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„Innovations, Enterprises, Regions and Management"

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Preface

Dear readers,

The International Scientific Conference INPROFORUM is a traditional event held by the Faculty of Economics, University of South Bohemia in České Budějovice. It is focused on the research achievements in the fields of Innovations, Enterprises, Regions and Organizations. The conference offers the opportunity to discuss relevant topics among academic and practising economists.

The 11th Anniversary International Conference INPROFORUM 2017 was dedicated to the topic „Innovations, Enterprises, Regions and Management ". Aim of the conference was to respond to new challenges in innovations, management and changes in enterprises and regional environment. The conference focus to exchange and discuss scientific new research results in this new context. "Innovations, Enterprises, Regions and Management "has been discussed in following sections:

- Regional and Global Aspects of Sustainability, and Bioeconomy
- Microeconomic and Macroeconomic Aspects of Social and Economic Development
- Economics of Agriculture
- Economic Impacts of Changes and Policies in the Fields of Finance, Accounting and Taxation
- Market Research and Sustainable Marketing in Trade and Tourism
- Management of Small and Medium Sized Enterprises
- Criminal Aspects of Entrepreneurship in the European Context
- Mathematical-statistical Methods and Optimization in Practice

It is our pleasure to offer the INPROFORUM result in this form of reviewed contributions and hope you will find it useful and interesting for your academic development.

On behalf of organizing committee

Miloslav Lapka

Session 1

Regional and Global Aspects of Sustainability, and Bioeconomy.

Measuring Sustainability of the EU Countries with the Selected Indices

Magdaléna Drastichová

Abstract: *Sustainable development (SD) and achieving SD goals has gained great importance worldwide. The European Union (EU) and additional five developed countries were assessed according to their Sustainable Society Index (SSI) and its three wellbeing dimensions, including its adjusted version named Sustainable Development Index (SDI), together with the crucial decoupling index – Resource Productivity (RP). Two main approaches to measure sustainability are deployed in this way, i.e. measurement of wellbeing in three SD pillars together with measurement of decoupling aspects. The Hierarchical Cluster Analysis (HCA) was applied to classify the countries into three groups according to the similarities in their Human, Environmental and Economic Wellbeing together with their RP levels in 2016. Cluster 1 that showed highest mean and median of human and economic wellbeing also showed the lowest levels for environmental wellbeing. On the other hand, Cluster 3 achieved the highest levels in environmental wellbeing but the lowest levels in the remaining wellbeing indicators. Cluster 2 has the highest mean and median of the RP indicator and medium-sized levels were achieved for three wellbeing indicators. No Cluster can be regarded as the most sustainable one, but Switzerland included in Cluster 2 is considered to be the most sustainable economy. Canada and the USA are the least sustainable economies according to the SSI and SDI.*

Key words: Cluster Analysis · European Union (EU) · Sustainable Development (SD) · Resource Productivity (RP)

JEL Classification: Q51 · Q01 · Q51

1 Introduction

Sustainable development (SD) and achieving SD goals has gained great importance worldwide. Since the World Commission on Environment and Development (WCED) adopted the most quoted definition of the SD, a huge number of measurement methods and indicators of the SD has been developed. According to this definition, SD is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987). The SD represents the overarching objective of the EU enshrined in its primary law, governing all the EU's policies and activities. The EU Sustainable Development Strategy (EU SDS) was launched in 2001 and renewed in 2006. This strategy provides an EU-wide policy framework to deliver SD (European Union, 2009). In this way, the aim of the SD is understood as the continuous global improvement of quality of life and wellbeing for current and future generations through reconciling economic efficiency, social solidarity and environmental responsibility (Eurostat, 2016). The Sustainable Development Indicators (SDIs) reflecting the key challenges of the EU SDS have been used to monitor the EU SDS and they are presented in ten themes.

The methodology applied in this Paper to investigate sustainability and the path towards the SD of the selected countries is based on the combination of two main approaches operationalizing and reflecting the SD concept. First, it is the application of appropriate SD / sustainability indices reflecting three pillars of the SD, i.e. the economic, social and environmental dimension, which need to be balanced. Second, decoupling is reflected in decoupling indicators measuring the relations between the economic and environmental pillar of the SD. Finally, the cluster analysis is used to create groups from the sample of countries according to the similarities of their sustainability levels. Accordingly, the Sustainable Society Index (SSI) and the Sustainable Development Index (SDI) representing the first approach and the Resource Productivity (RP) representing the second one are used to evaluate sustainability and path towards the SD in the EU countries together with additional developed countries. The SDI was created from the SSI using several author's modifications.

The Sustainable Society Foundation (SSF)[2] has developed the SSI, which shows at a glance the level of sustainability of countries. SSI integrates the sustainability and the quality of life. It is emphasised that environmental wellbeing without human wellbeing makes no sense, at least not for human beings. Economic wellbeing is not a goal in itself, but it is integrated as a condition to achieve human and environmental wellbeing. Thus, it can be regarded as a safeguard to wellbeing. The SSI is based on the SD definition of WCED (1987), to which the SSF added a third sentence to make explicitly clear that both Human Wellbeing and Environmental Wellbeing are included. It means that *a sustainable*

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[2] The SSF was established in 2006 with the objective of stimulating and assisting societies in their development towards sustainability.

society is a society that meets the needs of the present generation, that does not compromise the ability of future genera-
tions to meet their own needs, in which each human being has the opportunity to develop itself in freedom, within a
well-balanced society and in harmony with its surroundings (SSF, 2016). The SSI was published for the first time in
2006 and then updated every two years. The author's adjusted SSI version, named Sustainable Development Index
(SDI), is used in the analysis in this Paper. These indices represent the first approach based on the measurement of three
pillars of the SD, particularly three wellbeing dimensions: human, environmental and economic wellbeing dimensions
(HW, ENW, and ECW respectively).

In terms of the second approach, the decoupling concept is applied. It refers to breaking the link between two varia-
bles, often referred to as the driving force, mainly economic growth expressed in terms of GDP, and the environmental
pressures, such as the use of natural resources (materials, energy, land etc.), the generation of waste, or the emission of
pollutants. In other words, decoupling indicates breaking the link between environmental bads and economic goods
(OECD, 2002). The decoupling indicator – the RP was chosen as the crucial representative for sustainability assessment
of countries to show their resource efficiency and how their economic growth is decoupled from natural resource use.

The aim of the Paper is to evaluate sustainability in the EU countries together with the additional developed coun-
tries according to their wellbeing achieved in three SD dimensions and decoupling by means of three indices: the SSI,
SDI (for the *wellbeing approach*) and the RP (for the *decoupling approach*). The Hierarchical Cluster Analysis (HCA)
is applied to divide the sample of countries into the groups with similar levels of the ECW, ENW and HW, together
with their RPs. In the first – *wellbeing approach* – based on the SSI and SDI, 33 countries are examined, namely the
EU-28 and Norway, Iceland, Switzerland, together with two Northern American countries – Canada and the USA.
In the second – *decoupling approach* – 30 countries are evaluated, while the RP is not available for the USA, Canada
and Iceland. These three countries are also omitted from the HCA.

2 Methods

The indicators representing two applied approaches in the SD measurement and the method of cluster analysis, with the
focus on the HCA, are explained in this section. The SSI (SSF, 2016) comprises three levels: 3 wellbeing dimensions
(ECW, ENW and HW), 7 categories, and 21 indicators (two indicators are used for the Biodiversity area). The detailed
information, indicator description and calculation formulas can be found on SSF websites (SSF, 2016).

Table 1 Sources for the update of the SSI and the most recent available data year (period) used

Human Wellbeing		Environmental Wellbeing		Economic Wellbeing	
Indicator	**Year used / Source**	**Indicator**	**Year used / Source**	**Indicator**	**Year used / Source**
Sufficient Food	3-years average of 2014-2016 / FAO (2016)	Biodiversity Forest Area	2016 / IUCN and UNEP-WCMC (2016)	Organic Farming	2014 / FiBL (2016)
Sufficient to Drink	2015 / FAO (2016)	Biodiversity Protected Area	2016 / IUCN and UNEP-WCMC (2016)	Genuine Savings	2014 / World Bank (2016)
Safe Sanita-tion	2016 / FAO (2016)	Renewable Water Re-sources	2014 / World Bank (2016); 2016 / Euro-stat (2017)	GDP per capita	2016 / IMF (2016)
Education	2014, 2015 / UNESCO (2016)	Consumption	2012 / GNF (2016)	GDP per capita Growth	2014 – 2015 / World Bank (2016)
Healthy Life	2015 / WHO (2016)	Energy Use per capita	2014 / World Bank (2016)	Long-term Unemploy-ment	2014 / World Bank (2016)
Gender Equal-ity	2016 / WEF (2016)	Energy Sav-ings	2010–2014 / World Bank (2016)	Public Debt	2016 / IMF (2016)
Income Distri-bution	2012 (2013, 2014) / World Bank (2016)	Greenhouse Gases	2014 / IEA (2017)	R&D Ex-penditure	2015 (2014) / Eurostat (2017), OECD (2016)
Good Govern-ance	2015 / World Bank (2017)	Renewable Energy	2014 / IEA (2017)		

Source: Author's elaboration
Note: the meaning of the used abbreviations is included in References.

The scale of the score for included indicators is 1 – 10 where 1 indicates the lowest sustainability and 10 reflects the highest performance in sustainability. In the adjusted version referred to as the SDI, 23 indicators in total were used in the same seven categories and three wellbeing dimensions including HW, ENW and ECW dimensions (see Table 1). The 23 areas for the calculation of the indicators and data sources are included in Table 1. The particular indicators reflect the development in these areas and the scores (1-10) are assigned using the particular equations for conversion. These equations are constructed in such a way to reflect the contribution to the SD in the particular area for which the indicator is created. The categories in the HW include Basic Needs, Personal Development & Health and Well-balanced Society (3, 3, 2 indicators in the first column of Table 1 respectively). In the ENW, the following two categories are included: Natural Resources and Climate & Energy (4 and 4 indicators in the second column of Table 1 respectively). For the ECW two categories are used: Transition and Economy (2 and 5 indicators in the third column of Table 1 respectively). The calculation of the overall SSI and SDI is as follows. Firstly, the scores for the indicators are calculated using the particular equations. Secondly, the scores for the categories are calculated as the geometric means of the scores for the particular indicators while all the indicators are assigned the same weights. For two biodiversity indicators (forest and protected areas) and GDP per capita indicators (absolute level and growth) (see Table 1) the arithmetic means are computed and those are used for the calculation of the scores in the particular categories. Thirdly, the scores for the dimensions are calculated as the geometric means of the scores obtained in the included categories (all are given the same weights). Finally, the overall SSI and the SDI are computed as the geometric mean of the scores in three dimensions while all three dimension have the same weights.

Several adjustments were carried out to create the SDI from the SSI. Based on the analysis of the SSI dimensions, categories and the indicators, it was detected that for several indicators the more recent data and more appropriate sources can be used to obtain the updated SSI results. Moreover, one indicator included in the SSI was replaced, i.e. that of Employment, particularly the Unemployment Rate was replaced with the Long-term Unemployment Rate (in % of total unemployment). One indicator was completed with its growth rate, i.e. GDP per capita. Both indicators are included in the category of Economy. Additionally, one indicator is omitted, i.e. Population Growth in the category of Well-balanced Society and one indicator is added to the category of Economy, namely Total R&D expenditure (percentage of GDP). Then, new index – the SDI is created. As regards the score assignment, the positive relationship between the level of the indicator and the assigned score exists by Total R&D expenditure and GDP per capita growth rate, but negative dependence is typical of the Long-term Unemployment.

The headline indicator of the Sustainable Consumption and Production theme in the EU SDIs, the RP, is measured as GDP divided by Domestic Material Consumption (DMC). The RP provides insights into the EU SDS's objective to decouple economic growth from natural resource use. The GDP and DMC indicators represent the driving force and environmental pressure respectively. For the RP calculation, Eurostat uses GDP either in EUR in chain-linked volumes unit, to the reference year 2010 at 2010 exchange rates, or in Purchasing Power Standard (PPS) unit. Consequently, the indicator is expressed:

- in Euro per kg (Euro in chain-linked volumes, reference year 2010), for comparing the changes in one geographic area (one country) over time;
- in PPS per kg, for comparing different countries in one specific year;
- It is also calculated as an Index on year 2000, for comparing countries in different years (2000 = 100).

HCA attempts to identify relatively homogeneous groups of cases, or variables, based on selected characteristics, using an algorithm that starts with each case (or variable) in a separate cluster and combines clusters until only one is left. HCA was applied in this Paper to create clusters of analysed countries based on the most recent values of the following indicators: the RP (2016) and three sub-indices composing SDI (2016), namely the HW, ENW and ECW. The groups of countries were created while the Ward's method is used as the cluster method. As regards the measure, the squared Euclidean distance was chosen from the measures for interval to specify distance. This is because the quantitative variables are used. From the available standardization methods the Z scores were chosen because the variables included are measured in different units (Aldenderfer and Blashfield, 1984; Meloun and Militký, 2002; Řezánková et al., 2007).

3 Research results

This part includes the results of the selected indices represented the first and second approach to the SD measurement. Secondly, the results of the cluster analysis are summarized.

3.1 Results of the analysis of selected indices

First approach to the SD assessment is based on the evaluation of three SD pillars according to the SSI and SDI in 33 countries. Table 2 shows the groups of five countries that obtained the lowest and highest scores for the SSI dimensions in particular years together with the average results of all the years included in the assessment (the last line of Table 2).

Table 2 indicates that five Northern countries show the highest HW levels, except for Denmark in 2010 and Iceland in 2008 and 2010, together with Germany, Netherlands, Slovenia and Austria (in 2016, the score of Austria is relatively lower). The lowest levels are shown by the USA and several new member EU countries, such as Bulgaria, Malta (until 2010), Romania (until 2010) and Luxembourg (since 2010), and all five Southern countries including Cyprus (but since 2010, the scores of Portugal have been relatively higher). The highest scores in the ENW were shown by several new member countries, i.e. Croatia, Romania, Hungary and in more years by Bulgaria and Latvia, the Southern countries except for Cyprus, especially Portugal (in all the years), together with Switzerland in all the years as well. On the contrary, the Northern American countries – the USA and Canada, together with Belgium, Luxembourg and Estonia showed the worst performance in the ENW. The scores were very low also in the Czech Republic and Netherlands and in 2010 and 2012 also in Norway. As regards the economic performance, the Northern countries (except for Finland in 2016 and Iceland, which showed one of the lowest levels) together with Switzerland, Estonia, the Czech Republic and Luxembourg showed the highest ECW levels. On the other hand, Northern American countries, several new member EU countries and in more years Southern countries, especially Greece (in all the years), showed the poorest performance. Ireland has also shown low performance since 2010. As regards the new member countries, they showed the ECW score increase between 2006 and 2016, except for Cyprus, Slovenia, Croatia and Hungary.

Table 2 Countries with the highest and lowest levels of the scores in three wellbeing dimensions

Year	HW 5highest	ENW 5highest	ECW 5highest	HW 5lowest	ENW 5lowest	ECW 5lowest
2006	NO, IC, DK, SE, FI	PT, RO, BG, HR, CH	SL, LU, SE, DK, CH	MT, US, RO, BG, CY	LU, EE, CZ, BE, US	BG, MT, BE, GR, RO
2008	NL, NO, DK, SE, FI	SK, CH, RO, PT, HR	SL, NO, EE, DK, CH	MT, RO, US, BG, IR	BE, LU, US, CA, EE	GR, BE, IC, BG, MT
2010	NL, NO, SE, DE, FI	RO, CH, LT, PT, HR	EE, DK SE, NO, CH	MT, US, ES, BG, DK	US, BE, EE, CA, LU	IC, US, GR, PT, IR
2012	DE, NO, SE, IC, FI	CH, BG, HU, RO, HR	DK, SE, LU, CH, NO	US, BG, ES, IT, LT	EE, BE, NO, LU, CA	GR, IC, US, IR, PT
2014	NO, DE, NL, IC, FI	HU, CH, PT, RO, HR	EE, LU, SE, CH, NO	US, BG, LU, GR, IT	LU, BE, CA, EE, US	GR, ES, IR, HR, PT
2016	NO, IC, NL, DE, FI	PT, IT, CH, RO, HR	CZ, SE, EE, CH, NO	LU, US, BG, IT, GR	EE, CA, LU, US, BE	GR, CY, ES, HR, IR
Aver.	IC, NL, NO, SE, FI	HU, PT, CH, RO, HR	LU, DK, SE, NO, CH	US, MT, BG, ES, IT	EE, LU, BE, CA, US	GR, US, IC, HR, CA

Source: SSF (2016)
Note: In each field, the SSI scores for all the countries are ordered from the lowest to the highest one.

Using the updated data and the adjustments described in Section 2, the SDI for 2016 was created. The scores for countries in three wellbeing dimensions and the overall SDI are shown in Figure 1. Switzerland, followed by Slovenia, Austria and Croatia showed the highest SDI in 2016. Other new member countries, such as Slovakia, Hungary and Romania also showed high performance. The Northern American countries together with Estonia, Luxembourg, Belgium and Greece showed the poorest performance. As regards the SSI 2016, the Northern American countries showed the poorest performance as well and they were followed by Greece, Belgium, Ireland and Cyprus. Switzerland is the best performing county and it is followed by Romania, three Northern countries: Denmark, Norway and Sweden, and Latvia.

The differences between the SSI and the SDI are caused not only by the updates and differences of data sources, but especially by omitting the indicator of Population Growth and inclusion of the R&D expenditure, Long-term Unemployment instead of overall Unemployment and GDP per capita growth rate. In all the monitored years (see Table 2), Switzerland is the best performing country in the SSI, Sweden is one of the best performing countries and since 2010, Romania has shown one of the best results, Slovenia until 2012. The USA, Canada, Belgium and Greece showed low performance in all the years, while Iceland and Ireland showed decreases due to the economic crisis. However, in Iceland the score has been increasing in last two monitored years 2014 and 2016 after the previous decrease.

Figure 1 ENW, ECW, HW, SDI (geometric mean of three wellbeing dimensions), 33 countries, 2016
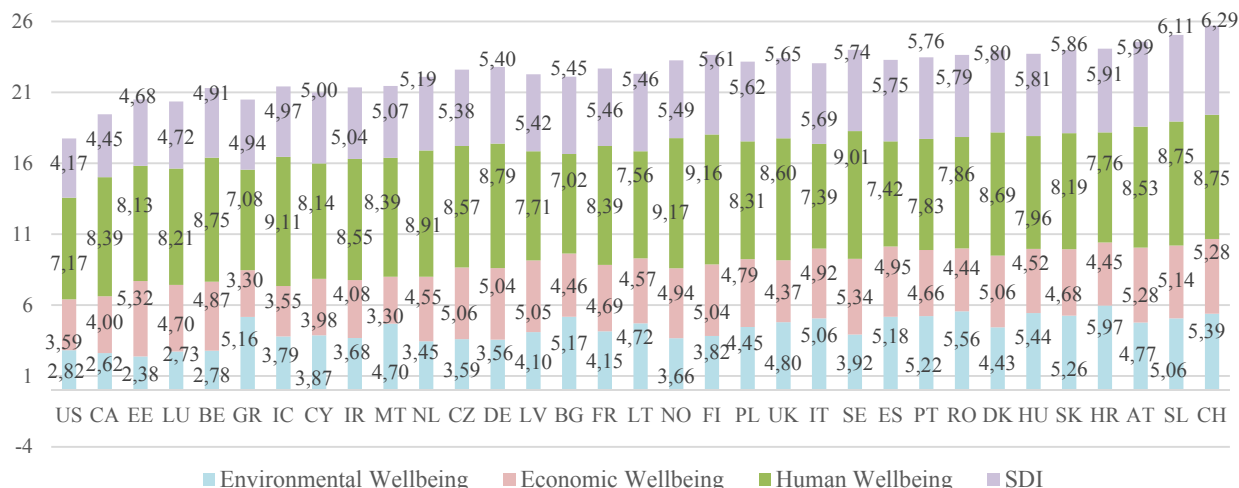
Source: Own processing
Note: The scores are ordered according to SDI from the highest to the lowest one.

Figure 1 also shows that the scores for the HW are relatively higher than those for the ECW and ENW while to the latter the lowest average scores were assigned. This applies both to the SSI and the SDI. Because the strong sustainability principle was used, which indicates that one dimension cannot be offset by others, the ENW score is often limiting factor for the overall sustainability level. The most important example is Estonia showing the second highest score for ECW (due to lowest public debt, relatively high share of Organic Farming and Genuine Savings measured by the Adjusted Net Saving indicator, see more in Drastichová (2016), etc.), but one of the lowest ENW score. This led to the third lowest SDI following two Northern American countries. On the other hand, Croatia, Romania and Hungary were able to achieve one of the highest SDI although their ECW and HW scores are relatively lower. This is also the case of Slovakia that showed slightly higher ECW and HW levels and slightly lower ENW level. To conclude, the countries that showed more balanced score levels (although no of them was high) also achieved the higher SDI and SSI scores than those showing high performance in one or two areas and poor performance in the remaining dimension(s), often in the ENW. Next, to assess decoupling over time in particular countries the first version of the RP indicator in Euro in chain-linked volumes, reference year 2010 (the changes between 2005 and 2016 in Table 3) is used. For comparison of countries the RP in PPS per kg (the second version) is used (the value of 2016 in Table 3).

Table 3 RP in PPS per kg (2016), RP in Euro per kilogram, chain linked volumes (2010) (change between 2005 and 2016)

Country	2016	2005 – 16	Country	2016	2005 – 16	Country	2016	2005 – 16
BG	0.6782	0.0363	CY	1.5684	0.4861	IR	2.2568	1.2516
RO	0.7014	-0.018	GR	1.613	0.1428	DE	2.3036	0.3595
LT	0.8199	0.0497	CZ	1.6701	0.3406	BE	2.7007	0.5335
EE	0.8508	0.0133	AT	1.7023	0.2787	FR	2.7878	0.6715
FI	0.9545	0.1121	HR	1.707	0.2785	ES	3.1725	1.6555
PL	1.2227	0.1631	DK	1.7357	0.4714	UK	3.5867	1.1557
NO	1.274	-0.797	HU	1.7979	0.4841	LU	3.6465	0.9763
PT	1.4352	0.1903	SK	1.8037	0.4547	NL	3.9588	0.9856
SE	1.4995	0.0615	SL	1.894	0.5495	IT	3.9788	1.8048
LV	1.5	0.1767	MT	2.02	-0.2201	CH	4.1103	0.7661

Source: Eurostat (2017)
Note: For Norway and Switzerland, the differences in 2006 – 2015 and 2005 – 2015 respectively were used due to the lack of data.

The lowest levels of the RP are typical of Bulgaria, Romania, Latvia and Estonia. All the new member states (13), Portugal, Greece, Austria and all four Northern countries showed lower RP than the EU's average is (RP 2016 = 2.2322 PPS per kg; the change = 0.5287 Euro per kg). The absolutely highest RP levels were achieved by Switzerland, Italy and Netherlands. In period 2005 – 2016, the highest increase of the RP was achieved by Italy, Spain, Ireland, the UK, Netherlands, Luxembourg, Switzerland and France. All these countries showed the highest levels of the RP in 2016. The only decreases were shown by Norway, Malta and Romania and the lowest increases by Estonia, Bulgaria and Latvia that showed low RP levels (except for Malta). Due to the economic crisis, in 2009, the RP dropped only in Malta, Switzerland, Luxembourg, Estonia and Germany. The highest increase occurred in Denmark, Ireland, Spain, the UK

and France. However, it must be considered that decoupling, which is associated with economic problems and recession, is not a sign of the SD. It is the result of the significant drop in GDP while the DMC declines at a lower rate.

3.2 Results of the cluster analysis

Before the analysis is carried out, the mutual dependence of the variables had to be examined. Accordingly, the correlation and multicollinearity of the used indicators were tested. The highest level of the Pearson Correlation (r) was achieved between the ENW and the HW (-0.478, significant at the 0.01 level (2-tailed)). It means that all the coefficients are below 0.9 while this and higher values indicate strong dependence (Sambandam, 2003). The multicollinearity was insignificant as well. According to Meloun and Militký (2002) the strong multicollinearity is present in data if the Variance Inflation Factor (VIF) is higher than 10. The VIF statistics was below 10 in all the examined cases (the highest VIF = 1.44). Based on the One-Way ANOVA, all the five indicators included were significant by the creation of the clusters at the 0.05 significance level. According to the calculated F-statistics, the RP has the highest influence because the calculated F-statistic showed the highest level (46.719). Table 4 and Figure 2 indicate the important results of the cluster analysis.

Table 4 The classification of 33 countries into the three Clusters according to the HCA

Cluster – Countries	1: AT, CZ, DK, EE, FI, DE, LV, NO, PL, SL, SE		2: BE, FR, IT, LU, NL, ES, CH, UK		3: BG, HR, CY, GR, HU, IR, LT, MT, PT, RO, SK	
	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
RP	1.510	0.421	3.493	0.547	1.491	0.535
ENW	3.977	0.725	4.191	1.084	4.976	0.693
ECW	5.098	0.166	4.791	0.279	4.223	0.504
HW	8.620	0.445	8.302	0.597	7.850	0.485

Source: Own processing

Cluster 1 that showed the highest means and medians for human and economic wellbeing also showed the lowest levels for the environmental wellbeing. The mean of the RP in Cluster 1 is only slightly higher than that of Cluster 3, but the median showed the lowest level in Cluster 1 (see Figure 2). On the other hand, Cluster 3 achieved the highest mean and median in the environmental wellbeing but showed the lowest levels in the remaining three indicators (only the median for the RP is slightly higher than that of Cluster 1). Cluster 2 has the highest mean and median of the RP indicator and medium-sized levels were achieved for three wellbeing indicators.

Figure 2 Boxplots including the standardized values (Z scores) of four indicators for the three clusters
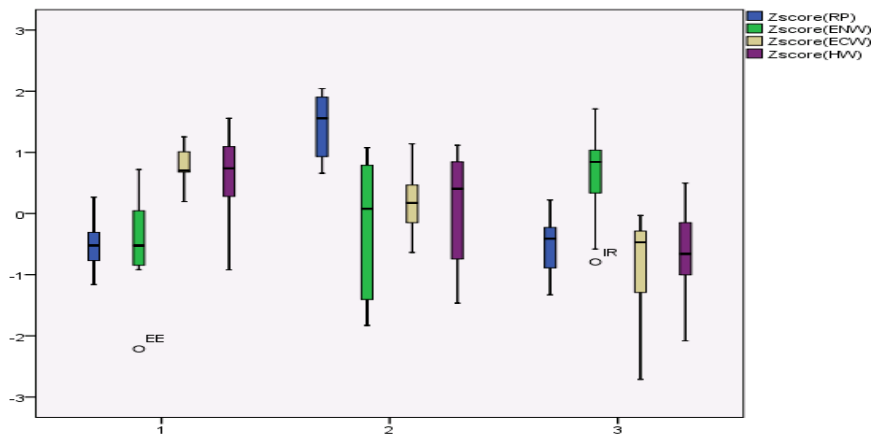
Source: Own processing

Although all the combinations of the indicators are crucial for the SD not only from the point of view of created clusters, but also from the long-term perspective, two combinations of indicators were chosen and displayed in Figure 3 and 4 according to the created clusters. Figure 3 shows the ENW and the HW values for three clusters, i.e. it captures the relations of the human and environmental wellbeing achieved in the countries. As it was indicated at the beginning of this subsection, the highest level of r for these two indicators was shown for the overall sample and it was negative (r = -0.478). The slight positive correlation was also found between the HW and the ECW (r = 0.383) and slight negative correlation between the ECW and ENW (r = -0.239). Although it is necessary to study the long-term development, this relation indicates that high level of human wellbeing could have been achieved at the expense of declining environmental wellbeing. The economic wellbeing also determines the human wellbeing. In Figure 3, the values are more scattered than in Figure 4, which is particularly related to the highest standard deviation of the ENW indicator for all three Clusters. For Cluster 1 and 2 the standard deviation of the HW is also relatively high.

Figure 3 Scatter chart displaying relations between the ENW and the HW for three Clusters (HCA, Ward method applied)
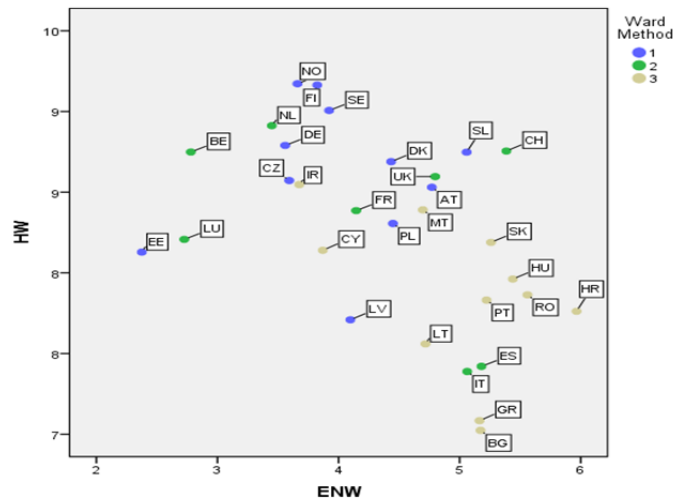
Source: Own processing

It can be seen in Figure 3 and 4 that in Cluster 3 the relatively high ENW values together with the relatively lower HW and ECW values prevail. The major exception is Ireland that is the outlier in the ENW for Cluster 3 (see Figure 2), i.e. it showed relatively low ENW (lowest in Cluster 3), but relatively higher HW value (and the low ECW that is typical of Cluster 3). Cluster 1 containing Northern economies, five new member countries, Austria and Germany shows relatively high ECW and HW but relatively lower ENW. However, the ENW levels of Slovenia and Austria are one of the highest. Lithuania showed the lowest HW and Estonia its second lowest level in Cluster 1 and, moreover, this country is the outlier in the ENW value that is the lowest in the overall sample (see Figure 2). In Figure 3, the values are most scattered for Cluster 2 due to the high standard deviations of the ENW and the HW. Spain and Italy show high ENW, but very low HW values, Switzerland achieved high values of both indicators, BENELUX countries showed relatively high HW and low ENW (Luxembourg also showed relatively lower HW) and France and the UK showed medium-sized values of both indicators. The values for both ENW and HW are higher for the UK than for France. Overall, as the ECW values in Cluster 2 are middle-sized for the majority of countries, high for Switzerland, the ECW for the UK showed the lowest level (see Figure 4). The second combination of the indicators for three clusters is shown by Figure 4, particularly the RP and the ECW levels. This directly shows how the economic performance of the country is combined with its environmental impact of the production, i.e. the effectiveness of the material use. No significant correlation was found between these two indicators ($r = 0.047$). There is also no significant correlation between the RP and other two wellbeing indicators ($r = -0.068$ and 0.158 for the ENW and the HW respectively). On the other hand, the differences between clusters are clearly seen in Figure 4, as compared to Figure 3. Cluster 1 shows relatively high ECW and relatively lower or medium-sized RP levels. Cluster 2 shows high RP (eight countries with the highest RP levels) and medium-sized ECW levels (except for Switzerland achieving high ECW). Cluster 3 showed relatively low ECW levels and low or medium-sized RP levels. Cluster 1 achieved the highest mean and median in the ECW (see Table 4 and Figure 2), with maximum represented by the ECW of Sweden (the highest ECW in overall sample) and minimum by the ECW of Poland. Greece from Cluster 3 showed the minimum for the ECW in the overall sample while Slovakia showed ECW's maximum for this Cluster. As the RP has the highest influence by the creation of Clusters, the classification into three groups according to the RP is obvious. The eight countries with the highest RP levels belong to Cluster 2, then the values for Cluster 1 and 3 are more intermingled, depending on the ECW that has the second highest influence by the construction of Clusters.

Slovenia, Austria and Denmark from Cluster 1 together with Switzerland from Cluster 2 and Croatia, Slovakia, Hungary and Romania from Cluster 3 showed the highest SDI levels (see Figure 1). As it can be seen in Figure 3 and 4, only Switzerland showed high levels of all the indicators included, Slovenia has very good performance in three wellbeing areas, but medium-sized RP. Similar results are typical of Austria showing slightly lower RP, HW and ENW than Slovenia, but slightly higher ECW. These three countries can be regarded as the most sustainable countries according to the analysed indicators. Canada and the USA are the least sustainable countries according to the SSI, SDI and their wellbeing dimensions (except for medium-sized HW levels of Canada). However, they are not included in cluster analysis due to the lack of data on the RP. The other unsustainable country should be Estonia that showed extreme values in two wellbeing areas, i.e. the lowest ENW and the second highest ECW together with relatively low HW and low RP. According to the strong sustainability principle, one wellbeing area cannot by offset by the other, so these results are clearly unsustainable. Similarly, BENELUX countries are the less sustainable EU countries due to low performance in the ENW although the HW of Netherlands and Belgium is relatively high and all three countries have high RP. Accordingly, high productivity of the resource use does not have to mean high environmental wellbeing. Other two less sustainable countries are Greece and Bulgaria. Except for high ENW, they show poor results in all other indicators. They

show absolutely lowest HW levels, Greece showed the lowest ECW and Bulgaria the lowest RP. Because Bulgaria is the least developed EU country, the challenge for this country is to increase the ECW and RP and to maintain high ENW. Greece was significantly affected by the economic crisis and thus it should focus on improvements in the economic wellbeing. In both economies, it should be a tool to increase their HW. Moreover, Cyprus and Malta can be regarded as the less sustainable countries as well; however, their extraordinary conditions of small island countries must be taken into account. The four Northern countries do not turn out to be the best performing countries in this analysis although they achieved high HW and ECW levels. The problematic issues are the low ENW and the RP levels that should work as limiting factors for further economic and human wellbeing increase. Although Denmark recently shows the lowest HW in this group, its ENW and the RP are relatively highest. This could have effects on future development in terms of sustainability.

Figure 4 Scatter chart displaying relations between the ECW and the RP for three Clusters (HCA, Ward method applied)
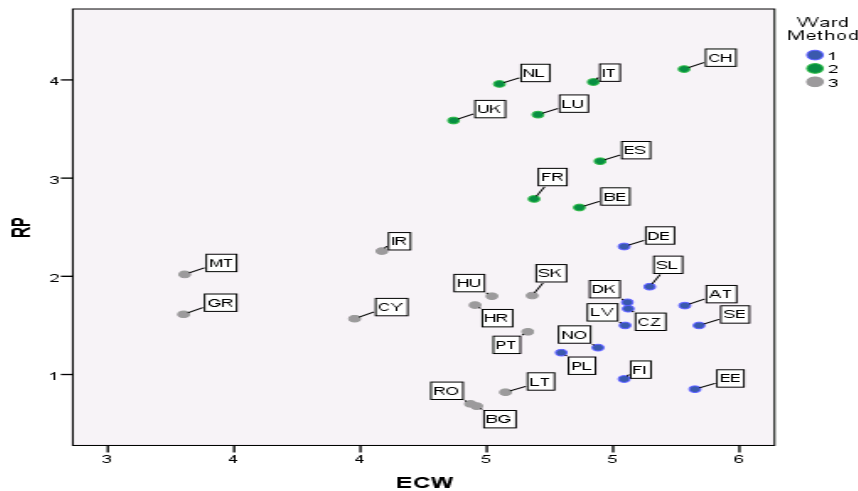
Source: Own processing

It is difficult to decide which Cluster is most and which least sustainable because each of them showed the highest performance in at least one included indicator. However, Cluster 2 does not show the lowest mean and median for any indicator, i.e. medium-sized levels were shown for three wellbeing indicators and the highest mean and median was shown for the RP. Switzerland is the most sustainable country of the overall sample. The crucial challenges for several Cluster 2 countries is to increase their ENW (BENELUX) and their HW (Italy, Spain). Cluster 1 includes the countries with the highest HW and ECW levels. Their average RP is significantly lower than that for Clusters 2, but only slightly higher than that for Cluster 3 and this Cluster showed the lowest ENW. The latter two aspects can undermine further development in the ECW and ENW and their sustainability although in this group are highly developed Northern countries and Germany. On the other hand, Slovenia and Austria that showed highest ENW levels in this group can be regarded as the most sustainable EU countries based on this analysis. More of less sustainable countries can be found in Cluster 3 that only showed highest mean and median in the ENW and lowest means and medians in other three indicators (although the median for the RP is slightly higher than that of Cluster 1). On the other hand, several new member countries included in this Cluster, i.e. Slovakia, Hungary and Romania showed highest SDI level in the overall sample that is affected by very high ENW levels. The performance in other indicators is weaker especially for Romania. Hungary and especially Slovakia can be regarded as the most sustainable countries of Cluster 3.

4 Conclusions

The aim of the Paper was to evaluate sustainability in the EU countries together with the additional developed countries according to their wellbeing achieved in three SD dimensions and decoupling by means of three indices: the SSI, SDI (for the *wellbeing approach*) and the RP (for the *decoupling approach*). The HCA was applied to divide the sample of countries into three groups showing similar levels of the ECW, ENW and HW, together with their RPs. The applied decoupling indicator – the RP had the highest influence by the creation of the clusters. The indicator of the economic wellbeing (ECW) had the second highest influence on the cluster creation.

It was detected that in the SSI and the SDI the assigned scores for the human wellbeing are relatively higher than those for the economic and environmental wellbeing dimensions while the latter showed the lowest average scores. Because the strong sustainability principle was used, which indicates that one dimension cannot be offset by others, the ENW score is often limiting factor for the overall sustainability level. The countries that showed more balanced score levels, although no of them has to be high, also achieved the higher SDI and SSI scores than those showing high performance in one or two areas and poor performance in the remaining dimension(s), often in the ENW.

Cluster 1 showed the highest means and medians for human and economic wellbeing and the lowest levels for the environmental wellbeing. The mean of the RP in Cluster 1 is only slightly higher than that of Cluster 3, but the median showed the lowest level in Cluster 1. Slovenia, Austria and Denmark that showed high ENW levels in this group can be regarded as the most sustainable EU countries. Poland also showed one of the highest ENW in this group, but medium-sized wellbeing scores and low RP. On the other hand, Northern countries (except for Denmark), Germany and the Czech Republic showed high HW and ECW levels but the low ENW levels and relatively low RP levels as well. This also applies to Lithuania and Estonia that also showed relatively low human wellbeing. Cluster 3 achieved the highest mean and median in the environmental wellbeing but showed the lowest levels in the remaining three indicators (only the median for the RP is slightly higher than that of Cluster 1). Slovakia and Hungary are best performing countries in this group because they showed highest ENW levels and middle-sized (or slightly lower) levels of other indicators. Cluster 2 has the highest mean and median of the RP indicator and medium-sized levels were achieved for three wellbeing indicators. All countries in this group show very high RP, however, the values of indicators in this group are more scattered. BENELUX countries showed low ENW levels, Southern countries showed low ECW levels. On the other hand, Switzerland showing the highest SDI, SSI as well as the RP is the most sustainable country of the overall sample.

Canada and the USA are least sustainable countries according to the SSI, SDI and their wellbeing dimensions (except for medium-sized HW levels of Canada), but they were not included in the cluster analysis. Moreover, Bulgaria and Greece from Cluster 3 can be regarded as one of the least sustainable countries showing good performance only in environmental wellbeing. These countries should utilize its components properly for improvements in the indicators in other wellbeing areas. The less sustainable countries are also BENELUX countries, small countries – Malta and Cyprus, and all countries showing significant imbalances in wellbeing dimensions, especially Estonia.

Although it is necessary to study the long-term development, the results indicate that high level of human wellbeing could have been achieved at the expense of declining environmental wellbeing. The economic wellbeing also determines the human wellbeing. On the other hand, countries have achieved different Resource Productivities determined by broader factors, which can further affect all three kinds of wellbeing. The less developed countries that still show lower ECW and HW levels and high ENW should focus on the development that will not reduce their ENW. They should also make efforts to decouple economic growth from environmental effects, i.e. to increase the RP in order to achieve high level of human wellbeing. The challenge for future research is to include longer time series of appropriate SD indicators and detect deeper relations between the wellbeing dimension and their links to the decoupling indicators.

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Economic Aspects of Public Administration Structure at the Municipal Level in the Czech Republic

Jiří Dušek

Abstract: *On a European scale the Czech Republic is typical of its disintegrated structure and a high number of municipalities, which is typical of other European countries as well, such as France, Italy, Germany and Spain. Nevertheless, the settlement structure is different compared to other EU member states because there are the least populated municipalities on average in the Czech Republic, which is reflected in their economic situation, autonomy and self-sufficiency. On this assumption the implemented analysis is based (on example of 623 municipalities in South Bohemia Region), aiming at miscellaneous relations of involving municipalities into structures of municipality cooperation in accordance with size category. The research of involving municipalities into individual ways and forms of municipality cooperation was carried out by author in 2007-2015, the findings were tested subsequently by correlation and regression analysis and completed with descriptive statistics. The analysis proved an unambiguous relation between level of cooperation and size municipality, which proved the relation to economic aspect of municipalities, having been examined, because the more closely the municipality is involved into the structures of cooperation, the more absorption ability and capacity the area has.*

Key words: Cooperation of Municipalities · Municipality · Public Administration · Region · South Bohemian Region

JEL Classification: O18 · R11· R51

1 Introduction

The current and anticipated future conditions for the development of cities and municipalities are now subject to a major change in paradigm. While in the past it was always growth (in population and the economy) that was the driving force behind local development, but now cities and municipalities are facing stagnation or deterioration in processes due to demographic and economic structural changes (Schwarting, Krökel, 2006, p. 6), these phenomena are typical not only of Central Europe but of the whole European territory. The particularly fragmented structure of municipalities, i.e. a large number of small and very small municipalities, has become the subject of many discussions during recent years (e.g. Bennett, 1993, 1997, Blažek, 2004, or Lidström, 1998). What is especially criticised according to Binek, et al, 2011, p. 18, is the social and economic development of the countryside, the stability of elected bodies of small municipalities, their financial management, the quality of their administrative action, the compliance with applicable laws, etc. The truth is that the size of the municipality decreases the relative cost of local government and the services provided, so these functions are simply cheaper. By merging municipalities, the cost of infrastructure construction will not go down and shared structures will remain the same (i.e. economic arguments cannot be overestimated). Many savings can be achieved through simple cooperation (e.g. within the framework of municipality unions), as stated by Ryšavý, 2006, who sees – as the carrying functions – the creation of a network of cooperation between rural areas and cities, particularly medium-sized centres, and also the interconnection of economic activities of small municipalities in rural areas. The already mentioned infrastructure, particularly transportation, is that lies behind the attractiveness of large municipalities for business, despite the lower cost of production factors in smaller municipalities. Insufficient infrastructure is however not only an issue for smaller municipalities. It also translates into the unattractive nature of regional towns such as Karlovy Vary and České Budějovice (see Novotná, Volek, Alina, 2014, Měrtlová, 2012, or Hálová, Alina, 2014 for more details).

2 Methods

Based on the findings from the theoretical sources and from an analysis of the research carried out in the area of interest, the author defined the following hypothesis: Larger municipalities are involved in cooperation between them more than smaller municipalities. The verification of the hypothesis should rebut the claims of some authors who speak about intensive involvement of smaller municipalities as a means of overcoming natural handicaps, resulting from a worse economic, administrative and technical background. Research into the involvement of municipalities in 12 ways and

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forms of cooperation between municipalities was carried out in 2007-2015 on a basic set of 623 municipalities in the South Bohemian Region. The results were subsequently tested in a correlation and regression analysis, supplemented by descriptive statistics. To be able to objectively evaluate the intensity of cooperation between municipalities in the region studied, the author constructed model for evaluating the cooperation between municipalities, using a quantification method. The quantitative expression of the dimension represents the value of a synthetic indicator referred to as the Coefficient of cooperation (Cc) – see more in Dušek, 2010, p. 87.

The Coefficient of cooperation (Cc) is in this contribution used to demonstrate differences in the quality of cooperation among municipalities. The coefficient of cooperation of a given area is calculated as an average of individual coefficients of cooperation found in the studied area.

$$C_C = \sum_{i=MCR}^{EGTC} V_i \tag{1}$$

where:

V_{MCR} member of micro-regions
V_{UTMSBR} member of the Union of Towns and Municipalities of the South Bohemian Region
V_{LAG} member of a local action group
V_{CL} member of clusters
V_{NHCN} member of the National Healthy Cities Network of the Czech Republic
V_{UTMCR} member of the Union of Towns and Municipalities of the Czech Republic
V_{ALGCR} member of the Association of Local Governments of the Czech Republic
V_{CIC} the municipality is a member of cross-border impulse centres
V_E the municipality is a member of Euroregions
V_{EGTC} the municipality participates in the European Grouping of Territorial Cooperation
i means of cooperation of municipalities

The construction of the formula is based on new typology of means and forms of cooperation of municipalities in the Czech Republic designed by the author, where the formula includes all statistically available forms of cooperation within the studied South Bohemian Region (the formula can be easily modified to suit a different region or even a country). These forms were assigned the same importance 1.0, although their significance for the development of the region varies. The reason for this decision was the fact that municipalities join micro-regions or local action groups first and participate in other "above-standard" types of cooperation later. Rather than the significance of the respective elements, the importance reflects the relevance of the database. In practice, the cooperation coefficient has a better declaration value in determining equal importance. It is apparent at first sight how many times a town or a municipality has participated in any form of cooperation in the studied region.

3 Research results

3.1 Development of the conditions and forming of cooperation in the Czech Republic

The development of the landscape is inherently linked with historical events, the development of the society, agricultural management, settlements and the development of crafts and/or the industry. It is according to these events that the development of the Czech landscape and its settlements can be divided into several stages – so-called "turning periods" in which there were fundamental changes resulting from the cultural and social development of current or past times (Lokoč, Lokočová, Kolářová Šulcová, 2010, p. 9).

Perlín, 1999, pp. 91-92, characterises the development of the settlement structure on the Czech territory and states that it is conditioned both by the time of its emergence (12th to 14th century) and by the configuration of the terrain. Rural Czech areas are characterised by small settlements with 30-100 residential buildings and a relatively dense network of smaller towns with 3,000-10,000 residents. These towns are composed of natural shopping centres and centres for the provision of various services. Since the middle of the 19th century, they have also been used as administrative centres for newly emerging state administration (political and judicial districts). Evidence of the fragmentation of the Czech settlement structure is a large number of municipalities or cadastral districts. The individual parts of the municipalities are local areas, the territory of which was originally divided. These parts either exist separately or they may have grown together with another part (urban area) during their further development. Separated parts of rural communities – small groups of houses are quite common in rural areas. In the Czech Republic more than 15,000 parts of municipalities are registered and it is only in rural areas, i.e. outside of towns, where 11,500 parts of rural villages are currently registered. The density of the settlement network can be documented with mean values. For every 10 square km in the Czech Republic there are almost 19 parts of municipalities and when excluding towns, i.e. in rural areas, this value drops to only 15 local parts. However, the number of settlements does not say anything about the administrative struc-

ture. The administrative structure, i.e. the structure of public administration, which performs the basic administrative and political administration in the respective area, is highly fragmented in comparison with the surrounding countries, which is due to the historical development and the scattered settlement structure.

The history of how municipal cooperation in the Czech Republic has been forming is directly connected with the historical development of the number of municipalities, which has repeatedly undergone fundamental changes over the past 100 years. The foundation for the formation of the present municipal structure was the division of the territory of Czech lands in the middle of the 19th century into approximately 13,000 cadastral municipalities. While, when Czechoslovakia emerged, the number of independent municipalities was 11,500, the number peaked in 1930 at 11,768 independent municipalities. The situation has not changed dramatically until the end of the 1940s, when in 1950 there were 11,459 municipalities in the Czech Republic. The slight decline when compared with the 1930s was caused by the immediate situation after the end of World War II and the post-war expulsion of the German population. The first breaking point in the territorial administrative division was the year 1948 (with the onset of the communist regime), after which the centralised economy led to a gradual, but violent administrative merging of municipalities, for example by establishing municipal committees, the municipality effectively lost their legal personality. Decision-making on the merging of municipalities was then the responsibility of the supreme bodies of national committees (the regional or district national committee) that were most active in the 1980s and were even setting up the so-called central municipalities. The integration process culminated in 1990 when there were only 4,100 independent municipalities, which is one of the largest declines in the number of municipalities in Europe between 1950-1990: with a 62.27% drop, the Czech territory was just behind the United Kingdom and Scandinavia where this level even approached 80%.

The second major breaking point in the territorial division of Czechoslovakia was the year 1989 and the Velvet Revolution, which triggered a wave of disintegration tendencies, unparalleled in the other post-socialist countries. If, for example, the growth in the number of municipalities in Slovakia between 1988 and 2011 was only +7.28%, in Poland it was +3.33% and in Romania in was +7.9%, in the Baltic States there was a further decline in the number of municipalities: -59.58% on average. While in all European countries the number of independent municipalities grew after 1989 only by a few percentage points, this growth in the Czech Republic reached an alarming +52.27%. This phenomenon has had a number of causes, from historical violent integration to public administration reform to accentuating principles of decentralisation, deconcentration and re-establishment of territorial administration instead of a system of national committees. The South Bohemian Region (+109.06%) and the Pilsen Region (+94.19%) reached the highest growth, while in the South Moravian Region it was only 21.04% of the municipalities and in the Zlín Region it was +24.8%. Since 2000, the number of municipalities has been stable at around 6,250 municipalities. The third, but not too big, breaking point is the definition of new municipalities (e.g. Bražec, Doupovské Hradiště, Kozlo, Libavá, Luboměř pod Strážnou, Polná na Šumavě) as of January 1, 2016 in the military zones of Boletice, Libavá and Hradiště.

This way, following the disintegration processes, the settlement structure of the Czech Republic is characterised not only by large fragmentation, but also by the fact that small municipalities were participating in the disintegration processes. Currently, the smallest Czech municipality is Vysoká Lhota in the Vysočina Region. It has 17 inhabitants. Kuřimany (28 inhabitants) in the Strakonice county is then among the smallest ones in the South Bohemian Region. So while a town needs to have at least 3000 inhabitants to be a town, no such condition exists for municipalities. The municipality can therefore exist with any population. The only condition applying to the size of the municipality is, according to Act No. 128/2000 Coll. on Municipalities (§ 19-25), the case of separation of a municipality from another municipality – a minimum of 1 000 inhabitants. The existence of a large number of small municipalities, mostly the rural ones, since the beginning of the 1990s has been accompanied by a number of long-term issues such as the depopulation of municipalities, population ageing, deterioration in the qualitative and quantitative level of the provision of public services and assets and/or other technical and civic amenities as well as other phenomena. Despite the constant changes in the budget and taxing and the "statistically" growing share of smaller municipalities in the total income of municipalities, there is a significant part of the municipalities with a size of up to 500 inhabitants where the budget has been continuously decreasing, leading to a lack of funds (higher costs of achieving comparable effects in public services or the provision of amenities when compared to larger municipalities) and the deterioration of basic functions of the municipalities and hence further depopulation of the municipalities → the so-called vicious circle of rural municipalities finances. It makes therefore sense that the gradual increase in disparities between municipalities leads to discussions addressing the fundamental contradiction between the democratic right to governance versus economic efficiency and the functioning of small municipalities in a way that makes sense. Any direct attempt to reform and reduce the number of municipalities is hardly feasible in the current political and social situation and the way of gradual economic depletion of municipalities is no correct and conceptual solution to the problem. Of the 6253 municipalities, it was already 51.7% of (3235 municipalities) that were declared indebted in 2014 and the debt level amounted to CZK 89 billion. So if we want leave the way of involuntary or voluntary merging, there is actually only one solution: cooperation between

municipalities. Among their biggest negative sides for the harmonious development of smaller municipalities are (Galvasová, et al, 2007, pp. 18-19) the following:

- low level of equipment – technical infrastructure,
- fast loss of jobs,
- lack of funds for the provision of activities within the competence of municipalities.

