutions, governments, media, religious and technological organizations, and unions. These are external factors that are extremely uncontrollable[12].

Reference books provide examples of studies of restrictions curbing entrepreneurship.[13] The classification of business activity determinants in the context of potential barriers to the functioning of small and medium-sized enterprises is presented, among others, by H. Waniak-

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Michalak: information, financial, technological, administrative, market, macroeconomic, social, fiscal, legal determinants.

The analysis of research results on the barriers to entrepreneurship indicated three basic factors conditioning the functioning of small and medium-sized enterprises. They include: lack of financial resources, insufficient demand in the local, regional, national, international market and the level of tax burden. The financial barrier to acquire foreign capital is related, among others, to:

- high price of bank credits, set by financial institutions on the basis of credit risk evaluation, which in the case of small entrepreneurs paying tax on recorded revenue without deductible costs or fixed amount tax and entrepreneurs having no credit history, is higher than in the case of the rest of enterprises,
- high collateral required by funding institutions,
- formal requirements to provide proof of an enterprise's good financial situation and high success rate of the planned investment as well as to complete the required documents[14].

In addition, the Polish Confederation of Private Employers Lewiatan (PKPP Lewiatan) in the study *Czarna lista barier dla rozwoju przedsiębiorczości 2011* [The blacklist of barriers to entrepreneurship development 2011] distinguishes the barriers which refer to the use of structural funds as external sources of funding and are related to the lack of systemic information about the support possibilities for entrepreneurs[15].

The studies pay special attention to tax barriers. For more than 70% of small and medium-sized enterprises lack of clarity and explicitness of indirect taxes and business income taxes is a significant barrier to development. The owners of small and medium-sized enterprises believe that the lack of clarity of tax regulations increases the risk of business activities and generates costs, which unreasonably burden their businesses, thus limiting competitiveness[16].

One of the most significant barriers to the development of the SME sector are formal and legal determinants. Entrepreneurs complain about the lack of consistency and clarity of legal regulations. They think that there are too many formalities connected with running an enterprise and excessive bureaucracy prevents efficient resolution of many ongoing matters[17]. Inflexible law is another barrier to the development of small and medium sized enterprises. Enterprises build their position through specialization and adaptation of their offer to clients' individual needs. In order to attain that position, the application of diversified forms in the labour law and the possibility of using various employment solutions are necessary. The barrier of inflexible law limits the possibilities of companies to adapt to the changes of economic conditions and decreases their competitiveness. The grey zone – concealing revenues and employment – acts as a barrier to the majority of small and medium-sized enterprises, since it reduces the competitiveness of law-abiding entities. The grey zone results from changing business activity regulations and level of taxes. Furthermore, the influence of particular barriers on enterprises' growth depends on economic conditions. In the times of boom barriers relating to the labour market and qualifications are more acute, while in the times of economic slowdown and recession barriers concerning the finance of an enterprise and demand level[18].

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3. Research objectives and source of data

The article focuses on external economic determinants of entrepreneurship with respect to the functioning of small trade enterprises in Poland. The research presented in the article intends to identify and evaluate factors constituting barriers to the functioning of small enterprises with reference to their financial situation as perceived by the management of the enterprises. The main emphasis of the study was on entrepreneurship barriers in trade. The article complements scientific literature on this subject and is a part of wider research on entrepreneurship barriers in Poland.

The subjective data referring to the ability of small enterprises in Poland to settle current liabilities and to their financial situation comes from the *Badanie Koniunktury Gospodarczej [Study of Business Tendencies]* conducted by the Central Statistical Office (GUS).

The study of business tendencies in trade encompasses the population of retail trade (5000 enterprises), i.e. units classified in section G (division 45 and 47) of the Polish Classification of Activities[19] (PKD 2007). The units being studied are divided into four size classes: small (number of employees up to 49, subdivided into micro – up to 9 and properly small – the rest)[20], medium (number of employees from 50 to 249) and big (number of employees 250 and more). The units were selected by the stratified sampling method, without replacement, proportionally. The study of business tendencies in trade is conducted at a monthly frequency. The survey addressed to the entrepreneurs can be divided into two parts – diagnostic and prognostic[21] with the data coming from the former part. Owing to data accessibility, 79 quarterly observations of small enterprises (10-49 employees) from the fourth quarter of 1993 to the second quarter of 2013 were used. In order to achieve the compatibility between the length of time periods, monthly data were adjusted to quarterly periods (according to the last month of a quarter) from 2005 onwards.

4. The Models and Variables

Linear econometric model was used to evaluate the financial situation of a small trade enterprise.

$$SytFin_t = c + \boldsymbol{\beta}\mathbf{x}_t + \varepsilon_t,$$

where the *SytFin* variable is the dependent variable of the model. It results from averaging entrepreneurs' subjective responses to the question about "the ability to settle financial liabilities when due". Vector $\mathbf{x}$ is the vector of the independent variables described in Table 1, $\boldsymbol{\beta}$ is the vector of the variables' coefficients. The legitimacy of the use of models without lagged variables was investigated for similar data in Zawadzka D., Ardan R, (2011).

[19] The Ordinance of the Council of Ministers of 24 December 2007 (Dz. U. 251, item 1885).

[20] The smallest units were included in the study due to their significant share in the whole retail trade (they generate around 32% of sales revenues).

[21] The diagnostic part is concerned with the entrepreneurs' evaluation of: the unit's general economic situation, number of sold products, sale of products in the past three months, the level of held stock of products, predominant sources of purchase of products, ability to settle financial liabilities, predominant sources of current assets financing, prices of products, barriers encountered in economic activities. The prognostic part is concerned with: the general economic situation, demand for products, the number of sold products, total financial situation, including financial liabilities, employment, prices of products, orders with suppliers, capital expenditure. *Badanie koniunktury gospodarczej. Zeszyt metodologiczny zaopiniowany przez Komisję Metodologiczną GUS*, (2010).

Table 1. Variables influencing the ability to settle financial liabilities when due in the opinion of small trade enterprises' management

Variable	Variable description
InsuffDem	Insufficient demand
SellSpace	Selling space
EmplCosts	Costs of Labour
DiffCredit	Difficulties in obtaining credit
HighInterests	High bank interests
HighBudget	High payments to state revenue
HighDuties	High level of customs duties and imports charges
MarketComp	Competition on market.
DiffContractors	Difficulties in settling accounts with contractors.

Source: own work.

Table 2 presents descriptive statistics of the variables.

Table 2. Descriptive statistics of the variables adopted in the model of financial situation barriers to small trade enterprises

Variable	Mean	Median	Maximum	Minimum	Std. Dev.
SytFin	-13.96	-13.3	11.0	-37.4	10.47
InsufDem	48.00	46.8	66.3	32.2	8.72
SellSpace	9.57	9.1	17.2	5.0	2.97
EmplCosts	48.51	57.3	67.3	17.0	15.10
DiffCredit	10.12	9.9	18.4	5.2	2.74
HighInterests	23.14	21.5	40.1	12.7	6.37
HighBudget	55.12	55.2	65.1	46.0	4.22
HighDuties	4.65	3.6	22.6	1.0	3.76
MarketComp	62.77	65.5	73.5	47.5	8.02
DiffContractors	18.78	20.0	31.0	3.1	7.34

Source: own work.

The study of the business tendencies has a qualitative nature and refers to the subjective evaluations of the management of trade enterprises. A typical question is formed in such a manner that a respondent has to indicate weather his/her situation in a particular respect improved, did not change or deteriorated in comparison with the subsequent period. The data is aggregated separately for each question, and the stages of this process provide data for the sections adopted in the study assumptions. In the case of a qualitative single choice question with three options, the first stage of the calculation consists in adding up the number of answers for each option – positive (situation improved), neutral (situation did not change) and negative (situation deteriorated) given by the subjects comprising a particular stratum (e.g. small enterprises manufacturing food products). The next stage consists in calculating the breakdown of the three responses, which add up to 100% (e.g. 50% positive responses, 30% neutral, 20% negative). This breakdown is the so-called business tendency mirror. The simple business tendency indicator for this type of question is calculated as the difference between the percentage of positive and negative responses, which creates the so-called balance of answers for a given question. It means that the balance of answers does not include the middle answer, i.e. the neutral answer[22].

Variables representing barriers to the enterprise's activity are highly correlated: 21 out of 36 pairs of variables have significant coefficient of correlation at 5% significance level, with the highest correlation between *SellSpace* and *DiffContractors* variables (-0,877). Nine of significant coefficients are negative. The *SellSpace* variable has 4 negative coefficients of correlations with other variables out of 5 significant ones, while the *EmplCosts* variable has 3 negative out of 5 significant. The *SellSpace* is the only variable with significant positive coefficient of correlation with *SytFin*. There is significant negative correlations between *SytFin* and such explanatory variables: *InsufDem, EmplCosts, HighInterests* and *DiffContractors*.

5. Results and Discussion

One of the key problems encountered by small trade enterprises is creating product range and suitable sales policy.[23] It is reflected in the structuring of current assets, thus, among others, in inventory management and trade credit offer addressed to consumers, that is in current receivables management and attention to cash flows, which ensure an enterprise's ability to settle due and payable liabilities (business stability), including payments to the suppliers of products and services. Out of all PKD units, trade enterprises have the highest share of financing by trade credit[24]. Therefore, current assets of trade enterprises are predominantly financed from current liabilities. The already mentioned values demonstrate similar variation, nevertheless, there is a noticeable trend to increase the share of fixed capital in the financing of current assets.

Table 3 presents the estimation results of the linear model using the method of least squares.

Table 3. Parameters' estimation results of the initial model of liquidity barriers to small trade enterprises

Variable	Coefficient	Standard Error	t-Statistic	Probability
InsufDem	-0.8025	0.1598	-5.0222	0.0000
SellSpace	0.5593	0.5287	1.0579	0.2938
EmplCosts	-0.0677	0.1230	-0.5502	0.5840
DiffCredit	-0.0857	0.3250	-0.2636	0.7929
HighInterests	-0.0275	0.1739	-0.1582	0.8747
HighBudget	0.2631	0.2638	0.9973	0.3221
HighDuties	0.6172	0.3126	1.9744	0.0523
MarketComp	0.2395	0.1375	1.7414	0.0861
DiffContractors	-0.2982	0.2694	-1.1066	0.2723
C	-2.8185	12.9354	-0.2179	0.8282
R^2	0.7242		F-statistic	20.1313
Adjusted R^2	0.6882		Prob (F-statistic)	0.0000
DW Statistic	1.7928			

Source: own work.

[22] *Badanie koniunktury gospodarczej. Zeszyt metodologiczny zaopiniowany przez Komisję Metodologiczną GUS*, (2010).
[23] Cf. Sławińska M., (2002).
[24] Cf. D. Zawadzka, (2009).

