Scientific Papers 37 (2/2016)

of the University
of Pardubice

Faculty of Economics
and Administration

Series D

SCIENTIFIC PAPERS OF THE UNIVERSITY OF PARDUBICE

Series D

Faculty of Economics and Administration

No. 37 (2/2016)

Vol. XXIII

SCIENTIFIC PAPERS OF THE UNIVERSITY OF PARDUBICE

Series D

Faculty of Economics and Administration

No. 37 (2/2016)

Vol. XXIII

Registration MK ČR E 19548

ISSN 1211-555X (Print)

ISSN 1804-8048 (Online)

Contribution in the journal have been reviewed and approved by the editorial board.
Contributions are not edited.

ABOUT JOURNAL

Scientific Papers of the University of Pardubice, Series D journal aims to be an open platform for publication of innovative results of theoretical, applied and empirical research across a broad range of disciplines such as economics, management, finance, social sciences, law, computer sciences and system engineering with the intention of publishing research results, primarily academics and students of doctoral study programmes in the Czech Republic and abroad.

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CONTENTS

ELECTIONS AND THE TAX STRUCTURE IN THE POST-SOCIALIST EU MEMBER STATES

Lucie Formanová, Michal Mádr

Abstract: *The article deals with the political business cycle theory, especially with effects of the term of parliamentary elections on the tax composition (direct versus indirect taxes). It includes a traditional political business cycle analysis evaluating the effects of elections on overall revenues. We use panel data regression analysis, namely fixed effects method with robust option and GMM dynamic panel data estimator to analyse the relationship between tax structure and elections. The analysis includes panel data of tax revenues divided to GDP from 11 post-socialist EU member States in time-period from 1996 to 2014, our models contain 209 observations. Using this data, we found out that political business cycle does not have any effect on direct tax revenues, however there is a minimal impact on indirect tax revenues (0.25% GPD). In election years, there is a decrease of indirect revenues by less than 2 per cent. Furthermore, our models did not identify the influence of post-election effects in observed timeline.*

Keywords: *Direct taxes, Indirect taxes, Tax structure, Parliamentary elections.*

JEL Classification: *D72, E62, H20.*

Introduction

The contribution deals with the issue of the tax structure (direct vs indirect taxes) in the post-socialist EU member States during election periods. Based on the fact that the representatives of the legislative power are responsible for the implementation of the tax policy, their behaviour and activities can be focused on the implementation such measurements which may increase their popularity among voters or get higher chances for their re-election in the democratic electoral systems. In this context, we deal with the political business cycle (PBC) in a detail. This model was firstly introduced by Nordhaus [19]. He focused on the identification of the impact of electoral cycle on fiscal policy implementation. His model assumes opportunistic parties and irrational voters. In his research he used the development of macroeconomics indicators, such as the inflation rate or the unemployment rate prior election and post-election year. Štiková [28] the opportunistic motives, explains as a politicians´ behaviour which is based on using such economic instruments in order to maximize their popularity and chances of re-election in following parliamentary election. The author states that the political affiliation is not important because the behaviour of each politician is influenced by the term of parliamentary election. Sjahrir [26] adds that the existence of political business cycle can arise only in the systems of direct elections.

The PBC theory predicts that politicians should manipulate fiscal policy just before elections by increasing public expenditures or decreasing tax burden of taxpayers. These steps can be considered as the efforts to determine the growth of economy and employment or rather as the effort to improve the living standard of voters. The post-election period should be linked with fiscal restriction, especially by a decrease of public expenditures or an increase of tax burden of citizens [27]. It means that the fiscal policy in tax field could be deformed especially in election year or in a period prior and after the election year.

Janků [14] adds that due to the assumption of the irrational voters, all next intentional pre-election fiscal expansion must be successful. The assumption of irrational voters became the object of critique. Therefore Rogoff and Sibert [23] introduced the model political business cycle which is based on the temporary information asymmetries between voters and political representatives. It is clear that the governments receive information about its competency more quickly than the voters can. Therefore the public sees the government's competency with a lag. As a consequence of that fact it is obvious that the incumbent party can have an incentive to lower taxes in election years to show their competency [23].

There are some studies which dealt with the impact of political business cycle on fiscal policy setting, for example Shi and Svensson [25], Doležalová [6], Štiková [28], Brender and Drazen [5], or Andrikopoulos [1]. The researches of above mentioned authors are oriented especially on macroeconomics indicators, as Nordhaus [19]. Mainly, they use indicators as GDP, the inflation rate or the unemployment rate. Related to the topic of this contribution (tax field of fiscal policy), it is necessary to modify the above described approaches while respecting the basic theoretical aspects (principles) of political business cycle. The realization of tax policy depending on political business cycle has been examined by many researches, for example by Foremmy and Riedel [11], Ehrhart [9], Mikesell [17], Petterson-Lidbom [20], Morozumi, Veiga and Veiga [18], Andrikopoulos et al [2] or Formanová, David and Křápek [12]. Within their analysis the authors are using various indicators, such as total tax collection or development of nominal or effective tax rates of different types of taxes.

The objective of this paper is to analyse the tax structure in the post-socialist EU member States and find out whether the tax policy determination is influenced by political business cycle. To fulfil the aim of the contribution we are going to use panel data regression analysis. The article is divided into 3 parts – statement of a problem, description of used method and discussion of received results.

1 Statement of a problem

Above mentioned authors analysed the existence of political business cycle on the basis of individual indicators. In addition to this, the existence of political business cycle can be analysed via composition of public expenditures or tax structure. Rogoff [22] states that there are some theoretical models predicting changes in the composition of expenditures rather than in total value of expenditures. The research of Drazen and Eslava [7] was focused on the identification of the existence of electoral cycle in the composition of public expenditures. Based on the fact that the political representatives cannot change the total value of public expenditures, the authors predict changes in their structure. Namely they expected an increase in expenditures which are positively accepted by citizens, whereas in other expenditures they expected a decline. Within their analysis they used data of Colombian municipalities, all in all they confirmed their assumption about manipulation in expenditure structure in pre-election years. They found out that the most significant components is infrastructure spending, e.g. road construction. Moreover, Ehrhart [9] focuses on the revenue side of state budget. She points out to the issue that no significant changes in overall tax revenue may mask a considerable electoral manipulation in the tax policy determination. She states that the representatives of the legislative power can change the tax structure according to the citizens´ preferences. The objective of her research was to analyse the impact of electoral cycle calendar on the composition of tax revenues (direct versus

indirect taxes). For testing she used the indicator of total tax collection and data of 56 developing countries in timeline 1980-2006. She revealed significant pre-electoral political budget cycle. She found out that the political representatives are using especially indirect taxes (e.g. value added tax) to increase their popularity prior parliamentary election. The author gives several examples, as the most visible one is in case of Ghana where there was a radical decrease of a tax on petrol prior election year 2008. Morozmi, Veiga and Veiga [18] combined both approaches and examined the effects on central governments´ fiscal policy conduct. In their research they included panel data from 107 countries over the 1975-2010 period. They concluded their research with the statement that in all democracies there is an increase in current spending and a reduction in taxes in election year. In established democracies, there is a reallocation of expenditure and revenue components in election years. In case of expenditure there is a shift from capital spending to grants to other governments units, in case of taxes there is a significant decrease in income taxes and an increase of consumption taxes.

On the basis of Ehrhart [9], we formulate our assumption that the electoral cycle can influence the tax structure in the post-socialist EU member States. As a consequence of described trends in behavior of representatives of legislative power, we expect to observe the changes in the tax structure in the election year and in the post-election year.

2 Methods

Regression models test the influence of elections on the tax structure. The models are based on Ehrhart [9]. Within the tax structure, we distinguish two types of taxes, direct and indirect. Both dependant proxies, Direct tax revenues (current taxes on income, wealth, etc., ESA2010 classification) and Indirect tax revenues (taxes on production and imports, ESA2010 classification), are divided to GDP in the manner of Brender and Drazen [5], Ehrhart [9], Katsimi and Sarantides [16] and Prichard [21]. Ehrhart [9] states six socio-economic indicators, the lagged dependent variable, GDP per capita, the degree of urbanization, the share of imports (indirect taxes), the rate of inflation and the share of population ages 14 and under. The first four proxies are used in the same way. The lagged dependent variables represent the persistence in tax revenues over time. The inclusion of the lagged dependent proxy may lead to biased coefficient estimates in case of fixed effect method (static panel data model), therefore it is necessary to execute the comparison with GMM system estimator (dynamic panel data model). The proxy GDP per capita (current euro) is expressed in the logarithmic functional forms and represents the economic development (e.g. [5], [9], [16] and [21]), whereas variable Urbanization (share of population living in urban areas) depicts the structure of the economy. The fourth, Import (the share of imports to GDP), is an important component of indirect taxes. The remaining two indicators, Inflation and Population, are included in the models, but in the different forms. Compare to Ehrhart [9], we do not use the logarithmic functional form for the Inflation with regard to the other proxies. The higher inflation (the annual change in the consumer price index) has negative effect on the real tax revenues (the Olivera-Tanzi effect). Ehrhart [9] as an indicator of the demographic pressures in the developing countries used share of population under 14, but in the context of the post-socialist EU member States we prefer share of population ages 15 to 64 (Population15-64). For evaluation of the importance of elections, we state four dummy proxies. The first, Election, is a variable coded 1 for year in which there is a legislative election. The other two dummy proxies take into the account of the parliamentary election term, it means, if the elections are held in the first half of a year (Election1st) or in the second half of a year (Election2st). Last one,

Post-election, represents "the Post-election effect", which follows the PBC theory introduced in the beginning of this paper.

We employ data by Eurostat (Tax revenues, GDP per capita, Import; [10]), the World Bank Group (Urbanization, Inflation and Population15-64; [31]) and the International Foundation for Electoral Systems (proxies of Elections; [13]). We assume that all variables, with the exception of Inflation, are positively associated with the tax revenues. The regression model is following:

$$Tax\,\mathrm{Re}v_{it} = \beta_1 Tax\,\mathrm{Re}v_{i,t-1} + \beta_2 X_{it} + \beta_3 Elections_{it} + \mu_i + \lambda_t + \mu_{it} \quad (1)$$

Where i and t are country and year indicators, $TaxRev_{it}$ are tax revenues, direct or indirect to GDP, $TaxRev_{i,\,t-1}$ is lagged dependent variable (direct or indirect), X_{it} are socio -economic proxies (log GDP per capita, Urbanization, Import, Inflation and Population15-64), μ_i are country fixed effects, λ_t are year fixed effects and μ_{it} is an unobserved error term.

For evaluation of the influence of elections on the tax structure, we use panel data analysis, the static and the dynamic methods. There are two basic methods in the static panel data, fixed and random effects. We chose the Hausman test for the determination of a suitable method (random effects are preferred under null hypothesis while preference for fixed effects is an alternative hypothesis). Econometric verification is verified by testing the occurrence of the unit root (the Fisher-type test and the Im-Pesaran-Shin test), homoscedasticity (the Wald test) and serial autocorrelation (the Wooldridge test). The tests are selected according to Drukker [8], and Wooldridge [30]. Within the dynamic methods, we use the GMM system estimator according to Arellano and Bover [3] and Blundell and Bond [4]. On the basis of the mentioned literature, we use two-step estimations. Economic verification is extended by the Hansen test of over-identification (the null hypothesis is that used instruments are valid) and the Arellano-Bond test for AR(1) and AR(2) processes in the first differences (the presence of first-order serial correlation and the absence of second-order serial correlation). In more detail, Roodman [24].

As the post-socialist EU member States, we consider the European countries, which has become the Members of the EU since 2004. It means Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. The reference period focuses on the period of 1996–2014 due to the data availability.

3 Problem solving

For evaluation of the influence of term of parliamentary elections on the tax structure, we use panel data analysis, namely fixed effects method on the basis of the Hausman test[1] and GMM dynamic panel data estimator. The models contain 11 cross-sectional units and 19 time series units, the sum is 209 observations.

First of all, the cointegration of unit roots was verified by the Fisher-type test and the Im-Pesaran-Shin test.[2] The model of fixed effects incorporates heteroscedasticity (Wald test) and serial autocorrelation (the Wooldridge test). Therefore the models are supplemented by the robust variance estimator. The estimated regression coefficients remain

[1] We reject a null hypothesis about the preference of random effects in favour of an alternative hypothesis about the preference of fixed effects. A Chi-square is 24.58 (p-value 0.00; the Direct tax revenues) and 46.33 (p-value 0.00; the Indirect tax revenues).

[2] Compare to the Levin-Lin-Chu test, both tests do not require strongly balanced panel data. Tests include the time trend and lags structure (1).

the same and heteroscedasticity and serial autocorrelation also persist in the model, but standard errors are calculated to be robust. Regarding the other tests, the paper states the adjusted coefficient of determination (within), nevertheless, its values have limited information capability in the panel data regression.

First of all, we start analysis with socio-economic factors. There are only two statistical significant proxies, the lagged dependent variable ("the persistence in tax revenues over time") and Urbanization (share of population in the urban areas). In more detailed view on the tax structure, urbanization has a positive effect on the Indirect tax revenues, whereas the Direct tax revenues are influenced negatively.

Out of the others, Inflation has significant and negative impact (the Olivera-Tanzi effect), but only in case of the Indirect tax revenues. If we focus on the relations between PBC and tax revenues, the first model indicates significant and negative influence of PBC on the Indirect tax revenues. In years, in which the parliamentary elections are held, the Indirect tax revenues decrease by 0.25 % GDP. It means, if there are the average indirect tax revenues circa 13.3 % of GDP, then the indirect tax revenues are lower by 2 %. Except for holding the parliamentary elections, there is a significant influence of the term of election, the parliamentary election in the first half of year affects the Indirect tax revenues, whereas election in the second half of year influences the Direct tax revenues. The more significant influence on the Indirect tax revenues can be explained by the fact that the Indirect taxes (e.g. value added tax) are levied on all citizens of the country, simply because they are included in prices of all products and services. The first model does not identify any "the Post-election effect".

Tab. 1: Elections and tax structure, OLS-Fixed effects, robust option

Proxies	**Direct tax revenues**				**Indirect tax revenues**			
	Election	**Election 1st**	**Election 2nd**	**Post-election**	**Election**	**Election 1st**	**Election 2nd**	**Post-election**
Const.	11.74** (2.77)	11.67** (2.84)	11.28** (2.64)	11.74** (2.79)	0.9 (0.19)	0.55 (0.12)	1.55 (0.32)	0.97 (0.2)
Y_{t-1}	0.74*** (19.28)	0.74*** (18.97)	0.74*** (19.08)	0.74*** (19.3)	0.64*** (18.08)	0.63*** (19.88)	0.64*** (17.74)	0.63*** (20.35)
GDPpc (log)	-0.14 (-1.8)	-0.14 (-1.72)	-0.15* (-1.82)	-0.14 (-1.77)	-0.18 (-0.83)	-0.18 (-0.78)	-0.18 (-0.82)	-0.18 (-0.78)
Urban	-0.11** (-3.02)	-0.1** (-2.93)	-0.11** (-3.00)	-0.1** (-2.92)	0.14** (2.27)	0.14** (2.2)	0.14** (2.17)	0.41** (2.18)
Import	-	-	-	-	0.01 (1.17)	0.01 (1.11)	0.01 (1.11)	0.01 (1.04)
Inflation	-0.001 (-0.04)	-0.001 (0.51)	0.001 (0.26)	0.001 (0.22)	-0.002*** (-13.12)	-0.002*** (-17.79)	-0.003*** (-18.75)	-0.003*** (-18.45)
Population 15-64	-0.01 (-0.68)	-0.03 (-0.73)	-0.02 (-0.53)	-0.03 (-0.73)	-0.06 (-1.08)	-0.05 (-0.98)	-0.07 (-1.18)	-0.06 (-0.98)
Elections	0.077 (1.19)	-0.1 (-1.4)	0.17** (2.89)	0.023 (0.23)	-0.24** (-2.12)	-0.26** (-2.42)	-0.21 (-1.13)	-0.02 (-0.23)
R^2 (within)	0.73	0.73	0.73	0.73	0.67	0.66	0.67	0.67
Fisher-type test	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
IPS test	0.002	0.001	0.002	0.001	0.001	0.001	0.001	0.001
Wald test	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Wooldridge test	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001

Source: Authors

*Notes: (.) denotes t-statistic, */**/*** means a significance level at 10 %/5 %/1 %; R^2 means an adjusted (within) R-squared; Fisher-type, Im-Pesaran-Shin, Wald and Wooldridge tests (p-value).*

The second model uses GMM system estimator with Windmeijer robust standard errors [29]. The estimator ([3]; [4]) is designed for dynamic "small T, large N" panels, but on the other hand Judson and Owen [15] state, that GMM is eligible, if T is about 20, which is in our case. In accordance with Ehrhart [9], we consider proxies Urban and Population to be exogenous, whereas Elections, Import, Inflation, GDP per capita and the lagged dependant variables are endogenous. Endogenous variables are instrumented only with the first-order lag values since our sample of panel data enables to use a limited amount of instruments. The matrix of instruments has been collapsed. On the basis of the mentioned literature, we use two-step estimations. The Hansen, AR(1) and AR(2) tests confirm that the estimates are reliable. It means that the used instruments are valid and the model incorporates only the first-order serial autocorrelation.

Compare to the first model, Urbanization is not important, in the other words, the lagged tax revenues and inflation, in case of the Indirect tax revenues, are only two significant socio-economic factors. Simultaneously the impact of (holding) elections is hardly any. Only in case of Indirect tax, there is a decrease in the tax revenue in parliamentary election years. However the effect is smaller than in the first model (about 0.2 % GDP or decrease by circa 1.5 %).

Tab. 2: Elections and tax structure, GMM-System, Windmeijer robust option

Proxies	Direct tax revenues				Indirect tax revenues			
	Election	Election 1st	Election 2nd	Post-election	Election	Election 1st	Election 2nd	Post-election
Y_{t-1}	0.74*** (5.9)	0.82*** (6.94)	0.82*** (7.03)	0.82*** (9.31)	0.96*** (10.61)	0.95*** (6.49)	0.94*** (6.63)	0.9*** (5.72
GDPpc (log)	0.09 (0.28)	0.08 (0.29)	0.12 (0.33)	0.07 (0.28)	0.19 (0.58)	0.22 (0.67)	0.17 (0.62)	0.17 (0.43)
Urban	0.14 (0.83)	0.02 (0.13)	0.005 (0.09)	0.19** (2.59)	0.003 (0.64)	0.002 (0.05)	0.01 (0.52)	-0.005 (-0.07)
Import	-	-	-	-	-0.001 (-0.07)	-0.001 (-0.05)	-0.003 (-0.15)	0.002 (0.07)
Inflation	0.001 (1.34)	0.001 (1.19)	0.002 (1.31)	-0.001 (1.45)	-0.004*** (-8.41)	-0.004*** (-10.61)	-0.004*** (-7.84)	-0.004*** (-7.61)
Population 15-64	-0.11 (-0.69)	-0.008 (-0.06)	0.001 (0.01)	-0.16 (-1.83)	-0.04 (-0.64)	-0.02 (-0.22)	-0.02 (-0.51)	0.002 (0.02)
Elections	-0.04 (-0.28)	-0.14 (-0.46)	0.13 (0.99)	0.05 (0.27)	-021** (-2.28)	-0.22 (-0.98)	-0.16 (-1.08)	-0.11 (-0.95)
Number of instruments	8	8	8	8	10	10	10	10
Hansen test	0.134	0.064	0.049	0.671	0.728	0.621	0.902	0.569
AR(1) test	0.041	0.025	0.021	0.032	0.012	0.009	0.007	0.006
AR(2) test	0.98	0.978	0.92	0.9	0.674	0.703	0.616	0.833

Source: Authors.

*Notes: (.) denotes t-statistic, */**/*** means a significance level at 10 %/5 %/1 %, Hansen, AR(1), AR(2) tests (p-value).*

Conclusion

The aim of this paper was to identify the effects of the term of parliamentary elections on the tax structure of selected 11 EU member States. We verified the political business cycle theory describing that the tax policy determination can be influenced by politicians´ behaviour which is based on using such economic instruments in order to maximize their chances of re-election in following parliamentary election. Those steps in tax policy determination are not desirable and subsequently they can distort the stated objectives of the economic policy.

For the purpose of qualification and evaluation of the influence of PBC on the tax structure in the post-socialist EU member States we used the panel data regression analysis. Furthermore, we constructed regression model and used two methods, fixed effects with robust option and GMM system estimator with Windmeijer robust standard errors. The results show, especially GMM system estimator, that PBC does not have an effect on the Direct tax revenues, whereas we identified a minimal impact on the Indirect tax revenues. The influence of PBC on the Indirect tax revenues is about 0.25 % of GDP, or we can say, the holding the parliamentary elections leads to a decrease by less than two per cents. Based on the PBC theory, we tested the importance of the parliamentary election term and the Post-election effects. On the basis of the results of the first model, the term of the elections may have significant impact, but the GMM system estimator does not bear it out. Moreover, both models did not indicate the influence of the Post-election effect. The insignificant impact of PBC is significantly influenced by the legislation of the European Union, which can be shown by example of the Indirect tax revenues. In that case, the Directives of the European Union regulates the minimal rates, moreover it enables to implement to the Tax Act only 2 tax rates, standard and reduced one.

As a possible extension, we propose a comparison of the post-socialist EU member States with the old ones. Also the PBC theory deals with the other topics, e.g. pre-determined and endogenous elections or quality of the political environment.

Acknowledgement

This contribution was supported by IGA Mendel University in Brno No. 15/2015, "The influence of economic and electoral cycle on tax policy of the Czech Republic focusing on Individual Income tax".

References

[1] ANDRIKOPOULOS, A., LOIZIDES, I., PRODROMIDIS, K. Fiscal policy and political business cycles in the EU. European Journal of Political Economy, 2004, Vol. 20, Iss. 1, pp.125-152. ISSN: 0176-2680.

[2] ANDRIKOPOULOS, A., LOIZIDES, I., PRODROMIDIS, K., Taxation and political business cycles in EU economies. Applied Economics, 2006, Vol. 38, Iss. 15, pp. 1761-1774. ISSN: 0003-6846.

[3] ARELLANO, M., BOVER, O. Another look at the instrumental variable estimation of error-components models. Journal of Econometrics, 1995, Vol. 68, Iss. 1, pp. 29-51. ISSN: 0304-4076.

[4] BLUNDELL, R., BOND. S. Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics, 1998, Vol. 87, Iss. 1, pp. 115-143. ISSN: 0304-4076.

[5] BRENDER, A., DRAZEN A. Political budget cycles in new versus established democracies. Journal of Monetary Economics, 2005, Vol. 52, Iss. 7, pp. 1271-1295. ISSN: 0304-3932.

[6] DOLEŽALOVÁ, J. Political cycle and fiscal policy in the countries of the European Union. EKONOMICKÁ REVUE – Central European Review of Economic Issues, 2013, Vol. 16, pp. 93–108. ISSN: 1212-3951.

[7] DRAZEN, A., ESLAVA, M. Electoral manipulation via voter-friendly spending: Theory and evidence. Journal of Development Economics, 2010, Vol. 92, Iss. 1, pp. 39-52. ISSN: 0304-3878.

[8] DRUKKER, D. M. Testing for Serial Correlation in Linear Panel-Data Models. Stata Journal, 2003, Vol. 3, Iss. 2, pp. 168–177. ISSN: 1536-8734.

[9] EHRHART, H. Elections and the structure of taxation in developing countries. Public Choice, 2013, Vol. 156, Iss. 1, pp. 195–211. ISSN: 0048-5829.

[10] EUROSTAT. Database. [cit. 2015-11-25]. Available from WWW: <http://ec.europa.eu/eurostat/data/database>.

[11] FOREMNY, D., RIEDEL, N. Business taxes and the electoral cycle. Journal of Public Economics, 2014, Vol. 115, pp. 48-61. ISSN: 0047-2727.

[12] FORMANOVÁ, L., DAVID, P., KŘÁPEK, M. The influence of electoral cycle on income tax policy focusing on an employment income. Proceedings of the 20th International Conference: Theoretical and Practical Aspects of Public Finance 2015. 2015, pp. 51-56. ISBN: 978-80-245-2094-0.

[13] INTERNATIONAL FOUNDATION FOR ELECTORAL SYSTEMS. Election Guide. [cit. 2015-11-25]. Available from WWW: <http://www.electionguide.org/elections/past/>.

[14] JANKŮ, J. The political business cycle in the Czech Republic. EKONOMICKÁ REVUE-Central European Review of Economic Issues, 2013, Vol. 16, pp. 121-130. ISSN: 1212-3951.

[15] JUDSON, R. A., OWEN, A. L. Estimating Dynamic Panel Data Models: A Guide for Macroeconomists. Economics Letters, 1999, Vol. 65, Iss. 1, pp. 9-15. ISSN: 0165-1765.

[16] KATSIMI, M., SARANTIDES, V. Do Elections Affect the Composition of Fiscal Policy in Developed, Established Democracies? Public Choice, 2012, Vol. 151, Iss. 1-2, pp. 325-362. ISSN: 0048-5829.

[17] MIKESELL, J. L. 1978. Election periods and state tax policy cycle. Public Choice, 1978, Vol. 33, Iss. 3, pp. 99-106, ISSN: 0048-5829.

[18] MOROZUMI, A., VEIGA F.J., VEIGA L.G. Electoral effects on the composition of public spending and revenue: evidence form a large panel of countries. [cit. 2015-10-05]. Available at WWW: <http://www.nipe.eeg.uminho.pt/Uploads/WP_2014/NIPE_WP_23_2014.pdf>.

[19] NORDHAUS, W.D. The Political Business Cycle. The Review of Economic Studies. 1975, Vol. 42, Iss. 2, pp. 169-190. ISSN: 1467-937.

[20] PETTERSSON-LIDBOM. A test of the Rational Electoral-Cycle Hyphothesis. Research Pápera in Economics. 2003.

[21] PRICHARD, W. Electoral Competitiveness, Political Budget Cycles and Taxation in Developing Countries. ICTD Working Paper 24, 2014.

[22] ROGOFF, K. Equilibrium political budget cycles. American Economic Review. 1990, Vol. 80, Iss. 1, pp. 21-36. ISSN: 0002-8282.

[23] ROGOFF, K. SIBERT, A. Elections and Macroeconomic Policy Cycles. The Review of Economics Studies, 1988, Vol. 55, Iss. 1, pp. 1-16.

[24] ROODMAN, D. How to Do xtabond2: An introduction to "Difference" and "System" GMM in Stata. Stata Journal, 2009, Vol. 9, Iss. 1, pp. 86-136. ISSN: 1536-8734.

[25] SHI, M., SVENSSON, J. Political budget cycles: Do they differ across countries and why? Journal of Public Economics. 2006, Vol. 90, pp. 1367-1389. ISSN: 0047-2727.

[26] SJAHRIR, B. S., KIS-KATOS, K., SCHULZE, G. Political budget cycle in Indonesia at the district level. Economics Letters. 2013, Vol. 120, Iss. 2, pp. 342-345. ISSN: 0165-1765.

[27] SPĚVÁČEK, V. Transformace české ekonomiky: politické, ekonomické a sociální aspekty. Praha: Linde, 2002. ISBN 80-86131-32-7.

[28] ŠTIKOVÁ, R. Modely politického cyklu a jejich testování v podmínkách ČR. Institut ekonomických studií FSV UK. Working Paper IES 2007/18, 2007.

[29] WINDMEIJER, F. A finite sample correction for the variance of linear efficient two-step GMM estimators. Journal of Econometrics, 2005, Vol. 126, Iss. 1, pp. 25-51. ISSN: 0304-4076.

[30] WOOLDRIDGE, J. M. Econometric Analysis of Cross Section and Panel Data. Cambridge, MA: MIT Press, 2002. 1096 p. ISBN: 978-0-262-30324-8.

[31] WORLD BANK GROUP. World Development Indicators. [cit. 2015-11-25]. Available from WWW: <http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators>.

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Received: 31. 12. 2015
Reviewed: 07. 03. 2016, 06. 05. 2016
Approved for publication: 08. 09. 2016

ECONOMIC ASPECTS OF SOCIAL SERVICES DEVELOPMENT IN SLOVAKIA IN THE CONTEXT OF DEMOGRAPHIC CHANGES

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Abstract: *At present, the global aging process of inhabitants represents a serious social challenge that is related to those countries whose size or economic power is not that significant aspect. Rapid increase of older population results in an increasing inquiry of long-term health care services (long-term care – LTC). As a result of a progress in research as well as investments in health care services, health care constantly improves, but there are increasing inequalities in health of vulnerable groups of inhabitants, such as elderly. The given article focuses on the above mentioned facts and its primary aim is to emphasize the importance of multi-dimensional analyses of available social services in the process of population global aging. In the presented partial results, the research focused on the analysis of social services providers in Slovakia from the point of view of their form, structure, capacity and regional differences. The secondary aim of the article is concentrated on an urgent need to resolve the issue of the Slovak population aging by means of chosen demographic indicators, as well as it focuses on a significance of legal framework formation that would provide long-term health care in Slovakia via social and health care services development.*

Keywords: *Ageing Population, Social System, Health System, Social Service Providers, Long-term care.*

JEL Classification: *I10, I15, I18.*

Introduction

Development of social services in Slovakia follows the National Priorities of Social Services Development for 2015 – 2020 (hereinafter the National Priorities) that also represents a tool of state policy for provisioning the social services system in the country. The National Priorities are drawn up in accordance with an activity of the Ministry of Labour, Social Affairs and Family of the Slovak Republic as well as the Strategy for Deinstitutionalization of Social Services System and Foster Care in the Slovak Republic [14]. They are based on the identified needs in the national and European context with an emphasis on availability and accessibility of social services and their long-term financial sustainability and efficiency (National Priorities). Similarly, the social services represent a significant part of primary aims of the Europe 2020 strategy. The main mission of the social services in Slovakia is a support of integrating people into society, social cohesion, routing to the services that are provided on the community level and developing of their potential in the field of employment and employability. The dependence of people on public and especially social services is created as a result of their unfavorable social situation. The citizens have their right to live free and independent life with a support of society on the basis of non-discriminatory principle. Many international documents have built their primary platform on respecting human rights and fundamental freedoms.

The National Priorities of Social Services Development in Slovakia reacts to current challenges of social help for citizens, where especially belongs a development of various care services at community level, including the needs of social services modernization. In Slovakia, there is a long-term lack of social services capacities that are provided in natural (home and community) environment of citizens, as well as insecure sustainability of the social services financing and their quality.

The National Priorities for 2015 – 2020 aims at:

- providing of social services availability in accordance with community needs,
- supporting of social services recipients' conversion from institutional care to community care,
- supporting development of social services available for people who remain in a spatially segregated location where a concentrated poverty and generational reproduction of poverty are present,
- increasing the quality of provided social services.

These aims (that are focused on availability, structure and quality of social services) may be accomplished when the present status of social services necessity, their development, determinants, as well as legal and other barriers are known.

1 Statement of a problem

Aging process of inhabitants of a particular country represents a significant determinant that influences needs and structure of social services [4]. The concepts and strategies of social development influenced by significant external influences and their penetration into different types of policies are getting more attention [13]. This issue that is constantly proclaimed at the international and also national level might be also well known as global aging [8]. The natural growth of population (the difference between a number of born alive infants and dead people) will stop in 2015 according to the Eurostat data. In 2011, the lowest population growth census in the history of population censuses was recorded when population, houses and apartments census was performed in Slovakia. Significant decrease of people in pre-productive age (0-14 years) from 18.9 % in 2001 to 15.3 % in 2011 was observed in comparison to data from 10 years ago [7] [11]. The perspectives of demographic development play a significant role in a formation of social services strategies [6]. They represent complex processes that require suitable methodological procedures and a sufficient amount of knowledge of the individual demographic processes [9]. The most frequent method is a (cohort) component method which is used by the Infostat perspectives in forecasting the medium-term development at a country level. It consists of the age groups shifting, either their increase, or decrease as a consequence of mortality, childbirth, migration and other demographic indicators [15]. The perspective till 2060 was formed in 2012 on the basis of the population, houses and apartments census from 2011. It has its basis in the number of citizens, age structure and composition of the population according to sex in a base year as well as in the rates of demographic indicators for the following period [5]. Both, length of forecasting period and transformation development of Slovakia that has been developing, influence the demographic perspectives. The slight increase of population number in Slovakia is expected till 2030 according to a medium scenario of population development and after 2030, a slight decrease is expected.

Table 1 shows a total number of inhabitants, main age groups and natural growth of population in a forecasting period.

Tab. 1: Forecasted number of inhabitants, main age groups and natural growth of population in SR

Year	Age structure of inhabitants - amount			Total number of inhabitants	Natural growth	Average age of inhabitants
	0 - 14	15 - 64	65 +			
2020	867,919	3,698,638	936,550	5,503,107	1,430	41.25
2030	785,829	3,594,565	177,579	5,557,973	-12,250	43.98
2040	700,565	3,456,245	1,375,214	5,532,024	-17,187	46.37
2050	709,531	3,118,909	1,641,562	5,470,002	-21,406	47.91
2060	678,530	2,899,363	1,767,037	5,344,930	-29,437	49.18

Source: processed on the basis of data [5]

In Slovakia, the decrease in number of inhabitants may be expected since 2030 as the data in the Table 1 shows, as well as the number of inhabitants in pre-productive and post -productive age will decrease, however, the number of citizens over 65 years will increase. The post-productive item will form one third of population according to a perspective. The average age of citizens will also be constantly increasing.

Aging process is not a newly established phenomenon. Its intensity and structure may be analyzed in the retrospective horizon, where regional disparities need to be quantified.

2 Long-term health care in Slovakia – applying research to practice

It is very important to know as demographic aspects and their development in a country so the present structure of social services providers, including their capacity calculations, morbidity limitation, availability, etc. in searching for resources to achieve the National Priorities for 2015 – 2020 aims. This area has been neglected for a very long time in terms of social and health policy of the Slovak Republic, which may be proved by an absence of legislative improvement of a long-term health care. In 2014, the research that analyzed a structure of the Slovak social services providers in detail was realized on the basis of our contractual cooperation with the Association of Health Insurance Companies. In Slovakia, there is still an absence of complex analyses of capacities and needs of health and social services, as well as complex analyses of the Slovak population morbidity. As a consequence of this fact, it is very difficult to determine the present, as well as potential demand for social and health services. Those special-purpose analyses that had been realized so far focused on chosen aspects of social services, while their structure and availability was only interpreted and evaluated in the summary indicators.

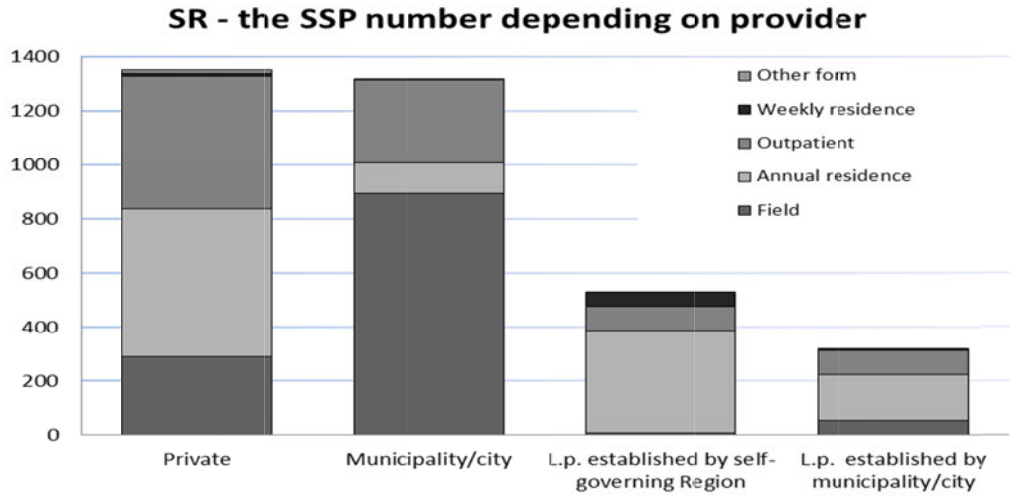
2.1 Methodology and database

The database of all the "Social services providers" in Slovakia (hereinafter the SSP) was used as the basis of our analysis. Totally, it includes 3518 items and 20 variables till 01.06. 2014, and in this article were applied the following: form of social service, guarantor, type of social service, Region of provided social service and facility capacity. MS Excel 2010 was used to process data – pivot tables and pivot diagrams. This special type of statistical tables contains data which are classified according to two or more statistical signs. A combination of classified aspects enables to emphasize the mutual connections and the SSP structure.

2.2 Partial research results

This chapter provides partial outputs of the analyzed SSP structure in Slovakia according to targeted criteria. Figure 1 illustrates their effort to participate in social services provisioning in a give region. Each of these forms has its particularities as the Social Services Act proposes [1]. However, a certain relation in this process may originate from a very low rate of the SSP as legal persons established by a city, or municipality, which is connected to predetermined and used model of social system in a given district.

Fig. 1: The SSP structure in Slovakia according to a guarantor

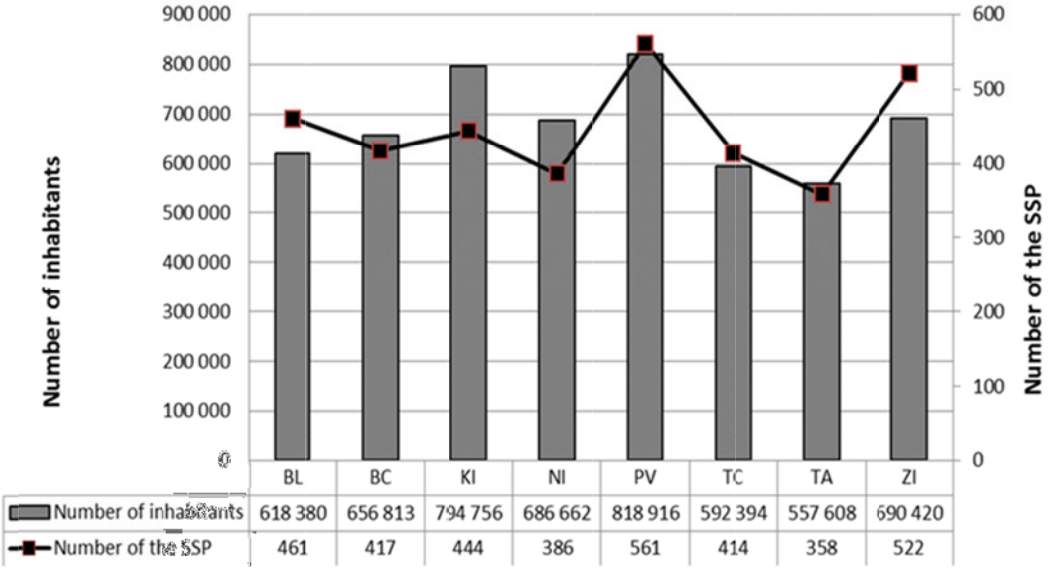


Source: own elaboration

As shown in Figure 1, in the structure of SSP by forms of social services weekly and annual residence dominates and a significant proportion in weekly residence has the Municipality/city. Significant proportion in the annual residence is covered by Private provider. Private provider is also dominant in the Outpatient form of SSP. A large share of SSP providing challenging weekly form of social services is being set up by Municipal/city. This justifies the significant status of municipalities/cities in the role of the founder that provides of social services. In this process the financial aspect is problematic. Current funding of long-term care through social welfare and minimum funding through public health insurance is inadequate. In addition to the need for increased funding from the public health insurance sources it is necessary to legislatively adjust the new long-term financing options. When setting the parameters of social policy in the different regions the indicator of development of population in the region should be monitored and also the related aspects of migration, changes in demand for social services in different regions in context of morbidity of population groups, etc. These facts are currently monitored in Slovakia only partially and on an insufficient level. Similarly, the form of social services provisioning in a given region may imply a direction of social policy predetermination in a given region. Each of these forms has its particularities as the Social Services Act proposes [1]. Provisioning of field social service or outpatient social service prevail over residence social service. If a field or outpatient social service is not suitable or effective and its provisioning does not sufficiently solve the unfavorable social situation of a person, the residence social service is provided. Weekly residence social service prevails over annual one with regard to preferences. Citizen has his/her right to choose a form of service and this right must be respected without any regard to given rules of preferences. Social service may also be provided via telecommunication technologies in such case that are efficient for a specific situation or an issue. The number of the SSP

in the individual Regions of Slovakia is not uniform. Similarly, there are evident disparities in the regional distribution (Figure 2).

Fig. 2: Number of the SSP and number of inhabitants (till 31.12.2014) in the self-governed Regions



Source: own elaboration

Abbreviations to the table:
Region: BL: Bratislava, BC: Banská Bystrica, KI: Košice, NI: Nitra, PV: Prešov, TC: Trenčín, TA: Trnava, ZI: Žilina

Figure 2 illustrates the regional disparities in the number of providers of the individual Regions. This fact may not be evaluated without any knowledge of contextual conditions, regional social policy, its development strategy, demographic aspects, as well as health policy aspects (e.g. burden of some industrial areas by higher rate of morbidity and mortality of inhabitants, there is a tendency of higher need for health and social services in chronic diseases in case of older inhabitants, etc.). An interesting view and valuable information for social policy is provided by the SSP structure in the individual Slovak Regions (Table 2 and Figure 3). In most of the Regions, there prevail the providers established by municipality/ city, except of three Regions (Bratislava, Nitra and Prešov).

Tab. 2: Number of the SSP according to a provider in the individual Slovak Regions

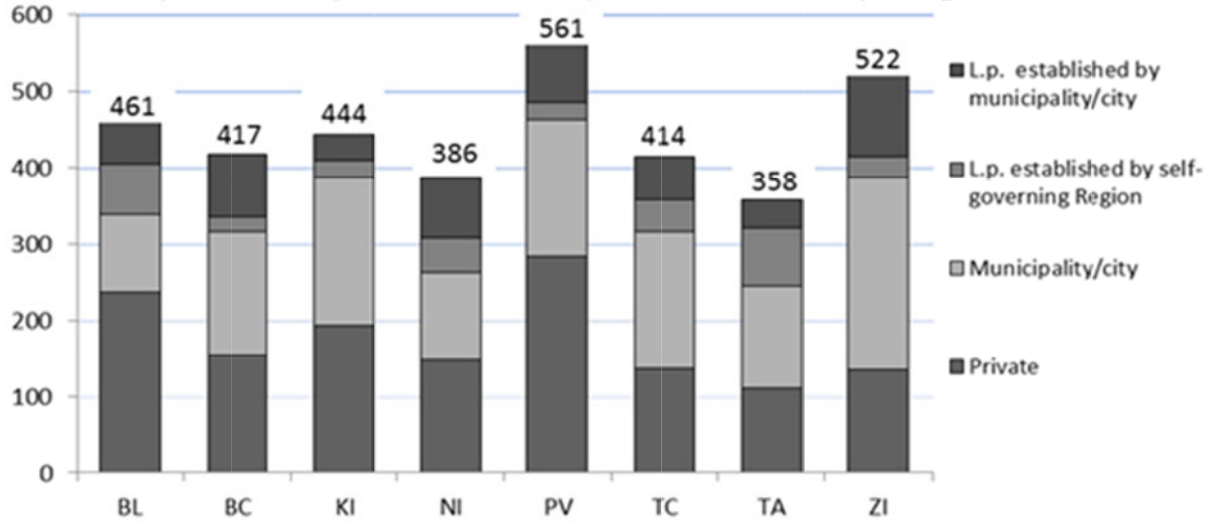
SR – number of the SSP (%) Provider	**BL**	**BC**	**KI**	**NI**	**PV**	**TC**	**TA**	**ZI**
Private	51	37	43	38	50	33	31	26
Municipality/city	22	39	43	30	32	43	37	48
L.p. established by municipality/city	14	5	5	11	4	10	21	5
L.p. established by self-governing Region	12	20		20	14	14	11	21
Total:	100	100	100	100	100	100	100	100

Source: own elaboration

Figure 3 confirms the fact that a significant place in social services provisioning have non-governmental organizations [12]. Here also belong physical and legal persons of business or non-business character (e.g. associations, movements, groups, foundations, interest groups, employers, entrepreneurs, etc.). The social basis (even if it is possible to gain profit for service provisioning) lies on service accessibility to citizens who have

a lack of resources to purchase these services, or to ensure their reimbursement from other resources.

Fig. 3: SR (Regions) – number of the SSP according to a provider



Source: own elaboration

In analyzing the forms of provided social services in the individual Regions, a dominance of three forms is obvious in these individual Regions: residence – annual, field and outpatient. Weekly residence social service is represented the least (Table 3).

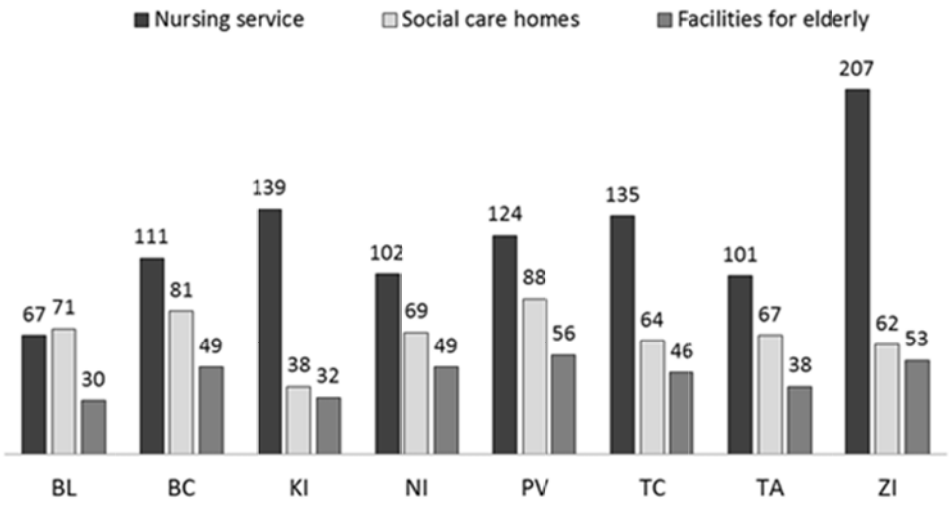
Figure 4 illustrates the number of the SSP that form a half of all the SSP in the individual Regions. It includes: Nursing service, Social care homes and Facilities for elderly. The Facilities for elderly are the most frequent in Žilina Region, except Bratislava Region.

Tab. 3: Forms of provided social services in the individual Slovak Regions

SR – number of the SSP (%) Form	**BL**	**BC**	**KI**	**NI**	**PV**	**TC**	**TA**	**ZI**
Residence - annual	32	41	28	43	32	33	33	29
Field	24	36	38	32	32	43	37	49
Outpatient	40	21	33	23	32	21	28	20
Residence - weekly	2	2	1	2	2	3	1	2
Other form	2	0	1	0	1	0	1	0
Total:	100	100	100	100	100	100	100	100

Source: own elaboration

Fig. 4: Number of the SSP in the individual Regions that form a half of all the SSP



Source: own elaboration

It is also necessary to analyze the SSP capacities in the individual Regions within the SSP analyses (Table 4). The largest capacity has those SSP which provide annual residence form of social service.

As the Table 4 shows, Facilities for elderly and Homes of social services have a dominant position in a given SSP structure from the point of given capacities in the SSP register. The main reason is a provision of a wider range of social services, such as in case of day care, or Nursing care facility. The given observation may be justified by a fact that Homes of social services, as well as Facilities for elderly are not strictly specialized in the chosen type of diagnosis, they are often adjusted to other various types of diagnoses that are particular for a given age category. This wider orientation of social services provisioning predetermines a higher demand for social and health care and simultaneously, for higher use of the SSP capacities, or the may signalize their potential insufficiency. Database of target group, i.e. number of socially dependent people who are differentiated with regard to individual diagnoses, or addictions to social service is necessary for an evaluation of their optimum.

Tab. 4: Capacity of the SSP facilities according to the social service form

SR – the SSP facilities' capacity*	Form of social service			Total	Rate (%)
Type of social service	Residence - annual	Outpatient	Residence - weekly		
Home of social service	17,609	1,711	705	20,025	42.1
Facility for elderly	14,372	132	1	14,505	30.5
Specialized facility	3,570	191	46	3,807	8.0
Shelter	2,121	-	-	2,121	4.5
Nursing care facility	2,049	24	14	2,087	4.4
Day care	-	1,474	-	1,474	3.1
Dormitory	-	965	-	965	2.0
Emergency housing facility	890	-	-	890	1.9
Rehabilitation center	28	603	43	674	1.4
Social housing facility	630	-	6	636	1.3
Home half way	-	344	-	344	0.7
Total	41,269	5,444	815	47,528	100.0

**Note.: The chosen SSP facilities are those where their capacity was given in all of the Regions*

Source: own elaboration.

3 Discussion

Present structure of social services in Slovakia is mainly influenced by demographic development. Actual demographic development is influenced by historical aspects as a consequence of significant differences' formation in the Regions' facilities of social services. In Slovakia, the social services do not cover a current need of the Slovak nation and they face an uneven allocation and insufficiency of financial resources for a very long time. In recent years, the system of the Slovak health care had been declined, including treatment and rehabilitation wards and long-term care institutions. Similarly, there absents a sufficient support from home nursing care in the natural (home) patient's environment. Homes of social services (HSS) are providers of social services exclusively, there absents their interconnection with health care. It is inevitable to build a system of effective and available nursing and rehabilitation care that would be connected with care and other services in order to help a disabled patient in his/her natural home environment as well as for long-term and seriously ill patients. Agencies of home nursing care (AHNC) that have a form of health facility, which provides a complex home nursing care, play a significant role. At present, their significance increases in accordance with a tendency of decreasing the number of hospitalization days in residential health facilities as well as moving a health care from hospital bed environment to home environment. In Slovakia, their insufficient support and financing present the main issue. Inevitable condition of existence of social services facilities is a management, available sources and effective economy of social services facility which will be set correctly. As available studies declare, almost 70 % of expenses of social services facilities are personal expenses. Financial evaluation of their employees is undersized now. Organizations which accept the social services facilities obligation often require grants prompts and projects as a consequence of providing the existence of such facility, while they do not have any resources for investment and development activities. Frequent changes in legislation, which amends an existence and function of these important

services, represent an obstruction in formation of stable links in the social system of the country [2]. An overview of main factors of SWOT analysis of social services development in Slovakia was created on the basis of available resources and results of our own research and seminars of long-term health care. These factors were divided into three blocks: procedural, structural and score (Table 5). "Procedural" factors convey an activity – process that lasts for a certain period of time and whose positive (strength) or negative (weakness) effect is significant and quantifiable. It is easier to implement measures on such factors that would lead to a development or improvement of social services quality in the regions or country. "Structural" factors indicate current or so-called margin of manoeuvre in the process of development or improvement of social services quality. Many times, they are a result of procedural activities and they have a form of, so-called "opportunity" or "threat" of social services development in Slovakia. The score factors are a consequence of terminated procedural activities that were realized in a specific place, i.e. either available opportunities were used in their realization or they were influenced by negative factors from external environment of a social system (in the Table written as "threats").

Tab. 5: Factors of SWOT analysis of social services development in Slovakia

Factors of SWOT analysis		**S**	**W**	**O**	**T**
Increasing demand for social services	C	x			
Activities' networking between the SSP and founder	A	x			
Wide network of public and private SSP (especially residence)	C	x			
Support of community types of social services at regional and national level	A	x			
Possibilities of social services co-financing	A	x			
High rate of the SSP residence in comparison to field or outpatient	C		x		
Insufficiently developed social services at community level	C		x		
Concept's discrepancy – community plans and the National Priorities	C		x		
Insufficient development of strategic documents of social services (absence of strategic framework of social services development in Slovakia)	C		x		
Absence of long-term care of deprived persons concept	C		x		
Non-system financing of social services, absence of unified approach to financing from a point of view of citizens and the SSP	A		x		
Low level of accessibility and debarrierization	A		x		
Low awareness of citizens to exercise their rights	C		x		
Insufficient level of education of social services employees	C		x	x	
Existing platform for formation of relevant strategic documents in social services development	B			x	
Support of innovation, modernization and integration of social services from the EU resources	B			x	
Possibility of participating approach of actors in formation of conceptual materials at national and regional level	B			x	
Formation of social services co-financing, while maintaining the law of choosing the social services providers by social services recipient	B			x	

Strong current potential of the private SSP to provide high quality social services	B			x	
Employees' interest in social services continuing education	B			x	
Transformation and deinstitutionalization processes	B			x	
Development and use of volunteering in social services	B			x	
Development of community centers	B			x	
Possibility to finance the projects from structural funds	B			x	
Existing platform for formation of economic incentives to develop community centers	B			x	
Fast process of global aging and increasing demand for demanding social services, increasing rate of socially excluded citizens	B				x
Permanent lack of financial resources to provide social services	B				x
Insufficient inter-departmental cooperation	B				x
Reluctance to finance innovative, alternative or pilot projects	B				x
Constant preference of institutionalized services from recipients' side	B				x
"Institutional" social care in the social services facilities and constant "institutional" thinking of employees	B				x

Notes: A - Procedural factors, B - Structural factors, C - Score factors, S - Strengths, W – Weaknesses, O - Opportunities, T - Threats.

Source: own elaboration on the basis [3] [6] [7][14]

The given factors and their aggregation into the structural, procedural and score groups help to find their continuity with the National Priorities of Social Services Development aims in Slovakia. These are focused on the aspects of social services availability in accordance with needs, but also requirements to form and maintain the necessary forms of social services and their quality. Also the National Priorities for 2015 – 2020 deals with the issue of supporting development and availability of social services in the areas of concentrated poverty. Aging index development in Slovakia is determined by a poverty risk that was faced by almost three-quarters of a million of people in 2011 (according to EU SILC 2011). It is inevitable to set an efficient system of pensions' provisioning that would prevent an elderly to fall below the poverty line, but also other social transfers, or other social protection tools in the process of its elimination. Significant factor in a given issue is a gender structure of poverty in Slovakia. There is recorded a growth of total rate of poverty risk since 2008 (poverty risk present more in women than men).

Conclusion

Population aging is presently a global demographic process that is evident in many developed countries all over the world. Change of demographic behavior was caused by a fast process of population aging during the last decades. It is inevitable to solve the issues connected to the consequences of population aging in economic and social area, health condition of elderly, the remaining years in health, or disease, life quality of elderly, as well as elderly health care and demand for social and health services with regard to demographic process. However, the negative consequences of population aging may be expected in economic and social sphere in a form of non-sustainable public systems – of pension payment and health care. Therefore, it is necessary to draw attention to the tools of state policy, such as the National Priorities of Social Services Development for 2015 – 2020. Municipalities, cities and self-governing Regions should elaborate these

National Priorities in their conceptual and planning documents, while the outcome should be an analysis of a status of social services provisioning in the Regions, and requirements and needs of their recipients. The partial results of the analysis of social services providers in Slovakia that are present in the article provide a valuable platform for creating of strategic and operative plans.

Acknowledgement

This work was supported by the VEGA Project No. 1/0929/14 **"***Multidimensional economic and financial evaluation of the implementation process and the use of one day health care and quantification of the financial impact on the health care system in the Slovak Republic"*.

References

[1] ACT NO. 448/2008 COLL. ON SOCIAL SERVICES AND ON AMENDING AND SUPPLEMENTING OF ACT NO. 455/1991 COLL. ON TRADE LICENSING (TRADE LICENSING ACT) AMENDING OF CERTAIN ACTS.

[2] ARNOLD, J., HOPE, T. *Accounting for Management Decisions*, 2nd edition, Prentice Hall International (UK) 1990. ISBN 10: 0130043915

[3] BARTÁK, M., GAVUROVÁ, B. Economics and social aspects of long-term care in the context in the Czech Republic and the Slovak Republic EU membership. In: *12th International Scientific Conference "Economic Policy in the European Union Member Countries*: Conference Proceedings: 16. - 18.9.2014: Karviná: Silesian University Opava, pp. 52-61. ISBN 978-80-7510-045-0

[4] BARTÁK, M. Health insurance in the Czech Republic, Slovakia, Germany and Austria - Common roots, common future? In: E a M: Ekonomie a Management, 2007, Vol. 10, No. 1, pp. 10-17. ISSN 2336-5604

[5] BLEHA, B., ŠPROCHA, B., VAŇO, B. *Prognóza populačného vývoja Slovenskej republiky do roku 2060*. Institute of Informatics and Statistics, Bratislava, 2013, pp. 70. ISBN 978-80-89398-23-2.

[6] GAVUROVÁ, B., ŠOLTÉS, V., ŠOLTÉS, M. Meranie zdravia a zdravotných rizík vo vybraných rómskych osadách na Slovensku – fakty a reflexie. In: *Nerovnosť a chudoba v Európskej únii a na Slovensku 2: Zborník statí z 2. medzinárodnej vedeckej konferencie*: Košice, 22. - 24. októbra 2014, Košice: TU, pp. 188-201. ISBN 978-80-553-1909-4.

[7] GAVUROVÁ, B., ŠTEFKO, R., BAČÍK, R. The Analysis of Social Services' Structure in a Specific Region and its Significance for Health and Social Policy in Slovakia. In: *Polish Journal of Management Studies*, 2014, Vol. 10, Iss. 2, pp. 43-53. ISSN 2081-7452.

[8] HALÁSKOVÁ, M., HALÁSKOVÁ, R**.** Approaches to Standardization of Public Services in the Czech Republic with Focus on Social Services.*Scientific Papers Univerzity of Pardubice*, 2014 Vol. 21, Iss. 30 (1/2014), pp. 40 -52. ISSN 1211-555X.

[9] HALÁSKOVÁ, M., HALÁSKOVÁ, R. Impacts of Decentralization on the Local Government Expenditures and Public Services in the EU Countries. *Lex*

Localis- Journal of Local Self – Government, 2014, Vol. 12, Iss. 3, 2014, pp. 623-642. ISSN 1581-5374.

[10] JUHAŠČÍKOVÁ, I., ŠKÁPIK, P., ŠTUKOVSKÁ, Z. *Obyvateľstvo v Slovenskej republike a krajoch SR,* vybrané výsledky Sčítania obyvateľov, domov a bytov 2011, Štatistický úrad SR, 2012.

[11] JUHAŠČÍKOVÁ, I., ŠTUKOVSKÁ, Z. *Obyvateľstvo Slovenskej republiky v kontexte Európskeho roku aktívneho starnutia*. ŠÚ SR, 2012, 90 p. ISBN 978-80-8121-144-7.

[12] OLÁH, M., SCHAVEL, M. *Úvod do štúdia a dejín sociálnej práce.* Prešov: Vysoká škola zdravotníctva a sociálnej práce sv. Alžbety, n. o. Ústav sociálnych vied a zdravotníctva bl. P. P. Gojdiča 2006. 1.vyd. 176 p.

[13] REPKOVÁ, K. Dobrovoľníctvo v sektore dlhodobej starostlivosti a aktívne starnutie. *Sociológia,* 2012, Vol. 44, No. 4, pp. 451-475.

[14] THE NATIONAL PRIORITIES OF SOCIAL SERVICES DEVELOPMENT FOR 2015 – 2020. Ministry of Labour, Social Affairs and Family of the Slovak Republic. [cit. 2016-01-21]. Available at WWW: <http://www.employment.gov.sk/sk/rodina -socialna-pomoc/socialne-sluzby/narodne-priority-rozvoja-socialnych-sluzieb.html.>

[15] VAŇO, B., JURČOVÁ, D., MÉSZÁROS, J. *Population projection of Slovakia until 2050. Institute of Informatics and Statistics*. Demographic Research Centre, 2002, Bratislava: Akty.

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Received: 08. 02. 2016
Reviewed: 26. 05. 2016, 30.05. 2016
Approved for publication: 08. 09. 2016

FINANCIAL PERFORMANCE EVALUATION OF THE CZECH AGRICULTURAL COMPANIES WITH FACTOR ANALYSIS

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Abstract: *The article is focused on determination of the financial indicators influencing corporate performance of agricultural companies. Traditional financial indicators (calculated from accounting data) are still used to evaluate performance level; this approach to evaluation and comparison of performance has been considered to be the most appropriate approach over a long period of time in spite of different accounting and financial indicators. Data from 1985 agricultural companies have been analysed. Correlation analysis and factor analysis have been employed to eliminate information duplication and reduce dimensionality. Application of these methods has reduced the basic set, originally formed by thirteen key financial indicators, into three key groups (indexes): operational factor, profit factor and return factor. At the same time, Pearson's chi-square test has indicated the dependency between the above mentioned factors (indices) and company size; the most significant factor being the "operational factor" with the strongest power in relation to the company size.*

Keywords: *Financial performance, Indicators, Factor analysis, Factor indexes, Agricultural companies.*

JEL Classification: *L21, L25, Q14.*

Introduction

Economic results, reported by the Czech agricultural sector in 2014, achieved an above -average positive outcome. The survey, made by the Agricultural Association of the Czech Republic based on the accounting data, suggested that the entire agriculture showed the profit amounting nearly to CZK 19 milliard (5331 CZK/ha). The value is more than twice as high as the long-term average of the economic results achieved in the years 2004-2014, reaching the sum of CZK 2400 CZK/ha, as the investigation of Agricultural Association of the Czech Republic confirmed.