Table 1 Number of municipalities of the Czech Republic in individual size categories of municipalities in 1921-2015

Size categories of municipalities	1921	1930	1950	1961	1970	1980	1991	2001	2011	2013	2014	2015
1-199	6 706	2 056	4 163	2 018	1 490	528	1 328	1 661	1 492	1 461	1455	1448
200-499		5 145	4 204	3 341	2 805	1 535	1 955	2 041	2 015	2 012	2001	2006
500-999	2 820	2 635	1 825	1 876	1 794	1 345	1 224	1 280	1 349	1 356	1369	1365
1000-1999	1 194	1 175	734	853	800	705	647	652	726	742	745	747
2000-4999	515	568	374	436	400	390	347	363	399	411	412	415
5000-9999	116	112	91	115	120	136	131	130	138	140	140	141
10000-19999	43	49	37	51	59	78	71	68	69	68	68	69
20000-49999	19	23	22	24	26	39	41	41	42	42	43	43
50000-99999	0	1	5	8	13	17	17	17	16	16	15	14
100000+	4	4	4	4	4	5	7	5	5	5	5	5
Total	11 417	11 768	11 459	8 726	7 511	4 778	5 768	6 258	6 251	6 253	6 253	6 253

Source: Czech Statistical Office, own processing.

When comparing the year 1980, when the population of the smallest number of municipalities was reached in terms of the population census, with the year 2015, the then biggest changes occurred in the category of municipalities of up to 199 inhabitants (+174.24%) and with 200-499 inhabitants (+30, 68%). A significant change occurred in municipalities of 10,000-19,999 inhabitants (-11.54%) and 50,000-99,999 inhabitants (-17.65%), as they were reclassified to ones in the higher/lower category. In the other categories there were only changes by a few percentage points during 1980-2015. Nowadays only 32% of the population lives in 93% of the municipalities.

3.2 Involvement of municipalities in cooperation between municipalities according to size

The experience and history of the development of municipal cooperation in the South Bohemian Region clearly demonstrate the important role of larger settlements in the initiation and development of cooperation between municipalities, especially if these are located in an economically weaker county of the region. Larger municipalities should have, subject to exceptions (e.g. size limitations for the local action group), broader possibilities of cooperation through better social capital and the economic, administrative and technical background, enabling the municipality to engage in various forms of cooperation, grants and contribution programmes, without the municipalities having to outsource these activities in part or in full, when compared with smaller municipalities. A practical example could be the Strakonice county or the emergence of the South Bohemian Euroregions, where, paradoxically, larger inner-county municipalities rather than border-close municipalities were getting engaged first. Similar experience is reflected in the past EU programming period 2007-2013. According to Vlasák, 2014, about one fifth of Czech municipalities – 1,191 to be exact (19% of municipalities out of 6,253 municipalities), did not use any EU funds, because they did not prepare any project financed from EU funds, even though several tens of billions of CZK were available in the individual regions. For smaller municipalities it is much easier to participate in projects through other cooperating entities (e.g. local action group), and other forms or methods of engagement are, for many reasons, difficult or even impossible for them.

The chart shows clearly that higher coefficients of cooperation are for municipalities with a higher number of inhabitants (2014), the results of the graphic analysis are distorted only the size categories of municipalities 50,000-99,999, where there is only one and the largest city of the region: České Budějovice, which approaches cooperation between municipalities only to a very small degree. Given its possibilities and size, České Budějovice does not see cooperation between municipalities as a priority and primary regional development tool, so they are only involved in the Union of Towns and Municipalities of the Czech Republic (1990), the Union of Towns and Municipalities of the South Bohemian Region and Euroregion Silva Nortica. When compared with 2007, České Budějovice is no longer engaged in Local Agenda 21. We should first examine the tightness of the dependence between the variables in the statistical analysis – Spearman's correlation coefficient of 0.3901134 points to, according to De Vause, 2014, the medium to substantial relationship of the two variables examined. When extending the analysis and adding the precise quantification of the impact of the population of the municipality on the coefficient of cooperation, we have to ask ourselves: By how much will the cooperation coefficient increase on average if the population of the municipality increases by 1000 people?

Figure 1 Coefficient of cooperation of municipalities in the South Bohemian Region
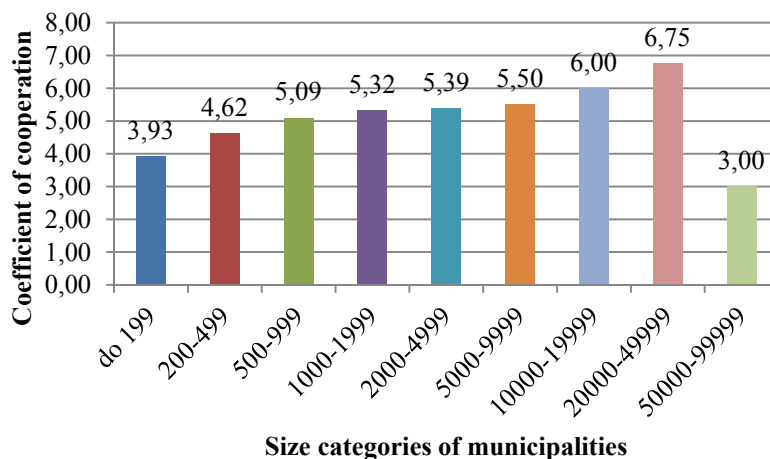
Source: Own processing

The answer to this question can be foreseen based on a linear regression model where the explanatory variable is the number of inhabitants (in thousand) and the explanatory variable is the cooperation coefficient:

$$C_c = \alpha + \beta \times number\ of\ inhabita\ nts \qquad (2)$$

where:
C_c coefficient of cooperation
α constant
β coefficient β

Linear regression will be used for estimating coefficients α (constant) and coefficient β which indicate how the Cc will change if the population grows by one unit (i.e. by 1000 inhabitants).

The significance test of the model (F-test) showed that the regression model is statistically significant. The P-value of the significance test (Significance F) of the model is equal to 0.029, so the model is significant on the 5% significance level. The P-values of partial significance tests are lower than the 5% significance level chosen. Both coefficients of the regression model are therefore statistically significant. The regression equation has this shape:

$$C_c = 4{,}53 + 0{,}0295 \times number\ of\ inhabita\ nts \qquad (3)$$

Therefore, the hypothesis can be unambiguously confirmed. The β coefficient, after the linear regression, is equal to 0.0295, which can be interpreted so that when the population of the municipality increases by 1000, the cooperation coefficient will increase by an average of 0.029.

Table 2 Linear regression output

Regression statistics	
Multiple R	0.087274871
Reliability R	0.007616903
Observation	623

ANOVA

	Difference	SS	MS	F	Significance F
Regression	1	10.9815	10.9815	4.766402	0.029394
Residue	621	1430.746	2.303938		
Total	622	1441.727			

	Coefficients	Standard error of the mean	t Stat	Value P	Lower 95%	Upper 95%
constant – α	4.526806412	0.062363	72.5877	0.00000	4.404338	4.649275
number of inhabitants (in thousands) - β	0.029526306	0.013524	2.183209	0.02939	0.002967	0.056085

Source: Own processing

4 Conclusions

The analysis showed a clear link between the level of cooperation and the size of municipalities, because the proposed regression model is statistically significant. We can therefore state that small municipalities have, thanks to their economic, administrative and technical background, lower capacities to engage in various forms of cooperation between municipalities and thus in grant and contribution schemes. We can therefore ask whether we can really eliminate or mitigate regional disparities through the current regional policy, because higher involvement of municipalities in municipal cooperation structures means a higher absorption capacity and capacity of the territory. The main issue with the structures of the Czech public administration is not only the current complexity of self-government, the increase of the agenda from the state and the lack of money for some investments, but also the complex, expensive and inefficient existing public administration system. The reason is that the current structure will, in the long term, bring problems regarding the standard of public services, their financing and the ever-increasing number of official agenda and obligations passed on to the municipalities without corresponding financial performance. We can see from the analysis of the economic results of municipalities (by size) that during recent years it has been the smallest municipalities (1-199 inhabitants) that have been showing the smallest dynamism in the growth of their total income. This means that the results of this analysis only confirm the economic problems of smaller municipalities. There is still the question how the problem of the fragmented municipal structure of the Czech Republic will be solved. Are we going to take way of merging municipalities (going from a voluntary phase to one forced by the state), or follow the example France and Finland and develop other alternatives such as cooperation between municipalities? Or will the current situation, where the state administration is transferred from some municipalities onto municipalities with extended powers, be evaluated as sufficient for overcoming the problems of the fragmented municipal structure? ... In the future, the political representation will be facing a difficult task regarding the public finance deficit: to decide how to improve the existing public administration system and make the provision of public services more efficient. From the mathematical point of view, unfortunately, it is not possible to reliably determine what is the optimum size of a municipality or town. So any attempt to voluntarily or involuntarily merge municipalities and create certain size structures becomes a matter of political decision-making.

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Western Balkans on their Way towards EU Integration: Trade Analysis

Tomasz Grodzicki

Abstract: *The paper aims to analyse the international trade of Western Balkan countries (Albania, Bosnia and Herce-govina, FYR Macedonia, Kosovo[5], Montenegro and Serbia) with the focus on EU integration. Over 75% of the total Western Balkans' trade is done with EU countries. Western Balkans are actively involved in the regional integration as all of them are the members of the Central European Free Trade Agreement (CEFTA). Western Balkans have been reducing trade barriers in recent years. Nevertheless. The Western Balkan countries still face with outdated procedures for border checks what make even regional trade difficult. The World Bank in its doing business report underlines that there is still room for improvement for the Western Balkans region, as the time and administrative burden in Western Balkans states are a way higher than in the EU member states as well as OECD countries.*

Another aspect is that the Western Balkan countries very often have their own free trade agreements with other non-EU countries (and they do not have free trade deals with EU member states). In this way, entering the EU will force the Western Balkan countries to follow EU single market rules, so no longer will they be allowed to keep their current free trade agreements.

1 Introduction

Albeit that the Western Balkans (WB) is a group of neighbouring countries, located in the Southeastern Europe, they are quite diverse in terms of their economies. They are all candidate or potential candidate countries to the EU, so it is vital to analyse them together. According to Tsanana (2014) the WB countries are in the process of catching up within themselves and the EU. They are all members of the Central European Free Trade Agreement (CEFTA) what was also the case for former EU candidate countries before joining the EU (like Central and Eastern EU countries). Nevertheless, being a part of CEFTA does not solve some particular trade problems (e.g. time and cost to export) of these countries. Therefore, it is of great importance for them to move forward and become an EU member state which automatically will make them a part of the EU Single Market, a common market, which is a higher level of economic integration.

However, one may argue that being a part of the EU, these countries will not be able to keep their current free trade agreements any longer. Some of them, like the free trade agreement between Serbia and Russia has recently been very profitable for both sides. This is obviously caused by the unstable political situation of Russia with other EU countries (but also with the US, Norway, Canada and Australia), and the introduction of the so-called 'embargo' in 2014.

Section 2 provides an overview on the importance of trade to the WB, indicating that trade is one of the biggest sectors of the WB economies. Then, section 3 continues with the main trade concerns of the WB which are trade openness, time and costs to export regarding border and documentary compliance. It also comments on the quality on transport infrastructure in the WB and it ends up with the note on the need for WTO membership for BiH, Kosovo and Serbia. Section 4 deals with the potential gains and looses of being outside the EU and its implications on trade. Section 5 concludes.

2 Methodology

This paper is to provide an overall picture on trade in the WB in the context of being outside the EU. It presents essential figures in order to analyse the following indicators: (1) structure of economy with a particular focus on trade, (2) trade flows, (3) trade openness, (4) cost and time to export, (5) top trading partners, (6) Quality of transport infrastruc-

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[5] Kosovo is a disputed territory and partially recognised state - http://www.kas.de/wf/doc/kas_37608-1522-1-30.pdf?140429132226

ture. It is crucial to mention that all these statistics come from the secondary sources, which include: the World Bank, the World Economic Forum, Eurostat, European Commission, other publications.

The main idea of this paper is to show the potential gains and losses of being outside the EU for WB trade. Thus, the paper presents a critical literature review, which clearly represents both sides of the analysed phenomenon. In line with the literature, the paper illustrates some crucial statistics for trade, which substantially contribute to this debate. Based on that structure, the paper then draws a conclusion on whether these countries are better-off in terms of trade potentials as non-EU countries or not.

3 The Importance of Trade to Western Balkans

Western Balkans, except for Albania, are still recovering from the Yugoslav Wars. This can be observed not only in the political and institutional dimension, but also in the economic sphere. When analysing the current prospects of European Economic Integration of the WB, one of the most important and inevitable part of the analysis should definitely be trade.

Figure 1 shows the structure of the economy in the WB countries as a percentage of gross value added in 2014. It can be clearly seen that in the most of these countries (except for Albania and Serbia) trade is the largest sector of their economies, amounting to more than 20% of gross value added in these countries.

Figure 1 Structure of economy in the WB countries, % of gross value added in 2014
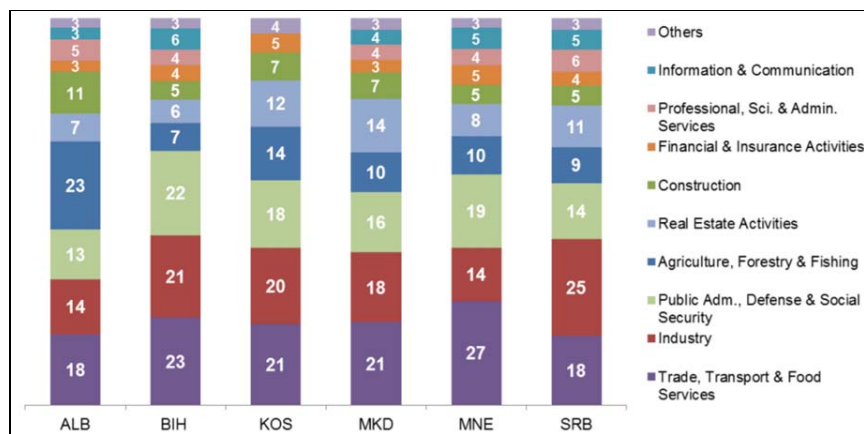
Source: Sanfey et al. (2016, p. 23)

Indeed, trade should be in the centre of attention when elaborating on European Economic Integration of the WB countries. Once we know that trade plays a great role in these economies, we then need to take a closer look into EU-WB trade flows and balance to see the magnitude of this phenomena.

Figure 2 Total goods: EU Trade flows and balance with WB countries for the period, 2006 - 2016
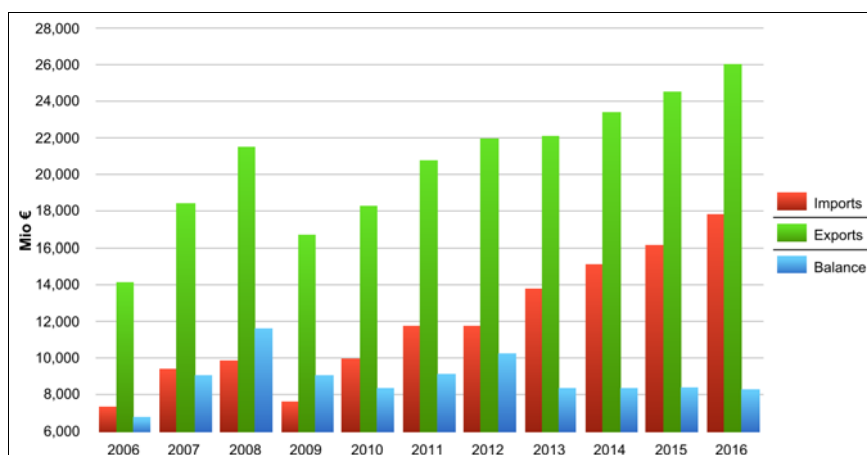
Source: European Commission (2017, p. 3)

Figure 2 illustrates the above mentioned EU-WB trade flows for the period of 2006 – 2016. In general, EU-WB imports, exports and balance of trade increased from 2006 to 2016. However, the dynamics of particular variables were

different. Imports from the EU to the WB were growing until 2008, it reached almost €10 million; then due to the financial crisis, it decreased quite significantly, to a level of less than €8 million . Finally, after 2009 imports were increasing pretty steadily: in 2010 it rose sharply, amounted to around €10 million, in 2011 and 2012 it reached quite similar number – less than €12 million, then it grew quite evenly so in 2016 it reached the number a bit less than €18 million. Exports started with the same upward direction as imports, so it was growing until 2008 reaching the level of above €21 million. After that, due to the financial crisis, it went down to the number of above €16 million. Then, the pace was similar to imports, and the final amount of exports in 2016 was around €26 million. However, the dynamic of balance was a bit different albeit it started in the same way. The balance did not recover soon after the financial crisis and it was decreasing until 2010. After that, it went through an increase and increase in its magnitude, and in from 2013 to 2015 it remained at quite the same level of more than €8 million.

It is crucial to know what are the main things traded in the WB. Table 1 shows the trade flows of the WB in 2016. Machinery and transport equipment are leading in this statistics for both imports and exports. They amounted to 28.8% and 29.5% for imports and exports, respectively. One of the most popular goods traded between the WB and the EU is cars. This can be clearly illustrated by the example of by OECD (2009), that car parts are imported from the WB to Germany but cars are exported to the WB from Germany.

Table 1 Trade flows of Western Balkans in 2016

	Imports				Exports			
	Value Mio €	% Total	% Extra-EU	% Growth*	Value Mio €	% Total	% Extra-EU	% Growth*
Total	17,746	100.0	1.0	9.9	25,967	100.0	1.5	6.0
0 Food and live animals	1,220	6.9	1.2	6.4	2,161	8.3	2.6	3.5
1 Beverages and tobacco	211	1.2	2.6	6.3	442	1.7	1.4	1.7
2 Crude materials, inedible, except fuels	984	5.6	1.7	5.2	478	1.8	1.3	-7.8
3 Mineral fuels, lubricants and related materials	954	5.4	0.4	-1.9	2,207	8.5	3.0	-11.8
4 Animal and vegetable oils, fats and waxes	102	0.6	1.1	6.0	106	0.4	2.0	-3.0
5 Chemicals and related prod, n.e.s.	1,899	10.7	1.0	16.7	3,734	14.4	1.2	5.5
6 Manufactured goods classified chiefly by material	3,276	18.5	1.8	1.5	6,561	25.3	3.5	10.2
7 Machinery and transport equipment	5,119	28.8	0.9	16.4	7,655	29.5	1.0	10.7
8 Miscellaneous manufactured articles	3,894	21.9	1.5	12.3	2,449	9.4	1.2	10.8
9 Commodities and transactions n.c.e.	45	0.3	0.1	-3.8	93	0.4	0.2	14.3
Other	42	0.2	n.a.	n.a.	82	0.3	n.a.	n.a.

Source: European Commission (2017, p. 4)

An inevitable part of the analysis of WB-EU trade is to calculate its share in the total EU trade. Table 2 clearly demonstrates that trade the EU and the WB was 1.30% of total EU trade in 2016. Serbia is the country that trades the most with the EU (0.59%) and then even BiH and FYROM together (0.53%) are not that strongly trade connected with the EU as Serbian economy. Albanian trade amounted up to 0.12% and Montenegro and Kosovo trade with the EU to a very small extent (0.03% each). Indeed, there is some potential in the WB countries but it seems that it is not fully used.

Table 2 EU trade with Western Balkans as a % of total EU trade in 2016

Serbia	BiH	FYROM	Albania	Montenegro	Kosovo	**Overall**
0.59%	0.29%	0.24%	0.12%	0.03%	0.03%	**1.30%**

Source: Own elaboration based on Eurostat data

4 The Main Concerns of WB Trade

Western Balkans are still in the process of regional integration so their economies are still quite diverse. Albeit that all of them are members of CEFTA, they are considered to have different trade characteristics. Trade openness is definitely an excellent indicator to compare different economies taking into consideration their imports, exports and GDP. This indicator is then constructed as a sum of imports and exports divided by GDP, and the result of it is illustrated in figure 3. These statistics are designed for every country of the WB separately and there is also a joint result for the WB. As a comparator, EU-11 were used which are simply: (1) selected countries from 2004 EU Enlargement (excluding only Malta and Cyprus), which include the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia; (2) newest EU member states: Croatia, Bulgaria and Romania. The WB countries are still lagging behind EU-11 for their trade openness, which is 80 on average, in comparison to 135 for EU-11. The trade openness of the WB reached around 70% of the total EU-11 trade openness. There is indeed room for improvement for the WB countries in this field. The best scoring countries within WB are FYROM, Serbia and Montenegro which are placed above the WB average. BiH, Albania and Kosovo are under the average of WB trade openness, therefore they need to work on this issue more efficiently.

Figure 3 Trade openness in 2016 in Central and Eastern EU countries and Western Balkans
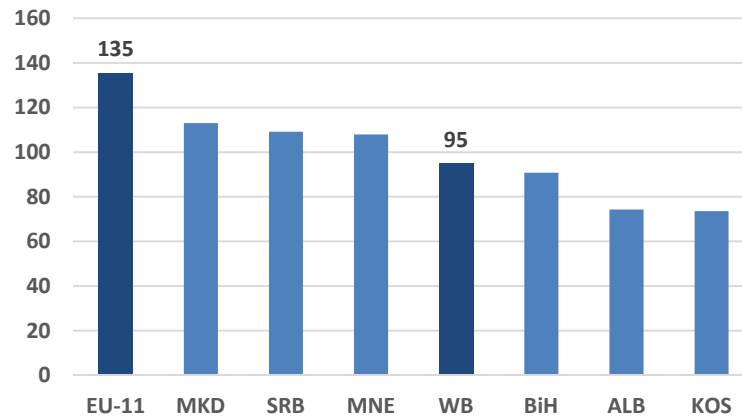
Source: Own elaboration based on data from the World Bank

This unused potential, mentioned in previous section, may be caused by numerous factors. One of them is their export-related burden. Figure 4 presents cost to export which is the amount of all the fees in $U.S., levied on a 20-foot container, associated with export. The figure considers border compliance and documentary compliance for the WB, EU-11, EU and EU-15 (old EU-member states). Figure 5 shows time to export which is measured in calendar days needed to comply with all needed procedures to proceed with export of goods. According to Sanfey et al. (2016) the most important findings from these figures are:

- Significantly larger costs to export in the WB, which are significantly worse in this statistic in comparision with the EU-11.

- Time to export is longer in the WB countries albeit the differences are not as large as in the costs.

- WB should therefore pay more attention to its integration with both European as well as regional supply chains. However, they need to (1) improve the quality of products and (2) strenghten the efficiency of processes which concerns both logistics and delivery methods. In addition, they should not forget that innovation is crucial for their competitveness in the market as it develops the technology used for these purposes. Competetiveness problems of the WB countries towards EU economies was also noted by Botrić (2013) who underlines the diffculties in transition of WB.

Figure 4 Cost to export, 2015   **Figure 5** Time to export, 2015
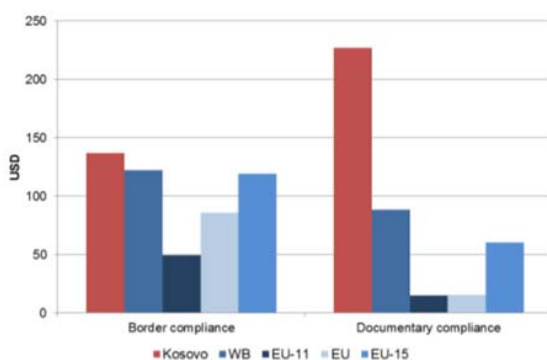
Source: Sanfey et al. (2016, p. 26)
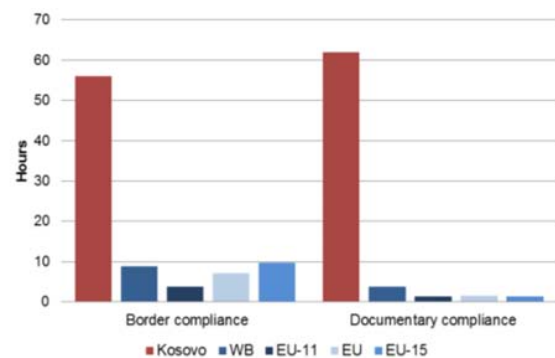
Note: Kosovo is presented separately from other WB countries as it is a clear outlier on these indicators.

It is crucial to know what are the main trading partners of the WB in order to better understand its trade specificity. Table 3 shows these data for 2016 and it seems surprising that regarding total balance the EU-28 is leading with the share of 74.1%. Second is China with 5.5% and then Russia with 4.7%. EU-28 is also tremendously leading in imports and exports, however, it is interesting that in the third place in both imports and exports is Turkey which is a bordering country. It is also quite understandable that Russia is second in Exports due to its embargo imposed on the EU which is more precisely described in section 4.

Table 3 Top trading partners of Western Balkans in 2016

	Imports				Exports				Total trade		
	Partner	Value Mio €	% World		Partner	Value Mio €	% World		Partner	Value Mio €	% World
	World	35,856	100.0		World	20,508	100.0		World	56,365	100.0
1	EU 28	24,361	67.9	1	EU 28	17,380	84.7	1	EU 28	41,741	74.1
2	China	2,940	8.2	2	Russia	796	3.9	2	China	3,092	5.5
3	Turkey	1,899	5.3	3	Turkey	530	2.6	3	Russia	2,648	4.7
4	Russia	1,852	5.2	4	USA	292	1.4	4	Turkey	2,429	4.3
5	USA	716	2.0	5	Switzerland	240	1.2	5	USA	1,008	1.8
6	Switzerland	384	1.1	6	China	152	0.7	6	Switzerland	624	1.1
7	Ukraine	288	0.8	7	United Arab Emi	99	0.5	7	Ukraine	376	0.7
8	India	278	0.8	8	Ukraine	89	0.4	8	Japan	319	0.6
9	Brazil	275	0.8	9	Egypt	69	0.3	9	India	310	0.6
10	Japan	262	0.7	10	Hong Kong	66	0.3	10	Brazil	286	0.5
1	EU 28	24,361	67.9	1	EU 28	17,380	84.7	1	EU 28	41,741	74.1

Source: European Commission (2017, p. 9)

It is commonly known that the quality of transport infrastructure plays a crucial role in trade. When infrastructure is in poor condition or not well developed, then this is definitely a barrier to trade which affects the time of delivery, and which consequently is a decisive factor of doing business. Figure 5 shows the World Economic Forum statistics on the quality of transport infrastructure. It can be undoubtedly seen that the quality of infrastructure in the WB region (Kosovo is omitted in this statistic) still remains as a challenge that these countries need to work on. While the old members of the EU (EU-15) are together ranked on 20th position worldwide, the WB countries are still lagging behind with their 104th place in the ranking. BiH and Serbia were hit the most in Yugoslav war so it might be the reason why these countries are placed below WB average in this ranking. The main problems of transport infrastructure in these countries are: poor quality of roads in Serbia and Montenegro, railroads in FYROM and Albania, inadequate river ports in Serbia, and limited plane transport in all WB, except for Serbia.

Figure 5 Quality of transport infrastructure by the World Economic Forum
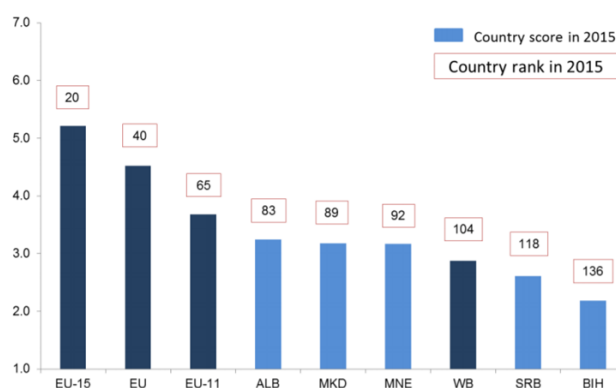
Source: Sanfey et al. (2016, p. 27)

Another problem only for BiH, Kosovo and Serbia is that there are not members of WTO yet. Stiblar (2008) urges these countries to join the WTO as soon as it is possible what would positively impact their net welfare. He then notices that the sooner they join the WTO, the better for them since WTO conditions are likely to be more and more demanding to be satisfied over time.

5 The Main Gains and Losses of being outside the EU for WB trade

Western Balkans countries are on their way towards the EU accession. This topic is widely debated and it seems that for the WB trade it will bring numerous advantages. However, one may argue that being outside the EU they can still gain some profits which otherwise would not be possible to earn. Croatia is a good example for the introduction of the trade dilemma of these countries. Before joining the EU, Croatia was also a member of CEFTA and according to Holzner (2013) it was expected that the Croatian exports to the EU will increase, however its exports to the CEFTA countries and other countries worldwide will decrease, on average.

A topical study of Šabotić et al. (2016) indicates that in the case of Serbia, the importance of free-trade agreement with Russia cannot be overestimated. As a proof for this, this paper presents the calculations of Serbia's exports to Russia over the last few years. Since 2014, when the Russian embargo was imposed on particular goods from EU countries, the US and Canada; there has been a great increase in Serbia's exports to Russia, mainly of agri-food products, which grew by 65% from 2014 to 2015. This phenomena is also presented in the research of Lubos et al. (2016) who specifically named the agri-food goods with the higher increase in number of tones sold, which are: pears and apples as well as pig meat.

Another important advantage of being outside the EU for the WB countries is that the negative effects of the economic crisis for trade were less damaging in the WB than in EU developed countries (Bjelić, et al., 2013). Since the WB countries are not strongly dependent on the EU Single Market, the effects of economic crisis were less damaging in the intraregional trade of the WB rather than in the EU-WB trade.

Nevertheless, there are numerous advantages of being an EU member regarding trade. The most important trade implications for the WB and the fact that they are not in the EU are:

- Although they are in CEFTA, which is a free trade agreement, they are not in the more advanced form of EU integration, which is the EU Single Market which include free movement of goods, people, capital and services within EU member states
- Being outside the EU, the WB countries are also outside the European Monetary Union (EMU) which means that they have higher transaction costs due to currency exchange (Kotilainen, 1992). It should be noted that Kosovo and Montenegro have adopted euro unilaterally so they do not face this issue, however they do not have any decisive power for e.g. euro creation since they do not have any representatives in the European Central Bank simply because they are not EU member states.
- Western Balkans do not receive the same structural funds as EU member states so it is hardly possible for them to catch up with the same favourable standards for trade like it is in the EU. The main concern here is: not enough money spent on infrastructure which then results in trade barriers.
- They are not efficient in trade governance in terms of border and documentary compliance. They still need to catch up with institutional development so they would decrease too much administrative burden which is common in these countries especially regarding export.

6 Results

This paper has analysed trade of the WB as a non-EU group of countries. Based on different analyses, this paper can clearly acknowledge the following facts:

- Trade is a very important sector of the WB economies, which needs to be treated with a proper consideration.
- Balance of EU-WB trade flows in goods has been increasing over time, on average, except for the financial crisis.
- Serbia is substantially the largest partner of the EU in terms of trade.
- WB countries are much worse in trade openness, cost and time to export than EU-11, their comparator EU-11; they still lack proper infrastructure

The potential gains for trade of WB countries from the fact of being outside the EU are: (1) trade agreements set at a country level (e.g. Russia – Serbia case) and (2) negative effects of economic crisis were less damaging in the WB than in EU developed countries Less damaging in the WB intraregional trade than EU-WB trade.

However, being a non-EU group of countries, the WB trade losses a lot due to not being a part of the EU Single Market. They also miss the opportunity to be in the EMU, what would allow them to minimise trad transaction costs. The WB do not have an access to the same structural funds as EU members states. They are also not efficient in trade governance in terms of border and documentary compliance.

7 Conclusion

When analysing trade in the WB countries, one may argue that being a part of the EU would make these countries more efficient in terms of international trade. They would need to follow regulations imposed at the EU level, and therefore there will be no room for their own (very often) inefficient policies, which in many cases depend on the political decisions, lacking the basis of economic rationale. However, being outside the EU can also be beneficial for the WB trade since some of them have their own well-developed free trade agreements, providing them with profit, which however would not be gained when being a member of the EU. This paper clearly indicates that even though there are some advantages and disadvantages for the WB trade of being outside the EU, these countries would be clearly better off in

the EU. Majority of trade flows of the WB countries are done with the EU countries. Thus, taking part in the EU Single Market these countries like the EU New Member States, could increase their trade flows to a greater extent.

In line with this paper, there might be done further research on this issue, such as comparative analysis of similar economies to WB ones and their way towards the EU Single Market. In this sense, the following comparators could be used: Croatia, Slovenia, Bulgaria and Romania (the group within the neighbouring region of WB). In addition, in order to draw an overall picture, there could be even more countries used in that research – all New Member States of the EU starting from 2004 Enlargement.

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Analysis of the Households´ Expenditures Structure in the Regions of the Slovak Republic

Daniela Hupková, Veronika Mihálová, Ľudmila Dobošová

Abstract: *The climate conditions, subsequent population density, natural resources and following developing industry cause significant differences in the territorial division of Slovakia. The resulting differences have led to a different level of living standards in individual areas, and this fact is transformed into a different range of household expenditures. The main aim of paper is to determine which regions in Slovakia are characterized by similar expenditures´ structure and vice versa, which regions differ with the structure of expenditures the most. To achieve defined aim we applied the Gatev´s coefficient of dissimilarity of structures, which allows us to compare couples of regions. During the research 28 pairs of regions will be created and for each pair will be calculated coefficient in range between 0 and 1. Based on this coefficient we will be able to identify the pair of regions with the most similar expenditure structure and a pair of regions with a least similar expenditure pattern. Once this goal will be achieved, determined pairs of regions will be undertaking advanced analysis to determine with which types of expenditure are regions most comparable, respectively not.*

Key words: Expenditures · Gatev´s Coefficient · Household · Regional Analysis

JEL Classification: R19 · R20 · D19

1 Introduction

The net cash expenses consist of expenditures on consumption and other net expenses. According to the Statistical Office of the SR (2016), the group of consumption expenditures is divided based to the spending into following 12 groups: food and non-alcoholic beverages, alcoholic beverages and tobacco, clothing and footwear, housing, water, electricity, gas and other fuels, home furnishings and home maintenance, healthcare, transport, post and telecommunications, recreation and culture, education, hotels, cafes and restaurants, various goods and services.

Households' consumption expenditures by Lisý a kol. (2016) represents more than a half of aggregate demand. Part of the income that households do not spend creates their savings. The low level of households' savings impacts the whole economy performance, its growth and yet again consumption.

Vojtková, & Labudová (2010), detailed examined the living standards in Slovakia, using statistical analysis of the expenditures structure, which was based on the differentiation of regional membership according to the regions of Slovakia. They have shown that spending on food and non-alcoholic beverages, as well as housing and transportation expenditures have fallen slightly as well as expenditures on education. On the other hand, expenditure on post and telecommunications, expenditures on hotel accommodation, cafes, restaurants, cultural expenditures, and healthcare expenditures recorded growth and other net expenditures (loan repayments) increased sharply.

Comparison of food and non-alcoholic beverages consumption of the Slovakian population has been considering by Nagyova, Stávková, & Kádeková (2013). After the EU membership changes in household income and wealth were reflected in final consumption and food expenditures. The first income quartile of households spent 609.9 Euro per person per year on the food and non-alcoholic beverages in the period 2004-2011, while the fourth income quartile spent 1013.53 Euro per person per year. The lowest income quartile had the lowest consumption of meat and meat products (44.03 kg per person per year), price elasticity has shown that if the meat price increases by 1%, demand will fall by 0.275 kg. They are characterized by both price and revenue inelasticity. By contrast, households in the fourth

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income quartile show price elasticity. In 2011, the lowest income quartile was characterized by the highest consumption of bread and bakery products, milk, cheese and eggs and the lowest consumption of vegetables and fruits.

Based on household data in the Philippines where is high incidence of malnutrition Schmeer's (2015) survey revealed that if women have higher incomes and greater control over their redistribution, the more household will spend on food. If women earn less, but they are a member of a richer household, they will also use their partner's earnings to increase their food expenses. The study also confirmed the opinion that if the developing country improves the economic status of women in terms of controlling the domestic budget and earning more money, they will spend incomes on goods that are beneficial for children.

When examining differentiation of household spending patterns in EU countries for the era of the years 1995-2011 found out Dudek, Koszela, & Krawiec (2013) that category in the expenditure on alcoholic beverages, tobacco and narcotics, expenditure on health there is neither convergence, nor divergence. Categories clothing and footwear and communication showed divergence, which means that there are significantly different expenditures in these categories in the EU countries. For other categories, such as food and non-alcoholic beverages, transport, education, housing, recreation and culture, furniture is confirmed that differences in households' expenditure on mentioned categories between the EU member states diminish.

2 Methods

The main goal of paper is to reveal a pair of regions with similar structure of expenditures and the pair of regions, where the structure of expenditures is the most distorted with applying the coefficient of similarity.

The methodology for analysing the structure of household spending will be implemented through a measurement of similarity in the contribution of individual items of expenditure in total expenditure. The Gatev coefficient of structural similarity is used, which is defined as:

$$Gk\,(p_1, p_2) = \left[1 - \frac{2 \sum_{k=1}^{m} p_{1k}\ p_{2k}}{\sum_{k=1}^{m} (p_{1k}{}^2 + p_{2k}{}^2)} \right]^{\frac{1}{2}} \tag{1}$$

where: Gk is the Gatev coefficient of structures similarity

p_{1k} is share of the k- category of expenditure on total expenditure of the first region

p_{2k} is share of the j- category of expenditure on the total expenditure of second region

m is number of expenditures categories (k=1, 2... m, where m=13).

The Gatev Coefficient form is only applicable for pairs of regions, so it is necessary to quantify the coefficient separately for each pair. Thus will be created 28 pairs of regions. The Gatev coefficient of similarity takes values from 0 to 1. Zero means complete equality of structures and vice versa 1 their non-uniformity. (Vojtková. & Labudová, 2010)

3 Research results

Although the structure of expenditures is in each region unique, there is certain similarity in dividing expenditures of inhabitants in different regions into individual categories of consumption. It can be said that residents of regions with a similar structure allocate the same percentage of net cash expenditures for an identical area of consumption, food, transport or education. The similarity of structures thus reveals the similarity of consumer behaviour and decision-making about the use of available funds by the population of different regions.

For requirements to find similarities we have quantified Gatev's coefficient of structures similarity based on the structure of net cash expenditures of all regions in Slovakia for the year 2015. As values of coefficient are closer to 0, the more they indicate similarity and contrariwise the higher they are, the regional spending structures differ more each other.

In 2015 structure of net cash expenses of Nitra and Banská Bystrica regions appears to be the most similar structures. The second most similar structures were in Trenčín and Žilina regions. We can state that inhabitants of these regions equally share their earnings to meet their needs.

Table 1 Gatev´s coefficient of similarity of net cash expenses structure in the year 2015

	BA	TT	TN	NR	ZA	BB	PO	KE
BA		0.08164	0.11784	0.09407	0.14322	0.09436	0.10168	0.15960
TT	0,08164		0.13514	0.11359	0.15086	0.11306	0.10243	0.17093
TN	0.11784	0.13514		0.09786	0.05068	0.09260	0.06866	0.13628
NR	0.09407	0.11359	0.09786		0.10395	0.04181	0.08449	0.07455
ZA	0.14322	0.15086	0.05068	0.10395		0.09395	0.06852	0.12586
BB	0.09436	0.11306	0.09260	0.04181	0.09395		0.06856	0.08473
PO	0.10168	0.10243	0.06866	0.08449	0.06852	0.06856		0.12035
KE	0.15960	0.17093	0.13628	0.07455	0.12586	0.08473	0.12035	

Source: Own processing

The greatest similarity for residents of Nitra and Banská Bystrica regions was in spending on education, on various goods and services, and on alcoholic beverages and tobacco. The difference in the share of education spending was the smallest in Nitra and Banská Bystrica regions and represented only 0.03%. In expenditures on various goods and services was difference 0.11%, while the population of Banská Bystrica region spent by 0.11% more of its net cash expenditures on that category than the population of the Nitra region. On the contrary these regions were at least similar in percentage shares in expenditure groups such as transport, food and non-alcoholic beverages and clothing and footwear. For transportation an inhabitant of Banská Bystrica region will spend 11.64% of his net cash expenses, while an inhabitant of the Nitra region will spend only 10.25%. For food and non-alcoholic beverages an inhabitant of the Nitra region will spend by 0.83% more of the net cash expenditures than an inhabitant of Banská Bystrica region and of the category of clothing and footwear he spends more by 0.72%.

Figure 1 Net expenditures structure of Nitra and Banská Bystrica regions in the year 2015
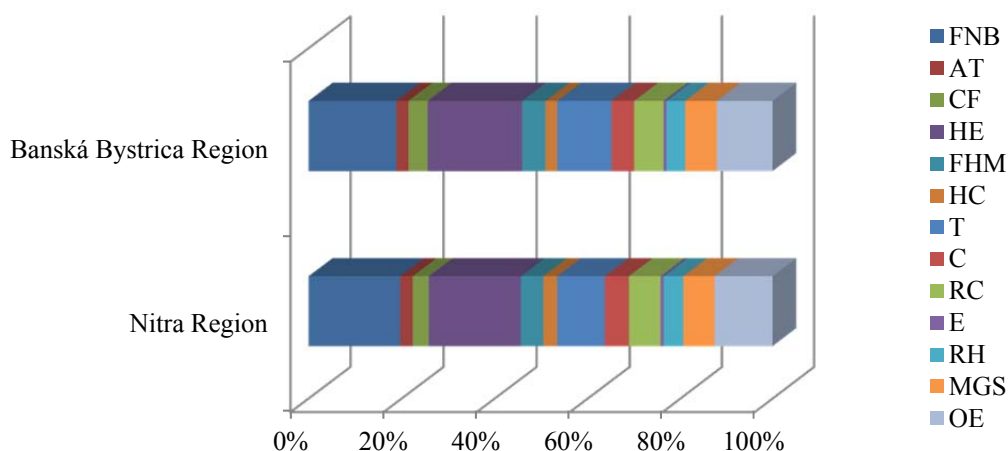
Source: Own processing

Note: FNB - Food and non-alcoholic beverages, AT - Alcohol and tobacco, CF - Clothing and footwar, HE - Housing and energy, FHM - Furnishing, house maintenance, HC - Health care, T - Transport, C - Communication, RC - Recreation and culture, E - Education, RH - Restaurants and hotels, MGS - Miscellaneous goods and services, OE - Other net cash expenses

For the purpose of examining the similarity of the expenditure structure between Nitra and Banská Bystrica regions, we quantified the Gatev coefficient values for analysed period 2005-2015.

Table 2 Gatev coefficient of expenditures structure similarity in Nitra and Banská Bystrica regions for period 2005 - 2015

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Gatev coefficient of similarity	0.1034	0.0826	0.1008	0.0646	0.0657	0.0333	0.0544	0.0616	0.0602	0.0798	0.0418

Source: Own processing

Quantification of the coefficient of expenditure structures similarity of the region Nitra and Banská Bystrica for the entire analysed period showed that in 2005 the value of the coefficient of similarity was up to 0.1034 and after the year 2010, at which reached a minimum, had declining trend. At the lowest value of the coefficient of similarity in the 2010 inhabitants in the Nitra and Banská Bystrica regions had the most similar representation of spending on their total expenditures among the 11 analysed years. From the year 2010 to the year 2014 was coefficient increasing, so the similarity of the structures has been weaker and in the last year has increased and had the second-lowest value in the analysed period. Nitra and Banská Bystrica are neighbouring regions. The similarity of spending structures is primarily due to income levels of inhabitants. Nitra and Banská Bystrica reached among the regions similar values of Gini's coefficient of income inequality. Residents of both regions receive monthly similar amount of gross nominal wages, and they have almost the same net monetary income, similarly high average disposable income. Very similar climatic conditions, relief and available land fund are also factors influencing the distribution of household spending. Both regions are based on agricultural production. The Nitra region, covered by the Danube Lowland with fertile soils, is a producer of cereals, oilseeds and oysters. Similar orientation is in agricultural production in the southern part of the Banská Bystrica region. Grape-growing and wine production are common to these regions. Banská Bystrica region also significantly focuses on forestry and timber production. Industry in both of these regions has relied on the natural resources they dispose. For both regions is food industry particularly important, but production is also oriented on the engineering industry as well. A common feature of these regions is the level of industrial development. Last but not least, the similarity of expenditures distribution among inhabitants of these regions is caused by small differences in prices of purchased goods and services, namely prices for housing, transport, and culture. The above-mentioned factors indirectly influence the decision-making of the inhabitants in redistribution their incomes to surveyed categories of consumption.

We can state that regions with the least similar expenditure structure, thus the most different, in the year 2015 were Košice and Trnava. Regions with a lower coefficient of similarity were Košice and Bratislava regions. The most significant values were recorded by the percentage share of expenditures in the form of other net expenses, food and non-alcoholic beverages, housing, water, electricity, gas and other fuels. From this difference can be also concluded that there are significant differences in the amount of expenditures for acquiring the basic needs of inhabitants of Košice and Trnava regions.

The share of food expenditures on total expenditures is for an inhabitant of Košice region higher by 3.55% than for the inhabitants of Trnava region and for housing, water, electricity, gas and other expenditures is higher by 3.44%. Other net expenses, mainly including taxes, but also purchases of securities and repayments of loans, reach up to 10.40% in the Košice region, while in the Trnava region up to 16.82%. The inhabitants of Košice and Trnava spent a similar share of their total spending on hotels, cafes and restaurants, as well on furniture, furnishings and routine apartment maintenance and education. The proportion of expenditures for furniture, furnishings and ordinary maintenance of the flat differed at least, only by 0.08%, as well as an inhabitant of Košice region spend on hotels, cafes and restaurants by only 0.09% more than an inhabitant of Trnava region. The share of education expenditures in total net cash expenditures was 0.63% in the Trnava region and 0.89% in Košice region.

Figure 2 Net expenditures structure of Trnava and Košice region in the year 2015
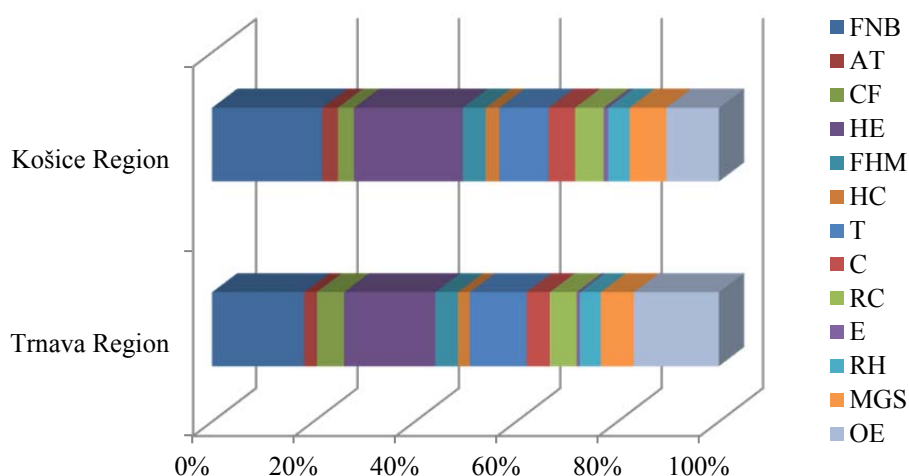
Source: Own processing

Note: FNB - Food and non-alcoholic beverages, AT - Alcohol and tobacco, CF - Clothing and footwear, HE - Housing and energy, FHM - Furnishing, house maintenance, HC - Health care, T - Transport, C - Communication, RC - Recreation and culture, E - Education, RH - Restaurants and hotels, MGS - Miscellaneous goods and services, OE - Other net cash expenses

The following table shows the development of the coefficient of structure similarity between the Trnava and Košice regions throughout the analysed period 2005-2015.

Table 3 Gatev coefficient of expenditures structure similarity in Trnava and Košice regions for period 2005 - 2015

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Gatev coefficient of similarity	0.1458	0.0616	0.0700	0.0935	0.1683	0.0768	0.0479	0.0269	0.0386	0.0541	0.1709

Source: Own processing

The similarity of the expenditures structure in Trnava and Košice regions varied over analysed 11 years. The coefficient of similarity reached highest value in 2015 when the share of money value allocated to individual expenditures categories by inhabitants of Trnava region was not comparable with spending of Košice region inhabitants. The significant difference in the structure of expenditures was also evident in years 2005 and 2009. The fact is also worthwhile in 2012, when the coefficient of similarity was the lowest and therefore the expenditures structure of the mentioned regions was very closely related. The overall period 2011-2014 was characterized by a high level of similarity.

The Trnava region is a region of western Slovakia and the Košice region is located in eastern Slovakia. Significant difference in Slovakia between the developed West and the less developed East was the source of confirmed differences in the inhabitants' behaviour of these regions concerning consumption decisions. The main reason for differences we consider level of incomes as either net cash income, the average disposable equivalent household income, as well as the average gross equivalent income of households are obviously diverse between these regions. The expenses for analysed consumption categories, whether expenditure on housing, clothing and food are different and present different share on household budget. This is exactly why households of these regions allocate a different percentage of their total expenditures for mentioned categories. Climate conditions, mineral wealth and natural resources have created different facilities for development of industry and establishing companies in Trnava and Košice regions. The Trnava region is located in the vicinity of the capital city, gave space for labour market in companies dealing mainly with the automotive, engineering, metallurgical, textile and chemical industries and is higher developed as Košice region. The lifestyle of inhabitants in Trnava and Košice regions is also very different.

4 Conclusions

The most similar expenditures structures in the year 2015 were in Nitra and Banská Bystrica region, and the second most similar pair was Trenčín and Žilina region. It is also worth mentioning the neighbouring location of these regions and resulting similar situation of social life or natural conditions. The inhabitants of Nitra and Banská Bystrica region spend a similar amount of their available incomes for education, alcoholic beverages and tobacco and various goods and services. Based on the estimation of the Gatev coefficient of similarity for these regions for the period 2005-2015, we can determine the year 2010 as the year when expenditures structures of these regions were the most similar and on the other hand year 2005 was the year of the weakest similarity. The reasons for the similarity of expenditure structures between Banská Bystrica and Nitra region are very similar income values of inhabitants, also similar level of industrial development and small differences in the price level of particular expenditures categories. The districts with the most diverse expenditures structure in the year 2015 can be considered Košice and Trnava and with a lower coefficient of similarity also Košice and Bratislava regions. In this case these are differently localized regions of Slovakia, which may be the cause of divergence. The Košice and Trnava regions show the largest differences in the spending on food and non-alcoholic beverages, housing, water, electricity, gas and other fuels and other net expenses. Based on the analysed period 2005-2015 it can be confirmed that in the first and the last analysed year and also in the year 2009 structures of mentioned regions were very different and on the contrary almost identical were in years 2011-2014. The expenditure structures of Košice and Trnava regions` inhabitants differed which was due to the difference in the industrial development of eastern and western part of Slovakia in combination with the income disparities of the population, accompanying with different spending, consumption and lifestyle.

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How Strong are the Pharmacy Chains within the EU?

Jaroslav Písek

Abstract: *The retail pharmaceutical market is undergoing a long-term change in structure. Pharmacies, formerly owned almost exclusively by pharmacists, are becoming part of the chain thanks to the liberalization of operating conditions. Chains are expanding successfully due to economies of scale and superior purchasing power. The aim of this paper is to create an up-to-date overview of the number of pharmacies, chain pharmacies, and shares of the largest chains in individual EU countries. Comparing the data obtained with older sources will indicate what future market development could be.*

Data sources are state authorities, national associations, and professional bodies, international organizations associating entities and companies active in the distribution of pharmaceuticals and the World Health Organization. Data were subject to a cross-country comparison and comparison with previously published data (2003 - 2015).