The analysis of parameters' estimation results of the initial model of liquidity barriers to small trade enterprises shows the statistical significance of one variable – *InsufDem* (insufficient demand). Insufficient demand adversely affects the liquidity of small trade enterprises. The tested model is significant at 1% level of significance (the value of F-statistic of 20.131). The model describes 72.42% of the statistical variability of the phenomenon. Durbin-Watson statistic lies in the inconclusive range[25], but it is much closer to its higher limit, which justifies with substantial reliability the application of the least squares method to estimate the model.

Next, optimal set of regressors was determined using adjusted coefficient of determination $\overline{R^2}$ as criterion.[26] For this purpose, regressors with smallest value of absolute value of the t-ratio were consequently eliminated until all t-ratios became greater than 1 in absolute value.

As a result, the estimation of the model was performed on the basis of five variables (Table 4).

Table 4. Parameters' estimation results of the final model of liquidity barriers to small trade enterprises

Variable	Coefficient	Standard Error	t-Statistic	Probability
InsufDem	-0.7252	0.0997	-7.2728	0.0000
SellSpace	0.7135	0.4695	1.5197	0.1329
HighDuties	0.5944	0.2735	2.1734	0.0330
MarketComp	0.2921	0.0985	2.9643	0.0041
DiffContractors	-0.3914	0.1955	-2.0020	0.0490
C	0.2692	11.0041	0.0245	0.9806
R^2	0.7202		F-statistic	37.5832
Adjusted R^2	0.7011		Prob (F-statistic)	0.0000
DW Statistic	1.8442			

Source: own work.

The research procedure applied enabled parameters' estimation of the final model of liquidity barriers to small trade enterprises, showing the statistical significance of four barriers/variables, *InsufDem* (insufficient demand), *HighDuties* (high customs duties and import liabilities), *MarketComp* (market competion) and *DiffContractors* (difficulties in settlements with contractors). Variables *InsufDem* and *MarketComp* are significant at 1% level, while the other two – at 5% level. There is no statistical evidence of first order autocorrelation of residuals.[27] The model is statistically significant.

[25] The inconclusive range occurs when the test $d_l \leq DW \leq d_u$ or $4 - d_u \leq DW \leq 4 - d_l$ gives no answer as to the existence of autocorrelation. The critical values of Durbin-Watson's test are accepted: lower d_l and upper d_u of the distribution depending on the number of estimated parameters (k+1) and the size of the sample T. The critical values of Durbin – Watson's test for 79 observations and 9 explanatory variables amount to respectively d_L=1.391, d_U=1.894. In: Savin N.E. and White K.J. (1977).
[26] Greene W.H., (2000), p.306.
[27] Upper critical value of DW statistics d_U=1.771 for 79 observations and 5 explanatory variables.

6. Conclusion

The research presented in this chapter allowed the identification of external economic barriers to the functioning of small trade enterprises in Poland. The data was provided by *Badanie koniunktury gospodarczej [Study of Business Tendencies]* conducted by the *Central Statistical Office (GUS)*. The evaluation of the identified barriers to entrepreneurship was performed by means of statistical tools. The conducted studies allowed to formulate the following general conclusions:

1. The barrier of difficulties in settlements with contractors has a statistically significant influence on the liquidity of trade enterprises. Its importance in this group stems from the fact that sale terms and conditions together with trade credit are indispensable while preparing sale offer.
2. As the entrepreneurship barriers at small trade enterprises should be treated primarily insufficient demand and difficulty in settlements with contractors that have a statistically significant negative impact on the financial situation of enterprises.
3. Perceptions of customs and import duty and of the market competition as obstacles in activity are concomitant with the improvement of the financial situation of enterprises.
4. Comparing with the study of all trading enterprises (see Zawadzka D., Ardan R, (2011)), a new significant factor for small enterprises is the market competition..

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Comparison Value at Risk with Extreme Value Theory

Kateřina Zelinková [1]

Abstract

The paper is focus on comparison of aproach Value at Risk and Conditional Value at Risk method by assuming normal distribution and Student distribution and Extreme Value Theory by assuming Pareto distribution. The structure of this paper is following. Firstly, the method Value at Risk and Conditional Value at risk for normal and Student distribution is explained and subsequently Extreme Value Theory. There are estimated value of given probability distribution and Extreme Value Theory. The data for determination of risk are four stock market indices (CAC 40, ATX, AEX a DAX).

Key words

Normal distribution, Student distribution, Value at Risk, Extreme Value Theory

JEL Classification: C16, G22, G32

1 Úvod

Value at Risk je považován za základní měřítko pro kvantifikaci tržního, pojistného, nebo kreditního rizika. Také se používá pro stanovení kapitálového požadavku v bankách či v pojišťovnách. Metodologie Value at Risk (VaR) je popsána v řadě knih, [1], [4], [7], [8], [10], [11]. Artzner [3] charakterizoval tzv. koherentní riziko, které je definováno čtyřmi předpoklady, tj. monotónnost, sub-aditivita, homogenitu a translační invarianci. Právě předpoklad subaditivita nemá Value at Risk, a proto se používá Conditional Value at Risk (CVaR).

Analytická metoda, která je v předloženém článku použita, náleží do skupiny tzv. parametrických lineárních VaR modelů. U této metody se většinou předpokládá, že rizikové faktory, v tomto případě výnosy, mají normální rozdělení, Studentovo t-rozdělení nebo smíšené rozdělení pravděpodobnosti. Tato metoda je efektivní a relativně rychlá, je vhodná spíše pro větší portfolia. Dále bude uvedena teorie extrémních hodnot (Extreme Value Theory – EVT), která se zabývá výskytem extrémních odchylek od střední hodnoty rozložení pravděpodobností. Tato teorie se v současnosti využívá při sofistikovaném řízení rizik, zejména při ohodnocení mimořádných pojistných událostí a dále při ohodnocení rizik souvisejících s tzv. tlustými konci. Teorie extrémních hodnot je popsána v řadě knih, např. [5], [6], [9].

Cílem předložené práce je srovnat přístup metody Value at Risk a Conditional Value at Risk za předpokladu normálního a studentova rozdělení pravděpodobnosti a metody teorie extrémních hodnot pomocí přístupu peak over thershold.

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2 Metody odhadu rizika

Následující podkapitoly obsahují charakteristiku a způsob stanovení Value at Risk, Conditional Value at Risk a hlavní princip teorie extrémních hodnot.

2.1 Value at Risk a Conditional Value at Risk

Value at Risk je velmi rozšířené měřítko v oblasti řízení rizik. Používá se pro kvantifikaci tržního, pojistného, kreditního či operačního rizika. Výhodou tohoto kritéria je, že poskytuje jedno číslo, které shrnuje celkové riziko portfolia finančních aktiv, a proto si získal oblibu mezi manažery, zejména finančních institucí.

Ukazatel Value at Risk je definován jako nejmenší predikovaná ztráta na dané hladině pravděpodobnosti za daný časový interval. Také lze charakterizovat Value at Risk jako jednostranný interval spolehlivosti potencionálních ztrát hodnoty portfolia po danou dobu držení, což lze zapsat:

$$F\left(x\right)=P\left(X\leq -VaR_{\alpha,\Delta t}\left(x\right)\right)=\alpha \tag{1}$$

kde $F(x)$ je distribuční funkce, α je hladina spolehlivosti and Δt je časový horizont.

Expected Shortfall (ES) se také nazývá Conditional Value at Risk (CVaR) nebo Expected Tail Loss (ETL). ES lze definovat jako průměrnou velikost očekávaných ztrát, které převýší hodnotu Value at Risk. Jedná se o veličinu, která tedy vyjadřuje střední hodnotu ztráty v případě, že ztráta bude vyšší než hodnota Value at Risk. Tedy hodnota CVaR je vždy vyšší než hodnota VaR. Matematicky lze CVaR vyjádřit následovně:

$$CVaR_{\alpha}\left(X\right)=-E\left(X/X<VaR_{\alpha}\right) \tag{1}$$

kde VaR_{α} je očekávaná ztráta, X je náhodná veličina vyjadřující zisk či ztrátu a představuje hodnotu VaR na hladině významnosti α.

Vzhledem k tomu, že CVaR udává konkrétní hodnotu ztráty při překročení hladiny neočekávané ztráty, umožňuje riziko popsat komplexněji než při použití VaR.

2.1.1 Výpočet VaR a CVaR pro normální rozdělení

Normální rozdělení pravděpodobnosti je jedním z neznámějších rozdělení pravděpodobností spojité náhodné veličiny. Náhodná proměnná X má normální rozdělení, jestliže se funkce hustoty rovná

$$\varphi(X)=\frac{1}{\sqrt{2\pi\sigma^2}}exp\left[-\frac{(x-\mu)}{2\sigma^2}\right], \tag{2}$$

kde μ zobrazuje střední hodnotu, σ^2vyjadřuje rozptyl a proměnná X nabývá hodnot z intervalu (-∞;∞). Obecně se znázorňuje normální rozdělení takto X – N (μ σ^2), za předpokladu, že proměnná X má normální rozdělení se střední hodnotou μ a směrodatnou odchylkou σ .

Pro standardní náhodnou proměnnou se často používá označení *Z*. Jakoukoliv náhodnou proměnnou lze pomocí standardní normální transformace přeměnit na standardní normální proměnu. Transformace náhodné proměnné na standardizovanou je velmi jednoduchá, je daná vztahem

$$Z=\frac{X-\mu}{\sigma}.$$

Normální rozdělení je v praxi značně využíváno díky svým vlastnostem, zejména jednoduchosti, která spočívá v potřebě pouze dvou snadno zjistitelných parametrů (μ ,σ^2).

$$VaR = \Phi^{-1}(\alpha)\cdot\sigma - \mu, \tag{3}$$

kde Φ^{-1}je inverzní funkce k distribuční funkci normovaného normálního rozdělení,α je hladina významnosti, σ je směrodatná odchylka, μ střední hodnota. Výpočet pro hodnotu Conditional Value at Risk má tvar

$$CVaR = \alpha^{-1}\left[\frac{1}{\sqrt{2\pi}}\exp\left(-\frac{1}{2}z^2\right)\right]_{-\infty}^{\phi^{-1}(\alpha)} \tag{4}$$

2.1.2 Výpočet VaR a CVaR pro Studentovo rozdělení

Studentovo t- rozdělení je kontinuální rozdělení pravděpodobnosti, kterým můžeme vyčíslit střední hodnotu a normální distribuci populace. Můžeme jej použít za předpokladu, že daný vzorek údajů je malý. Ve Studentově rozdělení je obsažen parametr, který se nazývá stupně volnosti a je označován písmenem *v*. Studentovo t-rozdělení úzce souvisí s normovaným normálním rozdělení a s rostoucím stupněm volnosti se k normálnímu rozdělení přibližuje. Pokud je $v \geq 30$, tak se toto rozdělení považuje již za normální. Čím nižší je stupeň volnosti, tím nižší je vrchol křivky funkce hustoty a tím těžší jsou její konce. Studentovo rozdělení pravděpodobnosti je více popsáno v knize [2].