The main driving forces behind strong results have been mainly the external factors, i.e., a very rich harvest and reasonable prices for animal commodities. As estimated, year-to -year agricultural production has increased by 4.8 %, mostly due to the record crop of corn and oil-seed rape. Higher animal production has not contributed to better results; on the contrary, increase in prices, especially for milk, as well as cattle, pigs and eggs. Despite good prices for animal commodities the prices for farmers (as the weakest link in the agriculture economic competition chain) were nearly by 4% lower in year 2014 compared to 2013 (with the vegetable production prices reporting the sharpest decrease, by more than 10%). Furthermore, volume of agriculture aid significantly influences the economic results. Comparing the sum of main agricultural aids (nearly CZK 30 milliard) and profit for the year 2014, i.e., CZK 19 milliard, it is rather clear that the Czech farming is profitable through these aids. Without such aids the Czech agriculture would report ca. CZK 11 milliard loss, or the food prices would have to be much higher in the Czech Republic [26].

Financial performance evaluation, including economic results, constitutes an important part of company management, as the evaluation figures help us to monitor and evaluate accomplishment of the basic economic objectives [27], [18].

1 Theoretical background

Recently, performance evaluation methods have significantly changed. Performance evaluation can be defined as the ability of a company to boost investments, put into business activities, contributing to continuous self-improvement and accomplishment of business objectives [23], [13], [15].

Performance evaluation is one of the tools helping the company management to decide how to do the business activity effectively [1], [12].

However, according to Tyrychtr, Ulman and Vostrovský [25] agricultural holdings predominantly focus on technical performance (more than 50% of all companies), only then on financial performance. At the same time, share of companies targeted at the efficient economic agriculture is increasing. Nevertheless, the level of this efficiency is below 13%.

Traditional financial indicators (calculated from accounting data) are still used today to evaluate performance; this approach to performance evaluation and comparison has been recognized as the most appropriate for a long period of time in spite of different accounting and financial indicators. Since 1980 traditional methods have been facing various views, identifying contentious issues in the use of these models, resulting in the search for other opportunities for performance evaluation [16], [14].

Over the time, the performance has been measured either by the company size or its productivity and profit. The scientific literature divides financial indicators of the company performance into three categories:

- ***Accounting results and derivative indicators*** – the accounting result is the result from the financial statement. The basic indicator, which can be explained by means of the structural analysis of the profit and loss statement. Accounting indicators express the company's performance in absolute values. The application of these indicators is recommended for various comparisons: proportion of personal costs to turnover; productivity rate; proportion of business margin to turnover, etc. These indicators provide a clear picture of productivity [2].
- ***Traditional production indicators (indicators of financial productivity)*** – these indicators provide information through the value of invested assets. The best known indicator is ROI (return on investment), calculated as the ratio of the economic result to the cost of investment. Another traditional productivity indicator is the ratio of the net economic results to the equity capital (ROE = return on equity). Ratio indicators of financial productivity provide information helping the company to compare its productivity, expected by shareholders, i.e., to evaluate so-called financial attractiveness.
- ***New category of financial indicators*** – represented by the metrics EVA (Economic Value Added); its positive value indicates that from purely financial point of view the company has successfully generated value after the payment of all capital investments, in particular from capital shareholders [17].

Areas of concern, related to the management, investors and creditors see the following Table 1, completed with the most frequently used methods of performance measurement.

Tab. 1: Performance indicators according to segments and perspectives

Management, Operational analysis	Gross margin Profit margin Added value	Net revenue result Structural analysis Revenue leverage
Investors/Shareholders productivity	Social capital productivity Earnings per share Cash flow per share	Net assets productivity Share quotation increase
Creditors, Liquidity	General liquidity Acid test	Liquidity value
Resource management	Stock turnover Receivables turnover	Suppliers turnover Asset turnover
Profit usage	Dividend per share Dividend ratio Distribution/un-allocation ratio	Dividend-coverage degree Dividends/Total assets
Financial leverage	Leverage degree Financial stability	Financial autonomy
Productivity	Economic value added Economic profit Cash-flow productivity	Gross productivity Net assets productivity Economic productivity (net)
Market performance	Value vectors Company value Accounting value	Value on market Relative movements of quotations
Debt service	Fixed-expenses coverage degree Cash-flow analysis	Interest-coverage degree Debt-coverage degree

Source: [7]

"Profit and loss statement", representing the influence of managerial operational decisions on the economic results of the company, has been used to study company performance (in this case the information whether the company generates profit or loss). In consideration of these results the balance must be extended to clarify certain important elements in the modification in the shareholders' capital with the aim to offer more detail information necessary to measure performance in company. Information related to the company's performance, especially as regards its productivity, is used for:

- evaluation of potential modifications of the company's economic resources in a way to be influenced in the future. Information related to performance and mainly the ability of its change are immensely important for decision-making process, e.g., the ability to forecast cash flows from the existing resources;

- declaration on efficiency in the use of new resources [17].

On the basis of its theoretical framework this article focuses on the financial indicators of agricultural companies in the Czech Republic, forming the part of financial performance. Data contained in the database Amadeus will be analysed by the factor analysis.

2 Methods

The main aim of this paper is to find crucial factors in the field of financial performance in agriculture companies (as one of the most important industry sector). Partial aim of the paper is to identify relationship between *observed factors* and *company size*.

Main hypothesis suggests dependence between realization of individual activities and their performance in connection with agriculture. Agriculture has become the very important part of industry production in the past. Data have been gathered from Amadeus database and processed by the statistical program IBM SPSS Statistics 22; subsequently, (1) factor analysis, and (2) dependency between two nominal variables by means of contingency tables and Pearson's chi-squared test have been studied.

The conditions for choice of companies:

1. geographical location (Czech Republic),
2. classification of economic activities according to CZ-NACE, reduced to agriculture sector (see Table 2).

According to selected NACE groups, the basic population has been defined, consisting of 2544 agriculture companies in the Czech Republic. Only 1985 companies have reported all required data to be used for investigation (see Table 2).

Tab. 2: Pivot table: company size and CZ-NACE groups

CZ-NACE	Company size				Total
	Micro	***Small***	***Medium***	***Large***	
1 – Crop and animal production, hunting and related service activities	762	745	288	4	1799
2 – Forestry and logging	85	63	14	1	163
3 – Fishing and aquaculture	6	11	6	0	23
Total	853	819	308	5	1985

Source: authors

Factor analysis is based on the selection of correlation and partial correlation coefficients. The correlation coefficient represents the closeness of linear dependence of individual variables and partial correlation coefficients. The partial correlation coefficient shows a similarity of two variables in such a situation that the other variables are assumed constant. If it is possible to explain the dependence of variables using common factors, the partial correlation coefficients are very small, close to zero. To assess the suitability of the factor analysis, two tests can be used [24], [4]:

- Kaiser-Meier-Olkin (KMO) is a coefficient which could reach values between 0 and 1. Its value consists of the rate of squares sum of the correlation coefficients and squares sum of the correlation and partial coefficients.

- The use of Bartlett's sphericity test lies in testing the null hypothesis stating that the correlation matrix of variables is unit (on diagonal, there are only ones, others are zeros). If the null hypothesis is rejected, the factor analysis may be used for the defined variables.

For the purposes of verification of the factor analysis Cronbach's alpha indicator must be used. This indicator is understood as a reliability coefficient, used as a kind of analogy with the correlation coefficient. Normally, values oscillate in the interval <0, 1>. Zero, as the extreme value, describes the situation in which individual variables are uncorrelated. On the other hand, the value 1 describes correlated variables. When the value is closer to 1, a higher degree of conformity is reported [9], [5], [21].

However, high Cronbach's alpha does not imply that the measure is dimensionless. If, in addition to measuring internal consistency, you wish to provide evidence that the scale in question is dimensionless, additional analyses can be performed. Exploratory factor analysis is one of the method to check dimensionality. Cronbach's alpha is not a statistical test; it is a coefficient of reliability (or consistency). The value could be expressed as the function of number of test items and the average inter-correlation among the items. Below, for conceptual purposes, we show the formula for the standardized Cronbach's alpha:

$$\alpha = \frac{N \times \bar{c}}{v + (N + 1) \times \bar{c}} \tag{1}$$

where

N equals to the number of items,

c-bar is the average inter-item covariance among the items,

v-bar equals to the average variance.

If the values increase the number of items (N), it is possible to increase Cronbach's alpha. Moreover, if the average inter-item correlation is low, the alpha will be low, too. As the average inter-item correlation increases, Cronbach's alpha increases as well. The values of Cronbach's alpha could be from 0 to 1. If the values are close to 0.5, it signifies a bad level of internal consistency. Over 0.7 means that the value is acceptable and values close to 1 are excellent. A "high" value of the alpha is often used (along with substantive arguments and other statistical measures) as evidence that the items measure an underlying (or latent) construct [8].

3 Results

According to analysis of results, it is evident that companies commonly use traditional financial indicators for measurement of their own effectiveness. Based on the analysis of descriptive statistical characteristics of the sample (see Table 3), conclusions will be presented merely as an explorative result limited by the resultant reliability. In the results of the paper there are characteristics of research barriers and future research possibilities.

Tab. 3: Descriptive statistics of variables

	Units	***Mean***	***Std. deviation***	***Variance***
x_1 – Cash flow	*[th EUR]*	346.78	606.23	367512.93
x_2 – P/L before tax	*[th EUR]*	167.06	467.44	218503.70
x_3 – Operating revenue	*[th EUR]*	2537.87	5239.57	27453062.23
x_4 – Sales	*[th EUR]*	2031.85	4910.34	24111398.72
x_5 – EBIT	*[th EUR]*	188.79	441.62	195026.36
x_6 – P/L after taxes	*[th EUR]*	134.79	387.20	149923.01
x_7 – ROA	*[%]*	4.76	11.34	128.67
x_8 – EBITDA	*[%]*	16.23	14.65	214.76
x_9 – Profit margin	*[%]*	5.51	13.04	170.06
x_{10} – Profit per employees	*[th EUR]*	6.45	19.27	371.42
x_{11} – ROCE	*[%]*	12.43	37.06	1373.54
x_{12} – ROE	*[%]*	14.14	45.96	2112.22
x_{13} – Average costs of employees	*[th EUR]*	11.26	8.43	71.10

Source: authors

Based on the statistical characteristics of the examined group the conclusions could be presented as an approximate result, limited by the resulting reliability. In the results of the paper there are characteristics of research barriers and future research possibilities.

For the purpose of factor analysis the value of Kaiser-Meier-Olkin test should reach the value of at least 0.5. For the indicators in factor analysis KMO is 0.737 (high level of acceptance). Factor analysis reveals the reduction in surveyed company performance indicators which companies use in their own measurement processes. Factor analysis shows the reduction in surveyed company performance indicators which companies use in their own measurement processes of implemented innovations. The main input into factor analysis has been the correlation matrix, illustrating individual correlation values of the chosen indicators.

Tab. 4: Correlation matrix

	Cash flow	*P/L before tax*	*ROCE*	*ROE*	*Operating revenue*	*Sales*	*EBIT*	*P/L after tax*	*ROA*	*EBITDA*	*Profit margin*	*Profit per employees*	*Average costs of employees*
Cash flow	1												
P/L before tax	0.941	1											
ROCE	-0.021	0.020	1										
ROE	-0.015	0.021	0.606	1									
Operating revenue	0.638	0.559	-0.019	-0.023	1								
Sales	0.562	0.498	-0.012	-0.017	0.992	1							
EBIT	0.941	0.977	0.017	0.017	0.584	0.520	1						
P/L after taxes	0.933	0.995	0.024	0.025	0.554	0.494	0.965	1					
ROA	0.160	0.271	0.167	0.147	0.013	0.009	0.256	0.286	1				
EBITDA	0.245	0.270	0.030	0.031	-0.092	-0.122	0.285	0.281	0.517	1			
Profit margin	0.283	0.390	0.110	0.104	-0.005	-0.025	0.361	0.410	0.769	0.748	1		
Profit per employees	0.188	0.274	0.110	0.072	0.017	0.011	0.262	0.289	0.523	0.469	0.644	1	
Average costs of employees	0.142	0.118	0.009	-0.010	0.081	0.070	0.123	0.120	0.088	0.087	0.134	0.312	1

Source: authors

According to correlation matrix there were found that exist closed relationship between almost all variables, except Average costs of employees. These variables were used such input into method of principal components gives for calculation.

Factor analysis gives up reduction of surveyed company performance indicators which companies use in own measurement process. The main input into factor analysis has been the correlation matrix showing the position of the individual selected correlation values. The values, listed in the Table 4, indicate that correlations exist in nineteen relations, as highlighted.

The total variance of the performance indicators is explained by means of eigenvalues, representing the total variance explained by each factor. The eigenvalues show that only five items have reached the minimum value of 1. From this point of view, Extraction Sums of Squared Loadings with cumulative percentage are important. Factor analysis has extracted four factors, which explains 81.406 % of the variance. This result confirms the good factor result of the interpreted variance.

In order to assess whether it is possible to use the factor analysis, Kaiser-Meyer-Olkin method (KMO) and Bartlett's test of sphericity have been used. The KMO method is based on selective correlation and partial correlation coefficients. The KMO value range is between 0 and 1. In our case, the KMO reached value is 0.737, which means that the performed level of usefulness of the factor analysis reaches high value. Bartlett's test of sphericity is a statistic test used to examine the hypothesis that the variables are correlated or uncorrelated. According to the KMO, no correlation has been found with other variables (Sig = 0.000). Nevertheless, Bartlett's test of sphericity is significant because of the value, lower than 0.05 (see Table 5).

Tab. 5: Indicators of innovation measurement in the company – rotated matrix

	Operational factor (OF)	***Profit factor (PF)***	***Return factor (RF)***	***Average cost per employee factor***
Cash flow	0.933	0.194	-0.051	-0.026
P/L before tax	0.915	0.310	-0.011	-0.068
Operating revenue	0.826	-0.255	0.038	0.270
Sales	0.777	-0.283	0.053	0.293
EBIT	0.919	0.289	-0.015	-0.054
P/L after taxes	0.907	0.326	-0.008	-0.063
ROA	0.096	0.779	0.167	0.070
EBITDA	0.076	0.825	-0.056	-0.078
Profit margin	0.164	0.913	0.063	0.045
Profit per employees	0.090	0.715	0.061	0.409
ROCE	-0.009	0.080	0.889	0.012
ROE	-0.003	0.065	0.888	-0.038
Average costs of employees	0.053	0.155	-0.038	0.869

Source: authors

Acceptable values of Cronbach's alpha have been specified for three indexes according to observed results in Table 5: (1) operational factor (0.705), (2) profit factor (0.830) and (3) returns factor (0.770). Cronbach's alpha value for the last factor could not be calculated because of the only one indicator included. Final values calculating acceptable factors need the transformation of individual coefficients. These coefficients express significance of the used elements. Their sum total must be 1. The individual factor indices have been defined by the procedures as follow:

$$OF = 0.1825 \times x_1 + 0.1885 \times x_2 + 0.1315 \times x_3 + 0.1210 \times x_4 + 0.1877 \times x_5 + 0.1887 \times x_6 \quad (2)$$

$$PF = 0.2496 \times x_7 + 0.2489 \times x_8 + 0.2743 \times x_9 + 0.2272 \times x_{10} \quad (3)$$

$$RF = 0.4991 \times x_{11} + 0.5009 \times x_{12} \quad (4)$$

These indices can be calculated for the individual agricultural company and on the basis of their results a list of businesses can be compiled. Indices can determine important factors of business, playing the key role in achieving the set of objectives. Proposed financial performance indicators should help companies to demonstrate a progress towards the objectives of sustainability. Also we can see basic statistics of observed indexes in Table 6.

Tab. 6: Descriptive statistics of observed indexes

	OF	***PF***	***RF***
Mean	753.7985	2329359.810	13.4859
Variance	8.4961	119.561	1285.495
Std. deviation	1526.22404	10.93440	35.85380

Source: authors

Pivot tables have been employed to find possible dependencies between observed factors and company size. Results of the dependency tests (see Table 7) examining dependence between individual factors and impact of company size. Results of the dependence examination in individual variable categories are depicted in the following results of Pearson's chi-square test.

Maintaining the % reliability of the test, the values for connection between individual factors and company size have been determined within 0.05, which represents 5% reliability level. Established values of α for the variables are: $\alpha_{OF} = 0.000$; $\alpha_{PF} = 0.000$, $\alpha_{RF} = 0.000$ (i.e., less than 0.05). Therefore, that bring us to the conclusion that an alternative hypothesis is applied – there are dependencies between all observed factors and company size.

Past results have revealed the relationship between company size and indices. Subsequently, degree of such dependence has been examined. To that end, the intensity of dependence determined by means of contingency coefficient.

Tab. 7: Pearson's test of the relationship between individual factors and company size

		Value	*Asymp. Sig. (2-sided)*
Operational factor and company size	Pearson Chi-Square	769.016	0.000
	Contingency Coefficient	0.548	
Profit factor and company size	Pearson Chi-Square	67.046	0.000
	Contingency Coefficient	0.195	
Return factor and company size	Pearson Chi-Square	70.985	0.000
	Contingency Coefficient	0.267	

Source: authors

The intensity of dependence ranges between <0;1>. That means that the higher the absolute value, the greater the intensity of dependence. For the first connection (operational factor and company size) the value 0.548 has been calculated, i.e., the intensity inclines to be strong. For the second connection (profit factor and company size) the value 0.195 has been calculated, i.e., the intensity inclines to be rather low. For the third connection (return factor and company size) the value 0.267 has been calculated, i.e., the intensity inclines to be low.

Conclusion

Financial performance evaluation employs traditional indicators, utilizing accounting data of the company. The advantage of such indicators is a relatively easy traceability as such data constitute the part of obligatory reporting (financial statements, balance and profit/loss statement form the part of annual balancing). With respect to the fact that the press release, published by Agricultural Association, has published the information related to the economic results of the Czech agriculture sector, the research itself has focused on the area of economic results, i.e., financial indicators. Earlier studies (e.g. [6], [19], [3]) describe the diversity of financial indicators based on peculiarities of the company's activities. Along with the traditional financial indicators: revenue growth, return on equity and EBIT, gross operating profit, net operating profit and sales achieved, etc. Financial performance indicators include such indicators as market share [10] and sales growth [20], which are described by researchers' opinions as the indicators of growth or competitiveness.

Financial indicators are frequently expressed as financial ratios. Ratios are a strategic management tool providing the key stakeholders with a concise and systematic way to organize the voluminous data contained in financial statements (e.g., balance sheets, income statements, and statements of cash flows) into meaningful information. Financial ratios refer to the numerical or quantitative relationship between two items or variables. This relationship can be expressed in various terms such as percentages or fractions [22], [11].

The main aim of this paper has been to find crucial factors in the field of financial performance in agriculture companies and identify relationship between *observed factors* and company size. Empirical research deals with factor analysis that gives up reduction of surveyed indicators. Our research has showed that there are three factor groups of financial indicators in the area of agricultural companies: operational factor, profit factor and return factor. These index groups consist of traditional financial indicators complemented of (for instance): profit per employee or average cost of employee

(the last two can be described as financial ratios). At the same time, dependence among the above mentioned factors (indices) and company size has been identified. In the first connection - between operational factor and company size - the intensity inclines to be strong. Consequently, we can say that this index is the most important from the point of dependence strength in relation to the company size. In the second connection - between profit factor and company size - the intensity inclines to be rather low and in the third connection - between return factor and company size - the intensity inclines to be low. Management of the agricultural company can compare its performance with performance of other companies in the market and can identify its weaknesses.

References

[1] ARENA, M., AZZONE, G., BENGO, I. Performance Measurement for Social Enterprises. *Voluntas: International Journal of Voluntary and Nonprofit Organizations*, 2015, Vol. 26, Iss. 2, pp. 649-672. Doi: 10.1007/s11266-013-9436-8

[2] BRIGNALL, T. J. S. A financial perspective on performance management. In *Irish Accounting Review*, 2007, Vol. 14, Iss. 1, pp. 15–29. ISSN: 0791-9638.

[3] CARDINAELS, E., VAN VEEN-DIRKS, P.M.G. Financial versus non-financial information: The impact of information organization and presentation in a Balanced Scorecard. In *Accounting, Organizations and Society*, 2010, Vol. 35, Iss. 6, pp. 565-578. Doi: 10.1016/j.aos.2010.05.003.

[4] CONTI, G., FRÜHWIRTH-SCHNATTER, S., HECKMANC, J. J., PIATEKE, R. Bayesian exploratory factor analysis. In *Journal of Econometrics*, 2014, Vol. 183, Iss. 1, pp. 31-57. Doi: 10.1016/j.jeconom.2014.06.008.

[5] CRONBACH, L. J. Coefficient alpha and the internal structure of tests. In *Psychometrika*, 1951, Vol. 16, Iss. 3, pp. 297-334.

[6] FERNANDES, K. J., RAJA, V., WHALLEY, A. Lessons from implementing the balanced scorecard in a small and medium size manufacturing organization. In *Technovation*, 2006, Vol. 26, Iss. 5-6. pp. 623-634. Doi: 10.1016/ j.technovation.2005.03.006.

[7] HELFERT, E. *Tehnici de analiz financiar*. Bucureti: BMT Publishing House, 2006.

[8] HINTON, P. R., BROWLOW, Ch., McMURRAY, I., COZENS, B. *SPSS explained*. Hove, Routledge, 2004.

[9] HRACH, K., MIHOLA, J. Metodické přístupy ke konstrukci souhrnných ukazatelů. In *Statistika*, 2006, Vol. 86, Iss. 5, pp. 398-418.

[10] CHEN J. - S., TSOU, H. T., HUANG A. Y. - H. Service Delivery Innovation: Antecedents and Impact on Firm Performance. In *Journal of Service Research*, 2009, Vol. 12, Iss. 1, pp. 36-55. Doi: 10.1177/1094670509338619.

[11] KOTANE, I., KUZMINA-MERLINO, I. Assessment of financial indicators for evaluation of business performance. In *European Integration Studies*, 2012, Vol. 6, pp. 216-224. Doi: 10.5755/j01.eis.0.6.1554.

[12] LEBAS, M. J. Performance measurement and performance management. *International Journal of Production Economics*, 1995, Vol. 41, Iss. 1, pp. 23–35.

[13] MARIA, B. Information system for modeling economic and financial performances. *Annals of the University of Oradea, Economic Science Series*, 2009, Vol. 18, Iss. 4, pp. 902-907.

[14] MOHAMED, R., HUI, W. S., RAHMAN, I. K. A., AZIZ, R. A. The Relationship between strategic performance measurement system and organisational capabilities: The role of beliefs and boundary control systems. *Asian Journal of Business and Accounting*, 2014, Vol. 7, Iss. 1, 107-142.

[15] MUCHIRI, P. N., PINTELON, L., MARTIN, H., DE MEYER, A.-M. Empirical analysis of maintenance performance measurement in Belgian industries. *International Journal of Production Research*, 2010, Vol. 48, Iss. 20, pp. 5905–5924.

[16] NEELY, A. *Business performance measurement: Theory and practice*. Cambridge University Press, 2004.

[17] NICU, I. E. Company performance measurement and reporting methods. *Annals of the University of Oradea, Economic Science Series*, 2012, Vol. 1, Iss. 2 pp. 700-707.

[18] O'SULLIVAN, D., ABELA, A. V., HUTCHINSON, M. Marketing performance measurement and firm performance: Evidence from European high-technology sector. *European Journal of Marketing*, 2009, Vol. 43, Iss. 5/6, pp. 843-862. Doi: 10.1108/03090560910947070.

[19] PHILIPS, P., LOUVIERIS, P. Performance measurement systems in tourism, hospitality and leisure small medium sized enterprises: a balanced scorecard perspective. In *Journal of Travel Research*, 2005, Vol. 44, Iss. 2, pp. 201-211. Doi: 10.1177/0047287505278992.

[20] PRIETO, I. M., REVILLA, E. Learning capability and business performance: a non-financial and financial assessment. In *Learning Organization*, 2016, Vol. 13, Iss. 2, pp. 166-185. Doi: 10.1108/09696470610645494.

[21] ŘEHÁK, J., BROM, O. *SPSS: Praktická příručka*. Brno: Computer Press, 2016, 336 p. ISBN 978-80-251-4609-5.

[22] SUAREZ, V., LESNESKI, C., DENISON, D. Making the case for using financial indicators in local public health agencies. In *American Journal of Public Health*, 2011, Vol. 101, Iss. 3, pp. 419-425. Doi: 10.2105/AJPH.2010.194555

[23] ŠULÁK, M., VACÍK, E. *Měření výkonnosti firem*. Praha: Eupress, 2005, 90 p. ISBN 80-86754-33-2.

[24] TARNANIDIS, T., OWUSU-FRIMPONG, N., NWANKWO, S., OMAR, M. A confirmatory factor analysis of consumer styles inventory: Evidence from Greece. In *Journal of Retailing and Consumer Services*, 2015, Vol. 22, pp. 164-177. Doi: 10.1016/j.jretconser.2014.07.001.

[25] TYRYCHTR, J., ULMAN, M., VOSTROVSKÝ, V. Evaluation of the state of the Business Intelligence among small Czech farms. In *Agricultural Economics*, 2015, vol. 61, Iss. 2, pp. 63-71. Doi: 10.17221/108/2014-AGRICECON.

[26] ZEMĚDĚLSKÝ SVAZ ČESKÉ REPUBLIKY. *Tisková zpráva Zemědělského svazu ČR ze dne 6. 3. 2015 k výsledkům hospodaření v zemědělství v r. 2014*. [cit. 2016-01-11]. 2015. Available at WWW:

<http://www.zscr.cz/media/upload/1425637252_2015-tz-k-vysledku-zemedelstvi-za-rok-2014.pdf (accessed Jan 11, 2016)>

[27] ZHANG, J. J., LAWRENCE, B., ANDERSON, CH. K. An agency perspective on service triads: Linking operational and financial performance. *Journal of Operations Management*, 2015, Vol. 35, pp. 56-66. Doi: 10.1016/j.jom.2014.10.005.

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Received: 22. 03. 2016
Reviewed: 02. 06. 2016, 06. 06. 2016
Approved for publication: 08. 09. 2016

COMPARISON OF USABILITY EVALUATION OF PUBLIC ADMINISTRATION WEBPAGES BY USER TESTING AND BY ANALYTICAL MODELS

Miloslav Hub, Barbora Musilová

Abstract: *The usability of user interfaces especially of webpages is currently a very hot topic. The existing scientific literature contains various methods for testing and evaluation of the usability of various user interfaces. The benefit of various usability evaluation methods is described in this article, especially evaluation of usability by models and user testing. The most commonly used methods for these purposes are usability testing and heuristic evaluation. However, there are also suggestions of usability evaluation through analytical models that allow us to evaluate usability without having to involve end-users or experts in this evaluation process. These methods and their applicability are described in the article as well. For the purposes of the research as representative websites of public administration were chosen websites of selected municipalities. Next, the paper deals with evaluation of the web pages of selected statutory cities usability where the usability is evaluated by both suggested and validated analytical model and usability testing. The main goal is to compare the results of usability evaluation by analytical models and usability testing that use real end users and to check the analytical model's ability to act like in a real situation.*

Keywords: *Analytical Models, Usability, Usability engineering, Usability evaluation, User interfaces, User testing.*

JEL Classification: *C88, H83, L86.*

Introduction

Usability is an approach to product development which includes user feedback within the development cycle in order to achieve cost reduction and to create such products and tools that comply with user's needs [15]. Usability of user interface as a accessibility [13] is important for both commercial [11] and public administration [14] software. The term usability is built on five attributes:

1. learnability - how difficult it is to learn,
2. errors - minimum errors when working with a system,
3. efficiency - achieve the highest possible efficiency,
4. satisfaction - user likes to work with the system,
5. memorability - ability to work with the system even after a longer period of not using it [12].

The goal of usability evaluation is to specify the requirements on user interface, to identify problems connected to usability or to improve the user interface [6]. Another term related to usability is usability engineering which represents so called usability evaluation within the product life cycle [12].

Usability might be tested in several ways; this article will focus on two of them - user testing and testing with the use of models with minimum utilization of users [6]. The main goal of this article is to compare these methods and the results achieved by using models and users. The goal of this comparison is to find out how much the methods using models differ from real user behaviour; the real user will be represented by an average user consisting of a few cooperating participants.

1 Statement of a problem

1.1 Comparison definition

The goal of this paper is to introduce the results of comparing two methods targeted on usability evaluation. Both methods will be used to evaluate web sites of five statutory cities on five tasks. The tasks will be the same for both methods. The comparison will consist of the most basic approach to usability evaluation - user testing and analytic modelling techniques which are not often used for usability testing.

1.2 Further process definition

The first step will be creating a research of already existing models which focus on usability evaluation; one model out of existing seven will be selected based on comparing models features. The selected model will be used to model created tasks and to evaluate the usability of statutory cities web sites. In the next step, the same web sites usability will be evaluated by using already existing user testing.

The results of both methods, especially time necessary to carry out presented tasks for individual statutory cities, will be compared and future process will be decided.

2 Methods

2.1 Methods for usability evaluation based on user testing

Usability testing with real users is a basic method of testing as stated in [12]. It is an irreplaceable method which provides direct information about how users work with computers. It is important to clarify the reason of testing - determining correct and wrong aspects of the interface together with interface improvement or evaluation of the overall interface quality [12]. Further, it is necessary to select a corresponding sample of users with the right knowledge, abilities etc. and a place for the testing.

User testing is a method based on monitoring the user during task fulfilment using particular hardware and software. From a certain viewpoint it is an irreplaceable method which is only complemented by the other methods. Usability testing consists of five phases: planning, trial test, live test, control test, results interpretation and presentation [12]. User testing offers a whole scale of options to scrutinize usability. It is possible to monitor participants' behaviour in their regular environment or in a carefully selected laboratory. Task fulfilment by participants may be monitored from a great distance using software which enables the participant and tester to be at different places; or they may be at the same place. The activity of participants is recorded for further research. Different types of interviews and sessions are organized with the participants to uncover their viewpoints, approaches, needs and reactions [6].

2.2 Usability evaluation methods based on models

Analytical usability evaluation represents using models created by an analyst. This method excludes utilization of users or experts for direct usability evaluation. Uncertainty can be modelled for example by a fuzzy apparatus [9]. Usability is evaluated only based on models describing user behaviour in selected environment. Modelling methods often enable predicting usability at low cost. They are usually used to complement other methods, e.g. user testing [6]. This type of usability testing, unlike user testing, does not have problems with slow speed as well as high time and financial requirements, although this might not be true in all cases. The methods of user and expert testing are limited by time, costs and user selection.

Usability evaluation might use one of the following models selected in accordance with the particular problem, available knowledge and available time and financial resources:

- Design analysis [6]
- Task environment analysis [10]
- Knowledge analysis [6]
- GOMS analysis [7]
- Cognitive task analysis [3]
- Programmable user models [1]
- UIDE analysis [5]

3 Statutory cities web sites usability

3.1 Goals of models

The main goal of the whole project described in this paper was evaluation of statutory cities web sites usability first using models and then using participants. In order to be able to use models, it is necessary to know clear goals which the models should reach, in other words the knowledge of concrete processes and information that users carry out and search at the websites. This whole process or path to the sought information might by described by a model in detail. Feasibility of the goal of sought information is a crucial element. Therefore, before creation of the model, cities were sent an email asking them to supply information on real traffic of users at their websites. The cooperating cities include Hradec Kralove, Olomouc and Pardubice, the information from these cities served to create 5 tasks for usability evaluation by both methods. The list of statutory cities was completed by adding Brno and Plzen.

Example of a created task:

Task 2 - find available jobs.

3.2 Usability evaluation – models

Comparison of descriptions and features of models found within the research led to selecting the NGOMSL model belonging to GOMS modules [6] (GOMS means “a set of Goals, a set of Operators, a set of Methods for achieving the goals, and a set of Selections rules for choosing among competing methods for goals” [2]). These models examine usability especially from the point of prediction. They deal e.g. with determining required

time for task accomplishment by the user, which holds true also for NGOMSL. NGOMSL uses external operators to determine task duration; the operators are taken from a model of lower level: KLM-GOMS. These external operators are actually keyboard operators providing information on time duration of pressing key by an average-experienced user, see Tab 1. Further it works with duration of waiting for system response and number of declarations and mental operators.

Tab. 1: Time necessary for keyboard typing - average user

Typing on keyboard	Words per minute	Time [s]
Average user	55	0.20

Source: [4]

NGOMSL model was used to record all 5 tasks for each statutory city. The record represents an example of a created model. This represents so called rule of selection which represents a signpost for further progress in the particular model. The example below under the selection rules represents the lowest step of hierarchical decomposition of solved task where keyboard operators are used with an assigned time of processing.

Example of a created model:

```
Rules of selection for goal: identify key words on home page.
If one of the key words exists on the screen, carry out the
goal: work with 1 key word.
If no key word is on the screen, carry out the goal: work
with array.
Return with accomplished goal.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Method for goal: Select 1 key word
Step 1. Determine stating position 1 key word     (1.20 s)
Step 2. Decide: If hands are not on mouse,
        move them onto mouse                      (0.40 s)
Step 3. Move cursor at the beginning
        of 1 key word                             (1.10 s)
Step 4. Click mouse button.                       (0.10 s)
Step 5. Return with accomplished goal
```

In order to determine task duration for all 25 models, following steps are followed [8]:

NGOMSL declarations time = number of processed declarations x 0.1 seconds,

primitive operators time = total time,

analyst defined operators time [4] = total time,

waiting time = total time when user is waiting for system response.

Tab. 2: Time of tasks processing

Time to process task [s]	Pardubice	Hradec Králové	Olomouc	Brno	Plzeň
Available jobs	20.30	13.00	12.40	7.30	9.00
Dog age	56.40	17.70	25.60	66.60	1000.00
Driving license	24.80	19.80	24.60	21.10	44.50
Online reservation	21.10	18.80	20.10	20.50	25.20
Magistrate department	37.90	26.60	19.60	26.90	15.70
Total time	160.50	95.90	102.30	142.40	1094.40

Source: Authors

Table 2 represents total times of task processing. The duration depends on complexity of goal accomplishment; only the time for statutory city Plzen needed to find the dog age threshold for paying dog fee is extreme compared to the others. Process of searching this information at Plzen website is difficult and depends on knowledge of further clues.

The results of usability show the winner is Hradec Kralove which achieves shorter time of tasks accomplishment in comparison to the other 4 cities.

3.3 Usability evaluation – user testing

Seven participants called Subject 1 to Subject 7 (five women, two men) were invited for testing. The age ranges between 24 and 69. All participants took part in a trial user testing, as the website of statutory city Pardubice had been used by minority of them, which even more the case for other websites of other cities. Trial user testing included providing a paper with key words which helped the participants in accomplishing the given tasks. The final user testing ran with no help to the participants and was recorder using Camtasia Studio 8 software.

All durations of task accomplishing were recorded and compared with the times obtained using models, see table 3 for a shortened overview.

Tab. 3: Subject_1 – Comparison of testing time and model time

Time to process tasks [s]	Pardubice	Hradec Králové	Olomouc	Brno	Plzeň
Available jobs – subject	18.06	7.26	8.17	4.23	16.00
Deviation available jobs	2.24	5.74	2.83	3.07	-7.00
Dog age – subject	67.15	16.12	13.17	158.18	1000.00
Deviation dog age	-10.75	1.58	12.43	-91.48	0.00
Total time[s] – subject	153.32	73.80	78.73	216.59	1109.34
Total time [s] – model	160.50	95.90	100.90	142.50	1094.40
Deviation [s]	7.18	22.10	22.17	-74.09	-14.94

Source: Authors

Each of the seven users differs in behaviour during task fulfilment from the other users; therefore, an average user was created by calculating the average time of recorded values for users. The total time of this user was compared with the time obtained by the model and a total deviation of -517.63 seconds was found. This means that the model works app 8 minutes faster compared to an average user; such a deviation is not acceptable, therefore, the model needs to be adjusted to match the user better.

3.4 Model modification

With such a large deviation of the model from the user, it was necessary to modify the model, more accurately to modify the model time. This means mostly modification of mental operators which represent user's thinking. It is assumed to be the greatest problem. The time of keyboard operators was not changed as these have been proven in practice many times and their values are considered correct.

By repeated work with user records with websites their "reaction" times to determine starting positions were obtained. The times were enquired at some tasks, in total 21 times were collected for each subject. Further, an average time of 10.70 seconds was generated which increased the time of the new model in comparison with the old model significantly. As this new time was not created from the full set of tasks, therefore, it need not correspond with the reality, experimental determination of real time was carried out. The task is to find a greatest similarity of the model with time of an average user. The first step was to decrease the time of 10.7 seconds to a half. The course of the experiment is recorder in table 4; the new deviation represents the difference between total model time and average user time.

Tab. 4: Experiment – finding real time

New deviation	Time [s]
-56.43	5.40
-45.53	5.50
-12.83	5.80
1.93	5.90
-8.97	6.00

Source: Authors

Conclusion

The paper dealt with comparison of user testing methods and methods working with models. Both of these methods are used to evaluate usability, each of them uses different means. In order to compare these methods, a research was carried out to map existing models used for usability evaluation. Feature and process study of these models led to selecting NGOMSL. This model was used to model five tasks and evaluate usability of five statutory cities websites. The results were tasks processing durations, the sum of which was app. 1600 seconds. Further part of the process was to carry out user testing with the use of sever participants, five women and two men. The result of user testing is so called average user which can process all five tasks at all web sites within app 2100 seconds. The comparison of results showed deviance of app. 520 seconds, therefore, the model did not reflect the reality. Repeated review of user testing results and experimental definition of mental operators' duration led to achieve deviation of only app. 2 seconds. In conclusion, it is possible to state that usability evaluation by models is possible, however, the results need to be verified by e.g. here used user testing which is based on behavior of real participants - users.

The next phase we would like to conduct in future is to suggest a generic methodology that could be used for every type of public administration information system user information. So we would like to focus to other types of graphical user interface for example to mobile equipment.

Acknowledgement

This contribution was supported by project of University of Pardubice SGSFES_2015001 with the title "Economic and social development in the private and public sectors".

References

[1] BLANDFORD, A., GOOD, J., YOUNG, R. M. Programmable User Modelling Analysis for usability evaluation. In *UCL INTERACTION CENTRE: Division of Psychology & Language Sciences and Department of Computer Science* [online]. 1998. [cit. 2015-05-11]. Available at WWW: <http://www.uclic.ucl.ac.uk/annb/docs/armpack/wp11a.pdf>

[2] CARD, S., MORAN T. P., NEWELL, A. *The Psychology of Human Computer Interaction*. Lawrence Erlbaum Associates. 1983. ISBN 0-89859-859-1.

[3] CRANDALL, B., KLEIN G. A., HOFFMAN, R. R. *Working minds: a practitioner's guide to cognitive task analysis*. Cambridge, Mass.: MIT Press, 2006, xii, 332 p.

[4] FRANK, A. U., CAMPARI, I. Spatial information theory: a theoretical basis for GIS. In *European conference, COSIT'93*. Marciana Marina, Elba Island, Italy, September 19-22, 1993: proceedings. New York: Springer-Verlag, c1993, xi, 477 p. ISBN 0387572074-. Available at WWW: <http://books.google.cz/books?id=BlWlDxRZ05MC&pg=PA409&lpg=PA409&dq=average+typist+%2855+wpm%29+pointing&source=bl&ots=HyRCRT-viL&sig=sNNj40dx6SBi9YSeR2yhU1XVh28&hl=en&sa=X&ei=OKpjVJqbFY7nata6gIAN&ved=0CCgQ6AEwAQ#v=onepage&q=average%20typist%20%2855%20wpm%29%20pointing&f=false>

[5] FOLEY, J., GIBBS, C., KOVACEVIC, S. A knowledge-based user interface management system. In *Proceedings of the SIGCHI conference on Human factors in computing systems - CHI '88* [online]. 1988 [quote 2015-05-11]. DOI: 10.1145/57167.57178.

[6] IVORY, M. Y. *An Empirical Foundation for Automated Web Interface Evaluation*. UC Berkeley Computer Science Division. Available also at WWW: <http://webtango.berkeley.edu/papers/thesis/>. Dissertation thesis. University of California at Berkeley. 2001.

[7] KIERAS, D. E. *EECS University of Michigan* [online]. [cit. 2015-05-11]. 2010. Available at: http://web.eecs.umich.edu/~kieras/

[8] KIERAS, D. GOMS modeling of user interfaces using NGOMSL. In *Conference companion on Human factors in computing systems - CHI '94* [online]. 1994 [cit. 2015-05-11]. DOI: 10.1145/259963.260467. Available at WWW: <http://www.idemployee.id.tue.nl/g.w.m.rauterberg/lecturenotes/GOMS96guide.pdf>

[9] KULICKA, J. Estimation of uncertainty for problem solving by fuzzy mathematic tools. In A. *Bilsel, M. U. Garip. Frontiers in Mathematics and Science Education Research. Proceedings of the Frontiers and Science Education Research Conference* 01-03 May 2014, Famagusta, North Cyprus. Famagusta, North Cyprus: Science Education Research Group at Eastern Mediterranean University, pp. 144-152. 2014.

[10] MORAN, T. P. Getting into system: ETIT analysis. In *Carnegie Mellon University: University Libraries, Digital Collections* [online]. [cit. 2015-05-11]. Available at WWW: <http://digitalcollections.library.cmu.edu/awweb/awarchive?type=file&item=359668>

[11] MYSKOVA, R. Economic Information Systems for Small and Medium Businesses and Evaluation of Return. In *WSEAS TRANSACTIONS on INFORMATION SCIENCE and APPLICATIONS*, Issue 3, Volume 8, March 2011, p. 119-128, ISSN: 1790-0832

[12] NIELSEN, J. *Usability Engineering*. Boston: AP Professional, 1993, 362 s.,pic., tb. ISBN 0125184069.

[13] ŠIMONOVÁ, S. E-Inclusion and disabled-people-friendly web. *Scientific Papers of the University of Pardubice Series D*. Pardubice: Univerzita Pardubice, 2006. Series D, Faculty of Economics and Administration, 10 (2006). pp. 164-168. ISBN 80–7194–851–9, ISSN 1211 – 555X.

[14] ŠIMONOVÁ, S., KOPÁČKOVÁ, H. eDocument in eGovernment. *WSEAS Transactions on Information Science and Applications*, 2010, vol. 7, no. 1, s. 92-101. ISSN: 1790-0832.

[15] TULLIS, T., ALBERT, B. *Measuring the user experience: collecting, analysing, and presenting usability metrics*. Burlington: Morgan Kaufmann, 2008. 317 s. ISBN: 978-0-12-373558-4.

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Received: 29. 02. 2016
Reviewed: 05. 07. 2016, 02. 09. 2016
Approved for publication: 08. 09. 2016

COMPARISON OF BAYESIAN ESTIMATES OF HEALTH CARE COSTS FOR CZECH AND SLOVAKIAN INSURANCE COMPANIES

Pavla Jindrová, Kateřina Seinerová

Abstract: *This paper presents an application of the Bayesian inference to estimate health care expenses by health insurance companies in the Czech Republic and Slovakia. In particular, the Bühlmann-Straub model is applied onto real data, covering time period 2010-2015, from all seven Czech and three Slovakian health insurance companies in order to calculate the credible health care costs per person and the corresponding credibility factors for each company. Computed credible health care costs per person are compared with the real estimations of health care costs per person quoted by analyzed health insurance companies. These real estimates are not available for all the Slovakian health insurance companies and two Czech health insurance companies. The results of Bühlmann-Straub model show that while the largest insurance companies can reliably predict the health care costs for the subsequent time period based on its own statistical data, the smaller companies can find out credible estimation of health care costs per person, taking into account data from all comparable healthcare insurance companies.*

Keywords: *Credibility Model, Bayesian Estimation, Bühlmann-Straub model, Health Insurance, Health Insurance companies.*

JEL Classification: *C11,C22, G22.*

Introduction

The history of the Czech Republic is interwoven with the history of Slovakia, for both the countries were one state up to 1th January 1993, therefore their further independent evolution is expected to be similar. This paper deals with problems related to health care costs refunded from the health insurance, hence nowadays, questions related to funding of the health care in post-communist countries are discussed.

Article provides estimates and comparisons of health care costs per person in Czech and Slovak health insurance companies. For estimating was used empirical Bühlmann -Straub credibility model, which was originally created for calculating premiums for short term insurance contracts [2]. The technique calculates a premium for a risk using two ingredients: past data from the risk itself and collateral data, i.e. data from other sources considered to be relevant.

Our application of this model to estimate healthcare costs per person in health insurance companies can be considered as original. The situation in the collection of insurance premiums of health insurance companies is fundamentally different compared with commercial insurance companies. Premium is not proportional to the health risks of the insured person, but depends only on his income. Therefore, the model was not used to estimate the premium, but to estimate the healthcare costs per person, which vary among health insurance companies for several reasons. It could be the amount of premium income, age of the insured persons, the structure of reimbursable medical activities, but also inefficient spending of funds.

Credibility estimates are actually information on level of these costs, if we estimate them as a linear function of the past data from the health insurance company itself and based on collateral data from other health insurance companies. The credibility formula for estimation healthcare costs per person P_c in next year is in the form:

$$P_c = Z\,P_r + (1 - Z)\,\mu \tag{1}$$

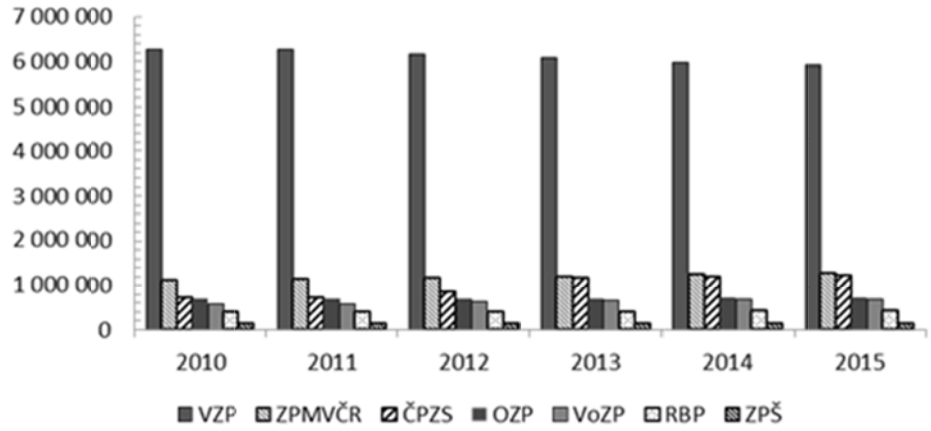
where P_r is estimation based on own past data in insurance company, μ is estimation based on collateral data and Z is a number between zero and one, known as the credibility factor. Credibility factor Z is a measure of how much reliance the company is prepared to place on the data from the company itself.

1 Statement of a problem

Each employed citizens of the Czech Republic and Slovakia, including foreigners living or being employed in each of these countries, have to pay insurance premium as a contribution to the public health insurance. Health insurance for the unemployed people, children, women on the maternity leave and retired people is paid by the state. Thanks to the health insurance system there is availability of health care for all the insured persons, regardless of the height of their payments.

Currently there are seven health insurance companies in the Czech Republic - Všeobecná zdravotní pojišťovna (VZP), Zdravotní pojišťovna ministerstva vnitra České republiky (ZPMVČR), Česká průmyslová zdravotní pojišťovna (ČPZP), Oborová zdravotní pojišťovna (OZP), Vojenská zdravotní pojišťovna (VoZP), Revírní bratrská pojišťovna (RBP) and Zaměstnanecká pojišťovna Škoda (ZPŠ).

Fig. 1: Number of insured persons in the Czech Republic



Source: Yearbooks of health insurance companies

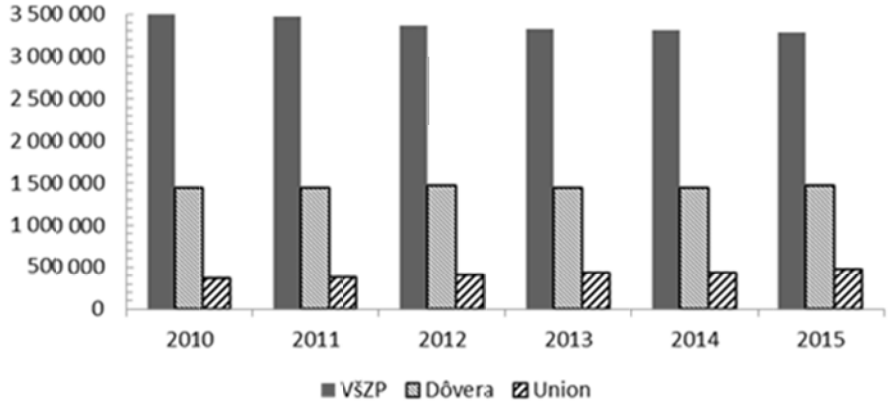
Fig. 1 presents the number of insured persons in the time period 2010-2015 for each Czech health insurance company. Evidently, VZP insures a major part of the Czech population, the number of persons it insures is even higher than sum of persons insured by all other health insurance companies. During the considered time period the number of persons insured by VZP decreases moderately, while the number of persons insured by some of the others insurance companies (especially ČPZS) increases.

There are three health insurance companies in Slovakia - Všeobecná zdravotná poisťovna, Dôvera zdravotná poisťovňa, and Union poisťovňa.

Fig. 2 presents the number of insured persons in the time period 2010-2015 for each Slovakian health insurance company. Evidently, Všeobecná zdravotná poisťovňa (VšZP)

insures major part of Slovakian population, the number of persons it insures is even higher than sum of persons insured by both other health insurance companies. During the considered time period the number of persons insured by VšZP decreases moderately, especially between 2011 and 2012.

Fig. 2: Number of insured persons in Slovakia



Source: Yearbooks of health insurance companies

To be able to ensure financial means, every health insurance company needs to appraise health care expenses for the subsequent time period. It is appropriate to use information about health care expenses based on the data from all the health care insurance companies in the country. For this purpose, it is necessary to estimate these expenses by applying mathematical and probabilistic models, for example those based on Bayesian analysis. Other possibilities of using Bayesian estimates in insurance are discussed in [2]-[12].

The time series of the total health care expenses and number of insured persons are the basis for estimates of the expenses of the health insurance companies in Czech Republic and in Slovakia. Data from all three Slovakian health insurance companies covering time period 2010-2015 are used for computation in this paper. Bühlmann-Straub model is applied to estimate the health care costs per person for the subsequent time period. Estimation of the health care costs for each health insurance company is a linear combination of estimated costs based on inner historical data of this insurance company and estimations based on outer information related to health care costs from all insurance companies. This approach taking both the own and the undertaken information into account guaranties objective estimates of the health care costs.

2 Data and methodology

The health care insurance in the Czech Republic is provided by seven health care insurance companies and in Slovakia by three health insurance companies. Computations presented in this paper are based on data extracted from their yearbooks covering time period 2010-2015, available on their websites.

Bühlmann-Straub model used in this paper follows here.

Let the insurance company, for which the estimates of health care expenses (resp. net insurance premium) are computed, is one of N insurance companies. Total expenses in previous n years are known for all these insurance companies.

Let Y_{ij} is a variable, describing total health care costs of the i-th health insurance company in the Czech Republic ($i = 1, \ldots, N$; $N = 7$) or in Slovakia ($i = 1, \ldots, N$; $N = 3$) in the j-th year ($j = 1, \ldots, n$; $n = 6$).

Let P_{ij} stands for the number of insured person for each health insurance company $i = 1, \ldots, N$ and each year $j = 1, \ldots, n$.

According to [1]-[5], standardized health care costs $X_{ij} = Y_{ij} / P_{ij}$, satisfy the following conditions:

- For every $i = 1, \ldots, N$ the distribution of variable X_{ij} depends on an unknown parameter θ_i, equal for all the years $j = 1, \ldots, n$.
- For every $j = 1, \ldots, n$ the variables $X_{i1} / \theta_i,\ X_{i2} / \theta_i, ..., X_{in} / \theta_i$ are independent, but not necessarily identically distributed.

Then, two functions depending on j can be defined as:

$$E\left(X_{ij} / \theta_i\right) = m(\theta_i);\quad D\left(X_{ij} / \theta_i\right) = \frac{s^2(\theta_i)}{P_{ij}} \tag{2-3}$$

The above mentioned relations express conditions satisfied for every risk $i = 1, \ldots, N$. Relationships between risks are described by the following conditions:

- Parameters of risks $\theta_1, ..., \theta_N$ are random variables, which are independent and identically distributed.
- For $i \neq k$ are $\left(\theta_i, X_{ij}\right)$ and $\left(\theta_k, X_{km}\right)$ independent.

Because parameters of risk $\theta_1, ..., \theta_N$ are identically distributed, values $E\left(m\left(\theta_i\right)\right),\ D\left(m\left(\theta_i\right)\right),\ E\left(s^2\left(\theta_i\right)\right)$ are independent on i and can be denoted as $E\left(m(\theta)\right),\ D\left(m(\theta)\right),\ E\left(s^2(\theta)\right)$.

Following formulas are used to simplify the calculation:

$$P_i = \sum_{j=1}^{n} P_{ij};\quad P = \sum_{i=1}^{N} P_i;\quad Y_i = \sum_{j=1}^{n} Y_{ij};\quad Y = \sum_{i=1}^{N} Y_i \tag{4-7}$$

$$\overline{X}_i = \frac{1}{P_i} \sum_{j=1}^{n} P_{ij} X_{ij} = \frac{1}{P_i} \sum_{i=1}^{n} Y_{ij};\quad \overline{X} = \frac{1}{P} \sum_{i=1}^{N} \sum_{j=1}^{n} P_{ij} X_{ij} = \frac{1}{P} \sum_{i=1}^{N} P_i \overline{X}_i \tag{8-9}$$

$$P^* = \frac{1}{Nn-1} \sum_{i=1}^{N} P_i \cdot \left(1 - \frac{P_i}{P}\right) \tag{10}$$

Then according to [1] and [4]-[12], the rules for estimating the parameters $E\left(m(\theta)\right), D\left(m(\theta)\right), E\left(s^2(\theta)\right)$ are:

$$estE(m(\theta)) = \overline{X};\quad estE(s^2(\theta)) = \frac{1}{N(n-1)} \sum_{i=1}^{N} \sum_{j=1}^{n} P_{ij} \left(X_{ij} - \overline{X}_i\right)^2 \tag{11-12}$$

$$estD(m(\theta)) = \frac{1}{P^*} \left\{ \begin{array}{l} \dfrac{1}{Nn-1} \displaystyle\sum_{i=1}^{N} \sum_{j=1}^{n} P_{ij} \left(X_{ij} - \overline{X}\right)^2 \\ - \dfrac{1}{N(n-1)} \displaystyle\sum_{i=1}^{N} \sum_{j=1}^{n} P_{ij} \left(X_{ij} - \overline{X}_i\right)^2 \end{array} \right\} \tag{13}$$

Credibility factor for the i-th risk is calculated in form

$$Z_i = \frac{P_i}{P_i + \frac{E(s^2(\theta))}{D(m(\theta))}} \tag{14}$$

The value of credibility factor shows the rate of reliability of own data for every health insurance company.

The estimates of parameters $E(m(\theta)), D(m(\theta)), E(s^2(\theta))$ are the same for all the insurance companies. Credibility factor Z_i differs for each company. The higher is the value of risk rate P_i, the higher is the value of credibility factor Z_i.

Then, according to [1]-[8], for the estimation of credible health care for the i-th risk, the following formula is used.

$$\begin{aligned} E(m(\theta)/X) &= Z_i \overline{X}_i + (1 - Z_i) E(m(\theta)) \\ &= Z_i \overline{X}_i + (1 - Z_i) \overline{X} \end{aligned} \tag{15}$$

3 Problem solving

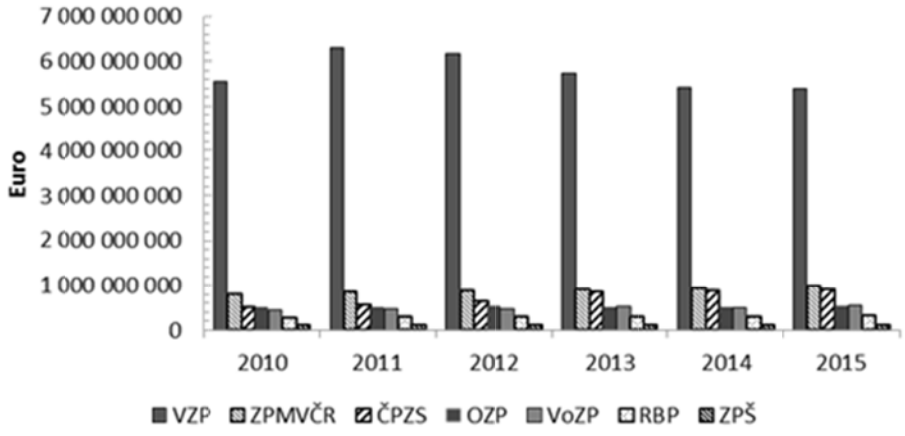
Bühlmann-Straub model was applied to compute credible net premium, here used as health care cost per person. The computation was based on a set of real data published in yearbooks of Czech and Slovakian health insurance companies.

3.1 Results for the Czech Republic

The basis for the computation of credible health care costs per person according to formula (15) was the data from all Czech health insurance companies in years 2010-2015, namely amount of persons insured by particular health insurance company (P_{ij}) and total health care costs paid by particular health insurance company (Y_{ij}) (in €). These values are shown in Fig. 1 and Fig. 3. Amount of insured persons in each health insurance company and each year presents the rate of insurance risk.

Total amount of insured persons P_i insured by each insurance company i in the whole period, total costs Y_i paid by each insurance company in the whole period, and average insurance costs per person in the whole period $\overline{X}_i$ for each insurance company were computed according to (4), (6) and (8). Results of computation of these characteristics are presented in Tab. 1.

Fig. 3: Health care costs in the Czech Republic



Source: Yearbooks of health insurance companies

Tab. 1: Chosen characteristics computed for the Czech health insurance companies

	P_i	Y_i	$\overline{X}_i$
VZP	36 705 665	34 531 321 284	940.76
ZPMVČR	7 203 659	5 413 941 518	751.55
ČPZS	5 907 897	4 382 431 857	741.79
OZP	4 255 418	3 150 649 418	740.39
VoZP	3 869 096	2 998 838 815	775.07
RBP	2 523 517	1 774 482 880	703.18
ZPŠ	825 230	658 663 744	798.16

Source: Authors

Then, following values are computed:

$$P = \sum_{i=1}^{7} P_i = 61\,290\,482; \quad Y = \sum_{i=1}^{7} Y_i = 52\,910\,329\,514; \quad \overline{X} = 863.27$$

Then values of $X_{ij} = \frac{Y_{ij}}{P_{ij}}$, representing standardized health care costs per person in each year and each insurance company (in €), are computed. These values are then used to estimate parameters of the model according to (11)-(13).

$$estE(m(\theta)) = 863.27; \; estE(s^2(\theta)) = 2\,514\,319\,266; \; estD(m(\theta)) = 14\,634.56$$

According to (14), values of credibility factors Z_i are computed for every health insurance company. It is necessary to find these values to be able to compute credible estimations of net insurance costs per person according to (15). Values of credibility factors and credible health care costs are presented in Tab. 2. The value of credibility factor Z_i shows the effect of inner data from the particular Czech health insurance company on the value of the credible health care costs per person. (1-Z_i) shows the same effect for the outer data from all the Czech health insurance companies.

Values of credible estimates of the health care costs per person can be used for appraising net insurance premium for the following year in every Czech health insurance company. Since the data used for computations covers period 2010-2015, computed values of credible estimates of average costs are estimates of net health care costs per person for each Czech health insurance company in 2016.