Out of 160 thousand EU community pharmacies, 16.7 % is wholly owned by Retail Pharmacy chains. James Dudley Management (2015) study which covers 20 European countries states 13.3 %. There is no single chain active in 11 member states. Pharmacy chains own 80% of community pharmacies and more in 4 EU countries.

Key words: Pharmacy · Chain · Community · EU

JEL Classification: I11 · F15 · F23

1 Introduction

Over the past 15 years, the conditions for opening and operating pharmacies have been liberalized in some of EU member countries. Consolidation we have seen in many of retail segment. In 2016, Starks's study "Structural change in food retailing" states: "Tesco is dominant in UK grocery retailing with 28 % share." Top 3 grocery chains in the UK share more than 50 % of the market. A similar situation can be observed in Germany where: "Consolidation, market saturation, strong competition and low prices are key characteristics of the German retail food market. The market leaders are Aldi, Edeka, Lidl and Rewe." (Wortmann, 2004)

In Taylor, Mrazek, and Mossialos (2004) described pharmaceutical distribution as follows:

"In much of Europe, only pharmacists can purchase or establish pharmacies, and in many instances, a pharmacist cannot own or be responsible for more than one pharmacy. Such regulations inhibit the formation of large managed pharmacy chains such as those most typically found in the UK and North America." (Taylor et al., 2004)

Vogler, Arts, and Habl (2006) state:

"In the last few years, deregulation of public services has taken place in the several Member States of the European Union. One of the sectors targeted is health care, and, among others, the pharmacy business. Pharmacy is, by tradition a strictly regulated sector, in order to guarantee the high quality of and broad accessibility to pharmaceuticals. Typical regulations in the pharmacy sector concern the establishment of new pharmacies (often based on the assessment of the public's needs), ownership issues (pharmacies owned by independent pharmacists, prohibition of pharmacy chains), as well as the quality of the training of pharmacists and other staff working in community pharmacies. The rationale behind deregulation in the pharmacy sector is the expectation that liberalization will increase competition and thus succeed in lowering, or at least containing, (public) expenditure, while accessibility to and quality of pharmacy services will be, at least, kept stable or even be improved by the opening of new outlets." (Vogler et al., 2006)

In 2011, Kanavos, Schurer, and Vogler elaborated a comprehensive study for the European Commission where, among other things, they claim:

"Greater efficiencies can be achieved by joint procurement and this can materialize through a horizontally or a vertically integrated structure or a cooperative. Countries, where horizontal or vertical integration are limited by current legislation, are taking advantage of the 'cooperative solution', e.g. Spain, France, and Greece." (Kanavos et al., 2011)

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Background document for Senato della Repubblica (2015) that provides Pharmacy chain overview contains detailed information of chains in full ownership with brands, owners, and number of shops for 15 EU countries (except Italy and Malta). The list includes 91 pharmacy chains with 13,605 branches.

According to the study of James Dudley Management (2015) which covers 20 main European markets is 13.3 % of all community pharmacies grouped in wholly owned retail pharmacy chains. The study also states: "Celesio, WBA, and Phoenix are the main players in the development of wholly owned retail pharmacy chains in Europe. The three companies between them control 35% of pharmacies in wholly owned chains". Celesio became McKesson Europe from September 12, 2017. WBA is an abbreviation for Walgreens Boots Alliance Company.

2 Methods

Data source by country: Austria (Österreichische Apothekerkammer, 2017), Belgium (Algemene Pharmaceutische Bond, 2017), Bulgaria (Groupement International de la Répartition Pharmaceutique, 2017), Croatia (Hrvatska ljekarnička komora, 2017), Cyprus (Ministry of Health Cyprus, 2017), Czech Republic (Státní ústav pro kontrolu léčiv, 2017), Denmark (Danish Medicines Agency, 2017), Estonia (WHO Collaborating Centre, 2017), Finland (The Association of Finnish Pharmacies, 2016), France (Ordre National Des Pharmaciens, 2017), Germany (ABDA – Bundesvereinigung Deutscher Apothekerverbände, 2017), Greece (Groupement International de la Répartition Pharmaceutique, 2017), Hungary (Groupement International de la Répartition Pharmaceutique, 2017), Ireland (The Pharmaceutical Society of Ireland, 2017), Latvia (WHO Collaborating Centre, 2017), Lithuania (WHO Collaborating Centre, 2017), Luxembourg (Groupement International de la Répartition Pharmaceutique, 2017), Malta (Government of Malta, 2017), Netherlands (Groupement International de la Répartition Pharmaceutique, 2017), Poland (Groupement International de la Répartition Pharmaceutique, 2017), Portugal (Groupement International de la Répartition Pharmaceutique, 2017), Romania (Groupement International de la Répartition Pharmaceutique, 2017), Slovakia (Szalayová, Skybová, Kandilaki & Szalay, 2014), Slovenia (Pharmaceutical Group of the European Union, 2017), Spain (European Pharmacist Forum, 2017), Sweden (Läkemedelsverket, 2017), United Kingdom (General Pharmaceutical Council, 2017).

We compared the data obtained country by country with figures from several studies (Paterson, Fink, Ogus, Merz, Fink, & Berrer, 2003; Taylor, Mrazek, & Mossialos, 2004; Vogler, Arts, & Habl, 2006; Kanavos, Schurer, & Vogler, 2011; James Dudley Management, 2015) and a list of chains of pharmacies for hearing of the Italian Senate on the amendment to the Competition Act (Senato della Repubblica, 2015).

3 Research results

Of the total number of 160,087, EU 28 pharmacies 16.7 % is wholly owned by Retail Pharmacy chains. 10.4 % is a share of chain pharmacies if we exclude UK data from the study.

Figure 1 EU 28 member states – number of pharmacies grouped in chains and outside of chains.
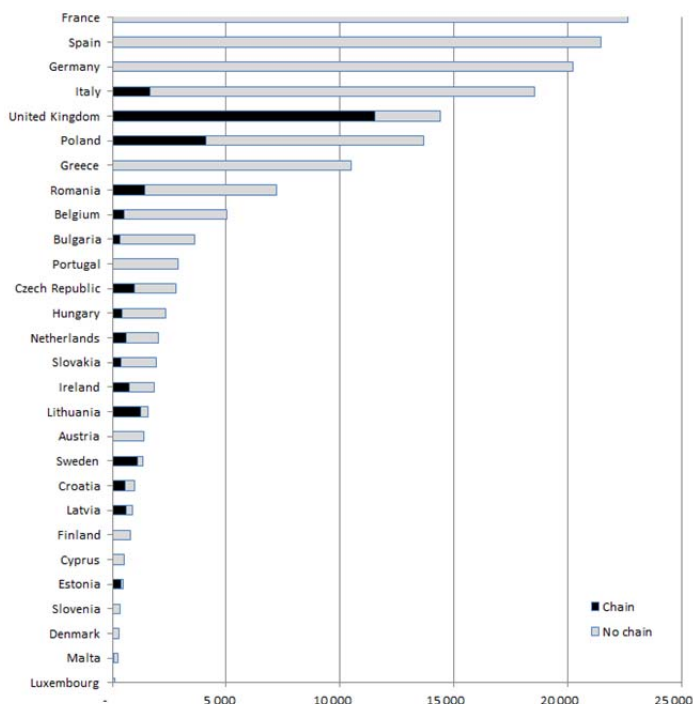
Source: Authors' elaboration. List of data sources is in the chapter 2 Methods.

Paterson et al. (2003) states 117 thousands of community pharmacies in "old" EU 15. Table 1 is a comparison of Paterson's data with recent figures.

Table 1 EU 15 member states – number of pharmacies 2003 and 2017.

	No of pharmacies 2003	No of pharmacies 2017
Austria	1,086	1,380
Belgium	**5,273**	**5,017**
Denmark	1,556	314
Finland	795	810
France	22,689	22,655
Germany	21,590	20,249
Greece	8,348	10,500
Ireland	**1,186**	**1,836**
Italy	**16,382**	**18,549**
Luxembourg	79	95
Netherlands	**1,600**	**2,000**
Portugal	2,778	2,900
Spain	19,439	21,458
Sweden	**1,889**	**1,339**
United Kingdom	**12,311**	**14,405**
Total	117,001	123,507

Note: Countries with chains in bold.

Source: Authors' elaboration. Data sources are Paterson et al. (2003) and sources listed in the chapter 2 Methods.

3.1 Pharmacy chains

23,853 community pharmacies are members of wholly owned pharmacy chains. Top 3 pharmacy chains operate 6,385 EU pharmacies (and 619 in Norway). Walgreens, McKesson, and Phoenix own 26.8 % of chain pharmacies in EU. Penta, the owner of Dr.Max chain, is very active in acquisitions into the healthcare segment. Dr.Max operates pharmacies in the Czech Republic, Slovakia and Poland (Penta Investments, 2017).

Table 2 Top owners of pharmacy chains in EU (number of pharmacies).

	Dudley (2015)	2017
Walgreens Boots Alliance	2,846	2,845
McKesson Europe	2,184	over 2,100
Phoenix Group	1,880	2,059
Penta Investments	850	1,024

Source: Authors' elaboration. James Dudley Management (2015), Celesio (2017), Penta Investments (2017), Phoenix Group (2017), Walgreens Boots Alliance (2016).

Table 3 Pharmacy chains and their shares by countries.

Country	% of chain pharmacies	% of Top country chains out of total chain pharmacies			Name and owner of chain		
		No. 1	No. 2	No. 3	No. 1	No. 2	No. 3
Sweden	84	37	34	29	Apoteket (state owned)	Apotek Hjärtat	Kronans Droghandel
Estonia	80	25	22	9	Terve Pere (Magnum)	BENU (Phoenix)	Eurovaistine
Lithuania	80	24	23	22	Camelia	Gintarine	Eurovaistine
United Kingdom	80	20	16	9	Boots (Walgreens)	Lloyds (McKesson)	Well (Bestway)
Latvia	70	27	17	9	Recipe Plus	a.Apotheka (Magnum)	Benu (Phoenix)
Croatia	60	13	8	6	Primapharme	Atlantic	Jadran
Ireland	40	13	11	4	Unicare (McKesson)	Boots (Walgreens)	Hickey's
Czech Republic	35	43	20	3	Dr.Max (Penta)	BENU (Phoenix)	IPC
Netherlands	30	83	13	11	Brocacef (Phoenix, McKesson)	VNA	Boots (Walgreens)
Poland	30	21	8	5	DOZ	Dr.Max (Penta)	Farmacol
Malta	20	48	0	0	Brown's		
Slovakia	20	60	15	14	Dr.Max (Penta)	City Farma	Farmacol
Romania	20	39	35	21	Catena	Sensiblu	Dona
Hungary	19	31	18	13	Benu (Phoenix)	Hungaropharma	Drogery med, Eli (Teva)
Belgium	10	54	20	20	Multipharma	Lloyds (McKesson)	EPC Group
Bulgaria	9	61	34	0	Mareshki	CSC	
Italy	9	11	0	0	Lloyds (McKesson)		

Source: Authors' elaboration. List of data sources is in the chapter 2 Methods.

4 Conclusions

The share of pharmacy chains remains relatively small especially when we exclude UK data (10.4 %). Our total EU 28 result of 16.7 % of chain pharmacies shows increase more than 3 % in two years in comparison with James Dudley Management's (2015) 13.3 % but data is not fully comparable. Dudley survey includes 18 EU countries, Norway, and Switzerland.

Data from the comparison of EU 15 shows 5.6 % of the increase in the number of all community pharmacies between 2004 and the last available figures. Recently the conditions for operating of pharmacies were liberalized in Greece (2015) and Italy (2017). Consolidation in "new" member states will bring probably an increase in a number of chain pharmacies although some of the countries try to reestablish limits for newly opened pharmacies (Hungary, Estonia). Penta announced to enter pharmacy retail market in Serbia, Romania and Italy (Penta Investments, 2017).

Horizontal integration in the pharmaceutical retail segment continues relatively slowly, which is probably due to the very varied conditions for the operation of pharmacies in the Member States and the problems of health financing in some of the countries.

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Innovation of the Plastics Industry – a Challenge or a Must?

Nikola Sagapová, Eva Cudlínová

Abstract: *Plastics have been shaping our economies, societies and everyday life. Although plastics had been seen as useful durable materials with numerous ways of their possible commercial application,and materials which had encouraged huge increase in standards of living of masses, currently we may see reflect waste plastics as one of the most alarming environmental problem of our time. Plastics have been impacting our environment due to bad waste management through their durability, which both led to their omnipresence in nature. This review paper intends to touch a very important and complex problem of plastics and plastic waste covering three aspects: technological, economic*
and environmental suggesting some means to handle this situation. We focus mainly on two streams of possible inovation, where first one is presented by biodegradable plastics made from biomass and second one is connected with recycling, although consumers power is taken into account as well.

Key words: Bioeconomy · Biodegradable Plastics · Innovation · Recycling · Circular Economy

JEL Classification: H23 · L15 · O00

1 Introduction

Fossil fuels dependency is one of the common characteristics of developed world countries today. Assuming the growing demand for energy and various products on one hand, and increasing waste on the other hand, the time has come to manage a sustainable shift towards post-oil era including post-oil society and economy. One of the most important materials shapping the whole world societies of last few decades are plastics, derived mainly from oil. Magnitude of plastics might be illustrated quite easily. We used to name historically significant breakthroughs in human development by the most characteristic material, that human beings broadly used in that eras, so we indicated the Stone Age, the Iron Age, the Bronze Age, therefore we might call the present era the Polymer Age (Ducháček, 2006), or more vernacularly the Plastic Age. Plastics are in fact artificial long chain polymeric molecules (Scott, 1999).

Plastics are cheap, light and versatile materials, that clearly dominate modern economy, while their production is expected to double in next twenty years. However, only 14% of plastic packaging is sucesfully collected in order to be recycled after use, while the rest enters directly the environment, or ends up in ladfills (MacArthur, 2017). More surprisingly, only 2% of all plastics is closed-loop recycled and recycling itself is challenged not only by the amount
of used plastics, but also by many other aspects, such as colors and other contaminants, but also quality and a lot of different types of plastic blends (World Economic Forum, 2016). Awareness of problems connected with plastic waste, especially its lack of degradability, and increasing land and water pollution, together with the incentives calling for closing of landfills derived the task for better solution for plastics, when on the notional other site from the recycling intentions stand the development of biodegradable plastics. However, understanding of interactions between materials, microorganisms and biochemical processes is needed to assure these materials do not burden the environment (Shah et al., 2008). Other problem, that has been currently discussed are the microplastic particles, that have been contaminating not only marine environment (Lots et al., 2017; Blumenröder et al., 2017), but also fresh waters (Ivleva et al., 2017), which both lead into their presence within food chain.

It is not only the materials, that harm the environment, but in fact the linear economy approach itself. First, natural resources become depleted and finally end up as waste and emissions (Huysman, De Schaepmeester, Ragaert, Dewulf & De Meester, 2017). Recycling represent the basic requirement for closing material loops heading circular economy and more sustainable society. However, as mentioned above, the portion of recycled plastics is still quite low, although even European Commission is proposing for higher recycling rates (European Commission, 2016). To illustrate the current situation on European market with plastic materials, and to show the gap between plastics production

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and plastics recycling, in 2014 European plastics industry produced more than 59 million tonnes of plastic materials, while in the same year, only 7,5 million tonnes od plastics waste were collected for recycling (PlasticsEurope, 2016).

Last, but not least, not only plastics materials, bad waste management, or linear economy are responsible for this harmful situation, it is also the result of consumer behaviour of end-users, therefore the problematic is deeply complex. Regarding all these obstacles, European Commission is expected to release new plastic strategy, that should be revealed before the end of year 2017. In this paper we suggest some incentives, that could enable at least partial solution to these challenges.

2 Methodology

The present paper neither a comprehensive nor a systematic review. The authors attempt to give a generic overview on issues associated tih plastics with the aim to point out various difficulties, risks and perspectives that shall shape plastics industry in the near future. The data were collected mainly through searching scientific literature (Science Direct, Scopus, WoS, Google Scholar), but involved also some sources that could be tagged as grey literature. The methodological approach to this review took steps to identify:

a) Background for innovation within the plastics industry. The authors reviewed literature on studies related to impro-per handling of plastics, lack of degradability, obstacles connected with recycling of plastic materials, potential risks when entering the environment and food chain.
b) Bioeconomy based solution. Reducing the amount of using nonbiodegradable plastics through increase of the amount
of bioplastics on market with considering its limits and challenges.
c) Circular economy based solution. Recycling as a potentially sustainable solution, despite recent obstacles, analysing ways to make recycling more economically feasible.
d) Role of consumer. Consumers can make a difference, their behaviour and choices might help to trigger the change.

However, the allocation of tools within these concepts was divided intuitively based on subjective decisions of authors, and might happen a part of later discussion on plastic and plastics waste management, which we try to unleash in between the lines.

3 Towards plastics industry innovation

3.1 Background for innovation

Talking about innovation in such scale as whole industry manner, it is necessary to explain, why the current situation is not sufficient. In case of the plastics industry, the main reasons might be indicated as follows:

- extremely high durability of material (Sivan, 2011)
- increasing plastic pollution worldwide (Avio, Stefania & Regoli, 2017)
- raising concerns about microplastics and toxins in food chain (Teuten et al., 2009)
- recycling obstacles (Rebeiz & Craft, 1995)
- landfilling as not suitable and sustainable solution (Thompson et al., 2009)
- China´s ban on import of plastic waste (The Guardian, 2017)
- need for energy recovery through shift from linear to circular economy (Ghisellini, Cialani & Ulgiati, 2016)
- reducing fossil fuels dependency (Rodríguez-Cabello et al., 2009)

Many of listed problems are interconnected and interact with each other. High durability of plastic materials, once appreciated, has been currently seen as one of the most alarming long-term threat connected with land and marine pollution (Law et al., 2010), occuring as the result of lack of degradability of these materials and global mishangling of plastic waste (Moore, 2008). Even if the material itself gets degraded into smaller fragments, such as microplastic and nanoplastic particles, the situation gets no better, because these fragments usually contain various toxins, that are being used for example to soften the plastic material, and these toxins might easily get into the food web, especially in case of marine environment, as they are potentially ingestible by marine organisms including micro- and nanoplankton species, which constitute the very foundation of marine food web (Andrady, 2011). Proper waste management all over the world is crucial for whole planet residents wellbeing (Agarwal, Chaudhary & Singh, 2015). Although there are iniciatives to replace nondegradable plastics derived from fossil resources by biodegradable ones (Steinbüchel, 2005), this might be also not the right and the only end solution, while we consider the recent need for energy recovery, encouraging closed-loop circularity in which we may consider waste as a potential new source (Huysman et al., 2015).

The concept of circular economy is theredore rising as a solution to challenges like waste generation, resource scarcity and sustaining economic benefits (Lieder, & Rashid, 2016). Plastics are valuable materials even in a form of post-consumer waste and turning them into high-quality products by mechanical recycling has been performed (Ambrose et al., 2002), shift to circularity by increased recycling, energy recovery could be granted. As European Union tends to stop landfilling and other countries have started banning import of plastics, actions are needed as soon as possible. Although recycling seems like suitable option, even recycling of plastics has its limits and obstacles, that may be represented by economical aspects, for example small local and regional markets for recycled products, high cost of input materiál and high compliance and logistics cost, environmental aspects, such as lack of the proper waste managemant, lack of producer responsibility, lack of environmental design, and social aspects, like negative society image towards plastic industry (Mwanza & Mbohwa, 2017). Other obstacles are presented by plastic materials nature and material depreciation, e.g. some of them are too small for collecting, have low economic value, while others are depreciated by contamination by food, or various chemicals such as additives, plasticizers, colors, but also by the content of mixed materials, that discourage recycling as they cannot be easily separated (Ellen MacArthur Foundation, 2016a).

As illustrated above, the plastic problematic is really a complex and difficult issue and probably there will not be the only one prefered solution path in the near future. The most likely scenario is that biobased biodegradable plastics will coexist with the ones based on petrochemicals as humankind has a need for both non-biodegradable and biodegradable plastics (Steinbüchel, 2005). From this perspective, we analyse both paths, when offering suggestions for encouraging innovations in the plastics industry.

3.2 Bioeconomy based solution

Although the term bioplastic may refer to polymers that are biobased, biodegradable, or have both properties (Imre & Pukánszky, 2013), we may distinguish two main alternatives to conventional plastics, biodegradable plastics and their subset compostable biodegradable plastics (Song et al., 2009). While nowadays, it is usual, that the biomass used for bioplastics production is generally first generation biomass stock, which means the feedstock (Lee & Lavoie, 2013), it is expected, that with improving biotechnological sector, the feedstock will experience a shift towards utilization of biowaste as materials and energy sources are approaching their physical limits, while the amount of produced waste is rapidly increasing (Morone, 2016), but probably also increasing production from third-generation algal biomass (Lee & Lavoie, 2013). Biowaste could be later key driver for soil fertility if used as fertilizer (Diacono & Montemurro, 2010), but also for economy, if used as production input as a resource with significant potential to be used for the production of chemicals materials and biofuels (Morone, Tartiu & Falcone, 2015).

Although biodegradable plastics might be seen as sufficient solution, doubts arise. First of all, there is high concern about competition for land with expanding agricultural areas dedicated to bio-products production (Piemonte & Gironi, 2010), which is one of the main factors of production, and at a global scale, lan dis becoming a scarce resource (Lambin & Meyfroidt, 2011). Need for land utilization will probably lead to higher land intensification to, which involves the intensification of biological productivity as for yield, turnoever time, photosynthetic efficiency and metabolism (Boyd, Prudham & Schurman, 2001), but also potential increase of using fertilizers and agrochemicals, that can cause huge environmental costs (Tscharntke et al., 2012). Increase in land demand for biomass supply might lead to utilization of marginal, degraded or abandoned agricultural land (Dauber et al., 2012) and potential shift to less fertile areas, that need higher fertilization (Rosegrant et al., 2013). This might also cause habitat destruction and engender biodiversity loss (Tilman et al., 2001; Tscharntke et al., 2005). The assessment of the ecological footprint based on the whole lifecycle analysis starting with feedstock analysis is needed to be implied with respect to local conditions and circumstances.

While biodegradable plastics are supposed to biodegrade in the natural environment, it is actually not an ultimate truth. The biodegradability of bioplastics is highly affected by their chemical and physical structure and also very dependant on the environment in which they are located (Emadian, Onay & Demirel, 2017). However, the biodegradation of bioplastics was reported very slow under home composting conditions, real soil environment (Rudnik & Briassoulis, 2011), very slow at the sea as the marine environment is much colder, and hard at all in the deep ocean (Wirsen, 1971). Although PHA has been shown to meet the biodegradability in the marine environment recently, PLA might remain for up to a thousand years (Moore, 2008). It is suggested that the highest biodegradation could be achieved at the interface of water-sediment, where the environmental conditions support the activity of plastic-degrading microorganisms (Tosin et al., 2012). Moreover, there is still very little known about the impact of the bioplastics on the microorganisms, which actually biodegrade them. If bioplastics represent an alternative to petroleum-based plastics, more comparable data on their direct effects on organisms will be needed especially within the aquatic ecosystems and their biota as they provide key ecosystem services to mankind (García Molinos et al., 2015). Also the screening of organisms that degrade polymers, or produce enzymes which degrade polymers may prove as environmentally profitable (Shah et al., 2008).

Another task is connected with the waste management and consumer behaviour. While recycling operations are well established in case of conventional petrochemical plastics, introduction of bioplastics to the market has created more issues to be adressed: potentional risk of contamination of the collected conventional plastics, pontentional cost of their separation, yields loss and impact on recycled materials quality and processing. Although mechanical recycling has been under attention as a favourable method for bioplastics like PLA (Soroudi & Jakubowicz, 2013), PLA shall not get into the same mechanical recycling stream like the conventional plastics as it completely blocks the filters of the mechanical recycling facility (M. Baxter, conference comment, September 26, 2017). Another task is if consumers do recognize conventional plastics and bioplastics, and are aware how to treat them, once they become waste. Biodegradable plastics can cause serious problem for the recycling industry if people put them in the recycle bin as it may ruin the whole batch. Eventhough biodegradable plastics were invented not only as an opportunity to reduce fossil fuels dependency, but also as a potential solution to environmental pollution, we suppose, that something labelled as biodegradable could easily end up in the natural environment, once consumers rely on the claim that these materials biodegrade in nature.Similar misconception may occur in case of compostable bioplastics which are currently not intended for home composting, but their compostability certifications refer to industrial composting (Kosior, Braganca & Fowler, 2006).

Last, but not least, biodegradable bioplastics shall follow the holistic and integrated approach for the ecodesign deriving the sustainable design process that is complex in involving both social an environmental factors (Colwill, Wright & Rahimifard, 2012). Bioplastics shall be used in sustainable manner, not as the end solution and ultimate conventional plastics replacement as mankind has the need for both biodegradable and nondegradable plastics (Steinbüchel, 2005). However, we suggest that bioplastics represent an opportunity for countries with huge amount of biomass and moreover biowaste, that is currently not being utilized, and for the countries with educated and environmentally conscious consumers with strong purchasing power once these plastics tackle the problematic issues that are source of uncertainty and many doubts nowadays.

As for the research and commercialization of bioplastics in the Czech republic, we briefly introduce two projects. The first one, already commercialized, is called Frusack. Frusack is compostable PLA sachet made of corn starch, intended to replace microten bags for fruits, vegetables and pastry. The second one comes out from the Hydal Corporation, established by Nafigate Corporation and Panara company, and is going to launch first large-scale production of PHB processed from used cooking oil. Although the technology originally comes from the Czech republic, the production will take place in Slovakia launching in January 2018.

3.3 Circular economy based solution

Although we mentioned, that PLA bioplastic material brings the potentional to get mechanically recycled in the future, therefore a hope to become a great solution within the circular economy concept, when we talking about recycling here, we consider conventional plastics to be recycled. The mechanical recycling of conventional plastics is an usual practice in Europe, however it still prevails a challenge to make the whole proces more successful and efficient to form the basis for feasible circular approach.

Plastic recycling sector nowadays suffer from many serious obstacles, that brake on development of the recycling market, which still remains underdeveloped, eventhough it is developing rapidly (Ellen MacArthur Foundation, 2017). We may indicate 4 main obstacles of establishing functioning recycling market with sufficient demand as follows:

- lack of quantity of recycled plastics (Froelich et al., 2007)
- insufficient quality of recycled plastics (Patel, Patel & Sinha, 2005)
- costs of recycled plastics in comparison to conventional virgin plastics (Ellen MacArthur Foundation, 2017)
- resistence to change amongst manufacturers (Trucost, 2016)

While global primary production of plastic materials rapidly increases (Geyer, Jambeck & Law, 2017), recycling lags in comparison to the plastics production, moreover plastics that do get recycled are recycled mostly into lower-value materials that are not again recyclable (World Economic Forum, 2016). Although sufficient stock of recyclate is crucial condition to trigger the demand, it is not the only condition. Even if there is enough of recyclate, the industry is struggling with its quality, which is the precondition for making vital recycled products. As a result of the need for both quantity and high stable quality of the recyclates, new technological solutions are being brought to the market to create the demand for the recycled materials on the market (European Commission, 2016). The quality of recyclates worsens by numerous compounds obtained in the plastic material products, e.g. additives, colours, but also food contamination (Briassoulis, Hiskakis & Babou, 2013), and multi-material plastics that makes recycling not only economically, but often also technically impossible (Ellen MacArthur Foundation, 2016b). Once the plastic gets properties like mono-material, clear and contaminant-free, it might be used as a vital subsititution to virgin plastics (Joint Research Centre, 2012). Recyclers are facing the cost challenge as well as they struggle the competition comming out from cheap virgin

plastics due to low oil prices that resulted even in recycling plants closures. If market does value plastic in the manner that reflects true social costs of all externalities and natural capital impacts for virgin fossil fuel- based plastics, circular economy approach could be achieved easier (Trucost, 2016). Nevertheless, it is extremely diffucult to internalize the externalities properly (Joskow, 1992). Eventhough oil prices show highly significant volatility turning out in unpredictable cost of supply for fossil feedstock-based plastics and therefore a risk for the business that could be lowered through diversification into recycled and renewably sourced alternatives (World Economic Forum, 2016), and plastics manufacturers using recyclate shall be protected from rising oil prices (Trucost, 2016), both virgin and recycled plastic prices have been volatile and declining for many types of plastic, especially for PET, which price for recycled one dropped by 30%-40% between 2012 and 2015 (Ellen MacArthur Foundation, 2016b). While cost is often set as the most significant purchasing criteria for plastic manufacturers, therefore low cost of oil may resut in very competitve conventional virgin plastic prices, plastic users may be ill-informed of the availability of other materials for production, or simply have aversion to risk and change (Trucost, 2016). In this paper we do not mention fifth obstacle, that can be identified as the existence of competition between recycling and incineration facilities that undermine recycling especially through contracts with municipalities about delivering their waste there, which in fact means less waste for recycling plants (Global Alliance for Incinerator Alternatives, 2013).

Considering all these obstacles, there is need to help the market to develop by some incentives to provide a better situation to empower circular economy. These incentives might be not only financial but also legislative. As for the legislative incentives, within the European context minimum recycling targets has been set, with regard to waste hierarchy applied as a priority order: prevention, preparing for reuse, recycling, other kind of recovery and disposal (Council Directive, 2008) establishing a trajectory towards waste avoidance and increased material efficiency througt recycling and re-use (Lazarevic et al., 2010). Other appliable legislative incentive might be setting a requirement for minimum recycled content in products which is commercially sensible (WRAP, 2009). We suppose that minimum recycling targets could be set as states target resulting in higher amount of material available for recycling, while minimum recyclate content in products would encourage brand owners and producers to put recyclates into their products. As for the quality, quality standards of recyclates should be set as there is need for fully recyclable materials, with standartized or no additives, colours, mixed materials in order to achieve pure streams of reliable stock. Within this incentive, there is also posibility for labelling similar to ecolabelling on our white goods, televisions, or vacuum cleaners, with A indicating perfect material for recycling. At least information about material content shall be required to make products more transparent (T. Emans, conference suggestion, September 26, 2017).

Besides legislative incentives, fiscal and other financial incentives could be implemented to make recyclates more competitive with virgin material plastics. As for the fiscal instruments, lower VAT on recycled polymers (Kandelaars, 1999), or higher carbon tax on virgin polymers (U.S. Congress, 1993) could be taken in account. As for the financial instruments, special fees could be applicated, such as fee per weight of material, fee per consumers packaging unit, or the bonus and malus system. Bonus could be given to producers after reduction of packaging, translucency, simplification of material content, recyclability, full material content information providing, while malus could be casted in case of mixed materials, using nonrecyclable parts, or content hard to recycle, depending on the actual needs (C. de Los Lannos. conference suggestion, September 26, 2017).

3.4 Role of consumers

The role of consumers is not negligible in both cases, no matter if bioeconomy concept or circular economy. Public awareness and educated consumers play a key role in achieving the goals of both economic frameworks. Green Public Procurement, also known as green purchasing, will help the plastics industry to make a shift towards more sustainable economy through purchasing power of consumers as it might create or enlarge markets for environmentally friendly products (Commission of the European communities, 2008). If we educate consumers, we may achieve public acceptance of packaging made of recyclates, although it might not be so colourful as it used to be in the past. Education might also increase demand for products made of recyclates just from the principle to support this iniciative and save the environment. However, to boost collecting of packaging, deposit return, pay-back schemes could be implemented as suportive to enable later recycling (Bolaane, 2006).

Consumers shall also rethink packaging, as many product nowadays are being packed into much more wrapping, than needed. Single use packaging should be reduced as it represents burden for whole society and usually becomes waste immediately. Waste is the symbol of inefficiency within modern economy and society and reresentation of misallocated ressources (Zaman & Lehman, 2013). Little wonder, that Zero Wate iniciative has recently becoming popular amongst consumers. In many applications we may refuse, reduce or reuse packaging, and recycling should not be seen as option number one, but probably the last one acceptable.

Raising concern about toxins in plastic materials might lead consumers to insist for more bans of various toxic chemicals used in plastics, while there is no assurance, that toxins can not get into tap water and food chain. Also producers could set own voluntary commitments, that their products do not contain harmful chamicals, even in case of chemicals, that are not banned yet, but might be potentially harmful.

4 Conclusions

When thinking about making a real shift within the plastics industry towards more sustainable future, it is necessary to take into account difficult challenges. Eventhough market conditions today are not favourable to enable flourishing bioeconomy, or circular economy, the change is needed and is needed rather sooner, than later. When free market does not enhance, what is primarily public interest, legislative and financial incentives might set ground for better products, that provide whole public better-off. However, there is need to rethink well all the possibilities and rethink technological innovations, when the consequences are highly unsure and risky as it happens in case of biodegradable bioplastics, where definitelly more research is needed before launching bioplastics in large scales. Last, but not least, bioeconomy will probably coexist with circular economy, or maybe it will behave like the precondition for establishing the circular economy, although in plastics case it seems to be the contrary issue.

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European Cross-boarder Regions and Economic Competitiveness

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Abstract: *This paper compares two chosen cross-boarder regions in the EU according to their contribution to the increase of competitiveness of the companies and institutions there. In the context of globalization, regions see themselves more and more exposed to a competition about qualified work force, company settlements, employment and European funds. In parallel, global challenges like an aging population or climate change ask for regional solutions and collaborations have become vital. Cross-border regions across Europe have developed to reduce barrier effects and foster new development potentials. The aim of the following study is to analyse the effects of the implementation of cross-border regions on the competitiveness of local companies and institutions. Therefore, a comparative case study of the European Region Donau-Moldau and the Euregio Meuse-Rhine has been designed. The analysis shows that the potential of CBRs relies in the fact to join forces and competencies and that these collaborations address relevant topics to foster the competitiveness.*

Key words: Cross-boarder Cooperation · European Regions · Competitiveness · Regional Development

JEL Classification: O18 · P25 · R11

1 Introduction

Regions have developed to new actors in the context of globalisation. Whereas international transport and telecommunication networks allow businesses to be relatively independent from their location; does the increasing development into a knowledge-based economy demand businesses to be anchored more locally. Innovation and technological development depend on the availability of qualified workers as well as education and research institutions and a strong network between economy, sciences and politics. Regions see themselves more and more exposed to a competition among regions about a qualified workforce, company settlements, employment and European funds. In parallel, challenges like climate change, an aging society or an increasing energy consumption ask not just for global but also regional and local solutions. For regions, cooperation has become vital to face all these challenges. Following the realisation of the internal market in the European Union, competition among European regions has increased and along the internal and external borders many cross-border regions have developed. These new collaborations aim to tackle border-related problems and exploit new development potentials. Across Europe a great variety of such cross-border regions has developed, so that the Association of European Border Regions (AEBR) counts more than 185 today. The chances and potentials of cross-border cooperation for local companies and institutions shall be examined in this study. For this purpose, two different cross-border regions, namely the 'European Region Danube-Moldau', a trinational cooperation along the German-Austrian-Czech border and the 'Euregio Meuse-Rhine', a trinational cooperation along the German-Dutch-Belgian border will be analysed. Both collaborations differ in age, whereas the Euregio Meuse-Rhine was found in 1976, the European Region Danube-Moldau is a young cooperation that had just been found in 2012.

The aim of the following study is to analyse the organisational arrangements, fields of activity, financial means and actions/projects of both cross-border regions and evaluate in which way the cross-border cooperation contributes to an increase in the competitiveness of local institutions and companies. Therefore, the projects and initiatives of both collaborations shall be evaluated against the objectives of the cooperation. Furthermore, it should be evaluated whether the organisational arrangements allow the collaborations to achieve their objectives. A comparison of the two CBRs will be conducted to identify factors that foster or hinder both collaborations and the question is raised whether both regions could learn from each other. Finally, the following research question will be answered:

Regarding their organisational arrangements as well as realised projects/initiatives, in which way do the European Region Danube-Moldau and the Euregio Meuse-Rhine contribute to foster the competitiveness of local companies and institutions?

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On the basis of this research purpose the following structure of the work has been developed: At first the term 'European Region' shall be clarified. Therefore central terms a 'region', 'border', 'cross border-cooperation' and 'cross-border region' will be examined. Furthermore, objectives and organisational structures of cross-border regions will be presented to then elaborate an own operational definition of the term 'European Region' as it is understood in this study. Then the framework conditions of cross-border cooperation in Europe will be described. After a short overview of the historical development of CBC in Europe, the initiatives of the Council of Europe to developed a legal basis for CBC will be presented. Then, the contributions of the European Union to foster CBC will be illustrated. First the INTERREG-initiative and its impact on the financial, institutional and thematic framework of CBC will be illustrated and then the new legal tool European Grouping of Territorial Cooperation (EGTC) is described. The following part is dedicated to highlight the term competitiveness and the relevant pillars that can contribute to foster competitiveness of local companies. Subsequently some general challenges and factors of success of CBC shall be highlighted. After a detailed description of the research method, the choice of case studies, criteria for analysis and research data, both European Regions shall be analysed. The analysis is designed as follows: Each case is studied separately and following the same criteria. First a characterisation of the territory where the CBR is located is given and then the historical development of the CBR is described. Subsequently objectives, fields of activity, organisational structures and financial means of the CBR will be examined. Then certain activities and projects of the CBR will be described and analysed. A short summary at the end of each case study sums up the most relevant conclusions. Finally, the results of both case studies will be compared and the contribution of the CBRs to foster the competitiveness of local companies and institutions will be discussed.

2 Literature review

In general, not many recent studies have been published on cross-border cooperation in Europe. Most publications date from the early years of 2000, see for example: Deppisch (2007), Kohlisch (2008) or Schmitt-Egner, 2005 who take a look on the issue under a policial science perspective. One important work on CBR on the German-Czech border has been published by Schramek (2014). Other relevant contributions are Student (2000), who compares CBRs from an economic perspective or Perkmann (2003), who tried to classify CBRs in Europe and whose works has been relevant to elaborate the definition of the term 'European region' in this work.

2.1 The term 'European Region'

Many different terms like Euroregion, Euregio, Eurodistrict or European Regions are the titles of different cross-border cooperations across Europe, that vary to a large extend in their geographical scope as well as organisational arrangements. To define what is understood as a European Region in the framework of this study, the approach is undertaken to define central terms like 'region', 'border', 'cross-border cooperation' or 'cross-border region' . This allows to clarify the characteristics of a 'European Region' like objectives, actors and organisational arrangements (Perkmann, 2003). The term region is very broad and frequently used in very different contexts. In this work, a region is understood not just as an 'action place' but also as an 'action unit'. As an action place a region is understood as a locality where social, economic or cultural actions take place, that can't be controlled. As an 'action unit' a region is also understood as an actor that has, on the basis of organisational arrangements, competences to act and to intervene and construct the 'action place'. By consequence, a European Region is characterised by some institutional arrangements that allow this region to intervene in cross-border actions (Schmitt-Egner, 1998, S. 54,55) (Schramek, 2014, S. 46). Furthermore a European Region is understood as a specific type of a cross-border cooperation. Perkmann (2003, S.156) defines a CBC as follows: „[…] a more or less institutionalised collaboration between contiguous subnational authorities across national borders." Consequently, a European Region is a type of collaboration between subnational authorities across borders. The aim of a CBC is to „[…] to offset the structural disadvantages imposed by their location, on the edge of their country and confined by the limits placed on the system (legal, economic, social, or even linguistic, cultural, religious, etc.) as a result of proximity to an international border" (Committee of the Regions, 2007). In the European Union borders have developed from physical barriers to so called 'soft borders', due to the realisation of the internal market and the Schengen Agreement. As soft borders, barriers occur due to the existence of different economic, political, legal, social, linguistic and cultural systems that exists between national states (Schmitt-Egner, 2005, S. 85, 86). Besides the dependence of different national states, contiguous subnational authorities often have common interests, problems or face the same challenges. These commonalities are at the basis of CBC (Schmitt-Egner, 2005, S. 163). Common fields of activity in CBC are cross-border economic cooperation and support of innovation and infrastructure; social issues and education, the labour market; environmental, natural, health and catastrophe protection; common history, culture and tourism (Schmitt-Egner, 2005, S. 168). Collaborations aim to exploit endogenous development potentials that are understood as all intraregional potentials of a region, like human (work force, capital, infrastructure etc.) and natural factors (landscape, environment etc.). As Schmitt-Egner (1998, S. 63) says, the overall objective of cross-border cooperation is to maintain, control and develop a common living space.

The Association of European Border Regions (Arbeitsgemeinschaft Europäischer Grenzregionen (AGEG) (Hrsg.), 2008, S. 58) distinguishes between two different types of CBC, so-called on-off activities and strategic, development-oriented collaborations. A European Region is of the latter type, as it is a long-term collaboration characterised by a certain organisational structure, objectives and a stratgy. By consequence a European Region is understood as a cross-border region, meaning "a bounded territorial unit of the territories of authorities participating in a CBC initiative […] equipped with a certain degree of strategic capacity on the basis of certain organisational arrangements." (Perkmann, 2003, S. 157) Cross-border regions are not a new administrative level, but networks of different actors. Local and/or regional authorities from both sides of the border are the main drivers of these collaborations, but not the only ones. To build up a cross-border region means to build up vertical, horizontal and lateral networks of actors from public administrations, politics, economy and the civil society. They can be involved in different ways in the organisational structure of the CBR. CBRs have no competencies on their own, but depend on agreements between these different actors. This type of network collaboration and decisional structure is also called Regional Governance (Deppisch, 2007, S. 27-28). There is a great variety of organisational arrangements of CBRs in Europe. They vary from loose forms to strongly institutionalised structures. Working communities are of the first type as they have no legal personality, are based on cooperation agreements and often don't have own financial resources or staff. Some examples are large-scale cooperation like the Working Community Alp or the International Lake Constance Conference (Internationale Bodenseekonferenz) (Arbeitsgemeinschaft Europäischer Grenzregionen (AGEG) (Hrsg.), 2000, S. B2, 22-25). A more institutionalised form of a CBR is a Euregio1, which is a small-scale collaboration between local and regional authorities with an own legal personality based on either private or public law2. These collaborations often have own administrative, technical and financial resources, a permanent secretary and own decisional structures. Most Euregios are involved in the preparation and implementation of INTERREG projects or programmes and many of these structures developed due to the launch of the INTERREG programme in 1990. Some typical examples are the EUREGIO Gronau or the Euroregion Neisse-Nisa-Nysa (Arbeitsgemeinschaft Europäischer Grenzregionen (AGEG) (Hrsg.), 2000, S. B2, 22; Perkmann, 2003, S. 155). The most institutionalised form of a CBR is to create a European Grouping of Territorial Cooperation (EGTC). This legal instruments allows public authorities to create a cross-border structure with a legal personality based on public law and has been implemented in 2006 by the EU. EGTCs vary strongly in their scale and objectives, e.g. EGTC Eurodistrict Strasbourg-Ortenau or EGTC PyrénéesMéditerranée (European Union (Ed.), 2017). In general, one can observe a trend to larger cooperations based on more functional interdependencies like the metropolitan cross-border regions Great Region Saar-Lor-Lux or Eurométropole Lille-Kortrijk-Tournai (Chilla und Weidinger, 2014, S. 9-10). In recent years many CBRs have developed that can't be necessarily classified as one of these types (Working Community, Euregio, EGTC) (Perkmann, 2003, S. 159) and in the scientific literature no typology of CBRs could prevail. Against this background and the preceding theoretical considerations, the following operational definition of a 'European Region' has been developed and will be used in this work:

A European Region is a cross-border region, whose action place is the sum of the territories of the actors involved. These actors are two or more contiguous public authorities that are separated by a national border. These actors become an action unit through the existence of an organisational structure. The aim of the collaboration is to maintain, manage and develop a common living space.

2.2 Framework of cross-border cooperation in Europe

Cross- border cooperation and cross-border regions evolved in Europe since the late 1950s especially along the western German border with contiguous Dutch, French and Swiss public authorities (e.g. 1 Or Euroregion. 2 Public law if bilateral agreements between states allow this. EUREGIO (Gronau), the Regio Basilensis and the Region SarLorLux) and in the 1970s and 1980s as large-scale working communities (e.g. ARGE Alp, International Lake Constance Conference, COTRAO) (European Commission, 2015a, p. 26-27). With the deepening of the European integration process since the 1980s many more such collaborations developed. The European Union (earlier European Economic Community) and the Council of Europe are two institutions that mainly influenced the legal, financial and institutional framework of cross-border cooperation in Europe. The European Union supported the economic and political integration and shaped especially the financial and institutional conditions of CBRs. The Council of Europe instead tried to ameliorate the legal framework of CBC and fostered the municipalities and regions as democratic actors (Haack, 2010, p. 109). Hereafter the most important initiatives of both institutions framing CBC in Europe will be presented, starting with those of the Council of Europe. One milestone was the European Charter of Local Self-Government that became effective in 1988 and that recognised the right of political, administrative and financial self-administration of municipalities. The signatory states of this Charter allowed their municipalities to be autonomous within the framework of their competences and recognized the right of association, meaning that municipalities where allowed to cooperate with other public authorities, even from different national states (as in CBC). This gave an important incentive to CBC, even though the legal framework for CBC was still complicated and just improved with the European Outline Convention on Transfrontier

co-operation (1980), also called Madrid Convention, and its three Additional Protocols. The objective of the Madrid Convention was to foster CBC and to support the economic and social progress of border regions. Therefore signatory states of the Convention agreed to facilitate the legal, administrative and technical framework of CBC. The Convention itself just made some legally non binding proposals for bilateral agreements, but neither created a new legal framework, nor gave more competences to local authorities. Just with the First Additional Protocol from 1995 the right to enter into an cross-border cooperation agreement and to create a cross-border grouping was granted to public authorities. With the Second Additional Protocol this right was extended not just to CBC but also to collaborations between non-contiguous authorities, meaning intraregional cooperation (Committee of the Regions, 2007, p. 30-33). On the basis of the Convention and its Protocols several bilateral agreements between contiguous national states were established to create a legal basis for CBC between local authorities located at that border. Nevertheless the general application of the Convention remained weak, as intergovernmental agreements for each border where still necessary to clarify which national law was applicable. Besides their little practical application, the Convention and its Protocols paved the way for the establishment of the legal instrument European Grouping of Territorial Cooperation (EGTC) of the EU (Committee of the Regions, 2007, p. 37; Krzymuski, 2014, p. 26).

In contrast to the Council of Europe, the European Economic Community and later the European Union supported especially the economic integration of its member states und started to support border regions and cross-border cooperation in order to decrease the social and economic disparities between European regions and to foster cohesion. The programme INTERREG was launched in 1990 to enable structurally weak border regions to adapt to the new requirements of the Internal Market, as the competition between regions had increased with the free movement of people, capital, goods and services (Europäische Kommission, 2015a, S. 20-21; Manzella & Mendez, 2009, S. 14, 15). INTERREG became and still is today, under its new name European Territorial Cooperation, the main initiative of the EU to support CBC and became in 2007 a proper objective of the European Cohesion Policy. Since five programming periods that lasted between four to seven years, the EU finances through INTERREG bi- or multilateral projects under the following three strands: cross-border cooperation (strand A), transnational cooperation (strand B) and interregional cooperation (strand C). Consortia of partners from at least two different member states cooperate to realise projects of common interest in different thematic fields (Interact, 2015). Whereas in the beginning the European Union financed mainly cross-border infrastructure projects, the thematic priorities in the current programming period are much broader and are related to the goals of the Europe 2020 Strategy, the European Union's strategy for smart, sustainable and inclusive growth. Today, projects in the fields research and innovation, education, support for SMEs, energy efficiency and climate change, infrastructure and mobility, environmental protection and social inclusion, inter alia, can be financed (European Commission, 2015a, p. 33-34). The INTERREG programme, which is financed by the European Regional Development Fund, influences the CBC in Europe in many ways. First, the EU provides through INTERREG financial means for cross-border cooperation and enables contiguous border regions to finance projects of common interest. This led to a considerable quantitative increase in the number of cross-border regions in Europe since the 1990s. Many of them are found because of the availability of financial means and can be called fund-driven or top-down initiatives (Perkmann, 2003; De Sousa, 2013). Second, as many of these CBRs depend on the European money, the EU influences the thematic priorities of the collaborations, as money is provided along certain investment priorities related to the Europe 2020 strategy (European Commission, 2015a, p. 21). Third, the INTERREG programme influenced the CBC in Europe in qualitative terms and contributed to the institutionalisation of collaborations across borders. For CBCs to receive EU funds the European Commission requires the establishment of a common cross-border development strategy and cooperation programme as well as common management structures and institutions for the management and distribution of the EU funds. This led to the institutionalisation of less formal collaborations and the development of many CBRs with similar organisational arrangements, the so called Euregio (Perkmann, 2003). Finally, local and regional authorities and CBRs became new actors and action units within the European multi-level-governance system through INTERREG. They are, on the basis of the principles of partnership and subsidiarity, directly involved in the policy making through the establishment and the realisation of the cross-border cooperation programme, which sets the thematic priorities under which projects can be financed (Interact, 2015, p. 2; Haack, 2010, S. 118). In addition to the INTERREG initiative, the EU also engaged in the facilitation of the legal framework of CBC with the creation of the European Grouping of Territorial Cooperation (EGTC) in 2006. This legal instrument can easily be applicate in all EU member states and allows public authorities to create a cross-border grouping with legal personality based on private or public law without the signature of an additional international agreement. As the grouping has an independent legal personality from its members it can conclude legal acts, has an own budget and can hire own personnel which facilitates the realisation of cross-border projects or the management of EU programmes (Committee of the Regions, 2007, p. 66-111; European Commission, 2015a, p. 62-64). Both institutions, the Council of Europe and the European Union mainly influenced the framework under which CBRs or European Regions (according to the established definition in chapter 2) develop and act today, regarding their legal status, financial means, institutional arrangements and often thematic objectives.

2.3 Competitiveness of Firms and Institutions

The competitiveness of regions and its economic subjects becomes more and more important issue. As known from other fields of research, competitiveness is a hard-to-catch expression and needs to be explained theoretically. The famous business economics description of the "ability to sell" (Balassa, 1962, p. 29) offers a first idea of what it is all about. Firms need to be competitive to be able to sell their products on international markets against the products of (foreign) competitors. It has simply to be more than, or at least as productive as comparable firms. According to the World Economic Forum (Schwab, 2015, p. 35) competitiveness is the "set of institutions, policies and factors that determine the level of productivity of a country". Therefore, an environment in which the firm can operate without too much obstacles of several kinds is a necessary condition. This is valid for CBRs and their policy space too.

The WEC defined 12 pillars, according to the development stage of the region, influencing the competitiveness of a nation and its firms. Institutions, infrastructure, macroeconomic stability, health and basic education constitute general necessities. In later stages of development, the importance of higher education, of the efficiency of the goods-, labour and financial market, the technological readiness and of the market size come into play. High developed countries are characterized as innovation-driven and are based on factors as innovation itself and business sophistication. All 12 pillars influence directly or indirectly the market position of a firm. But not all of them can be influenced by a region or a CBR. Special emphasis will be given to the following issues: Institutions, public or private are important for the framework wherein the single firm operates and determine the level of the so-called transaction cost. Infrastructure is not only about the access to certain product markets and the availability of an adequate energy and communication network, but also about the mobility of the work force. Health of the workforce is decisive for their productivity as well as the quality of education. An efficient labour market constitutes another important factor for local firms because it helps to allocate well the skills of the workers according to the needs of the firms. The possible market size determines the productivity of a firm through the possibility of taking advantage of economies of scale. Furthermore, an innovation-friendly environment and high business sophistication could constitute an advantage for a local high-tech industry (Schwab, 2015). In addition to these pillars, regional networks gain more and more importance for the competitiveness of local firms and institutions. Positive effects result from clustering, meaning the geographic proximity of regional firms along a value chain. In general, networks allow to bundle competences and resources, exchange experiences and knowledge and to achieve common goals more easily (Nuissl von Rein, 2013, S. 18, 19; Bachinger & Pechlaner, 2011, S. 4-9).