Funkce hustoty pro Studentovo t-rozdělení s *v* stupni volnosti je definována následujícím vztahem

$$f_v(t) = (v\pi)^{\frac{-1}{2}}\Gamma\left(\frac{v}{2}\right)^{-1}\Gamma\left(\frac{v+1}{2}\right)\left(1+\frac{t^2}{v}\right)^{-\left(\frac{v+1}{2}\right)}. \tag{5}$$

kde gamma funkce Γ je rozšířením funkce faktoriálu n! na neceločíselné hodnoty. Náhodná proměnná, která má Studentovo t-rozdělení se značí $T\sim t_v$. Studentovo rozdělení má střední hodnotu 0 a pro rozptyl $v > 2$, $\sigma^2 = v(v-2)^{-1}$.

Vztah pro výpočet Value at Risk za předpokladu Studentova rozdělení pravděpodobnosti je následující

$$VaR = \sqrt{v^{-1}(v-2)}t^{-1}(\alpha)\sigma - \mu. \tag{6}$$

Vztah pro výpočet CVaR za předpokladu Studentova rozdělení pravděpodobnosti je následující

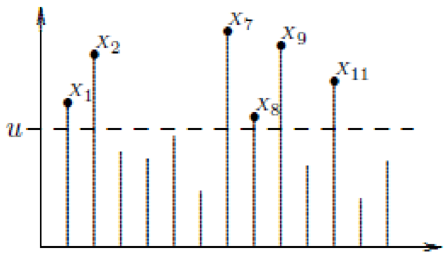
$$CVaR_{h,\alpha,v}(T) = \alpha^{-1}(v-1)^{-1}(v-2+x_\alpha(v)^2)f_v(x_\alpha(v))\sigma - \mu. \tag{7}$$

2.2 Extreme Value Theory

Teorie extrémních hodnot (Extreme Value Theory – EVT) je moderní odvětví statistiky, které se zabývá výskytem extrémních odchylek od střední hodnoty rozložení pravděpodobností. Teorie extrémních hodnot se dnes ve velké míře využívá pro posuzování rizik vyplývajících z výskytu vysoce nepravděpodobných událostí. Empirické výsledky ukazují, že extrémní události jako jsou velké zisky nebo ztráty, se vyskytují s vyšší pravděpodobností, než se předpokládá u normálního rozdělení. Z toho důvodu byla navržena další rozdělení pravděpodobnosti, která vystihují těžké konce. Právě Extreme Value Theory se zabývá těmito extrémními jevy.

Existují dva způsoby jak stanovit EVT. První způsob vychází z Fischer-Tippet-Gnedenko teorému nazývá se Block Maxima (BM). Druhý způsob vychází z Pickladns – Dlaekma – De Hann teorému a je označován jako Peak over Theshold (POT). V následujícím obrázku 2-1 jw graficky znázorněná metoda POT, která bude použita pro stanovení VaR a CVaR.

Obrázek 1 Excesses over threshold



V rámci této metody Peak over Thereshold se přistupuje k identifikaci extrémních událostí pomocí definování prahové hodnoty, jejíž překročení implikuje výskyt extrémní události. Podle příslušného Picklands – Dalkema - De Hann teorému lze velmi dobře aproximovat zobecněným Paterovo rozdělením, kde daná funkce je následující

$$F_{\xi,\beta}(x) = \begin{cases} 1\text{-}\left(1+\xi\dfrac{x}{\beta}\right)^{-1/\xi} & ;\xi \neq 0, \\ 1\text{-}\exp\left(\text{-}\dfrac{x}{\beta}\right) & ;\xi = 0, \end{cases} \tag{9}$$

kde ξ je parametr, který stanovuje těžší konce rozdělení and β je parametr míry. Odhad parametrů Paretova rozdělení pravděpodobnosti je pomocí metody maximální věrohodnosti. Funkce hustoty zobecněného Paretova rozdělení $F_{\zeta,\sigma}(x)$ je odvozena z distribuční funkce ze vztahu 2-11 derivováním podle *x* a má tvar

$$F_{\xi,\sigma} = \frac{1}{\beta}\left(1+\frac{\xi x}{\beta}\right)^{-1/\xi-1} \tag{10}$$

Předpokládejme, že takových pozorování je n_u. Funkce věrohodnosti má tedy tvar (pro $\xi \neq 0$)

$$L = \prod_{i=1}^{n_u} \frac{1}{\beta}\left(1+\frac{\xi(x_i-u)}{\beta}\right)^{-1/\xi-1}.$$

Maximalizovat tuto funkci je stejné jako maximalizovat její logaritmus, tedy

$$L = \sum_{i=1}^{n_u} ln\left[\frac{1}{\beta}\left(1+\frac{\xi(x_i-u}{\beta}\right)\right]^{-1/\xi-1}. \tag{11}$$

Výpočet Value at Risk v rámci EVT je dán

$$VaR = u + \frac{\beta}{\xi}\left[\left(\frac{n}{n_u}(1-\alpha)\right)^{-\xi} - 1\right] \tag{12}$$

kde α je úroveň spolehlivosti, n je počet všech pozorování a n_u počet překročení nad prahovou hodnotu u. Odhad Conditional Value at Risk má tvar

$$CVaR_{\alpha,\Delta t} = VaR_{\alpha,\Delta t} + \frac{\beta + \xi(VaR_{\alpha,\Delta t} - \mu)}{1-\xi} = \frac{VaR_{\alpha,\Delta t}}{1-\xi} + \frac{\beta - \xi\mu}{1-\xi}. \tag{13}$$

3 Aplikační část

V této části jsou odhadnuty hodnoty pro VaR a CVaR za předpokladu normálního a studentova rozdělení pravděpodobnosti, a také stanovení míry rizika pomocí teorie extrémních hodnot. Všechny odhady jsou počítány pro hladiny spolehlivosti ve výši 99,5 %, 99 % a 90 % a časový horizont je 1 den.

3.1 Data

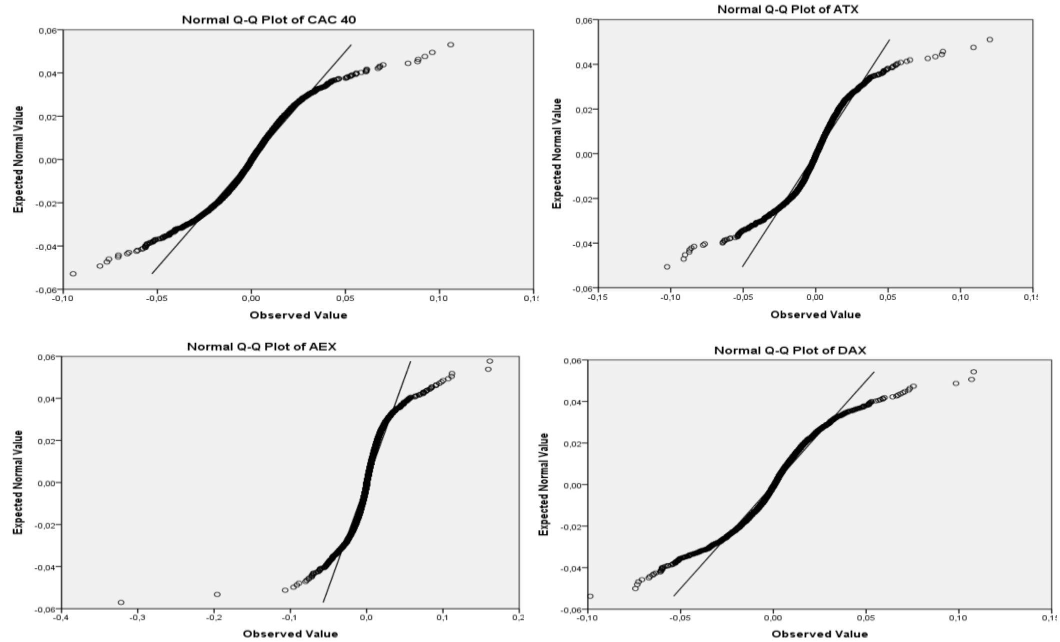
Odhad Value at Risk a Conditional Value at Risk byl proveden na logaritmických výnosech burzovních indexů CAC 40, ATX, AEX a DAX. Základní číselné charakteristiky, zejména střední hodnota, směrodatná odchylka, špičatost, šikmost uvádí následující tabulka.

Tabulka 1: Základní charakteristiky časových řad

Burzovní index	Střední hodnota	Rozptyl	Směrodatná odchylka	Špičatost	Šikmost	Začátek	Konec	Počet dní
CAC 40	0.0123%	0.00021	1.4319%	4.4591	-0.0232	01.03.1990	18.01.2013	5794
ATX	0.0236%	0.00019	1.3883%	7.5503	-0.3840	12.11.1992	18.01.2013	4993
AEX	0.0193%	0.00019	1.3705%	6.8837	-0.1317	31.12.1982	18.01.2013	6333
DAX	0.0299%	0.00021	1.4638%	4.6443	-0.0972	26.11.1990	18.01.2013	5606

Nejprve byly provedeny QQ ploty. Výsledky grafických testů jsou uvedeny v Obrázek 1.

Obrázek 1: QQ plot



Podle provedených testů dobré shody se ukázalo, že žádné testované rozdělení pravděpodobnosti nepopisuje věrohodně empiricky napozorovaná data. Nasbíraná data vykazují těžší konce rozdělení oproti zkoumaným teoretickým rozdělením pravděpodobnosti. Z toho důvodu je vhodné stanovit VaR a CVaR pomocí jiných typů rozdělení, které akceptují těžší konce rozdělení. Mezi takové přístupy patří právě použití Studentovo rozdělení a také teorie extrémních hodnot.

3.2 Výpočet VaR a CVaR pro normální rozdělení

V následující tabulce jsou odhadnuty hodnoty VaR pro dané burzovní indexy a jednotlivé typy hladiny významnosti. Kalkulace VaR se provedla dle vztahu (4).

Tabulka 1: Výpočet VaR pro normální rozdělení

	CAC 40	ATX	AEX	DAX
VaR 0.5 %	3.70%	3.60%	3.55%	3.80%
VaR 1 %	3.34%	3.25%	3.21%	3.44%
VaR 10%	1.85%	1.80%	1.78%	1.91%

Hodnota VaR znamená, že pokud budeme investovat do akciového indexu CAC 40 1000 Kč, tak maximální ztráta bude 36,8 Kč. Lze vidět, že čím vyšší je hladina významnosti, tím nižší je hodnota Value at Risk.

V tabulce 3 jsou odhadnuty hodnoty CVaR pro dané burzovní indexy a jednotlivé typy hladiny významnosti. Kalkulace CVaR se provedla dle vztahu (5).

Tabulka 2: Výpočet CVaR pro normální rozdělení

	CAC 40	ATX	AEX	DAX
CVaR 0.5 %	23.96%	23.22%	22.92%	24.48%
CVaR 1 %	26.00%	25.20%	24.88%	26.56%
CVaR 10%	15.77%	15.28%	15.09%	16.11%

CVaR tedy vyjadřuje střední hodnotu ztráty převyšující hodnotu Value at Risk na dané hladině pravděpodobnosti. Tedy pro burzovní index CAC 40 je středního hodnota ztráty převyšující hodnotu VaR rovna hodnotě 23,96 % na hladině pravděpodobnosti 0,5 %.