Tab. 2: Credibility factors Z_i and credible health care costs per person (in €) for the Czech health insurance companies

	Z_i	Credible health care costs
VZP	0.9953	940.40
ZPMVČR	0.9767	754.16
ČPZS	0.9717	745.23
OZP	0.9612	745.15
VoZP	0.9575	778.82
RBP	0.9363	713.38
ZPŠ	0.8277	809.38

Source: Authors

Tab. 2 shows the differences in values of credibility factors Z_i among the Czech health insurance companies, and subsequently big differences in estimates of net insurance costs per person in Euros.

Value Z_i = 0.9953 for major Czech insurer VZP shows that this health insurance company can rely from 99.53 % on its own. The second major insurer ZPMVČR has the credibility factor 0.9767. It means that this major insurance company can rely from 97.67 % on its own data and from 2.33 % on the information from all the insurance companies. Almost all of the health insurance companies have the value of credibility factor higher than 0.9, so the importance of their inner information is very high.

On the other hand, the credibility factor belonging to ZPŠ, with the smallest number of insured persons, has the smallest computed value 0.8277. This insurance company can rely only from 82.77 % on its own data and from 17.23 % on the information from all the insurance companies.

The values of credible health care costs per person differs are from 713.38 to 940.40 €. We can observe quite a big difference among the values of both credibility factors and health care costs. These results of credible health care costs per person we can compare with estimations of these values of several health insurance companies. These comparisons we can see in Tab. 3. By these values we can see, that the differences of our estimations and estimations of health insurance companies are not so big, so this theory is a good instrument for this area. It is remarkable, that any estimate of insurance company is higher than the credible estimate.

Tab. 3: Comparison of credible health care costs with estimation of health care costs/person by insurance companies for the year 2016

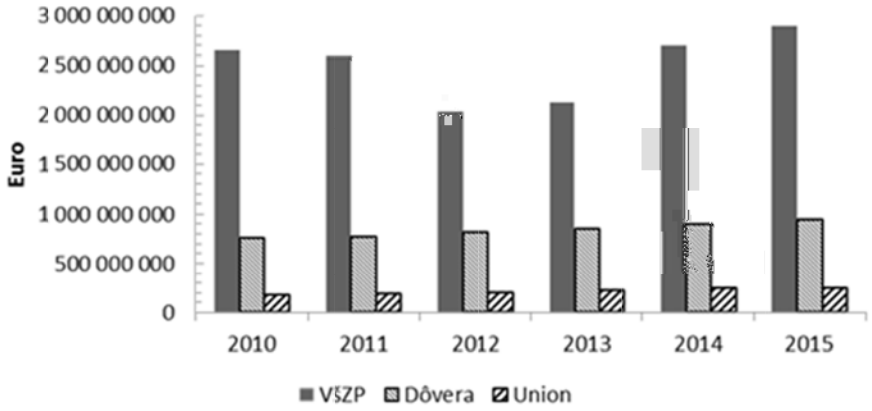
	Credible health care costs/person for 2016	Estimation of health care costs/person by insurance companies for 2016
VZP	940.40	994.64
ZPMVČR	754.16	Data not available.
ČPZS	745.23	809.14
OZP	745.15	822.94
VoZP	778.82	Data not available.
RBP	713.38	816.33
ZPŠ	809.38	898.59

Source: Authors and yearbooks of health insurance companies

3.2 Results for Slovakia

The basis for the computation of credible health care costs per person was the data from all Slovakian health insurance companies again in years 2010-2015. Amount of persons insured by particular health insurance company (P_{ij}), presenting the rate of insurance risk, is shown in Fig. 2 and total health care costs paid by particular health insurance companies in € (Y_{ij}) are shown in Fig. 4.

Fig. 4: Health care costs in Slovakia



Source: Yearbooks of health insurance companies

Values of characteristics P_i (total amount of persons insured by each insurance company i in the whole period), Y_i (total costs paid by each insurance company in the whole period), and $\overline{X}_i$ (average insurance costs per person in the whole period for each insurance company) are presented in Tab. 4. These characteristics were computed for all three Slovakian insurance companies in the similar way as the characteristics in the case of the Czech Republic.

Tab. 4: Chosen characteristics computed for the Slovakian health insurance companies

	P_i	Y_i	$\overline{X}_i$
VšZP	20 274 951	15 013 311 764	740.49
Dôvera	8 684 629	5 039 000 000	580.22
Union	2 503 597	1 274 760 630	509.17

Source: Authors

Then, the following values are computed:

$$P = \sum_{i=1}^{3} P_i = 31\,463\,177; \quad Y = \sum_{i=1}^{3} Y_i = 21\ 327\,072\,394; \quad \overline{X} = 677.84$$

Then the values of $X_{ij} = \frac{Y_{ij}}{P_{ij}}$, representing standardized health care costs per person in each year and each insurance company (in €). These values are then used to estimate parameters of the model:

$$estE(m(\theta)) = 677.84; \quad estE(s^2(\theta)) = 15\,324\,615\,762; \quad estD(m(\theta)) = 11\,012.44$$

Values of credibility factors and credible health care costs are presented in Tab. 5. The value of credibility factor Z_i shows the effect of inner data from the particular Slovakian insurance company on the value of the credible health care costs per person. (1-Z_i) shows the same effect for the outer data from all the Slovakian insurance companies. These credible estimates of the health care costs per person can be used for appraising net insurance premium for the year 2016 in every Slovakian insurance company.

Tab. 5: Credibility factors Z_i and credible health care costs per person (in €) for the Slovakian health insurance companies

	Z_i	**Credible health care costs**
VšZP	0.9358	736.46
Dôvera	0.8619	593.70
Union	0.6427	569.43

Source: Authors

Tab. 5 shows the differences in values of credibility factors Z_i among the Slovakian health insurance companies, and subsequently big differences in estimates of net insurance costs per person in Euros. Value Z_i = 0.9358 for major Slovakian insurer VšZP shows, that this health insurance company can rely from 93.58 % on its own. The second major insurer Dôvera has the credibility factor 0.8619. This insurance company can rely from 86.19 % on its own data and from 13.81 % on the information from all the insurance companies. Even greater effect of outer data on credible health care costs is evident at the smallest health insurer Union. The health insurance company Union has to rely on outer data from more than 35 %.

These results of credible health care costs per person we cannot compare with estimates of these values of health insurance companies for the year 2016, because data are not available.

4 Discussion

This section presents comparison of the results of Bühlmann-Straub model applied on the data from health insurance companies in the Czech Republic and Slovakia. The Czech Republic and Slovakia were established in 1993 after two federative republics of former Czechoslovakia decided to split into two independent states. Therefore, the similarity of these healthcare systems is expectable.

Computed values of the credibility factors Z_i are presented in Tab. 2 (the Czech Republic) and Tab. 5 (Slovakia). The highest values of the credibility factor Z_i belong to major health care insurance companies in each country, 0.9953 for Všeobecná zdravotní pojišťovna (VZP) in the Czech Republic and 0.9358 for Všeobecná zdravotná poisťovňa (VšZP) in Slovakia. These insurers originate from the same company.

Since the order of the health insurance companies in tables 1, 2, 4, 5 is given by the total number of insured persons, it is evident (in each country) that the higher is the amount of insured persons P_i, the higher is the value of the credibility factor Z_i. Then, values of the credibility factor in the Czech Republic are higher than in Slovakia, but the range of these values is significantly narrower in the Czech Republic.

The values of credible health care costs per person (in €) are again presented in Tab. 2 (the Czech Republic) and Tab. 5 (Slovakia). Similarly to the results of credibility factors, the highest values of the credible health care costs belong to major health insurers in both mentioned countries. The highest credible health care costs in the Czech Republic, 940.40 €/person is estimated by VZP, and the highest credible health care costs in Slovakia, 736.46 €/person is computed for VšZP. The second highest credible health care costs 809.38 €/person belong to the minority health insurer in the Czech Republic, whereas the minority health insurance company in Slovakia estimates the lowest health care costs (only 569.43 €/person). The difference between the highest and the lowest credible health care cost per person is more than 220 € in the Czech Republic, and almost 170 € in Slovakia.

Tab. 3 contains comparisons of credible health care costs with estimation of health care costs/person by Czech insurance companies for the year 2016. Data for comparison are not available for Slovaks insurance companies.

Values of the credibility factor evince similar characteristic in the Czech Republic and Slovakia, but the credibility health care costs in studied countries seem to be significantly different. However, the origin of these differences falls beyond the scope of this paper.

Conclusion

Every health insurance company needs to appraise its costs for the following time period. Estimates of these costs can be computed by applying Bayesian analysis, especially Bayesian models of credibility.

Results obtained by applying Bühlmann-Straub model on real data published by Czech and Slovakian health insurance companies, namely height of health insurance costs paid by insurance companies and amount of persons insured by these companies in years 2010-2015, show differences in estimations of health care costs per person among the insurance companies and mainly between the Czech and the Slovak Republic.

By applying Bühlmann-Straub model on the considered data, values of credibility factor are computed for each Czech and Slovakian health insurance companies. These values show

the effect of the inner data from particular insurance companies on the value of credible health care costs per person. All insurance companies should bother both inner and outer data, however, the majority effect on the results relates to the inner data of particular health insurance company.

The computed values of the credible health care costs can be used to estimate the real health care costs for the following time period in every insurance company. This information is very important for estimating financial means. Despite the fact that the history of the Czech Republic and Slovakia is interwoven, real health care costs and their future estimations differ a lot.

Acknowledgement

This contribution was supported by SGS University of Pardubice, FEA, No. SGS_2016_023, "Ekonomický a sociální rozvoj v soukromém a veřejném sektoru".

References

[1] BOLAND, P. J. *Statistical and Probabilistic Methods in Actuarial Science*. New York: Taylor & Francis Group. 2007. ISBN: 9781584886952.

[2] BÜHLMANN, H., STRAUB, E. Glaubwürdigkeit für Schadensätze. *Mitteilungen der Vereinigung Schweizerischer Versicherungs-mathematiker* 70, 1970, pp. 111–133.

[3] GOGOLA, J. Spôsob permanentnej úpravy výšky pojistného v neživotnom poistení. In *E + M Economics and Management*, Vol. 16 (4), 2013, pp. 134-141. ISSN: 1212-3609.

[4] JINDROVÁ, P. Credibility Risk Models in Accident Insurance. In *Proceedings of the 7th International Scientific Conference: Managing and Modelling of Financial risk*. Ostrava: VŠB – TU Ostrava, Faculty of Economics, Finance department. 2014, pp. 307-316. ISBN: 978-80-248-3631-7.

[5] JINDROVÁ, P., PACÁKOVÁ, V. Bayesian Probability Models for Critical Illness Insurance. In *Recent Advances in Mathematical Methods in Applied Sciences*. Athens, 2014, pp. 218-221. ISBN: 978-1-61804-251-4.

[6] JINDROVÁ, P., PACÁKOVÁ, V. Actuarial Models for Valuation of Critical Illness Insurance. In *International Journal of Mathematical Models and Methods in Applied Sciences*, Vol. 9, 2015, pp. 218-226. ISSN: 1998-0140.

[7] JINDROVÁ, P., SEINEROVÁ, K. Bayesian Estimates of the Regional Costs in Public Health System of the Czech Republic. In *Proceedings of the 12th International Scientific Conference: European Financial Systems 2015*, Brno: Masaryk University, 2015, p. 246-252. ISBN: 978-80-210-7962-5.

[8] JINDROVÁ, P., SEINEROVÁ, K. Bayesian Estimates of Health Care Costs in Slovakian Insurance Companies. In *International Journal of Economics and Statistics*, 2015, Vol. 3. p. 174-177. ISSN: 2309-0685.

[9] LINDA, B., KUBANOVÁ, J. Credibility Premium Calculation in Motor Third-Party Liability Insurance, WSEAS conference *Advances in Mathematical and Computational Methods*, Malta, 2012, pp. 259-263. ISBN: 978-1-61804-117-3.

[10] PACÁKOVÁ, V. Bayesian Estimations in Insurance Theory and Practice. In *Advances in Mathematical and Computational Methods: proceedings of the 14th International*

Conference on Mathematical and Computational methods in Science and Engeneering. 2012. pp. 127-131. ISBN: 978-1-61804-117-3.

[11] ŠOLTÉS, E., PACÁKOVÁ, V., ŠOLTÉSOVÁ, T., Vybrané kredibilné regresné modely v havarijnom poistení. In *Ekonomický časopis*, Vol. 54, No. 2, 2006, pp. 168-182. ISSN: 0013-3035.

[12] WATERS, H. R., *Credibility Theory*, Edinburgh: Heriot-Watt University, 1993.

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Received: 01. 05. 2016
Reviewed: 01. 06. 2016, 17. 07. 2016
Approved for publication: 08. 09. 2016

DATA ANALYSIS FROM AREA OF STRATEGIC PLANNING

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Abstract: *The text deals with the data analysis from an area of the strategic planning. It focuses on a searching of association rules by the Apriori algorithm. The administrative district of municipalities with extended powers in the Czech Republic were chosen as objects and were described by indicators based on the strategic planning. In the data pre-processing, selected rates of dynamics of the monitored indicators were calculated. Values of the average absolute increase of indicators were converted and were used to the searching of the association rules. Achieved results of three models were compared (e.g. by the support, confidence, rule support, and lift) and described. These models were differed in the way of the association rules searching (i.e. measure of the rule confidence; measure of the confidence difference; and measure of the confidence ratio). The association rules can serve as a support for a preparation of new strategic plans for e.g. municipality, region. Problem areas of the mentioned units could be selected on the basis of the achieved association rules.*

Keywords: *Data, Analysis, Strategic Planning, Apriori, Association Rules.*

JEL Classification: *C39, R58.*

Introduction

A systematic management of any organization, enterprise, municipalities or regions is the purpose of a strategic planning. It is aimed at the stimulating and mobilizing to use all own resources most effectively and it reflects changes in its immediate environments quickly and effectively. The concept of strategy represents a comprehensive set of standard, proven steps and tools that are used to change management, but also represents the very process of managing these changes. It is one of the most important tools of the regional development on all levels (whether for municipalities and micro-regions across the development strategy of the larger cities to national level) [4], [11], [20].

Today we can see the views that the management at the regional or municipal level is different than the company's management for companies and businesses. Although this strategic planning is not required by law, the § 38 par. 1 Act no. 128/2000 Call., About municipalities and Act no. 320/2000 Call., On financial control obliges legal obligation to manage economically, efficiently and effectively. The basic theoretical concepts, systems and methodologies engaged in the area of the strategic planning are valid for municipalities in the same way as for other levels of management. However, for the strategic planning at the municipal level there are certain specifics. These include the specifics of autonomous activities of the community and a direct contact with the population [17], [21]. We can see the strategic planning as a systematic way how to organize the changes and produce a broad consensus in the entire society and a common vision for the (socio)economic future [13].

The objective of this paper is to do an analysis of data from the strategic planning to Administrative district of municipalities with extended powers (MEPs) in the Czech Republic. Although the practice of the strategic planning does not take place at this level, (takes place e.g. at the level of municipalities, regions), it was used available data for the

MEP to represent the appropriate data mining methods in the monitored area of the strategic planning. Based on the key areas that fall into the category of the strategic planning, there were selected 23 basic indicators (attributes). They describe the problems of the strategic planning at the level of cities, towns and regions. They are focused for example on the areas of demography, tourism and unemployment which are still discussed (e.g. in [12], [15], [19]). Due to unavailability of data, some indicators from other areas are not included (e.g. brownfields, environmental); more about used attributes is in [16].

1 Problem formulation

In the Czech Republic, there are 205 MEPs in all regions (with the exception of Prague). The website of the Czech Statistical Office was a source of the data for the individual MEPs. We dealt with data from years 2001 to 2013. In a data pre-processing phase relative indicators (to the comparison of the individual MEPs (e.g. per 1,000 inhabitants; per hectare of the total area of the MEP)) were created. The next step in the data pre-processing was the calculation of some selected rates of dynamics of the monitored indicators by which it is possible to determine the fundamental development of the time series. An absolute increase, average absolute increase, growth rate, average growth rate and relative growth are examples of these rates of dynamics by [2]. As an input to the creation of a data matrix, the average absolute increase was chosen. The calculation of the average absolute increase Δ_{aver} is the following (1):

$$\Delta_{aver} = \frac{(y_2 - y_1) + (y_3 - y_2) + \ldots + (y_T - y_{T-1})}{T - 1}, \tag{1}$$

where y_t is time series, t = 1, 2, …, T. In total 45 MEPs were excluded from the data set for a lack of data for the year 2013. The values of the average absolute increase of the attributes higher than 0 were converted into the value 1 (the average absolute increase showed a positive development); values less than or equal to 0 into the value 0 (the average absolute increase showed a negative development). The positive or negative development of the indicators only was taken into account (the exact values of the average absolute increase Δ_{aver} were not used by the creation of any models). The data matrix A was created and contained 160 MEPs described by 23 attributes a_1, a_2, …, a_{23} (Tab.1). Based on frequencies (values were 1 or 0) selected attributes were excluded from the data set (i.e. the Age index (a_{13}) and the Legal entities (a_{19}); an occurrence of the value 0 for the attribute a_{13} was 3%; for the attribute a_{19} 1%).

Tab. 1: Data dictionary

ID	Description of Attribute	Value
a_1	MEP	2101 - 8122
a_2	Region	Stredocesky, Jihocesky, Plzensky, Karlovarsky, Ustecky, Pardubicky, Vysocina, Jihomoravsky, Olomoucky, Zlinsky, Moravskoslezsky
a_3	Development of indicator Number of inhabitants	{0;1}
a_4	Development of indicator Farmland	{0;1}
a_5	Development of indicator Forest land	{0;1}
a_6	Development of indicator Built-up area	{0;1}
a_7	Development of indicator Population density	{0;1}
a_8	Development of indicator Live births	{0;1}
a_9	Development of indicator Deaths	{0;1}
a_{10}	Development of indicator Balance of migration	{0;1}
a_{11}	Development of indicator Marriages	{0;1}
a_{12}	Development of indicator Divorces	{0;1}
a_{13}	Development of indicator Age index	{0;1}
a_{14}	Development of indicator Jobseekers	{0;1}
a_{15}	Development of indicator Vacancies	{0;1}
a_{16}	Development of indicator Applicants per one vacancy	{0;1}
a_{17}	Development of indicator Unemployment rate	{0;1}
a_{18}	Development of indicator Physical persons	{0;1}
a_{19}	Development of indicator Legal entities	{0;1}
a_{20}	Development of indicator Completed apartments	{0;1}
a_{21}	Development of indicator Flats in family houses	{0;1}
a_{22}	Development of indicator Beds	{0;1}
a_{23}	Development of indicator Number of guests	{0;1}

Source: Authors

2 Methods

The object of modeling is to find a set of association rules (rules) [6], [10], [18], [22] described area of strategic planning of MEPs in the CR. An Apriori algorithm [1], [8], [7], [14], [22] was used to the discovering of association rules in the data. Association rules are statements in this form (2):

If antecedents(s) Then consequent(s). (2)

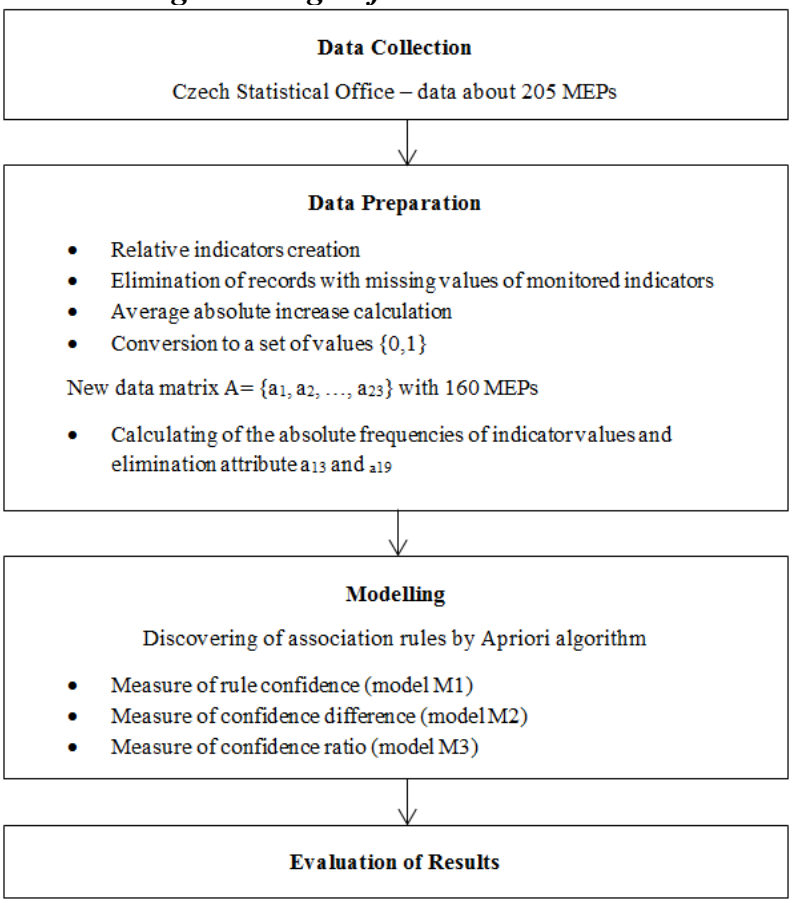
This Apriori algorithm [8] offers several evaluation measures for determining which rules to retain. The different measures will emphasize different aspects of the rules. Values are calculated based on the prior confidence and the posterior confidence).

The set of rules is described by rule ID, instances, support, confidence, rule support, and for example by lift [6], [7], [8]. Instances are calculated as the number of records for which the antecedent is true [9]. The rule support m_{RS} (in %) and confidence m_C (in %) are two measures of rule interestingness. They respectively reflect the usefulness and certainty of discovered rules [6]. The confidence m_C [6], [9] displays the ratio of rule support to antecedent support [9]. The lift m_L is the simple correlation measure [6]. It displays the ratio of confidence for the rule to the prior probability of having the consequent. Rules with the lift different from 1 will be more interesting than rules with lift close to 1 [9]. Application of this algorithm we can see e.g. in [5].

3 Problem solving

Three models on the basis of the Apriori algorithm were created in software IBM SPSS Modeler. There were used a measure of "rule confidence" (it is the default method; it uses the confidence m_C (or accuracy) of the rule to evaluate rules); measure of "confidence difference" (absolute confidence difference to prior); and measure of "confidence ratio" (difference of confidence quotient to 1; this evaluation measure is the ratio of rule confidence to prior confidence (or, if the ratio is greater than one, its reciprocal) subtracted from 1. Like confidence difference, this method takes uneven distributions into account. It is especially good at finding rules that predict rare events [9]). Design of the model creation is in Fig. 1.

Fig. 1: Design of the model creation



Source: Authors

By creation of all three models (M1, M2 and M3) some parameters were set (minimum rule confidence: 80%, minimum antecedent support: 50%, maximum number of antecedents: 7). Models were different by setting of evaluation measures.

Model M1: there were found 338 association rules on the basis of the rule confidence. Selected association rules of the strategic planning are in Tab. 2. There are the values of the consequent, antecedent, instance, support m_S (in %) and confidence m_C (in %), rule support m_{RS} (in %), and lift m_L. This association rule states

IF Applicants per one vacancy (a_{16}) = 1 AND Live births (a_8) = 1 AND Physical persons (a_{18}) = 1 THEN Jobseekers (a_{14}) = 1.

The positive development of the average absolute increase in 85 instances out of 160 MEPs for attributes a_{16}, a_8 and a_{18}. It means that the relative number of the occurrence of the antecedent is 53.125%. The confidence m_C is 97.647% and the rule support m_{RS} is 51.875%. The value of the lift m_L is 1.157; this rule is not very interesting (the difference is 0.157).

Tab. 2: Selected association rules by the rule confidence method

Antecedent	Consequent	Instances	m_S [in %]	m_C [in %]	m_{RS} [in %]	m_L
$a_3 = 1$ and $a_{18} = 1$	$a_7 = 1$	88	55.000	97.727	53.750	1.612
$a_{16} = 1$ and $a_8 = 1$ and $a_{18} = 1$	$a_{14} = 1$	85	53.125	97.647	51.875	1.157
$a_{23} = 1$ and $a_{18} = 1$	$a_{22} = 1$	81	50.625	91.358	46.250	1.169
$a_8 = 1$ and $a_5 = 1$ and $a_{18} = 1$	$a_{14} = 1$	94	58.750	90.426	53.125	1.072
$a_8 = 1$ and $a_{21} = 1$ and $a_{14} = 1$ and $a_{18} = 1$	$a_{16} = 1$	80	50.000	90.000	45.000	1.210

Source: Authors

Model M2: There were found in total 49 association rules by the confidence difference of the Apriori algorithm (model M2). Examples of these rules are in Tab. 3. The first association rule is the following:

IF Number of inhabitants (a_3) = 1 AND Physical persons (a_{18}) = 1 THEN Population density (a_7) = 1.

In this example, the average absolute increase of these attributes were for individual MEPs during the reporting period, a total positive in 88 of 160 cases. It means, the support m_S is 55.000%. The confidence m_C is 97.727%. On the basis of the lift value (m_L is 1.612) it is possible to rank among more interesting rules achieved by the confidence difference method.

Model M3: On the basis of the confidence ratio (model M3) in total 58 association rules were found. Examples of these rules are in Tab. 4. The association rule

IF Live births (a_8) = 1 AND Flats in family houses (a_{21}) = 1 AND Jobseekers (a_{14}) = 1 AND Physical Persons (a_{18}) = 1 THEN Applicants per one vacancy (a_{16}) = 1

ranks among the more interesting rules on the basis value of the lift parameter (m_L is 1.21). For this rule is true that the average absolute increase of attributes a_8, a_{21}, a_{14}, and a_{18} recorded the positive development is 80 instances. It follows that the support m_S is 50.000%. The confidence m_R is 90.000% and the rule support m_{RS} is 45.000% (this value ranks among the smallest values of all achieved association rules).

Tab. 3: Selected association rules by the confidence difference method

Antecedent	Consequent	Instances	m_S [in %]	m_C [in %]	m_{RS} [in %]	m_L
$a_3 = 1$ and $a_{18} = 1$	$a_7 = 1$	88	55.000	97.727	53.750	1.612
$a_{23} = 1$ and $a_{18} = 1$	$a_{22} = 1$	81	50.625	91.358	46.250	1.169
$a_3 = 1$ and $a_7 = 1$ and $a_{14} = 1$	$a_8 = 1$	81	50.625	87.654	44.375	1.150
$a_8 = 1$ and $a_{14} = 1$ and $a_5 = 1$ and $a_{18} = 1$	$a_{16} = 1$	85	53.125	87.059	46.250	1.171
$a_{22} = 1$ and $a_{21} = 1$ and $a_{14} = 1$ and $a_5 = 1$	$a_{16} = 1$	80	50.000	85.000	42.500	1.143

Source: Authors

Tab. 4: Selected association rules by the confidence ratio method

Antecedent	Consequent	Instances	m_S [in %]	m_C [in %]	m_{RS} [in %]	m_L
$a_{16} = 1$ and $a_{21} = 1$ and $a_5 = 1$ and $a_{18} = 1$	$a_{14} = 1$	85	53.125	96.471	51.25	1.143
$a_{23} = 1$ and $a_{18} = 1$	$a_{22} = 1$	81	50.625	91.358	46.250	1.169
$a_8 = 1$ and $a_{21} = 1$ and $a_{14} = 1$ and $a_{18} = 1$	$a_{16} = 1$	80	50.000	90.000	45.000	1.210
$a_3 = 1$ and $a_7 = 1$ and $a_{14} = 1$	$a_8 = 1$	81	50.625	87.654	44.375	1.150
$a_8 = 1$ and $a_{14} = 1$ and $a_{18} = 1$	$a_{16} = 1$	95	59.375	87.368	51.875	1.175

Source: Authors

4 Discussion

An interpretation of found knowledge is an important step in the process of the data mining [1], [3]. The interestingness, usefulness and intelligibility are main criteria for assessment of the knowledge. The basic question is, what is an importance of found knowledge for experts and end users. We can speak by [3] about knowledge in accordance with the common sense (in our case *If the population grows, then the population density is increasing.*); about knowledge in accordance with knowledge of experts (e.g. *If number of craft trades is increasing, then the capacity of accommodation facilities increases;* it can inform about development of the hostelry trades in area*)*; about new, interesting knowledge which gives the view on the given area; about knowledge which expert has to analyse, because it is not clear what it means, but it may be beneficial; and about knowledge which is contrary to expert knowledge.

An evaluation of the knowledge is based on various numerical parameters; in the case of the association rules, the support and confidence are examples of these parameters. It should be emphasized that not everything what is clearly demonstrated in the data, has the importance for the experts [3].

In the given area, the most association rules (in total 338) were achieved by the rule confidence method of the Apriori algorithm (the model M1). The maximum value of the support m_S was 90.000%, of the confidence m_C was 97.895%, of the rule support m_{RS}

80.625%, and of the lift m_L 1.643 (Tab.5). Based on the confidence difference evaluation measures (the model M2) 49 rules were achieved and by the application of confidence ratio (the model M3), there were 58 rules. The maximum support m_{Smax}, maximum confidence m_{Cmax}, maximum rule support m_{RSmax} and lift m_{Lmax} were identical for models M2 and M3. We can see in Tab. 5 the model M2 by the confidence difference and model M3 by the confidence ratio achieved lower values of the maximum support m_{Smax} (m_{Smax} is lower by 5.625% relative to the model M1on the basis of the rule confidence; and m_{RSmax} is worse approximately about 9.500%).

Tab. 5: Evaluation of models

Model	Count of Rules	m_{Smax} [in %]	m_{Cmax} [in %]	m_{Lmax}	m_{RSmax} [in %]
M1 (rule confidence)	338	90.000	97.895	1.643	80.625
M2 (confidence difference)	49	84.375	97.895	1.643	71.250
M3 (confidence ratio)	58	84.375	97.895	1.643	71.250

Source: Authors

Because of higher values of the lift m_L it is possible to state that attributes describing the development of the population living in the MEPs in the Czech Republic rank among the most interesting rules. These were attributes: Number of inhabitants a_3, Population density a_7, and Forest land a_5. The association rules composed of these attributes achieved the highest value of the lift m_L.

Rules related to the area of the unemployment rank among more interesting rules, too. These were mainly indicators: The Jobseekers (a_{14}), Applicants per one vacancy (a_{16}) in conjunction with the indicator Live births (a_8); where the positive development of a_8 had an influence on the indicator of the unemployment rate.

The selected association rules obtained on above mentioned method of the Apriori algorithm were compared with the data of the individual MEPs. The comparison of the data of the MEP Pardubice and selected association rules is in Tab. 6.

Tab. 6: Application of selected association rules to data MEP Pardubice

Antecedent	Consequent
$a_{16} = 1$ and $a_8 = 1$	$a_{14} = 1$
$a_{16} = 1$ and $a_{22} = 1$ and $a_{18} = 1$	$a_{14} = 1$
$a_{23} = 1$ and $a_{18} = 1$	$a_{22} = 1$
$a_8 = 1$ and $a_{14} = 1$ and $a_{18} = 1$	$a_{16} = 1$

Source: Authors

The association rule *IF Applicants per one vacancy (a_{16}) = 1 AND Live births (a_8) = 1 THEN Jobseekers (a_{14}) = 1* can be used for the MEP Pardubice (although, in the years from 2001 to 2013 there were several decreases of the indicator Live births (a_8), which however did not affect the overall development of the average absolute increase of the indicator during the time period.

The association rule IF *Number of guests (a_{23}) = 1 AND Physical persons (a_{18}) = 1 THEN Beds (a_{22}) = 1* it is true for the MEP Pardubice and covers two areas of the strategic planning. It is the area of tourism and area of the business. The positive development of the indicators Physical persons (a_{18}) and Number of guests (a_{23}) in the antecedent had the

influence on the indicator Beds (a_{22}). The positive development of the indicator Number of guests (a_{23}), which recorded the second biggest growth during the reporting period (it follows from the data before transformation), could be due to an increase of business in the provision of accommodation options (it is represented by the indicator Physical persons (a_{18}) in this association rule). The positive development of a_{18} of the MEP Pardubice caused more than double the growth of the indicator Beds (a_{22}). The indicator Legal entities (a_{19}), which was excluded, would probably be part of this association rule. This one (a_{19}) and the indicator Physical person (a_{18}) are focused on business.

Conclusion

The application of the Apriori algorithm on data from the area of the strategic planning was the content of this paper. The MEPs in the Czech Republic were chosen as objects and were described by 23 indicators based on the strategic planning. We focused on MEPs because of the availability of data from the given area, although the practice of the strategic planning does not take place at this level.

In the data pre-processing phase, selected rates of dynamics (i.e. the absolute increase, average absolute increase, growth rate, average growth rate, etc.) of the monitored indicators, by which it is possible to determine the fundamental progression of the time series, were calculated. Values of the average absolute increase of indicators were converted to values 0 or 1 (it follows from the positive or negative development of indicators on the basis of the average absolute increase values) and were used to the searching of the association rules.

Three models (M1, M2 and M3) based on the Apriori algorithm were created. They were differed in the way of the association rules searching (i.e. measure of the rule confidence; measure of the confidence difference; and measure of the confidence ratio). These models were compared and selected association rules of the individual models were described. It was mentioned that it is possible to apply the association rules on the data of the individual MEPs. The example of the MEP Pardubice was described in the context of the achieved association rules by the models.

The association rules could serve as a support for a preparation of new strategic plans for each unit (e.g. municipality, region). Problem areas of the units could be selected on the basis achieved association rules. For units that are facing a high unemployment rate, the priority should be to create conditions that would cause an influx of new businesses in the area. From achieved results of the models follows that the MEPs should aim attention to the tourism sector. Based on the result of the Apriori algorithm it can be deduced that higher number of tourists could affect the unemployment in the monitored area.

In the future work are going to focus on the other algorithms for the searching of association rules; deal with the collection of more appropriate indicators to modeling and work with the other rates of dynamics in the area of the strategic planning.

References

[1] ALSHAREEF, A., AHMIDA, S., BAKAR, A. A., HAMDAN, A. R., ALWESHAH, M. Mining survey data on university students to determine trends in the selection of majors. *In Conference Proceeding of the 2015 Science and Information Conference*, SAI 2015, pp. 586 - 590. ISBN 978-147998547-0.

[2] ARLT, J., ARLTOVÁ, M., RUBLÍKOVÁ, E. *Analýza ekonomických časových řad s příklady*. vyd. 1. Praha: Vysoká škola ekonomická, 2002, 147 s. ISBN 80-245-0307-7.

[3] BERKA, P. *Dobývání znalostí z databází.* Praha: Academia, 2003, 366 s. ISBN 80-200-1062-9.

[4] CIMBÁLNÍKOVÁ, L. *Strategické řízení: proč je želva rychlejší než zajíc.* Olomouc: Univerzita Palackého v Olomouci, 2012, 119 s. Monografie. ISBN 978-80 -244-2963-2.

[5] CHAN, CH. CH. H., LEE, M. H., KWANG, Y. CH. Association Rules Mining for Knowledge Management: A Case Study of Library Services. *In Proc. of the 9th WSEAS Int. Conf. On Mathematical Methods and Computational Techniques in Electrical Engineering*, 2007, pp. 64-69.

[6] HAN, J., KAMBER, M. *Data mining: concepts and techniques*. San Francisco: Morgan Kaufmann Publishers, c2006, 770 s. ISBN 15-586-0901-6.

[7] HRŽENJAK, M. P., MATETIĆ, M., BAKARIĆ, M. B. Mining association rules in learning management systems. *In Conference proceeding of 38th International Convention on Information and Communication Technology, Electronics and Microelectronics,* MIPRO 2015, pp. 986 -991. ISBN 978-953233085-4.

[8] IBM® SPSS Modeler Documentation [cit. 2016-04-29]. Available at WWW: <https://www.ibm.com/support/knowledgecenter/SS3RA7_17.0.0/clementine/association_output_modeltab.dita?lang=cs>.

[9] IBM® SPSS Modeler Documentation [cit. 2016-04-29]. Available at WWW: <https://www.ibm.com/support/knowledgecenter/SS3RA7_17.0.0/clementine/apriori_experttab.dita?lang=cs >.

[10] KASPAROVA, M., KRUPKA, J. Modelling of Associations in Students' Characteristics by Web Site Use as Learning Resources. *In Conference proceeding of 10th International Scientific Conference on Distance Learning in Applied Informatics,* DIVAI 2014, pp. 589-599. ISBN 978-80-7478-497-2.

[11] KEŘKOVSKÝ, M., VYKYPĚL, O. *Strategické řízení: teorie pro praxi*. 2. vyd. Praha: C. H. Beck, 2006, xiv, 206 s. C. H. Beck pro praxi. ISBN 80-717-9453-8.

[12] KNĚZÁČKOVÁ, R., VOLEJNÍKOVÁ, J. Meziregionální migrace v České republice. *In Scientific Papers of the University of Pardubice*, Series D, 2015. Vol. 22. Iss. 33, pp. 55 - 65. ISSN 1211-555X.

[13] LNĚNIČKA, L. Strategic Management in the Municipalities of the Czech Republic in 2014. *In Geograficke informacie*, 2014. Vol. 18, PT 1, pp. 126-140. ISSN 1337-9453.

[14] NENGSIH, W. A comparative study on market basket analysis and apriori association technique. *In Conference proceeding of 3rd International Conference on Information and Communication Technology*, ICoICT 2015, pp. 461 – 464. ISBN 978-147997752-9.

[15] PETR, P., KŘUPKA, J., PROVAZNÍKOVÁ, R. Statistical Approach to Analysis of the Regions. *In Conference proceeding of the 10th WSEAS International*

Conference on Applied Computer Science, 2010, pp. 280-285, ISBN 978-960 -474-231-8.

[16] PILC, M. Analýza dat z oblasti strategického plánování vybrané obce pomocí metod data miningu. Pardubice, 2015. Diplomová práce. Univerzita Pardubice. Fakulta ekonomicko-správní. Ústav systémového inženýrství a informatiky. Vedoucí práce Miloslava KAŠPAROVÁ.

[17] PŮČEK, M., KOPPITZ, D. *Strategické plánování a řízení pro města, obce a regiony.* Vyd. 1. Praha: Národní síť Zdravých měst ČR, 2012. ISBN 978-80-260-2789-8.

[18] SASIKALA, D., PREMALATHA, K., LOGESWARI, S. A Survey on Association Rule Mining. *In CiiT International Journal of Data Mining and Knowledge Engineering,* 2011. Vol 3, no 4, pp. 231-236.

[19] STOKLASOVÁ, R. Labour market modelling in the Czech Republic. *In Scientific Papers of the University of Pardubice*, Series D, 2015. Vol. 22. Iss. 35, pp. 139 - 148. ISSN 1211-555X.

[20] Strategické plánování. EC Consulting. 2008-2015 [cit. 2015-03-05]. Available at WWW: < http://www.ecconsulting.cz/strategicke_planovani.html>.

[21] Příprava, tvorba a realizace strategických plánů obcí a mikroregionů [online]. Ostrava, 2006 [cit. 2015-03-06]. Available at WWW: <http://alkut.cz/regrozvoj/strat_plan _obce_mikroreg.pdf>. Studijní opora. VŠB-TU Ostrava.

[22] WITTEN, I. H., FRANK, E. *Data Mining: Practical Machine Learning Tools and Techniques,* 2005. Morgan Kaufman Publishers: San Francisco. ISBN 0-12-088407-0.

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Received: 30. 04. 2016
Reviewed: 10. 07. 2016, 11. 07. 2016
Approved for publication: 08. 09. 2016

THE POTENTIAL EFFECT OF NON-TRANSPARENT LOBBYING ON COMPETITIVENESS THROUGH ECONOMIC FREEDOM IN THE EU – AN EMPIRICAL SURVEY

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Abstract: *The competitive strength of individual countries is not only affected by their economic efficiency and productiveness, there is also a broad range of other socio-economic and political factors that includes institutional quality. Crucial factors influencing institutional quality are transparency and the scope of civil and economic liberties. It should be easy to scrutinize how decisions are made, the influences behind them and how taxpayer's money is allocated. On the other side the plurality of interests is a necessary prerequisite and starting point for a free and open society. The lobbying and consultancy industry is a natural, important and legitimate part of the democratic decision-making process, however sometimes lobbying practices go beyond the legitimate representation of interests, and methods are deceptive. This kind of behavior is usually non-transparent and unfairly influences political processes, generating the potential for corrupt practices and excessive regulation of economic activities negatively influencing economic freedom and thus the competitiveness. The aim of the article is to prove the significant effect between economic freedom and competitiveness within the European Union countries based on an analysis of two indexes – the Economic Freedom Index and the Global Competitiveness Index. A direct and fairly strong dependence was proved.*

Keywords: *Competitiveness, Economic freedom, European Union, Lobbying, Transparency, Regulation.*

JEL classification: *E610, K40, O170, P48.*

Introduction

The growing demand for various levels of economic activities that have appeared throughout the globalization process has brought extraordinary attention to international competitiveness over the two most recent decades. The competitiveness of an economy can be defined as the ability of a specific country to positively assert itself on the global market [29]. The most useful definition of national competitiveness is the following: national competitiveness represents the degree to which it can, based on free and fair market conditions, produce goods and services that meet the test of international markets while simultaneously expanding the real incomes of its citizens. [24]. However, this aggregated ability is not only affected by its economic efficiency and productiveness, there is also a broad range of other socio-economic and political factors that may include institutional quality. Among factors influencing institutional quality are transparency and the scope of civil and economic liberties. It should be easy to scrutinize how decisions are made, the influences behind them and how taxpayer's money is allocated. On the other side the plurality of interests is a necessary prerequisite and starting point for a free and open society [20]. The lobbying and consultancy industry is a natural, important and legitimate part of the democratic decision-making process. However, sometimes lobbying practices go beyond the legitimate representation of interests, and methods are deceptive. This kind of behavior can take place backstage, be non-transparent and unfairly influence political

processes, generating potentially corrupt practices and excessive regulation of economic activities, all of which negatively influence economic freedom.

Because economic theory indicates that economic freedom affects incentives, productive effort, and the effectiveness of resource use, it should positively affect economic growth and national competitiveness as well.

In literature, there is a rather wide arrangement of studies that deal with the effects of economic freedom on promoting economic growth, e.g. [2], [4], [9], [10], [21]. Herciu and Ogrean [11] found a strong and direct link between economic freedom and national competitiveness. Verner [34] tested the relationship between the same variables for the most economic free countries, the four countries of Visegrad and the less economic free countries.

One of the serious symptoms of non-transparent lobbying is a privileged access. It can be a privilege to be regulated if the regulations somehow limit competition or disproportionately raise the costs of rival firms. That, unfortunately, can make these regulated (and privileged) firms powerful opponents of economic freedom [18]. Another likely outcome from non-transparent lobbying is corruption. Corruption erodes economic freedom by introducing insecurity and uncertainty into economic relationships [31]. Ali and Isse [1] have established a strong negative correlation between economic freedom and corruption. It is therefore possible to identify a connection between opaque lobbying and competitiveness through indicators of economic freedom, which are negatively affected by the consequences of non-transparent lobbying.

The economic crisis in Europe has not managed to change the essential priorities of economic policies of individual countries or the entire EU – increasing competitiveness. The European Union implemented its first decennial strategy for improving the competitiveness of its member countries and the EU as a whole, known as the Lisbon Strategy, in 2000. Problems associated with achieving the objectives and priorities stipulated in the Lisbon Strategy have been evident since the very beginning of its implementation, to be further accentuated by the global financial and economic crisis. The failure to achieve the objectives and aims of the Lisbon Strategy has even been admitted by the European Commission several times, e.g. at the beginning of 2010 not long before the implementation of the new decennial strategy - Europe 2020. The current strategy formulates relevant objectives with greater caution, so the ambition to become the most competitive and dynamic economy in the world has been replaced with support for enhancing economic competitiveness, as defined in the Sustainable development pillar. The relevant data published by The Heritage Foundation has shown that economic freedom reached its peak in 2008 followed by a decrease till 2014. The Foundation concluded that economic freedom has been adversely affected by the implementation of new government measures in response to the recent financial and economic crisis [31]. A more detailed analysis of these data for EU countries has shown a decrease in the average value practically in every sub-index of The Index of Economic Freedom during the period 2008 - 2014. The more a government does, the more opportunities are presented for rent-seeking. Rent-seeking is the process of expending resources in an attempt to influence public policy outcomes [33], [13]. Corporations know much more about how regulations affect their business interests than regulators or politicians do. It's not hard for lobbyists to take advantage of that knowledge gap. And the more valuable the privileged access, the more resources will be wasted in rent seeking [18]. Rent seeking is negatively related to economic freedom [5]. Del Rosal [7] classified the empirical papers on measurement

of rent-seeking into four categories: the indirect measure of rent-seeking costs, e.g. trade restrictions, monopoly position or regulation and other government-induced restrictions to competitive markets [33], [13]; estimations of rent-seeking cost by searching for sources of expenditures, e.g. budgetary changes [12], campaign contributions and in-kind gifts [28]; effects on aggregate economic performance, e. g influence of corruption on growth, bureaucratic efficiency [16], the change in income distribution [27]; other studies which do not fit appropriately into the previous categories, e.g. the relationship between government revenues associated with tariffs and the political régime [8].

The question in this survey is therefore laid out as follows: Can improving the economic freedom level be one of the methods to support competitiveness? In other words, has the decline in economic freedom in Europe during the global financial crisis influenced Europe's competitiveness? The aim of this paper is to prove or disprove the hypothesis of a link between economic freedom (expressed using the Index of Economic Freedom) and national competitiveness (expressed using the Global Competitiveness Index) within the European Union and to contribute to holding professional discussions about the factors that affect competitiveness. The emphasis is placed on non-transparent lobbying as one of the strong underlying factors affecting competitiveness.

The paper is structured as follows: Section 2 will briefly characterize the used indexes mentioned above; Methods, empirical results and discussion will be provided in Section 3 and Section 4 will conclude the paper and suggest further research.

1 Variables

This section provides an analytical description of the index of economic freedom and the global competitiveness index.

1.1 Economic Freedom

For the purpose of this research, the Economic Freedom Index (EFI) provided by the Heritage Foundation was selected. All of its ten components might be successfully influenced by particular interests if the decision-making process is not transparent. The actual report, “Lobbying in Europe – Hidden Influence, Privileged Access” provided by Transparency International has shown that a regional average score of 26 % in transparent lobbying reveals a low level of transparency around lobbying in particular, and public decision-making in general [19].

EFI is based on conservative values, focusing mainly on the evaluation of economic factors with an emphasis on the development of a market economy and minimizing governmental intervention. The index consists of ten components that are rated on a scale from 1 (oppressed country) to 100 (free country). The 10 measured aspects of economic freedom may be grouped into four broad categories: rule of law (property rights, freedom from corruption), government size (fiscal freedom, government spending), regulatory efficiency (business freedom, labor freedom, monetary freedom), and market openness (trade freedom, investment freedom, financial freedom). For more details see the Heritage Foundation [31].

1.2 The Global Competitiveness Index

Global Competitiveness Index (GCI) provided by the World Economic Forum (WEF) is a highly comprehensive index, which captures the microeconomic and macroeconomic foundations of national competitiveness. Competitiveness is defined as the set

of institutions, policies and factors that determine the level of productivity of a country. The level of productivity, in return, sets the sustainable level of prosperity that can be earned by an economy. [25, p. 3-4]

The GCI has 12 pillars divided to 3 sub-indexes: the basic requirement sub-index covers institutions, infrastructure, the macroeconomic environment and health and primary education; the efficiency enhancers sub-index focuses on higher education and training, goods market efficiency, labour market efficiency, financial market development, technological readiness and market size; the innovation and sophistication factors sub-index deals with business sophistication and innovation. Specific parts of sub-indexes have different weights with respect to calculating GCI. Calculating GCI is therefore based on a weighted average. The global competitiveness index may achieve values from 1(low) to 7 (high). Although there is some similarity in categories of "institutions" and categories that monitor EFI, they differ in methodology. For more details see the World Economic Forum [25], [35], [36].

2 Methodology and Methods

The methodology approach is based on the new institutional economics. The question of whether institutions are an endogenous or exogenous feature has not been clearly answered, even in the case of the new institutional economics. According to Thornton, Ocasio and Lounsbury [32] most authors assume an endogenous character of the institutions, because they are aware of the amount and diversity of institutional arrangements, which is the result of historical development, governance, state systems and the legal systems. Economic freedom or specifically the measurement of economic freedom can be considered as an endogenous variable because it is essentially a measurement of state regulation or degree of intervention of state authority into free market forces, which is closely related to the rules determining allocation mechanisms. Although both monitored variables can be classified as indicators of institutional quality, competitiveness can also be understood as a category of productivity or prediction of performance of the economy as defined above. Hanke and Walters [10] concluded that indicators of competitiveness are more "growth forecasts." A subsequent statistical analysis therefore examines how economic freedom affects the national competitiveness and conversely.

To determine the links between the data, methods of regression analysis were applied. For easier comparison and interpretation of the examined relationships, a correlation analysis was chosen as a suitable tool, although it assumes a linear character of regression between the variables; one independent variable – the Economic Freedom Index (EFI) – and one dependent variable – the Global Competitiveness Index (GCI). As there is assumed also the inverse dependence, the regression was carried out in a way where GCI is an independent variable and EFI is a dependent variable. The methods of regression analysis and correlation analysis were used because it is not difficult to gain relevant and substantive results. These methods are also well known and often used for examining the relationship between the data. The statistical set consists of 28 elements, n = 28. This is the basic set, because it includes all EU Member States. EU countries were selected not only for reasons that were mentioned in the introduction, but also for methodological reasons. For a more accurate determination of the degree of interdependence between economic freedom and competitiveness, it is necessary to isolate all the disturbing factors. One of them, the

most relevant, is the geographic location. Both historical determination and similar options of resources lead to "external" homogeneity.

A statistical survey of linear dependence starts with an analysis of correlation issues for values subject to monitoring. Any linear dependence proven between the values monitored will be followed by its interpretation in terms of a mathematical formula using regression. The values of variables are expressed in numerical form. When examining the number of values achieved by variables, these can be considered continuous variables. Variables may actually gain any values from the terminal interval that differs per index.

The significance level selected for all the subsequent tests is equal to 5 %, i.e. $\alpha = 0.05$. To accept or reject H_0 the significance level needs to be compared to the *P-Value*. The significance level of the test implies a reliability coefficient of $(1 - \alpha)$, which corresponds to 95 %. The software Statgraphics Centurion was used for calculations.

2.1 Result of statistical relation between the indicators in individual years

In the first instance, the relationship between two mentioned variables above for the time period 2001–2014 was tested. Both the regression and correlation analyses imply that there is a close relationship between the Economic Freedom Index and the Global Competitiveness Index.

2.2 Summary analysis – spatial perspective

In the second step of our testing of dependence we conducted correlation and regression analysis for all of the years 2004-2014 (2001-2003 are not included because not all values are available). A summary of correlation and regression analysis can be done, because indexes are spatial variables. The time factor is not important. The statistical set is 308 now, because the comparison is performed for the 28 countries which formed the contemporary European Union during the period 2004-2014.

2.2.1 Verification of the suitability of linear function

It can be assumed that there is a linear dependence between both indexes. Nevertheless, this assumption is confirmed by statistical calculation. Firstly, the correlation analysis proves that there is linear dependence. A correlation coefficient (0.6648) and P-Value (0.0000) show this direct linear dependence between The Economic Freedom and Global Competitiveness Indexes.

Secondly, the comparison of other possible functions indicates that the linear function is the most suitable function. This comparison is performed by R-squared. There can be found some other functions with higher R-squared than the linear function has. However, the variance is very low (R-squared for linear function is 44.2 % and this index for the best function is 47.3 %) and it is required that the function should be as simple as possible.

Thirdly, the homoscedasticity of the variance of random errors is proved. The F-test for comparing variances is used for this confirmation. The test statistic (F = 1,095) and P-Value (0,573) establish that the null hypothesis, which assumes that there is homoscedasticity, is not reject. This is another assumption of the linear model.

Finally, the correlation between the residue of Economic Freedom Index and the residue of Global Competitiveness Index verified that the course of indexes is not merely alike. The correlation coefficient is 0.6682 which means that the correlation is not spurious but real. These verifications confirm that the linear function is the most convenient for the exploration of dependence between EFI and GCI.

The combination of these criteria and tests leads to the verification of linear dependence between both indexes.

2.2.2 Regression analysis – EFI independent variable and GCI dependent variable

Regression models are mathematic models that express the concept of a course of variable dependence. The linear regression, which is used in this research, has the following general regulation of function:

$$\eta = \beta_0 + \beta_1 x \tag{1}$$

The estimation of unknown parameters of linear regression function is performed. The linear model for all of the years demonstrates that the coefficients b_0 and b_1 are both significant because the P-Value is less than 5 %. The results are arranged in the Tab. 1.

Tab. 1: Coefficients – EFI independent variable and GCI dependent variable

Parameter	*Least Squares Estimate*	*Standard Error*	*T Statistic*	*P-Value*
Intercept	1.04054	0.236941	4.39155	0.0000
Slope	0.053659	0.00344654	15.569	0.0000

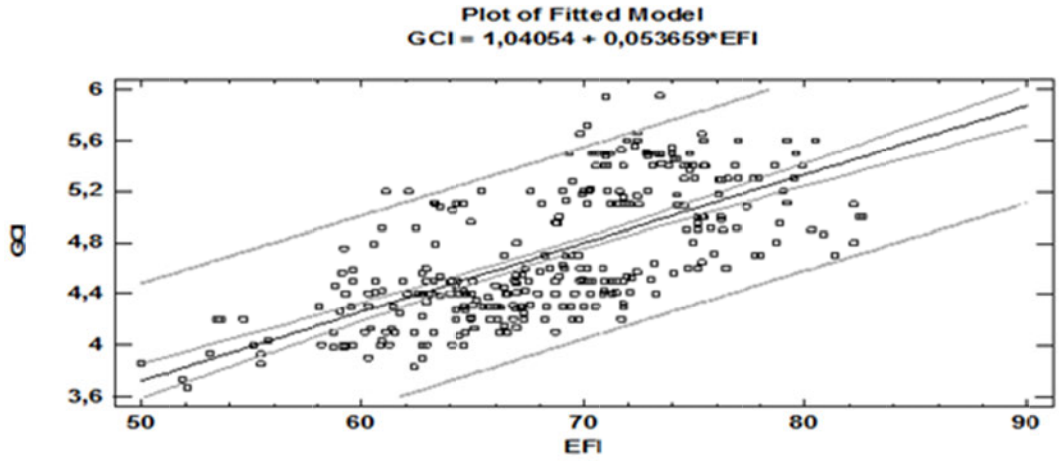
Source: own calculations based on [31], [17], [6], [3], [35], [36], [14], [15], [23], [26]

The R-squared is about 44 percent. It means that this model describes 44 percent of variability of global competitiveness. The mathematic formula is following:

$$GCI = 1.04054 + 0.053659*EFI \tag{2}$$

Fig. 1 shows the course of a defined linear model and values of indexes. The Analysis of Variance (ANOVA) is used for confirmation of the appropriateness of the chosen regression model. The F-Ratio (242.39) and P-Value (0.0000) prove that the test is statistically significant and the linear model is suitable.

Fig. 1: Linear model – EFI independent variable and GCI dependent variable



Source: own calculations based on [31], [17], [6], [3], [35], [36], [14], [15], [23], [26]

2.2.3 Regression analysis – GCI independent variable and EFI dependent variable

Naturally, this linear model for all of the years also shows that the coefficients b_0 and b_1 are both significant. The results are arranged in the Tab. 2.

Tab. 2: Coefficients – GCI independent variable and EFI dependent variable

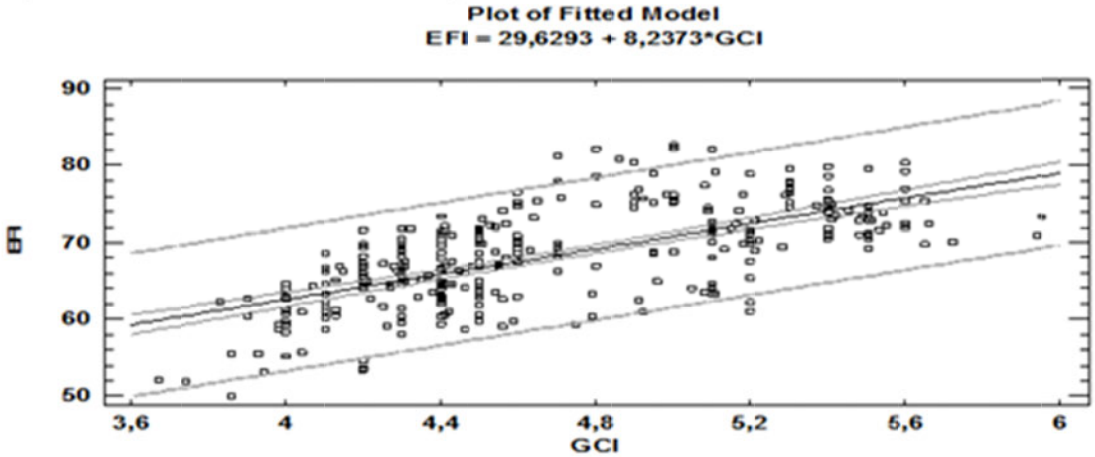
Parameter	*Least Squares Estimate*	*Standard Error*	*T Statistic*	*P-Value*
Intercept	29.6293	2.5085	11.8115	0.0000
Slope	8.2373	0.529085	15.569	0.0000

Source: own calculations based on [31], [17], [6], [3], [35], [36], [14], [15], [23], [26]

The R-squared is again about 44 percent and the mathematic formula follows:

$$EFI = 29.6293 + 8.2373*GCI \quad (3)$$

Fig. 2: Linear model – CGI independent variable and EFI dependent variable



Source: own calculations based on [31], [17], [6], [3], [35], [36], [14], [15], [23], [26]

The fitted model and the values of both indexes are shown in Fig. 2. The Analysis of Variance is used for confirmation of the appropriateness of the chosen regression model again. In accordance with the previous part of regression analysis the F-Ratio (242.39) and P-Value (0.0000) prove that the chosen linear model is appropriate.

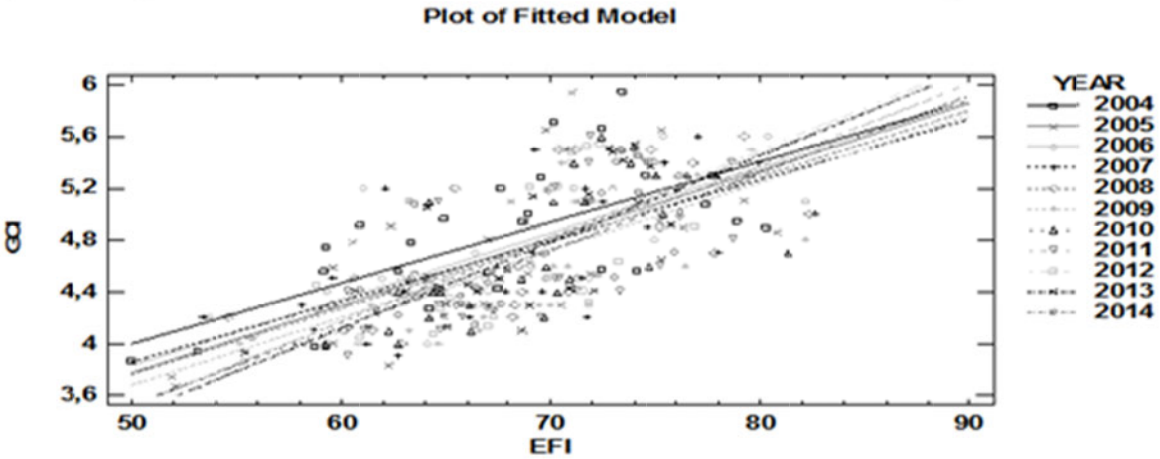
2.3 Comparison of different years - comparison of regression lines

A final step is to compare each year of the analysed indexes. Firstly, the GCI is a dependent variable and EFI is an independent variable. The comparison is made by level codes – YEAR. The R-squared is more than 46 percent.

Secondly, the EFI is a dependent variable and GCI is an independent variable. R-squared is the same as the situation where the dependence is the opposite way.