3 Methodology

The present study follows a qualitative and comparative case study approach. A holistic and detailed description of framework conditions, actors, organisational arrangements, strategies and projects/initiatives of each case study should allow to understand promoting and impeding factors for the collaboration. The analysis focuses on the one hand on institutional conditions and on the other hand on particular measures undertaken by the CBR to foster the competitiveness of local companies and institutions. Even though the transferability of results from one CBR to another is difficult as the context of each collaboration differs, a comparative approach has been chosen because it allows to learn from the experiences of other collaborations and to better use own development potentials. The conditions that foster competitiveness are transferable from one region to another and so a comparison of undertaken initiatives in this direction by both CBRs makes it possible to evaluate in which way CBRs can contribute to improve the framework conditions under which local institutions and companies operate. The comparison of projects and initiatives allows to evaluate the activities of each collaboration and to show up possible development perspectives. The choice of the two case studies was based on the theoretical sampling approach and the requirements from the registered research project. The requirement was to compare a German-Dutch collaboration with one located at the German-Czech border. Because of the tendency towards larger collaborations and the presence of more active and adequate cases, the analysis focuses on collaborations on the regional instead of the local level. Based on the elaborated definition of a European Region in chapter 2 the European Region Danube-Moldau located at the German-Austrian-Czech tri-border region was chosen as first and typical case study. This collaboration just exists since five years and has not yet been subject to scientific works. Based on the expected differences (older collaboration (since 1976), smaller cooperation area, stronger institutionalisation) the Euregio Meuse-Rhine located at the German-Dutch-Belgian tri-border region has been chosen as second case study. The analysis is separated in two parts, a single case analysis where cooperation area, organisational structure and projects/initiatives of each CBR are presented in detail and a comparative analysis where the impact of both CBRs on the competitiveness of local companies and institutions is evaluated following the elaborated pillars that foster competitiveness. The analysis of projects and initiatives of both CBRs follows two different approaches, due to the different age and number of realised projects. In the case of the European Region Danube-Moldau the activities of chosen so-called knowledge platforms (thematic working groups) between the foundation of the CBR in 2012 and July 2017 will be analysed. The choice of the working groups was made on the basis of their relevance for the competitiveness. The

following knowledge platforms have been chosen: 'Research and innovation', 'Collaboration of Universities', 'Collaboration of enterprises and the creation of clusters', 'Qualified work force and labour market' and 'Mobility, accessibility and transport'. In the case of the Euregio Meuse-Rhine, out of the great number of realized projects three projects in the fields 'Labour market', 'Collaboration of enterprises' and 'Research and innovation' have been chosen as best-practice examples for the comparison. For the whole analysis of both case studies and initiatives only secondary data has been used. The study is based on the analysis of the websites, publications, project reports, press releases, statutes and activity reports of both CBRs. For the description of the socioeconomic situation in the cooperation area and the financial resources of both CBRs statistical data mainly from Eurostat has been used.

4 Analysis

4.1 European Region Danube-Moldau (ERDV)

The European Region Danube-Moldau is located in the tri-border region between Bavaria (Germany), Austria and Czech Republic and lies inbetween the metropolises Prague, Vienna, Munich and Nuremberg. The CBR comprises the territories of the following regions: the German districts Upper Palatinate (Oberpfalz) and Lower Bavaria (Niederbayern) with Altötting, the Czech districts Pilsen, South Bohemia and Vysocina and the Austrian federal state Upper Austria and the Lower Austrian regions Mostviertel and Waldviertel. The cooperation area is nearly 65.000 km² and counts more than 6 mio. people. A polycentric structure of medium size towns and natural barriers that take the form of mountain ranges and rivers located at the border characterise the cooperation area. The regions share a long common history which has been disrupted by the First and Second World War and through the Iron Curtain until 1989. The natural and historical barriers led to an incomplete cross-border infrastructure. Nevertheless the overall socioeconomic situation in the ERDV is relatively strong and above EU average. Especially the production industry, tourism and small and medium size companies are the economic drivers. The ERDV counts numerous universities and research institutes. But a strong disparity of GDP and income is observable between Austrian and Bavarian regions on the one hand and the Czech regions on the other hand and leads to strong commuter flows from Czech Republic to Germany and Austria. The ERDV as an organisation has been created in 2012 as international working community between the political representatives of the above-named participating regions. On the basis of long-standing successful collaboration at the local level, the signatory regions aimed to cooperate on a more strategic and binding basis at regional level to deal effectively with more complex topics like labour market, cooperation of universities and cross-border transport. According to the statutes, the aim of the collaboration within the ERDV is to "develop the trilateral cooperation for the good of the people who live in the ERDV, to strengthen the region in the competition between regions and to support the European idea" (Europaregion Danube-Moldau, 2012, Präambel, own translation). The ERDV wants to strengthen its position between the metropolises and therefore develop a common development strategy, projects and positions. The collaboration takes place in the following seven thematic fields: 'Research and innovation', 'Cooperation of universities', 'Cooperation of enterprises and the creation of clusters', 'Qualified workforce and labour market', 'Tourism oriented towards nature, health, cities and culture', 'Renewable energy and energy efficiency' and 'Mobility, accessibility and transport'. The organisational structure of the ERDV can be characterised as little institutionalised as the collaboration is build on a legally non binding political working community. Decisions remain as yet non-binding and the cooperation is based on loose agreements. The political leaders of all member regions build together the Executive Committee and decide on the strategic objectives and annual programme. Seven trilateral working groups, so-called knowledge platforms with each about 30 experts from all member regions, develop and initiate projects and initiatives in the seven thematic fields to realise the strategic action programme. The ERDV disposes of own financial resources to finance its activities. But during the first 3 to 5 years (from 2012) the ERDV does not appear as own lead partner, but just initiates projects between existing partners. In general, cross-border projects on the territory of the ERDV can be financed through the following three bilateral INTERREG-Programmes: INTERREG V-A Austria-Czech Republic 20142020, Goal ETC Bavaria-Czech Republic 2014-2020 and INTERREG V-A Austria-Bavaria 2014-2020. The analysis of the undertaken and realised activities of the knowledge platforms between the foundation of the ERDV in 2012 and July 2017 has shown the following results. The selected knowledge platforms for analysis are: 'Research and innovation', 'Cooperation of universities', 'Cooperation of enterprises and the creation of clusters', 'Qualified workforce and labour market' and 'Mobility, accessibility and transport'. Infrastructure is seen as a prerequisite for the economic development and competitiveness of a region because it allows market access to firms. The cooperation area of the ERDV still has a great deal of action, especially in the area of cross-border road and rail transport. The ERDV addresses this topic in its knowledge platform on transport and mobility and can present a first important working basis with the 'Masterplan Transport'. Initial successes are already evident in the area of public transport, but larger, extensive traffic projects depend on higher-level decisions, so that substantial improvements can only be expected in the long term. ERDV also focuses on cooperation in the field of secondary and tertiary education. The cooperation area offers a great potential with more than 30 institutions, and there are already some bilateral partnerships between the universities of Pilsen,

Ceske Budejovice, Linz and Regensburg. Initial initiatives to increase student mobility and linguistic knowledge have been launched by the ERDV through mobility grants, and the CAST project shows how the ERDV can support universities in the development of joint courses of study. The topic of the labour market is also a focus of cooperation and commuter flows are evidence of a certain networking of the regions, which, however, is one-sided due to the wage gap. The language barrier within the ERDV represents a major challenge for the networking of the labour market. Therefore, the knowledge platform plans labour market initiatives in this area. However, concrete projects to increase workers' mobility have not yet been initiated. A platform for knowledge is also dedicated to the promotion of business cooperation. The Clusterland map makes it easier for ERDV companies to access information when it comes to finding cooperation partners. It shows that numerous growth poles lie within the ERDV area. The similar branch structures, especially between Pilsen, the Bavarian regions and Upper Austria, offer many potentials for cooperation. The analysis of the Smart Specialisation strategies allowed the regions not only to exchange best practices, but also to identify links for future cross-border cooperation. However, concrete initiatives to promote specific sectors, clusters and SMEs in the region have not yet been implemented, except for network events. Finally, the ERDV also aims to strengthen the region as a research and innovation location. To this end, the knowledge platform stimulates the exchange between scientists and companies through numerous events and supports the positioning of the ERDV through its publications 'location portrait' and 'health location'.

Overall, it can be said that the activities of the knowledge platforms so far are oriented towards the analysis of the existing situation in the cooperation area and the support of existing and / or initiation of new network events. Until now, the various publications (traffic master plan, university lecture, clusterland map, etc.), but less concrete projects for the promotion of companies or research facilities, are the results. This is certainly due to the fact that the ERDV is still a new cooperation and the structures have to be built up. A further reason could also be a lack of financial resources, as the financing of trilateral projects through INTERREG demands several projects proposals because only bilateral projects can be financed and because of the uncertain amount of financial resources of the ERDV. And finally it is difficult to know exactly which projects have been initiated by the ERDV, as the cooperation does not appear as project leader.

4.2 Euregio Meuse-Rhine (EMR)

The Euregio Meuse-Rhine is located in the tri-border region between Germany, Netherlands and Belgium. The collaboration consists of the territories of the Belgian provinces Limburg and Liège, the German-speaking Community in Belgium, the Dutch province Limburg and the German Region Aachen. The area of cooperation is much smaller than the one of the ERDV an is 10.700 km² large and counts about 4 mio. people. As the ERDV the EMR is characterised by a polycentric structure of medium size towns and a location between several metropolises. No natural barriers or physical borders are located in the trilateral cooperation area, what has led to an active economic, social and cultural exchange between the five member regions since many centuries. Especially the Dutch and Belgian province Limburg share strong cultural and historic ties. The EMR benefits from an excellent infrastructural connection and its close location to international hubs. This leads to a high mobility in the EMR and important commuter flows, especially from Belgian regions, which face higher unemployment, to the adjoining Dutch and German regions. The economic situation in terms of GDP is weaker than in the ERDV and the produced GDP per capita in purchasing power standards slightly below the EU average. Nevertheless the EMR has positioned itself as a strong Science and Technology Region and disposes of internationally renowned universities and research institutes. The collaboration between the five member regions started in 1976, when the Euregio was found just like the ERDV as an international working community. The EMR is one of the first cross-border collaborations in Europe. In 1991 the collaboration changed its legal status into a Dutch Stichting based on private law, that has its seat in Eupen, with the aim to intensify the collaboration and better administer European INTERREG funds. The aim of the collaboration is to reduce barriers related to the existence of an international border and to increase the quality of life for the local people through information, communication and collaboration between the five member regions. Based on the EMR 2020 strategy the current thematic fields of activity are 'Economy and Innovation', 'Labour market, education, vocational training', 'Culture and tourism', 'Healthcare' and 'Security'. Cross-cutting issues are for example 'Mobility and transport' and 'Sustainable development'. The organisational structure of the EMR can be described as very institutionalised and corresponds to that of a Euregio as described in chapter 2. The political leaders of the five regions build the executive board of the Euregio, which is the highest decision-making body and bears all responsibility for activities of the Stichting. A particularity represent the Euregio Council and the Social and Economic Council, two bodies that represent the non-governmental level: on the one hand the political parties of the regional parliaments and on the other hand representatives of the civil society, like trade unions, employers' association, Chambers of commerce and industry, universities etc. Although both bodies just have a consultative role, the participation of these 80 representatives allows a high legitimisation of the work of the EMR and formalises the involvement of civil representatives. The thematic work of the EMR takes place in so-called strategic monitoring

groups. These are groups of experts which differ in their composition according to the thematic requirements. The EMR has just a small own budget, as a consequence all cross-border projects on the territory are financed through the own INTERREG V-A Euregio Meuse-Rhine programme. The programme area corresponds to the area of the Euregio, so that also trilateral projects can be financed through it. Until 2013 the Stichting Euregio Meuse-Rhine was also Managing and Certifying Authority of the INTERREG programme. Out of the many realised projects of the EMR, three initiatives were chosen and presented as best-practice examples for concrete projects that support the competitiveness of local companies and institutions. The first initiative is the longstanding EURES partnership between the employees' and employers' associations of the five member regions and the establishment of a cross-border information point for local citizens, workers, employers, pensioners and commuters. The second projects, called 'The Locator', is a location information system for entrepreneurs that provides information on commercial property on the territory of the Euregio. And the third project is the initiative TTR-ELAt-region, that aims at positioning the territory of the EMR and adjoining regions as a knowledge- and technology region and therefore developed a cross-border strategy. Under the umbrella of this initiative concrete innovative cross-border projects and SMEs in selected sectors have been supported through INTERREG projects. With regard to the dimensions of competitiveness, the three project examples show that a cross-border region can improve the framework conditions for companies and stakeholders through concrete initiatives. The cross-border information point, the EURES partnership as well as the projects ' The Locator' improve access to information for businesses and workers by providing services. In this way, the mobility of workers is increased in the case of the cross-border information points and the EURES partnership and the labour market becomes more efficient by means of an improved mediation between job offer and demand. The 'Locator' project helps companies gain market access and can help reduce transaction costs by providing free information on commercial space. The TTR-ELAt initiative is an interesting example of a cross-border strategic approach to promoting research and innovation. The identification of common strengths in three sectors allows the actors (companies, research institutes) of the involved regions to specifically promote and expand these potentials. In this way, the actors can reach a critical mass that enables them to position themselves internationally as a leading technology group and to compete with competitors. However, the TTR-ELAt region also shows that increasingly functional regional definitions become more relevant and that collaborations follow a more strategic approach whose goal goes beyond the elimination of border-related barriers. The Euregio Meuse-Rhine initiated a more strategic orientation by publishing a joint EMR2020 strategy in 2013. Therein, it reaffirms its willingness to expand cooperation with other existing cooperation alliances and to position itself more as a "network of networks" in the future. Also the transformation into a EGTC on the basis of public law is discussed.

5 Comparative Analysis

Now that both case studies have been comprehensively analysed, the impact of cooperation in the European Region Danube-Moldau and the Euregio Meuse-Rhine on the competitiveness of local institutions and enterprises will be assessed. First of all, both regions are understood as intermediaries between the regional actors or impulse networks for cross-border cooperation. As outlined in chapter 4, networks offer the participants the opportunity to exploit potentials by pooling resources and competencies. They are based on the exchange of experiences and common learning processes, which can have positive effects on competitiveness. Both collaborations, through their work and organisational structures, try to institutionalise the networking of actors and to create new platforms for the exchange of experiences and the development of joint action strategies for common goals and problems. By offering access to the regional stakeholders (universities, business networks, research facilities, public institutions) through regular meetings within the knowledge platforms (European Region Danube-Moldau) or the strategic accompanying groups, they offer these actors new possibilities for cooperation. A comparison table 1 see below.

From a thematic point of view, both regions focus on fields of action that can have a positive impact on the competitiveness of companies on the basis of the pillars defined by the World Economic Forum. In the European Region Danube-Moldau as well as the Euregio Meuse-Rhine, activities are being organised to promote research and innovation, enterprise / economy, labour market and education. Both cooperations are also striving to improve the cross-border infrastructure. In the area of promoting research and innovation, the TTR-ELAt initiative in the EMR is a particularly interesting example of how the cross-border networking of business, research institutions and policy can enhance the competitiveness of local businesses and research institutes. By identifying cross-border development potentials on the basis of shared and complementary skills between regions, stakeholders can concentrate their resources and competences and reach a critical mass in targeted sectors that can allow them to compete internationally as a powerful technology region. Without the cross-border cooperation, it would be difficult for individual clusters and research facilities in the regions to compete internationally. The collaboration enables the targeted promotion of promising business cooperation and thus contributes to increasing the competitiveness of local businesses. To improve the cross-border labour market, CBRs can contribute to increase the mobility of workers by promoting the (foreign) linguistic knowledge. As the mobility is furthermore often hampered by the clashing of various tax, social security and legal systems in border regions,

CBR can also foster the mobility by the provision of information and employment services. Cooperation in the area of tertiary education offers the regions the opportunity to provide qualified and international staff for the resident companies. Joint courses of study, as planned by the ERDV, enable students to have different working methods and language skills as well as a limited mobility hurdle. In addition, international research collaborations and an international range of courses also increase the reputation of higher education institutions, thereby improving the quality of teaching staff and researchers, which can ultimately have a positive effect on the quality of teaching and research in the region. Furthermore, CBRs can contribute to the amelioration of cross-border transportation infrastructure. Especially in the field of cross-border public transportation CBRs have competences. Decisions on large-scale infrastructure projects are usually taken at a higher, national level, so that the possibilities for action here are mainly in the area of the common interest representation in decision makers and in the conduct of studies. However, as cross-border regions identify the relevant actors on both sides of the border and bring them together, they can make an important contribution to improving the infrastructure of the region. To sum up, the collaboration in a cross-border region offers various potentials in terms of the competitiveness of local companies and institutions. Firstly, it allows specific cross-border disadvantages to be identified for the development of resident enterprises and institutions and mitigated or reduced through targeted measures. Then, for local companies and institutions, the networking activities of the cross-border regions create opportunities to build up new cooperations. Finally, through the CBC, the competences and resources of the local companies and institutions can be pooled and synergy effects can be generated, which allow the individual actors to gain a stronger position in the international competition.

Table 1 Description for Chosen Regions

Description Indicators for Chosen Regions	European region Danube-Moldau	Euregio Maas-Rhein
Cooperation Area	7 regions, 3 states, 2 languages area: 64.950 km² inhabitants: 6.006.018	5 regions, 3 states, 3 languages area:10.663 km² Inhabitants: 3.929.184
Established in	2012	1976
Way of Founding	Top-down	Bottom-up
Founding Initialized by	Governors of neighbouring regions (Lower Bavaria, South Bohemia,Upper Austria)	Cooperation Activities in Region Aachen with the Dutch Province Limburg, and the German-speaking community in Belgium, and Provinces Limburg und Lüttich
Legal Form	Trilateral union which was established on a political level in the form of a working community, and which incorporates seven partner regions	Dutch Stichting
Organisation Form	International working group: presidency, trilateral coordination committee, ERDV-office, knowledge platforms, regional contact points	Stichting according to Netherlands' law: Board, EMR-office, Euregio-Council, Economic- und Social Council, Strategic Join Groups und temporary Working Groups
Main Themes	Research and Innovations, Entrepreneurship Cooperation, Cooperation of HEIs, Labour Market, Tourism, Transportation, Renewable Energy Sources,	Health, Security, Economy and Innovations, Labour Market and Education, Culture and Tourism
Financing	Own sources	INTERREG EMR

Source: Own processing

The contribution which cross-border regions can ultimately deliver through targeted activities is also influenced by organisational structures and the availability of financial resources. The availability of financial means for trilateral projects is a weakness of the European Region Danube-Moldau, as no trilateral projects can be financed through INTERREG and as the organisation finances only small projects until now. Furthermore different competences of the member regions are a challenge for the collaboration in the ERDV. The majority of activities of the ERDV concentrates on network activities and the analysis of the current situation in the ERDV. Concrete flagship initiatives are still missing. To overcome the non-binding nature of the collaboration, the establishment of an EGTC is discussed since 2017. All in all the ERDV can be characterised as top-down initiative. Whereas the Euregio Meuse-Rhine is much more institutionalised and a bottom-up initiative, meaning that the collaboration is largely supported by local economic, scientific and social partners. However, a key challenge for the Euregio Meuse-Rhine seems to be to adapt its own structures and, where appropriate, the spatial dimension to the new requirements of cross-border cooperation. The TTR-ELAt initiative shows that for a positioning as a technology and innovation region a larger spatial layout would be necessary than it was for the reduction of cross-border disadvantages under INTERREG. In this comparison, the potentials offered by a large-scale cooperation, such as the ERDV, are shown.

6 Conclusions

Faced with the increased international competitive pressure and against the background of growing global challenges, regions are increasingly developing their own strategies to create an attractive living and economic space for the population and companies. Partnerships and cooperation are thereby given a special role in regional development. The collaboration in cross-border regions have become more strategic and should contribute to foster the collaborating regions in the competition between regions and to better exploit regional development potentials. To what extent the cooperation in a cross-border region can promote the competitiveness of local businesses and institutions is shown by a comparison of the European Region Danube-Moldau and the Euregio Meuse-Rhine. Border regions are often characterised by a political deficit, which means that they are not widely respected by national decision makers. Through the creation of cross-border cooperation structures, local authorities attempt to overcome this deficit and create a new political space for action. The main actors of cooperation are mostly public administrations and the political representatives of the participating bodies. As network-like structures, their success and the contribution they can make to the competitiveness of local institutions and enterprises depends decisively on involving regional stakeholders from universities, research institutions, businesses and civil society in cooperation and structures. Only if the companies and institutions see value in the cooperation and develop their own interest, the collaboration can be successful. The networking and establishing of horizontal cooperation on every level involving also local population can bring a certain increase of welfare and therefore also competitiveness of regions (compare Kabai, 2017). Finally, the contribution that the cross-border regions can make is to reduce or limit the system barriers and partial structural deficits (such as lack of infrastructures) caused by proximity to a border through targeted measures and initiatives. The analysis of the activities shows that the EMR and the ERDV are launching projects and initiatives in fields of action relevant to the competitiveness of local businesses and institutions.

However, the selected method of describing and presenting the activities and selected projects of both CBRs only allows to evaluate to a very limited extend the real influence that these initiatives have had on the competitiveness of companies and institutions. This influence can only be estimated by means of general statements on the beneficial factors of competitiveness. Even in a quantitative, statistical study of company data, the effects of establishing a cross-border region on competitiveness are likely to be difficult to assess. A useful addition to the present work, however, could be the collection of empirical primary data in the form of a survey or the conduct of interviews of local companies and representatives. This would allow to evaluate in a more deeply way the impact that the creation of a CBR can have on the competitiveness and the added value it presents or not for local institutions and entrepreneurs. It would be especially interesting to conduct a survey on the territory of the ERDV, as it is a very recent and young collaboration that follows a new, more large-scale and strategic approach.

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How to deal with the complexity of assessing the local impacts of Renewable energy sources?

Lenka Zemková, Jan Macháč, Jiřina Jílková

Abstract: *In response to climate change, European Union directive set the goal of 20% share of renewable energy sources in the final energy consumption in 2020 to mitigate the CO_2 emissions. The Czech Republic has committed to the goal of 13%. Based on the Czech National Action Plan, Ministry of Industry and Trade expects to exceed this goal. There are a number of studies evaluating the impacts of constructing renewable energy sources (RES) at national level, which provide information about impacts on GDP or employment. These cover mostly the macro-economic level. Alternatively, the method of regulatory impact assessment (RIA) may be used. Another group of studies and analyses consists of environmental impact assessment (EIA), which is applied to evaluate the impact of construction of a specific resource.*

None of the above mentioned methods cover the complex assessment of the implementation of RES at the regional/local level. Given the wide variety of impacts (ranging from the impact on employment and municipal budget to the environmental impact), impact assessment on local level is a difficult task for decision-makers. To overcome these challenges, Regional impact assessment framework (RegioIAF) was developed. This method is based on a combination of RIA, EIA, LIA (local impact assessment) and multi-criteria analysis. The size of the positive/negative impact is determined for specified categories such as employment, regional GDP, revenues for municipality and environment. The main user of the RegioIAF will be the mayor who faces the decision, whether to build a renewable energy source or not.

Key words: Climate Change · Renewable Energy Sources · RegioIAF · Impact Assessment

JEL Classification: Q20 · Q50 · H72

1 Introduction

The EU goal of 20% share of renewable energy sources in the final energy consumption in 2020 increases the demand for these sources. As the Czech Republic has committed to contribute to the EU level with the 13% share of RES at the national level (Ministry of Industry and Trade, 2015), a lot of mayors face a decision whether to build a renewable energy source in the municipality and whether the municipality will benefit from it.

Currently, a few methods of impact assessment are used in the Czech Republic. Regulatory impact assessment (RIA) focuses on analyzing the social and economic impacts before a certain law comes into force. Environmental impact assessment (EIA) usually takes into account only positive or negative environmental effects when it comes to RES. Both of them evaluate the macro-economic level and do not focus on local/regional disparities. They do not cover all the locally relevant aspects. Local impact assessment (LIA) is not used in the Czech Republic, but it covers the local/regional situation.

Extensive literature research and the lack of available data show the impossibility of completely quantifying the overall impacts of construction and operation of the RES at the local/regional level. Literature research (e.g., Del Rio et al., 2008) also shows that mostly macro-economic level has been chosen to evaluate the operational impacts of renewables.

Decision makers and mayors must make a number of various decisions which means a lot of unnecessary bureaucracy. Concerning renewables, mayors face the decision whether to support building of a new source or not, whether this kind of RES is suitable for the municipality and which impacts (positive or negative) are linked with the operational processes. The demand for a complex impact assessment tool/framework arises among the mayors.

The aim of the paper is to answer a research question "How to comprehensively assess the impact of RES construction (from economic, social and environmental point of view)?" As the currently used evaluation methods do not cover

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all the important aspects for mayor´s decision, the paper introduces a new framework (RegioIAF) for the assessment (Del Rio et al., 2008).

The following chapter deals with the current methods, which are often used to assess the impact. Moreover, it briefly introduces the most important groups of impacts. The third chapter presents the logic of the RegioIAF and impact categories. The further use of the method is described in the conclusion.

2 Methods

Many different impact assessment methods are used in practice (EIA, SEA, RIA, LIA, TIA, LCA etc.). Their purpose is to reveal the impacts and to help with decision-making. In many cases, their results are the basis for bargaining, choosing the right option or for regulatory settings.

Each method focuses on certain impacts. Building of RES generates a wide spectrum of impacts, which includes not only environmental, but also economic and social impacts. This range of impacts is closest to the EIA. However, EIA is based on a more detailed analysis of the planned construction, which is too demanding (time and cost) for the initial assessment of the RES construction project. In order to simplify the impact assessment, we developed a new framework, which is based on a combination of the current methods. Instead of a common cost-benefit analysis (CBA), the tool is based mostly on a qualitative assessment and multi-criterial analysis. The goal is to assess the complex impacts in a simple way.

Our new framework combines impacts of three methods into one:

1. Social and economic impacts from regulatory impact assessment (RIA) (regional GDP, employment etc.) (e.g., Caroll, 2010)
2. Environmental impacts from environmental impact assessment (EIA) (Land use, agriculture, air or water quality etc.) (e.g., Tsoutsos et al., 2005)
3. Local principle from local impact assessment (LIA), which is used for social, economic and environmental evaluation of the municipality.

This framework is called RegioIAF and combines economic, environmental and social impacts at the local or regional level. The tool introduces an overall guideline for the mayors and focuses on more than macro-economic level. The impacts are based on the extensive literature research, which provides a comprehensive view of the importance of each impact. These are divided into two categories. There are primary impacts, which include regional GDP, costs and revenues for the municipality associated with the RES, employment (e.g., Dvořák et al., 2017), impacts on agriculture (land use), forestry and water management and environmental impacts. The environmental impacts (e.g., Lohse, In Press) are evaluated separately, because there are a few topics, which can be influenced by the RES in a positive or negative way. These include CO_2 emissions, biodiversity, erosion, water quality and consumption, air quality, noise and impacts on health. The secondary impacts are separated because of an existing probability of being calculated twice. Those are impacts, which may or may not occur and their estimation is based on the soft data. Situation in individual municipalities may differ significantly. Secondary impacts are e. g., energy prices, energy savings from waste heat utilization (e.g., García et al., 2017), business environment, infrastructure and technical level, education and human capital, municipality development (e.g., Kazak et al., 2017).

3 Research results

Based on RIA, EIA and LIA, the assessment process is divided into several steps (Fig. 1). First of all, it is necessary to define the RES project. Within this starting point, the location of RES, its capacity etc. are described. The next step consists of identification of impacts using the list of primary and secondary impacts and the description of each impact, including its size. Using the criterion weight, the overall impact is set. It is also appropriate to take partial values into account.

Figure 1 RegioIAF step by step
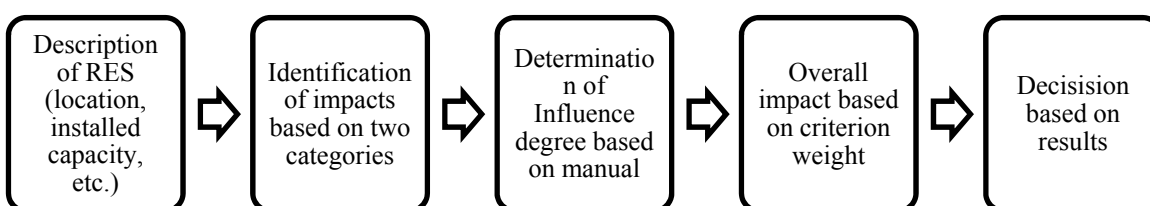
Source: own processing

This chapter consists of two tables, which together with the table of secondary impacts form the multi-criteria analysis of the regional impact assessment framework, which serves as a guideline for mayors of municipalities. The impacts are divided into two categories: primary impacts, which are the most important ones for the impact assessment and a high relevance of these impacts for the mayors can be expected and secondary impacts. The environmental impacts (as a part of the primary impacts) can be divided into several categories and each RES may influence just some of them. Therefore, a separate table for this type of impacts was designed.

3.1 Primary Impacts

The table 1 shows the multi-criteria analysis of primary impacts described in the previous chapter. The influence degree will be evaluated by the mayor himself and it will be based on the description of each impact and mayor´s awareness of the local/regional situation. The possible degrees are "positive", "negative" and "no impact" and the mayor will decide about the degree of significance.

Table 1 RegioIAF for primary impacts of RES

Regional Impact Type	Influence degree							Criterion weight	Overall impact
	NEGATIVE (-)			No	POSITIVE (+)				
	significant	middle	low		low	middle	significant		
	-3	-2	-1	0	+1	+2	+3		
Long-term employment									
Short-term employment									
Regional GDP									
Revenues for the municipality									
Costs for the municipality									
Agriculture/Forestry/Water									
Environment (summary)									
Overall impact								100 %	

Source: own processing

3.2 Environmental impacts

The next table (Table 2) describes the environmental impacts based on the literature research. Those are the most important impacts of different types of RES. Different kinds of the RES come with different impacts, e.g., photovoltaic energy will not affect water quality, but may influence biodiversity and land use. 1 MW of photovoltaic energy requires 7 acres of land, but no CO_2 emissions are associated with the energy generation (Workman et al., 2016). Overall, it is assumed that renewables bring more positive than negative impacts compared to fossil fuels. Positive externalities are expected in these cases, but for example small hydropower plants may affect the water quality in a negative way as well as threat the biodiversity in a river (Vezmar et al., 2014).

Table 2 RegioIAF for environmental impacts of RES

Regional Impact Type	Influence degree							Criterion weight	Overall impact
	NEGATIVE (-)			No	POSITIVE (+)				
	significant	middle	low		low	middle	significant		
	-3	-2	-1	0	+1	+2	+3		
Erosion									
Biodiversity									
Water quality and consumption									
Air quality									
CO_2 emission									
Noise									
Health									
Overall impact								100 %	

Source: Own processing

3.3 Secondary impacts of RES

Included secondary impacts are: (i) Energy prices and potential of waste heat utilization; (ii) Business environment; (iii) Infrastructure level; (iv) Municipality development; (v) Education and Human capital. It is not mandatory to take them into account. These data should be included very carefully, because there is a probability of counting some impacts multiple times as was described above. More secondary impacts could arise, these are the most important ones.

4 Conclusions

The paper focuses on the methods of assessing the impacts of RES construction and operation. With the EU directive requirements comes an increasing demand for the RES development. Mayors of the municipalities face the decision whether to support it or not. There are regulatory impact assessment and environmental impact assessment currently used in the Czech Republic. RIA is mostly based on the macro-economic level. EIA is not appropriate for the initial decision making due to high costs and time intensity. RegioIAF (as the output of the paper and the overall guideline for mayors) is based on social and economic impacts from RIA, environmental impact from EIA and the local/regional point of view from LIA. Regional Impact Assessment Framework together with multi-criteria analysis tables of primary, environmental and secondary impacts provides a tool for a complex evaluation as an argument for the municipality mayor.

The method is also applicable from the perspective of investors to promote the project and gain the support from the decision makers. The method can also be generalized and used to evaluate any other project.

However, the ambition of this approach is not to replace the EIA process, but only to develop a framework of assessing the impacts in the initial phase. It aims to help the decision makers to conclude, whether it is in the municipality's interest to start a construction. The EIA's task is to assess the environmental impacts in more detail and, if necessary, identify more favorable solutions.

Acknowledgement

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Session 2

Microeconomic and Macroeconomic Aspects of Social and Economic Development.

Economic Aspects of the Amortization of Human Capital in the Public Sector

Jaroslav Šetek, Jiří Alina

Abstract*: In the Czech Republic, for military service, the maximum age for leaving the retirement age is 65 years, in civil employment conditions up to 70 years. At the same time, the intention is to extend the retirement age (65-67 years after 2035). The age limit at the age of 65 is unacceptable for some professions of military service due to a faster amortization of human capital. Therefore, economically efficient social security systems should be put in place to terminate the military service of certain system functions.*

1 Introduction

In the Czech Republic, it employs less than 200 thousand people, of which approximately 120 thousand are in military service (military, security corps).

The entry into force of the Civil Service Act as of January 1, 2015 means in the Czech Republic the extension from two to three forms of regulation of employment relations and the labor market:

1. According to the Labor Code - Act No. 262/2006; falling within the sphere of private law.
2. Under the legislation on the service of members of the armed forces (Act No. 221/1999 on soldiers) and security corps (Act No. 361/2003 on the service of members of the security forces); falling within the area of public law; we can talk about military service, because in the army, police and other state security units these are militarily organized churches.
3. Under the Civil Service Act (No. 234/2014); falling within the area of public law; we can talk about the civil service.

Each of the above-mentioned legislative standards respects in some way the amortization of human capital. The most is the military service standards. However, this is not always the case for economic efficiency for the state. At the same time, it is clear that the mission of some professions would require the introduction of military service in terms of efficiency for the state, but also from the ethical aspects, while respecting the higher amortization of human capital. Typical professions are health rescuers.

2 Methods

The article is elaborated by the interdisciplinary approach of social sciences (especially economics, financial theory, law, sociology and political science.) The application of analytical, comparative, historical and analogous methods of thought processing prevails. of the law in military service in the public sector on the example of the Czech Republic.The analysis of the concept is given by the current ever increasing demand for these services (in particular army and police) of the public sector and its economic constraints.

2.1 The initial philosophy of the problem

In connection with the concept of human capital, the development of human capital is increasingly being discussed, investments in human capital in relation to the performance or competitiveness of the company. (Hlaváček 1999)

Human capital, understood as a distinct human resource facility (according to the biological and psychological typology of personality, health status, education, qualifications), is able to provide income from employment relationships through wages and salaries in productive age, or through postproductive labor transfers - senior age. (Becker 1997) As with the material capital, it is also about the amortization of human capital, that is the loss of the value of man's creative ability. The forms of this amortization are also physical and moral. Physical are accompanied by natural (aging ...) and

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pathological (illness, disability ...) social events. While moral are the manifestation of the inability of certain social groups to adapt to the tendencies of innovation stemming from scientific and technological development. (Becker 1971)

Apparently, the amortization of human capital is expressed as the depreciation rate, which gives rise to a pension entitlement at a certain level (aspect of employment time in a particular field, permanent loss of working capacity). The rate of wear and tear of human capital accelerates in particular in military service. This is mainly due to the "negative" features of service in the state's armed forces in a democratic political system, and hence a faster depreciation of their human capital. This is manifested in the areas of fundamental human rights and freedoms, political rights, social-labor, criminal law as well as increased stressors with increased risk of life threats and higher susceptibility to burnout syndrome. Some occupations in the army and security forces are termed extreme. (Šetek 2005)

2.2 Foreign experience of the European Union and NATO with amortization human capital in military service

Members of the armed forces and security forces are in all EU Member States and NATO are considered a special category of civil servants. Therefore, some specific rules within the social security system apply to these population groups. This system declares higher standards than the "civil sector" - that is, the employment relationship on the basis of the employment relationship. The social security system of members of the armed forces is fully within the competence of the political representation of each state. NATO Headquarters do not prescribe any binding standards for their members and future prospective candidates in how to implement the leniency system.

The service relationship in the armed forces and the security forces represents in this area a contractual relationship between the state and the individual. Exercise requirements thus guarantee soldiers and members of the security forces certain social security for the duration of the service, taking into account the interests of the needs for ensuring the state's defense and security. At the same time, the service relationship is linked to a number of constraints and obligations that do not exist in the civil sector. (Stiglitz 1997)

3 Research results

3.1 Retirement benefits - Recognition of amortization of human capital

What, in essence, is the probationary element of a professional 'disability' pension. Compensate for a decrease in earnings as a result of the amortization of human capital as a temporary or permanent decline in post-employment status. In terms of the Czech Republic, however, they have become the main competitive tool between the service in the armed forces and the security forces. From the point of view of employment policy, they have ceased to implement its regulatory instrument. (Šetek 2010)

The retirement benefit represents a repayable financial benefit, which is paid monthly to the beneficiaries from the budgets of the Ministry of Defense, Interior and Justice after termination of service for a minimum of 15 years. From the point of view of economic and social aspects, the Institute of Contributions performs several functions - regulatory (especially in the field of employment policy), compensatory, social, etc. In essence, it is a professional "disability" pension, as it replaces the amortization of human capital by a decrease in earnings due to temporary or permanent reduction in post-employment status. In addition, on the basis of sociological research carried out in the Czech Republic and abroad, it is shown that in terms of service, members generally wear out more quickly (as a result of physical stress and stressors) compared to conditions of employment. For this reason, the contribution should motivate members to voluntarily leave the service at the time of reaching the age, which may be considered as a limit for staying in service. Especially when extending the retirement age, it would be unethical if, for example, a member after 30 years of service (roughly 50-55 years old) was dismissed without adequate financial compensation for inadequate health, physical and other performance requirements. (Šetek 2006)

In all NATO countries and the European Union, a system of leniency requirements for members of state armed forces is declared for a fixed period of service. At the same time, it is legislatively protected that starting a civilian career as a result of the amortization of human capital during service did not mean the social decline of the retired. In terms of length of service, the amount of the contribution is significant. If it is too low, the retirement benefit loses the regulatory function, and the provision of the service contribution may seem unnecessary. If it is set too high, members are motivated to leave before they reach a reasonable age, thereby infringing the principle of a professional 'disability' pension. (Šefčík 1998)

The 15 years of service for the contribution are currently the same for members of the army and security forces. The percentage of the average monthly gross salary in favor of members of the security forces (for example, 15 years of service in the military 5%, while in security forces 20%) is fundamentally different. Based on a comparison of leaching requirements under the aforementioned laws, inadequacy can be noted for members of the security forces. This is a consequence of the incorrect setting of this time, already in the previous legislative regulation (Act No. 186/1992 on

the employment relationship of members of the Police of the Czech Republic), which only required 10 years of service for the award of the requisition. (Šefčík 1999)

3.2 The need for respect for the amortization of human capital in staffing within the system

As a result of inconsistent service legislation and inefficient personnel policies, there are a number of system functions in military and security services. Without the smallest analysis of a systemized location, therefore, a function of military service is provided, the purpose of which is not required, which results in insufficient admission to the amortization of human capital. As a result, there is an enormous financial burden on the staffing mandate of the relevant ministries (Defense of the Interior and Justice) (Tomek a kol. 2003)

For the above reasons, in addition to reforming the service, a fundamental change in personnel development is necessary. This would consist in reducing some of the systemic functions in the military service and in their subsequent transformation into civil service or employment. Army and security forces will primarily be system seats that can be personally secured by civil service and employment, particularly in logistics, economic and financial security, personnel, technical support, public relations, etc. (Wawrosz & Valencik 2014)

3.3 Area tax liability towards leniency requirements - non-transparency in the amortization of the human capital of the retired

According to financial legislation, not only income from gainful employment but also other income of individuals are taxed in the Czech Republic. According to Act No. 586/1992 Coll. The income tax stipulates that "taxpayers who have their domicile or habitual residence in the Czech Republic have a tax liability which applies both to income originating from sources in the territory of the Czech Republic and to income from sources abroad". From this statutory duty, the Act provides for some exceptions, since some income is exempt from tax (Section 4 of the Income Tax Act). We can not deny the state's ability to determine, according to the budget situation, what revenue will be exempt from tax. This would be fully justified when taxing retirement benefits after 1 January 2011. (Seek, 2011)

The flat tax on contributions of 15% from 1 January 2011 to 31 December 2016, granted before and after that date, appeared to be very chaotic. This was also one of the reasons why the tax burden on retirement benefits was lifted with effect from 1 January 2017. It is assumed that, for the regulation of employment and the recognition of "working" disability, it would be effective to introduce a tax burden on the supplementary pension insurance if its amount with the sum of other income exceeded the relevant amount. For example, it could be based on a multiple of the minimum wage, the amount of which is set by law on the basis of the performance of the economy. (Šetek 2011) This would respect the amortization of human capital in service. (Say 2003)

3.4 Retirement from preferential retirement categories - legal equalityin the amortization of human capital

In 2000, the European Union clearly retreated from the priority categories of pensions. This was done in the Czech Republic in 1992. At that time, Act No 235/1992 on the abolition of working categories and some other changes in the social security and divided into three working categories. Employees included in I and II. working categories were referred to as "preferred categories". (Šetek 2010)

The nature of the preference consisted of the different methods of calculating occupational retirement provision in the first category of work also when determining the lower age for entitlement to a retirement pension (special retirement age) compared to the general age limit. Military and security components were assigned I. or II. working category. This meant respecting the principles of "disability" as a result of a faster fall in human capital and early retirement. After the abolition of the working categories, legislation on services for the military and security forces was changed several times. Changes included the provision of funds that are now provided to members of the Army under Act No. 221/1999 Coll. On soldiers and Act No. 361/2003 Coll., On the employment relationship of members of security forces. Despite all reforms of service legislation, the escape system appears to be economically ineffective for the state. This is evidenced by the analysis below.

Act No. 221/1999 Coll. Soldiers, to a certain extent, are working on canceled working categories by increasing fixed-term contributions to certain system functions, such as aircraft and special services or special qualifications, or foreign operations under the aegis of NATO, the United Nations, the Organization for Security and Cooperation in Europe). The special nature or special degree of danger is estimated 1.5 times when calculating the leniency contribution, twice in foreign operations. The maximum allowance for benefits may be up to 60% of the average gross monthly wage for these selected service categories. (Tomek a kol. 2003)

Under Act No. 361/2003 Coll. it is not possible to increase the timing of the service for members of the security forces, so it is possible to point out some discrimination especially for the service in the Czech Police and the Fire Brigade.

In this service, there are categories similar to those in the army (eg Special Forces, Foreign Missions, Pyrotechnics, etc.). (Šetek 2010)

3.5 The need to extend military service to the medical rescue service

In accordance with the Act No. 239/2000 on the Integrated Rescue System, the Health Rescue Service is one of the three basic elements of the Integrated Rescue System in the Czech Republic, including among others the Fire Rescue Corps of the Czech Republic and the Police of the Czech Republic. Unlike these two state-run security services and the armed forces, it operates regionally. This is also apparently one of the main reasons why the Medical Emergency Service personnel in the exercise with the character of an extreme profession (such as police officers, fire brigades, soldiers) does not have a service relationship. (Šetek 2011)

For these professions, since 2011, he has been interested in granting the Minimum Life Exemptions for Medical Emergency Service to a minimum of 15 years after reaching the age of 50 years. This can be seen in the combination of the employment relationship with the Medical Emergency Service with the leniency of the service. In its essence it seems rather complicated and inefficient for the state. Efficiencies can be achieved by transferring the selected medical rescue service to military service. At the same time, it is necessary to reform the existing social security system for the award of leniency after 20 years of service to one Act on Service for Armed Forces, Security Corps and Medical Emergency Services. This would subsequently result in strengthening the effective operation of the integrated rescue system, defense and state security. For the state service, the Armed Forces, Security Corps and Medical Emergency Services would not compete in the labor market. There could be a seamless transition of appropriate professions and the transfer of experience between service components. A typical example is the possibility of employing medical rescue service professionals in military foreign missions (under the patronage of NATO, the United Nations and the Organization for Security and Cooperation in Europe) and vice versa. (Tomek a kol 2003)

In the context of economic efficiency and savings in public spending, a proper staffing policy would be necessary to transfer certain occupations of the Medical Emergency Service into a service relationship, which would strictly define the interests of the system in the employment relationship (executive rescuers) and the employment relationship (economic and financial security, logistics, human resources, technical security, etc.).

4 Conclusions

The system for securing retired persons is part of the legislation on service, based on two standards - Act No. 221/1999 on soldiers and Act No. 361/2003 on the service of members of the security forces. The current version of these laws directs competition between service conditions, which is considerably economically inefficient for the state.

For the above reasons, the system of social security for emoluments according to one law appears to be ideal. This does not have to be part of a single employment law. It would be sufficient in the aforementioned laws for the armed forces and the security forces to omit the social security areas after termination of service. Create a separate legislative standard for this area - such as the "Social Security Act for Elderly Employees".This law should also respect the amortization of human capital for systematized military service positions.

Then, the overall amortization of human capital from this ratio should be based on the following formula:

$$Amortization\ of\ human\ capital\ =\ basic\ amortization\ +\ preferred\ amortization \tag{1}$$

Where:
Basic amortization is.total length of service
Preferred Amortization is Multiple Service Times in Selected Extreme Positions

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Sectoral Variety in Innovations

Tomáš Volek, Martina Novotná, Martina Kaňková

Abstract: *Innovations is the driver for growth of long-term business competitiveness. The paper was focused on identify the main differences in innovation activities in sectors of the Czech Republic. It was found that the innovation activity in Czech Republic is below the EU average. The number of innovating enterprises has been decreasing over the years. The most innovative sector is manufacturing (automotive, petrochemical, pharmaceutical industry). In the service sector, the most innovation activity have sectors of information and communication technologies and banking sector. In the future, we can expect increase of innovations activity due to the growing economy, the state's innovation policy or the integration ideas Industry 4.0. (robotization and digitization).*

Key words: Sector · Innovation · Manufacturing · Czech Republic

JEL Classification: O31 · O11 · O33

1 Introduction

The product and service market is constantly changing and customer needs are changing at the same time. If companies want to maintain their competitiveness on the global market, it is necessary to continually adapt. Innovation is today driver of growth of long-term sectors competitiveness. The aim of this article is to identify the main sectoral differences in innovations.

OECD define innovation as implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations. The minimum requirement for an innovation is that the product, process, marketing method or organizational method must be new (or significantly improved) to the firm (Oslo Manual, 2005).

Innovation can be divided into technical innovation and non-technical innovation. Innovation can also be divided by intensity of change into incremental and radical innovation. Radical innovations are fundamental changes that represent revolutionary changes in technology. Incremental innovations are minor improvements or simple adjustments in current technology. The major difference captured by the labels radical and incremental is the degree of novel technological process content embodied in the innovation and hence, the degree of new knowledge embedded in the innovation (Dewar, & Dutton, 1986).

What are the main factors that affect innovation activity? Factors can be divided into internal factors and external factors. The present review identifies about 27 internal determinants, with the variables categorised into five groups namely, firms' general characteristics, functional assets, firms' culture, organisational strategies, and firms' structure. The external determinants can be sub-categorised into supply, demand and business environment-related factors. The supply factors include tracking down the technological information from competitors (Kolluru & Mukhopadhaya, 2017). Another significant factor is the size of the enterprise whether it is a large, small or medium enterprise (Forsman 2011, Vrchota & Řehoř 2017, Mura & Buleca 2012). Aboal and Garda (2016) reached the similar conclusion. These authors found that the main determinants of technological and non-technological innovations are the level of investment in innovation activities and the size of the firm. An important factor influencing innovation and absorption capacity of innovation is the sector (Ettlie & Rosenthal, 2011) or even branches of sectors (Keupp & Gassmann, 2013). An important role has a region (Hajek, Henriques, & Hajkova, 2014, Dušek, 2013), in which sector operates and human capital (Šetek, & Petrách, 2016).

2 Methods

The paper is focused on identify major differences in the use of innovation in the sectors. The analysis concentrate on innovations in sectors of Czech Republic (NACE-CZ). The first part of analysis deals with total innovation activity of enterprises in the Czech Republic and EU countries. The following part deals with innovation activities in individual

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sectors. The data source was Eurostat (National accounts), Czech Statistical Office, and analysis of investment activities of companies in the Czech Republic. The observed data were from the period (2012-2014). The article uses division into technical and non-technical innovations. Technical innovations contain product innovations and process innovations. Product innovations involve significant changes in the capabilities of goods or services. Process innovations represent significant changes in production and delivery methods. Non-technical innovations can be divided into marketing and organizational innovations. Organisational innovations refer to the implementation of new organisational methods - new communication mix. Marketing innovations involve the implementation of new marketing methods. These can include changes in product design and packaging.

3 Research results

3.1 Innovation and the Czech Republic

In the Czech Republic, 42% of companies innovated their products, processes, marketing or organizational methods in the period 2012-2014. The total innovation activity of enterprises in the Czech Republic declines over time. This situation is described in the following table 1. The number of innovating enterprises has fallen from 56% (2006) to 42% (2014). In terms of the type of innovation, only the share of enterprises with product innovation increased. On the contrary, the number of enterprises with organizational innovation declined sizeable. In terms of size, the large companies innovate the most (more than 77% of enterprises). On the other hand, small businesses (35%) are the least innovating. The largest decline in the number of innovating enterprises was recorded in small enterprises in followed period. Technical innovation prevails in all groups of enterprises..

Table 1 Basic indicators of innovation activities of enterprises in the Czech Republic

	2006–2008		2008–2010		2010–2012		2012–2014	
	number	%	number	%	number	%	number	%
Innovative enterprises total	**13 196**	**56.0%**	**10 623**	**51.7%**	**9 765**	**43.9%**	**9 063**	**42.0%**
Enterprises with technical innovation	**9 256**	**39.3%**	**7 145**	**34.8%**	**7 919**	**35.6%**	**7 686**	**35.7%**
Enterprises with product innovation only	1 366	5.8%	1 944	9.5%	1 963	8.8%	2 257	10.5%
Enterprises with process innovation only	2 851	12.1%	1 688	8.2%	1 670	7.5%	1 671	7.7%
Enterprises with product and process innovation	4 398	18.7%	3 016	14.7%	3 664	16.5%	3 153	14.6%
Enterprises with non-technical innovation	**11 085**	**47.0%**	**8 720**	**42.4%**	**7 039**	**31.6%**	**5 878**	**27.3%**
Enterprises with marketing innovation	3 076	13.1%	2 366	11.5%	2 484	11.2%	2 185	10.1%
Enterprises with organizational innovation only	2 686	11.4%	2 629	12.8%	2 053	9.2%	1 460	6.8%
Enterprises with marketing and organizational innovation	5 323	22.6%	3 726	18.1%	2 502	11.2%	2 234	10.4%

Source: Own calculations based on the data Czech statistical office

In the international comparison, enterprises in Germany and Belgium are the most innovate companies, see table 2. On the contrary, the smallest share of innovating firms are mostly newly acceding EU countries. The Czech Republic is well below the EU27 average (49.1%). This negative situation in the new EU member states is due to the large concentration of innovation in large enterprises. In the new Member States, they primarily invest in large companies that generate a significant share of the total revenue of the sector. On the other hand, small businesses in the new EU Member States innovate below the average of the old EU members.