3.3 Výpočet VaR a CVaR pro Studentovo rozdělení

Nejprve jsou odhadnuty stupně volnosti (v) Studentova rozdělení dle metody maximální věrohodnosti, jednotlivé hodnoty jsou uvedeny v Tabulce 4.

Tabulka 3: Stupně volnosti

CAC 40	ATX	AEX	DAX
8.14	6.08	4.14	5.02

V následující Tabulce 5 jsou odhadnuty hodnoty VaR pro dané burzovní indexy a jednotlivé typy hladiny významnosti. Kalkulace VaR za předpokladu studentova rozdělení se provedla dle vztahu (7).

Tabulka 4: Výpočet VaR pro Studentovo rozdělení

	CAC 40	ATX	AEX	DAX
VaR 0.5 %	4.75%	4.33%	5.50%	5.39%
VaR 1 %	4.16%	4.19%	4.52%	4.55%
VaR 10%	2.30%	2.19%	2.08%	2.26%

Hodnota Value at Risk je vyšší za předpokladu Studentova rozdělení pravděpodobnosti, než za normálního rozdělení.

V Tabulce 6 jsou odhadnuty hodnoty CVaR pro dané burzovní indexy a jednotlivé typy hladiny významnosti. Kalkulace CVaR se provedla dle vztahu (8).

Tabulka 5: Výpočet CVaR pro Studentovo rozdělení

	CAC 40	ATX	AEX	DAX
CVaR 0.5 %	29.26%	28.36%	28.00%	29.89%
CVaR 1 %	30.07%	29.14%	28.77%	30.72%
CVaR 10%	19.65%	19.04%	18.80%	20.07%

3.4 Výpočet VaR a CVaR v rámci EVT

Kalkulace EVT bude provedena dle metody Peak-over-Threshold (POT). Pro stanovení VaR a ES pomocí EVT je nutné stanovit prahovou hodnotu výše extrémní ztráty (u), která může být blízko 95. percentilu empirického rozdělení. Pak seřadíme pozorování x od nejvyššího po nejnižší a zaměříme naši pozornost na ta pozorování, kde $x > u$. Dále je nutné odhadnout parametry zobecněného Paretova rozdělení pravděpodobnosti. Pro odhad jednotlivých parametrů je opět použita metoda maximální věrohodnosti s využitím dat, jejichž výše přesáhla stanovený práh. Výsledky jsou uvedeny v následující Tabulka 6.

Tabulka 6: Odhady parametrů zobecněného Paretova rozdělení

	CAC 40	ATX	AEX	DAX
u	2.118%	1.933%	2.010%	2.225%
nu	291	251	290	281
β	2.828	1.943	2.487	2.87489
ξ	1.81458	1.1458	1.58	1.941458

Nakonec je určena hodnota VaR dle vztahu (12) a CVaR dle vztahu (13) pomocí EVT pro jednotlivé hladiny pravděpodobnosti.

Tabulka 7: Výpočet VaR a CVaR v rámci EVT

	CAC 40	ATX	AEX	DAX
VaR 0.5 %	29.78%	32.25%	33.09%	28.37%
VaR 1 %	30.06%	32.45%	33.37%	28.67%
VaR 10%	36.03%	36.38%	39.05%	34.79%
CVaR 0.5 %	35.31%	36.47%	43.03%	28.99%
CVaR 1 %	35.66%	36.70%	43.40%	29.30%
CVaR 10%	42.99%	41.20%	50.93%	35.81%

Výše kapitálu na krytí neočekávaných ztrát pro danou hladinu významnosti 0,5%, 1 % a 10 % je v případě VaR v rámci EVT mnohonásobně vyšší než v případě Value at Risk za předpokladu normálního či Studentova rozdělení pro všechny uvedené burzovní indexy.
V případě hodnoty CVaR není takový rozdíl mezi jednotlivými rozděleními. Pro burzovní index CAC 40 je hodnota $CVaR_{0,05\%}$ za předpokladu normálního rozdělení ve výši 23,96 %, za předpokladu Studentova rozdělení je ta hodnota vyšší, a to 29,26 % a v rámci EVT je 35,31 %.

4 Závěr

Cílem předložené práce je srovnat přístup metody Value at Risk a Conditional Value at Risk za předpokladu normálního a studentova rozdělení pravděpodobnosti a metody teorie extrémních hodnot pomocí přístupu Peak over Thershold.

Struktura práce je následující, nejprve je vysvětlena metoda Value at Risk a Conditional Value at Risk pro normální a studentovo rozdělení pravděpodobnosti a dále teorie extrémních hodnot. Použitá data jsou čtyři burzovní indexy, a to CAC 40, ATX, AEX a DAX.

V praktické části byly vypočteny hodnoty Value at Risk a Conditional Value at Risk za předpokladu normálního rozdělení a Studentova t-rozdělení a také pomocí metody teorie extrémních hodnot. Teorie extrémních hodnot a studentovo rozdělení se používá zejména v případech, kdy existují tzv. těžké konce.

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Flexible business model – real option approach

Zdeněk Zmeškal[1]

Abstract

There is in the paper flexible business model described. As the underlying random factor the GRI - gross return investment is applied. Introduced is a generalised binomial model, including the arithmetic and geometric random process

Key words

Business model, flexibilita, reálné opce, náhodný proces, binomický model

JEL Classification: G31, G32

1. Úvod

Oceňování a investiční rozhodování (capital budgeting) podniku a projektů je důležitou úlohou ve finančním rozhodování. Důležitým aspektem je flexibilita rozhodování, tedy možnost budoucích manažerských rozhodnutí. Rozlišuje se pasivní přístup (bez možnosti budoucích zásahů) a aktivní flexibilní přístup (s možností budoucích zásahů). S tím souvisí náhodný proces vývoje podkladových aktiv a cash flow. Jedním z přístupů je aplikace business modelu za rizika a flexibility.

Cílem příspěvku je popis flexibilního business modelu včetně zobecněného binomického modelu a aritmetických a geometrických náhodných procesů a prezentovat kategorizaci modelů za rizika a flexibility, včetně příkladů.

2. Zobecněný jednofaktorový binomický model

Stochastické procesy lze vyjádřit pomocí stochastických diferenciálních rovnic (SDE),které mají obecný tvar vyjádřený v případě Gaussova rozdělení Itoovou rovnicí

$$dx = \alpha(x,t)\cdot dt + \sigma(x,t)\cdot dz \, .$$

Propočet cen opcí lze řešit pomocí numerických lattice (svaz) metod lze provést pomocí replikačních nebo hedgingových přístupů. Častým řešením je binomický model. V případě, že se vychází ze skutečných stochastických procesů, pak základním principem je, že výsledek numerické aproximace musí odpovídat vybraným statistickým momentům. Vzhledem k tomu, že je Itoův proces je založen na normálním rozdělení, jsou odpovídajícími momenty střední hodnota a rozptyl (místo rozptylu lze použít i druhý moment, přičemž výsledek bude identický). Jednou z často kladených podmínek je, že má být splněna rekombinace, tedy že hodnota podkladového faktoru při růstu je opakem při poklesu, tedy $\Delta y + (-\Delta y) = 0$, přitom $y^u_{t+\Delta t} = y_{\Delta t} + \Delta y$, $y^d_{t+\Delta t} = y_{\Delta t} - \Delta y$, blíže viz Obr. 1.

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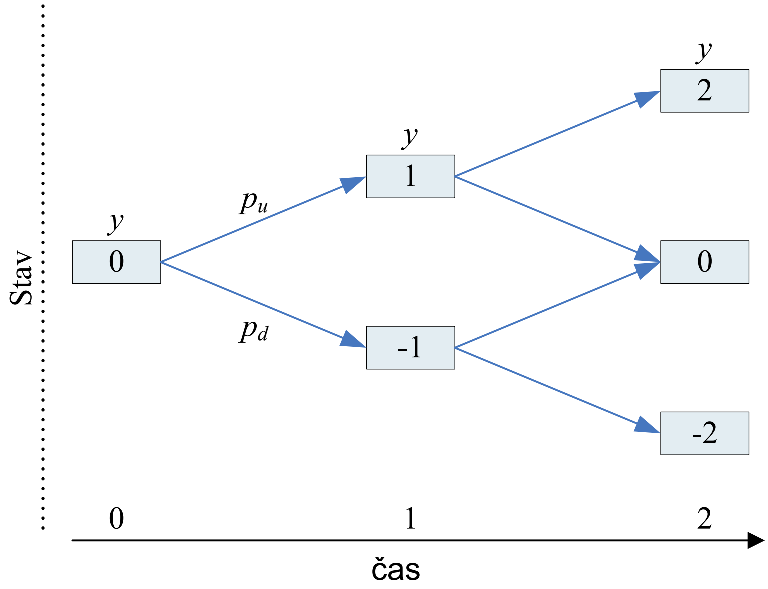
Obr. 1: Rekombinační binomický model



Tedy podmínky jsou následující:

$$p_u \cdot (\Delta y) + (1 - p_u) \cdot (-\Delta y) = E(\Delta y),$$

$$\left(p_u \cdot (\Delta y)^2 + (1 - p_u) \cdot (-\Delta y)^2\right) - \left(p_u \cdot (\Delta y) + (1 - p_u) \cdot (-\Delta y)\right)^2 = \operatorname{var}(\Delta y),$$

$$\Delta y + (-\Delta y) = 0.$$

Jde tedy o tři rovnice o třech neznámých, p_u, $\Delta y, -\Delta y$, což jsou pravděpodobnosti růstu, přírůstek a pokles hodnoty. Dále $p_d = 1 - p_u$ je pravděpodobnost poklesu. Řešení je následující,

$$p_u = \frac{1}{2} \cdot \left(1 + \frac{E(\Delta y)}{\Delta y}\right), \quad \Delta y = \sqrt{\operatorname{var}(\Delta y) + E(\Delta y)^2}.$$

Aby byla splněna podmínka nemožnosti arbitráže, pak musí platit, že $-\Delta y \le E(\Delta y) \le \Delta y$.

Přitom je důležité rozlišovat řešení v případě úplného (complete) nebo neúplného (incomplete) trhu. V prvním případě je výsledkem jednoznačné řešení, neboť počet neznámých odpovídá počtu rovnic. Ve druhém případě to splněno není, výsledkem je buď interval hodnot anebo je nutné přidat preference rozhodovatele pomocí užitkových funkcí a používat optimalizační metody řešení.

Je známo, že aby řešení odpovídalo principu nemožnosti arbitráže, pak stanovené pravděpodobnosti přechodu musejí být kladná čísla v intervalu $p_u \in [0;1]$.