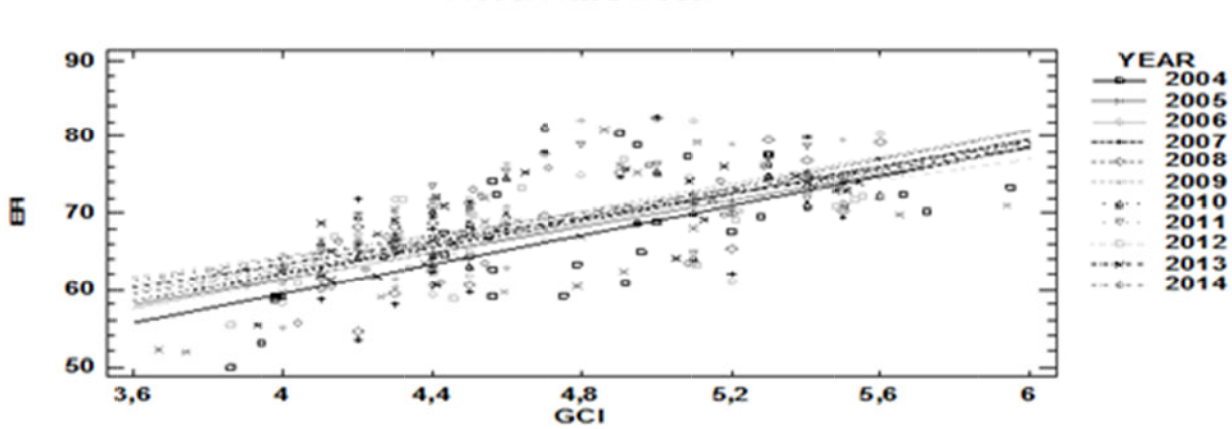
Because the P-value in the ANOVA test is less than 0.05 in both situations, there is a statistically significant relationship between the variables at the 95.0 % confidence level. The following Fig. 3 and 4 compare the values of individual years. Both figures show that all of the linear functions are similar. There is only a slightly different slope.

Fig. 3: Comparison of years – EFI independent variable and GCI dependent variable



Source: own calculations based on [31], [17], [6], [3], [35], [36], [14], [15], [23], [26]

Fig. 4: Comparison of years – GCI independent variable and EFI dependent variable



Source: own calculations based on [31], [17], [6], [3], [35], [36], [14], [15], [23], [26]

3 Discussion

Especially in times of crisis there is the tendency of governments to introduce significantly stronger regulatory measures than in periods of economic growth. In many cases, it is a political demand or the result of particular interests, rather than one based on the real needs of the economy.

Firstly, governments too often follow a "precautionary principle" – that is, regulating against the possibility of hypothetical harm without realizing that they are trying to extinguish "previous fires". This locks entrepreneurs into rigid rules that stifle innovative activity. Regulators must avoid hasty regulation. A number of tools are available for the determination of effective and useful regulation; one of them is the RIA system (Regulatory Impact Assessment). In essence, RIA attempts to clarify the relevant factors for decision -making. Its most important contribution to the quality of decisions is the action of analyzing – questioning, understanding real-world impacts, and exploring assumptions [22]. According to OECD [22] many regulatory failures stem from a faulty understanding of the problem and from inadequate attention to the indirect effects of government action that can undermine results. Rather, the reaction of regulators should be to encourage and enable the development of bottom-up, organic, self-regulating institutions.

Secondly regulatory intervention might be the result of powerful interest groups exerting pressure on politicians and regulators to capture rents. Decisions made by a politician can be

evaluated in terms of the objective of attracting the necessary support for successful reelection. Stigler [30] argued that firms will lobby legislators for regulation when such regulation provides: a) direct monetary subsidies, b) constraints on substitute products or subsidies on complementary products, c) an easier price-fixing/collusive atmosphere, and d) incumbent firms with the ability to control entry by potential new rivals. A more transparent environment will increase the accountability of governments for their decisions and decrease unfair lobbying practices. Transparency is an obstacle to pursuing unilateral interests or favoring one group over another in adopting unnecessary or questionable regulations.

Conclusion

The aim of this article was to answer the question of whether there is a relevant relationship between economic freedom and global competitiveness based on statistical analysis and thereby to point out a possible negative impact of non-transparent lobbying on competitiveness. Results have proven a statistically significant linear relationship between Economic Freedom Index and Global Competitiveness Index. This dependence is direct and fairly strong. The suitability of linear function was affirmed by correlation analysis, regression analysis, Durbin-Watson statistic and correlation analysis of residues.

It is possible to conclude that higher regulation of economic activities and thus restricting economic freedom leads to lower competitiveness.

Further research could be aimed at a more detailed distinction between transparent and non-transparent lobbying and its direct impact not only on economic freedom but on competitiveness in general and its individual pillars. Another relevant issue for further studies could be analyzing groups of countries clustered according to chosen parameters. This article is part of a complex project that deals with the issues mentioned.

Acknowledgements

This work was supported by the Czech Science Foundation, project No. 16-08786S "Impact of Transparency of Lobbying on Democratization and Its Consequences".

References

[1] ALI, A. M., ISSE, H. S. Determinants of Economic Corruption: A Cross-Country Comparison. *Cato Journal*, 2003, Vol. 22, Iss. 3, pp. 449-466. ISSN 0273-3072.

[2] BARRO, R. J. Democracy and Growth. The National Bureau of Economic Research, 1994, Vol. 1, Iss. 1, pp. 1-27. ISSN 0898-2937.

[3] BLANKE, J., PAUA, F., SALA-I-MARTIN, X. The Growth Competitiveness Index: Analyzing Key Underpinnings of Sustained Economic Growth [online]. Switzerland: World Economic Forum, 2003 [cit. 2014-08-13]. Available at WWW: <http://www.food-mac.com/Doc/200312/WorldEcoForum/Report03-04/GCI_Chapter.pdf>

[4] CARLSSON, F., LUNDSTROM, S. Economic Freedom and Growth: Decomposing the Effects. *Public Choice*, 2002, Vol. 112, Iss. 3-4, pp. 335-344. ISSN 0048-5829.

[5] COREY J. *Development in US States, Economic Freedom, and the „Resource Course"*. Frazer Institute: Studies in Mining policy, 2009, pp. 1-44 [cit. 2015-12-28].

Available at WWW: https://www.fraserinstitute.org/sites/default/files/Economic-Freedom-and-Resource-Curse-CA.pdf.

[6] CORNELIUS, P. K., BLANKE, J., PAUA, F. *The Growth Competitiveness Index: Recent Economic Developments and the Prospects for a Sustained Recovery* [online]. Switzerland: World Economic Forum, 2002 [cit. 2014-08-13]. Available at WWW: <http://intranet.oit.org.pe/WDMS/bib/virtual/coleccion_tem/prod_comp/gcr_gci.pdf.>

[7] DEL ROSAL, I. The Empirical Measurement of Rent-Seeking Cost. *Journal of Economic Surveys*, 2011, Vol. 25, Iss. 2, pp. 298-325. ISSN 0950-0804.

[8] DOUGAN, W. R., SNYDER, J. M. Are rents fully dissipated? *Public Choice*, 1993, Vol. 77, ISS. 4, pp. 793–813. ISSN 0048-5829.

[9] GWARTNEY, J. D., LAWSON, R. A., HOLCOMBE, R. G. Economic Freedom and the Environment for Economic Growth. *Journal of Institutional and Theoretical Economics*, 1999, Vol. 155, Iss. 4, pp. 643-663. ISSN 0932-4569.

[10] HANKE, S. H., WALTERS, S. J. K. Economic Freedom, Prosperity, and Equality: A Survey. *The Cato Journal*, 1997, Vol. 17, Iss. 2. ISSN 0273-3072.

[11] HERCIU, M., OGREAN, C. Interrelations between Economic Freedom, Knowledge Economy and Global Competitiveness – Comparative Analysis Romania and EU Average. *Studies in Business and Economics*, 2011, Vol. 6, Iss. 2, pp. 46-59. ISSN 1842-4120.

[12] KRATZ, E., ROSENBERG, J. Rent-seeking for budgetary allocation: preliminary results for 20 countries. *Public Choice*, 1989, Vol. 60, Iss. 2, pp. 133-144. ISSN 0048-5829.

[13] KRUEGER, A. O. The Political Economy of the Rent-Seeking Society. *American Economic Review*, 1974, Vol. 64, Iss. 3, pp. 291–303. ISSN 0002-8282.

[14] LOPEZ-CARLOS, A. *Global Competitiveness – Executive Summary* [online]. Switzerland: World Economic Forum, 2005 [cit. 2014-08-13]. Available at WWW: <http://www.bfsb-bahamas.com/download/Global%20Competitiveness.pdf>.

[15] LOPEZ-CARLOS, A., et al. *The Global Competitiveness Index: Identifying the Key Elements of Sustainable Growth* [online]. Switzerland: World Economic Forum, 2006 [cit. 2014-08-13]. Available at WWW: <http://www.weforum.org/pdf/Global _Competitiveness_Reports/Reports/gcr_2006/chapter_1_1.pdf>.

[16] MAURO, P. Corruption and growth. *Quarterly Journal of Economics*, 1995, Vol. 110, Iss. 3, pp. 681-712. ISSN 0033-5533.

[17] MCARTHUR, J. W., SACHS, J. D. *The Growth Competitiveness Index: Measuring Technological Advancement and the Stages of Development* [online]. United States: Centre for International Development at Harvard University, 2001 [cit. 2014-08-10]. Available at WWW: <http://www.cid.harvard.edu/archive/cr/pdf/2001growth _competitiveness.pdf>.

[18] MITCHELL, M. Economic Freedom and Economic Privilege. Heritage Foundation's' 2013 Index of Economic Freedom, 2013 [cit. 2016-03-02]. Available at WWW: <http://mercatus.org/publication/economic-freedom-and-economic-privilege>.

[19] MULCAHY, S. Lobbying in Europe: Hidden Influence, Privileged Access. Transparency International, 2015. ISBN 978-3-943497-80-9.

[20] MÜLLER, K. B., LABOUTKOVÁ, Š., VYMĚTAL, P. *Lobbing v moderních demokraciích*. Praha: Grada Publishing, a. s., 2010, pp. 256. ISBN 978-80-247 -3165-0.

[21] NELSON, M. A., SINGH, R. D. Democracy, Economic Freedom, Fiscal Policy and Growth in LDCs: A Fresh Look. *Economic Development and Cultural Change*, 1998, Vol. 46, Iss. 4, pp. 677-696. ISSN 0013-0079.

[22] OECD. *Regulatory Policies in OECD Countries. From Interventionism to Regulatory Governance*, Paris, 2002.

[23] PORTER, M. E., SCHWAB, K. *The Global Competitiveness Report 2008-2009* [online]. Switzerland: World Economic Forum, 2008 [cit. 2014-08-10]. ISBN-13 978-92-95044-11-1. Available at WWW: <http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2008-09.pdf>.

[24] PRESIDENT'S COMMISSION ON COMPETITIVENESS (1984). The Report of the President's Commission on Competitiveness, written for the Reagan administration. In Martin L. Roland (2003). *A Study on the Factors of Regional Competitiveness*. University of Cambridge [cit. 2015-03-01]. Available at WWW: <http://ec.europa.eu/ regional_policy/sources/docgener/.../competitiveness.pdf>.

[25] SALA-I-MARTIN, X., et al. The Global Competitiveness Index 2009-2010: Contributing to Long-Term Prosperity amid the Global Economic Crisis. *The Global Competitiveness Report 2009-2010*, 2009. ISBN-13 978-92-95044-25-8.

[26] SCHWAB, K. *The Global Competitiveness Reports* [online]. Switzerland: World Economic Forum, 2009-2015 [cit. 2015-01-10]. Available at WWW: <http://www.weforum.org/reports?filter[type]=Competitiveness>.

[27] SHUGHART, W. L., TOLLISON, R. D., YAN, Z. Rent seeking into the income distribution. Kyklos, 2003, Vol. 56, Iss. 4. pp. 441-456. ISSN 0023-5962.

[28] SOBEL, R. S., GARRETT, T. A. On the measurement of rent seeking and its social opportunity cost. *Public Choice*, 2002, Vol. 112, Iss. 1, pp. 115-136. ISSN 0048-5829.

[29] STANÍČKOVÁ, M., MELECKÝ, L. EU Competitiveness in the World Economy Globalization Process. *Současná Evropa*, 2013, Vol. 2013, Iss. 1, pp. 101-122. ISSN 1804-1280.

[30] STIGLER, G. J. The Theory of Economic Regulation. *The Bell Journal of Economics and Management Science*, 1971, Vol. 2, No. 1, pp. 3-21. ISSN 0005-8556.

[31] THE HERITAGE FOUNDATION. *2014 Index of Economic Freedom* [online]. Washington DC: The Heritage Foundation, 2014 [cit. 2015-01-10]. Available at WWW: <http://www.heritage.org/index/?utm_source=heritagefoundation&utm _medium=homepage&utm_campaign=headline140114>.

[32] THORNTON, P. H., W. OCASIO, M. LOUNSBURY. *The Institutional Logics Perspective: A New Approach to Culture, Structure and Process.* Oxford University Press, Oxford, 2012. ISBN-13 978-0199601943.

[33] TULLOCK, G. The Welfare Costs of Tariffs, Monopolies and Thefts. *Western Economic Journal*, 1967, Vol. 5, Iss. 3, pp. 224–32. ISSN 0715-4577.

[34] VERNER, T. The Effect of Economic Freedom on National Competitiveness: Causality from a Panel of Countries. *Journal of Economics, Business and Management*, 2015, Vol. 1, Iss. 3. ISSN 1611-1699.

[35] WORLD ECONOMIC FORUM. *Global Competitiveness Report 2004/2005* [online]. Switzerland: World Economic Forum, 2005 [cit. 2014-08-10]. Available at WWW: <http://www.ieseinsight.com/casos/study_0035.pdf>.

[36] WORLD ECONOMIC FORUM. *The Global Competitiveness Report 2007-2008* [online]. Switzerland: World Economic Forum, 2008 [cit. 2014-08-10]. Available at WWW: <http://www.allianceau.com/pics/advant/2007_WorldEconomicForum.pdf>.

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Received: 30. 12. 2015
Reviewed: 01. 02. 2016, 03. 03. 2016
Approved for publication: 08. 09. 2016

THE IMPACT OF CORRUPTION ON ECONOMIC GROWTH IN OECD COUNTRIES

Veronika Linhartová, Eva Židová

Abstract: *The question if and how corruption can influence economic growth of countries is not answered by literature without controversies. One may thus encounter the view that corruption is "sand in the wheels" of the economy, which impedes economic transactions, as it reduces the security of property rights and contributes to inefficient allocation of resources. On the other hand, there are authors who believe that corruption is precisely what "greases the wheels" of the economy, because it allows individuals to avoid administrative and bureaucratic delays. Based on the searches results of the theoretical literature and empirical studies, this contribution verificates the validity of hypotheses about the negative impact of corruption on economic growth on a sample member states of the OECD in the period 1999 - 2014. Through information from the professional literature is for this purpose derived econometric model that provides a comprehensive overview of how corruption function in a selected sample of countries on economic growth. Econometric model proved that corruption negatively influences the economic growth, not only directly but also indirectly in selected group of countries. As the transmission channels through which corruption affects economic growth were confirmed household expenditures and net exports.*

Keywords: *Corruption, Economic growth, Econometric analysis, Transmission channel, Organization for Economic Cooperation and Development.*

JEL Classification*: D73, H11.*

Introduction

Corruption is a substantial problem that has been encountered by society since time immemorial. It is a problem that is persistent and very widespread; despite this, it cannot be solved either very easily or successfully. Professional literature states that corruption influences a country's economic situation, primarily its economic growth. For decades, the problem of corruption's influence on economic growth has been the subject of many theoretical and empirical studies. Some authors consider corruption to be a driver of the economy, but others support the opinion that it "sands the wheels" of the economy. It is necessary to emphasize that the second opinion predominates in most of the studies.

The goal of this paper is to verify the validity the hypothesis that corruption negatively influences economic growth in the OECD member countries. The content of the paper also includes a description of the current state of corruption for the given group of countries.

1 Statement of a problem

One of the most significant arguments in favor of corruption's positive influence on economic growth was put forth by Leff [6] and Huntington [4] in the 1970s. According to them, corruption has the ability to hasten lengthy and ineffective administrative processes. For this reason, they said that it necessarily "greases the wheels" of the public administration's performance. On the other hand, Myrdal [12] stated that it could lead

to even greater delay and further inefficiency on account of trying to attract a greater number of bribes or increase their costs.

In relation to this, Tanzi [17] argued that bribes increase companies' start-up costs; moreover, these companies could have been able to use these funds in a more effective way. Other authors determined that corruption blocks innovation as well as the development of these companies; in consequence, it dampens economic growth. Besides this, it impedes the development of market economies and disrupts the free market system, because it increases levels of uncertainty. In certain areas, it threatens the fundamental role of the state or impedes government intervention. It also leads to poor distribution of resources, because the structure of public expenses often changes in favor of specific sectors, mainly those that have more apparent opportunities for corruption. [2], [8]

On the basis of his empirical study, Mauro [9] determined that countries that typically have low productivity and large public sectors have a greater likelihood of low economic growth and widespread corruption. More recent empirical studies warn that it is not possible to explain corruption's influence on economic growth without taking into account the institutional framework of individual countries. For example, the authors Meon and Weill [10] presented evidence that corruption has a detrimental effect on economies with effective institutions, while countries with ineffective institutional infrastructure can benefit from corruption.

1.1 Transmission channels

In investigating the relationship between corruption and economic growth, a number of authors have come to the conclusion that corruption's significant influence on economic growth tends to disappear when other important determinants of economic growth are integrated. This indicates that a significant part of the effect that damages economic growth is transferred indirectly through the main determinants of economic growth, which are also designated transformation or transmission channels.

One of the first studies devoted to modes of transmission was conducted by Mo [11]. Even though he found a significant negative relationship between corruption and economic growth, the resulting size of this effect actually decreased and became a statistically insignificant after integrating other determinants of economic growth, i.e., investment, human capital, and political instability. On the basis of these findings, these were designated transmission channels. The authors Pellegrini and Gerlagh [15] built on his work, but they defined trade openness as another transmission channel. On the basis of their study, they proved that the most important channel impeding economic growth is investment. Dridi [2] also dealt with this problem; he considered the transmission channels to be investment, human capital, political instability, inflation, and government expenses. With the help of a study, he determined that negative effects are primarily transmitted via human capital and political instability, while the investment channel's effect appeared to be smaller than that of previous empirical studies.

In conclusion, it is possible to state that there are various academic studies with differing results, but studies concerning corruption's negative influence on economic growth predominate. Certain studies have proved corruption's significant negative influence on economic growth; others have discovered that this effect is statistically insignificant and prioritize other factors such as variables influencing economic growth. Empirical studies also illustrate that corruption acts directly on economic growth in a negative way, as well

as indirectly via transmission channels. Investment, human capital, and political instability have been indicated as the most important transmission channels.

2 Methods

The validity of the hypothesis of corruption's negative influence was verified on a panel data sample in the program Gretl[3].

Due to the attributes of panel data, the estimation of the model's parameters was conducted using a fixed effects model. This choice was supported by rejecting the null hypothesis of Hausman test, which recommended the use of fixed effects model as an appropriate method for estimations.

A fixed effects model uses dummy variables to model individual effects. This regression has a great many explanatory variables, but it is still a regression model. For this reason, all the truths relating to regression models and equations are also valid here (1):

$$Y_{it} = \alpha_N D_{it}^{(N)} + \beta X_{it} + \epsilon_{it} \quad (1)$$

This model assumes the heterogeneity of the cross-sectional units in total members; therefore, it is necessary for the fixed effects model to create *N* various dummy variables, which are shown as $D^{(j)}$, where $j = 1,\ldots,N$. [7], [13]

It is necessary to verify and evaluate the estimated econometric model before applying it. The traditional set of preconditions that econometrics considers in the context of regression error, i.e., error terms (ϵi), are used here and are expressed in the following way:

$E(\epsilon i) = 0$. A zero mean value of the error term.

$var(\epsilon i) = E(\epsilon i^2) = \sigma^2$. Constant variance of error (homoscedasticity).

$cov(\epsilon i; \epsilon j) = 0$ *for* $i \neq j$. The error terms are not correlated.

ϵi has normal distribution.

Xi is fixed; therefore, it is not a random value.

The significance level set for the analysis is the standard, thus 0.05.

3 Problem Solving

As was mentioned in the introduction, the goal of this paper is to verify the validity of the theory of corruption's negative influence on economic growth. The analysis was conducted on the group of OECD member countries. For this reason, a description of the current state of corruption in the selected group of countries is included in the content of this paper.

3.1 The current state of corruption in the OECD countries

On the basis of its own analysis, the OECD emphasizes that corruption is a serious barrier to economic growth. According to this organization, not only is there a direct relationship between corruption and economic growth but also an indirect one, where corruption has significant negative impact on a whole range of key transmission channels. Even though the economies of the individual member states are different, the OECD tries

[3] This is a freely available program that is used to estimate econometric models. It is available at WWW: <http://gretl.sourceforge.net/>.

to achieve the highest, consistently sustainable economic growth for them; it does this in part by using anti-corruption agreements and other measures. [14]

Both countries with lesser standards of living and economic strength as well as very economically advanced countries are concerned with the problem of corruption. These conclusions are derived from surveys by the organization Transparency International, which annually publishes the Corruption Perceptions Index (CPI). CPI is annually published by Transparency International and takes values in the interval from 0 to 100, where 0 is a highly corrupt country and a value of 100 indicates a country without corruption. The results of this index for the OECD member countries in 2015 are listed in Table 1. For each country, their ranking in the index is presented; that year, the index included 168 of the world's countries. [19]

Tab. 1: List of the OECD Member Countries According to the Corruption Perceptions Index for 2015

	CPI	Ranking		CPI	Ranking		CP	Rankin
Denmark	91	1	**Australia**	79	13	**Slovenia**	60	35
Finland	90	2	**Belgium**	77	15	**Spain**	58	36
Sweden	89	3	**USA**	76	16	**South**	56	37
New	88	4	**Austria**	76	16	**Czech**	56	37
Norway	87	5	**Ireland**	75	18	**Slovakia**	51	50
Netherland	87	5	**Japan**	75	18	**Hungar**	51	50
Switzerland	86	7	**France**	70	23	**Greece**	46	58
Canada	83	9	**Chile**	70	23	**Italy**	44	61
GB	81	10	**Estonia**	70	23	**Turkey**	42	66
Luxembour	81	10	**Portugal**	63	28	**Mexico**	35	95
Germany	81	10	**Poland**	62	30			
Iceland	79	13	**Israel**	61	32			

Source: [19]

New Zealand and the Northern European countries have long been considered to be the OECD countries with the lowest levels of corruption. The reason for their high ranking could be that the judiciary, monitoring bodies, and other institutions that thoroughly and effectively uphold anti-corruption laws are strongly situated in these countries. The Western European countries are considered to have a somewhat higher risk of corruption; they typically have a transparent and effective public administration with high ethical standards. In contrast to these countries, the countries located in Central Europe ranked lower on the list. Although these states do have anti-corruption legislation, they show marked shortcomings. A high risk of corruption is perceived in the countries of Southern Europe, where prevention is neglected in the fight against corruption. Overall, Mexico is distinguished by the highest risk of corruption among the OECD member countries. In this country, the courts, police, and other institutions are perceived as being very corrupt, incompetent, and unreliable. [18]

3.2 Model formulation and variable specification

The validity of the theory of corruption's negative influence was tested on the group of 34 OECD member countries for the years 1999–2014. The model's specifications were derived from the empirical work of authors dealing with the identification of the transmission channels via which corruption influences economic growth. On the basis of these studies, the author of this paper assumed that corruption influences economic growth directly as well as indirectly via transmission channels. These transmission channels

are considered to be investment, human capital, political instability, government expenses, and trade openness. Household expenditure, one of the basic components determining gross domestic product, was included in the model along with these transmission channels, which are also determinants of economic growth.

After testing the variables' stationarity, the model was constructed as follows (2):

$$GDP\_Growth_{it} = ß_0 + ß_1 CPI\_Growth_{it} + ß_2 HOUSexp\_Growth_{it} + ß_3 INV\_Growth_{it} + ß_4 GOVexp\_Growth_{it} + ß_5 d\_NX_{it} + ß_6 HC\_Growth_{it} + ß_7 d\_PS_{it} \quad (2)$$

A description of the individual variables is presented in Table 2.

Tab. 2: Description of the Variables Used

Variable	Description of the Variable	Units	Positive/Negative
i	Respective country		
t	Respective year		
GDP_Growth	Gross domestic product[4]	Growth in %	
CPI_Growth	Corruption Perceptions Index	Growth in %	Positive
HOUSexp_Growt	Household consumption	Growth in %	Positive
INV_Growth	Investment[5]	Growth in %	Positive
GOVexp_Growth	Government expenditure	Growth in %	Positive
d_NX	Balance of international trade	Total change	Positive
HC_Growth	Human capital[6]	Growth in %	Positive
d_PS	Political Stability Index	Total change	Positive

Source: Author's own work acc. to [19],[20],[21]

3.3 Testing the hypothesis of corruption's direct influence on economic growth

The first part of the analysis verifies the validity of the hypothesis of corruption's direct negative influence on economic growth. If the analysis also helps prove the positive influence of certain determinants (with the exception of *CPI*) on economic growth, the next section will verify the hypothesis that corruption has an indirect negative influence on economic growth.

Estimation of the model parameters

The estimation of the parameters according to the model constructed above is presented in Table 3.

Tab. 3: Estimation of the Parameters of All the Explanatory Variables

	Coefficient	Std. Error	t-ratio	p-value	
const	−1.59284	0.307671	−5.1771	<0.0001	***
CPI_Growth	−0.0103355	0.0333384	−0.3100	0.7568	
HOUSexp_Growth	0.734814	0.0543707	13.5149	<0.0001	***
INV_Growth	0.0790306	0.0243012	3.2521	0.0013	***
GOVexp_Growth	−0.101885	0.0293375	−3.4729	0.0006	***
d_NX	1.66184e-05	9.63153e-06	1.7254	0.0855	*
HC_Growth	−0.00151059	0.00317462	−0.4758	0.6345	
d_PS	1.2073	0.719827	1.6772	0.0945	

Source: Author's own work, Gretl

[4] Nominal gross domestic product.

[5] Expressed using gross fixed capital formation as an indicator.

[6] Expressed using the number of students enrolled in secondary education as an indicator.

The model explains 71% of the variability of the *GDP* response variable ($R^2 = 0.71$). For the variable of *CPI*, it was not possible to demonstrate statistical significance; also, the opposite effect than that which was assumed when specifying the variables was demonstrated. The coefficient for the variable *GOVexp*, which appeared as statistically significant, was shown to be negative. It was not possible to prove statistical significance for either the *HC* or *PS* variables. Because of marked differences between the assumptions and results of this analysis, the model was tested after removing the statistically insignificant variables (with the exception of the *CPI* variable). The results of the testing are presented in Table 4.

Tab. 4: Estimation of the Parameters of Selected Explanatory Variables

	Coefficient	Std. Error	t-ratio	p-value	
const	−1.82541	0.266414	−6.852	<0.0001	***
CPI_Growth	0.0589403	0.0253376	2.326	0.0204	**
HOUSexp_Growth	0.706239	0.0493138	14.32	<0.0001	***
INV_Growth	0.0956146	0.0185622	5.151	<0.0001	***
GOVexp_Growth	−0.0982657	0.0245518	−4.002	<0.0001	***
d_NX	1.38665e-05	6.94496e-06	1.997	0.0464	**

Source: Author's own work, Gretl

This model explains 60% of the variability of the *GDP* response variable ($R^2 = 0.60$). After subsequent removal of the statistically insignificant variables *PS* and *HC*, the *CPI* variable's trajectory of influence on economic growth changed direction. After more detailed investigation, it was determined that the *CPI* variable is negative only when the *PS* variable is included in the model. Moreover, after eliminating these variables, the *CPI* variable's statistical significance increased and became statistically significant. No significant changes occurred for the other variables' coefficients.

Regarding the fact that the *CPI* variable showed low statistical significance in the previous models and had an ambiguous effect on the response variable, the possibility of it having a delayed effect on the response variable was thus verified. It is important to remark that the time delay was added only for the *CPI* variable and not for the other basic components determining *GDP*, because the paper's author did not assume that these determinants would influence the response variable with a time delay. Variables that did not show statistical significance in the previous models (*PS* and *HC*) were not included in the model. Length of the time delay is one year. The model's results are presented in Table 5.

Tab. 5: Estimation of the Model Parameters with Time Delay

	Coefficient	Std. Error	t-ratio	p-value	
const	−1.97784	0.246638	−8.019	<0.0001	***
CPI_Growth_1	0.0479353	0.0231518	2.070	0.0390	*
HOUSexp_Growth	0.784001	0.0483374	16.22	<0.0001	***
INV_Growth	0.0984342	0.0172087	5.720	<0.0001	***
GOVexp_Growth	−0.115576	0.0236606	−4.885	<0.0001	***
d_NX	1.37049e-05	6.53950e-06	2.096	0.0367	*

Source: Author's own work, Gretl

The model explains 64% of the variability of the *GDP* response variable ($R^2 = 0.64$). In this model, the variable of *CPI* came out positive and statistically significant. This indicates that corruption not only has a negative effect on economic growth immediately but also with a time delay.

3.4 Testing the hypothesis of corruption's indirect influence on economic growth

In the previous models, it was demonstrated that the variables *HOUSexp, INV, NX,* and *PS* had a positive influence on economic growth. Here the question arises as to whether this could be related to the transmission channels via which corruption can also indirectly influence economic growth. For the purposes of verifying this hypothesis, three models were constructed using the response variables of *HOUSexp, INV,* and *NX*[7]. In order for these response variables to be designated transmission channels, the *CPI* variable must be positive. With regards to the variables' stationarity, the models were composed in the following way (3), (4), (5):

$$HOUSexp\_Growth_{it} = ß_0 + ß_1 CPI\_Growth_{it} + ß_2 GDP\_Growth_{it} + ß_3 INV\_Growth_{it} + ß_4 GOVexp\_Growth_{it} + ß_5 d\_NX_{it} + ß_6 HC\_Growth_{it} + ß_7 d\_PS_{it} \quad (3)$$

$$INV\_Growth_{it} = ß_0 + ß_1 CPI\_Growth_{it} + ß_2 GDP\_Growth_{it} + ß_3 HOUSexp\_Growth_{it} + ß_4 GOVexp\_Growth_{it} + ß_5 d\_NX_{it} + ß_6 HC\_Growth_{it} + ß_7 d\_PS_{it} \quad (4)$$

$$d\_NX_{it} = ß_0 + ß_1 CPI\_Growth_{it} + ß_2 GDP\_Growth_{it} + ß_3 HOUSexp\_Growth_{it} + ß_4 INV\_Growth_{it} + ß_5 GOVexp\_Growth_{it} + ß_6 HC\_Growth_{it} + ß_7 d\_PS_{it} \quad (5)$$

Estimation of the model parameters

The type of effect that the variable of *CPI* has on the variable of *HOUSexp* was tested first. The results of this model are presented in Table 6.

Tab. 6: Estimation of the Model Parameters for the HOUSexp Variable

	Coefficient	Std. Error	t-ratio	p-value	
const	3.13766	0.180984	17.3367	<0.0001	***
CPI_Growth	0.0547152	0.0229164	2.3876	0.0176	**
GDP_Growth	0.618408	0.0892517	6.9288	<0.0001	***
INV_Growth	0.0448448	0.0256457	1.7486	0.0814	*
GOVexp_Growth	0.0231396	0.0288934	0.8009	0.4238	
d_NX	−1.44036e-05	5.38703e-06	−2.6737	0.0079	***
HC_Growth	−0.00261428	0.0022945	−1.1394	0.2555	
d_PS	0.191469	0.787346	0.2432	0.8080	

Source: Author's own work, Gretl

The model explains 73% of the variability of the *HOUSexp* response variable ($R^2 = 0.73$). In this model, the *CPI* variable was positive and statistically significant.

Investment was determined as the next possible transmission channel. The output of this model is presented in Table 7.

Tab. 7: Estimation of the Model Parameters for the INV Variable

	Coefficient	Std. Error	t-ratio	p-value	
const	−5.78367	1.29468	−4.4673	<0.0001	***
CPI_Growth	−0.0531045	0.107718	−0.4930	0.6224	
GDP_Growth	0.943176	0.332392	2.8375	0.0049	***
HOUSexp_Growth	0.635935	0.369327	1.7219	0.0861	*
GOVexp_Growth	1.08321	0.055328	19.5779	<0.0001	***
d_NX	−2.7027e-05	1.23476e-05	−2.1889	0.0294	**
HC_Growth	0.000480106	0.012249	0.0392	0.9688	
d_PS	4.00897	2.03678	1.9683	0.0499	**

Source: Author's own work, Gretl

[7] The previous models were unable to show statistical significance for the *PS* variable's effect on the response variable.

The model explains 78% of the variability of the *INV* response variable (R^2 = 0.78). In this case, it was not possible to demonstrate that the *CPI* variable was statistically significant, even though it showed negative influence on the *INV* response variable.

The last response variable was the variable of *NX*. The results of these models are presented in Table 8.

Tab. 8: Estimation of the Model Parameters for the NX Variable

	Coefficient	Std. Error	t-ratio	p-value	
const	8196.97	2157.19	3.7998	0.0002	***
CPI Growth	355.974	301.312	1.1814	0.2384	
GDP Growth	1722.58	779.661	2.2094	0.0279	**
HOUSexp Growt	−1774.04	678.631	−2.6141	0.0094	***
INV Growth	−234.742	176.417	−1.3306	0.1843	
GOVexp Growth	36.6948	271.086	0.1354	0.8924	
HC Growth	−13.0526	10.2876	−1.2688	0.2055	
d PS	3027.85	8211.63	0.3687	0.7126	

Source: Author's own work, Gretl

The model explains only 7% of the variability of the *NX* response variable (R^2 = 0.07). Not even in this case was it possible to demonstrate the *CPI* variable's statistical significance, even though it showed a positive influence on the *NX* response variable.

Statistical and economic verification

In all of the estimated models, the Gauss-Markov preconditions were fulfilled, with the exception of the precondition of identical distribution of the error term with a zero mean value. Thus, the hypothesis on the normal distribution of the error term was rejected. Thus, it is impossible to generalize the results of the model to the wider population (i.e., to other countries) or to other periods of time.

4 Discussion

The results of the analysis show that corruption effects economic growth in a truly negative way, because most of the models show the *CPI* variable as positive and, moreover, statistically significant. It even showed statistical significance when a time delay of one year was built in for this variable. This indicates that corruption can act on economic growth not only directly but also with a time delay. For example, the lower rankings of countries in the Corruption Perceptions Index are reflected in the investment activity of potential investors.

When the *PS* variable was included in the model, it was possible to observe the opposite effect and statistical insignificance for this variable. This is most likely caused by an existing dependence between the two variables, despite the fact that diagnostic checking of the model did not show the traditional preconditions to be violated. Many studies confirm that corruption is truly closely dependent on political instability. In countries with higher corruption, there is greater political instability – partly for the reason that a politically unstable country actually ranks lower in corruption perception indexes than a politically stable country. This is also partly on account of how international investors assess political stability, the degree of corruption, transparency, and government fairness. They do not want to invest in a country that is characterized by low political stability and a high level of corruption.

The *GOVexp* variable demonstrated the opposite effect than that which was assumed when specifying the variables. According to the analysis, this variable has a negative influence on the *GDP* response variable in the selected group of countries, although it is one of GDP's basic components. However, government expenditure should be necessary for individual countries' economies, because it makes it possible to increase the levels of human and material capital, support technological advancement, and thus contribute to economic growth. Moreover, it also creates suitable conditions for private investment, e.g., in the form of investment incentives, etc. On the other hand, it depends on how effectively these funds are spent. The group of countries includes those characterized by a great degree of reallocation and generous social support systems. Naturally, this also means that the populations of these countries pay high taxes. Because of this, individuals have lower motivation to work as well as a lesser tendency to invest, which undermines economic growth.

In the paper, the hypothesis on corruption's indirect negative influence on economic growth was also tested. The variables of *HOUSexp, INV,* and *NX* appeared as potential transmission channels, because it was possible to show their statistical significance and positive influence on the *GDP* response variable in the previous models. The analysis confirmed this assumption for *HOUSexp* and *NX*. For this reason, it is possible to consider them transmission channels, through which corruption influences economic growth. This means that, as the CPI value decreases (i.e., the growth of perceived corruption), household expenditure and net exports also decrease, which acts adversely on gross domestic product. Here, the question arises of how corruption is able to influence economic growth using these transmission channels. For the *INV* variable, it was not possible to prove that the hypothesis was valid.

It is possible that the transmission channel of household expenditure could be related to ineffective management within certain OECD countries. As an example, it is possible to list the problem of distributing public commissions, which is one of the most frequent areas of worldwide corruption and results in ineffective country management and wasting taxpayers' money. Due to this problem, national budgets show losses and it becomes necessary for countries to raise taxes, which leads to limiting household expenditure and, hence, to lowering economic growth.

Although the influence of corruption on net exports was found to be statistically insignificant, it is also possible to designate it a transmission channel. The reputation of a corrupt country can discourage potential international importers. Exporters most likely will not be interested in trading either with countries that strictly enforce compliance with a multitude of regulations and unsubstantiated ordinances so as to acquire a specific bribe or favor or with countries whose government bodies are markedly corrupt and show little possibility of enforcing the law. For this group of countries, this is the reason that, as the perception of corruption increases, these countries' net exports decrease and their economic growth is also damaged as a consequence.

Investment also appeared in this analysis as a potential transmission channel. However, corruption's negative influence on investment was not proved and, for this reason, it was not possible to consider investment a transmission channel, via which corruption could negatively influence economic growth. Conversely, the analysis shows that corruption has a positive influence on investment in the selected sample of countries, even though very insignificant. However, most of the authors of empirical studies have arrived at the opinion that a negative relationship between corruption and investment does exist on account

of insecurity and increased danger of failure, because corrupt agreements are not enforceable. Supplemental costs for necessary expenditures to cover up corrupt activities also increase. However, it is also possible to find corruption's positive influence on investment. For example, the problem of public commissions can be mentioned once again. When a public commission is announced by the government, e.g., the construction of a new highway, a company can pay in order to be selected as the winning bidder. Once it becomes the winning bidder, it can invoice exorbitant prices or cut back on quality. In this case, the company profits from corruption and can further develop its investment activities.

Conclusion

In conclusion, it is possible to state that the validity of the hypothesis of corruption's negative influence on economic growth was confirmed for the OECD member countries. A greater degree of perceived corruption in these countries is accompanied by lower economic growth. At the same time, the analysis demonstrated that corruption effects economic growth not only directly but also with a delay in time.

Nonetheless, this analysis also confirmed the assertion of authors of empirical studies that corruption's influence on economic growth becomes statistically less significant after incorporating other economic growth determinants. This demonstrated that corruption influences economic growth directly but also indirectly by means of these determinants. After testing this hypothesis, it was determined that corruption effects economic growth negatively via household expenditure and net exports.

It is not possible to generalize the results of this paper to other groups of countries or other time periods, because the hypothesis of the error term's normal distribution was rejected. Consequently, it is only possible to apply the conclusions presented here to the OECD member countries during the time period of 1999–2014.

Acknowledgement

This contribution was supported by SGS_2016_023.

References

[1] AHMAD et al. Does corruption affect economic growth?, *Latin American Journal of Economics*, 49 (2), 2012, pp. 277–305. ISSN 07190425

[2] DRIDI, M. Corruption and Economic Growth: The Transmission Channels. *In Journal of Business Studies Quarterly* [online]. 2013 [cit. 2016-03-18]. ISSN 2152-1034. Available from WWW: <http://jbsq.org/wp-content/uploads/2013/06/June _2013_9.pdf>.

[3] DZHUMASHEV, R. Corruption and growth: The role of governance, public spending, and economic development, *Economic Modelling*, 37, 2014, pp. 202–215. ISSN 02649993

[4] HUNTINGTON, S. P. *Political Order in Changing Societes*. New Haven: Yale University Press, 1968, 500 p. ISBN 0-300-01171-7.

[5] KEITA, K. LAURILA, H. Governance and Corruption-sand or grease in the wheels?. *Tampere Economic Working Papers* [online]. 2016. ISSN 1458-1191 [cit. 2016-06-14]. Available from WWW: <https://uta32-kk.lib.helsinki.fi/handle/ 10024/98484>.

[6] LEFF, N. H. *Economic Development through Bureaucratic Corruption*. New Brunswick: Transaction Publisher, 1989, 1025 p. ISBN 0-88738-163-4.

[7] LUKÁČIK, M., LUKÁČIKOVÁ, A., SZOMOLÁNYI, K. Panelová dáta v programe Gretl. *In Fakulta hospodárskej informatiky* [online]. 2011 [cit. 2016-04-18]. Available from WWW: <http://www.fhi.sk/files/katedry/kove/veda-vyskum/prace/2011/Lukacik-Lukacikova-Szomolanyi2011.pdf>.

[8] MAURO, P. Corruption and the composition of government expenditure. *In IMF Working Paper* [online]. *1998*. [cit. 2016-04-23]. Available from WWW: <http://www1.worldbank.org/publicsector/anticorrupt/CoreCourse2005/Mauro.pdf>.

[9] MAURO, P. The Persistence of Corruption and Slow Economic Growth. *In IMF Working Paper 02/213* [online]. 2008 [cit. 2015-12-23]. Available from WWW: <http://www.imf.org/external/pubs/ft/wp/2002/wp02213.pdf>.

[10] MEON, P. G., WEILL, L. Is corruption an efficient grease?. *In BOFIT Discussion Papers*, [online]. 2008. [cit. 2016-04-23]. Available from WWW: <https://helda.helsinki.fi/bof/bitstream/handle/123456789/8105/160134.pdf?sequence=1>.

[11] MO, P.H. Corruption and Economic Growth. [online]. 2001. [cit. 2016-04-23]. Available from WWW: <http://projects.iq.harvard.edu/files/gov2126/files/sdarticle-3.pdf>.

[12] MYRDAL, G. *Asian Drama: An Inquiry into the Poverty of Nations*, Pantheon, New York. [online]. 1968. [cit. 2016-04-23]. Available from WWW: <https://www.researchgate.net/publication/249663379_EconomicsGUNNAR_MYRDAL_Asian_Drama_An_Inquiry_into_the_Poverty_of_Nations_Vols_I_II_and_III_Pp_lxii_2284_New_York_Random_House_1968_850>.

[13] NĚMEC, D. *Základy ekonometrie*. Brno: Masarykova Univerzita, Ekonomicko-správní fakulta, 2012.

[14] OECD. *Consequences of corruption at the sector level and implications for economic growth and development*. Paris: OECD, 2015. ISBN 92-642-3076-9.

[15] PELLEGRINI, L. AND GERLAGH, R., L., GERLAGH, R. Corruption's Effect on Growth and its Transmission Channels [online]. 2004. [cit. 2016-04-23]. Available from WWW: <http://onlinelibrary.wiley.com/doi/10.1111/j.0023-5962.2004.00261.x/abstract>.

[16] ROSE-ACKERMAN, S. *Corruption: A Study in Political Economy*, Academic Press, 2013, p. 258. ISBN 9781483289069

[17] TANZI, V. Corruption Around The World. *In IMF Working Paper* [online]. 1998 [cit. 2016-04-21]. Available from WWW: <https://www.imf.org/external/Pubs/FT/staffp/1998/12-98/pdf/tanzi.pdf>.

[18] The Business Anti-Corruption Portal [online]. 2016 [cit. 2016-03-29]. Available from WWW: < http://www.business-anti-corruption.com/>.

[19] TRANSPARENCY INTERNATIONAL [online]. 2015 [cit. 2016-04-21]. Available from WWW: < http://www.transparency.org/cpi2015>.

[20] WORLD BANK. Indicators, [online]. 2016 [cit. 2016-03-15]. Available from WWW: <http://data.worldbank.org/indicator>.

[21] WORLD BANK. Worldwide Governance Indicators: Political stability [online]. 2016 [cit. 2016-03-15]. Available from WWW: <http://info.worldbank.org/governance/wgi/index.aspx#home>.

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Received: 01. 05. 2016
Reviewed: 02. 06. 2016, 06. 06. 2016
Approved for publication: 08. 09. 2016

THE FISCAL DIMENSION OF CZECH HEALTH SYSTEM IN THE MACROECONOMIC CONTEXT

Jan Mertl

Abstract: *The article focuses on the fiscal aspects of health care financing in recent socio-economic development, which has been difficult for public finance. This is justified by the size of health budget and the importance of health care for economic performance and social well-being. Together with absolute and relative increase of health expenditure, the significance of health expenditure is rising and the public policy must be adjusted accordingly. The significant socio-economic characteristics of health care that influence the behavior of health system stakeholders are taken into account. The models of health care financing are discussed and the significant characteristics of health care are described. Then the Czech health system of multiple public health insurance companies is analyzed with special focus on "state insured persons" social group. The article brings an overview of the fiscal aspects of current health systems and discusses possible configurations in this area.*

Keywords: *Health insurance, Health expenditure, Fiscal policy, Health care.*

JEL Classification: *I13, I18, H51.*

Introduction

Health care systems became in the 20th century the significant part of public budgets, in developed countries utilizing approximately 6 – 9 % of GDP for public expenditure on health (and additional private resources, too). This is connected with the character of health care as a mixed good, whose majority of consumption is universal by decision of public choice and thus the techniques of public financing are used in this area [15]. In this sense, new segment of public finance emerged with certain level of autonomy on the expenditure side and this has its consequences in behavior of fiscal policy.

Sometimes, we see fiscal approaches that treat health care equally to the other significant public sectors like army, police, justice, education etc. While this corresponds to the general theory of public finance and fiscal policy, because theoretically there is no or little reason to give "preference" to health care before other (also important) sectors, we can also discuss the characteristics of health care and its position in national economy and seek for approaches that justify some special treatment [14].

The last economic crisis caught Czech health system in difficult situation, since it diminished reserves of health insurance companies that have been accumulated before its onset. Moreover, the fluctuating "W" trend of GDP made the sustainable financing of health system difficult. For health economics and health policy, however, this process brought an interesting research material.

In this sense, this article aims to cover important aspects of health care's fiscal dimension, which have been triggered by the recent socioeconomic development. To achieve this it is strongly rooted in knowledge of health economics and recent experiences from health policy in the Czech Republic.

To clarify these issues, the following research questions are highly relevant:

- What are the principal theoretical schemes of health systems and characteristics of health care financing?
- Which macroeconomic trends do we observe recently in health systems and what fiscal consequences does it have?
- How does the Czech system of multiple health insurance companies perform according to theoretical and empirical aspects of health care financing?
- What is the significance of state insured persons social group in the Czech public health insurance system and which measures are taken in this area?

Scientific methods used to write this article include macroeconomic analysis of health expenditure, public policy evaluation of health resources' settings in the Czech Republic and synthesis of observed trends from the health policy point of view.

1 The socio-economic characteristics of health care

Many times the importance of health care system has been assessed and defined [16], [22]. There is no doubt about its specific characteristics [1], however to discuss its position in macroeconomic context, it is useful to stress out particular aspects that seem to be crucial for its assessment. Health care expenditure is counter-cyclical by nature, because the volume of health care consumption does not depend of economic cycle and can even increase in economic downturns because of the socioeconomic problems that increase in those times.

The demand for health care is highly inelastic and is driven by determinants of health, thus the incomes of population not being a dominant factor. The volume of health expenditure is largely proportional to the volume of health care demanded, e.g. the variable costs are significant share of health budget [10].

In guaranteed health care systems [21], the government takes over a responsibility for the availability and accessibility of health care to the population. If this is not achieved, the guaranteed universally available health care becomes merely "written on the paper", causing vast problems in accessibility and rapidly decreasing the responsiveness of health system to the health issues of the citizen.

Since people are born with "full stock of health" (not considering inborn defects) and then the determinants of health imply how this stock of health is managed, the possible failures of health policy and/or financing usually emerge in longer perspective. In this sense if we miss the health care goals and the health status of the people decreases, within a given population this cannot be in many cases "repaired" later. The population health status is overall crucial for the economic performance and the social well-being of the people.

Social dimension and addressing of health inequality is important, it is actually one of the achievements of developed countries. We cannot put those goals aside for fiscal reasons because it directly undermines the health status, quality of living and social harmony, which we consider as key aspects of dignified life. In this sense, the sustainability, predictability and accountability of health expenditure on health care is important [7]. Since we deal with social and human capital, the only similarly important sector of national economy is education.

2 The fiscal schemes of health financing

Generally, several possibilities how to allocate resources for universal health care exist in theory. First, we can treat health care system equally to police, army, justice and other "traditional" public finance areas financed from general taxation. In this approach, the health system is one of the important economic sectors and the level of health care expenditure is determined centrally by public choice and fiscal priorities. Hence, the position, power and governance quality [6] of the Ministry of Health is crucial, because the fiscal process is mainly determined by the government legislation procedures and respected negotiations. The risks of this approach include poor public governance practices and health budget being under threat, especially at times when the whole government budget is tight.

Second, we can establish one or more independent health insurance companies, which operate on social health insurance principle – solidarity according to health status and usually wealth (income). This creates a parafiscal payment, which becomes an income of those health insurance companies (company). They then have their own balance and budget, usually supervised by the public policy. When there are more insurance companies, the question of risk selection and the issue of character of competition between them appears [2]. This method is usually based on allocating a share of personal (work) income to health care, either as social health insurance contribution, payroll tax or earmarked health tax [4].

Third, we can do a strict regulation (especially regarding risk classification targeting community ratings) of commercial subjects selling private health insurance on the market and provide a government subsidy for the citizens so that everyone can afford that product, at least on the universal (standard) level. This approach emerged from the private health insurance markets and their failures, when the public choice decided to keep its principles as viable, and simultaneously wanted to achieve also goals that social health systems achieved. Still the questions about effectiveness of those (usually large) subsidies appear, and in some countries, the government enters the market by creating large programs for the poorer or sicker social groups (USA: Medicare, Medicaid).

Those are model approaches; in many countries, they slightly overlap or a big main system of one character is created, simultaneously a small "side" system is run on different principle – e.g. the case of Germany and social (90 % of people) and private (10 % of people) health insurance there. The reasons for this approach are different characteristics and performance of the means of financing in the social groups' spectrum. If well organized, it does not have to possess a significant threat as every citizen can choose the subsystem, which he will participate in, however from the theoretical point of view some systems look like a mess. To overcome this, we can usually identify the main or dominant health care financing approach for that country and then the supplemental ones used [3], [5].

From the fiscal policy point of view, those possibilities imply the following budget schemes:

1) A government expenditure program for health care – allocation within a health budget as a part of central public finance schemes. When allocating resources on the central level, supported by respected legislation determining the price level and amount of health care provided, the health sector is financed at the "pure" principles of public sector financing and allocation. In this scheme, the majority of health expenditure can be seen as more discrete, because the government can decide about them individually

and annually, although it does not have direct control of some variables that influence their need (e.g. drug prices etc.)

2) An independent institutional framework for financing health care, where the public choice and central government role is limited and the principal fiscal goal is to collect and allocate the agreed amount of money to specialized institutions (health insurance companies). In this scheme, the public finance flows can be seen as more mandatory, since they automatically allocate for health the public resources defined by law [13].
3) A subsidy scheme, when the people receive support based on their social status so that they are able to buy a highly regulated health insurance product commercially. In this scheme the income differentiation and level of regulation is important for the government position and fiscal volume of health expenditure.

It is worth noting, that selection of those schemes is a result of the health financing system selection and configuration, fiscal policy alone cannot select a particular scheme on its own.

3 Health expenditure in the international and macroeconomic context

Purely theoretically, the public health financing should provide stable resource of financing relatively to GDP, as when we take a share of wages (personal income) and allocate it for health care, it should fluctuate with GDP proportionally and thus copying the economic cycle, in the same way as general taxation works macro economically. The problem is, among others, that the health care sector does not shrink and expand with the economy as a whole symmetrically, e.g. as the sectors of information technology or civil engineering. Therefore, the expenditure, which has to be paid, is not mainly the exact function of the actual resources available or even consumers' demand, but rather the function of health care determinants (life style, environment, health care itself, and genetics) and their management in the economy [5]. The problem of health care needs is also important, as demand for some types of treatment and some drugs is highly inelastic, causing the necessity to pay for and provide health care without strict relation to resources available [10]. As an extreme example we can show an epidemics of infectious disease, which would have to be managed on the national level. Moreover, health care sector is a significant employer and its employees, even if they usually exhibit higher degree of loyalty that in other sectors, also demand their wages to be paid and valorized as they see the macroeconomic development in sense of the labour market theories, including the stiffness of wages aspects.

This does not mean, however, that health care does not have to respect economic laws and budget limitations; rather it means just that sometimes the care is provided and the whole sector works while creating deficits or imbalances that are publicly perceived as inefficiencies. First part of those inefficiencies is caused at the microeconomic level by inadequate management, and the second part is determined at the macroeconomic level by inadequate schemes of financing in relation to the economic development. For example, in the first part the hospitals could be indebted, in the second part the public health care coverage could be diminished or not innovated, leaving those who can pay out-of-pocket to buy the care they need and those who cannot being under-treated.

As for the relationships of health care expenditure at the macroeconomic level, the following data are appropriate for consideration. Behind them is the fact, that the relative

health care expenditure to GDP[8] is driven by two factors: actual trend of health policy decisions and needs with results in absolute health expenditure, and the development of GDP caused by general trends, which provides resources for health care system. For example, during the economic crisis (2008-2011) the relative health expenditure in majority of OECD countries fluctuated, but the main factor was not only the health expenditure itself, but also the changes in overall performance measured by GDP.

Tab. 1: Share of health care expenditure on GDP, OECD, 2003-2013, %

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Index 13/03
Czech Republic	6,6	6,4	6,4	6,2	6	6,4	7,3	6,9	7	7,1	7,1	1,076
Germany	10,3	10,1	10,3	10,1	10	10,2	11,1	11	10,7	10,8	11	1,068
Slovak Republic	5,4	6,5	6,6	6,9	7,2	7,5	8,5	7,8	7,5	7,7	7,6	1,407
Sweden	8,5	8,3	8,3	8,2	8,1	8,3	8,9	8,5	10,6	10,8	11	1,294
Switzerland	10,4	10,4	10,3	9,8	9,6	9,8	10,4	10,5	10,6	11	11,1	1,067
United Kingdom	7,1	7,3	7,4	7,6	7,6	7,9	8,8	8,6	8,5	8,5	8,5	1,197
United States	14,5	14,6	14,6	14,7	14,9	15,3	16,4	16,4	16,4	16,4	16,4	1,131

Source:[13], index own calculations (2013/2003)

Available data [13] shows that (with the exception of five countries) the index of share of total health expenditure on GDP has risen in the majority of OECD countries during the selected period. However, we can also see that in some countries, this trend has slowed down in recent years and since 2010, many countries experienced stagnation or slight decline in relative health care expenditure. This is consequent with the hypothesis, that the observed values are not result of the health policy and the changes in health expenditure alone, but when we measure health care expenditure relatively to GDP they are also determined by the overall economic development – see also [8]. This is supported by the next table, which shows the trends of real health expenditure per capita.

Tab. 2: Health care expenditure per capita, constant prices, constant USD PPPs, OECD base year, 2003-2013

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Index 13/03
Czech Republic	1314	1341	1425	1474	1503	1618	1756	1701	1744	1743	1740	1,324
Germany	3260	3226	3298	3375	3440	3552	3684	3795	3825	3929	3993	1,225
Slovak Republic	805	1007	1094	1234	1432	1566	1677	1625	1587	1657	1657	2,057
Sweden	2729	2768	2840	2915	2960	3007	3041	3033	3846	3899	3978	1,458
Switzerland	3891	3986	4015	3969	4024	4126	4235	4345	4437	4595	4683	1,203
Un. Kingdom	2361	2467	2569	2672	2743	2811	2956	2918	2915	2922	2939	1,245
United States	6098	6304	6460	6619	6773	6885	7075	7211	7281	7395	7510	1,231

Source: [13], index own calculation (2013/2003)

Here we can see vast differences for some countries, e.g. Slovakia (2,057 vs 1,407 in Table 1). Also we can see e.g. in Sweden, that the per capita expenditure has been very similar in 2008-2010 (3007;3041;3033 USD PPP), but the relative expenditure fluctuated (8,3;8,9;8,5 %).

Those findings suggest that the macroeconomic imbalances in relation to health care expenditure are significant enough to be included in health policy considerations and thoughts. Actually empirically, we can see that the countries already employ mechanisms that help to compensate them.

[8] As consulted with the Institute of Health Information and Statistics of the Czech Republic, the slight differences between national and international statistics are caused primarily by the revisions of GDP performed recently at the level of European Union. To have international comparison consistent the latest data (11/2015) from OECD are used. Because of the limited extent of the article, data for the other OECD countries are available at the weblink in references.

To name the significant examples: in the United States, the health insurance companies set their premium based on (highly regulated) insurance policies and thus do not take into account the wages (incomes) of the people directly. The clients either accept the offer or decline it, in the past they could remain even uninsured, now they are required to buy a plan under "Obamacare" health reform. In Germany, the rate of social health insurance was in the past changing regularly and was even different between branches of economy on the principle of (true) social insurance, allowing to get required resources as a share of wages paid to the employees. Now we see the trend of decreasing the number of social health insurance companies there and unifying the social health insurance rate, even if the possibility to change it remains. In the Great Britain, where the health care is paid from the government budget, the amount allocated into health care is a (largely) direct decision of public choice in each year among other budget priorities.

This means that the health care systems take different approach to manage the imbalances in the health care expenditure and needs in relationship to the resources available and health care needed: either they simply charge and spread the price (costs) of health care through highly regulated insurance mechanisms among the insureds, changing the proportion of the health expenditures on a personal income directly (if individual budget constraint allows). Or they change the rate of social health insurance, changing the overall share of indirect health labor costs. Alternatively, they change simply the amount of public expenditure flowing to health care from public budgets. If those mechanisms fail, the system exhibits deficits and/or does not provide adequate health care to citizens. The deficits can actually act as a "buffer" for the discrepancy between health system incomes and expenditure; theoretically, they can emerge also in the form of surpluses (reserves) in the times of economic growth when the incomes become usually higher. In addition, this buffer could be realized at the level of (social) health insurance company (companies), or it can be a part of central government budget balance.

4 Discussion of Czech health insurance macroeconomic aspects

Following the theoretical outline, we can now analyze important characteristics of the Czech health insurance system. As for the basic macroeconomic indicators, the values for last 5 years are the following.

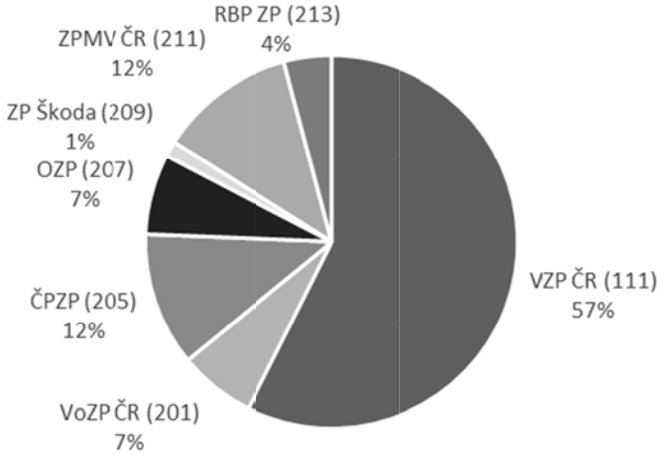
Tab. 3: Total expenditure on health care 2010–2014 (mil. CZK)

Expenditure items	2010	2011	2012	2013	2014 [1)]
Public expenditure	243 281	242 410	246 918	246 562	254 699
In: Direct expenditure from government budget	20 781	16 863	15 648	16 657	15 671
In: Health insurance companies	222 500	225 547	231 270	229 905	239 028
Private expenditure	45 754	45 358	46 388	44 381	45 224
Total expenditure	289 035	287 768	293 306	290 943	299 923

Source:[18], [1]) preliminary data

In the Czech Republic, kind of hybrid health system is running, and this has consequences in the measures taken. This hybrid character is rooted in the income structure of health insurance companies, their count and position and by different groups of the insured, although the coverage is universal by law.