Table 2 Innovation activity in EU countries

Country	Share of enterprises in the population in 2014	Country	Share of enterprises in the population in 2014
Germany	67.0	European Union (28 countries)	49.1
Luxembourg	65.1	Lithuania	43.3
Belgium	64.2	Czech Republic	42.0
Ireland	61.0	Croatia	39.7
United Kingdom	60.2	Spain	36.4
Austria	59.5	Slovakia	31.8
France	56.4	Estonia	26.5
Netherlands	55.3	Hungary	25.6
Finland	55.3	Latvia	25.5
Sweden	54.2	Poland	21.0
Portugal	54.0	Romania	12.8
Greece	51.0	Italy	48.7
Denmark	49.5	Slovenia	45.9

Source: Own calculations based on the data EUROSTAT

3.2 Innovation in sectors

Innovative business activity is different in sectors. The manufacturing has the highest innovation activity about 47% (Figure 1). On the contrary, agriculture has the lowest innovation activity. In manufacturing, the most innovative activity have production of other transport machine, petrochemical and pharmaceutical industry. In the service sector, the most important innovation activity have information and communication technologies sector and banking with insurance. The innovation activity in the Czech Republic is lower than EU average. Technical innovations have the greatest importance in the sectors.

Figure 1 Innovations in sectors of the Czech Republic
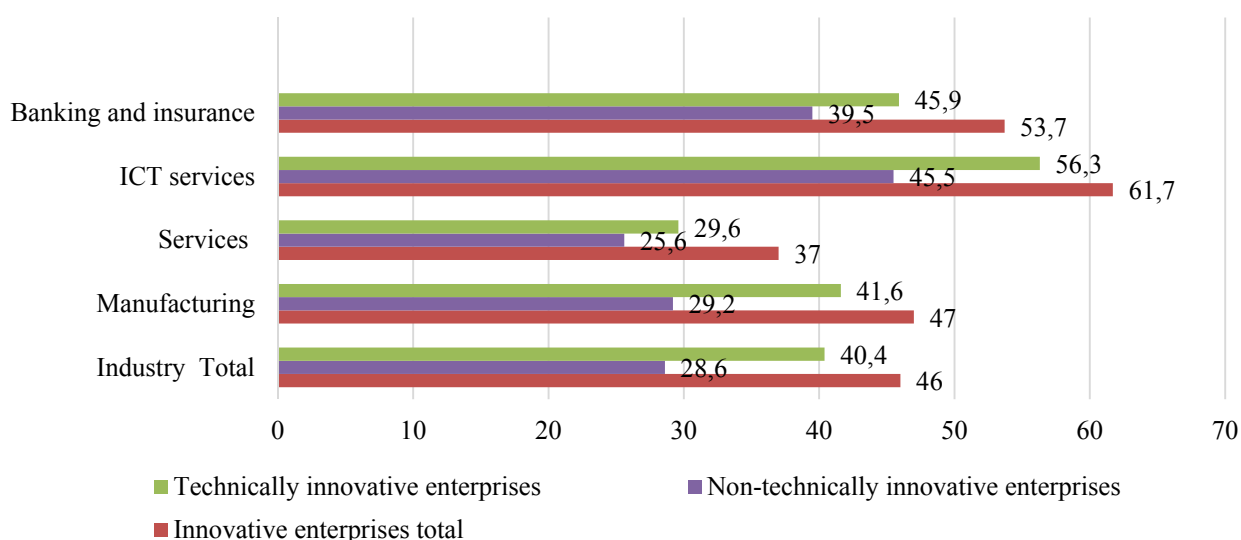
Source: Own calculations based on the data EUROSTAT

The following Table 3 shows us the international comparison of innovation activities in industry (EU states). The most innovate manufacturing firms are in Germany, Belgium and Italy. On the contrary, the least innovate firms are mostly in the new EU member states. The share of expenditure on innovation from total expenditure varies from country to country to the structure of individual economies. The largest share have countries with a high share manufacturing on GDP, such as the Czech Republic, Germany or Slovakia. On the other hand in countries with a lower industrial importance (Greece, Great Britain), the share of innovation expenditure to industry does not exceed 50%.

Table 3 Innovation activity in Manufacturing of EU countries

	Innovation activity in manufacturing (%)	Share of expenditure to innovation of manufacturing from total	Share of GDP (%)
Germany	72.6	77.4	22.9
Belgium	70.5	62.3	14.1
Italy	68	67.6	15.5
Austria	64.1	59.3	18.6
United Kingdom	64.1	28.6	10.2
Finland	60.5	70	16.9
France	59.8	50.5	11.3
Poland	59.1	46.6	18.9
Sweden	57	73.3	16.5
Greece	55.1	43.1	9.5
Romania	53.5	51.4	23.7
Latvia	50.8	40.1	12.3
Denmark	48	57.4	13.6
Czech Republic	47	74	26.8
Netherlands	43.7	58.4	11.4
Spain	39.3	50	13.7
Slovenia	32.9	70.3	22.9
Lithuania	28.9	32.2	19.2
Estonia	26.9	25	16.2
Hungary	25.7	68.8	23.1
Portugal	22.3	52.4	13.5
Slovakia	13.1	70.5	21.7

Source: Own calculations based on the data EUROSTAT

What is the assumption of innovation activities of Czech enterprises in the future? In the future, we can expect small increase of innovations activity. This assumption is based on three main factors that can increase innovation activity in enterprises. The first of these factors is the high growth of the Czech economy, which allows companies to invest in innovative activities. The second factor is the state's innovation policy orientated to supporting research and development in the form of tax relief or in the form of subsidies EU funds. The third factor is the fourth industrial revolution, ie. Industry 4.0, the growth of robotization and digitization (Gerlitz, 2016), not only in industry, but also in services (Services 4.0) and agriculture (Farming 4.0).

4 Conclusions

Enterprises competitiveness is determined in a present globalized world by many external and internal factors. Innovation is today the driving force to growth of long-term business competitiveness. The paper was focused on identifying the main differences in the use of innovations in various industries in the Czech Republic. The number of innovating enterprises has been decreasing over the years. The most innovative industry is manufacturing of other transport vehicles, petrochemical and pharmaceutical industry. In the area of services, Information and Communication Technologies and innovations are the most innovative. The innovation activity in Czech Republic is below the EU average. In the future, we can expect small increase of innovations activity due to the growing economy, the state's innovation policy or the integration ideas Industry 4.0. (robotization and digitization).

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Session 3

Economics of Agriculture.

Agri-Food Competitive Export Performance in EU Countries

Dominika Čeryová, Eva Ďurišová, Natália Turčeková, Izabela Adamičková, Miriam Bartošová

Abstract: *Export competitive performance is a main issue in the trade between European Union countries, which is based on agri-food market. Agriculture and food industry sector has been influenced by two main occurances in the past fifteen years. First of all by European Union expansion in 2004 by Central and Eastern European countries, which opened many possibilities for new twelve member states and strengthened its competition among old and new countries. The second affect was recorded by economic crisis in 2008.*

The main objective of this paper is to analyse export competitive performance in agricultural sector and food industry of selected European Union countries. Our analysis is concentrated from 2010 to 2015 with respect of European Union consists of 28 member states. In our paper, we have chosen two indicators: Balassa RCA index (Revealed Comparative Advantage) for a calculation of an advantage or a disadvantage of selected countries in a selected types of goods or services and EMS index (Export Market Share) describes the export performance in European Union area based on its member states. Our data came from Eurostat database of international trade which have been necessary to analyse RCA and EMS indexes.

Key words: Competition · Agriculture · Food industry · European Union · RCA index · EMS index

JEL Classification: Q18 · C19

1 Introduction

Export competitive performance is a main issue in the intra European Union trade based on agri-food market. Agriculture and food industry sector has been influenced by two main occasions in the past fifteen years. First of all by EU expansion in 2004 by Central and Eastern European countries and the second affect was recorded by economic crisis, which occurred in 2008. Firstly, the changes have been performed in the export competitive performance by creating risks and profits between old and new member states. The expansion in 2004 opened many possibilities for new twelve member states and subsequently strengthened its competition among old and new countries. Moreover, reduction in tariffs led to changes in agriculture and increased their competitiveness. Secondly, the economic crisis, which occurred in 2008, is still affecting economy in EU. There´s a fact that agriculture and food industry sectors are interested in other issues like globalization, transportation costs, mainly changes in consumer behaviour. These issues might be available for competitors to find out how to differentiate their products or services. It is really necessary to study the situation in EU agri-food market, as each member states compete together and how they can handle some opportunities and threats.

1.1 Exporting

Export might have a direct effect on productivity and the benefits will be stronger for export. First of all competitiveness upon exporting firms are likely to be serious in markets. They already have a significant number of local suppliers and may attract a quantity of suppliers who came from abroad. However, consumers can make greater demands on exporter regarding the quality of products. The second one are the opportunities to educate from offshore contacts which is going to be more useful. And the last one benefit is that firms shall be able to put on imperfect market higher prices to consumers in wealthy countries (Atkeson and Burstein, 2010). Most countries operate an export promotion agency to help domestic firms succeed in export markets. These programs help firms to lower variable or fixed costs of trading, e.g. by assisting firms to find a distributor, navigate foreign customs and product regulations, or adapt products to foreign tastes. Many papers have evaluated the effectiveness of these programs and have consistently shown that they

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boost both aggregate and firm-level exports in particular by helping existing exporters enter new product or destination markets. They also help firms survive on export markets, for example during a cyclical downturn. (Broocks and Van Biesebroeck, 2017).

1.2 European Union

As we know second largest exporter and the largest importer of agriculture products is EU. In each country are as consumption, trade or even their production in the case of agriculture, they are influenced due to their policies and also government programs. It has brought a turnover with a position in trading of agriculture production which subsequently over last years has led EU to the position of second largest exporter in the world in the case of agriculture products. In that time when prices were higher, the export of some products of EU has also increased. Thus CAP was trying to isolate the part of agriculture of European Union based on the findings of market forces. Thank to this, it grants an exemption to both consumers and producers in EU and consequently increase the regulation on countries which have an open agrarian market. The treaty of Rome provided for a common agricultural policy would: guarantee food suppliers at stable and reasonable prices, ensure a fair standard of living for farmers and improve agricultural productivity through technical progress and develop more rational production system that would employ resources more efficiently. Change in size is a remarkable feature of the EU. First of all in 1995 were included only 15 countries (EU15, accession of Sweden, Austria and Finland). In 2004 have joined 10 member states in May 2004 (EU10) and another two in 2007(accession of Romania and Bulgaria). Finally it has brought the total number of 28 member states of EU in 2013 (OECD, 2011).

The support of the EU for the rules-based multilateral trading system is crucial to the ability of the system to deliver the benefits from trade to all its members. The EU´s position as the world´s leading exporter of goods and the second-largest importer is testimony both to the importance of trade to the European consumer and producer, and to the significance of the EU as a market for most WTO members (Lajdová, 2010). The European Union is the largest exporter and importer in both merchandise and commercial services trade in the world. The EU accounts for 25.8% of the world gross domestic product, and its share in the world exports of goods and commercial services is 16% and 22% respectively (European Commission, 2012). But this leading position of the EU is not steady.

The globalization of the world economy and trade liberalization brings a growing interdependence of countries and regions and also more trade. But the movement of production from developed countries to developing countries is also accompanied by the transfer of know-how and technologies to these countries. Moreover, developing countries are usually able to offer better production conditions, especially cheaper labour force and easier regulations in the area of labour standards and the protection of the environment, than developed countries. The result of this development is that more countries are incorporated into world trade and this contributes to the growth of competition in the world market (Fojtikova, 2014). The Treaty of Rome authors gave competition policy – with its embedding in the Community's constitution – a privileged position in the founding of the European Community. Since the European Union was first conceived as an economic area, competition policy represented a fundamental policy pillar ensuring a well-functioning common market that would be undistorted by the domestic arrangements of Member States. Taking such a leadership role implies that European Commission actions not only have the immediate goal of ameliorating anti-competitive merger proposals, but also involve the additional goal of setting a benchmark to achieve desired levels of EU-wide merger control (Barros, Clougherty and Seldeslachts, 2013).

The international flows had developed during the last decades. The high developed countries are important exporters and producers, often net producers. In the some time, other countries belonging to the emrgent economies have become important exporters of agri – food products. Importers prefer to buy from the markets where products have the best price for the target market, while exporters choose the market with most advantageous product price. I tis more important for local agri – food products to be competitive on the EU market and to assess the potential gains of the increased demand (Liliana Cimpoies, 2016).

EU consumers in the 21st century are particularly concerned about the safety and quality of food. The EU food safety policies aim to protect consumer health through a farm-to-fork safety approach, imposing traceability requirements throughout EU food chains - while taking into account international agreements, such as the Sanitary and Phytosanitary and Technical Barriers to Trade agreements under the WTO (Jean-Christophe Bureaua , Johan Swinnen, 2017).

Firms will produce innovations when they have the ability to commercialize, to sell a product or service at a profit. The profitability of an innovation depends on the degree to which firms are able to capture the rents generated by their innovations. These factors are also related to market structure. Especially with respect to firm integration and alliances the individual firm's concern about appropriation will vary depending on the industry in which the alliance occurs and the degree to which the appropriability regime in the industry is tight or loose (Kostas Karantininis, Johannes Sauer, William Hartley Furtan, 2009).

2 Methods

The main objective of this paper is to analyse export competitive performance in agricultural sector and food industry of selected European Union countries. Our analysis is concentrated from 2010 to 2015 with respect of European Union consists of 28 member states. In this paper we use data taken from Eurostat Database of international trade. These data are consisted from two-digits codes from 01 to 24 (except of animal feeding, tobacco, fisheries and agricultural non-foodstuffs) and they are summarized into two sectors: agriculture and food industry, which are explained in the Table 1.

Table 1 Division of goods into two sectors: agriculture and food industry following by Eurostat

Agriculture	Food Industry
01- Live animals	02-Meat and edible meat offal
07-Edible vegetables and certain roots and tubers	04-Dairy products
08-Edible fruits and nuts; peel of citrus fruits or melons	09-Coffee, tea, mate, spices
10-Cereals	11-Products of milling industry, malt, starches
12-Oil seeds and oleaginous	15-Animal or vegetable fats and oils
	16-Preparations of meats, fish
	17-Sugar and sugar confectionery
	18-Cocoa and cocoa preparations
	19-Preparations of cereals, flour, starch of milk
	21-Miscellaneous edible preparation
	22-Beverages, spirits and vinegar

Source: Eurostat Database of international trade

In our paper, we have chosen two indicators:

- Balassa Revealed Comparative Advantage Index (RCA)
  The RCA is an index by which we could calculate an advantage or a disadvantage of certain country in certain type of goods or services. In our case we use only standard Balassa RCA index to calculate each member state of European Union in two sectors, both in agriculture and food industry. To calculate we have chosen the following equation:

$$RCAij = \frac{\left[\left(Xij / \sum_{j=1}^{n} Xij\right)\right]}{\left[\left(\sum_{i=1}^{m} Xij / \sum_{i=1}^{m} \sum_{j=1}^{n} Xij\right)\right]}$$

(1)

where:

X_{ij} exports of sector i from country j

n the number of countries analysed

m total number of sectors

- Export Market Share Index (EMS)
  The EMS index describes the export performance in European Union area based on its member states. Due to this index we have considered which country has the highest share on European Union market. EMS index could be calculated by the following equation:

$$EMS = \frac{\text{export of one sector (agriculture or food industry)}}{\text{total export of all sectors of all European Union countries}}$$

(2)

3 Research results

3.3 The Revealed Comparative Advantage

The RCA in agriculture sector and food industry sector of big countries includes seven countries. Based on the calculations of Eurostat Database and unifications of value we make a table (Table 2) of big countries for 2010-2015 period of time.

Table 2 RCA of big countries in agriculture and food industry sectors

agriculture sector		food industry sector	
	2010-2015		**2010-2015**
Spain	187.038	Luxembourg	118.222
France	114.704	Germany	117.210
Netherland	119.061	Belgium	103.017
Belgium	91.505	Italy	102.935
Italy	91.453	France	94.694
Germany	51.758	Netherland	93.192
Luxembourg	48.603	Spain	68.923

Source: Own processing based on Eurostat Database of International Trade

The result in RCA agriculture sector of big countries we may conclude, that Spain still holds its position (from 2000 is leader in RCA agriculture sector) and it achieves the highest value among all the big countries analysed. Netherland have taken over the position from France in the years 2010 – 2015 and became the second largest export leader in agriculture sector due to increasing they´re export. On the other hand, the result in RCA food industry sector of big countries show, that Spain has the lowest value. In the analysed period 2010-2015 the leader in food industry sector was belonged to Luxembourg and also closely to Germany.In this paper we also calculate the RCA index for small countries. Small countries include eight member of European Union. The results in years 2010-2015 are shown in the table (Table 3).

Table 3 RCA of small countries in agriculture and food industry sectors

agriculture sector		food industry sector	
	2010-2015		**2010-2015**
Greece	152.690	Ireland	124.568
Portugal	108.265	UK	116.778
Denmark	68.273	Sweden	114.302
Finland	64.425	Austria	113.029
Austria	63.396	Finland	112.396
Sweden	59.751	Denmark	111.229
UK	52.554	Portugal	96.931
Ireland	31.119	Greece	80.902

Source: Own processing based on Eurostat Database of International Trade

Based on the results shown in the table we can conclude that only Greece as a country is the most competitive in agriculture sector. While Portugal started to export much more in the analysed period and it might be in the next year close to Greece. Despite of those biggest agriculture exporters, the other countries are almost equal and are competitive with respect to each other. Ireland is the country with the lowest value of RCA index in agriculture sector. The results in RCA food industry sector of small countries based on calculations is clear, that small countries of European Union are more progressive and they are more competitive to each other. If we compare them with big countries, they are countries with higher export competitive performance.

The RCA in both analysed sectors of Central and Eastern Europe´s countries include thirteen countries. Till the year 2012 was composed from twelve member states of European Union, but after the year 2013 have joined Croatia as the last member state of European Union.

Table 4 RCA of Central and Eastern Europe´s countries in agriculture and food industry sectors

agriculture sector		food industry sector	
	2010-2015		**2010-2015**
Romania	227.680	Malta	110.356
Bulgaria	218.576	Poland	108.969
Cyprus	176.475	Estonia	108.641
Slovenia	166.567	Czech Republic	96.673
Hungary	165.009	Lithuania	94.635
Latvia	150.520	Croatia	94.295
Slovakia	127.171	Slovakia	90.098
Croatia	115.890	Latvia	81.438
Lithuana	114.257	Hungary	76.319
Czech Republic	109.039	Slovenia	74.604
Estonia	74.998	Cyprus	71.190
Poland	74.852	Bulgaria	57.247
Malta	55.934	Romania	54.030

Source: Own processing based on Eurostat Database of International Trade

In the analysed years countries such as Romania and Bulgaria have the highest export competitive performance in agriculture sector of Central and Eastern Europe´s countries. In 2013, when Croatia became a part of European Union has overtaken some of Central and Eastern Europe´s countries with high export performance. The results in RCA food industry sector based on calculation is clear, that countries such as Estonia and Poland are leaders in this sector rather than in agriculture sector. While for Malta, which has the lowest export performance in agriculture sector, in sector of food industry has the lowest value. When Croatia has joined after the year 2013 and became a part of European Union, it´s export competitive performance is close to some of Central and Eastern Europe´s countries. The Slovak Republic is ranked 7th in the list of countries, which belong to the Central and Eastern Europe´s countries, based on the calculation of RCA index in the agriculture sector and food industry sector.

3.2 The Export Market Share

The EMS in agriculture sector and food industry sector is calculated for seven big countries (Netherland, Spain, France, Germany, Belgium, Italy, Luxembourg) eight small countries (Greece, Portugal, Austria, Sweden, UK, Denmark, Finland, Ireland) and thirteen Central and Eastern Europe´s countries (Romania, Cyprus, Hungary, Bulgaria, Slovenia, Slovakia, Lithuana, Latvia, Czech Republic, Poland, Malta, Estonia, Croatia). All of them are members of European Union. The results are shown in the following table (Table 5).

Table 5 EMS in agriculture sector and food industry sector

agriculture sector in %		food industry sector in %	
	2010-2015		**2010-2015**
Netherland	19.33	Germany	18.73
Spain	17.14	Netherland	15.40
France	14.81	France	12.46
Germany	8.14	Belgium	9.01
Belgium	7.85	Italy	7.55
Italy	6.61	Spain	6.41
Poland	3.16	UK	5.59
Hungary	3.30	Poland	4.69
UK	2.48	Denmark	3.64
Denmark	2.22	Ireland	3.27
Romania	2.06	Austria	2.97
Czech Republic	1.83	Czech Republic	1.66
Bulgaria	1.78	Hungary	1.59
Austria	1.64	Sweden	1.13
Greece	1.34	Slovakia	0.94
Slovakia	1.27	Portugal	0.93
Portugal	1.02	Greece	0.72
Ireland	0.81	Lithuana	0.60
Lithuana	0.72	Romania	0.52
Sweden	0.58	Bulgaria	0.48
Latvia	0.51	Finland	0.36
Slovenia	0.45	Luxembourg	0.34
Croatia	0.22	Estonia	0.28
Finland	0.20	Latvia	0.28
Estonia	0.19	Slovenia	0.21
Luxembourg	0.14	Croatia	0.18
Cyprus	0.10	Cyprus	0.04
Malta	0.00	Malta	0.01

Source: Own processing based on Eurostat Database of International Trade

Based on results in EMS agriculture sector of big countries we may conclude, that in analysed period Netherland, Spain and France hold the highest market share. Consequently Germany, Belgium, Italy, Poland, Hungary, UK, Denmark and Romania have lower market share in agriculture sector. Other European Union countries have in the agriculture sector the lowest export market. During the economic crisis the EMS of several big countries have fallen and only Netherland was trying to keep their EMS in agriculture sector in analysed period. We could definitely see the differences between member states of big countries and small countries. Only five countries have EMS greater than 1%. Central and Eastern Europe´s countries have held the lowest EMP compare with either big or small countries. Only first three countries such as Poland, Hungary and Czech Republic have greater than 1%. In the food industry sector, Germany has the highest percentage value of EMS from all countries of European Union. We can state on the basis of the data given in the table that economic crisis might have an impact on decline in food industry sector of small countries in years 2010-2015. We may conclude that the results in agriculture sector and the results in food industry sector approxi-

mately did not change in Central and Eastern Europe´s countries. Poland, as a part of Central and Eastern Europe´s countries, has the highest export market share in both sectors and is seems rapidly increasing in food industry sector. After Croatia has joined in 2013, their EMS is a little bit lower than in agriculture sector. Despite of economic crisis which started in 2009, EMS in food industry sector of each Central and Eastern Europe´s countries has increased. If we compare Central and Eastern Europe´s countries with big or small countries in both sectors, our opinion is that they have been at least influenced by economic crisis.

4 Conclusions

The aim of this paper was to evaluate the export competitive performance at a sector level in intra European Union trade within the period of years 2010-2015. At first we could say that there is a relationship between agriculture and food industry sector concentrate in intra-EU market. Several countries play a key role in exporting. Spain and Netherland are holders of the highest export market share in agriculture sector, while according to our calculations in food industry sector Germany has hold higher export market share. Countries such as Spain, France, Netherland and Italy have the largest comparative advantage in agriculture. However in food industry sector Germany, Luxembourg and Belgium have higher comparative advantage. Secondly, it seems that there is a relationship between agriculture sector and food industry sector, which are interconnected. However they don´t have a similar tendency in export performance and thus we couldn´t examine which one is pushing or pulling to the other one. Thirdly, our analysis showed that the CEEC´s countries after an entrance into the European Union, were competitive and have had high comparative advantage in agriculture sector.

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Price Development within the Milk Commodity Chain

Barbora Daňková, Ivana Blažková, Věra Bečvářová

Abstract: *The paper deals with the milk commodity chain and its price development during the years 2001-2016. The price development is monitored within the context of chosen countries (Germany, Austria, Slovakia and Poland). The paper uses descriptive statistics and basic indices describing monthly price development within the milk commodity chain between 2001-2016. Within the research of commodity chain prices there were analysed milk farm prices and producer prices of butter and Edam cheese in the given countries. Based on the obtained findings, the essential knowledge and conclusions connected with the entrance of the Czech Republic to the EU and with the dynamics of agribusiness development conditions resulting from globalizing world market were deduced. In general, it can be concluded that the price level on the dairy markets in the original EU member states and in the new EU member states has been balanced bilaterally. This aspect was reflected in a comparable price trends at the downstream market levels of the commodity chain under examination.*

Key words: Agribusiness · Price · Commodity Chain · Dairy Products

JEL Classification: Q13 · Q11

1 Introduction

Milk and dairy products are permanently for a long time one of the basic commodities in a human nutrition. Even the structure and volume of production and consumption differs in the world regions, there is no doubt that milk is always crucial commodity in argumentation of food security and sovereignty. Other verifiable argument for preservation or increase of size of herds of milking cows and milk production is the increase of world population affecting the world demand for food. FAO statistics show the human population growth of almost 2.5 billion between 1985-2015. World cow milk production is around 640 mil. t., overall, it is possible to tell that milk regional world diversification correspond current milk consumption. The biggest milk world producer is Europe (72 % of milk is produced in EU), then North and South America (mainly USA and Brazil) and in Asia there are determinative India and China. The evaluation of production shares of individual world region gives a cursory view of world production, from which it is not exactly possible to derive development and behaviour of crucial players, market position and development tendencies including ability and expansion possibilities inside of globalizing processes in the international markets, which affects different strategies and policy instruments in diverse power.

Significant increase of production is demonstrable in China and India, where there is for a longer time meaningful increase of domestic demand. Large countries, such as China and Russia, or many populous regions, such as central Asia, North Africa or part of South America, have not enough domestic production. These countries are known as the biggest world importers of milk. On the other hand, milk production in France and Germany is affected by the milk quotas, which must be kept by EU members. From 2015 the quotas were cancelled and EU milk market should be able to react better to demand changes. Quotas influenced the deal for individual EU members (origin and new) onto milk production in CAP EU, influenced total development of cow milk production as a basic product used in related production phases of commodity chain. Even the assumption about same rules and conditions of common EU market is accepted, the milk production is determined by other factors of regional development of individual countries. Price is one of these factors. Its development is one of the most important drivers of formation of the commodity chain, e.g. their production size or actual demand and supply. Nowadays, current milk price situation is very actual not only in the Czech Republic. To define the development of the price at particular levels of milk commodity chain in the Czech Republic, there is the need to have knowledge about relations between prices in other countries connected with the Czech Republic, because these countries and the their price development could determine prices in the Czech Republic.

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The specific characteristics of the agrarian market are reflected in the price formation of agricultural commodities. Common features of most commodity markets include market structure approaching perfect competition, very inelastic supply in a very short period and low elasticity in the short term, low price and income elasticity of demand (Tomek and Kaiser, 2014). According to Tomek and Kaiser (2014), pricing on agrarian markets largely depends on the possibility of production storage, and storage for pricing has the following impact. The market for non-stackable commodities has perfectly inelastic supply in very short period. According to the results of Lechanova and Bečvářová (2006) or Blažková and Dvouletý (2017), the increase in the concentration of wholesalers and retailers creates disadvantageous conditions for processors who also seek to create greater concentration and interconnection to improve the bargaining power towards retail/wholesalers. These processes and the growing market power of the previous and subsequent stages become a dead end, from which companies try to get in the form of pooling and cooperation. Peltzman (2000) states that the following phenomenon has been observed in many sectors: the growth of input prices has been almost always reflected in the output price, however, decreases in input prices were followed by only partial decreases in output prices. Economists examining development of commodity verticals have recently focused on research of inter-segment price transmissions (e.g. Revoredo et al. 2004, McCorriston et al., 2001; McCorriston, 2002). According to McCorristonet et al. (2001), the vertical price transmission in the individual commodity verticals will not be complete, if there is an imperfectly competitive environment.

Therefore, the further research should be focused on the price development and its tendencies, as well as the possibilities of connection between related countries. The information of this research topic help to understand the next level price analysis what can be e.g. price transmission on commodity chain. This type of research was conducted for example by Lloyd et al., (2009), Blažková and Syrovátka (2012), Dudova and Bečvařová (2015) or Royer (2011).

The above mentioned facts imply the focused of our paper, which is the milk commodity chain in the Czech Republic. The aim of the paper is to analyze the development of milk and dairy products prices in relations with the neighbouring countries of the Czech Republic. The paper quantifies basic development tendencies of prices and the price effects on the milk commodity chain.

2 Methods

Evaluation of the price environment is based on the farm price of milk (FP) and processor prices (PP) of butter and Edam cheese. The paper uses monthly prices in the time period 2001-2016. The prices are evaluated with the use of the base indices (the base year 2001 = 1.00). For the next comparison it was used the base index, where the basic measure is 1.00 = German monthly price of a concrete market (milk, butter, Edam). Prices are obtained from the database Eurostat and are denominated in Euro for all commodity chain levels and all products (FP, PP, milk, butter and Edam). Therefore, i tis possible to evaluate the differences connected with manners and policy of final parts of commodity chain, e.g. some state interventions differences.

First, there are analysed milk farm prices in EUR/100kg in chosen EU countries, namely the Czech Republic, Slovakia, Poland, Austria and Germany. The price development is further evaluated through the milk farm price indices in these countries. Second, the development of butter producer prices in EUR/ton and their indices is described and evaluated in the given countries (except for Austria due to the low foreign trade with this commodity). Third, the analysis is focused on producer prices of Edam cheese in Germany, Czech Republic, Slovakia and Poland, i.e. development of prices and their indices. Finally, conclusions and consequences are deduced.

3 Research results

Firstly, there are analysed farm prices of milk where it is possible to see situation before entrance to European Union of Czech Republic, Poland and Slovakia. Analysis shows significantly lower farm prices in the Czech Republic, Poland and Slovakia before 2004 (see Figure 1, Graph No.1), i.e. the year of entrance to EU, then the prices in original countries represented by Germany and Austria. The equalizing of the milk farm prices started after the entrance to the EU, in the following period the development trends are basically comparable with the original two EU member states.

Indices of farm prices (see Figure 1, Graph No.2) make it possible to assess the development in more detail and to show that the price of milk in Poland, which was the lowest in comparison with other countries, grew most in comparison with 2001. Similarly, a high increase of milk farm prices was recorded in Slovakia and in the Czech Republic. Milk farm price indice in Germany and Austria oscillated around the value of 1, in Germany even with periods of moderate price decline.

Figure 1 Milk farm prices in chosen EU countries in EUR/100kg in period 2001-2016 (Graph No.1) and Indices of milk farm prices in chosen EU countries in period 2001-2016 (1.00 = 2001) (Graph No.2)
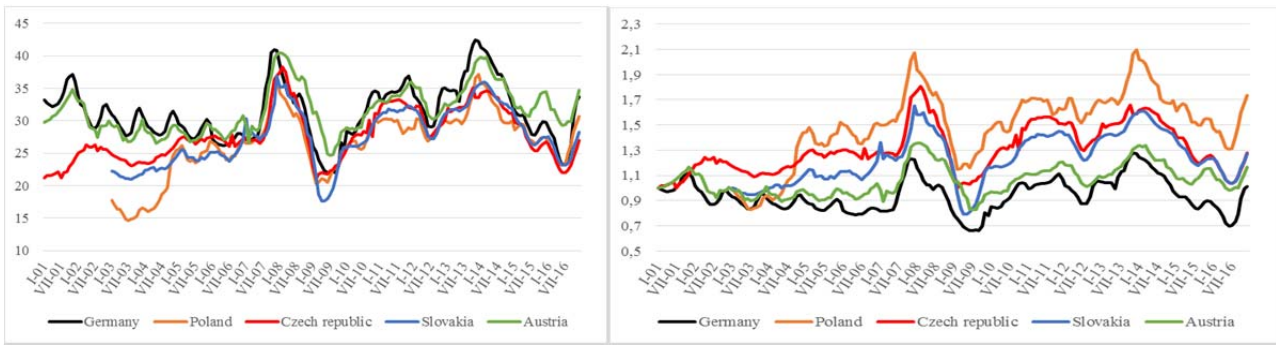
Source: Eurostat; own processing

The evaluation of the development of milk farm price indices in relation to developments in Germany (see Figure 2) shows that the milk farm prices in the Czech Republic, Slovakia and Poland are lower than in Germany over the whole period of observation. The only country, which at some stages exceeds farm prices of Germany, is Austria.

Figure 2 Indices of milk farm prices in Germany relation in 2001-2016 (1.00 = 2001)
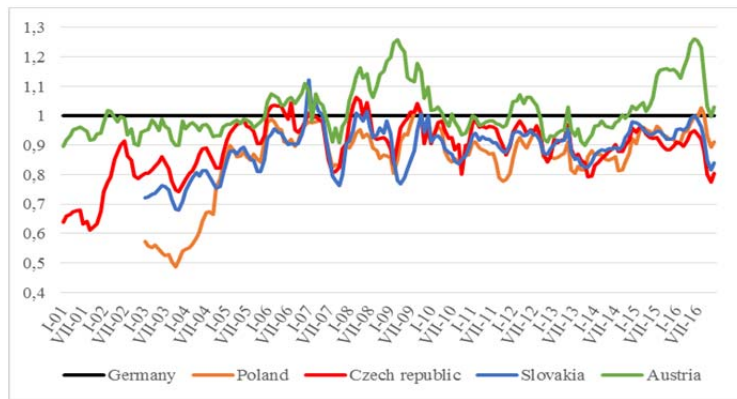
Source: Eurostat; own processing

When evaluating the producer prices of butter in chosen EU countries, it is appropriate to exclude Austria from our research to small interconnection of international butter trade with the Czech Republic. As in the case of milk, before the entrance into the EU, the butter producer prices in the Czech Republic, Slovakia and Poland were lower than in Germany. At the time of entrance into the EU, however, these prices were already comparable, both in terms of growth in these three countries and of the decrease in Germany (see Figure 3, Graph No.1).

Figure 3 Producer prices of butter in chosen countries of EU in EUR/ton in period 2001-2016 (Graph No.1) and Indices of butter producer prices in chosen countries in period 2001-2016 (1.00 = 2001)
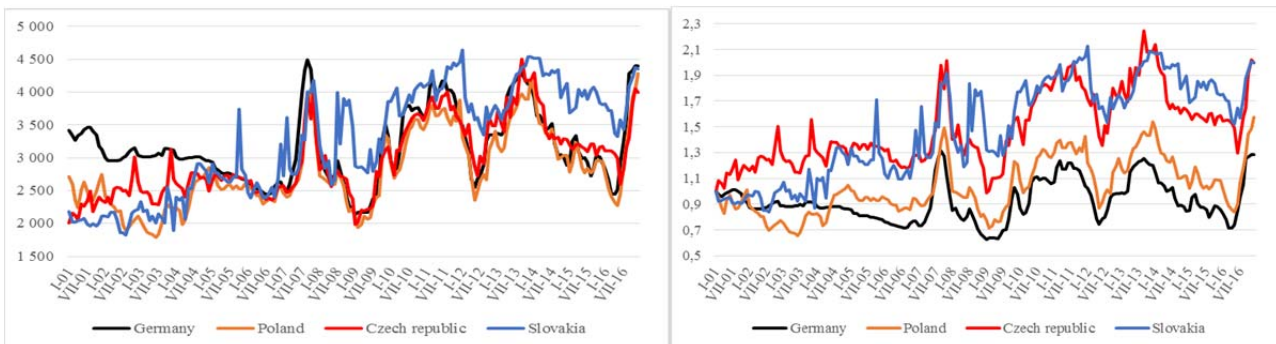
Source: Eurostat; own processing

After 2005, the butter producer prices in the Czech Republic, Slovakia and Poland started to develop in the same way as the butter producer prices in Germany. Since the middle of 2008, Slovak prices have partially changed and have been different from Germany, Poland and the Czech Republic. Butter producer prices in Slovakia are relatively higher than butter producer prices in other analysed countries. Significant butter producer prices growth is visible for all countries in 2016.

This development is seen more markedly in the assessment of butter producer price indices in individual countries (Figure 3, Graph No.2), confirming the assumption that, given the originally relatively lower prices (compared to Germany), butter producer prices grew most in Slovakia and in the Czech Republic. The overall development trend of the German butter producer prices can be assessed as declining, despite the fluctuations in 2007, 2011 and 2013. Similarly, the development of butter producer price indices in Poland can be characterized as decreasing.

The development of butter producer price indices in Germany's relations is presented in Figure 4. It indicates that before the accession to the EU, butter producer prices in Poland, Slovakia and in the Czech Republic were about 40% lower than in Germany. In the next period, after the accession of these countries to the EU, as mentioned above, prices in Slovakia were significantly higher than prices in Germany (roughly by 40%). The Czech prices are oscillating around German prices more closely than the Polish prices, whose indices are rather at the level of Germany. This could indicate more interconnected market between Germany and Poland than between Germany and the Czech Republic at this commodity chain level.

Figure 4 Indices of butter producer prices in Germany relation in 2001-2016 (1.00 = 2001)
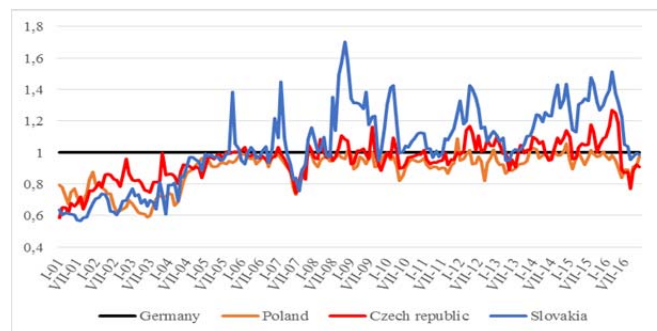
Source: Eurostat; own processing

Figure 5 Producer prices of Edam cheese in chosen EU countries in EUR/ton in period 2001-2016 (Graph No.1) and Indices of producer prices of Edam cheese in chosen EU countries, 1.00 = 2001, in period 2001-2016 (Graph No. 2)
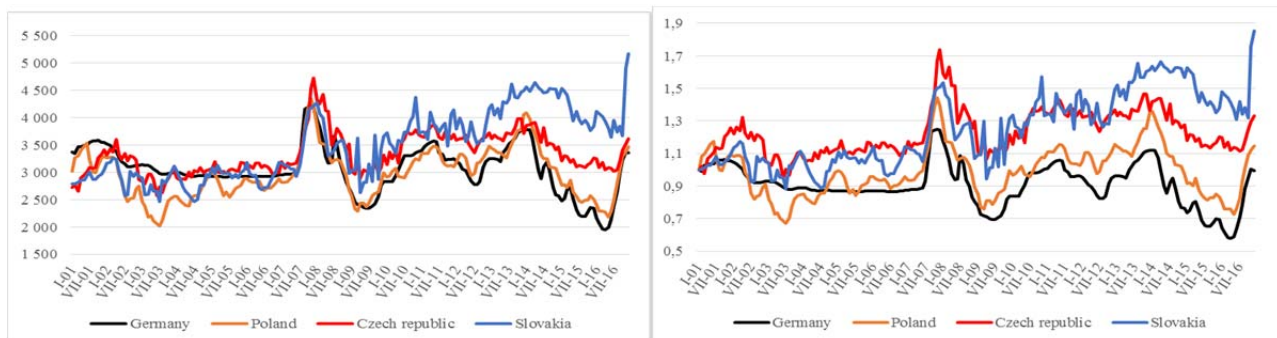
Source: Eurostat; own processing

Last part of our analysis was focused on producer prices development of Edam cheese in Germany, Czech Republic, Slovakia and Poland (similarly like in butter prices analysis we excluded Austria from the research). Figure 5 (Graph No.1) illustrates the development of producer prices of Edam in selected countries. The comparison shows that till 2007 the prices of Edam cheese in the Czech Republic and Germany were almost unchanged, the prices in Poland and Slovakia appear to be less stable. At the beginning of 2008, Edam producer prices jumped in all the countries under observation and subsequently followed a gradual decline. A significant difference in producer prices development occurs after 2013 when overall producer prices of Edam decreased. The most significant decrease was observed in Germany and Poland. A price reduction with no significant impact (and different price levels) occurs in the Czech Republic and

Slovakia. Approximately, from the middle of 2016, there is again a significant increase in Edam prices in all analysed countries with the lowest growth in the Czech Republic.

This assessment of price developments is confirmed also by the Graph No.2 in Figure 5, which reflects Edam producer price indices. It confirms that the producer prices of Edam cheese in Germany, unlike other countries, declined steadily until 2007, where the development was basically stable. Since 2007, following the significant fluctuation in the growth and subsequent fall in the producer prices of Edam, the producer price indices in Germany and Poland differ from the tendency of indices to predominately decline from developments in the Czech Republic (compensation, moderate growth, decline) and in Slovakia (strong growth, slight decrease). The same price development, i.e. increase, for all countries was observed in 2016.

Figure 6 Indices of Edam cheese producer prices in Germany relation in 2001-2016
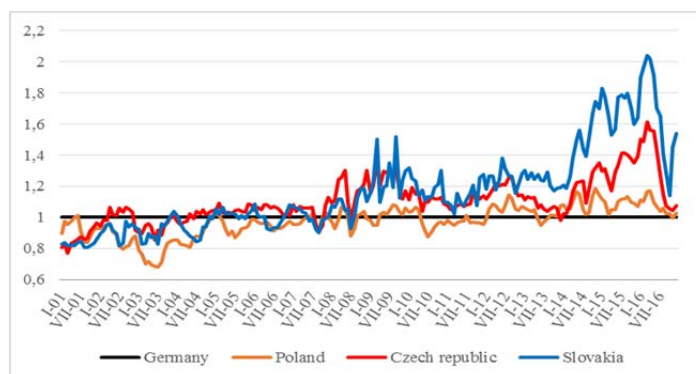
Source: Eurostat; own processing

Figure 6 shows the evaluation of the Edam producer price trends in the Czech Republic, Slovakia and Poland in relation to the price levels in Germany. It is generally accepted that until the year 2007, the Edam prices of all countries oscillated around the German market price. However, since 2007, the producer prices of Edam in the Czech Republic, and especially in Slovakia, have started to deviate very significantly from prices in Germany (Slovak Edam producer prices were at their peak once higher than Germany prices and the Czech prices by more than half). Again, at this commodity chain level, it can be deduced that the producer prices in Germany and Poland are more related to each other than to the prices in the Czech Republic.

4 Conclusions

The aim of the paper was to evaluate the development of the pricing environment of the milk commodity vertical. The individual price levels has been decomposed in detail on the basis of the development of prices of selected products, which can be regarded as typical product representatives (milk, butter and Edam cheese). Through the development of tendencies, overall ties and context of price formation within the milk commodity chain the situation in the Czech Republic and comparison with the situation on the other EU market were described and evaluated.

During the preparation of the accession of the Czech Republic to the EU, i.e. during the first period under observation, the level of the basic raw milk prices, i.e. milk farm prices, was lower and the growth was observed in all new member states (not only in the Czech Republic) in comparison with the EU. On the other hand, on the German and Austrian milk markets in this time milk farm prices were declining slightly, which also favoured the interactions of these countries with each other in the dairy industry. The bilateral equalizing of the farm price level on the dairy market in the original and the new EU member states has already occurred in a short time after accession to the EU, which was reflected in the comparable development on the downstream vertical market for low-value processed milk products.

The reactions in the milk-butter commodity chain was partially different. In spite of the low unit price of the raw milk, the butter producer prices have been directly and quite considerably rising even before the EU accession. On the other hand, according to the development of producer prices in the downstream stage of the milk commodity chain, the assumption of the significant price increase of Edam cheese (as the processed milk product with the highest value added) was not confirmed due to the relatively high level of Edam producer prices in the previous periods.

The fundamental change, which influenced the further development of (not only) price conditions within the milk commodity chain, was the orderly increase in milk and dairy products demand in the global market in 2007. It was driven by several factors: the increase in milk and milk products demand in countries exporting oil (China, Brazil, Rus-

sia and India), also the consequences of weather fluctuations (such as extreme drought in Australia and the floods in Argentina), which led to a decrease in the quality of feed and hence lower milk production. After the depletion of dried milk and butter stocks, the prevalence of demand was reflected in world and European milk prices. Specifically, the prices of milk and dairy products in the Czech Republic increased in the short term by about 28%.

Shortly after the sharp price increases in 2007-2008, there was a significant drop in prices and a gradual recovery in price growth. It also contributed to the further formation of horizontal and vertical ties and prices on the EU milk market and directly influenced further developments in the Czech Republic. The decline in the farm prices milk feedstock with regard to production costs and the search for additional support and income options, in some cases, meant the withdrawal of primary producers from the milk market. In the Czech dairy industry, producer prices growth, with regard to the structure of ownership and support for the development of processing capacities, has not significantly contributed to the increase in production at this stage. However, due to the influence of the market power of the final parts of commodity chain, the transnational trade clusters were able to assert their position on the Czech market in the pricing policy, including influence on the choice of key suppliers of milk and dairy products. In general, it can be concluded that the price level on the dairy markets in the original EU member states and in the new EU member states has been balanced bilaterally. This aspect was reflected in a comparable price trends at the downstream market levels of the commodity chain under examination.

Acknowledgement

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Development and Structure of Subsidies in Agriculture

Jana Lososová, Daniel Kopta, Radek Zdeněk

Abstract: *The paper is based on the results of research on the economic development of a sample of agricultural holdings operating on the territory of the Czech Republic. Businesses are broken down by LFA share, enterprise size, and the dominant specialization. Attention is paid to both the overall development and changes in the structure and volume of subsidies and their impact on the profit of farms.*

Key words: Subsidies · Farms · Profit · Agriculture

JEL Classification: Q10 · Q14 · Q18

1 Introduction

Subsidies in agriculture have an economic justification if the level of community welfare decreases due to the free exercise of market forces. Svatoš (1999) defines subsidies as a valuation of the public sector that affects the prices of products and services and the prices of factors of production. Bečvářová (2008) defines subsidies as transfers reflecting changes in the distribution of income, which are not connected with the flow of goods and services.

The nature of agricultural production means that farmers are often unable to respond adequately to changes in the prices of agricultural product and production inputs. The result is an inelastic supply of agricultural products coupled with the inflexibility of demand for most agricultural products and leads to fluctuations in agricultural product prices, causing a fluctuation in farmers' income, which leads to a reduction in their well-being (Grega, 2005). Farm subsidies are an important source of income for farmers, especially if they farm in less favoured areas.

Agriculture in the EU is one of the major sectors which employ almost 30 million people. The European model of agriculture ensures not only quality food but also permanent employment in rural areas. The aim of this article is to analyse the policy of subsidies in Czech Republic in 2004 – 2016 which represents its comparison based on selected economic indicators and identifies adequate relations and dependencies between the indicators and subsidies based on economic reasons.

The CAP receives approximately 40% of the total EU budget every year (EC, 2014). More than 70% of the money is used as a direct income subsidy (pillar I), approx. 20% can be used within the European Agricultural Fund for Rural Development (pillar II) and the rest of the money is used for payments to market price support. Compensatory subsidies within pillar II are provided in LFAs to prevent farmers from leaving the areas of natural restrictions. They represent about 4% of the CAP budget (EC, 2013). The European Commission endeavours to run environment-friendly agriculture in less favoured areas as it helps keep nature's diversity, increases the fertility of soil and protects soil from erosion. LFAs belong to areas endangered by emptiness and areas which suffer from specific natural restrictions. Nevertheless agricultural systems in less favoured areas are permanently forced to increase productivity and compete with intensive farming in more productive areas (de Graaff et al., 2011).

Merckx and Pereira (2015) criticize the current CAP and argue, that subsidies emphasize the ubiquitous maintenance of farming and active management of the landscape, without identifying and targeting areas where rewilding marginal farmland may be beneficial for biodiversity and ecosystem services. These policies have two perverse effects. First, they promote the maintenance of agricultural practices in areas that could often be considered degraded from the point of view of several ecosystem services. Second, they distort land prices, artificially increasing the market value of marginal farmland. Furthermore, whilst subsidies may delay abandonment, they are unlikely in the long run to achieve their goal of halting and reversing this process; not only farmland abandonment is a process prone to self-enforcing socio-ecological regime shifts (Figueiredo & Pereira, 2011), incentive payments can never fully compensate the direct benefits that people received from the environment in traditional farming communities (Fischer et al., 2012). Ruben and

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Pender (2004) say that policies for poverty alleviation and sustainable development in LFAs should take the existing diversity among farmers and the heterogeneity in resources as a useful starting point. Attention should be focused on the implications of this diversity for household decisions regarding land use, labour intensity, market exchange and social organisation.

Criteria for LFA classification are covered in studies of Dax (2005); Štolbová et al. (2007); Eliasson et al. (2010); Štolbová, Hlavsa & Lekešová (2010). The analysis by Jones et al. (2013) shows that in spite of an increased focus on livestock activities at the expense of mixed farming stocking rates decreased and the share of permanent pastures increased. Livestock payments in particular for cattle seem to have encouraged high expenditures on external inputs, whereas rural development payments seem to have encouraged more sustainable strategies such as the improvement of yields of mixed farming systems.

The evaluation of Czech agricultural enterprises shows that the highest losses after the subsidies are deducted from profits will appear in the mountain LFAs. The impact on economic indicators in the mountain LFAs seems to be significant. Enterprises which operate in mountain areas depend on the subsidies most of all. On the other hand they cope best with effects of unfavourable conditions (Lososová & Zdeněk 2013).

2 Methods

The data necessary to the research were based on original sample prepared at the University of South Bohemia in České Budějovice since 1996. The sample consists of about 100 farms all over the Czech Republic. The crucial data are collected from financial and production statements – Balance sheet, Profit loss statement, Annual statement on harvest and Statement on sowing areas. The data are completed by an original questionnaire with additional information on economy and production. The results are calculated as an average per farm or hectare of land or one worker. The paper used sorting of enterprises into groups according to the share of agricultural land in the LFA to the total utilized agricultural area (UAA), as well as the type of production and the size.

According to the relation to the less favoured areas, the enterprises are classified according to the methodology of FADN (2012):

- Mountain areas (LFA M) – more than 50% of UAA in mountain LFA;
- Other LFA (LFA O) – more than 50% of UAA in LFA and LFA M less than 50%;
- NON LFA – more than 50% of UAA outside the LFA.

Classification by type of farming was based on the prevailing share of revenues from crop and animal production, with the fact that businesses with sales of crop production or livestock production higher than 2/3 were belonging to the appropriate group and the other belongs to a group of mixed agricultural production.

To sort the size of the company the rules of the European Union (Annex I of Commission Regulation (EC) No 800/2008) were used. Given that there were only 0-5 micro-enterprises and large enterprises in the sample for each year, only the group of small and medium-sized enterprises was assessed.

For the evaluation of the development of subsidies the so called index of dependence on subsidies (IDS), which represents the cost rate adjusted for subsidies, where the value over 100% express what share of company costs is needed to be covered by subsidies (CZSO 2010),

$$IDS = Costs / (Revenues – Subsidies) \qquad (1)$$

In order to quantify the relationship between the volume of subsidies and the profit/loss, a simple linear regression based on annual time series was used, in the form of

$$y = \beta_0 + \beta_1 \cdot x + \varepsilon \qquad (2)$$

where y is the dependent variable, β_0; β_1 are parameters of the regression equation, x is an independent variable, and ε is a residual.

To determine the suitability of the model, a coefficient of determination (R^2) is used, which determines how many percent of the total variability of data is explicable by the regression model.

Bojnec & Latruffe (2013) find that regarding subsidies, they have a negative influence on technical efficiency, by contrast, they have a positive influence on allocative efficiency, but the influence on the overall economic efficiency is negative. As for profitability, subsidies have a positive relationship with it.