Tedy pravděpodobnost růstu s omezením obecně,

$$p_u = \max\left\{\min\left[\frac{1}{2} \cdot \left(1 + \frac{E(\Delta y)}{\Delta y}\right);1\right];0\right\}, \quad \Delta y = \sqrt{\operatorname{var}(\Delta y) + E(\Delta y)^2}.$$

Dalším základním konceptem je, že oceňování se provádí za rizikově-neutrální pravděpodobnosti, tedy že výnos podkladových aktiv (faktorů) musí být bezrizikový, *r*.

2.1. Typy stochastických procesů

Itoův proces je jedním z obecných typů stochastických procesů, který zahrnuje Wienerovy, Brownovy, mean-reversion procesy (Vašíčkův process, CIR (Cox-Ingersoll-Ross) proces, HW (Hull-White) proces). Tento proces lze rozdělit na dvě složky trend a odchylku (reziduum), pro proměnnou *x* je definován následovně:

$dx = trend + reziduum = a(x;t)\cdot dt + \sigma(x;t)\cdot dz$,

kde $a(x;t)$ je parametr trendu, $\sigma(x;t)$ je směrodatná odchylka změny proměnné, dt je časový interval, dz je tzv. specifický Wienerův proces. Wienerův proces je definován takto,

$dz \equiv \tilde{z}_T - z_0 = \tilde{z}\cdot\sqrt{dt}$, s tím, že $\tilde{z}$ je náhodná proměnná z normovaného normálního rozdělení $N(0;1)$. Dále platí, že střední hodnota $E(dz) = 0$, rozptyl $\operatorname{var}(dz) = t$ a směrodatná odchylka $\sigma(dz) = \sqrt{t}$.

Stochastické procesy lze rozdělit na aritmetické, s oborem kladných i záporných hodnot, a dále geometrické procesy s oborem hodnot pouze v oboru kladných hodnot. Aritmetické procesy jsou typické pro výnosy a geometrické pro ceny.

Pro aproximaci je nutné znát střední hodnotu a rozptyl. Obvykle se z obecného procesu pomocí Itoovy lemy upraví stochastická diferenciální rovnice. Následně pomocí integrálu a stochastického integrálu odvodí přírůstek hodnoty.

Dále budou uvedeny aritmetický Brownův proces (ABM), Vašíčkův (aritmetický) proces (VAP), geometrický Brownův proces (GBP)a Schwartzův (geometrický) proces (SGP).

Aritmetický Brownův proces (ABM)

$dx = a\cdot dt + \sigma\cdot dz$,

$\Delta x = a\cdot\Delta t + \sigma\cdot\sqrt{\Delta t}\cdot\varepsilon$,

$E(\Delta x) = a\cdot\Delta t$, $\operatorname{var}(\Delta x) = \sigma^2\cdot\Delta t$.

Vašíčkův (aritmetický) proces (VAP)

$dx = a\cdot(b - x)\cdot dt + \sigma\cdot dz$,

kde a je parametr rychlosti přibližování k dlouhodobé rovnováze, b je parametr dlouhodobé rovnováhy, x_t je ukazatel, σ je směrodatná odchylka rezidua.

$$E(\Delta x) = b + (a-b)\Delta t\cdot e^{-a\Delta t} - x,\quad \operatorname{var}(\Delta x) = \frac{\sigma^2}{2a}\left(1 - e^{-2a\Delta t}\right)\Delta t.$$

Geometrický Brownův proces (GBP)

$dx = a\cdot x\cdot dt + \sigma\cdot x\cdot dz$,

$d\ln(x) = \left(a - 0{,}5\cdot\sigma^2\right)dt + \sigma\cdot dz$,

$E(\Delta\ln(x)) = \left(a - 0{,}5\cdot\sigma^2\right)\Delta t$, $\operatorname{var}(\Delta\ln(x)) = \sigma^2\Delta t$.

Schwartzův (geometrický) proces (SGP)

$dx = a\cdot x\cdot[b - \ln(x)]\cdot dt + \sigma\cdot x\cdot dz$,

$d\ln(x) = a\cdot(b - x)\cdot dt + \sigma\cdot dz$,

$$E(x_t)) = EXP\left\{\left[\ln(x_{t-\Delta t}) \div EXP(-a\Delta t)\right] + \left[b - \frac{\sigma^2}{2a}\right]\cdot\left(1 - EXP(-a\Delta t)\right)\right\},$$

$$\operatorname{var}(x_t) = \frac{\sigma^2}{2a}\left(1 - e^{-2a\Delta t}\right)\Delta t.$$

2.2. Ocenění reálné opce dle binomického modelu

Procedura ocenění reálné opce vychází z replikační strategie a identity momentů procesů a binomického modelu.

Procedura řešení

(i) Stanovení rizikově-neutrální hodnoty růstu aktiv Δy.

(ii) Vyjádření vývoje podkladových rizikových aktiv (faktorů) x dosazením do rovnic $y^u_{t+\Delta t} = y_{\Delta t} + \Delta y$, $y^d_{t+\Delta t} = y_{\Delta t} - \Delta y$.

(iii) Stanovení rizikově-neutrálních pravděpodobností p_u, p_d.

(iv) Potom je propočtena hodnota aktiv A.

(v) Dalším krokem je stanovení vnitřní hodnoty VH.

(vi) V době realizace T se cena opce rovná vnitřní hodnotě, $f_T = VH_T$.

(vii) Dále následuje propočet ceny americké opce. Zpětným postupem od doby realizace se stanoví cena opce pro jednotlivé uzly, které jsou dány časem a stavem až k počáteční hodnotě.
V jednotlivých uzlech se cena opce určí jako současná hodnota střední hodnoty ceny opce v následujícím období, $f_t = \max\left[e^{-r\cdot dt}\cdot \widehat{E}(f_{t+dt}); VH_t\right]$, kde $\widehat{E}(f_{t+dt})$ je rizikově-neutrální střední hodnota, $\widehat{E}(f_{t+dt}) = \left[f^u_{t+\Delta t}\cdot p_u + f^d_{t+\Delta t}\cdot p_d\right]$.

(viii) Hledaná cena opce f_0 odpovídá ceně na počátku celého období, v daném případě hodnotě vlastního kapitálu firmy.

(ix) Stanovení typu rozhodnutí, Q_t, tedy buď využít nebo nevyužít opci, $Q_t = \arg\max_q \left[e^{-r\cdot dt}\cdot \widehat{E}(f_{t+dt}); VH_t\right]$

3. Flexibilní business model

Podniky poskytují zboží a služby. Tento proces přináší podnikům výnosy, jejichž výše záleží zejména na podnikatelských rizicích. Každý podnik má svůj odlišný postup na výrobu zboží, poskytování služeb a současně generování výnosů svým investorům. Tento specifický proces je zahrnut v business modelu.

3.1. Předpoklady modelu

Předpokladem modelu je plochá výnosová křivka v konstantní míře bezrizikové úrokové míry, R_f, efektivní trh a podnik maximalizující zisk. Předpokládá se jednoduchý podnikový model aplikovaný na sektor obchodních řetězců. Ústředním bodem business modelu je náhodná veličina tzv. návratnost investic, GRI, která měří tržby generované investicemi a předpokládá se, že je tato veličina nejistá a tudíž hlavním zdrojem podnikatelského rizika. GRI lze určit následovně,

$$GRI = \frac{T}{INV},$$

kde T jsou tržby a INV jeho kapitálové investice.

Pro stanovení hodnoty aktiv společnosti A, lze použít následujícího vztahu,

$$A = \frac{SA\cdot GRI\cdot m}{\rho},$$

kde SA jsou stálá aktiva společnosti, ρ představuje náklady kapitálu, $m = \frac{EBT}{T}$, přičemž EBT je hrubý zisk.

V tomto příkladu se předpokládá, že společnost je nezadlužená, a nemá povinnost platit daň ze zisku. Ve složitějším případě, se předpokládají fixní náklady společnosti, FC, jež jsou považovány za fixní výdaj na provozní účely. Fixní náklady jsou důležitým aspektem maloobchodních řetězců, a to z důvodu, že mnoho řetězců se potýká s neúspěchem, protože nemohou dosáhnout kritického počtu prodejen, které by tak hradily fixní náklady nezbytné pro provoz podniku. Dalším předpokladem je povinnost platit daň ze zisku a neuvažuje se se změnou čistého pracovního kapitálu. Z těchto podmínek je hodnota aktiv společnosti určena jako,

$$A = \frac{\left(SA \cdot G\widetilde{R}I \cdot m - FC\right) \cdot (1-t) + ODP - \Delta \check{C}PK - INV}{\rho}, \tag{1}$$

kde *FC* jsou fixní náklady, *t* je sazba daně, *ODP* odpisy, $\Delta \check{C}PK$ změna čistého pracovního kapitálu a *INV* investice.

Propočet hodnoty reálné opce je možné provést v souladu s procedurou uvedenou v kap. 2.2.

4. Závěr

V příspěvku byl popsán flexibilní business model na bázi binomického modelu a zobecněných náhodných procesů. Rizikovou náhodnou proměnnou je ukazatel GRI-gross return investment. Ukazuje se, že tato proměnná v kombinaci s možností flexibility je aplikačně vhodným přístupem při modelování oceňovacích a investičních procesů za rizika a flexibility.

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Deviation analysis method of the present value measure – generalised approach

Zdeněk Zmeškal, Dana Dluhošová[1]

Abstract

The paper is focused on possibilities of application the deviation analysis method in present value measure decomposition. Particular methods of the deviation analysis are described: gradual change method, method of deviation with residuals, logarithmic method, functional method, integral method. As an example of methodology application is presented net present value measure analysis deviation by the integral method.

Key words

Deviation analysis, present value, net present value, Taylor series expansion

JEL Classification: G30, G31

1. Úvod

Analýzy a metody analýz jsou významným metodickým prostředkem ve finančním rozhodování a řízení. S tím se pojí i analýza citlivosti a analýza rizik. Předvídání a posuzování odchylek řízeného ekonomického systému je klíčovou úlohou pro subjekty řízení.

Jedním ze základních úkolů finančních analytiků je provádět rozbory odchylek syntetických ukazatelů a hledat a vyčíslit faktory (vlivy), které k odchylkám nejvíce přispívají. Na základě toho jsou pak činěna rozhodnutí a opatření. Vždy lze při analýze stanovit výchozí variantu (bázická) a srovnávací variantu (komparativní). Metody analýzy odchylek se využívají při analýze minulého vývoje jednoho ekonomického subjektu, při porovnávání odlišností a jejich příčin porovnávaných ekonomických subjektů. Taktéž lze analyzovat při plánování a predikci dopad odchylek scénářů od základní varianty. Při zobecnění pak lze vše provádět v časoprostoru. Možné varianty jsou v Tab. 1.

Tab. 1 Varianty analýz odchylek

dimenze komparace	**časová fáze**	
	minulost	**predikce**
čas	A	D
prostor	B	E
čas&prostor	C	F

Ve financích se analyzuje celá řada ukazatelů, například výkonnosti, rentability, zadluženosti, likvidity. Důležitým nástrojem finančního rozhodování a oceňování je ukazatel present value. Cílem příspěvku je popsat možné přístupy a metody analýzy odchylek ukazatele present value.