Fig. 1: Shares of insured citizens in health insurance companies, 2014



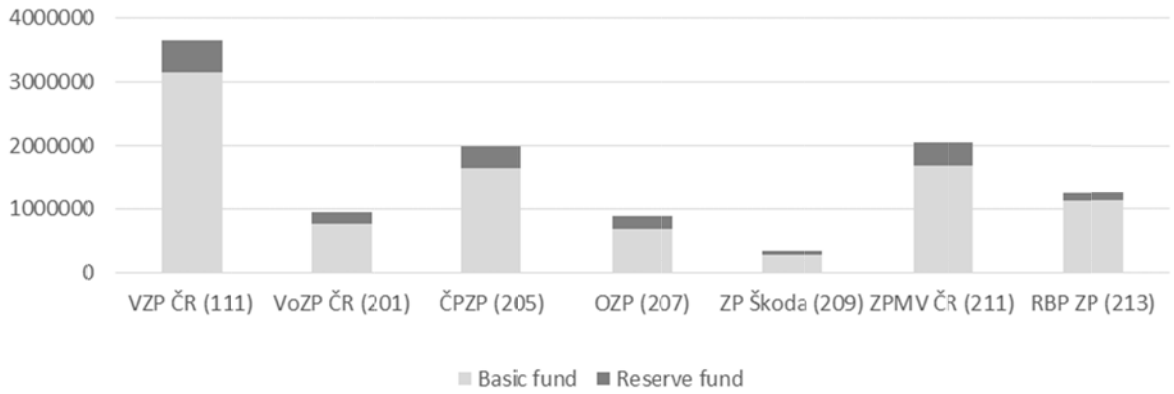
The names of insurance companies are original; their unique identification number is in parentheses.

Source: [12]

Figure 1 above shows that the insurance company VZP (111) retains dominant position on the market, all other companies having much smaller share of the insured. From micro economical perspective, this can be classified as an oligopoly with dominant firm. Behind this is also the issue on so-called state insured persons, which do not have taxable income and are not supposed to work (e.g. pensioners, students, unemployed, parents caring for children). Even if they can now choose a health insurance company freely, they originally were placed to VZP (111) by default and the incentives to change insurance company are rather limited and not price-based. Thus still, this company has largest share of state insured. By the way, this has significant solidarity implications, as there is a very high degree of solidarity within VZP's insured. Whereas the employees have paid, in 2014, 61 billion CZK annually and consumed 18,3 billion CZK, the state insured persons have in the same year paid just 26 billion CZK and consumed 94 billion CZK [11].

Next figure 2 shows the real balances on the basic and reserve fund of health insurance – e.g. "reserves" of the public health insurance system. We can notice, that some smaller companies have the reserves half as high as VZP (111), which has the largest number of insured, 5-6 times more than e.g. ZPMV (211).

Fig. 2: Balances on basic and reserve health insurance fund, 09/2015, K CZK



Source: [12]

Theoretically we can even sum up those balances and say that the system has "total" reserve at about 11,2 billion CZK, but since the companies operate independently of each

other, this is a purely theoretical calculation, and can be modified further through (annually returnable) government pre-payment, which was about 4,8 billion CZK in 2014. Moreover, the balance of health insurance companies is not determined solely by their operation (payments to health providers), by also by the government decision how to finance them and set the insurance redistribution scheme. This is necessary, because health costs now highly differ between the insured, and thus the issue of "cream-skimming" has to be avoided. These aspects mean that analyzing the performance of health insurance companies has several important factors to consider and they represent to some degree independent institutional framework for health financing.

Simultaneously, fiscal policy determines the overall balance of the health insurance companies significantly through the following measures.

- The health insurance rate, which is fixed at 13,5 % by law and was not changed since its introduction.
- The health insurance base and respective payment for so-called "state insured persons", changed arbitrarily (more on this later).
- Government pre-payments to health insurance (§ 12, Act No. 89/2012 Coll.) and subsidies to the health system or to big health providers (e.g. public health projects, hospitals).
- Changes in general taxation influencing health system (e.g. value added tax).

In this article, we can discuss in more detail the payment for so-called state insured persons. When the system of multiple health insurance companies (agents) was introduced in the Czech Republic at the beginning of the 1990's, among other elements this new category (social group) of the insured was introduced. The logic behind this was then to establish a system where every citizen must have a health insurance and has the right to choose health insurance company and for those who do not have disposable income will the government pay to the company chosen. Then it was assumed, that the insurance companies will be primarily employer based and the health expenditure did not so much differ between age and disease groups as it currently does.

Up to now, the category of state insured persons has vastly expanded and currently to this category belongs more than half of the citizens, with the total amount paid 59,9 billion CZK in year 2014 [9]. The following table shows its development in recent decade. Now no automatic changes take place so it depends on the public choice when and how much it is changed.

Tab. 4: Changes in amounts of stated insured persons, 2005-2016, CZK

Time	Base	Premium/amount
1.1.2005 - 31.12.2005	3 556	481
1.1.2006 - 31.01.2006	3 798	513
1.2.2006 - 31.03.2006	4 144	560
1.4.2006 - 31.12.2006	4 709	636
1.1.2007 - 31.12.2007	5 035	680
1.1.2008 - 31.12.2009	5 013	677
1.1.2010 - 31.10.2013	5 355	723
1.11.2013 - 30.06.2014	5 829	787
1.7.2014 - 31.12.2015	6 259	845
Since 1.1.2016	**6 444**	**870**

Source: [20]

Considering the structure of insureds and their burden, the indirect labour costs, including health insurance ones, are especially in the case of employees perceived as being high enough to stop any ceteris paribus changes (especially increases) of the current rate 13,5 %. In addition, the discrepancy between average amount of employee and state insured person is frequently stated and thus, when the overall balance of the system is challenged, there is an expressed demand for changing the amount paid for state insured persons [17]. Thus it can in the described environment act as a certain stabilizer of the health system overall balance. Generally said: although it is a theoretically controversial concept, the public policy and the stakeholders currently do not seem to have an intention to abandon it, actually the opposite is true and we can discuss the possible variants further.

The first aspect is how to set the base for the stated insured persons so that it is not dependent on public choice in the sense that if the public policy forgets about it, it is not changed and with the ongoing macroeconomic development is gets out-of-date; e.g. suggest some methods of its update (valorization). In this sense, the following possibilities exist [23]:

1. Make relationship to general average income base (used also for pensions valorization), or simply to the average wage in the national economy.
2. Administratively valorize the base regularly, e.g. by 5 % annually (percentage estimated from the average of growth of payments at other insured persons).
3. Unify the base with the base for persons without taxable incomes, which is currently the minimum wage.

Fiscally the third possibility is the most extensive, according to calculations done by the Ministry of Health [11] it would increase the resources by 30 billion CZK, in addition minimum wage is now set by discrete economic policy which compromises the rationality of related values. The second one, costing about 3 billion CZK is rather theoretical as it does not relate directly to the macroeconomic reality and thus is probably even more prone to being inadequate in time than the current scheme. The first one (currently being preferred at the stage of proposal) has fiscal dimension around 5 billion CZK in the first year and when utilizing similar schemes as pension valorization, the average values used for calculation cover longer term, which is macro economically favorable.

Within this first aspect, primarily the issue of changing the government expenditure for health care is resolved, in the conditions when we do not want to change the payments

of other social groups. In addition, as we have discussed the second aspect exists and this is the reaction to the economic cycle, which causes lowering absolute incomes of health insurance funds through macroeconomic channel as a whole.

This second aspects leads to the discussion about the anti-cyclical measures in health insurance. It is clear, macro economically, that with rising unemployment the number of state insured persons will also rise. Thus, the health insurance budget will lose its payment and in addition, the government will have to pay its amount for such a person. Actually it is theoretically interesting, that from the pure fiscal principle the decrease of public revenue from health insurance, similarly to the decrease from tax income, could be seen as an automatic macroeconomic stabilizer, however, in the current environment it causes deficits in health insurance budgets and creates additional expenditure pressure for the government budget. Therefore, the guardian of health budgets, or so called stewardship maker [21] Ministry of Health, to protect the interest of the health budget, discusses currently the introduction of weighted state insured person coefficient.

This coefficient measures the deviation of the actual number of state insureds from the average number of them during a selected period (seven years – approximately one economic cycle). It is computed as a linear share of the actual number of the state insureds to the average; when this number is equal to the average the coefficient is 1.

To simplify actual calculations and prevent constant changes its "resolution" is in current proposals set for every 2000 persons by 0,001, this number can be adjusted to the sensitivity desired. By this coefficient will be reduced/increased the total amount of money paid for the state insured persons, calculated with one of the valorization mechanisms described above. One of the discussed variants works with creating an lower and upper limit (0,95-1,05) for this coefficient to limit the extent of consequences for the government budget during large or sudden fluctuations of employment. This limits automatic fiscal dimension of the proposed anti-cyclical measure at the sudden big fluctuations of unemployment, which could be fiscally unsustainable.

Conclusion

While gaining fiscal importance and gradually moving from perceived "consumption only" branch of economy to the human capital investment approach [19], the health care system retains its specific characteristics. While some of them are similar to other sectors that have significant share of their budget filled from public resources, the degree of autonomy, strong presence of market imperfections and huge significance for social and human capital formation are an indispensable property of health systems. Simultaneously, usual factors of market demand do not drive health expenditure directly, but rather complex spectrum of health determinants influences their volume and trends.

In addition, the situation is complicated by inevitable existence of specific health system models, and the current analyses show clearly that it does not make much sense to try finding the "best" or "most efficient" one. Although it is important to analyze their effectiveness (and say what we mean by this term, too), the mix of resources collection and allocation differs from country to country and the theoretical models serve more like the schemes from which the actual practice is derived and combined.

Macro economically, the health expenditure is anti-cyclically based and keeps its volume and trend mainly based on health determinants' development. That is why the health budget and resources must be adjusted to those real needs and the macroeconomic fluctuations.

We identified three different basic approaches to the general fiscal position of the government. A government expenditure program (budget) for health care based on general taxation, an independent institutional framework for financing universally available health care based on social insurance or earmarked taxation and a subsidy scheme in highly regulated competition of health insurance companies, when the people receive support based on their social status.

Considering the position of central government, the degree of autonomy of other subjects (stakeholders) is important. This also influences where the government position is seen as more discretionary or more mandatory (automatic) in the relation to the health system. This is important for practice, because although the government with more mandatory position to the health financing can "simply engage the Parliament more frequently", changes of those mandatory budget agencies usually are more difficult to achieve [14].

A system of multiple health insurance companies has been running in the Czech Republic since 1990s. We can see it is a "practical compromise" between the theoretical models of health care organization and financing, struggling to fit them and therefore showing low adherence to pure public finance principles in some areas and often discrete fiscal adjustments. It also needs well risk-adjusted central redistribution of insurance payments and utilizes big fiscal subsidy for people who are not supposed to work (state insured persons).

This payment for state insured persons is theoretically debatable and could be minimized or replaced by the mechanisms of general taxation. However, there is little interest in Czech public policy to do it, and since the other parameters like health insurance rate remain fixed, this payment actually became one of the tools for optimizing the public health expenditure.

This is supported by recent public discourse about the methods of this amount determination that we discussed. They include its linking to the standard valorization procedure used for public pensions and introducing anti-cyclical measure which is sensitive to the number of state insured citizens and thus indirectly to the employment rate. Their acceptance and implementation depends on public choice, but technically, they strive for better automatic determination of the government payments fairly well.

For the future research and policymaking, the question of which health resources' allocation scheme will be the primary one in the Czech health system remains. This will determine also the fiscal schemes that are used. However, any such schemes will have to adjust to and deal with the macro economic development and actual characteristics and importance of health care, so the challenges for fiscal policy will, probably, stay very similar further.

Acknowledgement

The paper has been prepared within the project "Current trends in development of financial markets", supported by the Institutional support for long-term strategic development of University of Finance and Administration in 2016.

References

[1] ARROW, K. J. Uncertainty and the Welfare Economics of Medical Care. *American Economic Review.* 1963, Vol. 53, 5, pp. 941-973.

[2] CHONÉ, P., GRIGNON, M., MAHIEU, R. *Quelles fonctions économiques pour des opérateurs de soins dans le système de santé français?* 2001, Revue française d'économie, Vol. 16, 1, pp. 169-214.

[3] CULYER, A.J., MAYNARD, A**.** *Being reasonable about the economics of health.* Cheltenham : Edward Edgar Publishing, 1997.

[4] DOETINCHEM, O. Hypothecation of tax revenue for health. 2010. [Cited: 21.3. 2016] Available from WWW: <http://www.who.int/healthsystems/topics/financing/ healthreport/51Hypothecation.pdf>.

[5] DURDISOVÁ, J., MERTL, J. Evoluce sociálně-ekonomického pojetí zdravotní péče. *Ekonomický časopis.* 2013, Vol. 61, 2, pp. 155-171.

[6] EUROPEAN COMMISSION. *European Governance: A white paper.* Brussels, 2001.

[7] EUROPEAN COMMISSION. *Investing in Health.* Brussels, 2013. [Cited: 21.3. 2016] Available from WWW: <http://ec.europa.eu/health/strategy/docs/swd_investing _in_health.pdf>

[8] GERDTHAM, U., JONSSON, B. International comparisons of health expenditure: Theory, data and econometric analysis. In *Handbook of Health Economics*, vol. 1, 2000, pp 11-53

[9] MF ČR**.** Tisková zpráva. Čerpání výdajů státního rozpočtu 2014. 2015. [Cited: 1.4.2016] Available from WWW: <http://www.mfcr.cz/cs/aktualne/tiskove -zpravy/2015/pokladni-plneni-statniho-rozpoctu-cr-20131.>

[10] MOONEY, G. *Economics, Medicine and Health Care. Second edition.* Essex : Prentice Hall, 1992.

[11] MZ ČR. Návrh zákona, kterým se mění zákon č. 592/1992 Sb., o pojistném na veřejné zdravotní pojištění, ve znění pozdějších předpisů. Verze do připomínkového řízení. *OdOK - materiály v připomínkovém řízení.* 2016. [Cited: 8.2.2016] Available from WWW: <https://apps.odok.cz/kpl-detail?pid=KORNA6LHS2PA.>

[12] MZ ČR. Zůstatky na fondech zdravotních pojišťoven. *MZ ČR.* 2015. [Cited: 21.3.2016] Available from WWW: <http://www.mzcr.cz/obsah/zustatky-na-fondech-zdravotnich -pojistoven_2952_1.html.>

[13] OECD HEALTH DATA. OECD ILibrary : OECD, 2015. [Cited: 21.3.2016] Available from WWW: <http://www.oecd.org/health/health-systems/OECD-Health-Statistics -2015-Frequently-Requested-Data.xls>

[14] OECD. *Fiscal Sustainability of Health Systems: Bridging Health and Finance Perspectives.* Paris : OECD, 2015.

[15] ROSEN, H.S., GAYER, T. *Public Finance.* New York : McGraw-Hill Education, 2014.

[16] SUHRCKE, M., et al. *The contribution of health to the economy in the European Union.* Brussels : European Communities, 2005.

[17] TEMPUS MEDICORUM. *Valorizace platby za státní pojištěnce: finance versus zdravotnictví.* 2015, 5, pp. 3-8.

[18] ÚZIS. Výdaje na zdravotnictví 2010-2014. 2015. [Cited: 21.3.2016] Available from WWW: <http://www.uzis.cz/rychle-informace/vydaje-na-zdravotnictvi-2010-2014>.

[19] VALENČÍK, R., et al. *Perspektivy a financování odvětví produktivních služeb.* Praha: VŠFS EUPRESS, 2014.

[20] VZP. Vyměřovací základ státu. 2016. [Cited: 1.2.2016] Available from WWW: <https://www.vzp.cz/platci/informace/povinnosti-platcu-metodika/stat/vymerovaci-zaklad-stat.>

[21] WHO. *World health report 2000.* Geneve : WHO, 2000.

[22] ŽÁČEK, A. *Metody studia zdraví a nemoci v populaci.* Praha : Avicenum, 1984.

[23] ZDRAVOTNICKÝ DENÍK. Ministerstvo navrhuje pro valorizaci plateb za státní pojištěnce zlatou střední cestu. *Zdravotnický deník.* 2016. [Cited: 1. 2. 2016] Available from WWW: <http://www.zdravotnickydenik.cz/2016/01/ministerstvo-navrhuje-pro-valorizaci-plateb-za-statni-pojistence-zlatou-stredni-cestu/>

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Received: 20. 04. 2016
Reviewed: 21. 06. 2016, 28. 06. 2016
Approved for publication: 08. 09. 2016

SCENARIOS METHOD INSTRUMENTATION MODELING

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Abstract*: Rapidly changing market conditions are strongly influenced by organizations development mechanism which are caused by economic, technological, social permanent changes. There is a need to investigate the strategic decision-making efficiency which determines the ability of organizations to adapt to different business situations formed by uncertain environmental changes. Flexible strategic business decisions is a prerequisite for the organizations that are seeking to successful operations and to remain competitive in the business market. Anticipation of different scenarios of the future events enables prompt provision of its adaptation to different situations in the future and at the same time it allows to prepare for possible changes in advance. Scenario method as potential future events synthesis sequence identification enables more a more flexible organization functioning and more mobile human resources management of the organization's management process. The article analyzes the scenario method conception and characterization, performed scenario method advantages and disadvantages analysis as well the scenario method is analysed as a research tool. The article ends with scenario method instrumentation modelation and its development process in stages.*

Keywords: *Scenario method, Research instrument, Strategic decisions, The importance of scenario method, Scenario method modeling.*

JEL Classification: *C18.*

Introduction

The relevance and the main issues of the research

Every entity in order to provide an image of the future and adapt to function in it has flexible response and operate in social, economic changes effected environment. It also becomes an important to be able to direct their activities in the direction that ensure the organization's social, economic well-being effect. For this reason the organization must take into complex view for many factors such as technological changes, economic internationalization internationality impact on the internal and external environment, demographic trends, public and social development prospects and so on. An integral part of the successful of the organization is its ability to identify the sequence of events dependence with each other and to provide strategic action to analyze and solve them. All this organization brings to the uncertainty and methods for its successful operation planning and development becomes important and controversial issue.

In order to influence the development of successful organizational development scenario it is important effectively to identify of socio-economic trends and contributes to the formation of strategic decisions and tools for potential operational deviations removed. Scenario method describes the changing state of the environment and makes easier to identify strategic solutions that help to choose the right direction. The scientific literature defines different but at the same time matching scenario method definitions interpretations: as strategic decision prediction method; as a tool to help assess the organization's strategic decisions and their suitability for different situations; as a situation model of defining the

possible future consequences and their variations and so on. The authors agree that the scenario development method is a planning instrument which helps to reduce uncertainty and to increase the appropriate decisions. In this way the organization in order to successful operations has to adapt and use scenario method that effects and changes existing strategic decisions taken by perceiving the possible future strategic decisions. Scenario method in the scientific literature emphasizes how different elements and processes of fusion phenomenon that allows a possible future image where the organization will function. The scenario method practical application and its significance enables more discussions about a more flexible organization's strategic decision making and thus also attract the attention of this method alternative ingredients projections variations.

The research subject – scenario method instrumentation.

The research aim – to perform scenario method as potential research instrument analysis.

The research objectives:

1. To perform scenario method theoretical interpretations review and analysis.
2. To perform scenario method advantages and disadvantages analysis.
3. To prepare the scenario method as a research instrument modeling.

The research method. The research process is planned to organize by formulated three objectives. The research methods: scientific literature review and analysis, comparison, quantitative and qualitative data analysis, interpretation, comparative analysis, generalization.

1 Scenario method theoretical analysis interpretations

P. Schwartz [18] scenario method perceive as an alternative tool for the future environment which leads the decisions taken by the present. Author equate this method as descriptive narration. What is more, the scenario method as a tool can be used for strategic decision-making process which helps to reduce the uncertainty in which the organization operates [22]. The author also agrees with other scientists who examined the scenario method practical application. The scenario method involve constantly changing future environment which can be predetermined and expected in advance [18]. Other authors scenario method describes as a consistent imagine of the future projections which are formed by the logical assumptions [10], [18]. The scenario method describes as consistent events layout for a specific period of stage which allows the identification of existing and desired situations [2], [5]. J. Ratcliffe [14] scenario characteristics identified by two this method development forms:

1. The future ahead. This scenario method form provides an analysis of the current situation in which are formed a number of future scenario factors.
2. The future back. This scenario method form provides the desired imagine of the future situation which the organization take various measures to achieve it.

Authors who analyzes scenario method finds that scenario method help to identify different circumstances in which organization operate in the future [2], [8], [17]. Also they agree that scenario method adaptation in strategic decision process reduces the organization in which it operates environmental and strategic decision uncertainty [7], [13]. Schwab P. [17] scenario method describes as logically consistent process of evaluation hypothesis.

Scenario method helps to shape the organization's future performance projections which it can prepare in advance[23], [1], [11], [9]. Also the authors agree that this method of practical application allows the organization better to understand the environment in which it operates as a possible future consequences of present strategic decision [20]. Scenario typology divides into four dimensions:

1. „Status qua“ - the current situation transfer to the future;
2. „Collapse“ - when the system will no longer be able to maintain steady growth that causes fragmentation.
3. „Steady status“ - the moment when it is noted that the future situation repeated in the past.
4. „Transformation“ - different factors conditioned the situation changes [6].

Scenario method as possible future events stories that can be predict and seek feedback [19]. The author argues that the scenarios creating participants are experts who shape the scenarios by recourse to the available quantitative information. It can be argued that the scenario method approach to the organization's strategic decisions as a methodological tool can help to display organization's future. What is more, the scenario method is as thoughts, thinking visual experiment of organization position in the future which helps to identify future projections formed and influenced by the present decision taken by the organization [14]. P. R. Walsh [23] asserts that scenario method as a tool helps to assess the organization adopted strategic decisions and shape the opportunities to check the effectiveness and efficiency of that strategy. The scenario method can be decribed as a model of situation in other words the position of organization as a whole description [12], [20]. By T. Karp [8] opinion the scenario method technique helps to provide a simplified flow of information about the organization and operation of the unidentified environment. The author agrees that scenarios contributes to the organization's environmental future model.

To sum up, the scenario method application possibilities is broad and this method can be used in different fields of organizational management which is faced with uncertainty. Method application flexibility enables to identify different factors combinations that influence organization environment.

2 Scenario method advantages and disadvantages analysis

Analysing the scenario method concept and characteristics L. Fahey [5] identifies four main elements that describes scenario method structure: it is the period; the organization's goals; impact factors; action plan and layout of the situation; a story. Meanwhile, J. Ratcliffe [14] at scenario method process notes that:

First – the scenarios arrangement must be based on the organization's goals, decisions and planning.

Second – the scenarios arrangement must be based on logic and strategic decisions mutual compability.

Thirdly - the scenarios development process needs to be flexible to different organizations influencing situations.

Fourth – final scenarios must stand out of their unique individuality [15].

The author also notes that the scenario development participants has to be creative people and the experts in their fields resulting for high and qualitative results. Two scenario

types according their formation of style:

- According to intuitive style formed scenarios are based on the story, creative thinking and are based on informal methodology.
- According to analytical style formed scenarios are based on expert judgment and trends of cross-impact analysis [21].

However, many scientists agree that scenario building on the intuitive and analytical style or by other named mixed style is unique and characterized by an exceptional role model effect on the organization. It is also important to identify the scenario method advantages and disadvantages. Research authors scenario method advantages are presented in Tab. 1.

Tab. 1: The variety of interpretations of scenario method advantages

AUTHOR	INTERPRETATION
H. R. Hamilton [4]	– Scenario method provides several different factors development options; – scenario method makes it easier to identify undesirable future situations in which the organization must be avoided; – scenario method application in organization activity planning, strategic decision-making promotes better organization preparation and operation on constantly changing environmental conditions; – scenario method increases the members of the organization involvement into strategic decision-making process that promotes a stronger mutual communication and forms organizational value system.
D. Mietzner [10]	– At scenario development stage most of the members of the organization are involved who together increase organization strategic decision-making process; – scenario methodology flexibility enables integrated variety of solutions; – scenario method is characterized by flexibility and adaptation to constantly changing environment conditions.
A. Molis [12]	– Scenario creation helps to release complex alternatives that effects in real situations; – scenario method added value is focused on the strategic planning and strategic decision-making process which enables a more flexible strategic planning mechanism; – scenario method increases the effectiveness of strategic decisions and facilitates future events trends investigation; – scenario method reveals the individual environmental factors union and influence to the organization at constantly changing environmental conditions.

Source: Author.

To sum up, the scenario method advantages interpretations diversity revealed a common symptom which showed that the scenario method practical application in the strategic decision-making process allows to identify the potential future events and predict their development. Research authors scenario method disadvantages are presented in Tab. 2.

Tab. 2: The variety of interpretations of scenario method disadvantages

AUTHOR	INTERPRETATION
P. Goodwin, G. Wright [3]	– At scenario method decision-making stage it requires highly skilled members engagement and specific knowledge of certain data; – scenario method requires large time-consuming; – scenario method gives a large amount of information which requires his deep-processing and detail; – the organization that apply scenario method in their activities must be a learning organization and promote managerial thinking.
A. Barbanente, A. Khakee [1]	– The scenario usability are focus on the long term organization activities perspectives while the near-future plans for evaluation can not be elaborated; – practical scenario method application forms different business models in different situations in the future perspectives; – scenario method consistency teaching is based on the story what credibility can be regarded as sufficiently reasoned what could impair the quality of strategic decision-making.

Source: Author.

According to scenario method advantages and disadvantages interpretation analysis results show that the method use in organization activities is based on two directions: 1st direction based on strategic decision-making and 2nd direction based on strategic decision evaluation and selection process. In both of these directions authors finds scenario advantages and disadvantages bus most of them agree that the scenario method prerequisite for the application remains unpredictable, constantly exposed to a changing environment. In this way the authors agree that scenario method application of the strategic decision shape a wide range of flexible and future-changing factors formed organization's image.

3 Scenario method as a research instrument modeling

Scenario method in scientific sources is treated as a long term business planning tool for long term planning process which helps to formulate the current period of complex events on the organization in the near future. In this way the scenario method use consequence becomes present decision-making that forms and impacts future events to preferred organization direction. Scenario method practical application can be categorized according to different levels:

- 1st level → global scenarios include long-term strategic investment decisions;
- 2nd level → industry scenarios include the organization's industry development trend of changes in the specific time;
- 3rd level → competitor scenarios allow to identify their strategic decision-making and beha actions;
- 4th level → technological scenarios include strategic decision important for the organization that operates continuously unidentified environment [5].

The scenario method elements interact with each other and contribute to business innovation solutions [16]. It also states that the purpose of creating scenarios is based on the most efficient preparation for each possibly scenario variations in the future. According

to the author the scenario development process starts with the key factors affecting the organization identification. Other authos distinguishes three scenarios development principles:

1. The long term approach. The organization must establish the long term goals.
2. External factors evaluation. Organization is important to identify the external factors importance for long term goals.
3. Multiple perspectives. The organization while prepares scenarios must be based on the expected performance assumptions [4].

The authors notes that the scenario method use of the organization helps it to form the expected future performance trends and discern possible future development directions of events. Tab. 3 provides different authors scenario method development process stages.

Tab. 3: Scenario method development stages

AUTHOR	SCENARIO METHOD STAGES OF CREATION
M. Godet [2]	1.It is built up a detailed current situation picture in which are highlights the forces acting on it. 2.Defined concrete analysis system. 3.According to structural analyzes are identified system determinants (internal and external). 4.Identify system influencing, controlling and managing people. 5.Forming the desired organization performance scenarios.
A. Paul Dragos [13]	1.All of the current situation assessment elements are combined into a consistent and comprehensive system. 2.Identified these factors change trends in the perspective of time and identified the links between them. 3.Formed potential future image that is based on past trends projections. 4.Development of various future scenarios combinations.
J. Ratcliffe [15]	The scenario method formation divides into categories: 1.Optimistic; 2.Pessimistic; 3.Compromise.
L. Fahey [5] P. R. Walsh [23], Hamilton H. R. [4], T. Karp [8], M. Kajanus [7]	Scenario formation process stages: 1.Scenario goals and strategic objectives formulation; 2.Impact factors and interaction of participants identification; 3.Determined organizational performance trends and external environment opportunities and threats; 4.Analyzed impact factors combinations; 5.Creating and detailed primary scenarios; 6.Checking and considered primary scenarios logicality and plausibility; 7.Verifying scenarios matching the goals and objectives; 8.Final scenario development and analysis.

Source: Author.

According the scenario method development process stages analysis in order to elaborate scenario method development logic it is possible to formulate questions that help to achieve the expected results. In this way it is pursuated scenarios creation expediency

and effectiveness of the results. Those formulated steps with questions can be generalized scenario method development stages:

1. Scenario goal and strategic objectives formulation. Question: what is the purpose of scenario creation?
2. Impact factors and participants interaction identification can be carried out on the Pestel analyzes in order to identity the influence of external factors while the internal factors may be determined by the rating or selective method.
3. It is determined factors, external environment opportunities and threats that are affecting organization activities. Question: What would be required decissions if a certain factor would appear and begin to interact in reality? How does this affect the organization's strategic decisions? How do the current tasks must be shape? What is more, it is also important at this stage to identify positive, negative or unknown impact factors of influence on the organization. Possible signs adjustment as a possitive impact +, negative impact or effect -, neutral or unknown impact or effects +/-.
4. Analyzing the impact of factors combinations. It applies expert evaluation, using cross -impact analysis, morphological analysis.
5. Creating and detailed primary scenarios. Developed and described primary scenarios compositions.
6. Checking and considering primary scenarios logic and probability. According to authors [14]; [23] here are presented evaluation criterias:

   - valued scenario matching consistency criteria;

   - valued scenario matching probability criteria;

   - valued scenario matching difference criteria [15], [22].
7. Checking scenarios matching set goal and objectives implementation.
8. Final scenario development and analysis.

Analyzing the scenario development process factors and stages according different foreign authors and their research results it was found that scenario modeling presents successful and unsuccessful cases affected by external factors.To sum up the authors research resulst Tab. 4 shows organization scenario formation content.

Tab. 4: Organizations scenario forming content

	Successful organization activity	**Unsuccessful organization activity**
Strong external / internal factors influence	Organizations operating balance scenario	Organizations operating addiction scenario
Weak external / internal factors influence	Organizations operating potential downward scenario	Organizations independent operating scenario

Source: Author.

According the analysis of the information provided in Table 4 it should be noted that the strong external or internal factors influence of successful organization development forme organization's balance scenarios. Meanwhile by operating weak external or internal factors

influence of successful organization development forme organization's performance potential downward scenario. In assessing the unsuccessful organization's activities which are influenced by strong external environment is drawn up the organization's activities reliance scenario and reverse, under the weak external influence is drawn up independent organizations operating scenario.

The authors note that the scenario method is descriptive and according to the nature of presentation it is dealth with different situations in the future factors. The scenario method distinctive feature is the method flexibility in the combination of different factors to the overall prospects for the future a whole [3], [6]. What is more, the author emphasizes that this method helps to design different strategic decisions in a single methodological instument that help to face future situations and prepare for them in advance which is exposed by permanent environmental factors of uncertainty. Also this research notes that scenario method approach to the company's strategic decision-making process leads to the complexity of these decisions.

Conclusions

Future events that form environment changes and the ability to adapt and flexibly to receive , respond to changes becomes a prerequisite to an organization's business success. It is revealed that scenario method practical application allows operatively to react to different situations changes and prepare for them in advance. It was found that this reduces the vulnerability of uncertainty organization thereby improving the flexibility of adaptation.

Most of the scientific authors agree that the scenario method analyse the changing business environment indicators that helps to generate more likely prospects for the future. Practical method application in the organization reveal valuable information about the impact of external factors and it allow them to prepare for it and thereby to reduce their impact. In this way the organization is expanding the knowledge of the environment behavior system factors which facilitates business strategic management and strategic decision-making.

It was found that the scenario method application possibilities is broad but also it is emphasized that this methodology reveals strategic business decisions individuality in different circumstances. It is also revealed that the scenario method practical application must be continuously monitored, reported and controled. What is more, the scenario method allows to ensure the effectiveness of strategic decisions and also to reduce probability that the proper operation of the organization to develop and improve decision will remain obscured.

References

[1] BARBANENTE A., KHAKEE A. (2003). *Influencing ideas and inspirations. Scenarios as an instrument in evaluation*. Foresight, Vol. 5, No. 5, p. 3–15. Prieiga per internetą 2014-06-27 <http://www.emeraldinsight.com>

[2] GODET M. (1996). Creating the future: the use and misuse of scenarios, long range planning, Vol. 29, No. 2.

[3] GOODWIN P., WRIGHT G. (2001). Enhancing strategy evaluation in scenario planning. *Journal of Management Studies*, Vol. 38, No. 1, p. 1–16.

[4] HAMILTON H. R. (1981). Scenarios in corporate planning. *Journal of Business*

Strategy, Vol. 2, No. 1, p. 82–87.

[5] FAHEY L. (2003). How corporations learn from scenarios. *Strategy & Leadership*, Vol. 31, No. 2, p. 5–15.

[6] INAYATULLAH S. (1996). Methods and Epistemologies in Future Studies. F*oundations DD media group, Futures Study Centre*, Hawthorn, Australia, vol. 1, p. 186-203.

[7] KAJANUS M. (2000). A model for creating innovative strategies for an enterprise and its application to a rural enterprise. *Management Decisions*, Vol. 38, No. 10, p. 711–722.

[8] KARP T. (2004). Learning the steps of dance of change: improving change capabilities by integrating futures studies and positive organizational scholarship. *Foresight*, Vol. 6, No. 6, p. 349–355.

[9] MASON D. H., HERMAN J. (2003). Scenarios and strategies: making the scenario about the business. *Strategy & Leadership*, Vol. 31, No. 1, p. 23–31.

[10] MIETZNER D. (2005). Advantages and disadvantages of scenario approaches for strategic foresight. Technology, *Intelligence and Planning*, vol. 1, No. 2.

[11] MILLETT S. M. (2003). The future of scenarios: challenges and opportunities. Strategy *& Leadership*, Vol. 31, No.2, p.16–24.

[12] MOLIS, A. (2006). Europos saugumo ir gynybos politikos ateities scenarijai bei mažųjų valstybių interesai. *Politologija*, 4(44), p. 57–58.

[13] PAUL DRAGOS, A. (2003). Analytic Narratives and Scenario Building. *Futures research quarterly*, vol. 19 Issue 2, p. 61.

[14] RATCLIFFE J. (2002). Scenario planning: strategic interviews and conversations. *Foresight*, Vol. 4, No 1, p. 19–30.

[15] RATCLIFFE J. (2000). Scenario building: a suitable method for strategic property planning? *Property management*, Vol. 18, No. 2, p. 17-21.

[16] SCHOEMAKER P. J. H. (1997). Disciplined imagination from scenarios to strategic options. *International Studies of Management & Organization*, Vol. 27, No. 2, p. 43–70.

[17] SCHWAB P. (2003). Foresight using scenarios to shape the future of agriculture research. *Foresight*, Vol. 5, No. 1.

[18] SCHWARTZ P. (1996). The Art of the Long View. *Doubleday*, New York.

[19] STALEY D. J. (2002). A history of the future. *History and theory*, Vol. 41, p. 72–89.

[20] VASILIAUSKAS A. (2002). Strateginis valdymas. *Vilnius: Enciklopedija.*

[21] VERITY J. (2003). Scenario planning as a strategy technique. *European Business Journal*, Vol 15, No. 4, p. 185–195.

[22] VON REIBNITZ, U.H. (2003). Scenario Techniques. *Hamburg, Germany*.

[23] WALSH P. R. (2005). Dealing with the uncertainties of environmental change by adding scenario planning to the strategy reformulation equation. *Management Decisions*, Vol. 43, No. 1, p. 113–122.

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Received: 26. 04. 2016
Reviewed: 12. 05. 2016, 20. 05. 2016
Approved for publication: 08. 09. 2016

REGIONAL MOTIVATION DIFFERENCES OF SERVICE SECTOR EMPLOYEES IN URBAN AND RURAL AREAS IN SLOVAKIA

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Abstract: *Effective motivation programme should be consistent with all facts affecting employee work performance. Well-motivated staff help the organisation fulfil its goals and lead to long-term prosperity. The objective of the research is to determine the level of employee motivation in urban and rural areas in COOP Jednota Slovakia. A questionnaire is used to collect research data. We supposed that differences in people values living in urban and rural areas do not change despite the increased urbanization of Slovakia in the 21st century. Moreover, we supposed that significant differences in desired level of motivation of people working in urban and rural areas still exist. Following the obtained results we determine the order of 10 most important motivation factors of employees in urban and rural areas and we suggest that the organisation focuses on mentioned motivation factors when creating tailored motivation programme. Findings indicate that, regardless of the operation-related issues, the motivation factors associated with interpersonal relationships in the workplace are the most important. Other important motivation factors are associated with finances and stability, but the level of preferences varies.*

Keywords: *Employee motivation, Regional differences in Slovakia, Motivation programme, T-test, Urban and rural areas in Slovakia.*

JEL Classification: *M12, R11.*

Introduction

Thanks to globalization, the requirements on company competitiveness but also on the quality of human resources are increasing [23]. Competitiveness of each enterprise and results of its activity depend a lot on quality and efficiency of a usage of labour resources [16]. Good employees are the most valuable asset any company can have. Management literature (e.g. [20], [40]) asserts that people are the most important organisational resource and the key for achieving higher performance.

Management requirements affect employee behaviour and their motivation significantly. 21st century is characterised by fast pace and changes, increasing requirements and expectations [25] therefore the business world is undergoing consistent change [2]. Employees are affected by these dynamic factors in negative ways – they come into play to weaken their motivation and to ramp up stimuli. That is why it is necessary to increase the level of motivation, to improve its quality in enterprises, to orient it towards enterprise objectives and mission. State-of-the-art motivation of employees working in COOP Jednota Slovakia in the year 2014 is analysed as well as requirements and needs of rural and urban areas are compared in the paper. We supposed that differences in people values living in urban and rural areas do not change despite the increased urbanization of Slovakia in the 21st century.

Motivation is studied for very long time. Each human activity is affected by motivation. Many authors have been dealing with motivation so far. Therefore many different forms of motivation exist, for example [32], [46] the private sector, literature indicates that corporations usually link employees' satisfaction with the provision of financial (salary and high-powered incentives) rewards. Gomez-Mejia and Welbourne [14] argued that pay choices available to management have a positive impact on firms' performance and the effective use of human resources, whereas Spilerman [44] saw a positive relationship between the opportunity for hierarchical advancement and increased financial income. Researchers have taken various approaches to explain what motivates individuals. Some researchers believe innate personality traits are the primary motivators, while others believe external/situational factors (push-pull) are more important [8]. We can highlight Provazník [38]. He understood motivation as a system of factors those constitute inner driving powers of activity of man. These powers direct man's recognition, experience and actions [31]. They can be understood as dynamic tendencies of the personality. Employee motivation presents one of the serious matters managers deal with in the business environment [24], [29], [41], [6], [51]. Motivation in the workplace has been, owing to its positive impact on the employee performance at work, the centre of attention of scientists for many decades. It was proven that highly motivated employees can affect enterprise efficiency significantly [22], [12], [26]. Moreover, research studies show that lack of motivation affect the employee health in negative way, what is associated with lower performance at work as well as increasing healthcare expenditures due to worse health state. Rainey [39] presents that motivation at work is affected by many various factors associated with human nature, job description as well as the organisation. Theoretical knowledge of employee motivation helps us generate ideas how to improve it in order to improve employee performance and quality of work resulting in employee satisfaction that is the biggest asset an entrepreneur has.

Dreams of all managers are productive employees willing to work in accordance with business objectives [11]. Management of people as unique individuals is not easy. Therefore a good manager must be familiar with the employee behaviour. Motivation factors are specific for each individual, e.g. finances, personal success or competitiveness. The most difficult area in human resource management includes understanding how the person might think and feel [5].

Several motivation factors can be considered universal, i.e. positive as well as negative. They affect all types of employee motivation. Positive factors contribute to achieving goals [21], the opposite effect occurs due to negative factors. We try to avoid doing things we do not enjoy but it does not mean it happens. Independence is one of positive stimuli. Lack of independence at work presents negative impact. Employers must keep in mind that importance of the stimuli considered reliable in the past, e.g. job security, good working conditions or reasonable salary, can change and their effectiveness is not so high permanently [15]. Motivation varies as a function of different factors in the work environment, therefore they need to be updated regularly [43].

COOP Jednota is a Slovak retail system with a long-time tradition. It offers customers wide range of quality products including its own-brand products in more than 2,193 operation units throughout Slovakia. These operation units are divided depending on the number of employees into micro and small-sized, medium-sized and large units. 2,827 employees are working in 1,755 micro and small-sized units. 419 medium-sized units employ 6,371 employees. 19 large units of COOP Jednota exist in Slovakia [50]. They

provide jobs for 4,849 employees. Based on the annual report from 2015 totally more than 14,000 employees work for the company thus it is one of the top-ranked employers offering wide range of professional and personal development opportunities. System of fringe benefits together with continuing education is applied in the company. Supplemental retirement savings presenting funds for the employee future belong to traditional benefits. The objective of the paper was to compare the level of motivation of employees working in rural and urban areas following the research into desired and state-of-the-art level of motivation.

1 Literature review

Managers are often convinced of their ability to motivate others but sometimes it is not true as motivation is mainly an inner push in order to improve and have more energy. Motivation comes from the self: it is locked from the inside out [48, 4]. Employers can provide conditions and the environment but they cannot make staff feel motivated. Essential condition for creating good working environment is to get familiar with motivation factors affecting the employee motivation in positive way [5]. Therefore motivation in the workplace can be evaluated as a circle – needs of individuals are reflected in their desire for success that is reflected in goal-oriented behaviour, e.g. to fulfil goals of the enterprise following the satisfaction of a job well-done and performance-relevant reward [47]. Employee motivation is a way how managers can direct employees to achieve goals specific for the enterprise. It implies that essential part of motivation depends upon individual needs and requirements whereby the other part is out of control of the employee. Therefore the managers must be aware of the importance of both parts of motivation and of their key role in making employees feel motivated [1], [27].

When regional heterogeneity is taken into account the differences between rural and urban areas cannot be defined exactly. Various authors [7], [9], [10] present various definitions valid in specific time and space. Most definitions of rural and urban areas are based on population density or total population or on the level of urbanisation, distance from the residential area. Due to advantages and disadvantages of each definition it is necessary to analyse the issue with regard to the specific customs and traditions in the country.

2 Methodology

Comparative analysis and the application of the Student's T-test were used to handle results of the research. We proposed that significant differences in motivation of employees working in rural and urban areas exist due to their lifestyle as well as their living and working conditions. The goal-setting questionnaire was used to provide empirical evidence and to verify the hypothesis. The questionnaire consisted of 30 closed questions relating to 30 motivation factors [19]. Using the questionnaires, opinions, interests and respondents' approaches are recorded. They feel free and more relaxed when the participation in the survey is anonymous. Motivation factors are in alphabetical order not to affect respondents' decision and in order to be clear to all groups of respondents. Respondents had a chance to express their view on desired and actual state of motivation in studied enterprise considering the importance or the satisfaction with individual motivation factors. The questionnaire was divided into two parts. The first part was focused on socio-demographic and qualification characteristics of employees in the organisation. By means of this part we acquired information about respondents relating to their age, sex, number of years at work in the

organisation, completed education, and job position. This information was used to analyse motivation of employees and they were informed about the anonymous way of completing the questionnaire. In the second part respondents expressed their view on desired and actual state of motivation by one of the five levels of importance from a pre-defined 5-point rating scale, 5 - very important and 1 – unimportant. Respondents could define the importance of individual motivation factors affecting the employee performance more or less. Individual motivation factors through which we can acquire information about characteristics of work environment, working conditions, employee appraisal and reward system, about human resources management, health and social care system and system of employee benefits as well as information about employee satisfaction or dissatisfaction, value orientation, relation to work and enterprise or co-workers' relationship are included in the second part of the questionnaire. The questionnaires were submitted to randomly selected employees of COOP Jednota in various towns and villages in Slovakia in order to ensure variability and randomness of respondent selection necessary for relevant data acquisition.

The questionnaires were submitted via mail or personally and data were acquired from November 2014 to January 2015. Survey results were handled using mathematical and statistical methods, whereby the sample size had to be set prior to the survey.

Statistics formula, where n is a function of desired accuracy and confidence at estimating particular stimulus in population was used to calculate minimum sample size (n). The equation is as follows [36]:

$$n = \frac{z^2_{\alpha/2} \cdot \delta^2_x}{\Delta^2_{\bar{x}}} \qquad (1)$$

where:
n – sample size,
$z_{\alpha/2}$ – critical value of a standard normal random variable z (1.96 for $\alpha = 0.05$),
$\Delta\bar{x}$ – desired absolute accuracy,
δ_x^2 – standard deviation.

For example, with the 95 % confidence (ensured with critical value $z_{0,025} = 1.96$), desired accuracy $\Delta\bar{x} = 0.2$ and response variability specified by variance = 0.6, it is expected minimum sample size of respondents:

$$n = \frac{1{,}96^2 \cdot 0{,}6}{0{,}2^2} = 58 \text{ respondents} \qquad (2)$$

Responses of 58 respondents working in operation units in rural areas and 58 respondents working in operation units in urban areas will suffice to provide desired accuracy and confidence. Finally, 62 employees working in rural areas and 86 employees working in urban areas throughout Slovakia were engaged in the research and completed the questionnaire, whereby we meet criteria for minimum sample size.

For verifying statistical significance of differences in average levels of motivation of employees working in towns ($\bar{x}_M$) and in villages ($\bar{x}_V$) at the selected level of significance $\alpha = 0.05$ the Student's T-test was used [36]. The null hypothesis vs. the alternative hypothesis was tested, they were as follows:

$$H_0 : \mu_1 = \mu_2 \quad vs. \quad H_1 : \mu_1 \neq \mu_2$$

H_0: we suppose that averages of studied motivation factors (real, required) presenting the level of motivation of employees in urban areas are equal to averages of studied motivation

factors presenting the level of motivation of employees in rural areas and at the same time we suppose that the difference between them, if any, is caused only owing to the random variation of results.

H_1: we suppose that averages of studied motivation factors (real, required) presenting the level of motivation of employees in urban areas are not equal to averages of studied motivation factors presenting the level of motivation of employees in rural areas and at the same time we suppose that the difference between them cannot be considered accidental, therefore, it is statistically significant.

Individual values of the Student's T-test in our research were gathered using the programme STATISTICA 10. We mention also Fisher's F-test to assess the equality of variance of changes in satisfaction in both sampling units at the same selected level of significance ($\alpha = 0.05$), whereby the values of standard deviations show that the opinions of both sampling units are homogenous. If the value of F-test does not cross the critical value of F_α at the selected level of significance we can find out whether the employees in compared sampling unit are more homogenous or heterogeneous than those in the other studied sampling unit.

3 Results

3.1 Hypothesis Testing

Within the research 180 questionnaires were submitted to both sampling units. 148 were completed correctly; hence the questionnaire response rate is 82 %. Representative sampling unit consists of employees of COOP Jednota working in operation units in rural (62 respondents) as well as urban areas (86 respondents) throughout Slovakia. Table 1 shows the structure of 148 respondents in terms of age, education, job position and seniority.

Tab. 1: Structure of sampling unit

Age		**Education**		**Seniority**		**Job position**	
up to 30	35	Primary school	12	Less than 1 year	9	Manager	30
31 – 40	28	Lower secondary education	56	1 – 3 years	29		
41 – 50	45	Upper secondary education	67	4 – 6 years	20		
				7 – 9 years	22	Employee	118
50+	40	Higher education	13	10 years and more	68		

Source: own research

Hypothesis testing – we supposed that differences in desired state of motivation of employee working in urban areas in comparison to motivation factors preferred by employees working in rural areas exist – was evaluated due to the significance of differences of averages according to the importance of individual motivation factors (Tab. 2). Motivation factors (MF) with differences statistically significant are in bold at the selected level of significance (p-value).

Results of the Student's T-test show that the difference can be considered statistically significant in 18 from 30 analysed motivation factors, i.e. the requirements for the level of motivation of employees working in rural areas and employees working in urban areas are significantly different.

The differences considered statistically significant occurred mainly in motivation factors associated with:

- interpersonal relationship in the workplace (atmosphere in the workplace, good work team, communication in the workplace),
- financial reward of employees (fringe benefits, information about performance result, recognition, prestige),
- workload (working time, job performance, type of work, physical effort at work, mental effort),
- applying one's own ability (self-actualization, competences, individual decision making),
- the workplace environment as well (work environment, limitation of stress, mission of the company).

Physical effort at work, mental effort and limitation of stress in the workplace are motivation factors, from the group of 18, with differences considered statistically significant. Employees in rural areas work under difficult conditions as a consequence of heavier workload as well as of higher responsibility and autonomy. We suppose that is why they consider each of these three motivation factors more significant in comparison to employees in urban areas where work teams consist of higher number of staff therefore the workload can be divided among more employees. Subsequently, the work is easier and also the aspect of burnout typical for rural population is less common. In general, higher importance of individual motivation factors can be seen in respondents working in rural areas. It means that requirements for the level of motivation of these employees are higher. We suppose that it is owing to the dissatisfaction of employees working in rural areas that is much greater than of those working in urban areas. Thus we think, the more dissatisfied employees are, the higher requirements for the individual motivation factors they have.

By means of the values of F-test we appreciate the importance of differences of changes in satisfaction of both sampling units whereby individual standard deviations show the homogeneity of employees' opinions. The biggest difference in responses was seen in motivation factors atmosphere in the workplace, good work team and communication in the workplace. It shows evidence of differences in the quality of interpersonal relationships in individual operation units and the best way to improve it is to encourage managers because their approach can affect the team cohesion positively. Following the results we can conclude that the null hypothesis H_0 is rejected at the level of significance 5 %. Hypothesis H_1 is accepted and therefore we can consider the difference in individual motivation factors in both sampling units statistically significant with the reliability of 95 %.

Tab. 2: Hypothesis testing – desired state of motivation

S.N.	Average		Difference	T-test	P-value	Standard deviation		F-test	P-value
	Rural area	Urban area				Rural area	Urban area		
1.	4.77	4.26	0.52	4.46	**0.000**	0.42	0.84	4.00	**0.000**
2.	4.81	4.34	0.47	3.99	**0.000**	0.44	0.85	3.76	**0.000**
3.	4.60	4.27	0.33	2.86	**0.005**	0.69	0.69	1.01	0.965
4.	4.31	3.45	0.85	6.73	**0.000**	0.80	0.73	1.20	0.424
5.	4.65	4.50	0.15	1.14	0.257	0.77	0.76	1.02	0.927
6.	4.69	4.16	0.53	4.28	**0.000**	0.59	0.84	2.02	**0.004**
7.	3.76	3.74	0.01	0.10	0.924	0.92	0.84	1.19	0.465
8.	3.92	3.81	0.11	0.87	0.387	0.80	0.68	1.38	0.171
9.	4.45	3.93	0.52	4.77	**0.000**	0.62	0.68	1.22	0.421
10.	4.26	3.70	0.56	4.60	**0.000**	0.72	0.74	1.04	0.883
11.	4.56	4.30	0.26	2.25	**0.026**	0.69	0.70	1.03	0.898
12.	4.48	4.21	0.27	2.38	**0.018**	0.70	0.69	1.02	0.920
13.	4.48	4.05	0.44	4.19	**0.000**	0.65	0.61	1.12	0.634
14.	4.24	4.02	0.22	1.88	0.062	0.72	0.69	1.09	0.695
15.	4.19	3.66	0.53	4.39	**0.000**	0.72	0.73	1.02	0.930
16.	4.10	3.50	0.40	4.64	**0.000**	0.82	0.73	1.27	0.309
17.	4.60	4.50	0.10	0.76	0.446	0.71	0.79	1.24	0.373
18.	4.18	3.67	0.50	3.85	**0.000**	0.78	0.79	1.02	0.930
19.	4.35	3.95	0.40	3.21	**0.002**	0.83	0.68	1.48	0.096
20.	4.40	4.14	0.26	1.78	0.077	0.86	0.91	1.12	0.635
21.	4.56	4.29	0.27	1.82	0.071	0.78	0.98	1.57	0.062
22.	4.44	3.80	0.63	4.53	**0.000**	0.80	0.87	1.16	0.535
23.	4.32	3.65	0.67	5.22	**0.000**	0.81	0.75	1.16	0.525
24.	4.00	3.77	0.23	1.71	0.089	0.75	0.86	1.34	0.232
25.	3.94	3.74	0.19	1.31	0.192	0.81	0.92	1.31	0.271
26.	3.95	3.86	0.09	0.61	0.542	0.83	0.92	1.25	0.362
27.	4.08	3.59	0.49	3.66	**0.000**	0.91	0.71	1.65	0.333
28.	4.16	3.95	0.21	1.28	0.202	0.91	1.02	1.25	0.358
29.	4.55	4.15	0.40	2.90	**0.004**	0.76	0.86	1.28	0.311
30.	4.68	4.62	0.06	0.46	0.648	0.83	0.78	1.11	0.661

Source: own research

3.2 Comparison of the Most Important Motivation Factors

Effective motivation programme should be consistent with all facts affecting employee work performance. Well-motivated staff helps the organisation fulfil its goals and lead to long-term prosperity. The best way would be to create tailored motivation programme to suit requirements of each employee. It is time- and money-consuming, i.e. economically destructive. The company should focus on improving motivation factors to make employees satisfied. In the research we defined the most important motivation factors that employees working in urban and rural areas considered most significant and thus they help boost the motivation. Following the averages ($\bar{x}$) we selected 10 most preferred motivation factors

whereby the motivation factors presenting the most significant differences are in bold (Tab. 3).

Tab. 3: Comparison of 10 most important motivation factors

Urban areas			**Rural areas**		
S.N.	Motivation factor	$\bar{x}$	S.N.	Motivation factor	$\bar{x}$
1.	Basic salary	4.62	1.	**Good work team**	4.81
2.	Job security	4.50	2.	**Atmosphere in the workplace**	4.77
3.	Supervisor´s approach	4.50	3.	**Communication in the workplace**	4.69
4.	**Good work team**	4.34	4.	Basic salary	4.68
5.	**Working time**	4.30	5.	Job security	4.65
6.	Fair appraisal system	4.29	6.	**Fringe benefits**	4.60
7.	**Fringe benefits**	4.27	7.	Supervisor´s approach	4.60
8.	**Atmosphere in the workplace**	4.26	8.	**Working time**	4.56
9.	**Communication in the workplace**	4.16	9.	Fair appraisal system	4.56
10.	**Recognition**	4.15	10.	**Recognition**	4.55

Source: own research

Employees working in urban areas prefer finances and therefore the most important motivation factor is basic salary. It is followed by job security and supervisor´s approach. The personality of supervisor plays an important role especially in rewarding, recognising and engaging staff. Further motivation factors in ranking were associated with workload, financial reward as well as with social environment. Employees working in towns consider social relationships important. They appreciate good atmosphere and communication in the workplace even though they are not as important as finances and living conditions. Employees in operation units in towns are members of bigger teams and their interpersonal relationships are not so close and deep, they do not know each other because they are from different parts of the town and thus they are more self-centred.

3.3 Changes in Motivation Programme of the Company

Interpersonal relationships, good work team, atmosphere and communication in the workplace are the motivation factors considered the most significant by the employees working in rural areas. People in rural areas grow and live in small communities. They know each other and the values preferred by them are not those associated with career path but with cohesion and family-friendly workplace policy. Interpersonal relationships are followed by job security and living conditions that result from unfavourable economic conditions. Supervisor´s approach, recognition and fair appraisal system motivate the employees in positive way, too. Following the findings we suggest that the company, in order to motivate employees, should focus mainly on mentioned motivation factors when creating motivation programme. By comparison of motivation factors we found out that 10 most important motivation factors occurring in both sampling units are the same despite differences considered statistically significant.

Employees working in urban areas prefer financial reward because of higher living standards in towns in comparison to villages. On the other hand, employees working in rural areas prefer cohesion, interpersonal relationships because of way of living in small rural communities.

Despite mentioned differences we can state that, due to identical most important motivation factors in towns and villages, the people values are similar. Following the result we beg to state that it is possible, despite the increased urbanization of Slovakia in the 21st century, to create unified motivation programme for employees working in operation units of COOP Jednota in rural as well as urban areas. This motivation programme is for the company economically advantageous and according to our research also effective. We suggest creating motivation programme focused on motivation factors preferred by the employees in order to improve financial conditions and to strengthen relationships and cohesion among employees through various teambuilding activities.

Conclusion

In the research we analysed the level of motivation of employees working in rural and urban areas in operation units of the company COOP Jednota Slovakia. We used the Student's T-test to test the hypothesis in order to accept or reject the supposition that that significant differences in desired level of motivation of people working in urban and rural areas still exist [3]. We supposed that employee motivation is closely linked with lifestyle and thus with work and living conditions. Moreover, we can state that differences in people values living in urban and rural areas do not change despite the increased urbanization of Slovakia in the 21st century.

At the same time we can state that well-motivated employees with real opportunities for personal development, pay rise and reward to a fair standard and in accordance with how the organisation values them are the most valuable asset any company can have to fulfil its goals leading to long-term prosperity. Employee motivation is not something that management can do, rather it is a process that management can foster and allow to happen [17]. Because motivation is a system for stimulation of any behaviour (actions, activity) that is caused by various motives [45], and according to Marcinkeviciute [33], [34], [35], the basis of motivation is motives, these must be identified when we strive to measure current motivation. Employees must be motivated permanently. Motivation changes in time, therefore, the motivation needs of employees must be analysed and motivation programme must be updated time to time [18]. It is the role of managers to choose appropriate approach to the employee motivation. Seeing that motivation programme creating is demanding and money-consuming activity, its effectivity resulted from targeted analysis of employees [37]. On the basis of actual analyses [49], [28] we can make the following conclusions: motivation programme in the company COOP Jednota Slovakia can be created following the average importance of individual motivation factors unifiedly. Following our analyses and proposals, COOP Jednota tested changes in motivating employees. Their efficiency will be evaluated at the beginning of the year 2017. Moreover, we suggest paying more attention to motivation factors considered significant by employees working in rural and urban areas. In the future motivation requirements of employees can also change after meeting their needs. Therefore we suggest carrying out the analysis of motivation at regular 1-year interval [50], [19]. Economic factors together with economic and social conditions in dependence on development of people values in time that can change, should by observed at longer intervals (2 – 6 years).

References

[1] ADAIR, J. *Leadership and Motivation*. London: Kogan Page, 2009.

[2] ANTLOVÁ, K. Motivation and barriers of ict adoption in small and medium-sized enterprises. *In Economics and Management*, 2009, vol. 12, no. 2, pp. 140-155.

[3] ANWAR, A. S. et al. Job Satisfaction of Faculty Members of Universities in Pakistan: A Case Study of University of Sindh-Jamshoro. *In Modern Applied Science,* 2012, vol. 6, no. 7, pp. 89-95.

[4] ARMSTRONG, M. *Creating Success: How to Manage People.* London: Kogan Page, 2010.

[5] BAGSHAWE, A. *How to Improve Motivation.* England: Antony Bagshawe & Ventus Publishing ApS, 2011.

[6] BELÁS, J. et al. Impacts of the Foundation Internal Ratings Based Approach Usage on Financial Performance of Commercial Bank. *In Ekonomie a management,* 2012, vol. 15, no. 3, pp. 142-155.

[7] BENSON, M., O'REILLY K. Migration and the search for a better way of life: a critical exploration of lifestyle migration. *In The Sociological Review,* 2009, vol. 57, no. 4, pp. 608-625.

[8] BENZING, C., CHU, H. M. A comparison of the motivations of small business owners in Africa. *In Journal of Small Business and Enterprise Development,* 2009, vol. 16, no. 1, pp. 60-77.

[9] BIJKER, R. A., HAARTSEN, T. More than Counter-urbanisation: Migration to popular and less-popular rural areas in the Netherlands. *In Population, Space and Place*, 2012, vol. 18, no. 5, pp. 643-657.

[10] BITUŠÍKOVÁ, A. *Urbárna antropológia. Východiská a perspektívy.* Banská Bystrica: Univerzita Mateja Bela, 2003.