Adamišin & Kotulič (2013) say that slow structural change and high subsidization of agriculture calls for studies on whether such conditions could explain the low performance of the agricultural sector, and, if so, what is the effect of the implementation of the high subsidizing CAP on farms' behaviour and survival possibilities. As summarised by Gorton & Davidova (2004), the question of farms' productivity and efficiency in post-socialist countries is crucial to understand whether the countries could compete within the enlarged EU after their accession and how farm structures in these countries would evolve. In particular, farms' survival is an important issue, as it is decisive for land use and sustainable rural development, the presence of farms avoiding land abandonment and providing employment and green amenities in rural areas. Land abandonment has been relatively high in post-socialist countries after the transition, due to political and economic changes.

3 Research results

In 2016, the sample consisted of 95 entities, 44.2% of which operated outside LFA, 38.9% in LFA O and 16.8% in mountain LFA. In terms of the legal form of business, the agricultural holdings are divided according to the following proportion where 45% represent cooperatives, 41% joint-stock companies, 13% limited liability companies and 1% belongs to physical entities. The average business size is illustrated by assets amounting to CZK 160m, CZK 156m in LFA M, CZK 163m in LFA O and CZK 159m in NON LFA. The average total revenues of the holding amount to CZK 87.5m. In terms of LFA, the smallest revenue is produced in LFA M (CZK 70.2m), followed by LFA O (CZK 91.9m) and NON LFA (CZK 90.1m). The average number of employees per business is 49: the lowest number of employees is in LFA M (47.5 workers), followed by LFA O (51 employees) and NON LFA (48.4 employees).

According to the prevailing production orientation, 25.3% of the enterprises are engaged in plant production, 33.7% enterprises are focused on livestock production and 41% are enterprises engaged in mixed agricultural production. The average size of the enterprise, expressed in terms of the assets, is CZK 152m for plant production, for the company with a predominant livestock production it is CZK 168m and for the mixed production CZK 158m. There are no significant differences in the area of the cultivated land (crop production 1646 ha, livestock production 1562 ha and mixed 1588 ha).

According to the EU classification, 67.4% of farms are classified as small businesses and 32.6% medium-sized businesses. Small businesses manage in the average on 1194 ha and a medium-sized on 2421 ha of agricultural land. Total revenues are CZK 61.8m for average small enterprises and CZK 140.4m for medium-sized. The number of workers is 31 in the average small enterprise and 86 in the medium-sized.

For reasons of comparability, we monitor the development of subsidies in proportion to the size of the enterprise, in this case to the area of utilized land. The average growth rate of subsidies during the monitored period is 10% per year, with the largest increase in subsidies per hectare of agricultural land as a result of the accession of the Czech Republic to the EU, with the most dynamic growth being the first three years after accession (figure 1).

Figure 1 Development of subsidies in the LFA groups
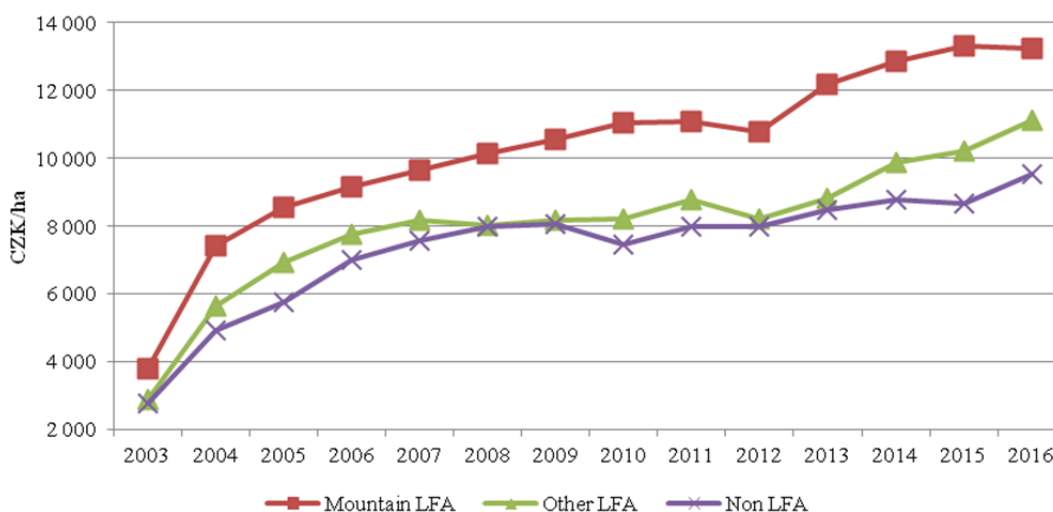
Source: Own processing

In 2016, the subsidies in the average enterprise were 10734 CZK per ha. The highest amount of the subsidies were provided to farms operating in the LFA M, where the average growth rate is 10.2%. The fastest growth of subsidies is in the farms focused to livestock production, with the growth rate 11%, the slowest increase of the subsidies is in the farms specialized on crop production (9.9%, see figure 2).

Figure 2 Development of subsidies according to the production orientation
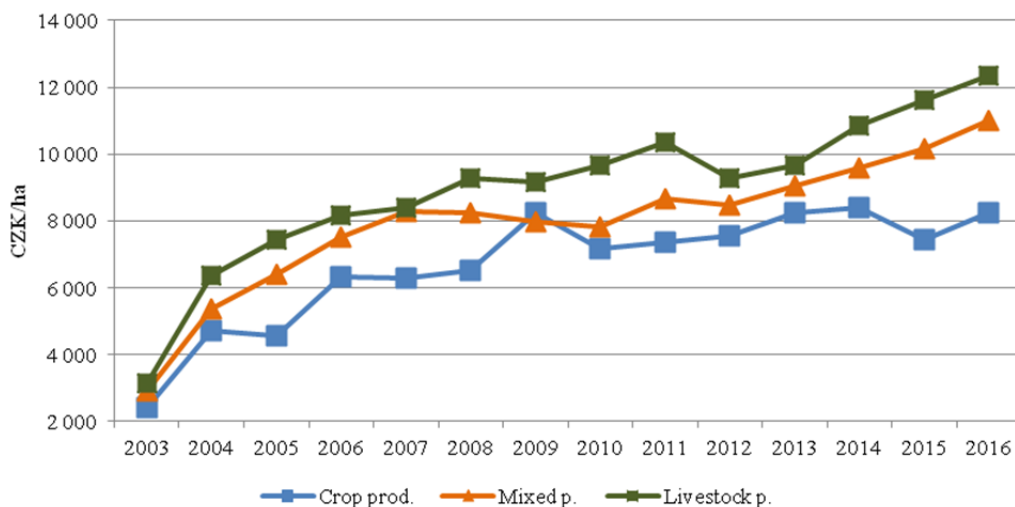
Source: Own processing

In the case of enterprises broken down by size, the amounts of subsidies per hectare of utilised land are very similar, with a significant fluctuation in 2010, when a medium-sized enterprise has received the subsidy by 12.5% lesser than a small enterprise (Figure 3).

Figure 3 Development of subsidies according to size of the farm
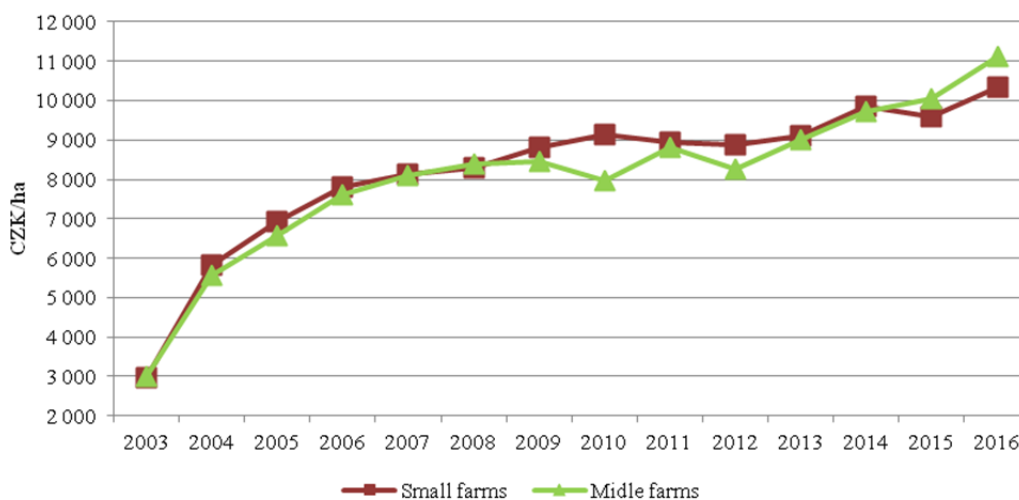
Source: Own processing

Besides the size of the enterprise, the development of subsidies can be compared with the economic indicators of the company, e.g. in relation to revenues from own products and services (Table 1). In 2016, the average company obtained CZK 293 of subsidies per CZK 1000 of revenues from own products and services. As can be seen from Table 1, the highest subsidies in relation to sales were obtained by the average enterprise in mountain LFA, 67% more than the average of the whole sample. By 13% more than average was acquired by a livestock-producing enterprise; on the contrary, the least subsidies in relation to revenues were obtained by an enterprise with predominantly plant production. The small business earned 8% more than the average, and the medium-sized business, by contrast, was 7% less than the average.

Table 1 Subsidies per CZK 1000 of revenues from own products and services

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Mountain LFA	189	340	405	435	440	449	594	479	482	440	488	468	457	491
Other LFA	116	203	247	267	247	249	323	285	263	214	236	232	260	307
Non LFA	83	143	150	197	188	201	253	224	204	180	203	202	188	237
Crop prod.	210	296	185	246	192	216	267	234	188	180	211	235	186	221
Mixed p.	96	168	187	221	224	222	291	251	269	225	250	223	258	311
Livestock p.	133	254	284	356	280	332	371	352	327	248	247	267	257	331
Small farms	163	303	337	391	323	329	423	385	306	287	289	283	279	317
Middle farms	98	171	189	226	214	224	288	238	239	192	212	212	214	274
Total	107	190	211	253	234	246	320	284	261	219	239	239	239	293

Source: Own processing

The other problem solved was the structure of individual subsidies calculated per hectare of agricultural land. For comparison, the years 2004 and 2016 are shown in figures 4 and 5. The amount of total operating subsidies is almost doubled in 2016 against 2004. The most significant increase was in SAPS, which is due to gradual levelling of direct payments with the states of EU-15. Subsidies on crop production show a decreasing trend. Till 2012, these payments are falling year-on-year, but have grown slightly since 2013. Nevertheless, the decrease compared to 2004 is on average 14%. A more pronounced increase was seen in the past two years for livestock production due to national payments, where in response to price cuts and drops in heads of dairy cattle in particular, the subsidies increased by 156% compared to 2004. Other types of subsidies can be considered relatively unchanged. Due to the increase in total subsidies, their share declines (except for other subsidies not allocated elsewhere). The compensatory allowance in the LFAs is slightly decreasing, while a slight increase is observed for agri-environment measures.

Figure 4 Structure of subsidies in 2004
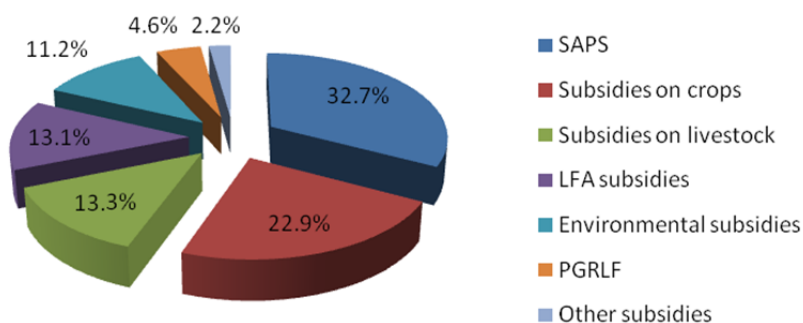
Source: Own processing

Figure 5 Structure of subsidies in 2016
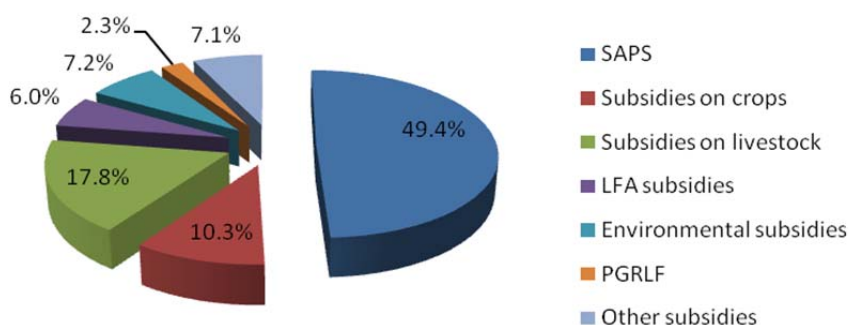
Source: Own processing

The cost rate adjusted for subsidies is labelled as an index of dependence on subsidies, where the value above 100% specifies what proportion of the company's cost is to be covered by subsidies (Table 2). In individual years this value fluctuates significantly. In all the years under observation, the highest dependency on subsidies is shown in the enterprise operating in the LFA M. On the other hand, the lowest dependence on subsidies is shown in the non-LFA company and for a plant-specialized farm. The enterprise focusing on plant production shows a decline in this indicator over the monitored years. Depending on the size of the enterprise, in all the observed years, there is a higher dependency on subsidies for a small enterprise, but over time the differences are diminishing. In 2016, the small business needed subsidies to cover 15.8% of the costs, and the medium-sized enterprise covered 15.1% of the costs by the subsidies. According to the production specialization of the company, the highest dependence on subsidies is reflected for the livestock-oriented enterprise in most of the years under review; only in 2015 the highest dependence on subsidies was manifested in the mixed-production enterprise, 17% of the costs being covered by the subsidies. The livestock producers in 2016 covered 19.5% and the plant producers covered 5% of the cost by the subsidies.

Table 2 Index of dependence on subsidies

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Mountain LFA	120.2	129.0	129.5	124.6	132.6	148.1	132.7	129.7	120.8	128.0	120.6	126.6	128.5
Other LFA	109.9	115.3	118.1	111.8	119.6	130.9	117.5	114.2	110.2	110.8	109.0	116.2	117.7
Non LFA	105.8	109.1	114.6	106.7	107.0	122.4	114.9	106.5	107.6	107.1	106.2	109.8	110.1
Crop prod.	114.2	108.4	116.9	108.4	111.7	122.2	112.8	102.0	104.7	104.8	109.9	105.6	105.1
Mixed p.	107.7	111.8	115.3	109.4	111.2	127.6	116.2	114.0	112.0	111.4	106.9	117.1	118.4
Livestock p.	113.9	119.1	126.5	113.6	126.0	132.9	124.8	122.2	112.3	113.0	111.4	116.2	119.5
Small farms	116.7	125.4	127.0	115.2	121.1	136.0	125.3	114.2	113.4	113.8	112.4	116.5	115.8
Midle farms	107.9	111.4	116.2	109.2	112.5	126.4	115.3	111.4	108.7	108.4	106.6	112.3	115.1
Total	109.2	113.5	117.9	110.3	114.3	128.6	118.4	112.4	110.1	110.3	108.7	113.9	115.5

Source: Own processing

Despite the fact that subsidies should have a neutral impact on the size of the profits, research suggests that weak influence is evident. The effect on profit is apparently from subsidies on production. The highest dependence of profit on the subsidies is evident for the enterprises operating in mountain LFA, where 33.6% of the variability of the profit can be explained by the variability of the subsidies, however by increasing the subsidies by CZK 1, the profit will increase by CZK 0.50; without the subsidies the loss would be CZK 2.5m (Table 3). The correlation coefficient of impact of subsidies on profit ranges from 0.33 to 0.58, which is a low to medium degree of dependence. The least dependent on subsidies are mixed-production and LFA O farms. The share of subsidies that make up the profit is highest in the NON LFA (72%) and in the crop production (65%). In enterprises broken down by size, the differences in the dependence of profit on subsidies are not significant.

Table 3 Dependence of the profit before tax on subsidies in 2004 - 2016

	Regression parameter β_1	Regression parameter β_0	Coefficient of correlation (r)	Coefficient of determination (R^2)
Mountain LFA	0.497	-2496.4	0.580	0.336
Other LFA	0.367	-472.2	0.326	0.106
Non LFA	0.724	-2205.5	0.472	0.223
Crop prod.	0.651	-990.7	0.401	0.161
Mixed p.	0.398	-566.7	0.348	0.121
Livestock p.	0.332	-409.5	0.361	0.130
Small farms	0.558	-1994.2	0.491	0.241
Midle farms	0.533	-1391.3	0.432	0.187
Total	0.520	-1413.9	0.434	0.188

Source: Own processing

4 Conclusions

Subsidies are provided to compensate for lower yields under less favourable conditions, but also to compensate for non-productive functions and for public utility services provided by farmers. By adjusting economic indicators by subsidies, the average enterprise in all areas is getting into a loss whose trend is growing. The most significant decline in the profit after deduction of subsidies would occur in mountain LFA, where the impact of subsidies on economic indicators is the highest. According to the production specialization, the largest loss would be occurred in livestock-orientated enterprises, a lesser loss would affect the mixed-production enterprises, and the lack of subsidies would affect at least farms focused on crop production. Without significant differences, the loss after deduction of subsidies would have affected small and medium-sized enterprises.

An important issue is also the structure of subsidies. The highest share of subsidies represents the single area payment, which was 50% of all operating subsidies in 2016 and represents a change of 16 points compared to 2004. Another significant change is the reduction of support for crop commodities from 24% in 2004 to 10% in 2016. On the contrary, the increase is evident in the last two years for livestock commodities due to national payments. In response to the reduction in milk prices and the decline in the dairy cattle in particular, the national payments for milk and cattle breeding were increased.

The dependence of the agricultural holdings on subsidies is most evident in mountain LFAs, but it means the stability of economic indicators of the enterprise in crisis years. The least dependent on subsidies are enterprises focused on plant production, that are the most affected by the changes in external conditions and the amount of the profit/loss is very sensitive to these changes.

Acknowledgement

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Consumers´ Behaviour in the Czech Pork Meat Retail Market

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Abstract: *Pork meat is a key component of humans´ diet. Consumers represent the final stage in the agri-food vertical. So, it is highly desirable to know determinants of consumers´ behavior when deciding to buy meat and meat products. Price, quality, freshness and country of origin are the most significant ones. Information about consumer preferences is essential for meat processors and for policy makers who support the branch. The aim of the paper is to characterize preferences of pork meat consumers based on the representative sample survey in the Czech Republic. Authors cooperated with GfK Czech that carried out primary research on preferences of meat consumers through representative sample survey in the Czech households at the end of 2015. The sample covered 1 044 respondents which are responsible for shopping in households. They were asked about preferred place of shopping, importance of meat parameters for shopping decision (country of origin, changes in preferences of quality, price, freshness and chance they could influence quality and range of available products). Czech consumers have recently preferred more packaged meat or counter sales rather than shopping at the butcher. An important finding is that relatively high share of consumers with basic education and one-person households does not have any preference of quality or does not concern for it. Low-educated people are more price sensitive than well-educated people. Older consumers prefer price more than quality. Consumers with higher education have recently increased their preference of quality more than less-educated people. In general, most consumers prefer domestic (national) origin of pork meat. Alternatively, one third of consumers does not have any preference of origin of pork meat.*

Key words: Meat Processing Industry · Pork Meat · Education · Age · Size of Household

JEL Classification: L66 · R21 · D10

1 Introduction

The article deals with consumer preferences when buying pork meat in the Czech Republic. According to the available data of the Czech Statistical Office (CZSO, 2014), average total meat consumption was 75.9 kg/person/year with 1.4% year-on-year increase. Pork meat represents more than half of total consumption (40.7 kg/person/year) making it an important part of human diet. Consumers of meat and meat products are the last part in the vertical. Therefore, it is important to know the factors that affect their buying behaviour. This will allow the meat industry to satisfy consumers' expectations, requirements and needs (Font-i-Furnols and Guerrero, 2014).

According to Marcuta et al. (2014), consumers are looking for food products that inspire them and offer them an emotional connection. Sensory perception is to a large extent influenced by personal preferences which results from many factors (age, education, traditions, eating habits). Consumers are diverse, they have different preferences and manufacturers face a great challenge to meet increasingly complex preferences. Consumers gain a lot of information about meat and its quality through advertisements, information campaigns or labels. This information is used by consumers along with other factors to create product quality insights that influence their choice and willingness to pay for them (Font-i-Furnols and Guerrero, 2014). According to Verbeke and Ward (2006), promotional campaigns can influence consumers' expectations of quality. Aspects such as the quality of the meat or the origin of the product become more important shortly after the information campaigns.

According to Fortomaris et al. (2006), visual aspects of meat in the context of the age and residence of the consumer are important for consumers. The impact of the price on consumer satisfaction is more apparent in fresh pork than in processed products. The issue of food safety is also a key factor in consumer demand (Redmond and Griffith, 2004).

According to Ngapo et al. (2007), consumer preferences also vary considerably between countries. Most often, consumers decide on the look of the meat. In general, pork without fat is preferred.

Consumers' product awareness is particularly important, because consumption is closely linked to the eating habits, traditional recipes, sensory properties, and the origin of products (Guerrer et al., 2009). According to Balcombe (2016),

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there is growing interest in information on country of origin and food labelling. At the same time, it was found the stronger the connection between the consumer and the country is, the greater the success rate of the product (Van der Lans et al., 2001).

Authors have found the interdependence of two factors, i.e. price and quality. Price is an important factor related to consumers' purchasing decisions and has a positive impact on the expected quality (Bello and Calvo, 2000). However, the relationship between price and actual food quality is not clear (Becker et al., 2000) and is influenced by demographic characteristics (Reicks et al., 2011). There is a positive relationship between low meat prices and low quality, due to discounts on meat offered with the end of shelf life (Schnitter, 2008). However, the relationship has not been confirmed by other authors (Bello and Calvo, 2000). According to Du Plessis and Du Rand (2012), the price is the most important factor compared to the safety, quality or origin of the product. Price sensitivity is not equal for all consumers, it varies by different income level of the household (Corcoran et al., 2001). Price preference is often associated with the age and sex of the consumer (Font-i-Furnols et al., 2011). Low prices may be preferred and are likely to be more important especially for the low-income consumer segment or for consumers who do not consider meat characteristics. On the contrary, the high price is one of the factors that can be explained by low consumption (e.g. lamb) in some countries where it is highly valued. Some people cannot afford to buy this type of meat frequently, its consumption is only occasional and is replaced by another, more affordable type of meat (Campo et al., 2008).

Based on a literature review, a large-scale questionnaire survey was used to broaden the understanding of the purchasing behaviour and preferences of Czech consumers of pork. The objective of the article is to characterize consumers' preferences concerning pork meat on a representative dataset. Moreover, authors identify the factors that limit the purchase of meat.

2 Methods

The paper presents selected results of the primary questionnaire survey that was conducted by authors and GfK Czech at the end of 2015. The investigation was related to consumer preferences when buying meat and meat products in the Czech Republic. The article focuses only on the issue of preferences of pork meat consumers.

A questionnaire was distributed in households in the Czech Republic. A set of 12 questions focused on the place of purchase of individual assortment categories and interest in the origin of meat including changes over the last three years (i.e. 2015 compared to 2013). Furthermore, the significance of selected purchasing factors (quality, price, use of preservatives, store format, store brand, freshness, bio-quality) was determined. The last two questions aimed at satisfaction with the freshness and quality of goods in the Czech market. The questionnaire also included the question of whether consumers have an opportunity to influence the quality and range of meat and meat products in the shop. The article presents the selected results of this survey on the example of pork meat consumers.

In order to define consumers' typology, questions were also evaluated according to the sex of the consumer, age, education and household size.

Respondents were interviewed from October to November 2015. The population was 15 to 69 years old. The survey was conducted in the form of face-to-face interviews in households in the Czech Republic. In total, 1 044 interviews with pork buyers were obtained. 818 women and 226 men were questioned. Respondents were further divided into age categories. In total, 233 consumers aged 15-29, 338 consumers aged 30-45, 298 consumers aged 46-60 and 175 consumers aged 61-69 were interviewed. From the education point of view, 142 people with elementary education were interviewed, 367 were without completed secondary education, 380 with secondary education and 155 were tertiary-educated. The interviews were conducted with people who make the bulk of the purchases and are a household member of one person (250 respondents), two (315 respondents), three (231 respondents), four (177 respondents) and 5 or more persons (71 of respondents).

The dataset was evaluated through descriptive statistics.

3 Research results

Figure 1 illustrates the importance of selected parameters when buying meat. For all types of meat, respondents rated importance of each parameter (1 = very important to 4 = not important).

Freshness, quality and price are the most important consumers' preferences of meat and meat products. The least important factors are bio-quality, store format, animal welfare and store brand. Foreign authors say that price is the most important factor (Bello and Calvo, 2000; Du Plessis and Du Rand, 2012). Other authors revealed taste as a key determinant of consumer's satisfaction (Resan et al., 2010, Grunert, 2005). Font-i-Fumols et al. (2011) and Bernués et al. (2003) present the origin or product region as one of the most crucial factors for consumers.

Figure 1 Importance of consumers' preferences of meat and meat products
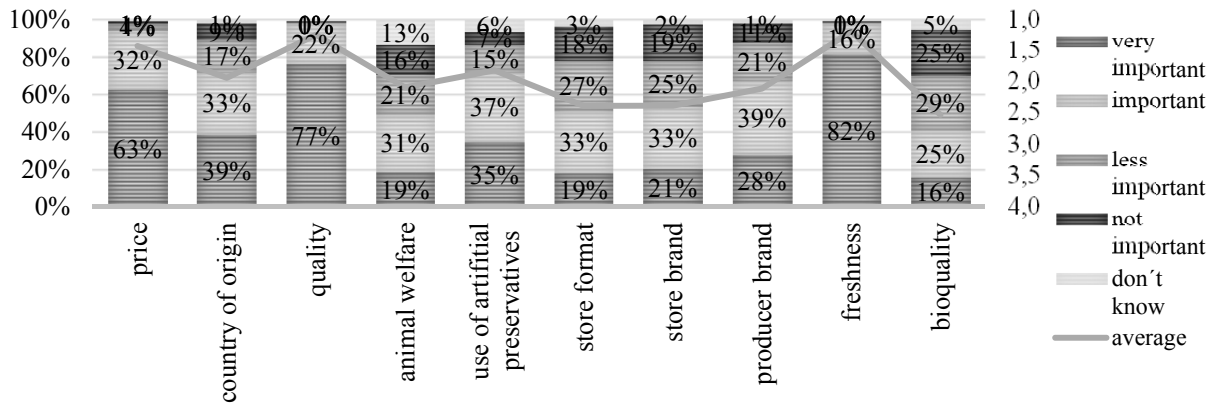
Source: GfK Czech, authors' calculation

Characteristics of pork meat consumers, i.e. sex, age, education and size of household according to the place of purchase is shown in Figure 2. Men mostly buy packed pork in a wide-assortment stores or butcher. On the contrary, women prefer counter sales followed by packaged meat. With the growing age of consumers, there is an increase in the preference of buying meat in a butcher's shop at the expense of packed meat in a wide-assortment store.

Secondary-educated consumers buy most often pork meat at the counter or packaged meat in wide-assortment stores. On the contrary, tertiary-educated respondents prefer buying packaged meat or butchers. For consumers with elementary education, there is a balanced share of the purchase of packaged or counter meat and purchases in butcher shops. People with elementary education buy pork meat less frequently than people with higher education (12% of respondents with elementary education do not buy pork at all).

Figure 2 Where consumers currently buy pork meat?
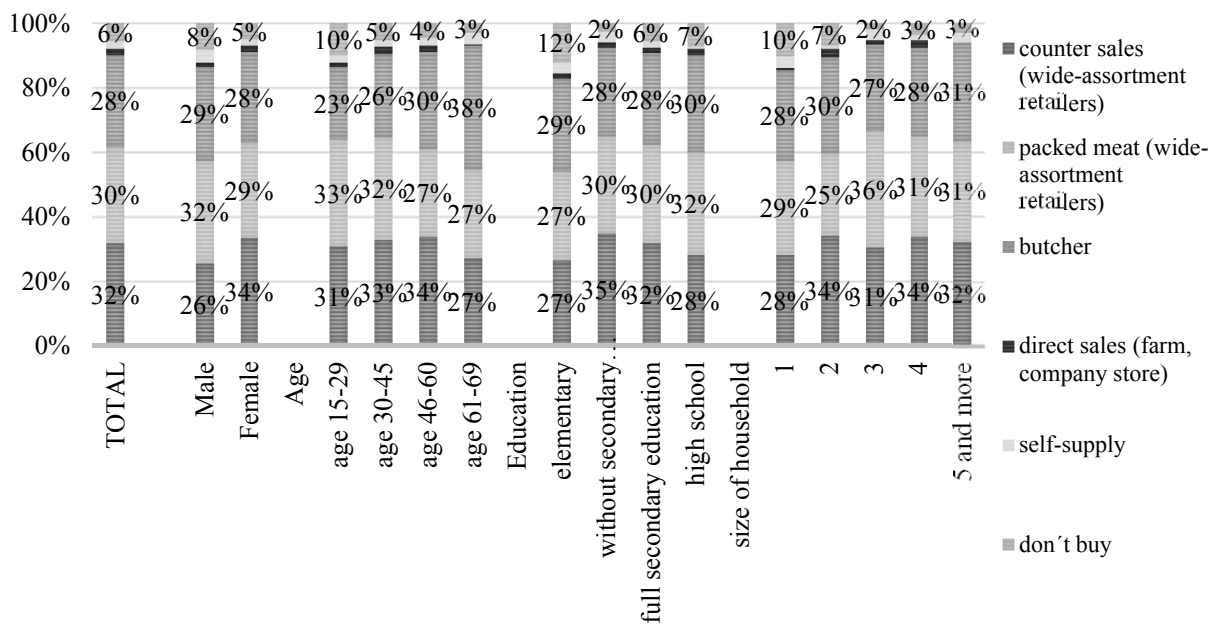
Source: GfK Czech, authors' calculation

Common features also include households with three or four members who buy mainly packaged and counter sales meat. Single-person households are specific as there is higher proportion of people who do not buy pork at all, compared to multi-person households. Figure 3 shows preferences of the country of origin.

Figure 3 *Are you interested in purchasing pork on its origin?*
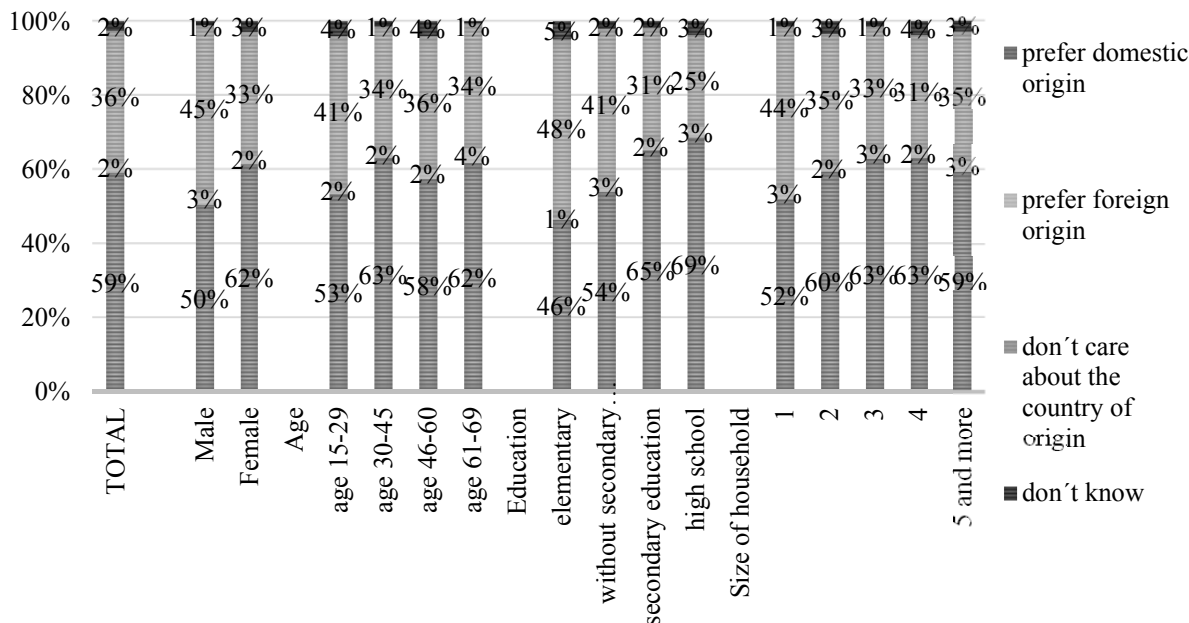
Source: GfK Czech, authors' calculation

Total of 59% of respondents prefer domestic pork meat production (Figure 3). About one-third of respondents don't know or don't care about the country of origin. With the growing age of the consumer, there is no growing preference of domestic origin, but age groups of 30-45 years and 61-69 years prefer it more. The greatest emphasis on domestic origin is the age group of 30-45 years (63%). If we evaluate the response set according to the respondent's educational attainment, then with the growing education there is a greater interest in domestic meat production and reduction of indifference, respectively ignorance of origin. Most of the tertiary-educated respondents are interested in the domestic country origin (69%). In terms of household size, there is a slight increase in interest in domestic production and a decrease in the lack of interest in origin in the size category of 1-4 members. The proportion of families with five or more members who are not interested in meat origin is growing. Over the last three years, there have been more significant changes in respondents' categories divided by gender, age, education and household size. Approximately 30-40% of respondents (by category) now prefer domestic products more than foreign. Abroad, there is growing interest in information on country of origin and food labelling. The country of origin is an important factor that affects the brand of the product and can also provide a competitive advantage (Balcombe, 2016). Results of Hersleth et al. (2012) showed that the country of origin is an important factor for consumers to buy, with home-like preference being preferred.

4 Conclusions

The objective of the article was to characterize consumers' preferences concerning pork meat on a representative dataset. Moreover, authors identified the factors that limit the purchase of meat. The most important factors for consumers' decision when buying meat are freshness, quality and price. Surprisingly, due to the long-term boom of organic farming for consumers, the quality of product or animal welfare is of relatively low importance.

The questionnaire survey showed that there are changes in place of purchase of meat and meat products, which also differ according to the characteristics of the consumer. A decrease in the purchase of meat and meat products in the butcher's is evident in general. Alternatively, purchase of meat packaged or counter sales in wide-assortments stores has been increasing. Pork is bought mainly by women on the counter or as packaged. Men prefer buying packaged meat and buying meat at a butcher. As the consumer's age grows, there is an increase in butchers' sales at the expense of counter sales. This is mainly the category of consumers aged 61-69 years.

The questionnaire survey revealed that most respondents prefer the domestic origin of production, respectively meat and meat products. About one third of respondents do not care about the origin of the production. Females prefer Czech origin more than men. Considering the age of the consumer, the growing age does not give rise to a greater preference of domestic origin. The same rule applies when speaking about the size of the household. On the contrary, there is a growing interest in domestic production of meat and meat products with growing education. Over the last three years (2012-2015), around 60% of respondents did not change their preferences regarding the country of origin when purchasing meat and meat products. People with elementary education or single-person households are least interested in

the origin of the products. Therefore, it would be advisable to target these consumer groups and to increase their interest in domestic production.

It can be concluded that the information campaign on the quality of meat and meat products and the country of origin preference has had a greater impact on consumers with higher education who also have the financial options to prefer quality over the price compared to low income groups of the population.

Acknowledgement

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The Czech Republic Farmland Fund Balance Modeling Considering the Arable Land Declines

Radka Procházková, Marie Prášilová

Abstract: *The agricultural land fund is an irreplaceable production factor being the principal component of the environment. Cultivated farmland area in the Czech Republic is decreasing continually. The question of self-sufficiency in basic foodstuffs production is important for every country, hence the most efficient use possible, of the farmland fund, too. Foodstuffs and feed product- ion depends upon the land area per capita of the population, available to the State, upon the farmland quality or upon agriculture intensification. There is 0.42 ha of farmland available per capita in the Czech Republic, of which 0.30 ha is arable land. Considering insufficiency of the Czech Republic in basic foodstuffs production, a further decline of the Czech agriculture production capacities is undesirable.*

The main aim of the paper is statistical analysis and modeling of the farmland fund balance in the Czech Republic. The solution is based on available databases of Czech Statistical Office, Department of Agriculture of the Czech Republic and the Eurostat. As a statistical instrument of the balances and forecasts, the adaptive time series models have been applied, the Holt model of exponential smoothing especially. A partial goal of the paper is the identification and analysis of factors causing farmland degradation and arable land area decline especially. The degradation process causes a chain reaction in most cases, and the degradations are linked to each other. Soil sealing connected with uncontrollable expansion of settlements currently is, together with erosion, the biggest problem of farmland. Over the last 50 years (since 1966) the largest decline affected the arable land, namely about 400 th. hectares.

Key words: Arable Land · Agricultural Land Fund · Farmland Degradation · Exponential Smoothing Methods · Prediction · CR · EU

JEL Classification: C22 · Q10 · Q15

1 Introduction

Soil is the basic means of production for the agricultural primary production. Definition of the CR agricultural land fund and its breakdown is given by the Act No. 334/1992 Coll., on the Protection of Agricultural Land Fund.

Landlords and land tenants are, by law, the main agents responsible for protecting the agricultural land fund. As it has been pointed out (Píšková, Touš, 2013), the situation in the Czech Republic is consider-ably complicated by the high share of rented farmland (76 % of the area being leased) and a low legal awareness of the land protection needs, especially on the part of the owners and tenants. The unfavourably too long interruption of ownership relations is being felt here.

Agricultural land fund quality is measured based on the agricultural land fund bonitations. The agricultural land fund of the Czech Republic is predominantly found in less favourable soil-climatic conditions. From a pan-European point of view Czech agriculture belongs to the sub mountainous up to the mountainous type. A larger part of the agricultural land fund, i.e., 60 %, is located on the less fertile down to infertile soils. 40 % of the arable land are above average of fertility. Out of those 60 % of land area there are 53 % below average of fertility and 6 % of arable land is an area quite unsuitable for farming (Report, 2015). In spite of the area of Czech Republic remaining since 2000 almost unchanged (Dec. 31, 2015 data giving 7,886,973 hectares), the farmland fund area dropped over the same period by 67,941 hectares. The share of farmland on the total area has gradually been reduced in favour of non-agricultural land. Changes in the level and structure of agricultural land fund have been caused by heterogeneous factors. Most often these are the climatic, natural, ecological, economical or socio-political factors. Accidental climatic factors can have a disastrous impact on the quality of farmland. The authors (Nowak and Schneider, 2017) have analysed three types of agricultural soils environmental degradation and they are looking for a way of the assessed risks elimination. These are: erosion, flood and loss of nutrients in the soil. The global demand for farm products is growing but farmland area is dropping.

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As the authors (Levers, Butsic, Verburg, Mueller and Kuenmerle, 2016) make us aware, this contradiction will require a further intensification of agricultural production, but using new instruments. These should be aimed at gentle handling and maintenance of the existing land fund. Based on the expected expansion of population numbers and the current tendencies in land fund transfers in the area given, authors (Ivan and Chebenova, 2016) offer a model of ecological stability considering changes in the land fund structure.

Agriculture and the landscape of Czech country have changed much over the last 60 years. Mainly the collectivization and consolidation of lands negatively affected the natural balance of ecosystems. Authors (Homoláč and Tomšík, 2016) offer the political connections, leading into the new ownership relationships after 1989. Large plots with small amounts of landscape elements are typical for farmed landscape in CR. Such areas then are excessively endangered by soil erosion. Owners and tenants of land are, according to law, the principal agents responsible for protection of the agricultural land fund. In the CR, however, the situation is very complicated by a high share of rented land (74 % of farmland area is rented). 70 % of land is farmed by legal entities, the rest are selfemployed farmers or natural persons. The too long interruption of ownership relations is still unfavourably reflected in some primary producers in the relation to soil and in the neglect of soil protection (Píšková and Touš, 2013). As Doucha (2015) is putting it: „Agricultural land use in the context of soil protection belongs to the most discussed topics in the Czech Republic – especially at present, when the negative consequences of the land ownership changes in the previous generations cause significant problems to the agriculture. The consequences of poor access to land use are reflected in the increasing erosion risks, the decreasing biological activity, the compaction of soil, etc.“ The soil quality deteriorates under the impact of degradation factors. There are significant changes appearing due to accelerated erosion, contamination from industrial production, mining and transport, soil compaction, organic matter loss, land closure for construction and acidification. Significant soil functions in the environment (production, filtration, accumulation, transformation, remediation, buffering, and environment for organisms) are impaired. In the CR, 67 % of the farmland area are potentially threatened by some form of water erosion. The most threatened soils are on 35 % of the CR area. Currently, the minimum soil loss in the CR has been established at about 21 million tons of topsoil annually, which can be expressed as an economic loss of at least 4.3 billion CZK. About 18 % of farmland in CR is potentially endangered by varying strength of wind erosion. The agrarian structure depends not only on the character of agricultural development, but on the access to different resources, too. Land use structures may vary substantially over time (Strojny and Piecuch, 2017).

Píšková and Touš (2013) call the irreversible loss of land area a serious problem with all the negative impacts. The matter is in the growing extent of raw materials extraction (especially gravel pits), the construction of warehouse areas, hypermarkets, residential housing areas etc., on the farmland. Built-up areas contribute to the disruption of water regime in the landscape, including the risks of increasing the frequency and extent of floods or the lack of water in the environment. Land seizures are directed mainly on flat areas with fertile soil, along roads and in the vicinity of towns. Pletichová and Gebeltová (2015) have pointed out that, the productive capacity decline of soils is influencing generation of the farmers´ incomes and the effective use of farmland, it causes its qualitative and quantitative degradation and it damages the competitiveness of Czech agriculture.

The protection of land is an essential part of EU agricultural policy. Currently is underway in the most EU Member States the soil degradation that threatens their sustainable use (Borská, Kadlecová, 2015). Interest in Agricultural Land Fund protection is a part of the environmental protection policy within the EU. However, protection of land as such remains fully within the competence of individual states.

2 Methods

Using advanced statistical methods from the domain of time series analysis adaptive approaches, the long-term development tendencies of the agricultural land fund structure over the 1999-2015 period have been described. These are considered in the context of historical data from the 1920-2015 years and future development forecasts are being constructed based on them. Besides trend functions, the adaptive models, too, have been applied in the trend description. Models of this type quickly react on the structural changes occuring in time and they are very suitable for prognosticating the future course of the time series loaded by irregularities and breaks in the trend.

The adaptive models start from the presumption that, the latest data from a time series are those most valuable for the future development forecast construction (Hindls, Hronová, Seger, Fischer, 2008). Therefore, the most actual data of the time series obtain the heaviest weights and the previous data either are quite excluded from study or they obtain lesser weights. In the present study, one adaptive approach has been exploited actually, the exponential smoothing method, that is. The parameter estimates can be obtained using the least squares method in the following format:

$$\sum_{k=0}^{n-1}\left(y_{n-k}-T_{n-k}\right)^{2} w_{k} = min,$$ (1)

where: y_{n-k} are the empirical values at the (n-k) moment,

$k = 0, 1, . . , n-1$ is the age of the data at the moment n,

T_{n-k} is the trend component at time (n-k),

w_{k} are the weights that are inversely proportional to the „age" of the data, i.e., with the age growing, the weight is decreasing.

It is assumed at that time that, the w_{k} weight is an exponential function of the type:

$$w_{k} = \alpha^{k}, \quad 0 < \alpha < 1, \quad k = 0, 1, ..., n-1,$$ (2)

where the α quantity is the balancing constant.

As it is clear from the (2) relationship, the weights w_{k} are an exponential function of the age of the data. Smoothing of time series based on the principle shown is called the exponential smoothing. Estimates of the trend model component T_{n-k} can be obtained using the minimized expression:

$$\sum_{k=0}^{n-1}\left(y_{n-k}-T_{n-k}\right)^{2} \alpha^{k}.....min.$$ (3)

For prediction of the T_{n-k} trend type two exponential smoothing methods have been used. For non-seasonal time series with constant trend in short sections of the series the Brown method has been used, with the α smoothing constant from (0 ; 1) interval. In case, the trend in short sections was approximately linear, the procedure was a double exponential smoothing procedure. In case of the Holt smoothing procedure, two smoothing constants, α and γ are being estimated, from the (0 ; 1) interval. The α constant is used for smoothing of the time series level (S_t), the γ constant for the (T_t) trend quantity balance.

$$\alpha_{Holt} = \alpha(2-\alpha); \quad \gamma_{Holt} = \frac{\alpha}{2-\alpha}$$ (4)

The α parameter adjusts the level of adaptation and it means, the higher is its value, the faster the method reacts on changes in the data. The γ parameter defines the levels of smoothing of the local linear trends (Montgomery, Jennings and Kulahci, 2008).

Real economic criteria should form the basis for decision making based on the appropriate trend function type. Finding the appropriate trend function type is then mostly dependent on the analysis of empirical data. The paper offers a criterion based on the comparison of sums of squares of deviations of the empirical time series values from the smoothed ones − Mean Absolute Percent Error MAPE (Hindls, Hronová, Seger, Fischer, 2008). Statistical computations have been performed in the STATISTICA software, version 13, environment.

3 Research results

The area of cultivated farmland in the Czech Republic is decreasing continually. Since the year 2000 till 2006 the decrease made it almost 148 th. hectares. According to the structural survey on agricultural subjects the average area of agricultural subjects fell from 136 down to 130 hectares. The shape of an average agricultural subject in 2016 is shown in the Figure 1. As to the last international comparison of 2013, the Czech Republic has gained several exclusive positions within the European Union. It has occupied first places: in the average area of farmland per one subject (133.0 hectares; the EU28 16.1 hectares); in the share of subjects above 500 hectares (6.9%; the EU28 0.3%); in the number of workers per one agricultural subject (5.0 persons; the EU28 2.0 persons) and in the share of rapeseed areas (11.9% of arable land; the EU28 3.9%).

Figure 1. Primary production structure of an average agricultural subject in the Czech Republic in 2016
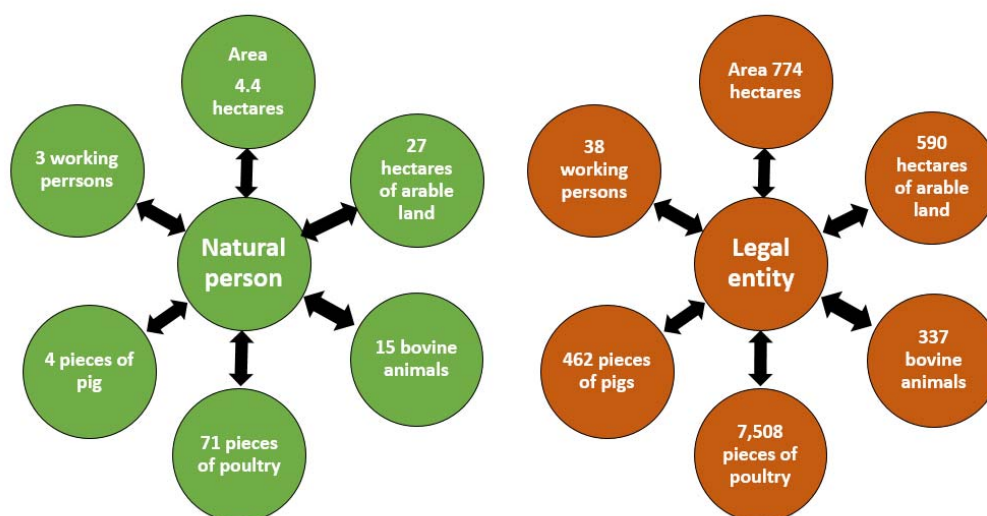
Source: Authors, using Czech Statistical Office, data 2017

3.1 Loss of the farmland in CR

Total area of the agricultural land fund of the Czech Republic as of Dec 31, 2016 was 4,208,374 hectares, which is 53.4% of the CR land fund total area (7,886,973 ha). Farmland area is permanently declining. The largest decreases took place in the Fifties till Seventies of the 20th century, following the farmland seizures for construction of buildings, transport networks and establishment of the surface and underground mines. Following the loss of the predominantly most fertile land, agriculture began to spread through the Seventies of the last century to less productive zones. Since 1990 until 2000 the loss of farmland was comparatively small and uniform (approximately by 1 thousand hectares annually). The sudden increase of the agricultural land fund area in 1997-1999 (total increase of four thousand hectares) results from the more accurate land fund record, when the areas formerly recorded as „other land" were included into the agricultural land category. Since 2000 till 2007 the loss of farmland increased, by about 4 to 5 thousand hectares annually. This loss is due first of all to transfers to the „other" and „construction" areas (construction of line structures – motorways, industrial zones etc.) and to the land intended for forest functions (forest land).

Since 1921 the farmland area lost 886 thousand hectares, which is a loss of more than 20%. The development of changes in the farmland structure since 1995 is shown in the Table 1.

Table 1 Land use in Czech Republic (ha)

State	Land area (ha)			Change (%)		Predictions*			
	1995	2005	2015	2005/1995	2015/2005		2020		2025
Arable land	3 142 642	3 047 250	2 971 957	-3,04	-2,47	↓	2 928 501	↓	2 887 210
Gardens	158 698	161 811	163 785	+1,96	+1,22	↑	165 797	↑	167 152
Orchards	50 091	46 992	45 613	-6,19	-2,93	↓	44 546	↓	43 492
Hop fields	11 425	10 967	10 149	-4,01	-7,5	↓	9 927	↓	9 655
Vineyard	15 632	18 907	19 811	+20,95	+4,78	↑	20 731	↑	21 664
Permanent grassland	901 333	973 791	1 000 620	+8,04	+2,76	↑	1 063 575	↑	1 093 265
Agricultural land total	4 279 823	4 259 481	4 211 935	-0,48	-1,12	↓	4 189 835	↓	4 167 873
Forest land	2 630 129	2 647 417	2 668 392	+0,66	+0,79	↑	2 670 727	↑	2 678 680
Built-up areas	129 294	130 077	132 119	0,61	+1,57	↑	133 408	↑	134 715

Source: Source: authors, using Czech Statistical Office, 2017
*Own estimates based on the exponential smoothing

Since 2000 to the present, 67,941 hectares of farmland have been lost, i.e., 11.6 hectares daily, at average. Partially (of 55%) this loss is caused by expansion of the forest areas and water areas. The extent of forest land expanded over the period 1990 till 2000 by 7 thousand hectares. A larger part of the increment follows the more accurate land fund record and the transfer of areas afforested by spontaneous air seed from the original farmland category into the forest land, especially in mountainous regions. Since 2000 till 2010 a significantly larger increase of forest areas appears, namely by 20 thousand hectares. Between 2010 and 2015 expanded the extent of forest land more rapidly, by 11 thousand hectares (mostly this was caused by the afforestation of low productivity areas and enclaves of unused farmland).

However, the losses of farmland have been caused by development, too. In 2006 already, the CR was found above average of the EU Countries as to the extent of covered surface per year (243 m^2 per head). Considering the location of Czech Republic in the middle of Europe, there is a considerable interest of private developer companies in continued surface coverage aimed at construction of transition centres and warehouses. Thanks to the Amendment to the Land Fund Protection Act certain success has been reached so far in slowing down the area coverage growth rate.

3.2 Decrease in arable land area in the Czech R. and decrease of arability in international comparison

Arable land covered 2,965,606 hectares in CR on Dec 31, 2016 (i.e. 37.6% of the total farmland area). Since 2000 there has been a considerable loss of arable land (117,000 hectares total). The loss of arable land is demonstrated, using both the current and predicted values from the Table 1. The adaptive model applied here showed MAPE = 0.3889%.