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2. Metody analýzy odchylek

V zásadě existují dva přístupy k analýze syntetických finančních ukazatelů pomocí soustav dílčích ukazatelů: (a) soustava ukazatelů charakterizující vybrané ukazatele firmy bez exaktní matematické přesnosti; (b) pyramidová soustava ukazatelů, která je přesně matematicky odvozena tak, že rozbor analytického syntetického ukazatele lze vyjádřit jako matematickou rovnici.

Předpokládejme funkci vrcholového ukazatele x na dílčích ukazatelích a_i, $x = x(a_1, a_2, \ldots a_n)$. Pak můžeme odchylku vrcholového ukazatele Δy_x vyjádřit jako součet vlivů vybraných dílčích ukazatelů Δx_{a_i} takto,

$\Delta y_x = \sum_i \Delta x_{a_i}$. (**Chyba! Pomocí karty Domů použijte u textu, který se má zde zobrazit, styl Styl2.**)

Je třeba poznamenat, že je možné analyzovat jak absolutní odchylku, $\Delta x_{\text{absolutně}} = x_1 - x_0$, tak relativní odchylku, $\Delta x_{\text{relativní}} = (x_1 - x_0)/x_0$.

Obecně může být funkce jakákoliv, nejčastěji se lze setkat s těmito typy funkcí: *aditivní vazba*, pokud $x = \sum_i a_i = a_1 + a_2 + \ldots + a_n$, *multiplikativní vazba*, pokud $x = \prod_i a_i$, vyskytují se *exponenciální vazby*, $x = a_1^{\prod_j a_j} = a_1^{a_2 \cdot a_3 \cdot a_4 \cdot \ldots \cdot a_n}$, ostatní nelineární vazby.

Základní myšlenkou aplikovaných metod je vyjádřit odchylku vrcholového ukazatele pomocí aproximace přírůstku $\Delta x'(a_1, a_2, a_3)$ podle poměru změny ukazatele na celkové změně ukazatelů takto,

$$\Delta y_x = \frac{\Delta x'(a_1, a_2, a_3)}{\Delta x'} \Delta y_x . \tag{2}$$

Protože bude aplikován Taylorův rozvoj, jeho obecný tvar lze vyjádřit takto,

$$\Delta f(F_1, F_2, \cdots, F_n) = \sum_j \frac{\partial f(\cdot)}{\partial F_j} \cdot \Delta F_j + \frac{1}{2} \sum_j \sum_k \frac{\partial^2 f(\cdot)}{\partial F_j \cdot \partial F_k} \cdot \Delta F_j \cdot \Delta F_k + \\ + \frac{1}{6} \sum_j \sum_k \sum_l \frac{\partial^3 f(\cdot)}{\partial F_j \cdot \partial F_k \cdot \partial F_l} \cdot \Delta F_j \cdot \Delta F_k \cdot \Delta F_l + \cdots .$$

Pro tři proměnné pak platí, že

$$\Delta f(F_1, F_2, F_3) = \left(\frac{\partial f(\;)}{\partial F_1} \Delta F_1 + \frac{\partial f(\;)}{\partial F_2} \Delta F_2 + \frac{\partial f(\;)}{\partial F_3} \Delta F_3 \right) + \\ + \frac{1}{2} \cdot \left(\begin{array}{l} 2 \cdot \frac{\partial f^2(\;)}{\partial F_1 \partial F_2} \Delta F_1 \Delta F_2 + 2 \cdot \frac{\partial f^2(\;)}{\partial F_1 \partial F_3} \Delta F_1 \Delta F_3 + 2 \cdot \frac{\partial f^2(\;)}{\partial F_2 \partial F_3} \Delta F_2 \Delta F_3 + \\ \frac{\partial f^2(\;)}{\partial F_1^2} \Delta F_1^2 + \frac{\partial f^2(\;)}{\partial F_2^2} \Delta F_2^2 + \frac{\partial f^2(\;)}{\partial F_3^2} \Delta F_3^2 \end{array} \right) +$$

$$+\frac{1}{6}\cdot\begin{pmatrix} 6\cdot\frac{\partial f^3(\,)}{\partial F_1\partial F_2\partial F_3}\Delta F_1\Delta F_2\Delta F_3 + \\ 6\cdot\frac{\partial f^3(\,)}{\partial F_1\partial F_2^2}\Delta F_1\Delta F_2^2 + 6\cdot\frac{\partial f^3(\,)}{\partial F_1^2\partial F_2}\Delta F_1^2\Delta F_2 + 6\cdot\frac{\partial f^3(\,)}{\partial F_1\partial F_3^2}\Delta F_1\Delta F_3^2 + \\ 6\cdot\frac{\partial f^3(\,)}{\partial F_1^2\partial F_3}\Delta F_1^2\Delta F_3 + 6\cdot\frac{\partial f^3(\,)}{\partial F_2\partial F_3^2}\Delta F_2\Delta F_3^2 + 6\cdot\frac{\partial f^3(\,)}{\partial F_2^2\partial F_3}\Delta F_2^2\Delta F_3 + \\ \frac{\partial f^3(\,)}{\partial F_1^3}\Delta F_1^3 + \frac{\partial f^3(\,)}{\partial F_2^3}\Delta F_2^3 + \frac{\partial f^3(\,)}{\partial F_3^3}\Delta F_3^3 \end{pmatrix} + ...$$

2.1 Aditivní vazba

Nejjednodušší lineární funkcí je aditivní vazba. Pro tři faktory je aproximace Taylorovým rozvojem,

$$\Delta x'(a_1 + a_2 + a_3) = \frac{\partial x(\,)}{\partial a_1}\cdot\Delta a_1 + \frac{\partial x(\,)}{\partial a_2}\cdot\Delta a_2 + \frac{\partial x(\,)}{\partial a_3}\cdot\Delta a_3 = \Delta a_1 + \Delta a_2 + \Delta a_3 .$$

Vliv jednotlivých faktorů je následující,

$$\Delta x_{a_i} = \frac{\Delta a_i}{\sum_i \Delta a_i}\cdot\Delta y_x , \tag{3}$$

přitom $\Delta a_i = a_{i,1} - a_{i,0}$, $a_{i,0}$, resp. $a_{i,1}$ je hodnota ukazatele i v době výchozí (index 0) a následné (index 1).

2.2 Multiplikativní vazba

Multiplikativní vazba pro tři faktory, funkce $x = a_1 \cdot a_2 \cdot a_3$. Podle toho, jak je řešena multiplikativní vazba, se rozlišuje pět metod: (a) metoda postupných změn, (b) metoda rozkladu se zbytkem, (c) logaritmická metoda rozkladu, (d) funkcionální metoda, (e) integrální metoda.

Při vyčíslení vlivu se u prvních dvou i integrální metody vychází z toho, že při změně jednoho z ukazatelů jsou hodnoty ostatních ukazatelů neměnné. U třetí a čtvrté metody je reflektována současná změna všech ukazatelů při vysvětlení jednotlivých vlivů.

2.2.1 Multiplikativní vazba pro metodu postupných změn

Rozklad pro součin tří dílčích ukazatelů $x = a_1 \cdot a_2 \cdot a_3$. Tedy,

$$\Delta x'(a_1\cdot a_2\cdot a_3) = \left.\frac{\partial x'(\,)}{\partial a_1}\right|_{a_{1,0}\cdot a_{2,0}\cdot a_{3,0}}\cdot\Delta a_1 + \left.\frac{\partial x'(\,)}{\partial a_2}\right|_{a_{1,1}\cdot a_{2,0}\cdot a_{3,0}}\cdot\Delta a_2 + \left.\frac{\partial x'(\,)}{\partial a_3}\right|_{a_{1,1}\cdot a_{2,1}\cdot a_{3,0}}\cdot\Delta a_3 =$$

$$= \Delta a_1\cdot a_{2,0}\cdot a_{3,0} + a_{1,1}\cdot\Delta a_2\cdot a_{3,0} + a_{1,1}\cdot a_{2,1}\cdot\Delta a_3$$

Vlivy jsou obecně vyčíslovány beze zbytku následovně,

$$\Delta x_{a_1} = \Delta a_1\cdot a_{2,0}\cdot a_{3,0}\cdot\frac{\Delta y_x}{\Delta x}, \Delta x_{a_2} = a_{1,1}\cdot\Delta a_2\cdot a_{3,0}\cdot\frac{\Delta y_x}{\Delta x}, \Delta x_{a_n} = a_{1,1}\cdot a_{2,1}\cdot\Delta a_3\cdot\frac{\Delta y_x}{\Delta x}.$$

Obecně pak $\Delta x_{a_i} = \Delta a_i \cdot \prod_{j<i} a_{j,1} \cdot \prod_{j>i} a_{j,0} \cdot \frac{\Delta y_x}{\Delta x}.$ (4)

2.2.2 Multiplikativní vazba pro metodu rozkladu se zbytkem

Vlivy jsou vyčísleny se zbytkem tak, že vzniká zbytek R, který je výsledkem kombinací současných změn více ukazatelů. Tedy,

$$\Delta x'\left(a_1 \cdot a_2 \cdot a_3\right) = \left.\frac{\partial x'(\,)}{\partial a_1}\right|_{a_{1,0} \cdot a_{2,0} \cdot a_{3,0}} \cdot \Delta a_1 + \left.\frac{\partial x'(\,)}{\partial a_2}\right|_{a_{1,0} \cdot a_{2,0} \cdot a_{3,0}} \cdot \Delta a_2 + \left.\frac{\partial x'(\,)}{\partial a_3}\right|_{a_{1,0} \cdot a_{2,0} \cdot a_{3,0}} \cdot \Delta a_3 =$$

$$= \Delta a_1 \cdot a_{2,0} \cdot a_{3,0} + a_{1,1} \cdot \Delta a_2 \cdot a_{3,0} + a_{1,1} \cdot a_{2,1} \cdot \Delta a_3$$

Jednotlivé vlivy lze vyčíslit takto, $\Delta x_{a_1} = \left(\Delta a_1 \cdot a_{2,0} \cdot a_{3,0} + R_1\right) \cdot \frac{\Delta y_x}{\Delta x}$,

$\Delta x_{a_2} = \left(a_{1,0} \cdot \Delta a_2 \cdot a_{3,0} + R_2\right) \cdot \frac{\Delta y_x}{\Delta x}$, $\Delta x_{a_3} = \left(a_{1,0} \cdot a_{2,0} \cdot \Delta a_3 + R_3\right) \cdot \frac{\Delta y_x}{\Delta x}$.