[11] BRODSKÝ, Z., MYŠKOVÁ, R. *Internet – Global information system supporting the collection of labour market information.* 2010, 14th WSEAS International Conference on Communications, pp. 225-228.

[12] DOBBS, M., HAMILTON, R. T. Small business growth: recent evidence and new directions. *In International Journal of Entrepreneurial Behavior and Research,* 2006, vol. 13, no. 5, pp. 296-321.

[13] EBERT, R., GRIFFIN, R. *Business Essentials, 9th edition.* New Jersey: Pearson Prentice Hall, 2013.

[14] GOMEZ-MEJIA, L., WELBOURNE, T. Compensation strategy: an overview and future steps. *In Human Resource Planning,* 1988, vol. 11, no. 3, pp. 173-89.

[15] GRAZULIS, V., BAZIENE, B. Employees' socialization in Lithuanian preschools – myth or reality (situational analysis). *In Filosofija, Sociologija*, 2009, vol. 20, no. 4, pp. 344-353.

[16] GREGOVÁ, E. Qualitative labor resources as a framework of enterprise competitiveness. *In Economics and Management,* 2007, vol. 10, no. 3.

[17] HERBIG, P., GENESTRE, A. International motivational differences. *In Management Decision*, 1997, vol. 35, no. 7, pp. 562-567.

[18] HITKA, M. et al. Impact of the economic crisis on the change in motivation of employees of woodworking industry enterprise. *In Drvna industria,* 2014, vol. 65, no. 1, pp. 21-26.

[19] HITKA, M. et al. Differences in Employee Motivation at Slovak Primary Schools in Rural and Urban Areas. *In International education studies,* 2015, vol. 8, no. 5, pp. 33-42.

[20] JUDGE, T., ILIES, R. Relationship of personality to performance motivation: a meta -analytic review". *In Journal of Applied Psychology*, 2002, vol. 87, no. 4, pp. 797-807.

[21] KAMPF, R., LIŽBETINOVÁ, L. The Identification and Development of Talents in the Environment of Logistics Companies. *In Nase more*, 2015, vol. 62, no. Special Issue, pp. 139-142.

[22] KAMPF, R. et al. Medziročné diferencie motivácie zamestnancov výrobných podnikov Slovenska. *In Komunikácie,* 2014, vol. 16, no. 4, pp. 98-102.

[23] KAMPF, R., BUCHÁČKOVÁ, P. User Benefits and Wider Economic Impacts of Infrastructural Project Investment. *In Journal of Information, Control and Management Systems,* 2005, vol. 3, no. 2, pp. 91-96.

[24] KANFER, R. et al. *Work motivation. Past, present, and future.* New York: Routledge, 2008.

[25] KOSTIVIAROVÁ, S., SOPKOVÁ, E. The evaluation of innovation activities of small and medium-sized business. *In Perspectives of Innovations, Economics and Business,* 2009, vol. 3, no. 3, pp. 18-19.

[26] KOUDELKOVÁ, P., MILICHOVSKÝ, F. Successful innovation by motivation. I*n Business: Theory and Practice,* 2015, vol. 16, no. 3, pp. 223-230.

[27] KROPIVŠEK. J. et al. Motivating employees of Slovenian and Croatian wood industry companies in times of economic downturn. *In Drvna industrija,* 2011, vol. 62, no. 2, pp. 97-103.

[28] KUCHARČÍKOVÁ, A. The importance of identification and analysis of educational needs for investment in human capital. *In Komunikacie,* 2014, vol. 16, no. 3, pp. 86-92.

[29] LATHAM, G. P., PINDER, C. C. Work motivation theory and research at the dawn of the twenty-first century. *In Annual Review of Psychology,* vol. 56, pp. 485-516.

[30] MALACHOVSKÝ, A., PĚČ, J. *Goals of tourism development in Slovakia in the context of regional development and selected tourism markets*. 2014, 17th International Colloquium on Regional Sciences, pp. 787-795.

[31] MANDYSOVÁ, I. SME and Human Resources in the Region. In International Scientific Conference *Region in the Development of Society 2014*. Mendel University, Brno 2014, pp. 565-570.

[32] MANOLOPOULOS, D. An evaluation of employee motivation in the extended public sector in Greece. *In Employee Relations,* 2008, vol. 30, no. 1, pp. 63-85.

[33] MARCINKEVICIUTE, L. Darbuotojų motyvavimo modeliai: metodinė priemonė. Kaunas: LŽŪU Leidybos centras, 2003a.

[34] MARCINKEVICIUTE, L. Lietuvos įmonių darbuotojų motyvavimo modelių ypatumai besikeičiančios rinkos sąlygomis: daktaro disertacija. Kaunas: Akademija, 2003b.

[35] MARCINKEVICIUTE, L. Darbuotojų darbo motyvavimo modeliai. *In Tiltai,* 2006, vol. 1, no. 34, pp. 11-20.

[36] MASON, R., D., LIND, D., A. *Statistical techniques in Business and Economics*. Boston: Irwin, 1990.

[37] POTKÁNY, M. et al. Target costing calculation in the woodworking industry to support demand at the time of global recession. *In Drewno - Wood,* 2012, vol. 55, no. 187, pp. 89-104.

[38] PROVAZNÍK, V. *Psychologie pro ekonomy*. Praha: GRADA Publishing, 1997.

[39] RAINEY, H. G. *Work motivation*. New York, 1994.

[40] RAINEY, H. G. *Understanding and Managing Public Organizations*. San Francisco: Jossey-Bass, 1997.

[41] RICHER, S. F. et al. A motivational model of work turnover. *In Journal of Applied Social Psychology,* 2002, vol. 23, no. 10, pp. 2089-2113.

[42] RIMARČÍK, M. *Štatistika pre prax*. 2007.

[43] ROBBINS, S. P., DECENZO, D. A. *Fundamentals of Management: Essential Concepts and Applications.* New Jersey: Pearson Prentice Hall, 2008.

[44] SPILERMAN, S. Organizational rules and the features of work careers. *In Research in Social Stratification and Mobility,* 1986, vol. 3, no. 5, pp. 41-102.

[45] SRIVASTAVA, S. K., KAKKAR, D. Estimation of motivation using entropy. *In Journal of Business Economics and Management,* 2008, vol. 9, no. 1, pp. 53-56.

[46] STACHO, Z. et al. Organisational arrangement of human resources management in organisations operating in Slovakia and Czech Republic. *In Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis,* 2013, vol. LXI, no. 7, pp. 2787-2799.

[47] TIJUNAITIENE, R., BALCIUNAS, S. Individualistic Motivation of Citizens Participating in Civil Society Organizations. *In Inzinerine Ekonomika - Engineering Economics,* 2010, vol. 21, no. 4, pp. 408-416.

[48] VETRÁKOVÁ, M. et al. *Human Resources and Their Management*. Banská Bystrica: Bratia Sabovci, 2011.

[49] VOKOUN J. et al. *Megatrendy – Dôsledky zmien v demografickom vývoji a urbanizácii na Slovensku.* Bratislava: Ekonomický ústav SAV, 2006.

[50] Výročná správa COOP Jednota, 2015 (interný document podniku).

[51] ZÁVADSKÝ, J. et al. Changes of employee motivation of slovak enterprises due to global economic crisis. *In Economics and Management*, 2015, vol. 18, no. 1, pp. 57-66.

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Received: 01. 05. 2016
Reviewed: 16. 05. 2016, 27. 05. 2016
Approved for publication: 08. 09. 2016

COLLECTIVE RISK MODEL IN HETEROGENEOUS PORTFOLIOS OF POLICIES

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Abstract**:** *The total amount of claims in a particular time period, in actuarial literature named as collective risk, is a quantity of fundamental importance to the proper management of an insurance company. The article aimed to present the possibility and procedure to approximate the collective risk model in a heterogeneous portfolio of policies. The key assumption in all models for aggregate claim amount is that the occurrence of a claim and the amount of a claim can be studied separately. We will show that mixture distributions are convenient as the probability models for claim numbers and for claim amounts in heterogeneous portfolios of policies. We have derived that the negative binomial distribution can be used as a model for claim frequency and the Pareto distribution as a loss distribution model when the portfolios of policies are not homogeneous. The concept of mixture distributions is an important one in insurance, since insurance companies generally deal with heterogeneous risks. The motor compulsory third party liability insurance is an important branch of non-life insurance in many countries; therefore application of the theoretical results is performed on data from this field.*

Keywords: *Collective risk model, Heterogeneous portfolio of policies, Mixture distributions, Negative binomial distribution, Pareto distribution.*

JEL Classification: *C1, C6, C8, G.*

Introduction

One of the primary goals of actuarial risk theory is the evaluation of the risk associated with a portfolio of insurance contracts. Many insurance contracts (in both life and non-life areas) are short-term, typically one year. Typical automobile insurance, homeowner's insurance and group life and health insurance policies are usually of one year duration.

The primary objective is to model the distribution of total claim costs for portfolios of policies so that business decisions can be made regarding various aspects of the insurance contracts. The total claim cost over a fixed time period is often modelled by considering the frequency of claims and distributions of individual losses separately. A few actuarial publications considered a number of different possible claim size distributions and discussed estimation procedures for them, for example [1], [2], [5], [6], [10], [13].

Insurance companies generally deal with heterogeneous or nonhomogeneous portfolios of policies, shortly with heterogeneous risks, which mean that the distribution of the claim numbers and sometime the distribution of individual claim amounts are differ among policyholders.

In the most of collective risk models practical examples in actuarial literature there is assumption that claim numbers have a Poisson distribution. This is because Poisson distribution generally leads to simple results than other claim number distributions and real data to verify this assumption are often not available. For the Poisson model of number

of claims N with parameter λ applies equality of $E(N) = D(N) = \lambda$, but expectation the heterogeneity across policies to result in greater variation than the Poisson would give.

Since insurance companies generally deal with heterogeneous risks, in our article we first theoretically derive distribution of the number of claims and distribution of the individual losses in heterogeneous portfolios using mixture distributions. Then we explain the theoretical approach to the approximation of the collective risk model in the case of heterogeneous risks.

Finally we verify the theoretical results on the real data of liability motor insurance, which provides us with an unnamed insurance company operating on the Czech insurance market.

1 Risk models in heterogeneous portfolios of policies

As already mentioned, we assume a heterogeneous portfolio of insurance policies. Our aim is to derive the distribution of the number of insurance claims and distribution of individual losses in case of heterogeneous risks and knowledge of these distributions use for collective risk model.

The concept of a mixture of distributions [2, p. 25], [1, p. 58], [10, p. 98] will be useful for our goals.

1.1 Modelling the number of claims

The Poisson model for the number of claims is a plausible model for a single risk. We would expect the heterogeneity across policies to result in greater variation than the plain Poisson would give.

Let N_i is the number of claims made by i-th policyholder during the year. The simplest model for claim numbers is the Poisson, so assume that the number of claims N_i made by policyholder i follows a Poisson distribution with mean λ_i,

$$N_i/\lambda_i \sim Po(\lambda_i)$$

i.e.

$$P(N_i = k) = \frac{\lambda_i^k}{k!} e^{-\lambda_i}, \quad k = 0, 1, 2, ... \tag{1}$$

We know that the values of λ_i will vary across the portfolio and so we apply the method of mixtures to the λ_i. We take $G(\alpha;\beta)$ as the mixing distribution for the Poisson means. So

$$N_i/\lambda_i \sim Po(\lambda_i), \text{ where } \lambda_i \sim G(\alpha;\beta) \text{ for } i = 1,2,...,n.$$

Random variable λ has a gamma distribution with parameters α and β, if

$$f(\lambda) = \frac{\beta^\alpha}{\Gamma(\alpha)} \lambda^{\alpha-1} e^{-\beta\lambda}, \ \lambda > 0 \tag{2}$$

We will show that the marginal distribution $P(x) = P(N = x)$ of the number N of claims in the whole portfolio of policies during the year is negative binomial $NB(\alpha;\pi)$ with parameters α, π.

Probability mass function is given by

$$P\left(N=x/\alpha,\,\pi\right)=\frac{\Gamma\left(\alpha+x\right)}{\Gamma\left(\alpha\right)x!}\pi^{\alpha}\left(1-\pi\right)^{x},\ x=0,1,2,\ldots, \tag{3}$$

The following gives this solution.

$$P\left(x\right)=P\left(N=x\right)=\int_{0}^{\infty}f_{N,\lambda}\left(x,\lambda\right)d\lambda=\int_{0}^{\infty}f_{\lambda}\left(\lambda\right)f_{N/\lambda}\left(x/\lambda\right)d\lambda=$$

$$=\int_{0}^{\infty}\frac{\beta^{\alpha}}{\Gamma\left(\alpha\right)}\lambda^{\alpha-1}e^{-\beta\lambda}\cdot e^{-\lambda}\frac{\lambda^{x}}{x!}d\lambda=\frac{\beta^{\alpha}}{\Gamma\left(\alpha\right)x!}\int_{0}^{\infty}\lambda^{\alpha+x-1}e^{-\lambda\left(\beta+1\right)}d\lambda=$$

$$=\frac{\beta^{\alpha}}{\Gamma\left(\alpha\right)x!}\cdot\frac{\Gamma\left(\alpha+x\right)}{\left(\beta+1\right)^{\alpha+x}}==\frac{\Gamma\left(\alpha+x\right)}{\Gamma\left(\alpha\right)x!}\left(\frac{\beta}{\beta+1}\right)^{\alpha}\left(\frac{1}{\beta+1}\right)^{x}$$

That is by (3) probability function of the negative binomial distribution $NB\left(\alpha;\pi\right)$, where $\pi=\frac{\beta}{\beta+1}$.

It is possible to derive that [2, p. 31]

$$E(N)=\frac{\alpha\left(1-\pi\right)}{\pi}<\frac{\alpha\left(1-\pi\right)}{\pi^{2}}=D(N) \tag{4}$$

To conclude, negative binomial distribution is more appropriate model of claims number in heterogeneous portfolios of policies than Poisson distribution, for which $E\left(N\right)=D(N)=\lambda$.

1.2 Modelling the claim amounts

The exponential distribution [1, p. 36], [10, p. 56] is one of the simplest models for individual claim amounts with density function

$$f(x)=\lambda_{i}\,e^{-\lambda_{i}x},\quad x>0,\ \lambda>0 \tag{5}$$

Suppose that each individual in a large insurance portfolio incurs losses according to an exponential distribution. Our practical knowledge of almost any insurance portfolio (car insurance, home insurance, housing insurance, equipment insurance etc.) tells us that the means of these various distributions will differ among the policyholders. Thus our description of the losses in the portfolio is that each loss follows its own exponential distribution, i.e. the exponential distributions have means which differ from individual to individual [3], [6], [14].

We must now find a description of the variation among the individual means. One way to do this is to assume that the exponential means themselves follow a distribution. In the exponential case, it is convenient to make the following assumption.

Denote the average claim for each policyholder as θ_{i}, where $i=1,2,...,n$. Let $\lambda_{i}=\frac{1}{\theta_{i}}$ be the reciprocal of the mean loss for the *i*-th policyholder. We assume that the variation among

the λ_i can be described by a known gamma distribution $G(\alpha;\beta)$ of the variable λ, i. e. $\lambda \sim G(\alpha;\beta)$ with probability density function by (2).

The marginal distribution of individual claims X in a whole portfolio of policies in this case is [2, p. 29], [10, p. 101]:

$$f_X(x) = \int_0^\infty f_{X,\lambda}(x,\lambda)\, d\lambda = \int_0^\infty f_\lambda(\lambda)\, f_{X/\lambda}(x/\lambda)\, d\lambda =$$

$$= \int_0^\infty \frac{\beta^\alpha}{\Gamma(\alpha)} \lambda^{\alpha-1} e^{-\beta\lambda} \times \lambda e^{-\lambda x} d\lambda = \frac{\beta^\alpha}{\Gamma(\alpha)} \int_0^\infty \lambda^\alpha e^{-(x+\beta)\lambda} d\lambda =$$

$$= \frac{\beta^\alpha}{\Gamma(\alpha)} \cdot \frac{\Gamma(\alpha+1)}{(x+\beta)^{\alpha+1}} \int_0^\infty \frac{(x+\beta)^{\alpha+1}}{\Gamma(\alpha+1)} \lambda^\alpha e^{-(x+\beta)\lambda} d\lambda = \frac{\alpha\beta^\alpha}{(x+\beta)^{\alpha+1}} \tag{6}$$

That is density function of the Pareto distribution $Pa(\alpha;\beta)$ [8], [15]. This result gives us a very nice interpretation of the Pareto distribution. $Pa(\alpha;\beta)$ arises when exponentially distributed losses are averaged using a $G(\alpha;\beta)$ mixing distribution.

1.3 Modelling the collective risk

When we derived that the probability model for the number of claims in heterogeneous portfolio of policies is negative binomial $NB(\alpha;\pi)$ and the probability model for the individual losses is Pareto $Pa(\alpha;\beta)$, we are going to construct the probability model for the random variable *S*, so called the *collective risk model* as it is defined in [1], [4], [10], [11], [12].

Recall that the random variable *S* denotes the aggregate claims paid by the insurer in the year in respect of this risk. When the variable *N* denotes the number of claims and the random variable X_i denotes the amount of the *i*-th claim, thus

$$S = X_1 + X_2 + ... + X_N \tag{7}$$

where $X_1, X_2, ..., X_N$ are independent, identically distributed variables, $N, X_1, X_2, ..., X_N$ are mutually independent, and if $N = 0$ than $S = 0$.

The distribution of *S* is an example of a compound distribution. When *N* is negative binomial, *S* has a compound negative binomial distribution. If we denote as *G*(*s*) distribution function of *S* and *F*(*x*) the distribution function of X_i, so $G(s) = P(S \le s) = F_S(s)$ and $F(x) = P(X_i \le x)$. The *k*-th moment of X_i about zero for $k = 1, 2, 3, ...$, will be denoted as $m_k = E(X_i^k)$.

We will focus on determining the approximate collective risk model for *S*, not exact expression for *G*(*s*). For the approximate methods we need to know the moments of *S*. Basic expressions, known in actuarial literature, for example derived in [1], [3], [4], [5], [10], we can write as

$$E(S) = E(N) m_1$$

$$D(S) = E(N)\left(m_2 - m_1^2\right) + D(N)\, m_1^2 \tag{8}$$

$$M_S(z) = M_N\left(\ln M_X(z)\right)$$

By the formulas (8) we can calculate all basic moments of S if we know the relevant moments of N and X.

We now determine the basic formulae for the mean, variance and skewness of the compound negative binomial distribution for S, which are derived in [1, p. 83]:

$$E(S) = \frac{\alpha \cdot (1-\pi)}{\pi} \cdot m_1 \tag{9}$$

$$D(S) = \frac{\alpha \cdot (1-\pi) \cdot \left(\pi \cdot m_2 + (1-\pi) \cdot m_1^2\right)}{\pi^2} \tag{10}$$

$$skew(S) = \frac{\pi^2 \cdot (1-\pi) \cdot m_3 + 3 \cdot \pi \cdot (1-\pi)^2 \cdot m_1 \cdot m_2 + 2 \cdot (1-\pi)^3 \cdot m_1^3}{\sqrt{\alpha} \cdot \left(\pi \cdot (1-\pi) \cdot m_2 + (1-\pi)^2 \cdot m_1^2\right)^{1,5}} \tag{11}$$

Note that the compound negative binomial distribution is always positively skewed. By section 2.2 the individual losses in heterogeneous portfolios of policies are distributed by Pareto $Pa(\alpha;\beta)$ with density function (6). To be able to substitute to formulae (11), (12), (13), the k-th moment about zero, $k = 1, 2, 3$ of $X \sim Pa(\alpha;\beta)$ we need. The expressions for these moments by [1], [6] and [9] are

$$m_1 = E(X) = \frac{\beta}{\alpha - 1}, \qquad \alpha > 1 \tag{12}$$

$$m_2 = E(X^2) = \frac{2\beta^2}{(\alpha-1)(\alpha-2)}, \qquad \alpha > 2 \tag{13}$$

$$m_3 = E(X^3) = \frac{6\beta^3}{(\alpha-1)(\alpha-2)(\alpha-3)}, \qquad \alpha > 3 \tag{14}$$

2 The translated gamma approximation to *G(s)*

Now we will use the results of Chapter 2 to find approximations for the distribution of collective risk $S = X_1 + X_2 + ... + X_N$.

Because $X_1, X_2, ..., X_N$ are independent, identically distributed variables, when number of claims N is reasonable large, a normal approximation to the distribution of S may be used by Central limit theorem. But the normal distribution can take negative values and is symmetric, while aggregate claims S are always nonnegative and in case of compound negative binomial distribution always positively skewed.

One alternative to the normal approximation which does not have these deficiencies is translated gamma distribution. We denote $G(\alpha;\beta)$ the gamma distribution with mean $\frac{\alpha}{\beta}$, variance $\frac{\alpha}{\beta^2}$, and skewness $\frac{2}{\sqrt{\alpha}}$.

Let μ, σ^2 and γ denote the mean, variance and coefficient of skewness of *S*. We assume *S* has approximately the same distribution as the random variable $k + Y$ where *k* is a constant and *Y* has a gamma distribution $G(\alpha, \beta)$. The parameters *k*, α and β are chosen so that $k + Y$ has the same first three moments as *S*.

Equating the coefficients of skewness, variance and means of *S* with the same characteristics of $k + Y$ gives the following three formulae:

$$\gamma = \frac{2}{\sqrt{\alpha}} \qquad \sigma^2 = \frac{\alpha}{\beta^2} \qquad \mu = k + \frac{\alpha}{\beta} \tag{15}$$

from which α, β and k can be calculated.

3 Methods for practical application

The Chapter 2 and Chapter 3 contain all the necessary information to allow us to find the translated gamma approximation to collective risk *S* based on the real data of insurance company about the number and the amount of claims for each policyholder.

Such data are required to estimate the parameters of the negative binomial distribution of number of claims and parameters of the Pareto distribution of individual losses in a heterogeneous portfolio of policies. The goodness of fit tests can be used to verify whether data may come from the expected distributions with estimated parameters.

The method of moment is easy to use to estimate parameters of negative binomial distribution $NB(\alpha;\pi)$ from expression of $E(N)$ and $D(N)$ by (4) if we estimate $E(N)$ by sample mean and $D(N)$ by sample variance [7, p. 100], [2, p. 32].. Maximum likelihood estimates [2], [10] provide some statistical software packages, for example Statgraphics Centurion.

The method of moments [1, p. 41] to estimate parameters α and β of Pareto loss distribution $Pa(\alpha;\beta)$ is very easy to apply given data $x_1, x_2, ..., x_n$ of individual losses with sample average $\bar{x}$ and sample standard deviation *s*:

$$\tilde{\alpha} = \frac{2s^2}{s^2 - \bar{x}^2} \qquad \tilde{\beta} = (\tilde{\alpha} - 1)\bar{x} \tag{16}$$

The estimates obtained in this way will tend to have rather large standard errors and so the maximum likelihood estimators of parameters of $Pa(\alpha;\beta)$ are preferred [1, p. 41], [10, p. 72]. We denote as $\hat{\alpha}$, $\hat{\beta}$ the maximum likelihood estimates given data $x_1, x_2, ..., x_n$ from the $Pa(\alpha;\beta)$ distribution. If log-likelihood function we denote as ℓ we find $\partial\ell/\partial\alpha$ and $\partial\ell/\partial\beta$. We equate the two expressions for parameter $\hat{\alpha}$ and find maximum likelihood estimator $\hat{\beta}$ satisfies $f(\beta) = 0$ where [2, p. 16], [10, p. 72]

$$f(\beta) = A - B = \frac{\sum_{i=1}^{n} \frac{1}{\beta + x_i}}{\sum_{i=1}^{n} \frac{x_i}{\beta(\beta + x_i)}} - \frac{n}{\sum_{i=1}^{n} \ln\left(1 + \frac{x_i}{\beta}\right)} \tag{17}$$

Substituting $\hat{\beta}$ in A or B we can find $\hat{\alpha}$.

Pareto model often gives an excellent fit when we need to find a distribution with rather more weight tail what is typically feature in a heterogeneous portfolios of the policies.

Various statistical tests may be used to check the fit of a proposed model, the most often *Chi-Squared test* [2], [10], [16].

Chi-Squared test divides the range of X into k intervals and compares the observed counts O_i (number of data values observed in interval i) to the number expected given the fitted distribution E_i (number of data values expected in interval i).

Test statistics is given by

$$\chi^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i} \tag{18}$$

which is compared to a chi-squared distribution with $k - p - 1$ degrees of freedom, where p is the number of parameters estimated when fitting the selected distribution.

4 Application of the theoretical results

Practical application of theoretical results mentioned in previous chapters we provide based on data from unnamed Czech insurance company. We know the individual data of the number of claims and of the claim amounts (in CZK) in the portfolio of 25 752 policyholders for compulsory third party liability motor vehicles insurance.

This application at first presents the results of fitting a Poisson and a negative binomial distribution to the data on variable N that is the number of claims made by a policyholder in this portfolio.

Tab. 1: Estimation of Poisson parameter λ
25752 values ranging from 0.0 to 3.0
Fitted Distributions

Poisson
mean = 0.0409289

Source: Output from Statgraphics Centurion XV

Tab. 2: Parameters estimation of $NB(\alpha;\pi)$
25752 values ranging from 0.0 to 3.0
Fitted Distributions

Negative Binomial
event probability = 0.900157
number of successes = 0.369005

Source: Output from Statgraphics Centurion XV

The output of the procedure *Goodness-of-Fit Tests* in Tab. 3 shows the results of chi-squared test run to determine whether *N* can be adequately modelled by a Poisson distribution. The chi-squared test divides the range of *N* into 3 groups and compares the number of observations in each class to the number expected based on the fitted Poisson distribution. It is obvious that the Poisson distribution gives a very poor fit to the higher claim frequencies. Since the smallest *p*-value amongst the tests performed is less than 0.05, we can reject the hypothesis that *N* comes from a Poisson distribution.

Tab. 3: Results of Chi-squered test for Poisson distribution of N

	Lower Limit	Upper Limit	Observed Frequency	Expected Frequency	Chi-Squared
at or below		0.0	24773	24719.28	0.12
	1.0	1.0	909	1011.73	10.43
	2.0	3.0	70	20.99	114.44

Chi-Squared = 124.984 with 1 d.f. *p*-value = 0.0

Source: Output from Statgraphics Centurion XV

Tab. 4 shows the results of fitting a negative binomial distribution to the data on *N*. The estimated parameters of the fitted distribution are shown in Tab. 2. It means the results of tests run to determine whether *N* can be adequately modelled by a negative binomial distribution with estimated parameters.

Tab. 4: Results of Chi-squered test for negative binomial of N

	Lower Limit	Upper Limit	Observed Frequency	Expected Frequency	Chi-Squared
at or below		0.0	24773	24771.61	0.00
	1.0	1.0	909	912.65	0.01
	2.0	2.0	65	62.37	0.11
	3.0		5	5.37	0.03

Chi-Squared = 0.150921 with 1 d.f. *p*-value = 0.697657

Source: Output from Statgraphics Centurion XV

The chi-squared test in Tab. 4 divides the range of 4 classes and compares the number of observations in each class to the number of expected based on the fitted negative binomial distribution. The fit of the negative binomial to the higher frequencies is very good. Since the *p*-value = 0.697657 the test performed is greater than 0.05, we do not reject the hypothesis that *N* comes from a negative binomial distribution. These results correspond with the sub-chapter 2.1.

According to derived equation (6) can be assumed that the individual losses are Pareto distributed. We have used the data about 979 claim amounts in our portfolio and we have fitted the Pareto model to the data. The calculations of chi-squared test procedure by (18) for fitted Pareto distribution have completely done in Excel and results of calculations present Tab. 5.

Maximum likelihood method gives us the estimators of two parameters of Pareto distribution by solution equation (17) with help of *Solver*:

$$\hat{\alpha} = 5.608 \text{ and } \hat{\beta} = 7511.3 \qquad (19)$$

Now we can perform chi-squared test on the Pareto distribution with maximum likelihood estimators of parameters by (18).

Tab. 5: Chi-squared test for the Pareto model

UL	O_i	***F*(*UL*)**	p_i	E_i	χ^2
2000	741	0.733906	0.7495805	733.8393	0.069873
4000	155	0.908755	0.1748483	171.1765	1.528706
6000	46	0.962843	0.0540884	52.95259	0.912863
8000	20	0.982867	0.0200241	19.60361	0.008015
10000	9	0.991322	0.0084542	8.276653	0.063218
over 10000	8		0.0086785	8.496214	0.028981
Total	**979**				**2.611656**

Source: own calculations

Tab. 5 contains the chi-squared test procedure based on real data. In the headings there are: *UL* –upper limit of the intervals, O_i – observed frequencies, E_i – expected frequencies, *F*(*UL*)- value of the Pareto distribution function in upper limit *UL* of the intervals, p_i - probability that random amount of claim is just from *i*-th interval under Pareto model with parameters estimated by maximum likelihood method. The χ^2 statistic is computed by (18), and we get

$$\chi^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i} = 2.612$$

We have found *critical value* $\chi^2_{0.95}$ = 7.815 as a 95th percentile of χ^2 distribution with 6-1-2 = 3 degrees of freedom and *p*-value = 0.45545, using the *Insert Function* in Excel, which indicate good fit for the Pareto distribution, because χ^2 = 2.612< 7.815 and *p*-value is greater than 0.05. This result is also consistent with theoretical findings in sub-chapter 2.2.

We have confirmed a good fit with negative binomial distribution with parameters in Tab. 2 of variable *N* and a good fit with Pareto distribution with parameters (19) estimated by maximum likelihood methods of variable *X*, so we can calculate the *k*-th moments about zero, $k = 1, 2, 3$ for $Pa(\alpha; \beta)$ with parameters (19) by expressions (12), (13), (14). Tab. 6 contains the results of calculations.

Tab. 6: The moments about zero for the Pareto model

m1	1630.0288
m2	6786732.5496
m3	58636257773.6073

Source: own calculations

Now we know all the necessary values to be used for the formulas (9), (10), (11) to calculate three basic characteristics of collective risk *S* in Tab. 7.

Tab. 7: The basic characteristics of collective risk model S

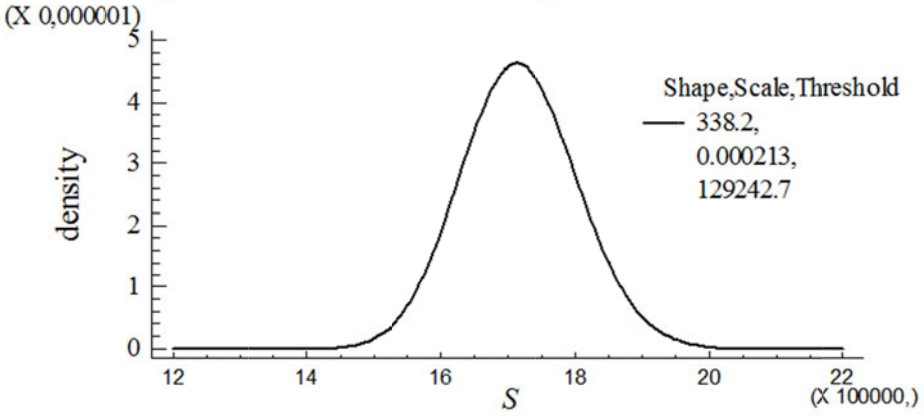
$E(S)$	1718058.0962
$D(S)$	7463870619.6988
$skew(S)$	0.1088

Source: own calculations

Now we can calculate parameters of the translated gamma distribution (Fig. 1) which has the three relevant basic characteristics same as distribution of collective risk *S*. From (15) we get:

$$\alpha = 338.2 \qquad \beta = 0.000213 \qquad k = 129242.7$$

Fig. 1: Density of translated gamma distribution



Source: own processing in the Statgraphics

5 Discussion

The reason for approximating the distribution of collective risk *S* in insurance company by a translated gamma distribution is that it may be easier to obtain quantiles (percentiles) for $(k+Y)$ such as for *S*, or values for quantities such as $P(a<k+Y<b)$ than for $P(a<S<b)$. The values of cumulative distribution function and quantiles for gamma distributions are readily obtained from most statistical computer packages or from Excel.

The some high percentile, the most often 95-th $S_{0,95}$ of the collective risk model determines for an insurance company so called *risk premium RP*. The risk premium in our heterogeneous portfolio of policies we get as

$$S_{0,95} = k + Y_{0,95} = 129\,242.7 + 1\,733\,540.578 = 1\,862\,783.284\,\text{CZK}$$

Conclusion

The theoretical results in Chapter 2 and demonstration of their application to real data in Chapter 5 confirmed that the number of claims *N* in a heterogeneous portfolio of policies has a negative binomial distribution and so collective risk *S* has a compound negative binomial distribution. We have shown procedure of approximation of collective risk model by translated gamma distribution in case when individual losses are Pareto distributed according to the results in subchapter 2.2. These results are very useful for insurance practice since insurance companies deal mainly with heterogeneous risks. Knowledge of the

collective risk model for the insurance company is particularly useful for determining the risk premium and for reserves estimation.

References

[1] BOLAND, P. J. *Statistical and Probabilistic Methods in Actuarial Science*. New York: Chapman&Hall/CRC, 2007, pp. 35-61.

[2] CURRIE, I. D. *Loss Distributions*. Institute of Actuaries and Faculty of Actuaries, London and Edinburgh, 1993.

[3] DAYKIN, C. D., PENTIKÄINEN, T, PESONEN, M. *Practical Risk Theory for Actuaries*, Chapman & Hall, London, 1996.

[4] DICKSON, D.C.M., WATERS, H. R. *Risk models*. Institute of Actuaries and Faculty of Actuaries, London and Edinburgh, 1993.

[5] GRAY, R. J., PITTS, S. M. *Risk Modelling in General Insurance*. Cambridge University Press, Cambridge, 2012.

[6] Hogg, R.V., KLUGMAN, S. A. *Loss Distributions*. John Wiley& Sons, New York, 1984.

[7] HOSSACK, I. B., POLLARD, J. H., ZEHNWIRTH, B. *Introductory statistics with applications in general insurance*. Cambridge University Press, Cambridge, 1992.

[8] JINDROVÁ, P., SIPKOVÁ, Ľ. Statistical Tools for Modeling Claim Severity. In: *European Financial Systems* 2014. Proceedings of the 11th International Scientific Conference. Lednice, June 12-13, 2014. Brno: Masaryk University, 2014, pp. 288-294. ISBN 978-80-210-7153-7.

[9] KRISHNAMOORTHY, K., *Handbook of Statistical Distributions with Applications*. Chapman & Hall/CRC, USA, 2006, ISBN 1-58488-635-8.

[10] PACÁKOVÁ, V. *Aplikovaná poistná štatistika*. Iura Edition, Bratislava, 2004.

[11] PACÁKOVÁ, V. Modelovanie a simulácia rizík v neživotnom poistení. *E+M – Ekonomie a Management*, Technická univerzita v Liberci, 3/2007, ročník X, s. 109-121, ISSN 1212-3609.

[12] PACÁKOVÁ, V., BALCÁRKOVÁ V. Možnosti aproximace rozdělení kolektivního rizika. *Scientific Papers of the University of Pardubice*. Series D, Fakulta ekonomicko-správní 18(3/2010). s. 138-144. ISSN 1211 – 555X, MK ČR E 19548.

[13] PACÁKOVÁ, V. a kol. *Modelování a simulace pojistných rizik*. Vydavatelství Univerzity Pardubice, Pardubice, 2012.

[14] PACÁKOVÁ, V., ZAPLETAL, D. Mixture Distributions in Modelling of Insurance Losses. In: Proceedings of the 2013 International Conference on *Applied Mathematics and Computational Methods in Engineering*. (AMCME 2013). Rhodes Island, Greece, July 16-19, 2013, pp. 122-125. ISBN: 978-1-61804-200-2

[15] PACÁKOVÁ, V., GOGOLA, J. Pareto Distribution in Insurance and Reinsurance. Conference proceedings from 9th international scientific conference *Financial Management of Firms and Financial Institutions*, VŠB Ostrava, 2013. pp. 298-306. ISBN 978-80-248-3172-5.

[16] PACÁKOVÁ, V., BREBERA, D. Loss Distributions and Simulations in General Insurance and Reinsurance. *International Journal of Mathematics and Computers in Simulation.* NAUN, Volume 9, 2015, pp. 159-167.

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Received: 01. 05. 2016
Reviewed: 01. 06. 2016, 17. 07. 2016
Approved for publication: 08. 09. 2016

ALTERNATIVE SOURCES OF BUSINESS DEVELOPMENT: MEZZANINE FINANCING

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***Abstract**: The purpose of the study is to conduct a comprehensive analysis of the nature of mezzanine financing, its pros and cons, role in the system of investment activity in the world practice, as well as to assess the degree of adoption of the tool at the national capital market in Russia. The study lists multiple options of realization and tools of mezzanine financing with private placement. The characteristic features of this type of financial product are listed. Belonging to the mezzanine area of bridge financing is proved, as well as a new mortgage refinancing tool – "factory of mortgage-backed securities." The significance of the use of the mezzanine product in the state support programs abroad, as well as in Russia in the field of residential mortgage lending and co-financing of international transactions, was emphasized. The admissibility of various structures of the transaction and therefore its universality were determined as the basic advantage of mezzanine financing. The subjects of mezzanine capital were described, acting both as a lender and investor due to its specifics. The conclusion emphasized the limited possibilities of the development of mezzanine financing practice in Russia, mediated by the passivity of credit institutions, as well as the imperfection of the legislation regulating loan subordination and mortgage loan securitization.*

***Keywords:** Mezzanine financing, Mezzanine loan, Option, Bridge financing, Mezzanine financing fund, Mortgage security, Convertible debt note.*

***JEL Classification:** E52, G11, F21, O16.*

Introduction

In the conditions when the banking organizations cannot come to terms with the incurrence of operating losses, while demanding to secure the loan agreement with highly liquid collateral, the offers of alternative loans become inevitable. In such cases, public offering usually significantly transforms the ownership structure, which does not always meet the expectations of the owners of small and medium businesses. In addition, there is no guarantee that investments will be proportional to the business value in the process of public offering. As a rule, the floatation and the asset valuation are carried out by venture funds that try to minimize their risks.

Feeling the banking pressure "from the bottom" and the venture pressure "from the top", the business is looking for inflow of available funds. Experience in financing international companies showed that one of the most effective alternative tools is a mezzanine loan product.

1 Methods of research

Applying of the method of abstraction was used to identify a number of key concepts that reflect the financial and economic substance of mezzanine financing. As a result of the system analysis, typology, institutions, variations in the structuring of mezzanine

transactions are indicated. Comparative analysis was used to identify the advantages and disadvantages of mezzanine financing as compared to other debt instruments. Statistical analysis was actualized in the study of international experience, the practice of Russian companies and the state in realizing the benefits of mezzanine schemes. The study is based on the official data of large Russian companies, associations, online projects of information agencies and analytical groups; publications in Russian and foreign periodicals devoted to the development of mezzanine financing.

2 Results of the study

Word "mezzanine" comes from Italian "mezzano" – "medium, intermediate", "located in the center", which goes back to the Greek "mezos" – "medium". Mezzanine financing is a hybrid between debt financing and direct investment; way to finance the realization of a venture project where the investor does not join the capital of the company but rather contributes resources for its development through debt obligations with the simultaneous acquisition of the option with the right to purchase stocks of the borrower in the future at a pre-determined price. Accordingly, the financier acts both as a lender and investor (shareholder) in the mezzanine financing. The instruments of mezzanine financing are: subordinated debt obligations, preferred stocks, warrants, special zero-coupon bonds (PIKs – payment in kind) [9].

Mezzanine lending is an unsecured financial product that does not require liens on liquid assets. With a weaker security than that of a bank loan, the mezzanine debt for investors is accompanied by an increased rate of return. On the other hand, the collateral mediates the fact that the required rate of return for the mezzanine investor is lower than the yield expected by private equity funds for their investments. The lender who has granted a mezzanine loan assumes the part of the shareholder risks, but can receive big profit due to the freedom to decide whether to realize the acquired option or not until last [19].

The target yield of mezzanine financing is 25-35% per annum and is composed of two parts:

- Current interest payments on mezzanine loan; the rate corresponds to the market rate or below, depending on the deal;
- revenues from the sale of the share in the company (participation in the growth of the company's value, which can be structured through the options and warrants).

The strategy of exit from the mezzanine deal can be realized through: the sale of a stake to a strategic investor; the sale of a stake to a private equity fund; arranging the IPO (the first public sale of shares of a joint-stock company); distribution of dividends; execution of the put/call option.

At the moment, the mezzanine financing is implemented in the following versions:

- Mezzanine loan is usually unsecured in the US and subordinated in Western Europe. Subordination means that the lender is provided the right to subsequent retention or pledge of the property with the conclusion of interloan agreements. The "structural subordination" is also possible, in which the senior lenders enter into loan agreements with the companies holding the assets secured by the assets themselves or guarantee from such companies, while the mezzanine lender provides to the borrower’s holding company a loan secured by the stocks of companies that hold real assets;

- financing with registration of "non-public" participation of the investor who acquires a stake in the borrower's company but does not assume any liability to the creditors of the company;
- financing secured by the issuance of convertible bonds providing for fixed payments of interest and repayment of principal at the end of the financing term while enabling the investor to acquire stocks of the borrowing company at a predetermined conversion price instead of the return of principal;
- financing secured by the issuance of preferred shares of the borrowing company that provide preferential rights to participate in the profits and liquidation value in comparison with the holders of other shares of the company [14].

Thus, a mezzanine loan must be distinguished from mezzanine financing. The term "mezzanine financing" is broader and also includes financial instruments (stocks, bonds, options, etc.) used in the securities market. In addition, the mezzanine financing differs from project financing. Repayments within the project financing is made with the funds generated by the project, while within mezzanine financing it is made with the proceeds from the sale of assets or stocks of the company, which is the object of investment. Finally, the borrowed funds for the projects are raised through the open market or through a loan from a pool of lenders; mezzanine financing is only made through the financial instruments placed directly following the results of negotiations between the investor and the borrower in private using the buy-and-hold strategy [18].

Mezzanine financing may also take a form of bridge financing, a type of short-term lending that allows the enterprise to quickly and reliably obtain the necessary amount of funds for a perspective deal without suspending its operations or a project. Bridge loans are offered by the established syndicate of investors who financed the company at the previous stages.

The main feature of bridge financing is that it is directly connected to the future issue of securities and limited in period by a placement date, i.e. the loan is repaid when the company receives funds from the public deal. Bridge financing is often made in the form of convertible debt notes, using which the company can achieve the next stage of long-term financing. The interest rate on the notes usually accumulates and is paid when they are redeemed. The parties make a preliminary agreement (Term Sheet) prior to the bridge financing campaign. The document stipulates the basic arrangements between the company management and the lenders, including on the terms of the conversion of the bridge notes in the company's shares. The notes are converted into shares either automatically (upon the occurrence of a certain event) or at the request of the holders with an additional fee and a discount on the price. Investors can optionally convert the debt notes into "future" stocks, the issuance of which is expected in the next round of funding [20].

In 2012, JSC "Megafon" has raised a bridge loan of $2 bln from a syndicate of non-resident banks: Citibank N.A, BNP Paribas Bank, Barclays Bank PLC. The loan was provided for 6 months with the option of extension for another 6 months. The borrowed funds were provided in tranches within 1-3 months from the date of conclusion of the agreement. The purpose of the loan was buyback of 25% of the own shares from Russian holding Altimo, part of "Alfa Group"[15].

In 2013, the size of the bridge loan raised by NK "Rosneft" to buy 50% of TNK-BP amounted to $11.88 bln. A group of banks including Bank of America, Merrill Lynch,

Barclays Bank and BNP Paribas were lenders and arrangers of the loan. Share of one bank in the bridge loan is about $720 mln. Both of the above-noted companies have used the proceeds from the placement of bonds to repay the bridge loan [1].

The interest rate is mediated by the short term of lending, low volume of financing and risks undertaken by the investor. In Russia, the cost of raising capital for two months at 70% per annum will be about 11.6% and may be covered by growth in the value of real estate sold [2].

In this case, the cost of bridge financing in the volume of all the costs will not affect the financial stability and the financial performance of the project. On the contrary, the funds raised will help cover the needs in initial investment, carry out obligations to contractors on time and meet the deadlines of the project.

In world practice, Kohlberg Kravis Roberts (KKR) in the merger with Del Monte Foods decided to issue 119 bonds of the new enterprise to raise investments in 2010. To realize the plan, the company took advantage of the bridge loan totaling $1.6 bln, paying 8.75% in 60 days after the issue and the rest within a year. In addition, loan notes may be converted into bonds with 11.75% coupon [16].

An example of a fixed-term bridge financing is 7 bln euros approved by creditors and received by Greece in 2015, which almost immediately left the country to repay the expiring loan from European Central Bank (3.5 bln euros), as well as arrears to the International Monetary Fund totaling 2 bln euros. The remainder of funds was to finance current government spending before negotiations on a new three-year loan program in the amount of about 86 bln euros [6].

The use of mezzanine financing in the state support programs abroad was noted (see Table 1).

Tab. 1: Use of mezzanine financing in the state support programs abroad

Country/development institute	Description of the programs used	Annual volume
Germany/German State Bank KfW (Germany's federal government owns 80% of shares, Germany's federal states own 20% of KfW)	ERP-Innovations program: unsecured loans for R&D up to 5 mln euros and for the implementation up to 2.5 mln euros (term is up to 10 years). "Entrepreneur's capital" program: the division of a refinanced loan into "senior tranche" (risk is born by a partner bank) and "subordinated tranche" (100% of risk is born by KfW)	800 mln euros
France/OSEO (Agency for support of small and medium enterprises of innovation businesses)	"Contrat de Developepment Participatiff" program: a loan for "intangible" expenses, acquisition of shares in companies, IT expenses, staff training, marketing. The key component is a seven-year subordinated loan with a two-year grace period of up to 3 mln euros	930 mln euros
USA/SBA (Small Business Administration, the US government agency that provides support to entrepreneurs and small businesses)	Small Business Investment Companies: investment companies set up with the SBA support (through the issuance of debt securities, SBA offers $2-3 for the "senior" tranche per $1 of investment in the "junior" tranche from private investors). Instruments are subordinated loans + PIK (Deferred interest – PIK – Pay-In-Kind) and warrants. Recipients of support include Apple Computers, FedEx	1.9 bln dollars
Canada/ Development Bank of Canada (the bank is fully owned by the government of Canada)	Subordinated loans for a period of 3 to 7 years up to 10 mln Canadian dollars + additional instruments (revenue share, % from the increase in the company value, etc.). The main focus is medium-sized companies with strong growth rates and good market positions	500 mln dollars

Source: [13,3,12,22]

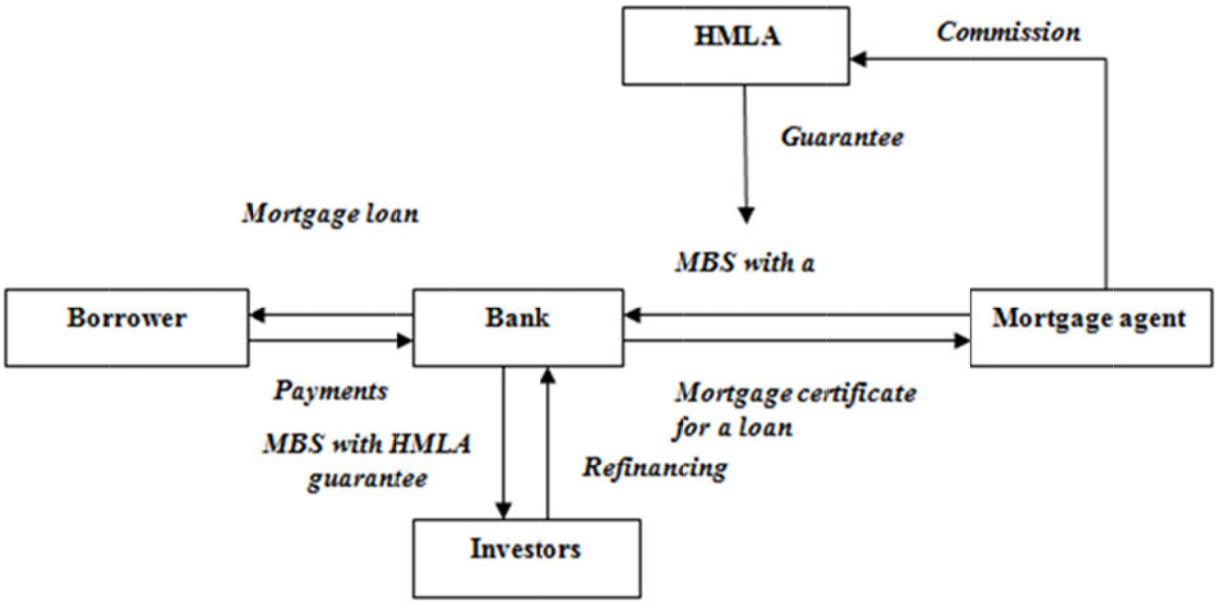
In order to reduce the cost of housing for builders and consumers and development of the rental housing market in Russia, the Unified Development Institute in the housing sector represented by the Housing Mortgage Lending Agency (HMLA) is going to take the following measures as part of the Development Strategy for 2015-2020:

- Issuance of infrastructure bonds secured by a flow of lease payments and their sale to market investors through the Special Project Financing Companies (SPFC) (start in 2016-2018);
- issuance of mortgage-backed securities (MBS) secured by obligations of the lessor on security of the built rental housing;

- introduction of a new effective mortgage loan refinancing tool – "MBS factory" (Figure 1). "MBS factory" provides the following mechanism: the bank issues loans to borrowers and transfers mortgage certificates to a mortgage agent who expeditiously releases and registers single-tranche MBS in the Bank of Russia after receiving HMLA guarantees. The bank may keep MBS received from the mortgage agent on the balance sheet or sell them to foreign investors, thus receiving refinancing. Advantages of the "MBS factory" are: affordable funding of banks in the sufficient target volume for mortgage lending; reduction in a mortgage rate thanks to reduction in the reserves of originator's banks, simplification and reduction in the cost of loan refinancing procedures; standardization of MBS, their approach to the level of risk on federal loan bonds (FLB). From September 2009 to November 1, 2015, 22 guarantees for a total amount of 101.2 bln rubles have been granted under the program of provision of guarantees on mortgage securities of third parties.

In 2014, Housing Finance Bank with the support of HMLA and VTB Capital has completed a series of transactions totaling 2.4 bln rubles for the securitization of part of its mortgage portfolio. Three tranches ("A", "B" and "C") of mortgage bonds totaling 1,179,109 thous. rubles were placed within the first transaction. The amount of tranche "A" amounted to 1,002,243 thous. rubles (coupon rate is 9.5%). The amount of tranche "B" (mezzanine tranche) totaled 58,955 thous. rubles; the amount of junior tranche "C" totaled 117,911 thous. rubles. The maturity date of the issue is 28.02.2046. Three tranches ("A", "B" and "C") of mortgage bonds totaling 1,218,107 thous. rubles were placed within the second transaction. The amount of tranche "A" totaled 1,035,391 thous. rubles (coupon rate is 9.25%). The amount of tranche "B" (mezzanine tranche) totaled 60,905 thous. rubles; the amount of tranche "C" totaled 121,811 thous. rubles. The maturity date of the issue is 28.07.2044.

Fig. 1: Innovative mechanism of MBS issue ("MBS factory")



Source: [4]

While issuing the senior tranche that floats the market, the bank reserves the junior tranche as a credit support in order to be able to undertake first risks in the pool of mortgage loans and thus ensure a high ranking for the senior tranche. The greater the amount of the

junior tranche is, the less profitable the securitization transactions for banks are. HMLA has decided to buy back the middle between the junior and senior tranches – a mezzanine tranche – in order to reduce the required amount of credit support. The mezzanine tranche accumulates not so much the credit risks of the pool as the risks associated with the legal protection of the mortgage and mortgage-backed securities market functioning, as well as the existing infrastructure [11].

When studying the areas of common interest of the state support mechanism, practice of international cooperation, and mezzanine financing, we should note the establishment of a platform in 2015 by Russian Direct Investment Fund (RDIF), Russian-Chinese Investment Fund (RCIF) and China Construction Bank (CCB), which will allow to increase lending to Russian and Chinese companies from Chinese banks. The potential volume funding amounts to $20-25 bln. This entails not direct loan guarantees but rather deal co-financing mechanism: the fund will participate in the financing of the company that receives a loan from the Chinese investor (mezzanine financing). At that, the company subject to investment issues two tranches of financial instruments with varying degrees of reliability: the first tranche is more reliable, the second is less reliable; the first tranche holders bear reduced risks, the second tranche holders get a higher rate for the greater risks. The potential funding volume amounts to $20-25 bln [5].

3 Own findings

Mezzanine financing has advantages for both parties to the transaction. For investor, debentures represent a priority in the bidding line, while an option allows the recipient of funds to pay the lender in a convenient form in the future. In addition, the mezzanine financing allows to avoid blurring of the charter capital, as most of the lender's compensation comes from interest payments, and the company often has the right to buy back the shares issued in favor of the mezzanine investor [24].

The use of mezzanine financing may allow to optimize the conditions for concurrent obtaining a bank loan for a specific project. This is due to the credibility and professionalism of mezzanine investors, which increases the reliability of the project in the eyes of the lending bank. Risk reduction is also achieved due to avoiding dependence on a single lender [23].

A key advantage over other instruments is that mezzanine financing allows many variations of the transaction structure. This allows to use mezzanine in virtually all types of transactions, including: working capital financing; business expansion/capital investments; lombard financing; leveraged buyouts (LBO); merger of two companies; buyout of the company together with the direct investment fund; manager buyout (MBO); buyout by one of the owners; owner’s partial cash out; investment project for companies using the light taxation system (Table 2).

Tab. 2: Options for the development of business and the use of various sources of funding

Type of transaction	Source of funding		
	Bank loan	Mezzanine financing	Direct investment
Working capital financing	+	+	
Business expansion / Capital investments	+ (only on security of assets)	+	+
Lombard financing	+	+	
Leveraged buyout		+	+
Merger of two companies		+	+
Buyout of the company together with the direct investment fund			
Manager buyout		+	
Buyout by one of the owners		+	+
Owner's partial cash out		+	+
Investment project for companies using the light taxation system		+	+

Source: [17].

Hedge funds, pension funds, private equity funds, insurance companies and banks with the relevant departments usually act as mezzanine investors. In Europe, mezzanine capital is provided by banks and specialized independent "investment boutiques." In the US, the main participants in this market are historically the insurance companies, pension funds and trust funds.

In Sberbank's corporate and investment unit (Sberbank CIB), Sberbank Merchant Banking (MB) operates – a structural unit realizing its own investment aimed at further development of the largest enterprises in various sectors of the economy, the bank's clients. At that, MB identifies the following perspective areas: consumer goods, medicine and pharmaceuticals, financial services and retail. MB provides capital to finance projects such as organic growth, mergers/acquisitions (M&A), financial restructuring, and participates in the deals on consolidation of assets in separate fragmented sectors of the Russian economy.

The activities of the specialized mezzanine financing funds in Russia should be noted, in particular:

- Hi Capital: 18 projects have been financed totaling more than $1 bln with a target yield of 20-25% (IRR);
- Mezzanine Financing Fund (MFF), the company selection parameters: ratio of Debt/EBITDA < 5X; share of government contracts in the company's portfolio no more than 15%; turnover of the company at least 300 mln rubles; availability of a unique sales proposition and established development strategy; investment payback period 3-5 years; size of transactions 100-1,000 mln rubles; profitability of the project at least 30% IRR [17].

- FIRST ICG: investment consulting group in the area of fundraising, debt restructuring, investment planning, M&A and consulting in the field of corporate finance;
- Volga River Growth: target capital size is $300 mln. Investors of the Fund are both Russian and foreign individuals and institutional investors, including EBRD. The target size of financing is $10-50 mln. Investment term is up to 5 years. 3 transactions are in the active phase. Features of investment policy and the parameters of the transaction of the Fund are shown in Figure 2.

Fig. 2: Features of investment policy and parameters of mezzanine transactions of Volga River Growth Fund

Investment policy

Focus on fast-growing medium-sized companies	• Revenue > $30 mln • Growth in revenue > 15% per year • Positive cash flow • Relatively low debt level (debt/EBITDA≤4)
Financing of the organic growth and M&A	• LBO, MBO • Working capital • Debt refunding
No sectoral focus	• Countercyclical sectors (fast food, discounters) • Non-cyclical sectors (food) • Export-oriented sectors (petrochemicals) • Import substitution (agriculture, pharmaceuticals)

Parameters of transactions

Structure	• Hybrid investment (debt + investment bonus) • Investment term: 18-48 months • Amount of investment: $10-50 mln.
Security	• Deposit of shares of the holding company • Personal guarantees of the owners
Target yield	• Current yield of 10% + rate of mezzanine debt • Investment bonus increases the yield to 25%

Source: Authors

In addition, foreign mezzanine funds have participated in the activities of Russian entities in the market of financial capital. For example, a microfinance institution (MFI) "Center for Financial Support" LLC (Viva Money brand) raised external funding from the British fund Izurium Capital in the amount of $10 mln in early 2014. The company provides Russian citizens access to microlending and other financial services, especially in small towns, where such services are most in demand [8]. The funds obtained through mezzanine financing were additional funding source for the MFI and were aimed at increasing the portfolio and expansion of the branch network within the geographic expansion [25].

4 Discussion

The mezzanine funds abroad do not actively participate in the management of the assets of the funded companies and originally agree with the strategy, personnel and operating decisions of the shareholders. In Russia, one of the requirements for control is a seat in the board of directors. However, the interest of the mezzanine investor is focused not on earnings from the maximum rise in price of shares of the investment object, but rather on receiving the expected return on mezzanine investments.

There is another difference between venture capital funds and mezzanine funds. Most venture capital funds employ personnel with experience in the field of high technologies. In contrast, mezzanine funds tend to employ finance professionals who know how to conduct negotiations on the participation in the capital as part of mezzanine financing transactions.

Mezzanine financing is used by the companies which:

- do not count on project financing due to lack of own funds and have exhausted the possibilities of raising bank loans [7];
- hope to raise long-term money (up to 5 years), while enjoying stable cash flows or a significant amount of capital.

Builders usually resort to mezzanine loans in financing of real estate in order to provide additional funding for construction. Mezzanine loans of this kind are provided on security of not the building object of real estate, but rather the shares of the holding company of the builder [10].

An example of the use of mezzanine financing for business expansion is announcement of Softline, a global provider of IT solutions and services, about fundraising from "Sovcombank" in the form of a mezzanine loan for 4 bln rubles. Softline will invest it in the uptake of IT companies in Russia, CIS countries, Latin America and Southeast Asia. The funds raised will allow Softline to implement a global strategy – to become the largest player by the scale of business in target markets thanks to a unique set of assets, and to carry out an initial public offering (IPO) [21].

Conclusion

The advantages of mezzanine financing for the borrower can’t be ignored thanks to the possibility to postpone the payment of a substantial part of the investor's revenue until the full repayment of the mezzanine debt and to deduct the cost of raising and maintaining mezzanine financing from the taxable profits of the borrower with proper structuring of the transaction.

However, mezzanine financing also has negative features:

- High cost and complexity of arrangement compared to bank financing because of higher interest rates and individual structuring of each transaction;
- strict requirements to the management team, transparency and accountability of the borrower;
- limited possibility of early exit of the investor, particularly in the case of financing small and medium-sized enterprises without debt securitization [14].

The current Russian legislation makes loan subordination impossible, which mediates the need to use a foreign special-purpose vehicle (SPV), which receives the main and mezzanine financing and then provides a loan to the Russian company. SPV is usually established in the country of Anglo-American law. The investor acquires shares of such SPV at par value. In this case, the bank can issue the loan either to the SPV or directly to the Russian operating or subholding company. Options and shareholder agreements in respect of the SPV are subject to English law, which allows to securely formalize and implement approaches to arranging mezzanine transactions that have been used in the West for decades but are unattainable under the Russian legal system.

The existing mechanism of securitization in mortgage housing lending also has disadvantages. The instrument is inconvenient for banks and investors due to its lack of liquidity and regulatory benefits and the long duration of the MBS issuance process. Many issues of such securities are "technical" in nature and are used as collateral for repo (repurchase agreement) with the Bank of Russia [4]. Finally, the reasons hampering the development of this financial instrument include lack of information about the service and unwillingness of many banks to develop this instrument because of its high risks.