The percentage of arable land on farmland area has been decreasing slowly over the years and it was 70.5% at Dec. 31, 2016. In comparison with other EU Countries this is one of the highest figures. Higher levels within EU in the year 2014 comparable were recorded in Poland, Latvia, Hungary, Sweden, Malta, Denmark and Finland. As given by Pletichová and Gebeltová (2015), the common agricultural policy within the EU Countries motivates the farmers to the extension of permanent grassland areas using subsidies. The percentage of arable land on farmland area is decreasing and slowly increasing is the permanent grassland area in the CR what can be seen in the Table 1. Over the Sixties till Seventies of the last century the permanent grassland area decreased, plowing up was taking place. Since the start of the Nineties only, the increase of permanent grassland areas has taken place, on the contrary. The highest year-to-year increase within the period studied was recorded in 1966, 44 thousand hectares namely, what makes it an increase by 5%. After 2000 the permanent grassland areas go on increasing at a slower rate, at an average of 2.8 thousand hectares annually. While in 1995 the permanent grassland areas covered 21.1% of farmland area, in 2015 the share was 23.8%, with an increment of almost 100 thousand hectares.

4 Conclusions

According to the Czech Statistical Office data, since 1989 lost the agricultural land fund more than 84 thousand hectares (a loss of 2 %). The time series adaptive models chosen show a further decrease of agricultural and arable land in the CR and they offer a significant fundament for further aiming of the primary farm production and the Czech agrarian policy. To a degree this decrease is caused by the expansion of forest areas and water areas and partially by development. The built-up land irretrievably loses not only its own production capacity, but it also ceases to fulfil ecological functions. Outcomes of the analyses are in line with conclusions by Borská and Kadlecová (2015). „Disposals essentially do not relate to forest land plots, as to preferably remove arable land is also tempting because it is easier and can be used for development without added costs. Forest land needs to be modified, and this increases the initial costs by harvesting timber and removing roots. Likewise, land plots with old disused buildings (in particular in the suburbs) are not attractive, as the cost of removing unnecessary structures, liquidation and landfilling are also economic brakes". Also Píšková and Touš (2013) warn that, frequently the highest quality plots are being built over. Soil sealing together with uncontrolled expansion of housing estates and with erosion currently create the biggest problem of the agricultural land fund. Among the soil sealing causes there always are, according to Pletichová and Gebeltová (2015) and Píšková and Touš (2013) comparatively low prices of plots, when it better pays to the developers to build on the greenfields, than to exploit the more expensive plots in the built-up area of the town or to regenerate older buildings (the so-called brownfields). Through the loss of farmland also biodiversity in the area decreases, relief of the territory changes as well as the complete face of the landscape. New buildings also bring a potential danger of contamination of the neighbourhood by waste water and the environmental burden by increased traffic volumes.

The percentage of arable land on farmland area in the CR is decreasing and the areas of permanent grassland slowly expand, what is in line with the EU Common Agricultural Policy, motivating farmers to the expansion of permanent grassland areas using subsidies. By the way, according to the analyses by Pletichová, Gebeltová (2015), the relationship between the volume of subsidies paid (SAPS+TNA, AEM, LFA) and the soils production capability change (difference GARE) has not been confirmed.

The Strategic Framework of the Czech Republic until 2030 supports indirectly the total loss of arable land. However, this should concern the low quality land with low yields. The State also should go on, according to the Strategic Framework, supporting transfers of arable land into the ecologic farming regime. Currently, only about 2 % of the Czech arable land area have fallen there.

The question of self-sufficiency and efficient exploitation of the agricultural land fund is important for every country. Foodstuffs and feed production are directly connected with the acreage of farmland. The Czech Republic has reported the decrease of farmland fund acreage on a long-term basis and the forecast models chosen have extrapolated this trend.

The market itself is able to appreciate instant, not lasting, values. Effective protection of land can only be ensured by State regulation. According to Borská, Kadlecová (2015) increasing payments for exclusion of land from the Agricultural Land Fund, which has been approved, is a step in the right direction, but it is in-sufficient. The value of removed and permanently destroyed land should be comparable to its yield over thousands of years, and its water management, climatic and aesthetic functions must be taken into consideration. During the last decade, Europe is experiencing intense land degradation that is caused or worsened by human activities. Enough fertile land is a prerequisite for the survival of future generations. The point is for the losses to become smaller, or even for there to be no losses at all.

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The Performance of Grape Wine Production and Trade in the Czech Republic

Nahanga Verter, Věra Bečvářová

Abstract: *Given that grape is an integral agrarian input for wine production in the Czech Republic, and wine is largely produced in the Moravia region and consumed across the country, this article attempts to assess the performance or trends of its production and trade in recent decades. The descriptive findings suggest that the grape area harvested, yields, prices, winemaking and consumption may have implications on production and trade in the Czech Republic. The statistical data also show that Czech wine export (of fresh grapes) has been highly volatile as it has concentrated in only two economies that shared border with the country. Similarly, the country has been a net importer of wine as consumption outweighs production, implying that there is room for more production and export. Export promotion should be encouraged and diversified beyond the EU markets. Arguably, this measure may well reduce external demand/market volatility or shocks, enhance competitiveness and accelerate foreign earnings for grape wine producers, and traders in the country.*

Key words: Area Harvested · Czechia· Export · Import· Yield

JEL Classification: Q10 · Q15 · Q17

1 Introduction

Grape (vitis vinifera) as a kind of fruit, deciduous woody vines that grow in clusters, is industrial product widely planted by both smallholder and large-scale farmers worldwide. Globally, the fruit is substantially used for winemaking. The product is also eaten fresh or used for raisins, juice, vinegar, jelly, seed oil, and seed extract. Czech Republic (Czechia) is widely well-known for wine and beer production, and consumption. The most important input (plant) used for winemaking in the Czech Republic are grapes, substantially grown in the South Moravian region of the country (Žufan, 2004; Hejmalová and Šperková, 2011; Kučerová, 2014; Syrovátka, Chládková and Žufan, 2015), thus, Czech wine is widely referred to as Moravian wine. Prior to the Czechia joining the European Union (EU), there were high expectations that all facets of agricultural activities, such as grape production would be improved. Wine grape industries, and small holder farmers expected that date with a specific strategic hope, that through the EU Common Agricultural Policy (EU CAPs), their productivity and competitiveness would be intensified (Tomsik, 2002). Similarly, after accession in 2004, the total acreage of vineyards steadily improved. The structure of the grape wine on and industry changed in the positive direction. In 2004, the applicants for subsidies received 25,423 thousand CZK, and the amount increased to 78,662 thousand CZK in 2009/2010 (Sedlo and Tomsik, 2012). Nonetheless, grape out in Czechia has not substantially improved as expected, implying that there are factors that have undermined its development.

Various factors may well impact grape production, and those factors vary from region to region within a nation or nation to nation, their unique denominator is the aspects of nature. Grapes are specifically sensitive to climate change because of the intrinsic connection between the climate and its features. The climate change would affect the quality of grapes produced (Berli et al., 2008; Webb, Whetton and Barlow, 2008; de Orduna, 2010; Vlahović, Potrebić and Jeločnik, 2012; van Leeuwen and Darriet, 2016), as well as the quantity, yield per hectare (Bindi et al., 1996; Bock et al., 2013; Mozell and Thach, 2014; Petrović, Krstić and Stanišić, 2015; Fraga et al., 2016), frost injury and ice damage, diseases, labour cost and availability (Centinari et al., 2016), technology, consumption patterns (Žufan, 2004), and price in countries such and the Czech Republic and Slovakia (Tomsik et al., 2016). Although previous studies have attempted to underline that factors that influence grape cultivation and output in countries, recent descriptive studies on this topic is needed, thus, the rationale for this study. This study is an attempt to add to the available body of research related to grape wine performance in Czechia. This current study aimed at assessing position of Czechia in grape wine production and trade with reference to other major producing economies. The study also aimed at highlighting the possible prospects and challenges of the sector in the country in recent decades. This article is structured as follows: part 1 presents an introduction, part 2 presents methods, while part 3 presents descriptive analysis. Finally, part 4 concludes the study and profiles some recommendations.

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2 Methods

The statistical data for the study are obtained from the reputable organizations as follows: Food and Agriculture Organization of the United Nations (FAOSTAT); Czech Statistical Office (CSO); and International Trade Centre (ITC). The study is both descriptive in nature. The descriptive analysis for the period 1993-2016 as presented in tables, figures and percentages shows the trends in grape wine production, trade, and consumption in the Czech Republic.

3 Research results

3.1 Grape and wine production

Area harvested: Grapes as integral agrarian input in winemaking, its global area harvested, rather than increase, slowly declined from 7.6 million hectares in 1993 to 7.1 million hectares in 2014. Notwithstanding, except for the EU (or Europe as a whole), area harvested in China, the USA, Asia, Africa and Americas increased within the period under study. Grape cultivation in the EU substantially decreased from 4.3 million hectares (or 56.2% of the world cultivated) in 1993 to 3.2 million hectares (or 44.7% of the world cultivated) in 2014 (Table 1). The downward trend is partially because of the EU's CAP effort to curtail overproduction of the product.

Despite the downward trend in Europe in general, and Spain, in particular, the country (Spain) has been the largest cultivator of grape in the world regarding area harvested (13% of global cultivated), but was the second largest producer of the product in raw quantity output (9.3% of the world cultivated) in 2014 (Table 1 and Table 2). It implies that China, France, Italy, and Spain are the largest producers of grapes partly owing to their large farms relative to other producing economies. Although the grape area planted in Czechia has been far below the largest producers, and has been fluctuating over the years, the country's area harvest increased from 11 thousand hectares in 1993 to 16 thousand hectares in 2010, before slightly sliding to less than 16 thousand hectares in 2014. Similarly Czech share (% of global area harvested) slightly rose from 0.15% in 1993 to 0.23% in 2010, and then declined to 0.22% in 2014. On the hand, Slovakia drastically reduced from about 27 thousand hectares in 1993 to about 9 thousand in 2014 (Table 1).

Table I Grape area harvested (ha, '000) and global share (%) in the CR and some leading producers in 2014

Year/	1993		2000		2005		2010		2014	
economy	ha	Share	ha	Share	ha	Share	ha	Share	ha	Share
Spain	1,235.0	16.3	1,167.7	15.9	1,161.4	15.8	1,002.1	14.2	931.1	13.1
China	139.0	1.8	286.1	3.9	411.3	5.6	555.1	7.9	770.1	10.8
France	902.0	11.9	861.0	11.7	854.8	11.6	771.5	10.9	757.9	10.6
Italy	948.3	12.5	872.7	11.9	793.0	10.8	777.5	11.0	702.9	9.9
Turkey	567.0	7.5	535.0	7.3	516.0	7.0	477.8	6.8	467.1	6.6
USA	307.5	4.1	383.0	5.2	378.3	5.1	385.2	5.5	418.6	5.9
Czechia	**11.1**	**0.15**	**11.2**	**0.15**	**14.2**	**0.19**	**16.0**	**0.23**	**15.8**	**0.22**
Slovakia	26.8	0.35	17.5	0.24	13.1	0.18	8.2	0.12	8.8	0.12
World	7,574.3	100.0	7,337.5	100.0	7,373.0	100.0	7,047.8	100.0	7,124.5	100
Americas	768.8	10.1	872.8	11.9	909.9	12.3	957.6	13.6	1,003.8	14.1
Africa	315.7	4.2	308.1	4.2	336.0	4.6	325.4	4.6	350.2	4.9
Asia	1,638.4	21.6	1,660.4	190.2	1,788.1	24.3	1,832.1	26.0	2,100.3	29.5
Europe	4,787.1	63.2	4,375.4	59.6	4,164.8	56.5	3,735.5	53.0	3,498.6	49.1
EU	4,256.2	56.2	3,979.2	54.2	3,778.4	51.2	3,391.3	48.1	3,181.4	44.7

Source: Own processing based on FAOSTAT. Notes: share= proportion (% of global area harvested)

Yields: In terms of yield per hectare, data available from FAO (2017) indicate that, Vietnam recorded highest in grapes yield (hectogramme per hectare) in the world, followed by Egypt, India and Peru, while the USA recorded 9th, China 11th, Italy 32nd, France 43rd and Spain 52nd positions in the world in 2014. As presented in Table 1, and Figure 1, some of these countries, among the leading producers of grapes not only due to their yields per acre, but also area harvested, where the reverse has been the case in Slovakia (70th) and the Czech Republic (75th). Generally, in advanced economies, grape yield per hectare has increased as a result of efficient use of advanced technologies coupled with modern farm inputs. Surprisingly, grape yield per hectare in Czechia and Slovakia is below not only the EU levels, but also the world and African averages. Given that these countries are also advanced not just economically, but also in agriculture, it is rather surprising that their performance with regards to yield per hectare has lagged behind global and African averages. Why this sluggish performance? Soil fertility and climate change have been identified as among the constraints militating yield per hectare (Bindi et al., 1996; Bock et al., 2013; Fraga et al., 2016) in Czechia (Sedlo and Tomsik, 2012). Sadly, grape farmers hardly receive any compensation when their output falls due to adverse weather conditions (Tomsik et al., 2016). Nevertheless, looking at area harvested, Czechia and Slovakia still have a great prospect to increase annual production for domestic consumption, earnings and competitiveness.

Figure 1 Grape yields (hg/ha) in Czechia and some leading producing countries, 1993-2014
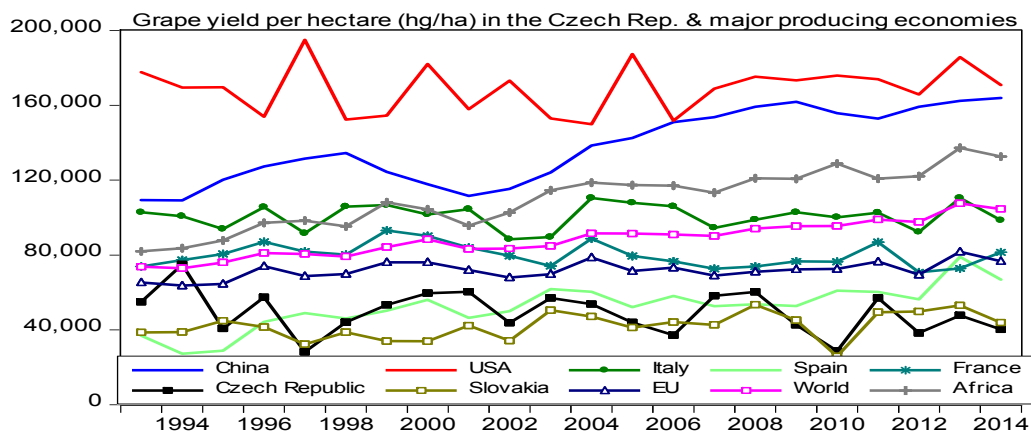
Source: Own processing based on FAOSTAT

Grape output: The global grape output rose from about 56 million tonnes in 1993 to 74.5 million tonnes in 2014. This upward trend has been recorded partly because of the high demand for the product in both cultivating and consuming economies. Despite the numerous challenges that grape farmers have faced, the fruit crop is still a major input for wine and fruit juice processing not just in the Czech and Slovakia Republics, but also in other producing and importing countries. The statistical evidence also shows that even though the EU share of grape production dwindled from about 50% (28 million tonnes) of global grape output in 1993 to about 33% (24 million tonnes) in 2014, it is still substantial as it is up to 1/3 of the world's output (Table 2). As earlier pointed out, it is important to reiterate that EU's production and competitiveness in the world fluctuated partly because of its agrarian measures, via Common Agricultural Policy (CAPs), which to some extent attempts to curtail/reduce (control overproduction) or stabilize (or increase) some agrarian production, such as grape. Also, under the auspices of the WTO, the EU CAPs (Czech included) has been compelled to reduce domestic support to its producers and export subsidies that distort global agricultural market signals.

Table 2 Czechia, Slovakia and five major global grape producers (quantity, tonnes, '000) in 2014

Year/ economy	1993			2000			2008			2010			2014		
	Qty	Rank	Share	Qty	Rank	Share	Qty	Rank	Share	Qty	Rank	Share	Qty	Rank	Share
China	1,520	8	2.72	3,373	6	5.20	7,236	2	10.73	8,652	1	12.85	12,628	1	17.0
USA	5,464	3	9.78	6,974	3	10.75	6,640	3	9.84	6,778	3	10.07	7,152	2	9.60
Italy	9,750	1	17.46	8,870	1	13.68	7,793	1	11.55	7,789	2	11.57	6,931	3	9.30
Spain	4,568	4	8.18	6,540	4	10.08	5,952	5	8.82	6,108	4	9.07	6,223	4	8.35
France	6,657	2	11.92	7,763	2	11.97	6,019	4	8.92	5,894	5	8.75	6,173	5	8.29
Czechia	**61.10**	**53**	**0.11**	**66.94**	**53**	**0.10**	**98.32**	**53**	**0.15**	**45.92**	**59**	**0.07**	**63.53**	**56**	**0.09**
Slovakia	103.50	49	0.19	59.37	58	0.09	51.62	58	0.08	21.12	69	0.03	38.45	63	0.05
World	55,853	-	100	64,849	-	100	67,455	-	100	67,325	-	100	74,500	-	100
Asia	11,742	-	21.0	14,541	-	22.4	18,974	-	28.1	20,089	-	29.8	26,378	-	35.4
Americas	10,271	-	18.4	13,124	-	20.2	14,134	-	21.0	14,316	-	21.3	14,841	-	19.9
Europe	30,418	-	54.5	32,576	-	50.2	27,814	-	41.2	26,781	-	39.8	26,636	-	35.8
EU	27,811	-	49.8	30,304	-	46.7	25,546	-	37.9	24,621	-	36.6	24,400	-	32.8

Source: Own processing based on FAOSTAT. Notes: Rank= global ranking; share= proportion (% of global production)

Just as the EU's sluggish performance, the volume of grape output in the Czechia and Slovakia also steadily declined from 164.6 thousand tonnes or accounting for 0.33% (Czechia 0.11% and Slovakia 0.19%) of global output in 1993 to about 102 thousand tonnes or accounting for 0.14% (Czechia 0.09%, and Slovakia 0.05%) of global quantity production in 2014 (Table 2). This shows that the trend in grape output and the positions of these two countries in the world have changed tremendously in the opposite direction during the period under study. Nonetheless, Czech performance has surpassed Slovakia during the period under review.

Wine production: Global wine production rose from about 26 million tonnes in 1993 to over 29 million in 2014. Notwithstanding, as experience in grape output, even though the Italy, Spain and France recorded as the first, second, third largest wine producers in the world their annual output declined during the period under review. As earlier mentioned, this is partly attributed to the EU's effort to curtail overproduction of the production. Although Czechia ranked 30th in Wine production in the world, it's annual wine output has steadily increased, albeit at a slow pace, global share has remained the same (Table 3). Also, given that Czechia is a net importer (Table 4 and Table 5), there is a need for the country to intensify its production to meet domestic demand and export.

Table 3 Czechia, Slovakia and top wine producers (tons, share) in the world in 2014

Indicators		1993		2010		2014	
Rank	Economy	tonnes	share	tonnes	share	tonnes	share
1	Italy	6,267,160	24.20	4,469,318	16.54	4,796,600	16.48
2	Spain	2,650,700	10.24	3,610,000	13.36	4,607,850	15.83
3	France	5,331,440	20.59	4,531,671	16.77	4,293,466	14.75
4	USA	1,944,100	7.51	2,711,000	10.03	3,300,000	11.34
5	China	500,000	1.93	1,600,000	5.92	1,700,000	5.84
30	**Czechia**	**45,490**	**0.18**	**46,276**	**0.17**	**52,000**	**0.18**
36	Slovakia	56,050	0.22	27,785	0.10	32,527	0.11
	World	25,895,265	100	27,028,149	100	29,105,841	100

Source: Own processing based on FAOSTAT. Notes: Rank= global ranking; share= % of global output

3.2 Grape wine trade

Historically, Slovakia and Czechia has experienced intra-industry trade in wine products, as both countries have been the largest trading partner with one another (Kučerová, 2014). Nonetheless, wine trade between the two economies has not been solely depended on domestic production. Evidence from studies have proven that imported wine varieties to these countries are re-exported (Tomsik and Sedlo, 2013). Table 4 presents the top export destinations for Czech and Slovak wine of fresh grapes (2204) in 2016. Slovakia, Poland, China, and Germany, accounted as the leading wine of fresh grapes importing countries from the Czechia. A critical look at the export destination shows that Czechia is concentrated in only two countries, Slovakia 43% and Poland about 27% (or 60% in both countries). Arguably, the vulnerability of Czechia to shocks within its destination partners has been intensified. This might be partially the reason why the average export growth rate (quantity) for the period 2012-2016 was -23% in the country.

Table 4 Top importing markets for wine of fresh grapes (2204) from Czechia in 2016

Economy/ Indicator	Export 2016 ($ '000)	Bal. 2016 ($ '000)	Share in exports (%)	Qty (tonnes) exported 2016	Export growth-value 2012-16 (%)	Export growth- qty 2012-16 (%)	Export growth-value 2015-16 (%.)	Average tariff faced (%)
World	25,647	-173,976	100	10,957	-12	-23	-13	-
Slovakia	11,088	2,903	43.2	6,583	-24	-30	-39	0
Poland	6,839	6,828	26.7	2,496	13	11	73	0
China	1,524	1,509	5.9	53	0	-26	1,261	14.7
Germany	1,238	-17,435	4.8	382	161	233	-26	0
Switzerland	840	821	3.3	60	123	112	-45	13.4

Source: Own processing based on ITC trade map

Table 5 Top supplying markets for wine of fresh grapes (2204) imported by Czechia in 2016

Economy/ Indicator	Import 2016 ($ '000)	Bal. 2016 ($ '000)	Share in imports (%)	Qty impor- ted 2016	Import growth-value 2012-16 (%)	Import growth- qty 2012-16 (%)	Import growth-value 2015-16 (%.)	Average tariff faced (%)
World	199,623	-173,976	100	170,079	-4	2	3	-
Italy	50,343	-50,308	25.2	46,283	-4	1	12	0
France	36,489	-36,484	18.3	9,455	-7	-1	5	0
Spain	28,211	-28,043	14.1	43,206	4	16	-10	0
Germany	18,673	-17,435	9.4	10,018	9	11	6	0
Hungary	18,461	-17,735	9.2	21,704	7	15	-1	0

Source: Own processing based on ITC trade map

On the other hand, supplying markets for wine of fresh grapes (2204) imported by Czechia in 2016 as presented in Table 5 shows that wine imported into the country was also concentrated in 5 countries (76.2% of total imports), albeit more diversified than export destinations. Also, Czechia has been substantially a net importer of wine of fresh grapes. For instance, in 2016 the country exported $25,647- imported $199,623= -$173,976, or exported 10,957 (tonnes) - imported 170,079 (tonnes) = -159,122 (tonnes). Arguably, Czechia could be classified as a wine consuming nation rather than a producing nation, as the country's imports largely outweigh exports.

The growth potential of demand and the market size are the factors that drive the attractiveness of the Czech wine markets (Kučerová, 2014). Nevertheless, there is a need for market diversification beyond the European borders to reduce global market shocks, stimulate competitiveness, and for more earnings to be ensured. Although there is a market access to wine trade within the EU borders, non-EU countries charge import duties (Table 4 and Table 5). Arguably, this partially impeded the Czechia from penetrating, non EU countries. Also, Czech export growth rate drastically decreased during the period 2012-2016, while quantity import growth increased within the same period under study.

3.3 Wine consumption in the Czech Republic

Wine, as known beverage left deep traces in tradition of several nations, and the way it is consumed, very often reflects the culture, customs and lifestyles of local communities across the globe, especially in non-Muslim regions. Besides health benefits, wine is very often symbol and sign of prestige, especially within wealthy consumers, and its' consumption is influenced mostly by tradition, confession, habits and level of life standard (Vlahović, Potrebić and Jeločnik, 2012). Similarly, the consumption of beer and wine in Czechia could be historically considered traditional (Syrovátka, Chládková and Žufan, 2015). Implying that the demand for production and consumption might be sustained.

Figure 2 Structure of consumption of alcoholic beverages in Czechia in 2015
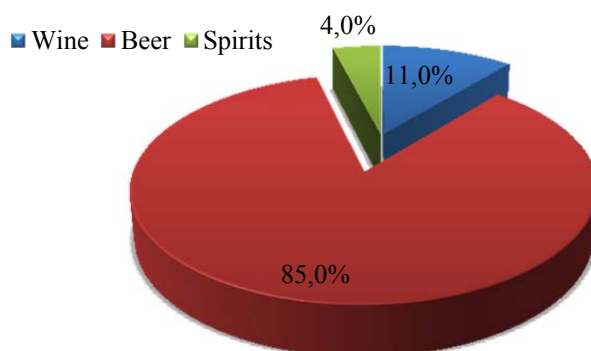
Source: Czech Statistical Office, 2016

Wine Consumption in Czechia has grown, but also fluctuated over the years. For instance, consumption per capita in the country increased from 15.4 litres per capita in 1995 (Syrovátka, Chládková and Žufan, 2015) to 19.84 litres per capita in 2012, but declined to 18.9 litres per capita in 2015 (Table 6). Also, Syrovátka, Chládková and Žufan (2015) analyse the development of consumer demand for wine in Czechia using elasticity coefficients derived from the constructed dynamic model for the period 1948–2012, and their result show a linear trend in the development of demand for wine in the country.

Table 6 Consumption of alcoholic beverages and cigarettes (annual per capita averages), 2007-2015

Indicators	Unit measured	2007	2008	2009	2010	2011	2-12	2013	2014	2015	Index 2015/2014
Alcoholic beverages	litre	185.8	183.2	177.6	170.9	168.8	175.2	172.3	173.3	172.4	99.5
Spirits (40%)	litre	8.2	8.1	8.2	7.0	6.9	6.7	6.5	6.7	6.9	102.5
Wine	**litre**	**18.5**	**18.5**	**18.7**	**19.4**	**19.4**	**19.8**	**18.8**	**19.5**	**18.9**	**96.9**
Grape-based wine	litre	16.1	16.3	16.5	17.3	17.3	17.5	16.2	16.6	16.4	98.7
Non-grape based wine	litre	2.4	2.2	2.2	2.1	2.1	2.3	2.6	2.9	2.5	86.6
Beer	litre	159.1	156.6	150.7	144.4	142.5	148.6	147.0	147.0	146.6	99.7
cigarettes	ks	2,345	2,107	2,071	2,028	1,988	1,947	1,904	1,950	2,010	103.1

Source: Czech Statistical Office, 2016

Between 2014 and 2015, the overall consumption of alcoholic beverages in Czechia declined by 0.8 litres (-0.5%); beer and wine consumption declined by 0.4 litres (-0.3%) and 0.6 litres (-3.1%), respectively. On the other hand, spirits consumption (40%) increased by 0.2 litres (+2.5%), and cigarettes consumption rose by 60 pieces (+3.1%) within the same period. The overall consumption of alcoholic beverages in terms of pure alcohol in the country reduced by 0.4 litres (-3.7%) due to decrease consumption of wine and beer (Table 6) in the country (Czech Statistical Office, 2016).

Globally, Czechia has been the highest consumer of beer per capita in the world, and beer has been the country's domestic drink (Slováčková, Birčiaková and Stávková, 2016). Czechia was ranked 28th position in the global wine consumption, with 0.81% (of quantity global consumption) in 2015 (Wine Institute, 2017). The structure of alcohol consumption in the Czechia as shown in Figure 2 and Table 6, even though beer consumption has been recorded highest, wine consumption has increased, but slowdown in 2015. Also, the substantial negative trade balance in grape wine (both in monetary values and quantity) shows that the relevance and demand for the product in the country cannot be overemphasized. Arguably, more wine production is needed to meet domestic consumption, and reduce pressure on the foreign exchange or trade balance.

4 Conclusions

Given that grape is a key agrarian input for wine production in Czechia, and wine is largely produced in the Moravia region and consumed across the country, this article attempts to assess the performance or trends of its production and trade in recent decades. The study is descriptive in nature. The descriptive findings suggest that the grape area harvested, yields, prices, winemaking and consumption may have implications on production and trade in Czechia.

Statistical data show that grape yields in Czechia have been below the EU, Africa and global averages. Also, Czech wine export (of fresh grapes) has been highly volatile as it has been concentrated only in two economies that shared border with the country. Similarly, the country has been a net importer of wine as consumption outweighs production, implying that the demand for wine product is more than domestic production. Export promotion should be encouraged and diversified beyond the EU markets. Arguably, this measure may well reduce external demand/market volatility or shocks, enhance competitiveness and accelerate foreign earnings for grape wine producers, and traders in the country.

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Development of New Organization Forms in Viticulture and Wine Industry in the Czech Republic - the Segment of Wines with Original Certification

Abstract: *The changing market environment (both locally and globally) is reflected in the changing position of individual wine-growers and wine-makers on the market. One of the ways how to strengthen the position of wine-growing and wine-making enterprises within the increasing competition on the current market is a cooperation in the form of horizontal or vertical coordination/integration of the interested enterprises and the formation of wine clusters. Typical characteristics of some wine clusters is their derivation from a specific factor - terroir of vineyards. One of the forms of demonstrating the characteristics of a terroir based wine is a certification system of wines with original certification (VOC). Development of clusters of wine-growing and wine-making enterprises in the Czech Republic on the basis of VOC appellation system has not yet received in the professional literature much attention. The aim of the research, whose partial results are presented in this paper, is deepening of the knowledge about the concept of appellation system VOC in the context of the Czech Republic and about the development of new associations of regional wine producers that are using the VOC appellation system. For this purpose, existing VOC associations in the Czech Republic were identified, their attributes were defined and their form was more precisely characterized based on the selected set of attributes. VOC certification was in the Czech Republic legislatively defined and introduced in 2004. Currently 7 such associations exist in the Czech Republic. From the analyses and comparisons carried out can be concluded, that the conditions for VOC certification are defined as a framework by law. Nonetheless, the analysis of the association characteristics shows that within this legislative framework, individual associations seek/choose their own specific solutions. This implies that rules and concrete operation forms of VOC associations are still being shaped. Further research in this field should focus on evaluation of the relationship between the chosen form of association and its performance results.*

Key words: Appellation · Viticulture · Terroir · Appellation System· Wines with Original Certification

JEL Classification: Q12 · Q13 · D23

1 Introduction

Viticulture and wine industry have in the Czech Republic a long history. Both industries are currently again significantly growing. As is well known, viticulture and wine industry play their important role in the landscape formation and are also directly associated with a local culture. As already proven, these specific local characteristics can be successfully used in the given environment to strengthen the position of wine-making enterprises within the increasing competition (Lintner, 2014). Changing market environment, both locally and globally, which is reflected in the changing position of individual wine-growing and wine-making enterprises on the market, confirms that only the appropriate ratio of quality and price of wine itself does not guarantee in the current conditions a market success. It is the entire complex of relationships and activities, from working in vineyards, through wine production to the marketing and business capacities of a wine-growing enterprise. In this context, customer focus and knowledge of customers' needs is becoming a competitive advantage as many customers are already highly sophisticated with an active orientation in a wide range of domestic wines as well as wines from around the world. This type of customer often seeks a winery with unique values (Gosh, 2005).

One of the ways how to strengthen the position of wine-growing and wine-making enterprises on the current market and how to effectively use the given potential represents mutual cooperation, specifically in the form of horizontal or vertical coordination/integration of interested enterprises. Enterprises can strengthen their competitiveness within coordinated activities and thus improve their negotiating position on the market (Bečvářová, Zdráhal 2013). The formation

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of regional associations of wine producers is a strategic business decision that responds to changes in market conditions (Tomšík, Prokeš, 2011). The quality of the network formation within the wine cluster is a factor that not only enhances the competitiveness of a winery, but also, above all, gives the opportunity to better respond to the dynamics and character of ongoing changes in the business environment.

Existence of many different types and forms of interconnection of wine clusters can be explained by the heterogeneity of the wine regions. Typical characteristic for wine clusters is their derivation from a specific factor of uniqueness, so called terroir of vineyards. One of the cooperation forms of wine-growing and wine-making enterprises, which are based on terroir of vineyard, represents system of certification. It stands for a confirmation of quality through obtaining the name 'wine with original certification' (VOC). This form of classification and its principles emphasizes the uniqueness of a place where grapes are grown, the typicality of varieties and other factors together forming this terroir, which gives the wine its originality and uniqueness on a global scale. This wine certification system has its roots in countries with a long winemaking tradition, such as France (AOC), Spain (DO), Italy (DOC) or Austria (DAC).

Wines in the Czech Republic can be certified as wines with original certification (VOC) since 2004. Certification is authorized by the Ministry of Agriculture pursuant to the provisions of § 23 of Act No. 321/2004 Coll., On viticulture and wine industry and on amendment of some related acts, as amended. These wines are specific for conditions and environment from which they come from.

Research work focused on the development of cooperation between wine-growing and wine-making enterprises based on terroir was mainly handled by Prokeš and Tomšík (Tomšík and Prokeš 2011; Prokeš and Tomšík 2012a; Prokeš and Tomšík 2012b; Prokeš 2013), in connection with the development of tourism is it an article of Prokeš, Skálová and Němčík (2016). Results of these studies confirm that emerging associations have a character of clusters. On the example of specific selected associations (VOC Znojmo and VOC Modré Hory) can be demonstrated, that this competitive advantage is positively reflected on the performance of cluster enterprises (sales growth in the segment of bottled wines, higher realized price of product for certified wines and also benefits in a form of information and knowledge sharing).

Formation and development of a wine cluster bring also a positive aspect for the development of the micro-region, concretely development of a potential for tourism. In addition to these studies, existence and character of another seven VOC associations, which currently exist in the Czech Republic, have not yet been investigated and evaluated.

The aim of the research, whose partial results are presented in this paper, is deepening of the knowledge about the concept of appellation system VOC in the context of the Czech Republic and about the development of new associations of regional wine producers that are using the VOC appellation system. For this purpose, existing VOC associations in the Czech Republic were identified and their form was more precisely characterized based on the selected set of attributes. This knowledge can be used for further research in this area.

2 Methods

As a basis for carrying out the exploratory survey served information from the Wine Fund and the evaluation of more detailed data obtained from individual associations and their characteristics resulting from their presentation, especially on websites, and information specifically mentioned on this issue in the media. Information was used both for describing the development of VOC associations as a whole, as well as for the characteristics of individual associations.

Specific associations are listed as follows: VOC Znojmo, VOC Pálava, VOC Mikulov, VOC Modré hory, VOC Blatnice, VOC Valtice a VOC Mělník.

Own research, focused on three fundamental areas (born of organisations, quality features of their products, characteristics and of its own characteristics, is based on the evaluation and comparison of the following attributes:

- year in which the association was founded,
- wine-growing area in which the association operates,
- number of members at the time of the formation of the association,
- number of members in 2017,
- number of members assigned to VOC certification,
- desired sugar content level
- level of the maximum grape yield,
- conditional alcohol content
- possibility of producing Cuveé wines.

Based on this comparison, identical as well as different characteristics among observed associations are identified and the overall conclusions and possible directions for further research in this area are formulated.

3 Research results

3.1 Establishment and development of VOC associations in the Czech Republic

In the Czech Republic, VOC certification was legislatively defined and introduced in 2004. This is a new way of categorizing wines, based on the place where the grapes are grown and the way wine is produced. This certification system should guarantee the character of the produced wine according to traditional varieties and procedures for a given territory. According to the existing classification method, which works on the basis of the evaluation of the sugar content of the wine juice, sugar content of VOC wines has to achieve at least the level of a sugar content of quality wines.

The VOC system is based on associations established in individual wine regions, which share the same terroir. On this principle, the emerging association makes a request to the Ministry of Agriculture of the Czech Republic for the authorization to certify the wines as VOC. Interestingly, wine classification is carried out by commissions made up of members of the winemakers themselves. Under the rules defined by the association, they decide whether the wine meets all the criteria.

The first association was founded in the Czech Republic in 2009 (VOC Znojmo). In 2017, there have been already 7 associations operating in the Czech Republic. Namely, VOC Znojmo, VOC Pálava, VOC Mikulov, VOC Modré hory, VOC Blatnice, VOC Valtice and VOC Mělník. Several other associations are currently undergoing the certification process.

Most of the existing associations are located in the wine region of Moravia, located in all viticultural subregion. Figure 1 documents their localization.

Figure 1 Localization of VOC associations in the Czech Republic
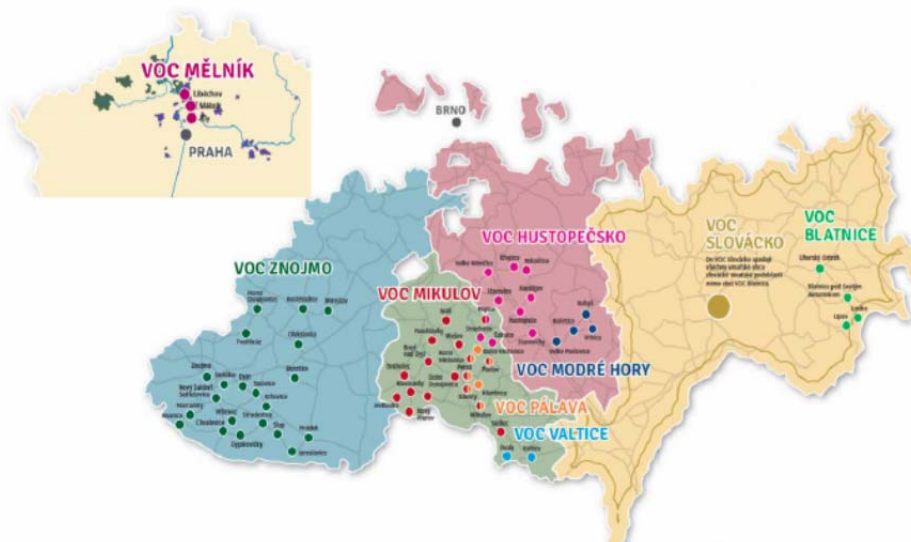
Source: Wine of Czech Republic

Based on this procedure, high standard of wine should be maintained. The certification system should also meet the rules of simple communication with a customer, the vineyards should be in the highest quality class, the quality of wine should be high, grapes have to grow under strict conditions, and the wine should be produced in a natural way.

According to Pavloušek (2004), the VOC system should meet the following conditions:

- maximum possible simplicity of the whole system and marketing intelligibility, ie. a maximum three-tier system that is comprehensible to every customer, not only for wine lovers.
- the vineyards must be independent and bonitated. Only the highest quality vineyards should reach the highest third evaluation class.
- the quality of the vineyards must reach such a level, at which the combination of the vineyard and the variety provides grapes of stable quality and without distinction in the year.
- strict conditions for agro-technology and grape quality ensured
- the natural process of vinification.

When comparing the appellation system introduced in the Czech Republic, some specificities can be identified in comparison to the practice abroad, which is based mainly on many years of tradition of the Roman certification system. Rules and operation forms are still being formed in the Czech Republic. These wines are currently trying to attract the attention of the wine consumers.

3.2 Establishment and development of VOC associations in the Czech Republic

The analyses show that individual VOC associations differ in their character. Basic differences between VOC associations are shown in Table 1. As can be seen from the overview, observed associations differ significantly in the number of members. The highest number (29 members) was found at VOC Blatnice. The lowest number (4 members) has VOC Mělník, which is also the youngest association of this type. For all associations it was not possible to trace the number of their founding members, however, in the case of VOC Mikulov, VOC Pálava and VOC Valtice, it is possible to see an increase in the number of members during their existence and development. The increase is particularly evident in case of VOC Mikulov, which was originally formed by three founding members in 2011 and currently has 12 members.

When comparing the range of products, ie the number of varieties categorized as VOC (selected as typical for the given region and labelled as VOC), individual associations again differ among themselves. The lowest number of varieties has VOC Pálava (only one). The highest number of varieties has VOC Mikulov, where the varieties amount to six.

Expert opinions, however, differ in how many varieties can be classified as typical, bearing the unique terroir features. Until now, limits have not been set and the selection of varieties is up to the associations themselves.

Possibility of the expansion of VOC wine range represents also production of cuveé. However, only certain number of associations' statutes allow this step. Sugar limits of wine juice, which also significantly affect the quality of wine, also differ among individual statutes. The most strict conditions have VOC Mikulov and VOC Pálava, namely 21 ° NM.

Factors that affect the quality of the product and that are limited by the associations` statutes are sugar content of wine juice, grape yield per hectare and alcohol content. Yield of the grapes per hectare of the area, limited by the associations' statutes, has a significant impact on the quality of the input material and consequently on the quality of wine. Differences between associations exist even here, although they are not very significant, except for VOC Mělník, which allows a yield of up to 11 t/ha.

Table 1 Attribute of individual associations VOC and their comparison

Characteristics	VOC Znojmo	VOC Mikulov	VOC Modré hory	VOC Pálava	VOC Blatnice	VOC Valtice	VOC Mělník
A	2009	2011	2011	2012	2013	2015	2015
B	ZNO	MI	VP	MI	SL	MI	MĚ
C	nd	3	nd	3	nd	4	nd
D	19	12	16	6	29	5	4
E	3	6	3	1	4	2	3
F	19°	21°	19°	21-27°	20°	20°	18°
G	2.5 kg per head	max. 7 t/ha	max. 7 t/ha	max. 5000 l/ha	nd	max. 7 t/ha	max 11 t/ha
H	max. 13.9 %	nd	min. 12 %	nd	nd	min. 11.0 %	nd
I	yes	no	yes	nd	yes	yes	yes

Source: Own processing

Note.: A - year in which the association was founded, B - wine-growing area in which the association operates, C - number of members at the time of the formation of the association, D - number of members in 2017, E - number of members assigned to VOC certification, F - desired sugar content level, G - level of the maximum grape yield, H - conditional alcohol content, I - possibility of producing Cuveé wines. MI –Mikulovská, MĚ – Mělnická, SL – Slovácká, VP – Velkopavlovická, ZN -Znojemská, nd – the information could not be traced. nd – the information could not be traced.

VOC wines do not bear on their labels an information about the so-called Germanic method of certification, ie data on the sugar content of grapes, which divides wines to table wines, quality wines, etc. This designation is, however, already used in the Czech Republic. It is a way of distinguishing the "quality" of wines. 21 ° NM sugar content of the wine juice corresponds to a wine with an attribute of high-quality wines. Restriction of alcohol content in wine repre-

sents another limiting factor of wine quality. It differs among individual associations especially because of different varieties of grapevine.

Apart from the above-mentioned comparative attributes, other differences can be found in the statutes of the associations and other documented associations. These statutes specifically regulate the care of the vineyard, form of the wine production, ripening, as well as packaging and wine preservation.

Comparison shows that conditions for VOC certification are on one hand defined as a framework by law, the analysis of specific conditions, criteria and rules of the individual associations on the other hand shows that the given framework allows a choice of specific own solutions.

4 Conclusions

Categorization of wines with original certification (VOC) is a form of appellation system, created on the basis of the place of origin and the ascending quality of the wine. It undoubtedly means a progress in a communication between customer-wine lover and winemaker. This certification method is new in the Czech Republic and requires a creation of a completely new classification and legislation. It is, however, based on the historical tradition of wine certification by location. It can be perceived as a natural way of certification, which has been already used over centuries, when the name of wines was usually derived from their place of origin that also corresponded to the economic and social system of the "old Europe". Based on this form of quality defining and strengthening of the knowledge based cooperation, associated enterprises are currently striving to find their competitive advantage. This in terms of a support of a further development leads to the creation of joint investments, such as investments into technical equipment, human resources or support of a creation and presentation of the business brand.

Characteristics that all the wine clusters have in common is in case of VOC associations derived from a specific factor, terroir of vineyards, which in conjunction with other factors adds wine to uniqueness on a global scale. The aim of connecting the wineries that share the same terroir is the use of market opportunities, R&D in the industry, new technologies, development and promotion. Although this link is related only to specific transactions, it undoubtedly creates a certain kind of interdependence between business entities. Through this form of cooperation, member wineries should be able to gain in importance and use this potential to achieve their goals.

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Session 4

Economic Impacts of Changes and Policies in the Fields of Finance, Accounting and Taxation.

Using CFEBT Risk Triangle and Pental Accounting for Detection Risks of Accounting Errors and Frauds

Zita Drábková, Jiří Dušek

Abstract: *This paper focuses on options of CFEBT risk triangl and Pental accounting for detection of accounting errors and frauds. These approaches are based on similar hypothesis about financial performance and cash flow. This paper deals with comparable selected approaches as a tool for decreasing of information assymetry between creators and users of accounting records and financial statements.*

In addition it presents the CFEBT risk triangle of accounting errors and frauds and using Pental accounting as tools of the forensic accounting. The CFEBT model was designed and based on the hypothesis of a relationship between loss or profit and an increase in cash flow in the period of five years, i.e. whether the sum of their value in five years with minor variations lead to a simila results. Pental accounting is based on the similar hypothesis of pental equation. As a conclusion, this paper shows possible aspects of using selected approaches for accounting users.

1 Introduction

The financial statements represent a significant source of information for users of financial statements, i.e. the owners, Corporate Governance, potential investors, the state, creditors, customers and the public. On the one hand, people using accounting records as the main source of information request top quality of the records, while on the other hand it is impossible to ignore various influences and motivations of the creators which significantly affect the content of particular items of records. Regarding the information asymmetry acting among record creators and users, it is necessary to search for tools and possibilities enabling its decrease, or identification of risk of the reliability of the presented accounting records (Drábková, 2017).

Prevention and detection of accounting fraud is also engaged in Steve Dawson´s publication. Steve presents the six elements of an effective anti-fraud program – fraud risk assessment, control activities, information, communication, anti-fraud environment and monitoring (Dawson, 2015). Every year, fraud investigation departments for corporations receive dozens of reports on potential accusations of fraud. A number of publications and research studies maintain that it is important to find a method of fraud risk detection, with an emphasis on a solution that is fast, e.g. (Bloomfield, 1995). Moreover, results of research of a large telecommunication company imply that technical inspections manage to detect no more than one third of fraud cases. Specific recommendations for the management to introduce internal auditing and set up different organizational internal controls for preventing frauds of financial statements were published in the form of results of a case study carried out in a construction company operating in the construction industry (Horvat & Lipicnik, 2016). A proposal of methodology for distinguishing probability of truthfulness of accounting reports as a tool for differentiating between fraudulent and truthful reports was published by authors Purda and Skillicorn (Purda & Skillicorn, 2015).

The main methods (strategies) of creative accounting and accounting frauds were selected with the view of analysis of the impact of creative accounting techniques on the M-score CFEBT model. These selected techniques are subsequently reflected in the quality of a true and fair view of accounting. (Drábková, 2013; Drábková, 2015). Based on results of previous research into the information capacity of accounting and testing of M-score of the CFEBT model conducted by a number of case studies in the context of Czech accounting standards and IFRS, a complex tool of risk management of accounting errors and frauds in the form of a risk triangle of accounting errors and frauds was designed, which includes analyses of three basic risk areas (vertices) of accounting errors and frauds. (Drábková, 2017).

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Pental Accounting presents additional dimensions of double-entry accounting. It does not exist separately, it is an integral part of double-entry accounting .It was not invented but was discovered . It has been in existence since the beginning of double-entry accounting. Pental accounting based on 5 pillars: Debit; Credit; Profit; Minus; Plus. (Dušek, 2009)

2 Methods

The objective of the present paper is to compare two approaches of detection and risk management of accounting errors and frauds which are based on a similar hypothesis stipulating a link between the generation of profit (loss) and cash flow. The paper is based on an analysis of the CFEBT and Pentalogue approach and compares these concepts to determine their usability for detecting the risk of manipulation of financial statements.

Pental accounting may be understood as a financial controlling tool, which supplements accounting with modifications of profit (loss) in the sense of modifications of impacts on the generation of cash flow. The software solution of Pental accounting is currently used by 120 accounting units. The CFEBT risk triangle of accounting errors and frauds was designed on the basis of previous research and tests of risks of accounting errors and frauds in case studies that examined accounting units in the context of Czech accounting regulations and IFRS. The CFEBT risk triangle may be considered a complex tool of forensic accounting, or, rather, an anti-fraud system of detection and risk management of accounting errors and frauds from the perspective of individual group of accounting users. CFEBT´s scores of three levels are able to evaluate discrepancies between financial performance and cash flow on the basis of materiality. A modified version of the second level of CFEBT is based on elimination differences between profit or loss and an increase in cash flow.

The first M-score level of the CFEBT model is defined as follows:

$$CFEBT = \frac{\sum_{t=1}^{n} CF_t - \sum_{t=1}^{n} EBT_t}{\sum_{t=1}^{n} EBT_t} * 100 \tag{1}$$

Where

CF: total increase or decrease in cash before tax during the analysed period t

EBT: earnings before taxes generated for the analysed period

If $CFEBT \geq materiality$, detailed tests of relations of impacts in the second and third levels follow. (Drábková, 2015)

The second M-score level of the CFEBT model (modified CFEBT score) complies with the established hypothesis as to the relation between the generation of cash flow and earnings. Monetary means and monetary equivalents for the analysed accounting period are modified by changes in assets and liabilities, which represent a possible inflow and outflow of monetary means. The sum of EBT gained in the analysed period is modified by expenses reported as non-monetary expenses:

$$CFEBTm = \frac{\sum_{t=1}^{n} CFm_t - \sum_{t=1}^{n} EBTm_t}{\sum_{t=1}^{n} EBTm_t} * 100 \tag{2}$$

Where

CFm: increase in cash flow before taxes in the analysed period, modified by reported future cash-in and -out flows

EBTm: earnings before taxes gained for the analysed period modified by non-monetary expenses

The third M-score level of the CFEBT model expresses a ratio of operative cash flow generated in the analysed period and modified earnings in the analysed accounting period. Where expressed in percentage, this value presents a ratio of generated cash flow from operating activities to generated earnings which include only those expenses and revenues that are directly transformed in cash flow in the current or future accounting periods:

$$CFEBTom = \frac{\sum_{t=1}^{n} \text{CF}om_t - \sum_{t=1}^{n} \text{EBT}m_t}{\sum_{t=1}^{n} \text{EBT}m_t} * 100 \tag{3}$$

Where

CFom: increase in operative cash flow before taxes in the analysed period

EBTm: earnings before taxes gained for the analysed period modified by non-monetary expenses

For a statistical analysis of causes of accounting errors and frauds, seven financial indicators were designed for the individual accounting periods, and these indicators allow a comparison between cash flow and earnings in terms of accounting, i.e. net of income taxes.

The pental accounting is doing in a Pental equation:

Profit/Loss - Minus + Plus = Money. (4)

3 Research results

3.1 CFEBT risk triangl of accounting errors and frauds

The CFEBT risk triangle was designed as a complex tool for detection and management of accounting errors and frauds on the basis of many-year research into relations and links of financial statements in the context of Czech accounting standards and IFRS. The following image presents the individual vertices of this triangle as partial components of risk analysis - three red risk factors (areas), which yield individual results and are subsequently evaluated as to their mutual links.

The fraud triangle was proposed by Dr. Donald R. Cressey in order to determine the factors that bring about an opportunity for committing a fraud. If all these factors are met, a "space" for committing a fraud is created. For this reason, the triangle has been established not from the view of users of outputs or financial statements, but from that of a perpetrator. This triangle accordingly identifies a risk of committing a fraud in the line of identification of risk factors that might ultimately lead to committing a fraud.

If accounting is respected as the main information source for a group of various users (decision-makers), especially owners, Corporate Governance, managers, internal and external auditors, prospective investors, employees, suppliers, customers, banks, providers of credits, loans, subsidies, public supervision authorities, the point of view of these users must be changed.

The outcome may have a form of an anti-fraud system based on the triangle of risk of accounting errors and frauds, covering aspects of committing a fraud, using the "eyes" of authors of accounting (by assessment of causes - manipulation techniques) and users of accounting (identification of consequences - impact of manipulation).

The triangle, established as delineated above, may represent a solution to the issue of reducing the information asymmetry between authors and users of financial statements. The proposed triangle of risks of accounting errors and frauds is built on results of long-term research into accounting relations, principles and links, creative accounting techniques, audits based on empirical analyses, consultations with experts from the ranks of auditors, tax advisors, specialists and tax administrators, as well as on a 20-year practice as a tax advisor and advisor in CAS and IFRS.