Obecně tedy pro vliv daného faktoru platí, že

$$\Delta x_{a_i} = \left(\Delta a_i \cdot \prod_{j \neq i} a_{j,0} + R_i\right) \cdot \frac{\Delta y_x}{\Delta x}. \tag{5}$$

Problémem je přiřazení zbytku R dílčím vlivům. Neexistuje všeobecně akceptovatelný způsob. Možností je rovnoměrné rozdělení, $R_i = \frac{R}{n}$, nebo proporcionální rozdělení dle jednotlivých vlivů, $R_i = \frac{\Delta a_i \cdot \prod_{j \neq i} a_{j,0}}{\sum_i \Delta a_i \cdot \prod_{j \neq i} a_{j,0}} \cdot R$, či změny ukazatelů, $R_i = \frac{\Delta a_i}{\sum_i \Delta a_i} \cdot R$.

2.2.3 Multiplikativní vazba pro logaritmickou metodu

Odvození vyčíslení vlivů vychází z vyjádření indexů ukazatelů,

$$I_x = \frac{x_1}{x_0} = \frac{a_{1,1}}{a_{1,0}} \cdot \frac{a_{2,1}}{a_{2,0}} \cdot \frac{a_{3,1}}{a_{3,0}} = I_{a_1} \cdot I_{a_2} \cdot I_{a_3}.$$

Tedy, přírůstek se dá vyjádřit, $\Delta x'\left(a_1 \cdot a_2 \cdot a_3\right) = \ln I_{a_1} + \ln I_{a_2} + \ln I_{a_3}$. Pro vlivy jednotlivých ukazatelů platí:

$$\Delta x_{a_i} = \frac{\ln I_{a_i}}{\ln I_x} \cdot \Delta y_x. \tag{6}$$

Je zřejmé, že u této metody se pracuje se spojitým výnosem, neboť logaritmus indexu vyjadřuje spojitý výnos.

2.2.4 Multiplikativní vazba pro funkcionální metodu

U funkcionální metody se vychází ze všech stupňů Taylorova rozvoje.

$$\Delta x'\left(a_1 \cdot a_2 \cdot a_3\right) = a_{2,0} \cdot a_{3,0} \cdot \Delta a_1 + a_{1,0} \cdot a_{3,0} \cdot \Delta a_2 + a_{1,0} \cdot a_{2,0} \cdot \Delta a_3 +$$
$$+ \frac{1}{2} \cdot \left(2 \cdot a_{3,0} \cdot \Delta a_1 \cdot \Delta a_2 + 2 \cdot a_{2,0} \cdot \Delta a_1 \cdot \Delta a_3 + 2 \cdot a_{1,0} \cdot \Delta a_2 \cdot \Delta a_3\right)$$
$$+ \frac{1}{6} \cdot 6 \cdot \Delta a_1 \cdot \Delta a_2 \cdot \Delta a_3.$$

Jestliže podělíme předchozí výraz hodnotou x_0, pak

$$\frac{\Delta x'(a_1 \cdot a_2 \cdot a_3)}{x_0} = \frac{\Delta a_1}{a_{1,0}} + \frac{\Delta a_2}{a_{2,0}} + \frac{\Delta a_3}{a_{3,0}} + \\ + \frac{1}{2} \cdot \left(2 \cdot \frac{\Delta a_1 \cdot \Delta a_2}{a_{1,0} \cdot a_{2,0}} + 2 \cdot \frac{\Delta a_1 \cdot \Delta a_3}{a_{1,0} \cdot a_{3,0}} + 2 \cdot \frac{\Delta a_2 \cdot \Delta a_3}{a_{2,0} \cdot a_{3,0}} \right) \\ + \frac{1}{6} \cdot 6 \cdot \frac{\Delta a_1 \cdot \Delta a_2 \cdot \Delta a_3}{a_{1,0} \cdot a_{2,0} \cdot a_{3,0}}.$$

Dále, pro možnost přiřazení odchylky faktorům, upraví se rovnice takto:

$$\frac{\Delta x'(a_1 \cdot a_2 \cdot a_3)}{x_0} = \frac{\Delta a_1}{a_{1,0}} + \frac{\Delta a_2}{a_{2,0}} + \frac{\Delta a_3}{a_{3,0}} + 2 \cdot \left(\frac{1}{2} \cdot \frac{\Delta a_1 \cdot \Delta a_2}{a_{1,0} \cdot a_{2,0}} \right) + 2 \cdot \left(\frac{1}{2} \cdot \frac{\Delta a_1 \cdot \Delta a_3}{a_{1,0} \cdot a_{3,0}} \right) \\ + 2 \cdot \left(\frac{1}{2} \cdot \frac{\Delta a_2 \cdot \Delta a_3}{a_{2,0} \cdot a_{3,0}} \right) + 3 \cdot \left(\frac{1}{3} \cdot \frac{\Delta a_1 \cdot \Delta a_2 \cdot \Delta a_3}{a_{1,0} \cdot a_{2,0} \cdot a_{3,0}} \right),$$

Dosazením do $\Delta y_x = \frac{\Delta x'(a_1, a_2, a_3)}{x_0} \frac{x_0}{\Delta x'} \Delta y_x$ zajistíme, že

$$\Delta y_x = \left(\frac{\Delta a_1}{a_{1,0}} + \frac{\Delta a_2}{a_{2,0}} + \frac{\Delta a_3}{a_{3,0}} + 2 \cdot \left(\frac{1}{2} \cdot \frac{\Delta a_1 \cdot \Delta a_2}{a_{1,0} \cdot a_{2,0}} \right) + 2 \cdot \left(\frac{1}{2} \cdot \frac{\Delta a_1 \cdot \Delta a_3}{a_{1,0} \cdot a_{3,0}} \right) + 2 \cdot \left(\frac{1}{2} \cdot \frac{\Delta a_2 \cdot \Delta a_3}{a_{2,0} \cdot a_{3,0}} \right) + \\ + 3 \cdot \left(\frac{1}{3} \cdot \frac{\Delta a_1 \cdot \Delta a_2 \cdot \Delta a_3}{a_{1,0} \cdot a_{2,0} \cdot a_{3,0}} \right) \right) \cdot \frac{x_0}{\Delta x} \cdot \Delta y_x .$$

Ve finanční terminologii jsou výrazy $R_{a_j} = \frac{\Delta a_j}{a_{j,0}}$ a $R_x = \frac{\Delta x}{x_0}$ diskrétními výnosy, pak

$$\Delta y_x = \left(R_{a_1} + R_{a_2} + R_{a_3} + 2 \cdot \left(\frac{1}{2} \cdot R_{a_1} \cdot R_{a_2} \right) + 2 \cdot \left(\frac{1}{2} \cdot R_{a_1} \cdot R_{a_3} \right) + 2 \cdot \left(\frac{1}{2} \cdot R_{a_2} \cdot R_{a_3} \right) + \\ 3 \cdot \left(\frac{1}{3} \cdot R_{a_1} \cdot R_{a_2} \cdot R_{a_3} \right) \right) \cdot \frac{1}{R_x} \cdot \Delta y_x .$$

Z předešlého vztahu lze stanovit vlivy přiřazené jednotlivým faktorům následovně:

$$\Delta x_{a_1} = \frac{1}{R_x} \cdot R_{a_1} \cdot \left(1 + \frac{1}{2} \cdot R_{a_2} + \frac{1}{2} \cdot R_{a_3} + \frac{1}{3} \cdot R_{a_2} \cdot R_{a_3} \right) \cdot \Delta y_x ,$$
$$\Delta x_{a_2} = \frac{1}{R_x} \cdot R_{a_2} \cdot \left(1 + \frac{1}{2} \cdot R_{a_1} + \frac{1}{2} \cdot R_{a_3} + \frac{1}{3} \cdot R_{a_2} \cdot R_{a_3} \right) \cdot \Delta y_x , \tag{7}$$
$$\Delta x_{a_3} = \frac{1}{R_x} \cdot R_{a_3} \cdot \left(1 + \frac{1}{2} \cdot R_{a_1} + \frac{1}{2} \cdot R_{a_2} + \frac{1}{3} \cdot R_{a_2} \cdot R_{a_3} \right) \cdot \Delta y_x .$$

Obdobně lze odvodit rozklady pro čtyři a více ukazatelů.

2.2.5 Multiplikativní vazba pro integrální metodu

U integrální metody je postup obdobný funkcionální metodě s tím rozdílem, že je aplikována pouze lineární složka Taylorova rozvoje 1. stupně. Pro tři faktory,

$\Delta x'(a_{1,0}, a_{2,0}, a_{3,0}) = a_{2,0} \cdot a_{3,0} \cdot \Delta a_1 + a_{1,0} \cdot a_{3,0} \cdot \Delta a_2 + a_{1,0} \cdot a_{2,0} \cdot \Delta a_3$, a tedy

$\frac{\Delta x'}{x_0}\left(a_{1,0}, a_{2,0}, a_{3,0}\right) = \frac{\Delta a_1}{a_{1,0}} + \frac{\Delta a_2}{a_{2,0}} + \frac{\Delta a_3}{a_{3,0}}$. Dosazením do $\Delta y_x = \frac{\Delta a_1}{a_{1,0}} + \frac{\Delta a_2}{a_{2,0}} + \frac{\Delta a_3}{a_{3,0}} + \frac{x_0}{\Delta x'} \cdot \Delta y_x$, $R_{a_j} = \frac{\Delta a_j}{a_{j,0}}$, a $R_{x'} = \frac{\Delta x'}{x_0}$, pak $\Delta y_x = \left(R_{a_1} + R_{a_2} + R_{a_3}\right) \cdot \frac{1}{R_{x'}} \cdot \Delta y_x$.

Jednotlivé vlivy lze přitom vyjádřit následovně:

$$\Delta x_{a_1} = \frac{R_{a_1}}{R_{x'}} \cdot \Delta y_x, \quad \Delta x_{a_2} = \frac{R_{a_2}}{R_{x'}} \cdot \Delta y_x, \quad \Delta x_{a_3} = \frac{R_{a_3}}{R_{x'}} \cdot \Delta y_x.$$

Je tak zřejmé, že pro jakýkoliv počet prvků platí, že

$$\Delta x_{a_j} = \frac{R_{a_j}}{R_{x'}} \cdot \Delta y_x, \qquad R_{x'} = \sum_{j=1}^{N} R_{a_j}. \tag{8}$$

2.3 Exponenciální vazba pro integrální metodu

V souladu s předchozím postupem bude analyzovaná funkce $x = a_1^{\prod_{i=2} a_i}$. Pak podle Taylorova rozvoje 1. stupně:

$$\Delta x' = \frac{\partial x'(\ )}{\partial a_1} \cdot \Delta a_1 + \sum_{i=2} \frac{\partial x'(\ )}{\partial a_i} \cdot \Delta a_i = \prod_{i=2} a_i \cdot a_1^{\left(\prod_{i=2} a_i - 1\right)} \cdot \Delta a_1 + \sum_{i=2} \ln a_1 \cdot a_1^{a_i} \cdot \Delta a_i \ .$$

Z toho plyne, že

$$\Delta x_{a_1} = \frac{\prod_{i=2} a_i \cdot a_1^{\left(\prod_{i=2} a_i - 1\right)} \cdot \Delta a_1}{\Delta x'} \cdot \Delta y_x,$$

a $\Delta x_{a_i} = \frac{\ln a_1 \cdot a_1^{a_i} \cdot \Delta a_i}{\Delta x'} \cdot \Delta y_x$, pro $i \geq 2$. (9)

2.4 Zhodnocení a shrnutí

Obecně použitelnými metodami pro nelineární funkce je *funkcionální metoda* a *integrální metoda*.