References

[1] BASIC INDICATORS OF PRODUCTION AND FINANCIAL ACTIVITIES OF OJSC "NK "ROSNEFT" iIN 2014. [cit. 2016-03-17]. Available from WWW: <http://www.rosneft.ru/docs/report/2014/2014/indices.html>.

[2] BUILDER'S BRIDGE FINANCING. [cit. 2016-03-16]. Available from WWW: <http://sig-company.ru/services/investments/bridg_zastroychik.html>.

[3] DE RUIJTER KORVER M., ONGENA S. European mezzanine. *Applied Financial Economics,* 2008, vol. 18, 20: 613-622.

[4] DEVELOPMENT STRATEGY OF THE CONSOLIDATED DEVELOPMENT INSTITUTE IN THE HOUSING SECTOR – JOINT STOCK COMPANY "AGENCY FOR HOUSING MORTGAGE LENDING" for the period of 2015 – 2020. [cit. 2016-03-16]. Available from WWW: <http://www.ahml.ru/common/img/uploaded/files/agency/Strategiya_AIZHK_2015_2020_2015_10_29prn.pdf>.

[5] DMITRIEV K. Chinese capital is ready to move to Russia, 2015. [cit. 2016-03-16]. Available from WWW: <http://www.km.ru/economics/2015/05/14/ekonomika-i-finansy/758739-kirill-dmitriev-rfpi-kitaiskii-kapital-gotov-nachat->.

[6] EUROGROUP APPROVED THE BRIDGE LOAN OF 7 BILLION EUROS TO GREECE. [cit. 2016-03-16]. Available from WWW: <http://www.interfax.ru/business/454121>.

[7] EZANGINA I. A., SHAKHBAZYAN E. M. Microfinance institutions in Russia: experience of the past, present, and future prospects. *Economics and Entrepreneurship,* 2015, 4-1(57-1), pp: 854-859.

[8] EZANGINA I. A. Project management as a tool for the efficient organization of intercompany networks. *Urgent Problems of the Human and Natural Sciences,* 2012, 5, pp: 94-99.

[9] FEDOROV S. A., MERORIO-PELLICER L. B. Mezzanine financing as one of the options to prepare to quit the investment process. *Oil, Gas and Business,* 2012, 8, pp: 33-36.

[10] FINANCIAL ALTERNATIVE OR WHICH FINANCING METHOD TO CHOOSE: QUICK ROUND OF QUESTIONS. [cit. 2016-03-16]. Available from WWW: <http://www.rusbonds.ru/snwsinf.asp?id=778085>.

[11] HOUSING FINANCE BANK WITH THE SUPPORT OF HMLA HAS SUCCESSFULLY COMPLETED A SERIES OF TRANSACTIONS FOR THE SECURITIZATION OF ITS MARTGAGE PORTFOLIO. [cit. 2016-03-16]. Available from WWW: <http://www.ahml.ru/ru/press/PR/index.php?id4=5200>.

[12] JEON S. H. Mezzanine financing in US real estate and Korean institutional investors. Massachusetts: Massachusetts Institute of Technology. Center for Real Estate. Program in Real Estate Development, 2015.

[13] LOOKING FOR REIABLE "SUPPORT": FINANCIAL INSTRUMENTS FOR GROWING COMPANIES. [cit. 2016-03-16]. Available from WWW: <http://icgfirst.ru/includes/4.pdf>.

[14] LURIE V., MELIKHOV E. Mezzanine financing: international experience and Russian practice, 2013. [cit. 2016-03-18]. Available from WWW: <http://terraexterna.com/node/23>.

[15] MEGAFONE HAS RAISED A BRIDGE LOAN FOR $2 BILLION FROM CITI, BNP PARIBAS AND BARCLAYS. [cit. 2016-03-17]. Available from WWW: <http://www.forbes.ru/news/81207-megafon-privlek-bridzh-kredit-na-2-mlrd-u-citi -bnp-paribas-i-barclays>.

[16] MERGERS AND ACQUISITIONS IN RUSSIA. [cit. 2016-03-16]. Available from WWW: <http://mergers.ru/companies/Kohlberg-Kravis-Roberts-KKR>.

[17] MEZZANINE FINANCING FUND. [cit. 2016-03-16]. Available from WWW: <http://maksimdygai.github.io/fmf/more.html>.

[18] PETRIKOVA E. M. Mezzanine loan as an alternative to project financing of investment projects. *Finance and credit,* 2013, 28(556), pp: 39-47.

[19] PRAT M., CROWE A. Mezzanine finance. *Bank of England Quarterly Bulletin,* 1995, November, pp: 370-374.

[20] RUSSIAN BANKERS' ASSOCOATION: BRIDGE FINANCING. [cit. 2016-03-19]. Available from WWW: <http://arb.ru/b2c/dictionary/bridzh-finansirovanie-423428/>.

[21] SOFTLINE HAS GOT MEZZANINE FINANCING FOR 4 BILLION RUBLES FROM "SOVCOMBANK". [cit. 2016-03-16]. Available from WWW: <http://softline.ru/news/23131>.

[22] STAMM H. Mezzanine financing for German SMEs. *Butterworths Journal of International Banking and Financial Law,* 2007, vol. 22, 3: 164-165.

[23] TETREVOVA L. Mezzanine finance and corporate restructuring. Scientific papers of the University of Pardubice. *Series D, Faculty of Economics and Administration,* 2009, 14, pp: 256-263.

[24] VASILESCU L. G., POPA A. Mezzanine Finance - an Alternative for the Firms´ Financing. Proceedings of the International conference: Competitiveness and Stability in the Knowledge-Based Economy. Craiova: University of Craiova, 2006, pp: 424-432.

[25] VIVA MONEY HAS RAISED BRITISH FUND FINANCING OF $10 MILLION. [cit. 2016-03-16]. Available from WWW: <http://vivadengi.ru/news/viva-dengi-privlekla-finansirovanie-britanskogo-fonda-na-10-mln-doll/>.

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Received: 06. 04. 2016
Reviewed: 16. 05. 2016, 23. 05. 2016
Approved for publication: 08. 09. 2016

ENTERPRISE SOCIAL NETWORKS AS A MEETING TOOL IN THE CZECH REPUBLIC

Jana Školudová

Abstract: *Meetings are an essential prerequisite for successfully communicating and transferring internal information. The question is whether or not businesses in the present day are organizing and leading meetings effectively. The goal of this paper is to conduct a comparison of the requirements for effective meeting leadership with the current state of businesses in the Czech Republic. Furthermore, the paper aims to answer a research question relating to the feasibility of using enterprise social networks for conducting company meetings. The goal of the survey research was to map the current state of the investigated problematic and its trends. The paper's methodology is based on managed interviews conducted in 2014. An overall comparison of the data that was acquired shows the current trends and points to a discrepancy between the requirements for conducting meetings and reality. The results indicate the possible use of modern technologies for more effectively conducting meetings within businesses in the form of enterprise social networks. The paper discusses the use of the latest trends and innovations concerning technologies that help managers effectively transfer internal information; it also outlines a concept for further research directions. The paper attempts to emphasize the fact that it is necessary to pay attention to modern technologies and embrace new, sophisticated tools for ensuring effective meeting leadership.*

Keywords: *Management, Information Technology, Human Resource Management, Enterprise Social Network, Meeting, Organization.*

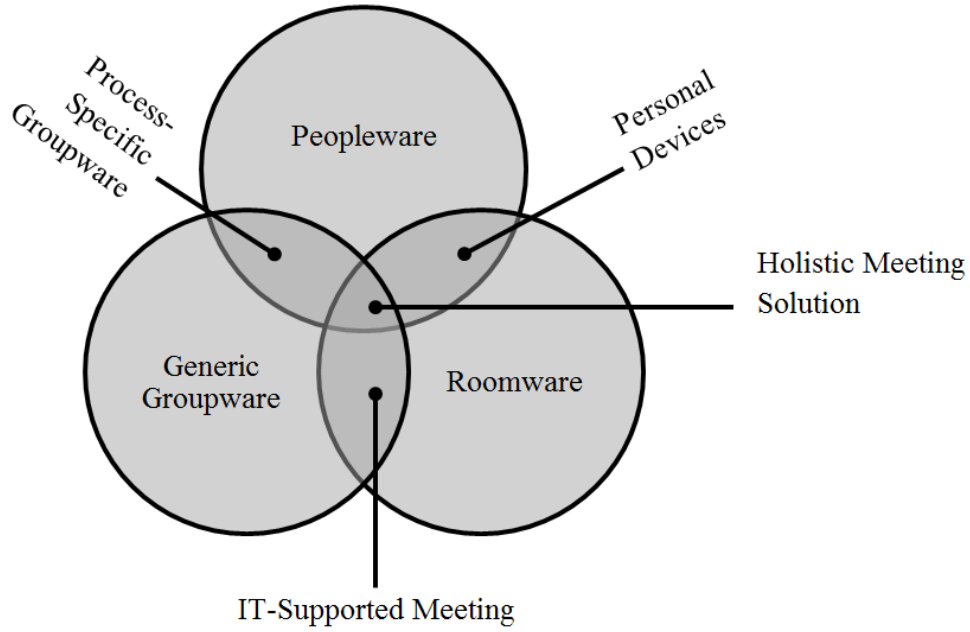
JEL Classification: *M12, M15, M19.*

Introduction

Meetings are an important form of interaction in business environment [19]. Working meetings are one of the basic tools of corporate management at all levels of management. Working meetings performs two basic functions. The first is a meeting of staff for communication, coordination and cooperation in solving specific tasks, projects and other business activities. Another function is the method of training of workers in the workplace, if at a meeting one or more workers to educate others. [9] Meeting effectiveness describes the extent to which meetings help achieve the goals of the meeting attendees (i.e. employees) and the organization [18]. Nixon and Littlepage found that good meeting procedures (i.e. promoting open communication, task-oriented focus, systematic approach, and timeliness) were related to meeting effectiveness [16]. Meeting effectiveness is determined by meeting characteristics that are set up or occur prior to the meeting and during the meeting itself [1].

Fig. 1 shows different dimensions that have to be considered when designing meeting support. It is important to note that the different dimensions overlap. This paper focuses on IT support during the working meetings.

Fig. 1: Dimension of working meetings



Source: Adjusted by [1]

Meetings are often not held in a way that makes all participants feel engaged. Meeting support systems try to overcome this barrier by helping meeting participants in the meeting workflow. [19] Based on technologies, there are some systems for meeting scheduling for arranging meetings, some with more attention to user preferences [2], [6]. Development of technology and the ability of organizations to recognize trends, new business opportunities, become the determining factor of competitiveness [7]. Search sophisticated technologies are a key factor for efficient internal communication in all organizations. One possible technology offers Enterprise Social Networks, using this tool, users can quickly connect anywhere in the world [10].

New approaches emphasize the role and quality of the human factor, an example communication skills, decision making and innovative thinking. We can follow the research trend emphasizing endogenous approach. [15] The company PwC conducted international research that interviewed 1344 general directors from 68 countries. The research results reflect trends influencing business conduct not only right now but also in the next three years; this is due to the growth of the global economy. Technological progress, demographic changes and advancement in the economic strength of individual countries are three main factors that influence business conduct. In particular, these are the digital economy, social media, mobile devices and big data. [17] Providers of enterprise social networking provide many benefits for the organization [4], [23], or [8]. Therefore, the paper also deals with the research topic described below. Working meetings and internal social networks were chosen from among the primary aspect of human resource management and aspect of IT management.

1 Statement of a problem

The goal of this paper is to conduct a comparison of the requirements for effective meeting leadership with the current state of businesses in the Czech Republic. Furthermore, the paper aims to answer a research question relating to the feasibility of using enterprise social networks for conducting company meetings.

2 Methods

The paper's methodology of the primary research uses the basis of guided interviews conducted from October to December of 2014. Methodology of the secondary research was based on questionnaire survey, of 2015, in the months of January-February.

2.1 The primary research methodology

The paper's methodology uses the basis of guided interviews conducted from October to December of 2014. The basic sample for interviewing included all top and line managers, predominantly HR managers. Non-probability quota sampling was used for determining the respondent sample [5], [22].

Companies were selected on the basis of predetermined criteria and determination by secondary analysis. The following criteria were established:

- Legal entity;
- number of employees greater than 50 – to increase the validity of the data in the research investigation;
- all areas of the Czech Republic;
- actively engaged in business.

2.2 The secondary research methodology

Subsequently it was conducted further research and tested the chosen research question. Methodology of research was based on questionnaire survey, of 2015, in the months of January-February. The questionnaire was prepared in an online form using Google Forms. Online link for completing the questionnaire was sent by e mail form, incl. cover letter.

Sampling of respondents was determined by the following criteria:

- Legal entity;
- all sectors according to CZ NACE;
- all areas of the Czech Republic;
- actively engaged in business.

3 Problem solving

Empirical generalization and interpretation of the determined results was conducted on the basis of the research results.

3.1 The results of the primary research

Tab. 1 depicts the so-called hard data that was acquired, which represents the numbers in percentages of the data listed by the respondents. The most common types of legal business entities for the respondent sample were the private limited company and the joint-stock company. The largest number of organizations fell into the 50-250 employee range with the 1001-5000 employees range following. The highest number of respondents was listed pure line or line and staff organizations; next ensued divisional and matrix structures.

Tab. 1: Hard Data

Organization Size		**Organization Structure**	
50 - 250	59 %	Pure Line	27 %
251 - 500	6 %	Staff	8 %
501 - 1000	12 %	Line and Staff	27 %
1001 - 5000	18 %	Divisional	12 %
More than 50000	4 %	Line – Functional	12 %
		Matrix	14 %

Source: Own calculation

Tab. 2 shows the form of working meetings with comparison need for communication and share documents online. According to the answers of respondents working meetings are held in oral form, which does not coincide with the need to communicate and share business documents online. The overall comparison of acquired data presents the current trend and points out the contradiction between the requirements for the organization of working meetings, including document sharing and reality.

Tab. 2: Type of working meetings vs. the need to communicate and share documents online

Type of working meetings		**The need to communicate online**		**The need to share documents online**	
Oral	87 %	No	36 %	No	14 %
Online	13 %	Yes	64 %	Yes	86 %

Source: Own calculation

3.2 The results of the secondary research

Secondary research follows on primary research. The minimum number of respondents was set at 272, according to the above formula (1). Calculating of the minimum number of respondents is as follows [13]:

$$n \geq (z^2 \text{ x } p \text{ x } q)/\Delta^2 \qquad (1)$$

where: n denotes the minimum number of respondents; z denotes reliability coefficient; p and q denotes percentage of respondents knowledgeable and ignorant of the issue; Δ denotes the maximum permissible error.

Return of questionnaires in absolute terms amounted to 842, which is sufficient due to the calculated minimum number of respondents (272).

Research question is as follows: Implementation of enterprise social networks does not affect the effectiveness of working meetings.

For statistical evaluation was used program STATISTICA. The reference constant was determined 3 (no change). The level of significance of the test was determined $\alpha = 0.05$. Results were calculated by t-test, based on the composition of the data matrix, the selected test, defined variables and constants reference. The following Tab. 3 comprehensively represents the results of the test performed.

Tab. 3: T-test result in STATISTICA

Variable	Test averages against the reference constant (value)							
	Average	**St.dev.**	**N**	**St.er.**	**Constant reference**	**T**	**SV**	**p**
x_1	**3.990385**	0.794339	104	0.077891	**3.000000**	12.71495	103	**0.000000**

Source: Own calculation

Tab. 3 shows that p value was less than the significance level α and the average value of the variable x_1 is greater than the reference constant. We admit that the implementation of enterprise social networks positively affect the efficiency of the working meetings.

4 Discussion

Mainly companies with a large number of employees engaged in internal communications systematically. It is interesting to observe the different approaches of enterprises to internal communication. [11] Human resource management must create conditions for increasing an organization's intellectual capital and a positive climate within the organization. It is appropriate that the organization have a thorough strategy for developing internal communication. [12] In recent years, information technology has had a great influence on human resource management [21]. This technological development allows companies to use modern tools to manage internal communications including the effective working meetings.

It is important to allow personal and technical connections at the meeting, i.e., technical devices that people bring to a meeting, such as smart phones or networked PDAs. The underlying goal is to reflect these contexts in computer systems for meeting support. An analysis of current meeting support systems shows that there is still space for improvement when considering all design perspectives simultaneously. [19]

Enterprise social networks can offer a variety of benefits to modern business management. The results of the research questions and conducted by T-test show that the use of enterprise social networking managers can achieve more efficient management meetings. These benefits support many researches, see references [14], [20], or [3]. Significant advantage is the ability to quickly and efficiently prepare documents for corporate meetings. Workers can provide the required topics, key issues relating to the topic of the upcoming business meeting. Can be prepared plan of the content of the working meetings more purposefully, and on the basis of a preliminary discussion with co-workers. Another advantage is the possibility of organizing business meetings online (if the situation requires limited by invitation only) that allows greater availability of the participation of employees and managers across the organization structure throughout the world. After the meeting, it is possible to place the minutes of the meeting on the internal network or share the minutes of the meeting with other workers. Enterprise social network also enables to publish video from the business meeting. Very valuable information is a feedback from employees. Employees can comment on individual, discussed agenda items, time and work schedules, responsibilities of employees, and the overall conduct of meetings. It will be interesting to continue monitoring new IT trends in business management.

Conclusion

Enterprises made up of foreign divisions throughout the world that need together to share information, plan, solve problems, make new strategic decisions. The overall comparison of the research data presents current trends and research results encourage the use a potential management tool for working meetings. Using this modern enterprise's internal software allows comply business requirements and implement working meetings online. Other advantages include the online share, comment and evaluate the working documents in real time across geographic mobility of employees. This meeting support software bridges the gap to the personal and corporate contexts.

In conclusion, it is possible to add that, there are many factors that affect the effective working meetings. One of the factors is knowledge of internal communication, leadership meetings, the purpose of the meetings, participants, place and date of a meeting, IT support, and others factors. The researches presented in this paper add another perspective to working meeting support. Future development of research could be focused on the comparison of online social networks and enterprise social networking.

References

[1] ALLEN, J. A., LEHMANN-WILLENBROCK, N.K., LANDOWSKI, N., Linking pre-meeting communication to meeting effectiveness, In: *Journal of Managerial Psychology*, Vol. 29(8), pp.1064-1081. 2014.

[2] BICHARRA GARCIA, A.C., KUNZ, J., FISCHER, M.: Cutting to the chase: improving meeting effectiveness by focusing on the agenda. In: *Proceedings of the ACM Conference on Computer Supported Cooperative Work*, CSCW'04, Chicago, Illinois, USA, pp. 346–349. New York, NY, 06–10 November 2004.

[3] ČÍŽEK, Jakub. Yammer: vlastní Facebook pro firmy a organizace. *Živě.cz*. [cit. 2016-04-15]. Available at WWW: http://www.zive.cz/bleskovky/yammer-vlastni-facebook-pro-firmy-a-organizace/sc-4-a-155854/default.aspx.

[4] Collaboration Tools. *Yammer*. [cit. 2016-04-15]. Available at WWW: <https://about.yammer.com/product/features.>

[5] GAVORA, P. *Úvod do pedagogického výzkumu*. Brno: Paido, 2010, ISBN 978-80 -7315-185.

[6] HERLEA, T., CLAESSENS, J., DE COCK, D., PRENEEL, B., VANDERWALLE, J.: Secure meeting scheduling with agenda. In: *Steinmetz, R. et al. (eds.) Proceedings of IFIP CMS 2001*, Communications and Multimedia Security Issues of the New Century, May 21, Darmstadt, Germany, pp. 327–338. 2001.

[7] HYNEK, J. *Technické trendy jsou studnou příštích inovací*. Moderní řízení. 2015. Vol. L, NO. 10, p. 15. ISSN 0026-8720.

[8] IBM Connections Content Manager. *IBM – Česká republika*. Copyright IBM Corp. [cit. 2016-04-15]. Dostupné z WWW: <http://www-03.ibm.com/software/products/ cs/connections-content-mgr.>

[9] KAŇÁKOVÁ, E. *Jak efektivně vest porady*. 1th. ed. Praha: Grada Publishing, a. s., 2008. 176 p. ISBN 978-80-247-1625-1.

[10] KAZDOVÁ, A. *Síťování objevuje skryté talenty a inovace*. Moderní řízení. 2015. Vol. L, NO. 6, p. 26. ISSN 0026-8720.

[11] KEJHOVÁ, H. *Jak se poučit z nešvarů interní komunikace*. Moderní řízení. 2015. Vol. L, NO. 10, n. 40. ISSN 0026-8720.

[12] KEMP, J. M., PATÁKOVÁ, O. *Jak řídit pracovní porady*. Praha: Grada, 1996. 105 s. ISBN 8071693162.

[13] KOZEL, R., MYNÁŘOVÁ, L., SVOBODOVÁ, H. *Moderní metody a techniky marketingového výzkumu*. 1th. ed. Praha: Grada, 2011. 304 p. ISBN 978-80-247-3527-6.

[14] LEONARDI, P.M., HUYSMAN, M., STEINFIELD, CH. Enterprise Social Media: Definition, History, and Prospects for the Study of Social Technologies in Organizations, In: *Journal of Computer-Mediated Communication*, Vol. 19, Iss. 1, pp. 1-19. doi:10.1111/jcc4.12029.

[15] MANDYSOVÁ, I., The Public Policy and the Business Environment. In: *Proceedings of the 18th International conference Current Trends in Public Sector Research*. Masaryk University, Brno 2014, ss. 276-283, ISBN 978-80-210-6611-3, ISSN 2336-1239.

[16] NIXON, C., LITTLEPAGE, G., Impact of meeting procedures on meeting effectiveness, In: *Journal of Business and Psychology*, Vol. 6 No. 3, pp. 361-369. 1992.

[17] PŘIKRYL, J., 2014. *Ředitelé firem jsou už optimističtější*, In: Moderní řízení. Vol. XLIX, NO. 6, p. 30. ISSN 0026-8720.

[18] ROGELBERG, S.G., ALLEN, J.A., SHANOCK, L., SCOTT, C. and SHUFFLER, M. Employee satisfaction with meetings: a contemporary facet of job satisfaction, In: *Human Resource Management*, Vol. 49 No. 2, pp. 149-172. 2010.

[19] SCHÜMMER, T., TANDLER, P., HAAKE, J. The next-generation business meeting: from i-lands to flexible meeting landscapes. In: *Universal Access in the Information Society*, 2012, Vol. 11(3), pp.239-258. 2012.

[20] SOCIALWEB.CZ, Social Business a řízení porad. *Socialweb.cz.* [cit. 2016-04-25]. Available at WWW: <http://www.socialweb.cz/scenare/scenar-social-business-a-rizeni-porad.>

[21] STONE, D. L., DEADRICK, D. L., LUKASZEWSKI, K. M., JOHNSON, R., January 2015. The Influence of Technology on the Future of Human Resource Management. In: *Human Resource Management Review*. doi:10.1016/j.hrmr.2015.01.002.

[22] SURYNEK, A., KOMÁRKOVÁ, R., KAŠPAROVÁ, E., *Metody sociologického a sociálně psychologického výzkumu*. Praha: VŠE, 1999, 119 p. ISBN 80-7079-203-5.

[23] Transformujte svou firmu prostřednictvím sítě Yammer. *Microsoft Česká republika*. [cit. 2016-04-15]. Available at WWW: <http://www.microsoft.com/enterprise/cs-cz/solutions/yammer/default.aspx.>

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Received: 28. 04. 2016
Reviewed: 26. 05. 2016, 06. 06. 2016
Approved for publication: 08. 09. 2016

ALTERNATIVES FOR EVALUATING A COUNTRY'S ECONOMIC DEVELOPMENT

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Abstract: *Although real GDP is considered a key macroeconomic indicator for a nation's economic development, various criticisms of its method of measurement and interpretation have been appearing increasingly more often. In the previous century, Simon Kuznets already expressed certain doubts. There are a number of alternative methods and proposals (or additions) to GDP for assessing the current level of societal development. This paper deals with comparing these alternatives. Attention is also devoted to analyzing empirical data concerning the development of real GDP and the Human Development Index (HDI). Data will be compared for the Czech Republic and the other countries that jointly entered the EU together with the Czech Republic in 2004 (the EU-10). The reason for this double comparison is to judge the development of this group of countries through the lens of the double comparison method. From the analysis we conducted, it follows that a country's economic development judged on the basis of real GDP shows different characteristics than economic development perceived as satisfaction with a fuller quality of human life.*

Keywords: *Economic growth, Quality of life, Gross domestic product, Human Development Index, European Union.*

JEL Classification*: A13, E01.*

Introduction

Actual data from the Czech Statistical Office (CZSO) confirm that, in comparison with other new EU member countries, the Czech economy is growing at a record rate. According to the first estimates (March 2016), the annual real GDP growth rate for 2015 was 4.3%. Thanks to rapid growth, the Czech Republic has reached 86% of the economic average for the EU (measured in purchasing power per capita) and ranks ahead of Cyprus and Malta. It is clear that this information has been very positively accepted by all the domestic economy's economic actors. Gross domestic product (GDP) is commonly considered a key statistical indicator; it an aggregate output measure used by the System of National Accounts to comprehensively describe the state and development of a national economy. As a reminder, this measure is the financial expression of the overall value of goods and services newly created during a given time period in a specific territory [3]. From the methodological perspective, it is possible to definitively state that real GDP is one of the most complicated indicators monitored by current statistics. Moreover, measuring and interpreting this macroeconomic aggregate measure is in fact becoming increasingly more frequently the subject of professional discussion and debate. We will be leaving the methodical limitations and technical complications that relate to determining and demonstrating real GDP outside the scope of this paper. In this regard, we shall start with the fact that the CZSO fully complies with international methodological standards specified by the EU countries, whose basis is currently represented by the European System of Accounts 2010 (ESA 2010). In this paper, our interest turns to critical discussion of GDP's suitability for expressing an economy's development – whether another

(more suitable) indicator or even a whole system of indicators should be used for this purpose.

In the context of the perspective described above, this paper's goal is to discuss certain alternative proposals (or additions) to GDP using qualitative comparative analysis. Next, our attention will focus on comparing empirical data concerning the development of real GDP and the Human Development Index (HDI). Data will be compared for the Czech Republic and the other countries that entered the EU together with the Czech Republic in 2004 (the EU-10). The reason for this double comparison is to judge the economic development of this group of countries through the lens of the double comparison method. Using the results of this qualitative and quantitative analysis, the paper's conclusion discusses selected problems related to the evaluation of a country's economic development and its interpretation using a wider theoretical and practical perspective.

1 Problem Statement

1.1 Critical opinions regarding the GDP

GDP is an indicator that is used to evaluate three empirical conditions: the maturity of an economy, the intensity of its development, and the standard of living of its population. Although these three problems distinctly overlap, they are not equivalent. Therefore, it is not possible to evaluate them using the same number [1]. Certain doubts on the predicative ability of macroeconomic aggregate indicators as a measure of a society's well-being have been recorded as early as the 1930's. It is enough to note that Simon Kuznets, one of the fathers of the System of National Accounts, explicitly warned in 1934 that "the welfare of a nation can scarcely be inferred from a measure of national income" [9]. His prescient warning was unheeded. According to modern critics, real GDP is not only a poor indicator of society's advancement, but it cannot fully account for a society's actual state and does not express anything about the state of the society or the environment. Therefore, the growth of real GDP alone cannot be confused with development as a broader and essentially more socially important concept [12]. Critical opinions agree that the actual growth of a country determined on the basis of GDP is distorted by the fact that official data do not take sufficient consideration of the growth of the quality of goods or the population's quality of or satisfaction with life; the data are not able to describe the influence of negative externalities, the growth of criminality, corruption, or the benefit of nonmarket exchanges for the population. According to [14], GDP does not distinguish which economic processes contribute to the general welfare and does not express anything about the sustainability of development. In the end, pressure for the statistical growth of GDP can then lead to the majority of the people actually being worse off than they were. As stated by Anantha Duraiappah of the United Nations University, who presented a study in 2014 on the limitations of classic GDP measurement in relation to the concept of Beyond GDP, something as simple as a morning bird song can give a wider dimension to economic calculations, because it reveals much about the state of the environment – about pollution levels, climate change, or biodiversity. Even in the future, GDP and other traditional yardsticks will still provide information for understanding economic performance, but the perspective on world development must be balanced. It is necessary to expand it to include the state of the environment and social indicators [5].

1.2 Alternative approaches to estimating economic development

Suggestions for alternative indicators of economic development and methods or proposals for recalculating GDP so that it better expresses "the actual development of economies" are a reaction to the GDP criticism mentioned above. Not only individual experts, but also institutions (e.g., the European Commission working group, the OECD, the World Bank, the UN, etc.) have been intensively involved in searching for alternatives and additions to GDP over the last fifty years. The concept of the Net Economic Welfare (NEW) measure, which is methodically linked to the original GDP alternative (called the Measure of Economic Welfare or MEW), is particularly well known. This was proposed in 1972 by William Nordhaus and James Tobin [11]. NEW modifies the degree of overall national production by adding the value of nonmarket activities, leisure, and the shadow economy – including deductions for negative externalities. Bhutan's index of "Gross National Happiness" – whose idea was presented in the 1970's by Bhutan's king – is another world-renowned alternative to GDP. The purpose of constructing this index was to measure the happiness of the local inhabitants. The index includes data on health, education, the state of the environment, governance, preservation of cultural heritage, use of leisure time, and the population's emotional well being. The Genuine Progress Indicator (GPI) is a methodically composed alternative to GDP that also takes into account losses caused by crime and social inequality, damage to the environment, loss of leisure time, or, conversely, the benefits of volunteer work and housework. The index was originally proposed in 1989 by American scientists from Boston University under the name of the Index of Sustainable Economic Welfare (ISEW) [4]. As presented in [10], [2], three American states (Vermont, Maryland, and Oregon) currently measure their economy according to the GPI on the basis of 26 specific criteria. It can be stated that Czech economists' approach to the problem under discussion is more restrained. For example, [8] believes that the average growth of real domestic demand could be a welfare indicator; however, the problem with this is that growth of real demand can be covered by increasing a deficit in the balance of international trade. Another alternative indicator, which it is the closest one when GDP to being a measure of welfare, is the so-called Gross Domestic Income (GDI), which presents a GDP modified by using revenues (or losses) caused by annual change in terms of trade [8]. It is possible to assume that the most well known and, at the same time, the most accepted alternative to GDP today is the so-called Human Development Index (HDI), which has been in use since 1975. The Pakistani economist Mahbub ul Haq is behind this idea. Amartya Sen proposed the design of the final index [13]. As of 1990, the index has been published in the periodical Human Development Reports, provided by the United Nations Development Programme (UNDP). As of 2008, this index has been published independently of the program and monitors the development of 194 of the world's countries.

1.2.1 The Human Development Index

We assume that, although it is impossible to consider the HDI a comprehensive tool for determining economic development, it the closest when compared with the approaches listed above. Its construction complies with the UNDP's definition of human development, which states that people need to attain three basic conditions in order to expand their opportunities. It is necessary for them to lead a long and healthy life, acquire education, and have access to the means of ensuring a respectable standard of living. Therefore, the index's construction is focused on these three key parts: economic prosperity, which takes into account the measure of gross national income (GNI per capita); the health of the

population; and the population's educational level. In 2010, the HDI accepted significant changes to its methodology. The final HDI value for a specific country in a specific year is reached by multiplying the resulting values of all three dimensions (of the indexes) and then finding their cube root. The actual indicator of all three dimensions of human development, including minimum and maximum values, are listed in the following table (Table 1).

Tab. 1: Construction of the HDI as of 2010

Dimension of Human Development	Indicator	Index	Minimum value	Maximum value
Health	Life expectancy from birth	**Life Expectancy Index**	20 yrs.	85 yrs.
Education	Expected number of years of education from school entrance age	**Education Index**	0 yrs.	18 yrs.
	Average number of years of education in the adult population		0 yrs.	15 yrs.
Standard of Living	Gross National Income per capita (PPP in USD)	**GNI Index**	USD 100	USD 75,000

Source: Authors' own work acc. to [17]

2 Methods

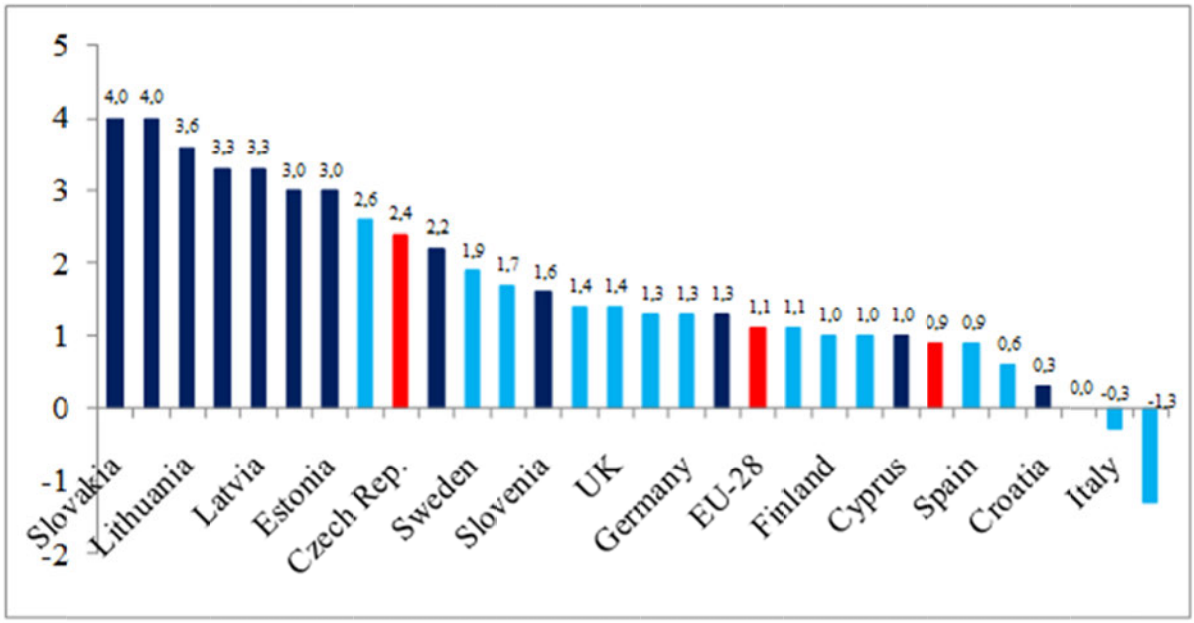
The next section will be approached on the basis of empirical induction. In order to evaluate the economic development of the selected group of countries in the subsequent section, we will use empirical data expressing the real GDP growth rate for the period of 2004–2014. Official statistical databases (CZSO, Eurostat) are used as the source of data. In the next step, a comparison of these countries' economic development will be conducted using the alternative indicator – the HDI. The source of data for the HDI is the official UNDP database [17]. Concerning the previously mentioned change to the HDI's composition method in 2010, this part of the comparison will be conducted in two phases. The results from the comparative analysis will be further discussed and developed into general conclusions.

3 The Economic Development of the EU-10 Countries

In the following graph, we can track the average growth rate of the EU countries' real GDP from 2004 to 2014 (Fig. 1). From EU-10 countries, Slovakia and Poland show the greatest dynamic for the years under investigation, as can be clearly seen in the graph. Both countries identically show a 4% average real GDP growth rate. The next countries are those with an average growth rate greater than 3% (Lithuania, Latvia, and Estonia). In this regard, the Czech Republic has the sixth most dynamic economy among the EU-10 group. Over the ten year average, it has been growing more quickly than Malta, Slovenia, Hungary, and Cyprus. Detailed analysis of the empirical data of individual EU-10 economies shows that, from the perspective of real GDP, a growth trend has been noticeable since 2000, but it was only in 2004 that this signified more pronounced growth for these countries. The high

growth dynamic typical for the EU-10 countries in the early period after EU entry was primarily seen on a wide scale in 2006 and 2007. The real GDP growth rate reached more than 11% in Estonia and Latvia. High growth also accompanied development in Slovakia (10.4%), Lithuania (7.8%), and the Czech Republic (6.9%). However, in 2008, an unpleasant downturn occurred caused by the global financial crisis, and all the post-transformation economies underwent an economic slump together with the more advanced European economies. In the Czech Republic, the steepest drop in real GDP was recorded in 2009, when the real GDP growth rate reached -4.8%. Afterward, slightly revived economies returned in 2010 and 2011. In regard to current development, it seems that the world and European economies have completely recovered.

Fig. 1: The Average Real GDP Growth Rate of EU Countries for 2004–2014 (%)



Source: Authors' own work acc.to [7]

A comparison of the group of countries being investigated from the perspective of the development of the HDI shows somewhat different conclusions. The table (Table 2) summarizes the results of the analysis conducted for 2005. It covers the time period of the first year of these countries' membership in the EU. On the basis of the HDI values that were determined, the table's first column depicts the ranking of countries within the EU-10 and EU-28 groups. Among other things, it is clear from the table that, of the Visegrad 4, the Czech Republic attained the best evaluation. On the whole, these countries achieved better ratings than the Baltic states. The data listed in table form corresponds to the HDI construction method valid up until 2009. In this original method, real GDP per capita (using PPP in USD) was included in the HDI as an indicator of standard of living. The Education Index was composed of two sub-indicators – adult literacy in percentages with a weight of 2/3 and the percentage of children enrolled in primary, secondary, and tertiary education with a weight of 1/3. If we separate the hard indicator (the macroeconomic indicator of GDP) from the HDI and we determine the order of countries accordingly, then there is a noticeable difference when compared to the HDI's ranking. On the basis of soft indicators (the Education Index and the Life Expectancy Index), the reason for lower rankings appears within economic development. Even despite higher GDP per capita scores, countries with lower levels of health or education show a drop in ranking. For example, Cyprus drops on account of having the lowest percentage of children enrolled in school (77.6%), and Estonia falls because of having the lowest life

expectancy (71.2 years). Nonetheless, the opposite situation also occurs and countries that have a relatively low GDP per capita increase their ranking on account of the contribution of solid results from their soft indicators. Poland best demonstrates this situation. It is interesting that the results of the analysis conducted for the following years (2006–2009) did not show any significant changes in the rankings of the groups of countries investigated, and individual countries in the EU-10 group retained their ranking. Estonia was the only exception, with a ranking that gradually grew from 2006 levels to take a higher place.

Tab. 2: GDP of the EU-10 Countries in 2005

EU-10 Ranking (EU-28 Ranking)	Country	HDI	Indicator Values			
			Life Expectancy (yrs.)	GDP per Capita (PPP in USD)	Adult Literacy (%)	Percentage Enrolled in School (%)
1.(15.)	**Slovenia**	**0.917**	77.4	22,273	99.7	94.3
2.(16.)	**Cyprus**	**0.903**	79.0	22,699	96.8	77.6
3.(18.)	**CR**	**0.891**	75.9	20,538	99.0	82.9
4.(19.)	**Malta**	**0.878**	79.1	19,189	87.9	80.9
5.(20.)	**Hungary**	**0.874**	72.9	17,887	99.4	89.3
6.(21.)	**Poland**	**0.870**	75.2	13,847	99.8	87.2
7.(22.)	**Slovakia**	**0.863**	74.2	15,871	99.0	78.3
8.(23.)	**Lithuania**	**0.862**	72.5	14,494	99.6	91.4
9.(24.)	**Estonia**	**0.860**	71.2	15,478	99.8	92.4
10.(25.)	**Latvia**	**0.855**	72.0	13,646	99.7	90.2

Source: Authors' own work acc. to [17]

Part of the new HDI construction method was monitoring the development of the EU-10 group during a period of three years (2010, 2012, 2014). Relating to this, we present the example of the calculation of the HDI for the Czech Republic in 2014 (Table 3). The output data are GNI per capita at USD 26,660 and a 78.6 year life expectancy. For the Education Index, the values of 16.4 years and 12.3 years were used, i.e., expected period of enrollment in school and the actual average number of years enrolled in school, respectively.

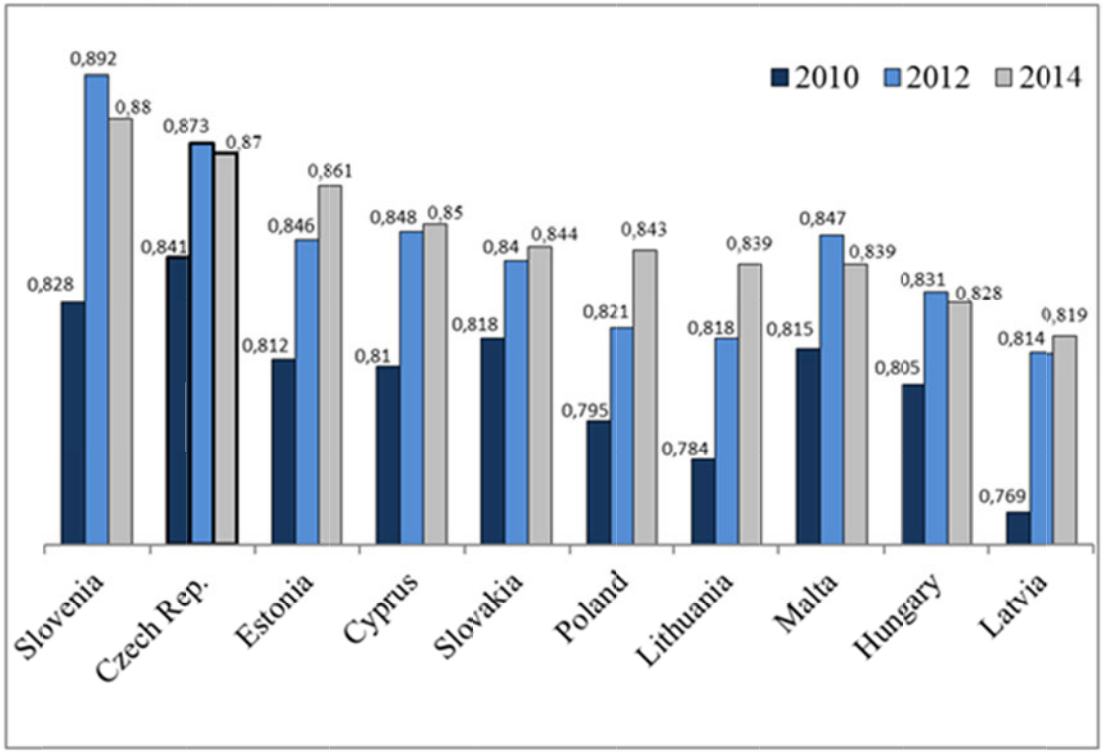
Tab. 3: Establishing HDI Values for the Czech Republic in 2014

Index	Calculation	Resulting Value
Life Expectancy Index	$\frac{(78,6 - 20)}{(85 - 20)}$	0.902
GNI Index	$\frac{[\log(26\,660) - \log(100)]}{[\log(75\,000) - \log(100)]}$	0.844
Expected number of years of education from school entrance age	$\frac{16,4 - 0}{18 - 0} = 0,911$	0.866
Average number of years of education in the adult population	$\frac{12,3 - 0}{15 - 0} = 0,820$	
Education Index	$\frac{0,911 + 0,820}{2}$	
HDI	$(0,902 * 0,844 * 0,866)^{1/3}$	**0.870**

Source: Authors' own work acc. to [17]

From the graph, it is clear that overall six countries (Estonia, Cyprus, Slovakia, Poland, Lithuania, and Latvia) show growing indicator values during this period. The data supports the fact that the Czech Republic, with a 0.841 index value, was the country with the best 2010 index value of the 10 countries under investigation. However, we lost this position during the next period. The actual HDI values rank the Czech Republic behind Slovenia, which has been the most successful EU-10 country since 2012.

Fig. 2: HDI Development for the EU-10 Countries (2010 – 2014)



Source: Authors' own work acc. to [17]

The following table (Table 4) presents the results of the comparative analysis of the EU-10 countries according to HDI values for 2014. The table's first column first lists the ranking of these states within the EU-10 and then their ranking within the EU as a whole. As is clear, the HDI ranking of the EU-10 countries changed drastically in 2014 in comparison with 2005. The unequivocal reason is the previously mentioned change in the HDI's method of construction; however, the influence of the countries' ten years of membership in the EU is also expressed. This was reflected the most in health care as well as in an increasing standard of living. In terms of the HDI, entry into the EU had the most significant influence on life expectancy, which increased for all ten of the countries in question. The greatest jump – of an unbelievable 5.6 years – was recorded by Estonia between 2005 and 2014 and the population of another six countries increased their life spans by at least two years. Improving the population's life style can also take credit for this success.

Inasmuch as it concerns the countries' ranking, the same ranking (in comparison with 2005) was retained only by three countries (Slovenia, Poland, and Latvia). The greatest jump was made by Estonia (by six places). Slovakia jumped up two places and the Czech Republic and Lithuania one. Conversely, the most marked drop was recorded by Hungary (four places), then Malta (three places), and Cyprus (two places). The detailed values of the individual indicators entering into the HDI subsequently yield an interesting comparison. For example, Malta, which attained the second greatest value for Gross National Income (GNI) per capita (27,930) moves to the seventh place in the HDI evaluation because of having the worst level in the Education Index – despite having the longest life expectancy (Cyprus is similar but not so extreme). The opposite situation can be seen for Estonia, whose GNI value is in sixth place; nonetheless, the country comes in third in the HDI on account of its top ranking in the Education Index.

Tab. 4: The HDI of the EU-10 Countries in 2014

EU-10 Ranking (EU-28 Ranking)	Country	HDI	Indicator Values			
			Life Expectancy (yrs.)	GNI per Capita (PPP in USD)	Expected Time Enrolled in School (%)	Number of Years Enrolled in School (%)
1.(12.)	**Slovenia**	**0.880**	80.4	27,852	16.8	11.9
2.(15.)	**CR**	**0.870**	78.6	26,660	16.4	12.3
3.(17.)	**Estonia**	**0.861**	76.8	25,214	16.5	12.5
4.(18.)	**Cyprus**	**0.850**	80.2	28,633	14.0	11.6
5.(19.)	**Slovakia**	**0.844**	76.3	25,845	15.1	12.2
6.(20.)	**Poland**	**0.843**	77.4	23,177	15.5	11.8
7.(21.)	**Lithuania**	**0.839**	73.3	24,500	16.4	12.4
7.(21.)	**Malta**	**0.839**	80.6	27,930	14.4	10.3
9.(24.)	**Hungary**	**0.828**	75.2	22,916	15.4	11.6
10.(25.)	**Latvia**	**0.819**	74.2	22,281	15.2	11.5

Source: Authors' own work acc. to [17]

4 Discussion

The results of the comparison of empirical data conducted above for the selected group of countries allows us to further develop our discussion focused on alternative options for estimating a country's economic development. From the analysis we conducted, it follows that a country's economic development judged on the basis of real GDP shows different characteristics than economic development perceived as satisfaction with a fuller quality of human life. Evaluating economic growth of the EU-10 group after their entry into the EU only on the basis of the dynamics of GDP growth rate shows other characteristics and a different comparative ranking for the countries. From the perspective of the HDI, Poland and Slovakia, which are at the top of this ranking, slide to the second half of less successful countries when looking at the EU as a whole. The opposite situation is seen for Cyprus and Slovenia. Estonia shows the greatest dynamic concerning the development of HDI indicators for the time period in question. Our conclusions correspond to the conclusions of empirical studies that deal with GDP alternatives. For example, it was proven for GPI that, although American GDP steeply increased between 1950 and 2008, GPI has been stagnating since the 1970's and tends towards a straight line [10], [2]. The population of countries that show a greater GDP growth rate thus are not necessarily happier or lead a higher quality life in reality. Relating to this, let us recall the Easterlin paradox, which states that growth in the living standard of poor countries means that their satisfaction also increases greatly but, when people attain a certain level of well-being, further growth in wealth does not lead to growth in happiness [6]. In other words, the limit value of additional wealth decreases when its value increases. From this perspective, GDP looses something of its interpretative significance. Moreover, it is possible to state that this

was also one of the main reasons why the key macroeconomic aggregate indicator of gross national income (GNI) was selected as an indicator of living standard during the transition to a new, more effective method for constructing the HDI. It is generally known that this indicator is somewhat overlooked in relation to evaluating a country's economic level, because its value generally increases more slowly than GDP values. When judging economic performance, GNI does not rest on a territorial but rather on a national perspective and also includes the balance of net income from assets abroad.

The results of this analysis also confirm the necessity of a comprehensive investigation of the causes and, primarily, the results of a country's economic development. Economic growth is only one of the conditions needed to achieve economic development – not the rule. For example, economic growth can be achieved by an increase in military expenses, or it may actually only be felt by a minority of the given population. In this context, even the current economic boom in the Czech economy mentioned in the paper's introduction is not longer such positive information. According to analysts, this is an accidental result of the interplay of a number of factors over time, mainly precipitate use of European funds, low prices for oil and fuel, and a stable Czech koruna. According to [16], the statistically proven concurrent growth of the Czech economy is not built on a healthy foundation. To a large degree, it is financed by redistribution and grant programs and gained at the expense of future debt, which cannot yet be seen in the higher growth dynamic of the standard of living in Czech households, i.e, individual residents. According to the statistical data, the contributions made to the Czech economy's recovery by the individual components of GDP were really varied. The greatest growth rate was shown by government institution expenditure, which naturally influences the deficit amount in a negative way, and the overall debt of the government sector. It is possible to consider the only positive, "healthy" benefit of GDP growth to be the development of international trade. The Czech economy's development is also accompanied by a number of internal problems that are able to influence (or are already influencing) its economic condition in a negative way. The following are some of the primary problems: work is little equipped with capital, a decrease in industrial production's growth rate, a decrease in the influx of direct foreign investment, a decrease in total labor productivity (67% of the EU average), high hourly labor costs, insufficient workers with the appropriate education (primarily, technical fields, adequate language skills, and the decreasing quality of education). Other weak points of the Czech economy are ineffective government regulation, considerable bureaucratic red tape (primarily for beginning entrepreneurs), an unstable business environment and the development of a shadow economy stemming from this, and a long-standing high perception of corruption.

It is clear that, to judge the effectiveness of a country's economic performance, economic development, or the efficacy of economic policies, a mere time series of real GDP values or the annual GDP growth rate does not appear to be sufficiently informative. Therefore, we prefer approaches that propose supplementing (not "fine-tuning") the actual quantification of economic performance using suitable, comparable qualitative indicators of societal well-being. However, we believe that, although the HDI fulfills these requirements in many respects, the problematic of societal welfare indicators still encompasses an entirely wider scope. The adjustment of its parameters will always be controversial and the actual quantification of its methods difficult.

Conclusion

Although the interpretative significance of the indicator of real GDP as a standard, objective measure of a country's economic performance is becoming weaker, it is an indicator that is logical, methodically sophisticated, and consistent for the purpose of international comparison. For credible approximation of a depicted reality, the current statistic does not have a better indicator. Nonetheless, it is clear that there is room to continue to work on its development. As mentioned in the introduction, the estimation of real GDP is also linked to many methodical and technical problems. We hold the opinion that, at the current level of societal development and, primarily, concerning requirements for its sustainability, society must recognize GDP's inadequacies and reflect this in its thinking. In this regard, perfecting the methods and models for estimating a country's economic maturity and alternative approaches to estimating economic development are undoubtedly an important challenge for scientific research.

Acknowledgments

This paper was created with the support of the University of Pardubice's research project SGS FES 46022: "Economic and Social Development in the Private and Public Sector."

References

[1] BENÁČEK, V. Zkreslení HDP v průběhu transformace. In Měříme správně HDP?, 2005, No.39, pp.87-105. ISBN 80-86547-42-6.

[2] BŘEŠŤAN, R. Blahobyt měřený přes pračky a brýle. In Ekonom, 2014, Vol. LVIII, No. 26, pp.18-21. ISSN 1210-0714.

[3] ČESKÝ STATISTICKÝ ÚŘAD. Veřejná databáze. 2015. [cit. 2015-12-08]. Dostupné na WWW: <https://vdb.czso.cz/vdbvo2/faces/cs/index.jsf?page=statistiky#katalog=30834>

[4] DALY, H. E., COBB, J. B. Jr. *For the Common Good: Redirecting the Economy Toward Community, the Environment, and a Sustainable Future*. 1989. Boston: Beacon Press. ISBN 0807047058.

[5] DURAIAPPAH, A. K. Beyond GDP – Transitioning into Sustainability. In UN looks at alternative measures of the wealth of nations - including birdsong, the number of girls attending school and a good night's sleep. 2014. [cit. 2016-04-05]. Dostupné na WWW: <http://www.independent.co.uk/news/world/politics/beyond-gdp-un-looks-at-alternative-measures-of-the-wealth-of-nations-including-birdsong-washing-9392525.html>

[6] EASTERLIN, R. Does Economic Growth Improve the Human Lot? Some Empirical Evidence. In Paul A. David and Melvin W. Reder, eds., Nations and Households in Economic Growth: Essays in Honor of Moses Abramovitz. New York: Academic Press. 1974. [cit. 2016-04-04]. Dostupné na WWW: <http://graphics8.nytimes.com/images/2008/04/16/business/Easterlin1974>

[7] EUROSTAT. *GDP and main components.* 2015. [cit. 2016-01-25]. Dostupné na WWW: < http://ec.europa.eu/eurostat/web/national-accounts/data/main-tables>

[8] KUBÍČEK, J., TOMŠÍK, V. Alternativní pohledy na odhad vývoje ekonomiky. In Měříme správně HDP?, 2005, No.39, pp.57-67. ISBN 80-86547-42-6.

[9] KUZNETS, S. National Income 1929–1932. 1934. A report to the U.S. Senate, 73rd Congress, 2nd Session. Washington, DC. US Government Printing Office No 124, p. 7. [cit.2016-04-07]. Dostupné na WWW:<http://www.socialprogressimperative.org/system/resources/W1siZiIsIjIwMTQvMDEvMDQvMDMvNTYvMTYvOTU3LzE5MzQwMTA0X25hdGlvbmFsaW5jLnBkZiJdXQ/19340104_nationalinc.pdf>

[10] MARYLAND GENUINE PROGRESS INDICATOR OVERVIEW. Maryland Genuine Progress Indicator. MD DNR. Retrieved 16 November 2014. [cit.2016-04-07]. Dostupné na WWW: <http://www.gpiinthestates.org/states-using-gpi)>

[11] NORDHAUS, W., TOBIN, J. Is Growth Obsolete? In Economic Research: Retrospect and Prospect, 1972, Vol. 5, Economic Growth. ISBN: 0-87014-254-2. [cit.2016-04-05]. Dostupné na WWW: <http://www.nber.org/chapters/c7620.pdf>

[12] SEN, A. Real National Income. In Review of Economic Studies, 1976, Vol. 43, p.19-39. [cit.2016-04-06]. Dostupné na WWW: <http://econpapers.repec.org/article/ouprestud/v_3a43_3ay_3a1976_3ai_3a1_3ap_3a19-39.htm>

[13] STANTON, E. A. *The Human Development Index: A History*. 2007. [cit. 2016-04-04]. Dostupné na WWW: <http://scholarworks.umass.edu/cgi/viewcontent.cgi?article=1101&context=peri_workingpapers>

[14] STIGLITZ, J. *Report by the Commission on the Measurement of Economic. Performance and Social Progress*. 2009. [cit. 2016-04-04]. Dostupné na WWW: <http://www.insee.fr/fr/publications-et-services/dossiers_web/stiglitz/doc-commission/RAPPORT_anglais.pdf>

[15] SYROVÁTKA, M. Jak ne(měřit) kvalitu života: Kritické pohledy na index lidského rozvoje. In Mezinárodní vztahy, 2008, Vol. 43, No. 1, pp. 9- 37. ISSN 0323-1844.

[16] ŠEVČÍK, M. Ekonomický boom v ČR v roce 2015 – skutečnost či iluze? In Boom české ekonomiky. Anomálie, nebo trvalý trend?, 2016, No 24, pp.113-120. ISBN 978-80-7542-011-4.

[17] UNDP. *Human Development Reports.* 2016. [cit. 2016-01-22]. Dostupné na WWW: <http://hdr.undp.org/en/2013-report>

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Received: 25. 04. 2016
Reviewed: 30. 05. 2016, 09. 06. 2016
Approved for publication: 08. 09. 2016

PROCESS OF CONSIGNMENT STOCK IMPLEMENTATION

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Abstract: *Consignment stock concept is very important in case of short-term assets management in terms of completely innovative approach helping to manage inventories in which the supplier supplies his inventory and maintains a stock of material at the buyer´s stock. This article deals mainly with the process of Consignment stock implementation itself and considers the approach of Battini, Grassi, Persona, Sgarbossa (2010) by filling new phases and particularizes each separate phase and step. This paper focuses mainly on an analysis finding out possible obstacles while the Consignment stock implementation. Main goal of this paper is to propose a new methodology for the process of the Consignment stock concept implementation. The analysis is based on both quantitative and qualitative surveys held in the Czech Republic.*

Keywords**:** *Consignment Stock Concept, Implementation, Just-in-time, Supply Chain, Inventory Policy, Vendor Managed Inventory.*

JEL Classification: *E21, E23, R41.*

Introduction

CS is a logistic technique in which the vendor, instead of the buyer, is in charge of managing the buyer's inventory and triggering replenishment orders [5]. The consignment stock is an innovative approach to manage inventories in which the vendor removes his inventory and maintains a stock of material at the buyer´s plant [2].

CS is one type of coordination mechanism that is being practiced in industry. It is an innovative approach to manage inventories in which the vendor removes its inventory and maintains a stock of materials at the buyer's plant [20]. In a traditional supply chain where products are sold under wholesale, an upstream entity (supplier) sells a product to a downstream party (retailer) who in turn serves market demand. The retailer owns and controls the inventory and thus incurs the cost of stocking excess inventory to meet demand that exceeds expected demand and/or incurs stock-out costs when demand exceeds supply. Alternatively, under a consignment contract, the supplier maintains ownership and control of inventory, determining the stocking level and product pricing. The retailer is paid a fee marketing the product and handling sales transactions. Thus purely from the standpoint of inventory risk, the supplier will generally prefer a wholesale contract while the retailer will prefer consignment [9].Consignment stock is one of the types of stocks that can be used in logistics. Storage is one of the most important parts of the logistics system. Storage is the connecting link between manufacturers and customers. It ensures, for example, storage of products in its origin, between the point of origin and the point of consumption and also provides the management with the necessary information about the conditions, status and deployment of inventory. The main objective of warehouses but bridge the space and time [14].

1 Statement of problem

1.1 Principle

The consignment stock is an innovative approach to manage inventories in which the vendor removes his inventory and maintains a stock of material at the buyer´s plant [3]. Consignment stock system is an innovative approach to inventory management based on the already mentioned strong cooperation between the two sides. The aim of the partners is a win-win situation. Both of the co-operation will benefit [20]. The Consignment Stock (CS) inventory policy is becoming an important strategy that companies adopt to face new manufacturing and supply chain management challenges. A CS policy implies great collaboration between the buyer and supplier, pushing them towards a complete exchange of information and a consistent sharing of management risks [8].

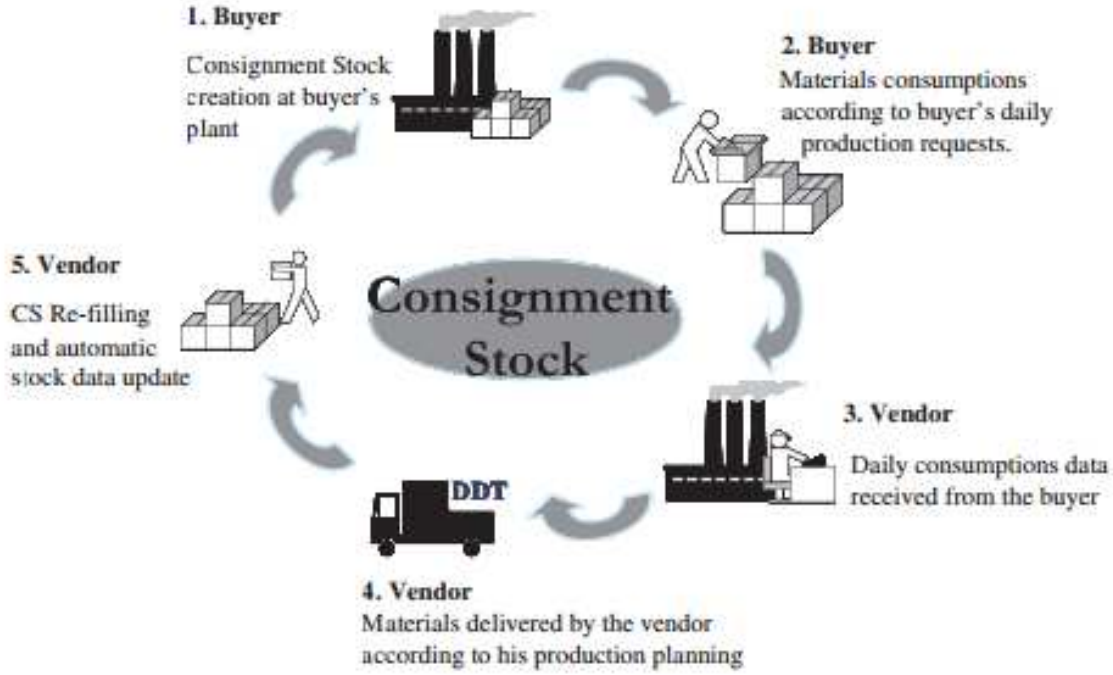
This makes possible a partial suppression of the vendor's warehouse, which can be replaced by that of the buyer. Consequently it is possible to minimize both the ordering and the stock holding costs of the buyer, because materials formally owned by the vendor can be collected (that is, purchased) by the buyer only upon demand. On the other hand, the vendor gets visibility regarding the customer's demand and can use this precious information to schedule production and replenishment orders in an optimal way. As a counterpart, in doing so he is responsible for keeping the buyer's inventory between a maximum (S) and a minimum level (s) and he also supports any additional cost due to stock-outs if his stock management strategy is not suitable to assure the required service level [6].This is a special kind of Vendor management inventory known by the acronym VMI.

The CS policy is already widespread in a number of industrial realities and it is obtaining raised consensus in both small and large contexts, since it offers a partial solution to the 'cycle time reduction' problem and avoids any shortage of materials through enhanced communication between suppliers and buyers. The technique in fact allows partners, the vendor and the buyer, to reduce management costs and increase their flexibility. In particular, the buyer virtually removes the procurement lead time, since the responsibility of the replenishment lies completely with the vendor, who keeps a stock of its property at the buyer's plant: the buyer uses the stock of materials according to his daily production requirements. Outsourcing of materials can easily incorporate the CS policy to enhance supply chain operations [1].

This kind of stock establishes the customer with the supplier. Goods stored at the expense and risk of the supplier and the customer has the right to remove goods as needed within a certain timeframe pay for the goods. Alternatively, it may notify the supplier of the need to supplement the warehouse. This system is enjoying a consignment store usually in the supply of spare parts. In the Czech Republic have used it as manufacturers of computing and manufacturers should also foreign brands of automobiles [18].

Consignment Inventory is inventory that is in the possession of the customer, but is still owned by the supplier. In other words, the supplier places some of his inventory in his customer's possession (in their store or warehouse) and allows them to sell or consume directly from his stock. The customer purchases the inventory only after he has resold or consumed it.

Fig. 1: Consignment stock policy: A conceptual model.



Source: [1]

Consignment stock implementation could be implemented due to the particular reasons. One of the most important is supplier chain finance and logistic costs. In a supply chain, the total costs associated with the inventory [4] consist of following:

- Opportunity costs consisting of warehousing, capital and storage,
- costs associated with inventory as incoming stock level, work in progress,
- service costs, consisting of costs associated with stock management and insurance,
- cost held up as finished goods in transit,
- risk costs, consisting of costs associated with pilferage, deterioration, damage,
- cost associated with scrap and rework,
- cost associated with shortage of inventory accounting for lost sales/lost production.

The key benefit to the customer should be obvious; he does not have to tie up his capital in inventory. This does not mean that there are no inventory carrying costs for the customer; he does still incur costs related to storing and managing the inventory. So what's in it for the supplier? This is where the benefits may not be so obvious—or may not even exist [13]. The supplier has the product or group of products for which believe they will sell and fall into the hands of end users mainly. The trick is that before we get products for end consumers, we need to get to the stock to the retailer. Traders are hesitant whether or not to store products because they do not have complete confidence in the suppliers do not want to invest money and risk to keep them in stock remained something that is not for sale [13].

Increasingly, competition has forced companies to seek stronger cooperation and strengthen the relations with its suppliers. One example of such a cooperation is cooperation between two partners which will help to minimize costs and maximize profits of the entire system. Many researches showed that joint decisions business partners lead to the effective functioning before deciding if every man for himself within the same organization.

Basic elements of consignment stock. Production and delivery of a schedule determined so as to minimize the total annual cost of the entire supply chain. Whenever something is produced, it is sent to the seller, who then sells the products in individual doses. Implementation of the consignment warehouse in cooperation seller and the buyer must be a fixed order. In order to avoid the production of the additional costs, should each machine to produce the maximum capacity [5]. The best way to reduce the investments in inventory is to eliminate the investments altogether. Reducing inventory in this way can be achieved without risk and with full access to the inventory by having someone else hold and / or pay for the inventory. This approach, sometimes known as consignment stocking, transfers both the ownership and the management of replenishment of the inventory to the vendors. Your company only pays for what it uses, when it uses it [15].

Benefits of Consignment Stock. First, the primary benefit that can be derived from a consignment agreement is that it allows the consignee to save money on inventory costs. As the consignee, you do not need to put money on the goods that you sell. You pay the consignor only after you have sold the merchandise. This could mean improved cash flow on the part of the consignee. Next, consignment can actually save you time because you do not have to wait for new inventory every time you run out of stock. Typically, the person or company that consigned the goods will automatically replenish your inventory right after you sell some or all of the consigned goods. It is in the best interest of the consignor to keep the agent well-supplied. Third, a consignment agreement is more convenient compared to a drop shipping arrangement where the retailer only takes orders and does not hold any inventory from the supplier. The consignee will have the merchandise on hand, easily accessible and ready for sale. Moreover, the consignee does not have to worry about goods running out of stock indefinitely, as resupplying the inventory happens regularly under a consignment setup [10].

Risks Associated with Consignment. The party supplying the stock faces the biggest risks under a consignment agreement. For one, the consignor will not receive any money until part or all of the consigned stock has been sold. In effect, the consignor's cash flow may suffer as more money is spent on manufacturing the goods, while cash coming in may be too slow to cover subsequent production runs. Next, the consignor may be exposed to higher product returns if the agents or consignees simply allow the goods to rot or become damaged in warehouses. After all, the consignee does not have any money invested in the consigned merchandise. Without a good profit sharing agreement, the consignee may not be too keen on pushing the consignor's products in the market. In addition, since resupplying or restocking the consignment inventory is done regularly, there is a risk of overstocking or duplicate inventories. This could be detrimental for both the consignor, who would have more goods sitting idly in the agent's warehouse, and for the consignee, who may spend more on inventory storage costs. Lastly, the record keeping systems of the party consigning the goods and the retailer or agent are not always the same. So, a consignment stock may become disadvantageous if it brings about discrepancies in the records of both consignor and consignee. For the consignee, any misplaced item could mean paying for something that has not generated a profit. Meanwhile, inconsistencies on the consignor's side could lead to lost merchandise [10].

2 Methods, methodological approaches

This part presents a methodological framework able to address all the problems emerging when a project for the implementation of CS policy is going to be addressed

in actual industrial situations. Logistics and manufacturing constraints typical of actual industrial systems constitute the base for the model, followed by the ten phases as Battini (2010) describes in more detail below the following concept. During the implementation of the project, it is necessary to accomplish each task independently from the partners' constraints, which should be individually addressed by both partners. Effective communication from the beginning of the partnership is of the utmost importance to reduce start-up times and inception delays. A CS implementation project should be based on a concurrent engineering paradigm, to ensure that the different activities, developed during the execution of the project, will be carried out by a cross-functional buyer-vendor group, with a continuous reciprocal agreement to prevent any delay in implementation time. Only with an integrated approach will the partners realize annual savings and effective implementation of this policy, without incurring high start-up cost [2].

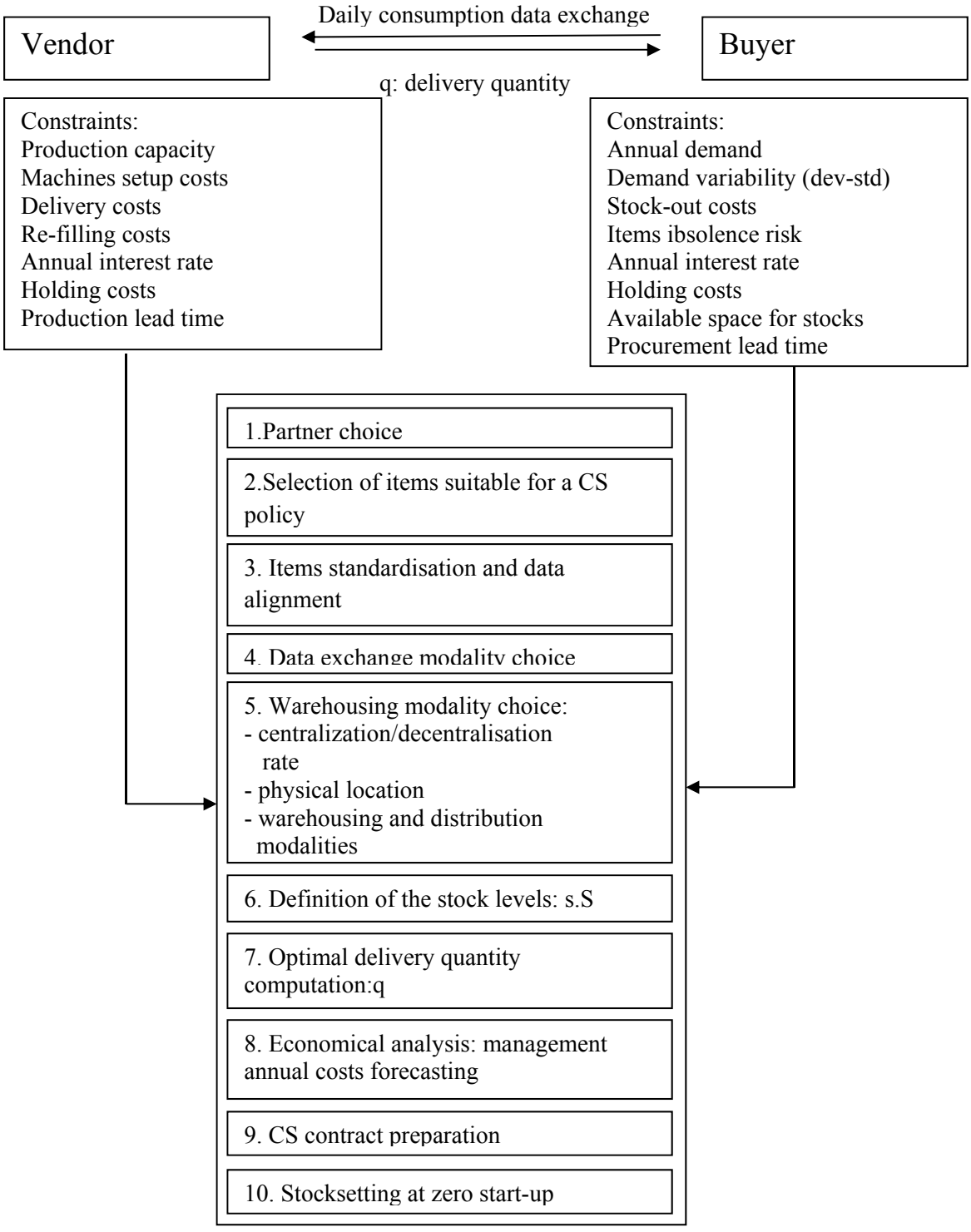
Battini [2] particularizes step two – Selection of items suitable for a CS policy as following:

Tab. 1: Critical factors analysed in step 2 of the framework.

Critical factors
(1) Item annual consumption rate (in pieces and monetary value) (2) Item consumption variability during the year (market demand variability) (3) Item Life cycle (obsolescence risk) (4) Item standardization level (5) Supply criticalities: (variable lead times, high geographic distance vendor-buyer, etc.) (6) Item dimension and physical characteristics (7) Item stock-out costs

Source: [2]

Fig. 2: Methodological framework for CS policy implementation



Source: [2]

For the purpose of this paper, we used both quantitative and qualitative surveys obtained in the Czech Republic held between October 2015 and January 2016. Respondent/organizations were sampled from various industries, company sizes and annual sales. A field of survey used to investigate the research questions therefore a structured questionnaire was utilized as the main data collection as the first step of our research. There were in total 231 companies contacted in different industries and locations of the Czech Republic. 54 companies did not reply with any feedback or refused to participate, thereby we were able compile 177 feedbacks. The response rate was therefore 77%. In additional,

68 participants were small size, 51 medium size and 58 large size companies. The industry distribution of the sample is shown in Table 2.

Tab. 2: Industry distribution

Name of Industry	Number of firms	Percentage
Steal/metal manufacturing	33	19%
Food manufacturing	17	10%
Retail industry	17	10%
Chemical product and Drug manufacturing	16	9%
Paper industry	16	9%
Plastics industry	15	8%
Service industry	14	8%
Building industry	12	7%
Auto/ Auto parts industry	10	6%
Electronics industry	11	6%
Textile manufacturing	9	5%
Wood industry	7	4%
Total	**177**	**100%**

Source: authors

3 Key results

Out of this sample, on one hand we found out that 22% do not use any logistic model due to the fact, that they are either not interested or don't have any need of the adoption based on a kind of industry, type of the material, not such sufficient amount of orders etc. On the other hand, 78% of respondents adopted some of particular logistic models. The distribution of those logistic models share in the Czech Republic shows Table 3.

Out of the 78% respondents using any log.model, the most adopted concept is the Consignment stock (42%), then the Safety stock (36%) followed by the Buffer stock concept (17%). The last option – Others - there is meant be included other concepts such as the Smart bin concept, Kanban or a different agreement on safety stock, delivery conditions, stock optimization bases and different types of partnership based on inventory optimization.

Tab. 3: Share of selected logistic models usage

Type of selected logistic model	No. of answers	% of answers
Consignment stock*	58	42%
Buffer stock*	23	17%
Safety stock	49	36%
Other	8	6%
Total	**138**	**100%**

**MIN and MAX concept*

Source: authors

According to the results of our research, in the second part/step of our research, we contacted some of respondents again in order to discuss the complexity of Battini´s concept [2] with them. Therefore, there was the research investigated with just those respondents using the Consignment stock MIN and MAX concept. For the purpose of our survey, we contacted those 58 respondents that use the Consignment stock MIN MAX concept as found out from the previous research as shows the Table 3. We were able to conduct an interview with 34 companies/respondents, 24 respondents refused to keep on participating. Structured

phone interviews were utilized as the main collection method. Phone interviews conducted with the persons in charge of the responsibility about the Consignment stock concept adoption. During our phone interviews, we paid attention to the comments, arguments and other hints respondents gave to the presented Battini´s [2] process of the CS stock concept implementation.

Tab. 4: Specification of missing steps of the Consignment stock concept

	Missing steps	**Explanation**
1.	Agreement with contractor	Agreement with the full concept of the Consignment stock with contract needed in the very first steps of the process in order to continue in the whole process of implementation
2.	Agreement with internal specialists/departments	Approval from internal specialist necessary in order to continue in the whole process of implementation
3.	Trial version	There might appear particular inconveniences while getting started working with the e-platform for data exchange
4.	Feedback requirement	Crucial part of major projects in general
5.	Suggestions for treatment and process improvement	In case of inconvenience, requirement to find out way in order to improve the process
6.	Implementation of proposed and agreed amendments	After implementation of proposed amendments another feedback/ improvement needed if necessary

Source: Authors

In accordance to the interviews with our respondents that adopted the Consignment stock concept, while there are defined/proposed steps of the Consignment stock implementation process. Table 4 demonstrates the result of identified crucial missing steps of the implementation process presented by Battini [2].

Ad) Agreement with contractor and internal specialists

These steps of the process might stop the whole project in the very beginning. There are some cases when partners just do not agree on those conditions proposed in the contract or that R&D specialists do not find the implementation as secure and do not prove this kind of cooperation with the supplier. It is necessary to have the contract signed Table 5 shows results dealing with the consideration of agreement with a contractor – contract agreement-wise.

Tab. 5: Consideration of agreement with contractor

	No. of answers	**% of answers**
Not at all	9	26%
Before the process of implementation	7	21%
During implementation	15	44%
After implementation	3	9%
Total	**34**	**100%**

Source: Authors

Table 6 demonstrates respondents' opinion on the timing of agreement with internal specialists in the process of the Consignment stock implementation itself. As it is crucial

to ensure safe implementation, approval of internal specialists as it has to be one of the very first factors needed to consider. On one hand, just 15% respondents receive a successful approval and on the other hand, 52% respondents either do not approve or don't receive an approval at all.

Tab. 6: Consideration of agreement with internal specialists

	No. of answers	**% of answers**
Not at all	18	52%
Before the process of implementation	5	15%
During implementation	7	21%
After implementation	4	12%
Total	**34**	**100%**

Source: Authors

Ad) Trial version

Due to the fact, that consignment stock implementation could cause very considerable problems, additional costs, stop of a production of a customer and other unexpected problems; recommendation to start a kind of *trial version*. The supplierwould get an access to the application or the tool used for consignment stock check of information and start delivering according to these pieces of information but still maintaining a strong cooperation with the customer support. There is still a way to avoid probable problems and solve them in advance. According to a research based on seventy contacted companies, which forty-three returned answering the question of whether companies pay an attention to a trial version of the exchange-data-tool usage, see chart below. Thirty-three percent of respondents agreed with at least kind of helping suppliers with the software usage. Thirty-four percent of respondents do not pay any attention to suppliers getting learn how to supply in the new agreed way of CS concept.

Tab. 7: CS concept implementation – trial version usage

	No. of answers	**% of answers**
Yes	4	12%
Rather yes	11	33%
Rather no	7	21%
Not at all	12	34%
Total	**34**	**100%**

Source: Authors

Ad) Feedback, suggestions for treatment and process improvement

Another step includes analysis, definition of stock level as Battini [2] explains, followed by full implementation. The very important step is missing in his concept though. In fact, *feedback, suggestions for treatment* and *process improvement* must not be forgotten in the whole process. Just the implementation itself is not enough to ensure reversible partnership. The supplier should always have the space for discussion and amendment of the settings. Feedback is a huge part of the majority of processes in general followed by improvement phase. According to the above-mentioned research, there is a result – whether companies require and pay attention to feedback from suppliers after the Consignment stock implementation process. Table 8 below demonstrates that 47% of respondents do not pay any attention to any feedback from suppliers and do not play any role in any treatment and process improvement. 26% of respondents ask for at least any feedback.

Tab. 8: CS concept implementation – feedback request

	No. of answers	**% of answers**
Yes	5	15%
Rather yes	9	26%
Rather no	4	12%
Not at all	16	47%
Total	**34**	**100%**

Source: Authors

Moreover, we divided the original concept into 5 basic phases such as a preparatory and analytical phase, trial version, implementation and a final phase. In accordance to the interviews, there were added following steps into the framework considered as crucial from our respondents` point of view as pointed out in the Table 4.

Tab. 9: Process of the Consignment stock concept implementation

A. Preparatory phase

- Partner choice
- Agreement with contractor
- Selection of items suitable for a CS policy
- Agreement with internal specialists/departments

B. Analytical phase, preparation of settings

- Consignment stock contract preparation, start of negotiation process
- Items standardization and data alignment
- Data exchange modality choice
- Warehousing modality choice:
    a) Centralization/decentralization rate
    b) Physical location
    c) Warehousing and distribution modalities
- Definition of the stock levels: *s, S*
- Optimal delivery quantity computation: *q*
- Economical analysis: management annual costs forecasting
- Conclusion of contract
- Sum all the analyzed and agreed settings up

C. Trial version

- Trial system of orders and deliveries according to the e-platform for data exchange including full customer´s assistance

D. Implementation

- Stocks setting at zero and start-up
- Full supplier´s responsibility for orders and delveries

E. Final/post implementation

- Feedback
- Discussion in regards the process running
- Suggestions for treatment and process improvement
- Implementation of proposed and agreed amendments

Source: Authors

Conclusion

Due to the fact how challenging Inventory management is in an extremely competitive environment, we focused on one of the innovative methods of costs and inventory reduction and inventory optimization – Consignment stock concept. In this paper, there was a discussion about particular steps of Consignment stock implementation process presented by Battinni [2]. For this reason, we focused on the proper realistic information, how are some particular logistic models spread in the Czech Republic. Moreover, as we used both qualitative and quantitative research, we were able to amend Battini`s [2] concept.

Firstly, the presented research results showed that 78% of respondents adopted any of presented logistic models and 22% are not interested or don't have any need of the adoption based on a kind of industry, type of the material, not such sufficient amount of orders etc. Both Consignment stock MIN MAX concept and the Safety stock are the most spread logistic models in the Czech Republic as found out from the quantitative survey. Moreover, based on our interviews, deeper look into the respondent´s opinion who adopted just the Consignment stock concept – discussing about the Battini`s [2] concept, we were able to define a few crucial missing steps of the implementation process itself such as: agreement with a contractor and internal specialists in the very beginning of the whole process itself, trial version for suppliers, feedback, suggestions and treatment for the process improvement, implementation of proposed and agreed amendments. After clarifications these missing parts, we were still in touch with respondents in order to find out, whether those specified steps are missing in their implementation process as well.

In conclusion, therefore, there is a greater focus on the complex concept, with specification of those additional particular missing steps we were able to amend the Battini`s [2] concept including the new steps. Future work might focus on analytical and numerical model comparing vendors´ costs (set-up costs, holding costs, obsolesce costs and stock-out costs) with real return on sales.

References

[1] BATTINI, D. Consignment stock inventory model in an integrated supply chain. *International Journal of Production Research*, 2010, 48(2): 477-500. DOI: 10.1080/00207540903174981. ISSN 00207543.

[2] BATTINI, D. Consignment stock inventory policy: methodological framework and model. *International Journal of Production Research,* 2010, 48(7): 2055-2079. DOI: 10.1080/00207540802570669. ISSN 00207543. Production Research Vol. 48, No. 2, 477-500

[3] BATTINI, D., GUNASEKARAN, A., FACCIO M., PERSONA, A., SGARBOSSA, F. Consignment stock inventory model in an integrated supply chain. *International Journal of Production Research* Vol. 48, 2009, No. 2, 477-500

[4] BHAGWAT, R., SHARMA, M. S. Performance measurement of supply chain management: A balanced scorecard approach. *Elsevier Science.* Computer & Industrial Engineering 53, (2007) 43-62

[5] BRAGLIA, M. Consignment stock theory with a fixed batch manufacturing process. *International Journal of Production Research*. 2013, 2015-11-13, 51(8): 2377-2398. DOI: 10.1080/00207543.2012.740577. ISSN 00207543.

[6] BRAGLIA, M., GABBRIELLI, R., & ZAMMORI, F. Consignment stock theory with a fixed batch manufacturing process. *International Journal Of Production Research*, *51*(8), 2377-2398, 2013. doi:10.1080/00207543.2012.740577. [cit. 2015-11-13]. Available from WWW: <http://web.a.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=3&sid=b941ef16-a1fc-4910-83f6-903195af8b58%40sessionmgr4003&hid=4209>

[7] CEYHUN, A., OZKARAHAN, I. Supplier evaluation and management system for strategic sourcing based on a new criteria sorting procedure. *Elsevier Science.* Int. J. Production Economics 106 (2007) 585-606.

[8] Consignment stock of inventories in the presence of obsolescence. Consignment stock of inventories in the presence of obsolescence, 2005. [cit. 2015-11-13]. Available from WWW: <http://search.proquest.com/docview/218651071/49DB806FAC8747C4PQ/1?accountid=9646>

[9] DE MATTA, R. E. Consignment or wholesale: Retailer and supplier preferences and incentives for compromise. *Omega,* 49: 93-106. DOI: 10.1016/j.omega.2014.05.011. ISSN 03050483.

[10] *Financial Web*: Benefits and Risks of Consignment Stock. Financial Web: Benefits and Risks of Consignment Stock, 2016. [cit. 2015-11-13]. Available from WWW: <http://www.finweb.com/investing/benefits-and-risks-of-consignment-stock.html#axzz44P90DRHp>

[11] HUANG, H.S, KESKAR, H. Comprehensive and configurable metrics for supplier selection. *Elsevier Science.* Int. J. Production Economics 105 (2007) 510 – 523

[12] JABER, M. Y. A consignment stock coordination scheme for the production, remanufacturing and waste disposal problem. *International Journal of Production Research*. 2014, 52(1): 50-65. DOI: 10.1080/00207543.2013.827804. ISSN 00207543.

[13] PIASECKI, D. (2000). Consignment Inventory: What is it and When Does It Make Sense to Use It. 2016. [cit. 2016-03-16]. Available from WWW: <http://www.inventoryops.com/ConsignmentInventory.htm>

[14] SIXTA, J., MAČÁT, V., (2010). Logistika - teorie a praxe: Logistický podnik, controlling, skladování, doprava, technologie, informační systémy, příklady z praxe (Dotisk 1. vydání). Brno: Computer Press a.s. ISBN 978-80-251-2563-2

[15] SLATER, P. Smart Inventory Solutions (Second Edition). New York: *Industrial Press Inc.* 2010. ISBN: 978-0-8311-3401-3

[16] SEURING, S., MÜLLER, M., 2008. From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production* 16 (2008) 1699-1710

[17] VALK, W.V.D., WYNSTRA, F., 2005. Supplier involvement in new product development in the food industry. *Industrial Marketing Management* 34, 681-694

[18] (a) VANĚČEK, D., Prof., Ing., (1996). Logistika (1. díl). Jihočeská univerzita v Českých Budějovicích
(b) VANĚČEK, D., Prof., Ing., (2008). Logistika. Jihočeská univerzita v Českých Budějovicích

[19] Yi, H. Z., & SARKER, B. R. An operational consignment stock policy under normally distributed demand with controllable lead time and buyer's space limitation. *International Journal Of Production Research*, *52*(16), 4853-4875. doi:10.1080/00207543.2014.892645, 2014. [cit. 2015-11-13]. Available from WWW: <http://web.a.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=2&sid=b941ef16-a1fc-4910-83f6-903195af8b58%40sessionmgr4003&hid=4209>

[20] ZAHRAN, S. K. Payment schemes for a two-level consignment stock supply chain system. *Computers,* 2015, 2015-11-13, 87: 491-505. DOI: 10.1016/j.cie.2015.05.024. ISSN 03608352.

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Received: 30. 12. 2015
Reviewed: 15. 02. 2016, 04. 04. 2016
Approved for publication: 08. 09. 2016

REGIONAL DISAGGREGATION OF INDUSTRIAL INVESTMENT: THE CASE OF CZECH REGIONS

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Abstract: *Properly structuring of industrial investment can increase the competitiveness and innovation potential of each region markedly; and results in welfare increasing. The intention of this study wasn't evaluating the allocation of investment but develops the method of gaining the regional disaggregated data of industrial investment. Such data are valuable for further regional development analysis, nevertheless the two dimensional matrix of regional investment in industrial structure for many regions, i.e. Czech NUTS III regions is not available at the moment. The aim of this paper is to present the developed methodology of values estimation within the industrial structure at regional level; to verify this principle on the sample of Slovak regions and to apply the methodology on Czech regions over sixteen years period between 1995 and 2010. Due to many limitations and accuracy requirements of such an approach, the presented method cannot be applied to reliably disaggregation of whole regional industrial investment structure. Still we found an evidence to believe, that the method is applicable on the industries and industrial groups of construction; financial and insurance activities; trade, transportation, accommodation and food services; and public sector services.*

Keywords: *Industrial structure, Czech NUTS III regions, Slovak NUTS III regions, Investment allocation, Regional disaggregation, Employment.*

JEL Classification: *E22, R11.*

Introduction

Regional development is dependent on the effective use of resources, which is the basis for the ability of a region to compete with its surroundings in terms of the attractiveness which the region potentially has but also which it is able to transform into the real allocation of capital investment, as well as its human factor. [1], [2] Economic potential is determined by the quantity and quality (including structures) of fixed (tangible, intangible, financial) as well as human capital, so when assessing the competitiveness of a region it is relevant to pay attention to the development (growth) of capital, which in the case of fixed capital is represented by investment.

Empirical studies show a strong correlation between investment and product. Countries which allocate a high share of their GDP to investment also show a high level of growth and vice versa. [11] Considering the fact that fixed capital figures both on the input and the output side of the production process, it not only influences the volume of production but also the accumulation of fixed capital as separate entities. A targeted accumulation of fixed capital logically requires an appropriate response in consumption. The existence of investment must sacrifice part of the current consumption in favor of an increase in future consumption. [13] Nevertheless, the allocation of investment is a crucial element in addressing the industrial structure of the economy and its competitiveness, since investors knowing well, that: "Investment should be optimally distributed so as be channeled into a region with a higher capital return," as Pražák noted. [12, p. 19] Properly structured industrial investment in a region can significantly increase its competitiveness

and innovation potential and ultimately increase its prosperity. This issue was addressed in 2000 in a study of experts from the European Commission who compared the development of European competitiveness - especially in relation to the USA and Japan - with structural (sectoral and industrial) changes in the European economy. [6]

1 Statement of a problem

Information on the development of the industrial structure of a regional economy - not only performance and employment but also investment as indicators of the further development of the industrial structure of a region, is very important for analyzing and managing the region's economy. The availability of the necessary data is also a prerequisite even though without that analysing of industrial structures many complications reveals. Dobrescu [5] showed some of them in his study of macroeconomic relationships interactions with structural variables. The aim of this study is to propose a methodology for obtaining industrial-allocated data on regional investment for further analysis of regional development. The issue of GDP components regionalization have been already opened by some Czech authors, for example Kramulová and Musil [9] approached to such an issue via experimental estimates of components of GDP by expenditure, while Krejčí and Sixta [10] used alternative methods for estimating the values of stock and consumption of fixed capital. Currently, in the framework of the data reported on the Czech economy .there are statistical data showing the industrial structure of investments on the one hand and their regional values on the other hand. A two-dimensional matrix that would capture the industrial-regional distribution of investments at the level of NUTS III - usually for relatively small countries the rating level of regional development is used because it has a certain degree of legitimate power, especially if it is bound to the definition of higher self-governing terrestrial units - is however not available. The absence of any reporting of industrial-regional investment is not limited exclusively to the Czech Republic. Statistical offices in Austria, Hungary, Poland and many other countries also do not disclose these elementary data. In contrast, for example, the statistical office of the Slovak Republic publicly reports these data. This fact gave the authors the idea that the availability of data on Slovak regions and the similarity of the Czech and Slovak environments, not only in economic aspects, underlined by the high level of synergy following their long-standing integrity within a single state, could be used to regionally distribute sectoral investment in Czech NUTS III regions.

The objective of this paper is to present a methodology for the regional determination of industrial investment and apply it to the level of Czech regions for a sixteen year period from 1995 to 2010. In order to verify the methodology it was first applied to Slovak regions and subsequently Czech regions at the level of NUTS III. Slovak NUTS III regions represent a comparable sample, which can be used to determine the differences between officially published results of the Statistical Office of the Slovak Republic on the regional-industrial distribution of investment [14] and the results of the application of the methodology created by the authors. A high level of conformity between the two results reflects the correctness of the methodology and its applicability to the Czech (and possibly other national) economic reality. The outputs of the application of the methodology can subsequently be used for a detailed evaluation of the distribution and development of industrial investment in each region on a lower regional level than the existing published data allow.

2 Methods for determining the industrial structure of regional investment

We may ask, of course, if there is any scientific reason to assume that formulas learned on the Slovak regions, are well enough established to use them on the Czech regional disaggregation; or, to believe that the main components and relationships in booth economies are pretty similar and work pretty similar. There is no single unambiguous argument to assume the outlined hypothesis is true; however there are many rational arguments to adopt and follow it, especially in the situation, when we face the lag of data that are very desirable for any deep intentional analysis of Czech regions. We can mention some of the most significant facts for our further research:

a) booth countries constituted one before 1993 – many cornerstones and conditions for further development were (and still are) pretty similar to booth;

b) the regional patterns of booth countries involve some similar signs – the region of capital city can be regard as the heavy outlier within the terms of economic performance and employment, while the other regions show pretty balanced development of the main economic indicators (see [7]);

c) there are no principal differences in the employment structures between the Czech and Slovak regions (see [3], [14]);

d) regional industrial structures of booth countries are shaped under the influence of similar factors – booth can be labelled to be the small open industrial economies, where manufacturing plays the leading role (see [3], [7], [14]);

e) regions across booth countries converge in many key economic indicators [15];

f) there are no principal differences in the effects of creativity and innovations involvement between the Czech and Slovak regions [8].

The first step in creating the methodology was to check the availability of the data. The authors not only wanted to develop the methodology but to apply it to real data of the Czech economy for a sufficiently long period of time, which in this case was the longest available period from 1995 and 2010. Should they be reasonably acceptable the obtained values would potentially be useful in a range of subsequent empirical studies. Relevant statistical data available in the Czech Republic include time series of the state of fixed assets at current prices per industry (19 industries of CZ-NACE), employment per capita in the individual region (14 regions) and per industry (11 industries or industrial groups), and gross fixed capital formation (GFCF) at current prices per region and per industry or industrial group. A major limitation is the high degree of industrial aggregation of data on fixed assets and especially investment and employment, which is justified by the need to protect "... individual data, especially within small regions and industries" ... which "... allows the publication of industrial breakdowns only to a certain degree of aggregation according to the letters, at the same level of detail as it is required by the statistical office of the EU (Eurostat)." [4]

As we have already mentioned, in terms of the required data the comparative sample of Slovak regions is saturated at the NUTS III level in the form of a two dimensional matrix showing the industrial allocation of GFCF. Therefore, its use in the evaluation of the proposed methodology seems to be wholly appropriate.

Development of the methodology for determining regional sectoral investment takes into account the following grounds and assumptions:

α) economic sectors are represented by 11 separate industries or industrial groups based on the valid CZ-NACE classification;

β) the methodology of the labor force sample survey used by the Czech Statistical Office (CZSO) and Slovak Statistical Office (SOSR) and the application of workplace methods for the regionalization of indicators of the GFCF, when the investment data are classified according to the place of execution [3, 14] are accepted;

ϒ) investment is represented by the GFCF as the decisive representative of the gross capital formation;

δ) the structure of industrial-regional employment reflects the allocation of industrial -regional investment;

ε) coefficients of industrial and regional investment do not significantly differentiate between the NUTS III regions within a single NUTS II at a given time;

ζ) price changes are not taken into account, the indicators are in current prices;

η) the diversity of the impact of cyclical developments in the individual regions is not taken into account;

θ) extra-regional or territorial enclaves etc. are not taken into account;

ι) there is no fundamental difference between Czech and Slovak regions, or the methodology applicable to the disaggregation of investment for the Slovak regions is also applicable to the Czech regions.

The capital intensity indicator, usually considered to be significant in the evaluation of the industrial allocation of investment, was not considered taking into account the prospective purpose of the proposed methodology, i.e. to assess the performance of a region in relation to the development of the size industrial investment, because the status values with which this indicator works, do not correspond to incremental values in the form of investment.

In summary, the outcome of the regional distribution industrial investment is considered to be: the size of investments in the given region as a whole, the size of investment in the given industry, employment in the given industry in total and regionally recognized. The presented methodology is based on the top-down principle of regionalization, or more precisely disaggregation of values reported for higher territorial units (in this case NUTS II) on lower level regions (here NUTS III). NUTS II regions, which are also delimited as the NUTS III regions, are not considered in this analysis and will therefore not further artificially distort the proposed methodology. Taking into account the method of collection and subsequent reporting of data that can be used as the initial inputs of the presented methodology by the official statistical authorities, the methodology can be considered more of a mixed method pursuant to the methodology of the European System of National and Regional Accounts ESA. The above-mentioned “disaggregation key” can be illustrated as follows.

To determine regional industrial investment the following input data are required:

I_t^R - the total value of investment in region *R* at time *t* in current prices;

I_t^S - the total value of investment in industry[9] *S* at time *t* in current prices;
$E_t^{R,S}$ - employment in industry *S* in region *R* at time *t* in number of persons;

where *R = 1, 2, ..., n; S = 1, 2, ..., m*; *and t = 1, 2, ..., k*. These conditions are valid in equations below - from (1) to (5) - as well. The procedure for calculating industrial regional investment can be represented by the following four basic steps:

I. Calculation of the relevant weight of industrial-regional employment $wE_t^{R,S}$ in individual years

$$wE_t^{R,S} = \frac{E_t^{R,S}}{\sum_{R=1}^{n} E_t^{R,S}} \tag{1}$$

The weight reflects the "range" of industry *S* in region *R* at time *t* using the parameter of employment. It is a classic weight indicator whereby the sum of the values of all industries for each region equals *1*.

II. Calculation of the coefficient of the relationship between the total investment of a region and the total investment of a industry $rI_t^{R,S}$ in individual years

$$rI_t^{R,S} = \frac{I_t^S}{I_t^R} \tag{2}$$

The relation coefficient can be seen as a certain form of weight which is specific for each territorial unit. It is not a weight in the true sense; it represents the relation between investment in the industry *S* in the economy of a higher reporting unit and the investment that was made in region *R* at time *t*.

III. Calculation of the coefficient of the industrial structure of investment $cI_t^{R,S}$ as the product of the relative weight of the industrial and regional employment and the relation coefficient between industrial and regional investment in individual years.

$$cI_t^{R,S} = \frac{wE_t^{R,S} \cdot rI_t^{R,S}}{\sum_{S=1}^{m}\left(wE_t^{R,S} \cdot rI_t^{R,S}\right)} \tag{3}$$

This indicator expresses how much industrial investment of industry *S* is bound to a unit of regional investment in region *R* at time *t*. Balancing the coefficient eliminates the inter-industrial reallocation of the next step.

IV. And finally, **calculation** of the industrial value of investment in each region $I_t^{R,S}$, using the product of the above coefficient of the industrial structure of investment $cI_t^{R,S}$ and the value of the total investment in the monitored region I_t^R.

$$I_t^{R,S} = cI_t^{R,S} \cdot I_t^R \tag{4}$$

The logical question is "Why was an employment indicator used in the key of the calculation of the regional distribution?" We can answer as follows: Other relevant data in the related industrial breakdown at the monitored level showing at least a certain degree of positive correlation are not publicly available (for Czech regions).

3 Problem solving and discussion

3.1 Verification of the proposed methodology

Based on the correlation analysis, which was applied to a comparative sample of Slovak regions, the correlation between regional-industrial employment and the regional-industrial distribution of investment was demonstrated only in certain industries. A nonparametric

[9] The term "industry" here also refers to statistically reported industrial groups.

approach to the measurement was applied due to the fact that most of the input data lacked normality. A summary of the results of the analysis is shown in Table 1: The top part of the table shows the frequency of occurrence, where Spearman's rank correlation (ρ) for a defined level of significance (α) was significant during the period 1995 to 2010. Relevant levels of significance in this analysis are 0.05 and 0.10. The highest reliability is naturally desirable but taking into account the method of reporting the regional-industrial investment or its estimation the authors consider a significance level of 0.10 as being sufficient. Nevertheless, due to the fact that a large number of values fall outside the desired significance, we have used for "illustration purposes" a less common level of significance of 0.15. The lower part of table shows the minimum and maximum values of correlation coefficient (ρ) at a significance level of 0.10 of the entire sample for the monitored period.

Tab. 1: Summary of the analysis of the relation of investment to employment

α	A	BDE	C	F	GHI	J	K	L	MN	OPQ	RSTU
0.05	43.8	31.3	0.0	43.8	50.0	18.8	93.8	12.5	0.0	87.5	0.0
0.10	68.8	31.3	6.3	56.3	62.5	31.3	100.0	25.0	6.3	87.5	0.0
0.15	87.5	50.0	12.5	68.8	75.0	37.5	100.0	37.5	18.8	93.8	6.3
ρ min	0.68	0.86	0.71*	0.71	0.71	0.68	0.71	0.71	0,71*	0.79	x*
ρ max	1.00	0.96		0.96	0.96	0.93	1.00	0.96		1.00	

*Notes: * only one (or none - "x") case at a significance level of 0.10 has been found; Explanation of shortcuts (industries substituted) used as follows: A - agriculture, forestry and fishing; B - mining and quarrying; D - electricity, gas, steam and air conditioning supply; E - water supply, sewerage, waste management and remediation activities; C - manufacturing; F - construction;*
G - wholesale and retail trade, repair of motor vehicles and motorcycles; H - transportation and storage; I -accommodation and food service activities; J - information and communication;
K - financial and insurance activities; L - real estate activities; M - professional, scientific and technical activities; N - administrative and support service activities; O - public administration and defence, compulsory social security; P - education; Q - human health and social work activities;
R - arts, entertainment and recreation; S - other service activities; T - activities of households as employers, undifferentiated goods-and services-producing activities of households for own use;
U - activities of extraterritorial organizations and bodies.

Source: author's own work based on [14]

The high correlation coefficient values and the frequency of their significance at low levels of probability suggests that for industries K and OPQ there is a very strong link between regional-industrial employment and the allocation of investment, which is confirmed throughout the period. Hence, the use of employment for the allocation of regional investment in these industries appears to be a step in the right direction. For the industries GHI, A, and with a greater level of benevolence also industry F, the results of the strength of ties are less convincing but there is still a sizeable degree of dependence and their significance does not completely exclude for these segments employment from a further "round of balancing" in the framework of the overall "disaggregation key" – by this one is no single factor used to determine industrial-regional investment. A major turning point in the development of interdependence was also identified for these industries, which occurred approximately in the middle of the monitored period. While for industry A the strength and significance of the dependence of investment and employment is clearly recognizable after 2002 - correlation coefficients in the range of <0.9; 1> and on the level of significance 0.05, often 0.01 (similar to industries K and OPQ), before the turning point in 2002 the significance level was around 0.10, with coefficients fluctuating at around 0.65. For industries F and GHI this development was the opposite - a statistically demonstrable dependence until 2002 (2004 for GHI) - and in subsequent years the dependence was not

observed. With this in mind, however, industries K, OPQ, GHI, F and A are perceived as being "preferred" for the application of the methodology. Values indicating a low correlation, found in industries BDE, C, J, L, MN, and RSTU prevent employment for being further considered as one of the determinants of the industrial determination of regional investment in these segments.

3.2 Comparison with actual values

Another step towards assessing the correctness of the proposed methodology was to apply the "disaggregation key" to input data on Slovak NUTS II and NUTS III regions which are also available for Czech regions from the database of the Statistical Office of the European Union - Eurostat [8], and to compare the disaggregation values obtained by the methodology with actually reported values of regional-industrial investment in regions of Slovakia. This comparison was also made for the whole of the monitored period. Two years were selected for the presentation of the detailed results of the comparison – a year in the middle of the interval, which can be described as being relatively "boring" or unaffected by any extraordinary events which could have the potential to significantly impede the methodology (2002), and vice versa a "turbulent" year in which the strongest impact of the economic crisis was recorded (2009). The time of the impact of the crisis can be connected with the potential occurrence of an extraordinary event and can thus be regarded as a convenient test of the methodology's elemental resistance to external influences. A comparison of the two years is expressed by relative deviations included in Table 2. The deviations were determined based on the formula (5)

$$\sigma = \left| \frac{I_t^{R,S} - V_t^{R,S}}{V_t^{R,S}} \right| \cdot 100\ \% \tag{5}$$

where $I_t^{R,S}$ means calculated values of regional-industrial investment at time *t*; and $V_t^{R,S}$ are reported values of regional-industrial investment at time *t*.

The industries and industrial groups previously excluded from the methodology were included in the comparison in an attempt to repeat the complex verification, which would in finding analogies of the resulting values with the previous correlation analysis or the measurement of low deviations for the sectors, for which significant correlation relationships with high coefficient values were recorded, continue to support the accuracy of the considerations on the basis of which the "disaggregation key" was developed.

The values of "disaggregation error" indicate the rate of error measured when comparing the cumulative values (outputs of the disaggregation) for industries and officially reported values. Based on the balance of the "disaggregation key" let us say the coefficient $cI_t^{R,S}$, the rate of error did not reach values that would cause a substantial distortion of the whole sector. During the entire period the disaggregation error of the individual industries in most cases ranged in the interval <0.5%; 0.5%>, with the highest measured value being -1.72%. The size of the resulting errors can largely be attributed to the officially reported values being rounding off. Only a very small part of the errors can be attributed to the disaggregation method used.

Tab. 2: Measured deviations for years 2002 and 2009 (in %)

2002	A	BDE	C	F	GHI	J	K	L	MN	OPQ	RSTU
Trnava	0	4	5	0	1	10	4	4	8	5	32
Trencin	23	23	0	7	5	7	4	16	8	2	13
Nitra	18	20	4	6	3	3	6	13	11	3	37
Zilina	11	12	5	1	5	0	1	46	21	8	26
Banska Bystrica	10	16	7	0	6	0	1	27	16	9	45
Presov	6	17	12	4	3	3	7	35	3	5	8
Kosice	8	6	10	4	2	2	6	35	3	5	8
Disaggregation error	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

2009	A	BDE	C	F	GHI	J	K	L	MN	OPQ	RSTU
Trnava	10	12	21	16	13	14	18	16	53	14	15
Trencin	14	21	3	14	8	8	2	6	0	12	19
Nitra	0	8	26	0	4	5	12	8	30	2	5
Zilina	2	25	0	6	14	12	0	5	17	19	12
Banska Bystrica	4	61	2	18	13	12	1	4	14	16	20
Presov	6	26	1	4	3	4	0	13	9	2	18
Kosice	6	11	0	7	3	2	0	10	7	2	19
Disaggregation error	**-1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Notes: interval borders applied for the visualisation have been set as follows:

<0; 5>	(5; 10>	(10; 25>	(25; ∞)

Source: author's own work based on [14]

Table 2 clearly shows that in 2002 the rate of error of the preferred industries K, OPQ, GHI and F ranged below 10% in all cases, and in most cases (20 of 28) it was below 5%. The last of the preferred industry - A has a higher rate of error; however, these deviations were expected due to the aforementioned weak correlation in the first half of the period. We also confirmed the expected high rate of error for the industries BDE, L, MN and RSTU. In contrast, the low rate of error for industries C and J was unexpected. Low deviations were measured for these industries in several of the other years of the monitored period; however, the measured rate of error and its volatility are higher than for the preferred industries.

The year 2009 confirms the low reliability of the disaggregation, which can be attributed to sudden unsystematic changes due to increased volatility on the labor market and a higher degree of caution of potential investors. These factors are significantly reflected in the development of employment and volume of investment during an economic crisis. Nevertheless, industry K within Slovak NUTS III regions shows a low rate of error although, paradoxically, the previous and the following years have a higher rate of error. A relatively lower rate of error was also found in industry A, which could be expected in relation to the above-mentioned turning point. Similarly, the higher deviations in industries GHI and F are not surprising. In contrast, the higher error for industry OPQ in 2009 may at first glance seem like an utter failure of the methodology. However, due to the fact that adverse developments in times of economic crisis are controlled by saturating part of private investment through higher public sector spending and favoring training activities, a higher rate of error for industry OPQ is rationally justified. A rate of error comparable to the preferred segments was found even for industry L – when comparing other years, however, it is an exceptional phenomenon - and again for industries C and J.

A summary of the results of the comparison of the calculated and actual values is included in Table 3. Table 3 shows the average absolute value of annual industrial

deviations for all of the regions. The lower part of the table shows the average deviation value for the entire period. The median value is also given in addition to the classical (arithmetic) average, which is related to the cumulative values of the deviations - top of the table.

Tab. 3: Comparison of deviations of calculated and actual values - summary (in %)

	A	BDE	C	F	GHI	J	K	L	MN	OPQ	RSTU
1995	13	18	9	10	5	10	6	11	14	10	17
1996	15	15	11	7	5	15	5	14	16	7	21
1997	17	14	6	8	4	7	3	10	11	5	16
1998	15	12	9	5	5	12	7	12	5	4	26
1999	17	14	8	6	5	16	3	9	5	3	18
2000	20	9	14	7	7	6	3	6	9	4	26
2001	10	11	9	5	3	5	8	14	16	7	23
2002	11	14	6	3	4	4	4	25	10	5	24
2003	7	8	8	20	3	5	6	20	16	5	19
2004	3	4	8	18	3	4	7	15	15	9	23
2005	7	9	16	15	10	12	8	18	16	17	22
2006	21	5	17	11	9	10	13	10	12	15	21
2007	13	24	16	11	12	10	12	15	18	11	12
2008	12	19	20	15	10	14	6	10	10	9	21
2009	6	23	8	9	8	8	5	9	19	10	15
2010	10	19	10	11	11	15	99	8	15	8	28
Average	12	14	11	10	7	9	12	13	13	8	21
Median	12	14	9	10	5	10	6	12	14	8	21

Notes: see notes below Table 2

Source: author's own work based on [14]

Table 3 confirms the relatively low rate of error of disaggregation for industries K[10] and OPQ, and to a limited extent also industries GHI and F i.e. for the period of the proven dependencies between employment and investment. On the contrary, for industry A the correlation relationship in the reduction of error was not strong enough for the disaggregation of investment to be acceptable based on the methodology, although at first glance a certain amount of reduction in the rate of error is definitely present. The certain but not entirely accepted suitability of the proposed methodology for industries C and J is probably due more to the higher impact of the relation between the total investment in the region and the total investment in these segments than the links between investment and employment, which is offered as a possible way of modifying the methodology for industries C and J.

3.3 Application of the created methodology on Czech regions

After verifying the methodology of industrial allocation of regional investment on Slovak regions it is possible to proceed to the final stage, i.e. the disaggregation of industrial investment in Czech regions. Since it is not possible to unambiguously verify the applicability of the methodology on a sample of Czech regions, it is necessary to recall the basic principle on which the methodology is based, i.e. suitable for Slovak regions,

[10] The value for 2010 can be considered an excess caused by the Trencin Region, which a 91% decrease from the previous year. This radical change, which is not reflected in employment, caused a large distortion in the disaggregation of the whole NUTS II region - Western Slovakia; the error for the Trencin Region reached 621%, which hugely distorted the following average value for 2010 and the whole of the period. If we omit 2010, the average value of the industry K, presented in Table 3, would be 6% and the median would remain unchanged.

applicable to Czech regions. The value the industrial-regional allocation of investment was calculated for so-called preferred industries for which a low rate of error was confirmed on a comparative sample and for which there are no reservations about the credibility of the values for – industries F, GHI, K and OPQ. The most accurate values can be considered those for investment disaggregated in industries K and OPQ. Values were calculated for each year of the monitored period (1995 - 2010), for each of the 11 Czech regions (NUTS III regions) that are not currently recognized as NUTS II regions, and the disaggregated values for some years are shown in Table 4. Disaggregation error indicates the rate of error measured by comparing the cumulative values (outputs of disaggregation) for the industries and officially reported values per industry.

Tab. 4: Regional-industrial allocation of investment in Czech regions (in mil. CZK)

1995	**F**	**GHI**	**K**	**OPQ**	**2000**	**F**	**GHI**	**K**	**OPQ**
South Bohemia	1707	6309	986	3397		1517	6566	157	2747
Plzen	899	3549	503	1882		1167	6108	150	2841
Karlovy Vary	312	1601	96	1708		282	1922	34	966
Usti	921	4181	391	3932		1273	6191	117	2968
Liberec	485	3125	457	2031		1179	3718	156	1886
Hradec Kralove	577	3567	908	2783		1157	6205	287	3748
Pardubice	540	3608	725	2309		835	4438	223	2271
Vysocina	692	2495	519	2228		1155	5555	182	2496
South Moravia	1888	7014	1921	7123		2487	12476	578	5614
Olomouc	663	2726	782	2601		1362	7117	173	3614
Zlin	749	2709	1082	2185		1165	6051	158	2509
Disaggr. error	**-0.04%**	**-0.19%**	**0.70%**	**-0.13%**		**0.08%**	**-0.17%**	**-0.47%**	**0.06%**
2005	F	GHI	K	OPQ	**2010**	F	GHI	K	OPQ
South Bohemia	2233	8231	579	4900		2336	12326	661	5570
Plzen	1391	5217	432	2900		1744	9360	555	4997
Karlovy Vary	515	4019	43	2003		549	3346	62	3061
Usti	1434	10260	121	4281		2586	10831	123	8429
Liberec	937	4434	174	2707		1037	3382	110	4360
Hradec Kralove	979	5525	314	3246		1025	4665	156	5621
Pardubice	831	4975	192	2952		1271	5066	261	5851
Vysocina	1209	7617	187	3740		1433	8555	369	4102
South Moravia	3157	23173	641	10457		3676	21792	1513	11978
Olomouc	1410	9559	104	5135		1738	10427	321	9974
Zlin	1355	7910	96	3844		1169	7492	225	6975
Disaggr. error	**0.16%**	**-0.04%**	**-0.40%**	**0.13%**		**0.67%**	**0.16%**	**0.37%**	**-0.06%**

Source: author's own work based on [7]

The presented summary table indicates very low disaggregation error, whose variation ranges around one percent during the period (0.80% for industry GHI, 1.02% for industry F, and 1.07% for industry OPQ). The highest value of variation was reached by industry K (1.29%). This low level of deviation can be regarded as being acceptable and not preventing the application of the developed methodology on the preferred industries.

Conclusion

By demonstrating the correlation between employment and investment in the industries and industrial groups F (construction), GHI (wholesale and retail trade; repair of motor vehicles and motorcycles wholesale, transportation and storage, and accommodation

and food service activities), K (financial and insurance activities) and OPQ (public administration and defense; compulsory social security, education, and human health and social work activities), and also by considering the relationships between industrial and regional allocations of investment, a methodology was developed for the regional disaggregation of industrial investment in these industries. The application of disaggregation was primarily targeted to Czech regions. The principle of the methodology is to use NUTS II regions for which regional-industrial investment is reported in a two-dimensional matrix, and at the NUTS III level, where only one-dimensional values are reported for industrial and regional investment separately. A two-dimensional matrix of region-industrial employment which is reported for NUTS III regions was also used.

The developed methodology was evaluated by applying it to a sample of Slovak NUTS III regions for which the required data are publicly reported. Based on the analysis of the correlation between employment and investment, followed by an analysis of deviations between the values from the methodology and officially reported values, the applicability of the developed methodology to determine industrial-regional investment in industries F, GHI, K and OPQ was recognized as being acceptable. For industry A (agriculture, forestry and fishing) a low rate of error was also not confirmed even though the existence of dependencies between industrial-regional employment and investment was demonstrated. On the contrary, industries C (manufacturing) and J (information and communication) showed relatively low deviation despite the apparently weak link between investment and employment. The anomaly found for industries C and J can either be attributed to chance, which due to the relatively stable rate of error does not seem likely, or possibly a greater effect of the relationship between total investment in the industrial and total investment in the region which may exist in these industries. This can also be considered for industry A; however, these possibilities have not been further investigated but are encouraged to be verified in their future. The resulting findings could also contribute to the development of a new methodology for regional disaggregation of industrial investment in these segments.

The structure of investment in industries and industrial groups F, GHI, the OPQ in Czech regions between 1995 and 2010 was subsequently determined through the application of the methodology developed for the allocation of industrial-regional investment in a two dimensional matrix based on one-dimensional values of industrial and regional investment, and the expected relationship between employment and investment. The obtained values could be used as input data for further analysis of the economic reality, creating significant potential to complement an area of regional development that has yet to be scientifically described.

Acknowledgement

The paper was prepared with the support of IGA University of Pardubice in relation to the project No. SGFES-2014002.

References

[1] ANNONI, P., DIJKSTRA, L. *EU Regional Competitiveness Index RCI 2013*. Luxembourg: Publication Office of the European Union, 2013. ISBN 978-92-79-32370-6.

[2] CAPELLO, R., FRATESI, U., et al. *Globalization and Regional Growth in Europe: Past Trends and Future Scenarios*. Berlin: Springer, 2011. ISBN 978-3-642-19250-0.

[3] CZSO (Czech Statistical Office). *Mimořádné revize národních účtů 2011 a 2014*. 2013. [cit. 2014-12-13]. Available from WWW: <http://apl.czso.cz/pll/rocenka/rocenka.avizo_revize?id=REGIONAL>.

[4] CZSO (Czech Statistical Office). *Roční národní účty: Regionální účty HDP, THFK, Zaměstnanost*. 2015. [cit. 2015-03-28]. Available from WWW: <http://apl.czso.cz/pll/rocenka/rocenka.indexnu_reg>.

[5] DOBRESCU, E. Modeling the Sectoral Structure of the Final Output. *In Romanian Journal of Economic Forecasting*, 2013, Vol. 16, Iss. 3, pp. 59-89. ISSN: 1582-6163.

[6] EC. *European Competitiveness Report - 2000*. Luxembourg: Office for Official Publications of the European Union, 2000. ISBN 978-92-829-0523-3.

[7] EUROSTAT. *Statistics*. 2015 [cit. 2015-03-16]. Available from WWW: <http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database>.

[8] KLOUDOVÁ, J., SCHWASZCZ, O. Komparace kreativního potenciálu regionů v České a Slovenské republice ve vztahu k vybraným makroekonomickým indikátorům. *In Regionální studia,* 2013, Vol. 6, Iss. 2, pp. 13-23. ISSN: 1804-1280.

[9] KRAMULOVÁ, J. MUSIL, P. Experimentální odhad složek výdajové metody regionálního HDP v ČR. *In Politická ekonomie,* 2013, Vol. 61, Iss. 6, pp. 814-833. ISSN: 0032-3233.

[10] KREJČÍ, I., SIXTA, J. Využití alternativních metod při odhadech stavů a spotřeby fixního kapitálu. *In Politická ekonomie*. 2012, Vol. 60, Iss. 6, pp. 780-800. ISSN: 0032-3233.

[11] MANKIW, G. *Principles of Macroeconomics*. London: Cengage Learning, 2003. 464 p. ISBN 0-324-17189-7.

[12] PRAŽÁK, P. Modely vzniku a eliminace ekonomických regionálních disparit jako úlohy optimálního řízení. *In E+M Ekonomie a Management*, 2012, Vol. 15, Iss. 2, pp. 15-25. ISSN: 1212-3609.

[13] SAMUELSON, P., NORDHAUS, W. Economics. New York: McGraw-Hill Companies, 1998. ISBN 0-070-57947-7.

[14] SOSR (Statistical Office of the Slovak Republic). *RegDat – databáza regionálnej štatistiky*. 2015. [cit. 2015-04-10]. Available from WWW: <http://px-web.statistics.sk/PXWebSlovak>.

[15] ZDRAŽIL, P., KRAFTOVÁ, I. Do the V4 Regions Converge?. *In 15th International Colloquium on Regional Sciences. Conference Proceedings*. Brno: Masarykova univerzita, 2012. pp. 48-58. ISBN 978-80-210-5875-0.

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Received: 22. 11. 2015
Reviewed: 18. 03. 2015, 05. 04. 2016
Approved for publication: 08. 09. 2016

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[1] BELODEAU, B., RIGBY, D. *Management Tools and Trends 2009*. Bain&Company. [cit. 2010-02-25]. Available at WWW: Available from WWW: <http://www.bain.com/bainweb/PDFs/cms/Public/Management_Tools_2009.pdf>.

[2] BERGEVOET, R. H. M., ONDERSTEIJN, C. J. M., SAATKAMP, H. W., VAN WOERKUM, C. M. J., HUIRNE, R. B. M. Entrepreneurial behavior of Dutch dairy farmers under a milk quota system: goals, objectives and attitudes. *In Agricultural Systems,* 2004, Vol. 80, Iss. 1, pp. 1-21. ISSN: 0308-521X.

[3] GREENACRE, M. *Correspondence Analysis in Practice*. Boca Raton: Chapman & Hall/CRC, 2007. 280 p. ISBN 978-1-58488-616-7.

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Title	Scientific Papers of the University of Pardubice, Series D
Publisher	University of Pardubice Faculty of Economics and Administration Studentská 95, 532 10 Pardubice, Czech Republic
Registration number	IČ 00216275
Edited by	Ing. Martina Kynclová
Periodicity	3 per year
Volume number	23
Issue number	37 (2/2016)
Place	Pardubice
Publication Date	16. 09. 2016
Number of Pages	205
Number of Copies	90
Edition	First
Printed by	Printing Centre of the University of Pardubice

MK ČR E 19548
ISSN 1211-555X (Print)
ISSN 1804-8048 (Online)

ISSN 1804-8048 (online)
MK ČR E 19548