U *metody postupných změn* je předností jednoduchost výpočtu a bezezbytkový rozklad. Za nevýhodu lze považovat skutečnost, že velikost vlivů jednotlivých ukazatelů je závislá na pořadí ukazatelů ve výpočtu, při n činitelích lze získat 2^{n-1} různých výsledků. Je nutné zachovávat metodiku, a tedy pořadí ukazatelů při různých analýzách.

U *metody rozkladu se zbytkem* je výhodou, že výsledky nejsou ovlivněny pořadím ukazatelů a rozklad je pouze jediný a jednoznačný. Problémem však je existence zbytkové složky, kterou nelze jednoznačně interpretovat a přiřadit jednotlivým vlivům.

Při rozkladu pomocí *logaritmické metody* je výhodou, že je reflektována současná změna všech analyzovaných ukazatelů zároveň. Nevýhodou je skutečnost, že se vychází z výpočtu logaritmů indexů, a tudíž nutnou podmínkou uplatnění metody je, že indexy musejí být kladné.

U *metody funkcionální analýzy* se oproti logaritmické metodě využívají diskrétní výnosy. Výhody jsou shodné s logaritmickou metodou, navíc je odstraněn problém záporných indexů ukazatelů.

U *integrální metody* jsou obdobné výhody jako u funkcionální metody. V některých případech může být jednodušší interpretace. Odpadá problém dělení současného působení více faktorů.

3. Dekompozice ukazatele present value

Současná hodnota (PV - present value) je jedním ze základních principů finančního rozhodování a oceňování. Obecně lze formulovat tuto veličinu takto,

$$PV = \sum_{t=0}^{T} FCF_t \cdot (1+R)^{-t} \ ,$$

kde FCF_t jsou volné finanční toky v roce t, R je sazba nákladů kapitálu, T je doba životnosti projektu nebo podniku.

3.1 Dekompozice odchylek ukazatele PV pomocí integrální metody

U integrální metody se aplikuje první (lineární) úroveň Taylorova rozvoje, viz kap. 2.2.5.

$$\Delta PV' = \sum_{t=0}^{T} \frac{\partial PV(\ )}{\partial FCF_t} \Delta FCF_t + \frac{\partial PV(\ )}{\partial R} \Delta R + \frac{\partial PV(\ )}{\partial t} \Delta t \text{, tedy}$$

$$\Delta PV' = \sum_{t=0}^{T} (1+R)^{-t} \cdot \Delta FCF_t + \sum_{t=0}^{T} FCF_t \cdot (-t)(1+R)^{-t-1} \cdot \Delta R + \sum_{t=0}^{T} FCF_t \cdot (1+R)^{-t} \cdot \ln(1+R) \cdot \Delta t$$

Vlivy jednotlivých faktorů jsou následující:

$$\Delta x_{FCF_t} = \frac{(1+R)^{-t} \cdot \Delta FCF'_t}{\Delta PV'} \cdot \Delta y_x \ ,$$

$$\Delta x_R = \frac{\sum_{t=0}^{T} FCF_t \cdot (-t)(1+R)^{-t-1} \cdot \Delta R}{\Delta PV'} \cdot \Delta y_x \ , \tag{10}$$

$$\Delta x_t = \frac{\sum_{t=0}^{T} FCF_t \cdot (1+R)^{-t} \cdot \ln(1+R) \cdot \Delta t}{\Delta PV'} \cdot \Delta y_x \ .$$

3.2 Dekompozice odchylek PV pomocí funkcionální metody

U funkcionální metody se aplikují vyšší stupně Taylorova rozvoje. V případě dvou stupňů,

$$\Delta PV' = \sum_{t=0}^{T} \frac{\partial PV'(\ )}{\partial FCF_t} \Delta FCF_t + \frac{\partial PV'(\ )}{\partial R} \Delta R + \frac{\partial PV'(\ )}{\partial t} \Delta t +$$

$$+ \frac{1}{2} \frac{\partial PV'^2(\ )}{\partial R^2} \Delta R^2 + \frac{1}{2} \frac{\partial PV'^2(\ )}{\partial t^2} \Delta t^2 +$$

$$+ \sum_{t=0}^{T} \frac{\partial PV'(\ )}{\partial FCF_t, \partial R} \Delta FCF_t \cdot \Delta R + \sum_{t=0}^{T} \frac{\partial PV'(\ )}{\partial FCF_t, \partial t} \Delta FCF_t \cdot \Delta t + \frac{\partial PV'(\ )}{\partial R, \Delta t} \Delta R \cdot \Delta t$$

Konkrétně tedy,

$$\Delta PV' = \sum_{t=0}^{T}(1+R)^{-t}\cdot\Delta FCF_t + \sum_{t=0}^{T}FCF_t\cdot(-t)(1+R)^{-t-1}\cdot\Delta R + \sum_{t=0}^{T}FCF_t\cdot(1+R)^{-t}\cdot\ln(1+R)\cdot\Delta t +$$
$$+\frac{1}{2}\sum_{t=0}^{T}FCF_t\cdot(t)(t+1)(1+R)^{-t-2}\cdot\Delta R^2 + \frac{1}{2}\sum_{t=0}^{T}FCF_t\cdot(1+R)^{-2t}\cdot(\ln(1+R))^2\cdot\Delta t^2 +$$
$$+\sum_{t=0}^{T}(-t)(1+R)^{-t-1}\Delta FCF_t\cdot\Delta R + \sum_{t=0}^{T}(1+R)^{-t}\cdot\ln(1+R)\cdot\Delta FCF_t\cdot\Delta t +$$
$$+\sum_{t=0}^{T}FCF_t\cdot(-t)(1+R)^{-t-1}\cdot\ln(1+R)\cdot\Delta R\cdot\Delta t$$

Jednotlivé vlivy jsou následující,

$$\Delta x_{FCF_t} = \frac{(1+R)^{-t}\cdot\Delta FCF_t + \frac{1}{2}\sum_{t=0}^{T}(-t)(1+R)^{-t-1}\Delta FCF_t\cdot\Delta R +}{\Delta PV'}$$
$$\frac{+\frac{1}{2}\sum_{t=0}^{T}(1+R)^{-t}\cdot\ln(1+R)\cdot\Delta FCF_t\cdot\Delta t}{\Delta PV'}\cdot\Delta y_x$$

$$\Delta x_R = \frac{\sum_{t=0}^{T}FCF_t\cdot(-t)(1+R)^{-t-1}\cdot\Delta R + \frac{1}{2}\sum_{t=0}^{T}FCF_t\cdot(t)(t+1)(1+R)^{-t-2}\cdot\Delta R^2 +}{\Delta PV'}$$
$$\frac{+\frac{1}{2}\sum_{t=0}^{T}(-t)(1+R)^{-t-1}\Delta FCF_t\cdot\Delta R + \frac{1}{2}\sum_{t=0}^{T}FCF_t\cdot(-t)(1+R)^{-t-1}\cdot\ln(1+R)\cdot\Delta R\cdot\Delta t}{\Delta PV'}\cdot\Delta y_x \qquad (11)$$

$$\Delta x_t = \frac{\sum_{t=0}^{T}FCF_t\cdot(1+R)^{-t}\cdot\ln(1+R)\cdot\Delta t + \frac{1}{2}\sum_{t=0}^{T}FCF_t\cdot(1+R)^{-2t}\cdot(\ln(1+R))^2\cdot\Delta t^2 +}{\Delta PV'}$$
$$\frac{+\frac{1}{2}\sum_{t=0}^{T}(1+R)^{-t}\cdot\ln(1+R)\cdot\Delta FCF_t\cdot\Delta t + \frac{1}{2}\sum_{t=0}^{T}FCF_t\cdot(-t)(1+R)^{-t-1}\cdot\ln(1+R)\cdot\Delta R\cdot\Delta t}{\Delta PV'}\cdot\Delta y_x$$

4. Ilustrativní příklad aplikace integrální metody pro dekompozici NPV

Analyzovat odchylky ukazatele present value je častým problémem. V kapitálovém rozpočetnictví jsou investiční projekty vyhodnocovány pomocí ukazatele *NPV- net present value*. Takto mohou být porovnávány varianty projektů, vyhodnocen plán se skutečností (postaudit), nebo scénáře s bazickou variantou.

4.1 Zadání

Jsou známy údaje o výchozí a srovnávané variantě investičního projektu. Odchylka hodnot NPV mezi variantami činí 24,5 peněžních jednotek. Úkolem je identifikovat vlivy včetně jejich velikosti, které odchylku zapříčinily. Potřebné vstupní údaje jako finanční toky FCF, náklady kapitálu R, ekvidistantní doby realizace t, jsou uvedeny v Tab. 2.

Tab. 2 Vstupní data NPV - odchylka

Varianta	Ukazatel						
	FCF_0	FCF_1	FCF_2	FCF_3	R	t	NPV
výchozí (0)	-500	200	300	400	0,1	-1	**230,3**
srovnávaná (1)	-480	220	310	430	0,12	-1,5	**254,8**
odchylka	20	20	10	30	0,02	-0,5	**24,5**

4.2 Řešení

Odchylky jsou propočteny u integrální metody dle (2.10). Výsledky jsou prezentovány v Tab. 3. Je zřejmé, že celková odchylka NPV ve výši 24,5 p. j. je pozitivně ovlivněna lepšími finančními toky FCF v jednotlivých letech (celkově 70 p.j.), a negativně ovlivněna růstem nákladu kapitálu (-24,0 p.j.) a prodloužením ekvidistantní doby realizace (-9,2 p.j.).

Tab. 3 Výsledky NPV - odchylka

Varianta	Ukazatel						
	FCF_0	FCF_1	FCF_2	FCF_3	R	t	celkem
$\Delta PV'_i$	20,0	18,2	8,3	22,5	-28,7	-11,0	
vliv (%)	68,3%	62,1%	28,2%	76,9%	-98,0%	-37,5%	100,0%
vliv (p. j.)	16,7	15,2	6,9	18,8	-24,0	-9,2	24,5

5. Závěr

Předmětem příspěvku byla analýza odchylek ukazatele present value. Prezentovány byly metodické přístupy analýzy odchylek. Jako obecné metody pro nelineární funkce se ukázaly metoda funkcionální a metoda integrální. Ukázalo se, že present value je klíčovou mírou při rozhodování a oceňování projektů a podniků. Jako ilustrativní příklad byla prezentována integrální metoda analýzy odchylek NPV. Celou metodiku lze aplikovat u mnoha dalších úloh, například při oceňování hodnoty podniku dvoufázovou výnosovou metodou.

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