Figure no. 1 illustrates a triangle of risk of accounting errors and frauds affecting the following areas of the internal control system (see the Model Coso):

- Risk identification,

- Risk assessment,

- Risk management.

The triangle comprises 3 groups of risk factors in relation to financial statements:

The triangle comprises 3 groups of risk factors of accounting errors and frauds. Essentially, the outcome of evaluation thereof is subject to the fact if risks are evaluated by users who have at their disposal internal information from in-house sources of the accounting unit concerned (management, internal and external auditors, owners,....) or by users who analyse risks only using information derived from financial statements, annual reports and other publicly accessible information sources.

Figure1 CFEBT risk triangle of accounting errors and fraud

Source: own processing

Quality of internal control system:

This area of the anti-fraud system assesses individual risk factors that represent opportunities to manipulate financial statements - for examples of such risk factors. These imperfections of the internal control system enable authors of accounting to carry out manipulations beyond the scope of the true and fair view of accounting within the bookkeeping system. For auditors, this area embodies a framework of reliability tests, i.e. the evaluation of the extent to which auditors may rely on a functioning control system of the given accounting unit, effectiveness of management of error and fraud prevention processes, addressing to responsibilities and processing data techniques, which all have an influence on accounting. Users who have at their disposal only external information sources typically evaluate risks on the basis of disclosed information about risk management, the set-up of the system of transaction prices with affiliated persons and the quality of set-up processes, which information is disclosed mainly in the notes to financial statements, annual reports, websites of business corporations, certificates of quality, etc.

Causes (reasons for) of occurrence:

This component of the anti-fraud system analyses the actual reasons for motivation or pressure to manipulate financial statements. Reasons for manipulating financial statements may vary, ranging from greediness, to dire living conditions any employees, managers or owners might have, and to any objectives to be granted a credit, subsidy, an important contract, etc. This area of the triangle compares median values of selected significant accounting items and indicators calculated in the area of causes and reasons of the triangle of accounting errors and frauds. The proposed anti-fraud system is based on calculations of 7 variables (ratios especially ROE, ROA, personnel costs to revenue ratio and accruals ratio and CF ratios). Financial analysis results are interpreted in terms of risk detection and in the context with the evaluation of risks of impacts (consequences) in a true and fair view of accounting using the three-level CFEBT model.

Next, any detected risk accounting areas are included in correlation relations in order to determine any manipulation techniques used in respect of financial statements (methods of creative accounting, which deforms the true and fair view of accounting to a considerable extent).

Accounting relations vs true and fair view:

This part of the proposed anti-fraud system epitomizes its foundation stone and consists in the risk identification of manipulation of financial statements using the CFEBT model in its three levels.

At the first level of CFEBT, M-score is calculated with the aim of determining compliance of EBT and changes in funds and cash equivalents (cash). The second level of M-score modifies EBT and a change of CF by undervalued or overvalued items based on non-cash costs (revenues) and expenses (income) that are not included in EBT. The third level represents M-score of operating CF and modified EBT.

Results of the CFEBT approach and the statistical analysis may be used for improving the quality of decisions at various levels: not only for independent users to increasing the efficiency of the internal control system, but also for setting up of management processes of managerial accounting, which proceeds from financial accounting reports.

The anti-fraud concept delineated above clearly implies the following axiom:

"An efficient management of risk of accounting errors and frauds is dependent on the awareness of the management as regards accounting aspects and relations, and it contributes to the minimization of the information asymmetry between authors and users of financial statements."

The intensity of reducing the information asymmetry is obviously subject to the fact whether the proposed anti-fraud system is availed by a user who detects and assesses risks in the position of an external user (prospective investors, banks, business partners,...), or an internal user (internal auditors, Corporate Governance, managers, owners,…), in accordance with their opportunities of access to input information from accounting.

3.2 Comparison CFEBT approach with Pental accounting

Pental equation presents relations between profit and loss and money. The Minus Plus is the exact answer to the question of why it is not equal to or equal to the profit/loss of money. The Minus Plus in the pental equation can be used multiple times for one accounting transaction, for example Profit/Loss - Minus + Plus - Minus + Plus = Money. The Pental Accounting was intended for those who want to read more information not only in relation to money.

Table1 Pental items for selected accounting transactions

				Pental items			
Accounting transactions	Debit	Credit	TCZK	Financial performance	Minus	Plus	Money (cash flow)
Purchase of material in cash	501	211	10	-10	0	0	-10
Service revenues in cash	211	602	20	20	0	0	20
Purchase of material non-cash	501	321	30	-30	0	30	0
Service revenues non-cash	321	221	30	0	-30	0	-30
Interest credited to a bank account	221	662	40	40	-40	40	40
Purchase of goods non-cash	131	321	50	0	-50	50	0

Source: own processing

Table nr.1 presents examples of selected financial transaction scheme in accordance with the Pental equation. These are plus and minus modifications, which transform the profit (loss) into money directly upon procurement of accounting.

Accordingly, the Pental accounting serves a control function that is included in a pental equation. This is an explicit link to double-entry bookkeeping. The basic check consists in the equivalence of four basic pental summaries. CF summary and Money summary show pental entries used for creating the final balance of money.

PE profit and loss account and PE balance sheet show pental entries used for generating the profit (loss). Here, cash transactions are not given, save for direct cash transactions in the profit (loss). Non-inclusion of certain accounting transaction in pental summaries. The base represents a correctly completed number register of pental correlations. Absences of any correlations are shown in the control report.

A breach of the pental equation means that certain pental summaries are erroneous.

Compared with the pental accounting serves table no.2 illustrates individual modification and informative items, including their percentage share in EBT. These data bear a great importance for the final evaluation of the risk of rigging of financial statements based on overall results of the risk analysis of causes and impacts of accounting errors and frauds. So, after the first level of CFEBT score it followed an analysis of fluctuations in the relationship between EBT and cash flow in the reviewed accounting periods.

Table2 Modification items of 2nd M-score of level CFEBT model

Item no.	Description of item (modification, informative) *
1	Receivables-1, from members
2	Receivables -2, from controlled and managed entities
3	Receivables -3, from accounting units with substantial influence
4	Receivables -4, trade receivables
5	Receivables -5, from institutions
6	Receivables -6, other receivables
7	Estimated accrued revenues
8	Advance payments provided
9	Inventory
10	Tangible fixed assets
11	Intangible fixed assets
12	Long-term financial assets
13	Payables to members
14	Payables to controlled and managed persons
15	Payables to accounting units under substantial influence
16	Trade payables
17	Advance payments received
18	Payables to employees (institutions)
19	Other payables
20	Estimated accrued expenses
21	Payables from notes and debentures
22	Credits and loans received
23	Depreciation
24	Adjustments
25	Reserves
26	Gains or losses from acquired property in assets
27	Gains or losses from revaluation of assets and liabilities
28	Gains or losses from capital interest
29	Gains or losses from revaluation in transformations
30	Receivables from adjusted registered capital
31	Accrued revenues
32	Deferred expenses
33	Equity capital
34	Total revenues from assets and materiál
35	Total expenses on sale of assets and material

Source: own processing

* EBT and CF non-cash and informative items: changes in values over the reviewed period

The CFEBT risk triangle, specifically the vertex Impact of risk of accounting errors and frauds during a minimum of 5 accounting periods, analyses the discrepancy between the generation of the profit (loss) and cash flow for the accounting periods observed.

Unlike pental accounting, the triangle allows to evaluate - in addition to the principle of the double-entry principle - the economic substance of presented accounting transactions in time and in the sense of true and fair view of accounting. The third level of CFEBT score makes it possible to evaluate whether the risk of discrepancy has originated in the operating area.

Interlinked with tests of causes of occurrence of accounting errors and frauds and the quality of the internal control system, the triangle represents a complex anti-fraud system for users of accounting records, enabling users to evaluate risks of individual accounting areas, hence reducing the information asymmetry between users and authors of accounting.

4 Conclusions

Pental accounting primarily serves a control function, which is contained in the pental equation of individual accounting transactions. This aspect presents an unambiguous link to double-entry accounting. In case the pental equation is violated, an error in the double-entry principle may be detected. Unlike the CFEBT approach, this method brings no options of detection and control of disturbance of an economic substance between the generation of profit (loss) and cash flow in time.

For the needs of effective management, the areas, identified in the above manner, may be instrumental for improving the quality of accounting management and informative capacity of accounting with regard to evaluating the financial health of a business corporation. Efficiency of internal control systems is tested within the third vertex (risk factor) of the proposed CFEBT risk triangle of accounting errors and frauds, which, however, is not addressed in the present contribution.

We believe that the risk triangle of accounting errors and frauds may be used on various decision-making levels of users of financial statements with respect to their decision-making process. In addition, the evaluation of this complex tool may reduce the information asymmetry *vis-à-vis* authors and users of reported accounting outputs such that users are able to make a best-quality decision based on accounting data available to them.

In combination with the pental accounting tool, the CFEBT may minimize the risk of accounting errors and frauds. Pental accounting focuses on the risk of a breach of the double-entry principle in the given accounting period, the CFEBT risk triangle allows to reduce the risk of accounting errors in time, especially from the perspective of users of accounting records and accounting information.

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Detection of Outliers as a Possible Method of Accounting Fraud Revelation

Marcela Hradecká

Abstract: *The globalization and the development of enterprising environment allowed the rise of many multinational corporations all over the world. At the same time there appears the phenomenon of sophisticated methods of accounting fraud and tax optimization. Tax avoidance and tax evasion with the aim to reach the highest savings in paying taxes. Financial and tax authorities of individual states have to react to the new situation quickly and to apply the most efficient and effective methods in accounting fraud detection and prevent corporate tax evasion on global scale.*

Both financial and non-financial methods are used in the fraud detection. This article is concerned with the possible use of the outliers method for the accounting fraud detection. This method refers to the extreme values analysis, their detection and demonstrability and draws attention to numerical values that are unusual in some way.

Key words: Fraud · Detection Methods · Outlier · Measures Clustering · Dendrogram

JEL Classification: M2 · M41 · M42

1 Introduction

Accounting undergoes constant development. In reaction to the global changes and to harmonize international accounting the Council of the European Union issued in June 2013 the new Directive 2013/34/EU on the annual financial statements, consolidated financial statements and related reports of certain types of undertakings amending Directive 2006/43/EC and replaced the 4th and 7th EU Directives. The objective of the EU strategy for growth and employment entitled „Europe 2020" for smart and sustainable growth is to offer a simplified regulatory framework to encourage entrepreneurship and innovation where the SMEs are provided with the right information and supplementary support in markets outside the EU and the bureaucratic load is limited.

Simplification and reduction of administrative load in the area of reporting, accounting and financial information, however, will not prevent creative and sophisticated methods of accounting fraud. Particularly in the area gross operating result of turnover. A really risky area is the services provision often referred to as *transfer services* and the related methods of calculation of the transfer price.

Outliners Detection methods can be classified as one of the possible methods for accounting fraud detection. Extremes and extreme values are part of standard analysis of processes and data. The term "extreme" is usually understood as data which reached an unexpected value or size. This means that they refer to extremely high value or unusual value aberration.

2 Methods

Mathematization of economics and quantitative methods are at present considered a part of research. Outliners Detection methods are divided into one-dimensional and multi-dimensional method. Detection is realized by mathematical analysis of data and can be illustrated by Scatterplot (correlation point diagram). Correlation is the relation between two processes or values. Another possible representation is by Boxplot which is a method for graphically depicting groups of numerical data through their quartiles.

The detection of extremes requires definition of extreme values. Fundamental for the reviewer is whether the extreme value is in the frequency or data area, The extremes in data set "source matrix" are distinguished

- Extreme values in the frequency area. Frequency of the occurrence of extreme values that excess the frequency of other values of the researched data. The characteristic feature is therefore the frequency of extreme data. Frequency

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extremes can be visualized by any graphic rendering which shows the frequency or by percent ratio of the individual groups of data in the total data set.

Figure 1 Boxplot with quartiles for the occurrence of outliers in normal distribution
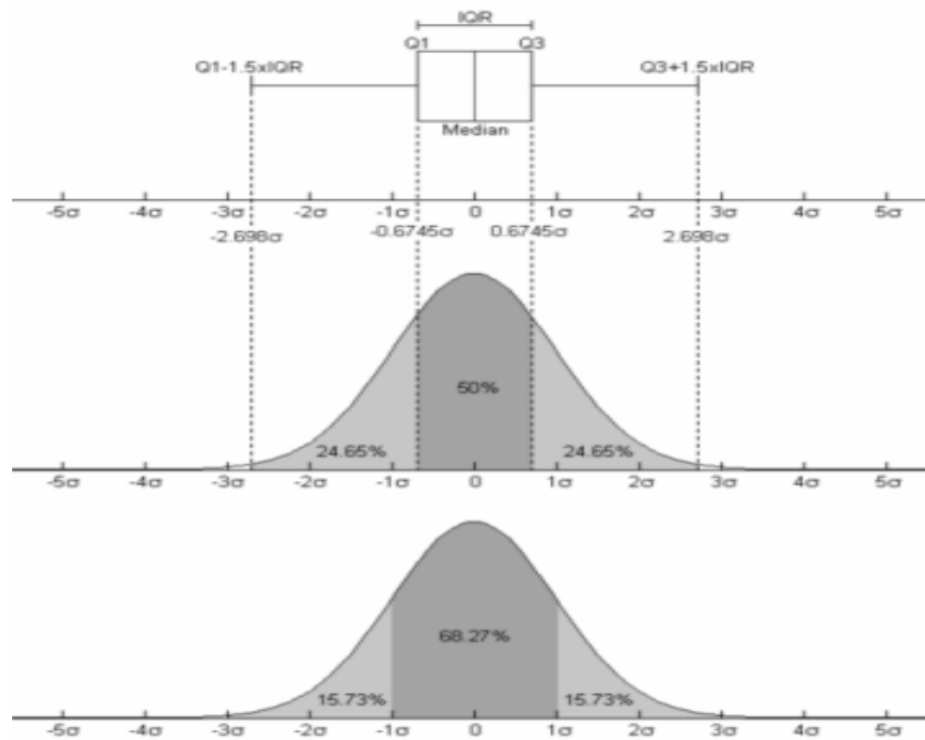
Source: Voženílek, Kaňok, Tuček (2008)

Figure 2 Frequency extremes displayed by graph of probability density
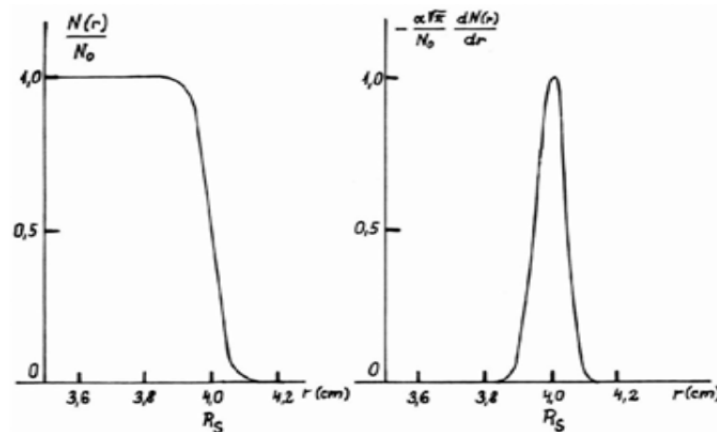
Source: Voženílek, Kaňok, Tuček (2008)

- **Extreme values in the data area of the dataset.** Extreme values that exceed or do not reach the characteristic values that are commonly occurring in the researched data. Data extremes can be defined as lying beyond the clustering of the data set. The visualization of the extreme values in the data area can be effectively done by scatter plot.

Analysis of extremes – outliers, consequently proves the truth of the claim of extremity of the researched value. Sophisticated multi-dimensional methods are used for such analysis. These can prove that the value is extreme. While searching for the extreme it is necessary to distinguish the set realities. Extreme values ate of two types. They are defined as values set by precepts or laws or as values set by statistical methods. During the analysis of a large set of data the values of median and arithmetic mean. An example of a sophisticated method is the cluster analysis. Traditional application of the cluster analysis is the acquisition of detailed description and gaining of insight into the sets of data in

taxonomy. This method aggregates the data of common sets of data on the basis of similarity or dissimilarity and also the distance. The extent of similarity of data is crucial when conducting the cluster analysis. The objective is to divide the set of data into two or more groups, that is clusters based on the similarity of the values of the data. Mutual points of the values of data in multi-dimensional space can also be described by the distance and subsequently graphically visualize their description.

Figure 3 Scatterplot for extreme presentation within data area
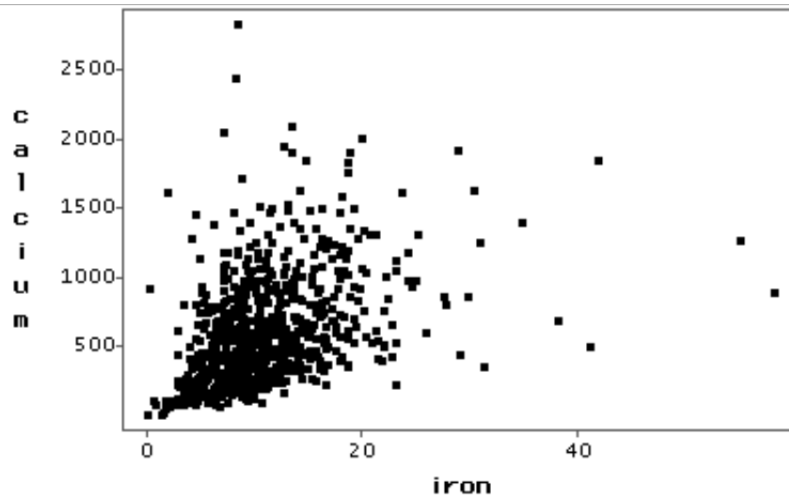
Source: Voženílek, Kaňok, Tuček (2008)

Multi-dimensional analysis should be:

- Suitable for resolving the given problem area
- Correctly and precisely calculated according to the set parametres
- Well presented and its conclusions should contribute to the given research

Quantitative results of clustering depend on the existence of clusters in data and on the given criteria of the cluster definition. The result of the analysis is the dendrogram (cluster tree), where there the similar values (points) are in the same cluster while different values will be in another cluster.

In my many years of experience, I have been systematically engaged in identifying problematic items in accounting statements in terms of creative accounting and fraud. Their testing with a focus on corporations and selected directions. In particular payout ratio or fictitious services in performance consumption. The aim of the research is to analyze problematic items of accounting statements in terms of creative accounting and fraud.

Another partial objective is to create a set of synthetic indicators for fraud detection in accounting. The intention is to prevent the reduction of corporate taxes on a global scale. You can use the Cluster Analysis method to detect a large amount of data (corporations) in the data area, allowing multiple dimensions to be tracked within one analysis across selected corporations. The corporation can be assigned to a data set by subject of economic activity. For example, in price controls in the health sector or in comparison to the provision of transfer services in relation to the contribution to the development of the corporation.

The results of the analysis are dependent on the correct input parameters. The analysis carried out in the framework of the research was focused on services in performance consumption in relation to the created value added in the given accounting period and on the created contribution to the development of the corporation. According to the survey, this indicator is a "contribution to corporate development" more important than indicator of the payout ratio. The payout ratio expresses how much of the net profit was paid to shareholders and what portion of the net profit was transferred to the reinvestment of the corporation. The indicator for the development of the corporation analyzes what part of the added value created, adjusted for labor costs, or asset write-offs remains for the development of the corporation after the eventual payment of net profit to the shareholders.

3 Research results

Cluster analysis was used for the detection and identification of outliners. This method is very sensitive on the presence of non-significant outliners that rise over the usual values of data. The research that used the multi-dimensional method of cluster analysis was conducted on a sample of corporations selected on the basis of criteria (character of the economic activity, size of the corporation, employer, and so on) so that the sample contained corporations from different branches. The selected detection method allows the analysis of data from accounting books, managerial reporting and account sheets including closing the book and the profit and loss accounts. The amendment of the Law 563/1991 Coll. on Accounting and the Implementing regulations 500/2002 Coll.., led to significant changes in accounting since 1st. January 2016. This refers especially the extent of the entries of the Profit and loss account. The implementation of the Directive 2013/34/EU on the annual financial statements, and consolidated financial statements into the Czech legal framework led to simplification of accounting data with micro and small accounting units (corporations). This simplification, however, has a negative impact as it makes the detection of accounting fraud more difficult. There were changes also in the structure of entries in the other accounting units (corporations) Profit and loss account. Some entries such as "added value" and "margin" were excluded from the list of entries.

The outliers detection method was applied on selected data and entries of Profit and loss account of selected corporations. The objective of the analysis was the detection of outlines in the data area. The calculated values of the accounting indicators were put into the source matrix.

Input variables for the source matrix:

- Indicator – Services / Added value
- Indicator – Services / Added value adjusted
- Indicator ROS – EBIT (Return on sales - Earnings before interest and taxes) / Performance (Sales from the main activity
- Indicator PM – EAT (Earnings after Taxes) / Sales derived from the main activity
- Indicator – Contribution to development of corporation (Retained earnings) / Added value adjusted

Table 1 Input variables for the source matrix

Name of corporation	SE / AV adjusted %	SE / AV %	ROS %	PM %
Corporation 1	214,25	58,35	13,54	11,72
Corporation 2	155,03	57,80	21,61	17,28
Corporation 3	271,84	27,64	0,69	0,69
Corporation 4	381,08	80,43	9,26	7,15
Corporation 5	294,35	63,76	10,76	10,76
Corporation 6	403,95	71,69	8,11	6,55
Corporation 7	171,71	65,54	7,40	5,75
Corporation 8	198,68	90,17	16,47	13,15
Corporation 9	136,57	53,59	7,51	5,91
Corporation. 10	134,60	47,59	26,87	21,59
Corporation 11	546,64	87,20	4,17	4,17
Corporation 12	177,30	91,42	20,59	20,59

Source: Author´s processing

It is evident from the source matrix that the indicator of the ration Services to Added value represents what percentage of the added value do the services represent. The added value is the value which is created by processing, which every provider of services or seller adds by its effort to the value of the purchased or their own semi-products. This indicator is rather unprecise, because the added value in the Profit and loss account does not include the personnel costs (salaries) or amortization amount. The analysis was therefore extended to include the indicator of the ration between Services and Added value adjusted by the personnel costs (salaries). From the defined ratio it is clear that if the corporations calculated the prices for provided services correctly and in due form the indicator would hardly reach such extreme levels. This partial result of the conducted research confirmed the fact that the calculation of provided services and sold products is not a commonly encountered part of the internal instructions of corporations. The consequence of the

non-existing price calculation of goods and services can be the distorted economic result but also the opportunity for fraud.

Figure 4 Fraud triangle
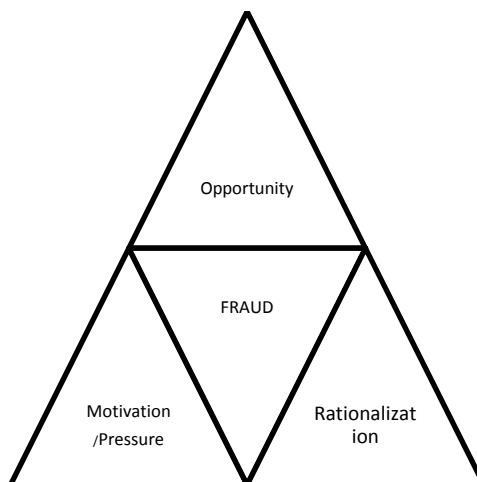
Source: Author´s graphic processing (**https://www.bccpa.ca**)

The indicator Services to Added value ratio was for the further analysis excluded and replaced by the indicator Contribution to development of corporation / Added value adjusted Contribution to development of corporation (Retained earnings) can be understood as an amount which remains in the corporation after payment of EAT (Earnings after Taxes) to the stock owners or partners.

Table 2 Input variables for the source matrix

Name of corpora-tion	PM – EAT %	ROS %	SE / AV %	Retained earnings / AV adjusted %
Corporation 1	11,72	13,54	58,35	30,44
Corporation 2	17,28	21,61	57,80	23,64
Corporation 3	0,69	0,69	27,64	91,09
Corporation 4	7,15	9,26	80,43	38,82
Corporation 5	10,76	10,76	63,76	16,39
Corporation 6	6,55	8,11	71,69	35,64
Corporation 7	5,75	7,40	65,54	60,38
Corporation 8	13,15	16,47	90,17	24,88
Corporation 9	5,91	7,51	53,59	56,67
Corporation 10	21,59	26,87	47,59	7,63
Corporation 11	4,17	4,17	87,20	38,08
Corporation 12	20,59	20,59	91,42	-17,81

Source: Author´s processing

It is clear from the source matrix that the resulting values of the business performance ratio indicator for adjusted value added represent how much of the created value added is retained in the corporation (corporation) for further development and growth of the corporation. The optimum of this indicator ranges from 38% to 60%.

Presentation of Cluster Analysis Conclusions
Data (the proper variables) in the source matrix were analyzed through the all combination of methods and distances of the cluster analysis. The Nearest Neighbour Method combined with the Euclidean distance based on the minimal distance of the value were used for the detection of outliners in accounting.

The output of the multi-dimensional method "Cluster analysis" are the separate „*Dendrograms*" from selected combinations of methods and distances.

Table 3 Resultant Distances Matrix

Distances connection	Merger schedule											
	Obj. N.1	Obj. N.2	Obj. N.3	Obj. N.4	Obj. N.5	Obj. N.6	Obj. N.7	Obj. N.8	Obj. N.9	Obj. N.10	Obj. N.11	Obj. N.12
27,8099	Corp. 9	Corp. 10										
40,5752	Corp. 4	Corp. 6										
40,98258	Corp. 2	Corp. 12										
45,27614	Corp. 1	Corp. 7										
46,19888	Corp. 1	Corp. 7	Corp. 9	Corp. 10								
49,8458	Corp. 1	Corp. 7	Corp. 9	Corp. 10	Corp. 8							
63,60174	Corp. 1	Corp. 7	Corp. 9	Corp. 10	Corp. 8	Corp. 2	Corp. 12					
105,5718	Corp. 1	Corp. 7	Corp. 9	Corp. 10	Corp. 8	Corp. 2	Corp. 12	Corp. 5				
162,673	Corp. 1	Corp. 7	Corp. 9	Corp. 10	Corp. 8	Corp. 2	Corp. 12	Corp. 5	Corp. 4	Corp. 6		
437,2879	Corp. 1	Corp. 7	Corp. 9	Corp. 10	Corp. 8	Corp. 2	Corp. 12	Corp. 5	Corp. 4	Corp. 6	Corp. 11	
3960,066	Corp. 1	Corp. 7	Corp. 9	Corp. 10	Corp. 8	Corp. 2	Corp. 12	Corp. 5	Corp. 4	Corp. 6	Corp. 11	Corp.3

Source: Author´s processing using software Statistica

Table 4 Resultant dendrogram
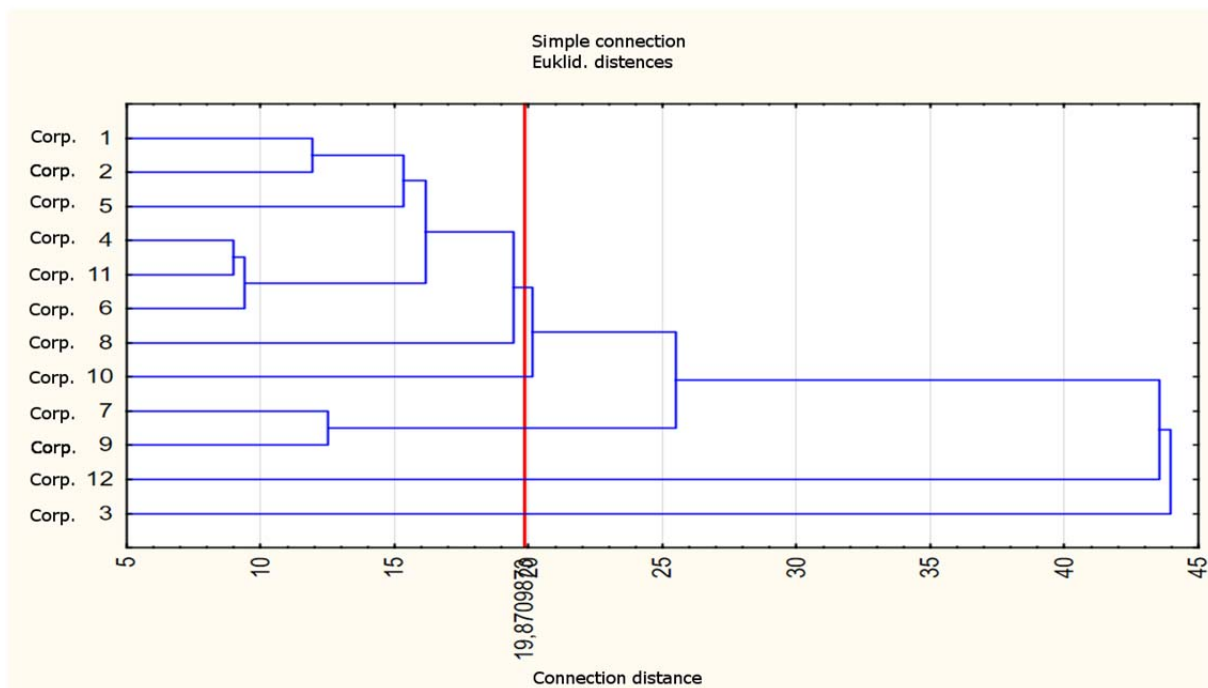
Source: Author´s processing using software Statistica

Resultant dendrogram and the matrix of clusters describes the submission of corporations into clusters according to distance of connectors and presents the detected outliners.

- Indicator – Services / Added value, Ukazatel – Služby / Přidaná hodnota (SL/PH)
- Indicator ROS – EBIT (Return on sales - Earnings before interest and taxes) / Performance (Sales from the main activity, Ukazatel ROS – EBIT (hospodářský výsledek před zdaněním) / Výkony (tržby z hlavní činnosti)
- Indicator PM – EAT (Earnings after Taxes) / Sales derived from the main activity, Ukazatel ZM – EAT (čistý zisk po zdanění) / Tržby z hlavní činnosti
- Indicator – Contribution to development of corporation (Retained earnings) / Added value adjusted, Ukazatel – Příspěvek na rozvoj podniku / Přidaná hodnota PH upravená

The conducted analysis shows that from the selected sample of data and from the pre-set ordinary criteria it is necessary to concentrate on corporations with low values of indicators ROS and PM. And to research in detail the internal and external effects on low cost effectiveness and the profit margin under 10%. In the case of the indicator Services to Added value ratio it is necessary to concentrate on corporations with high value of this indicator. These values indicate wrongly set or missing calculations of provided services or goods and also rather high values of transfer services.

Figure 1 3D Sequence graph
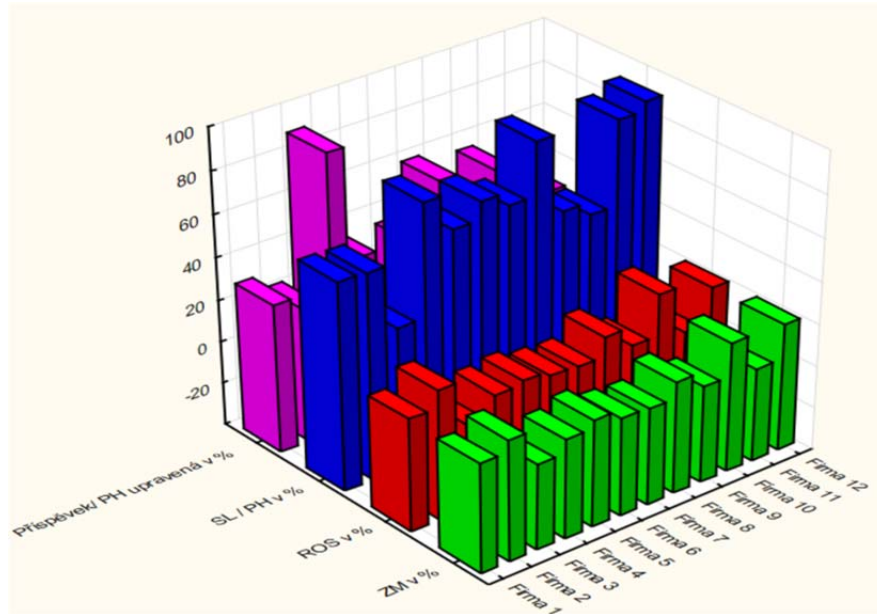
Source: Author´s processing using software Statistica

The last researched new indicator is the ratio between the Contribution to development of corporation (Retained earnings) and the Added value adjusted. While considering the results of the analysis it is necessary to concentrate on corporations with low values. These values indicate wrongly set or missing calculations of provided services or goods. Another criterion of this indicator are the legal norms of the Czech Republic. Principally the Law 90/2012 Coll. on commercial companies and cooperatives (Law on commercial corporations), §40, section 1. Business Corporation shall not pay out net profit if that could lead to its bankruptcy. This means that if stock owners or partners of the corporation prefer the payment of dividends and shares on profit to retaining profits for re-investment the statutory bodies of the corporations have to take into account that some part of the created added value (added value adjusted) have to remain in the corporation for its development.

Graf 2 3D Sequence graph
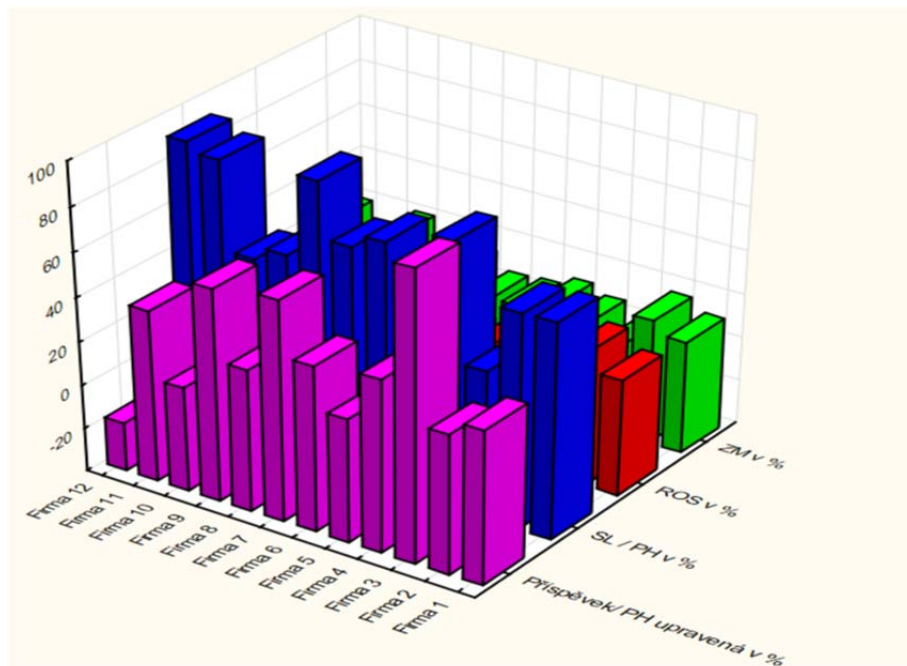
Source: Author´s processing using software Statistica

- Indicator – Services / Added value, Ukazatel – Služby / Přidaná hodnota (SL/PH)

- Indicator ROS – EBIT (Return on sales - Earnings before interest and taxes) / Performance (Sales from the main activity, Ukazatel ROS – EBIT (hospodářský výsledek před zdaněním) / Výkony (tržby z hlavní činnosti)

- Indicator PM – EAT (Earnings after Taxes) / Sales derived from the main activity, Ukazatel ZM – EAT (čistý zisk po zdanění) / Tržby z hlavní činnosti

- Indicator – Contribution to development of corporation (Retained earnings) / Added value adjusted, Ukazatel – Příspěvek na rozvoj podniku / Přidaná hodnota PH upravená

Provided the indicator of the ratio between Contribution to development of corporation (Retained earnings) and the Added value adjusted was researched only separately it could be graphically presented also in the following way.

Graph 3 Indicator of the ratio between Contribution to development of corporation (Retained earnings) and the Added value adjusted

■ Contribution to business development / PH modified in %
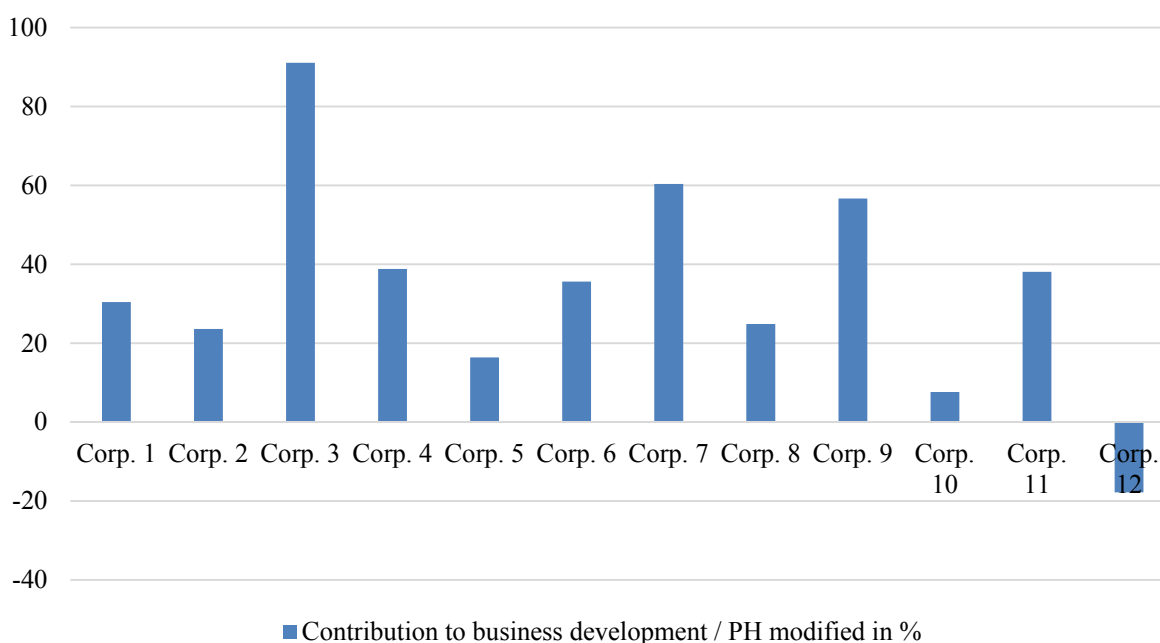
Source: Author´s processing

The conclusive research question: „*Why should or could the Tax and Financial Authorities use Outliners Taxonomy for detection of accounting fraud?* "

Financial Authority processes every year data of many corporations. Outliners Taxonomy allows the analyses of large data files and effectively detect fraud in accounting as well as tax evasions. Multi-dimensional analyses can be used also for detection of wrongly set transfer prices. Principally for setting the usual market price and also the interest on loans to connected persons or otherwise connected parties with the aim of tax avoidance or evasion.

4 Conclusions

The amendment of accounting introduced by the new Directive 2013/34/EU on the annual financial statements brought no effectivity into comparative accounting. Detection of accounting fraud would profit from separate statements assigned by subject matter. The entry of services in the profit and loss account should be reported separately in the attachment to the closing of books as calculation services that can be assigned to the calculation of prices of services or goods that create the added value (added value adjusted) and the other operational services. These other operational services are usually part of transfer services for international tax optimization. Financial Authority suggests that the tax recognition of cost interests should be at max. 20% of EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization). For the area of services could be proposed and recommended independent taxation of operational services which cannot be assigned to the calculation. Provided there was a link between the tax recognition of costs only according to material and time assignability into the calculation of the price of services and goods, Financial Authority would improve its effectivity and the tax payers could prepare better for the possible tax control.

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Zákon č. 563/1991 Sb. o účetnictví

Směrnice č.2013/34/EU

Modern Methods of Payment

Liběna Kantnerová, Michal Turek

Abstract: *This work analyses the citizens´knowledge concerning payment tools in comparison of the Czech Republic with a similar research in the USA. The data were acquired through a questionnaire in a sample of 947 respondents. On the basis of the comparison of the obtained data we may say that in most parametres and indices the Czech respondents have a lot in common with their counterparts abroad.They use the same (and in some cases of higher quality) technologies and their interest in this field is of the same direction. Based on these findings we can say that in the contemporary globalized society the differences in people´s behaviour in various territorial milieus are diminishing and the world is divided not according to the territory, but to the access to the Internet and technologies in general.It is possible to confirm the speculation that the milieu of new technologies and methods in the field of payment the Czech Republic is at the front of the development and its citizens can use most of the comforts offered at present.*

Key words: Payments Methods · Debit Cards · Credit Cards · Mobile Payments

JEL Classification: G21 · G23

1 Introduction

Since the beginning of human civilization people have been trying to develop payment methods together with the developmnet of trade. With the start of electronic era when material money became a history, electronization in the field of payments is reaching quite a high speed. This is nowadays, together with the origin of a new sort of money – electronic money , a symbol of modern payment method. The trend offered by the providers of these services positively aims at the speed, simplicity and easy accessibility of services related to using money, with the stress laid upon the security and protection of financial means. The year 1987 is indicated as the origin of the network Internet. By the time computer networks were used only for scientifc or military purposes and their range was as to the number of users limited.(Kantnerová, 2016).

Right at the end of the 80s and at the beginning of the 90s worldwide standards for the Internet run were established including the origin of www system for browsing, storing and refering to documents. At the beginning of the 90s other technologies started to expand: mobile networks.The first and still most used methods are payments by cards and via the Internet, which nowadays can hardly be ranked among modern payment methods. There are lots of novelties on financial matkets at present, for example in the field of payment terminals. Apparently the best known and developed is the project of mobile readers named Square, belonging among the so called start-ups. One of several definitions describing the milieu of strat-ups was created by an American entrepreneur and author Eric Ries: ″Start-up is an organization aimed at creating a new product or service in an extremely uncertain conditions″ (Ries, 2015). At present it is possible to carry out payments also via NFC, Apple Pay, Android Pay and Samsung Pay.

Phones have also reached their climax, nevertheless according to Maurer ″their number in the world standard is still enormous ″(Maurer, 2015). For payments SMS, SIM and USSD services can be used. There are several operating systems on the market for smartphones, well known is Android, iOS, Windows , Blackberry or Symbian. The first two – Android from Google and iOS from Apple prevail on the market. Payments then can be divided into payments by mobile phone substituting a card and by smartphone substituting a computer with electronic banking. In the world the mass expansion of technology of direct payments by mobile phones started approximately in 2015. The development of these payments is connected with the expansion of hardware equipment of smartphones, when most of these devices is equipped with a chip supporting NFC payments. Devices equipped in this way with the help of chips simulate a payment card, and at the same time enable banks to eliminate the impact of mobile operator and thus to increase the profit from the payments; therefore banks fully support this method of payment.

Significantly more widespread is the usage of mobile applications for conducting Internet banking. In this field applications substituted mere usage of Internet bankíng via the Internet browser installed in a cellar phone. These applications are issued directly by particular banks and they are practically a simplified version of Internet banking adapted with a displey fromat to a smartphone. Securing payments carried out from these applications works on the principle of

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uniquely generated access codes in an application, in the CR e.g. Unicredit Bank or sending SMS with a code e.g. MO-NETA Money Bank, a.s.

Among the best known applicatioms for direct payments we can name MasterCard Mobile or mobilPay Wallet, both working on the basis of an electronic purse. This type od payments is expected to be flourishing in the future, especially when the first implementations of technology HCE (Host card emulation) are coming into existence. In the CR the Bank of Commerce , a.s. is the first to introduce this technology as it announced establishing HCE by 2017. The substance of this technology is an emulation of a payment card on the software basis when the card data are stored in cloud in servers of a mother bank (contrary to NFC chips) and a mobile device access these data from the distance only at the moment of payment. The main contribution of this technology is a bigger safety, payments are verified by *token* , i.e. software key unique for each device, each tradesman and each particular payment, together with simplified implementation of payment cards for mobile devices.

MasterCard announced early October 2017 the launch of its new innovative payment solution in 12 European countries. This service is provided by a mobile app called "Identity Check Mobile" and was initially launched in the United States last February. France is not part of those pilot countries in Europe and will have the service deployed progressively in 2017. The principle is simple: people can pay with their fingerprints or with a selfie**.** In order to make sure that the selfie is a not a previously taken photo, the app asks the user to blink while taking the photo and processing the facial recognition (Castellani, S., 2017). On the other side can be using of payment card disapointing, as stated Soukal and |Hedvicakova (2013). This new noncommercial-banking product was meant to be a new tool of effectiveness in the social benefit system in the Czech Republic. The goal was effectiveness in costs, transaction time reduction and directness. However the implementation scheme turned out to be defective from design.

When mapping modern methods of payment at present, we have to mention also using the so called QR (quick response) code. There is certain similarity in usage with a linear code, marking huge amount of goods all over the world. The origin of code can be set to the beginning of the 90s.

While a linear code can be loaded with a relatively small number of figures and letters, with the construction of QR code these problems were removed. The code was at first used only in logistics.

Its wider usage came with smartphones, it was possible to download applications for reading the QR codes free of charge, for example. *QR droid – a* well known browser of codes promarily designed for an operation system Android, - *Scan for iPhone* a browser for iOS, *Quickmark* – a universal browser for most operating systems, *ScanLife* – another universal browser supporting reading not only QR codes, but also linear codes.

QR codes are at present divided into several types and also from 2005 are subject to a unified stardardization ISO/IEC18004:2015.[29]

In the CR using QR code is standardized within domestic payment system in Czech Crowns via the standard of the Czech Bank Association in its latest version from August 2015.

A comparatively essential event in the world of new systems of payment became the origin of new platforms for money transfer between accounts, e.g. PayPal, Google Wallet, Android Pay, ApplePay, Alipay or SamsungPay which work on the basis of electronic purses, the so called e-wallets.

It is interesting that these payment systems did not origin from the impulse of banks, but outside the banking world. All these systems emerged primarily as services for money transfers for a particular tradesman. As we can see from the service names, most of them work in this way also nowadays, with the exception of PayPal (a dominant payment system) which emerged as one of the first systems on the Internet.

2 Methods

The aim of his presented paper is to confirm or not the idea, that in the environment of new technologies and methods in the field of payment the CR is at the front of the development and its citizens can use most facilities offered at present.

For the practical part of this paper we have chosen a questionnaire method to obtain the biggest possible sample of respondents in a relatively short time period. The questionnaire was created in Microsoft Office Word (2010) programme and then implemented into www.vyplnto.cz designed for questionnaires; 947 respondents took part in it and the return was 82.5%. It included 17 questions, for a greater simplicity and clearness there were closed and semi-closed

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[29] http://www.iso.org/iso/home/store/catalogue_ics/catalogue_detail_ics.htm?csnumber=62021

questions. The content consisted of two main areas: the first included information about the structure of the respondents´sample (questions 1- 4). The following questions tried to uncover the respondents´knowledge concerning payment methods. Some of the questions were chosen with the intention to enable comparing the answers with the data from the questionnaire of the TSYS company. From the questionnaire a sample of questions applicable on respondents in the CR was chosen. The collection of data in the Czech Republic was done during 2016.

3 Research results

More women than men participated in the questionnaire – 613, which is 64.75% of the total number of respondents, the most numerous group being respondents aged 25 – 34 (37.59%) with a university education (46.15%, see the attachment). The questions were directed at financial literacy concerning new methods of payment and at safety in paying.. Another question concerned frequency of various methods of payments. Question deals with the most frequent activity of the respondents in the field of new payment methods too. Answers to questions are then compared with similarly formulated questions in the TSYS questionnaire.

880 respondents know the difference between a debit and a credit card (92.92%). 475 respondents use a debit card (50.16 %) .75.18 % respondents consider the safety of cards satisfactory. 474 respondents know chip or EMV cards, 473 respondents do not. 803 respondents are not familiar with the term tokenization, only 144 are. From the total number of respondents 564 (59.56 %) declared they have a chip card, 383 do not. Payments by cards are implemented several times a week (426 respondents , 44.98 %). The total expense by card was 1,000 – 5,000 a month (39.98%). As the biggest advantage of the debit card the respondents see the possibility of simple remittance from the client´s account (645 respondents – 69.96%). With credit cards they appreciate their flexibility of settlements (177 respondents – 19.2%). 62.8% respondents do not own a credit card.

37.8 % respondents declared they would not use the card more often,the second most frequent answer was discounts (16.16%). 622 respondents (65.68 %) answered they do not want to use cellar phones for payments.

Table 1 The comparison of payments methods in the Czech Republic and USA

PREFERENCE TO PAYMENTS METHODS IN % OF RESPONDENTS							
	Debit cards	Cash	Credit cards	Alternative payments	Some other	Branded credit cards	Prepaid credit cards	Money order, cheque
Preferred Payment Type (Czech Republic)	50.16	28.41	18.16	1.16	0.84	0.84	0.21	0.21
Preferred Payment Type (USA)	43.00	9.00	35.00	3.00	5.00	1.00	2.00	2.00

Source: Own processing, Payments Study (2016)

Table 2 Knowledge of payment card concepts

	Knowledge of EMV or chip card	Knowledge of Tokenization	Ownership of chip card
Preferred Payment Type (Czech Republic))	50.05	15.21	59.56
Preferred Payment Type (USA)	48.00	8.00	22.00

Source: Own processing, Consumer Payments Study (2016)

Figure 1 The comparison of the situation in the Czech Republic and USA

Which option would be most appealing when paying with your mobile phone?
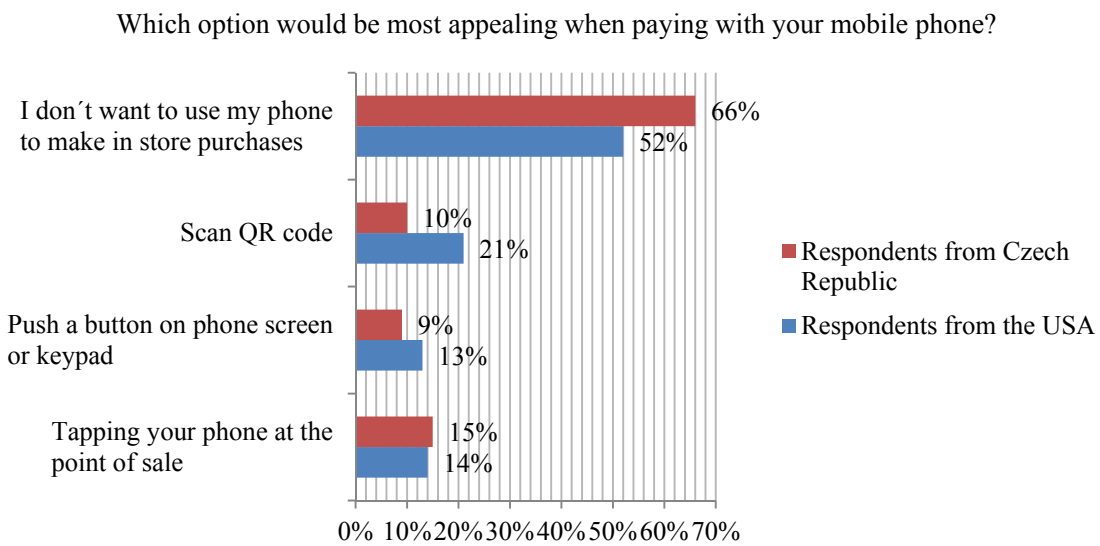
Source: data from the research, Consumer Payments Study (2016)

Figure 2 The comparison of the situation in the Czech Republic and USA

Select the following statements that best describes the actions you took last year
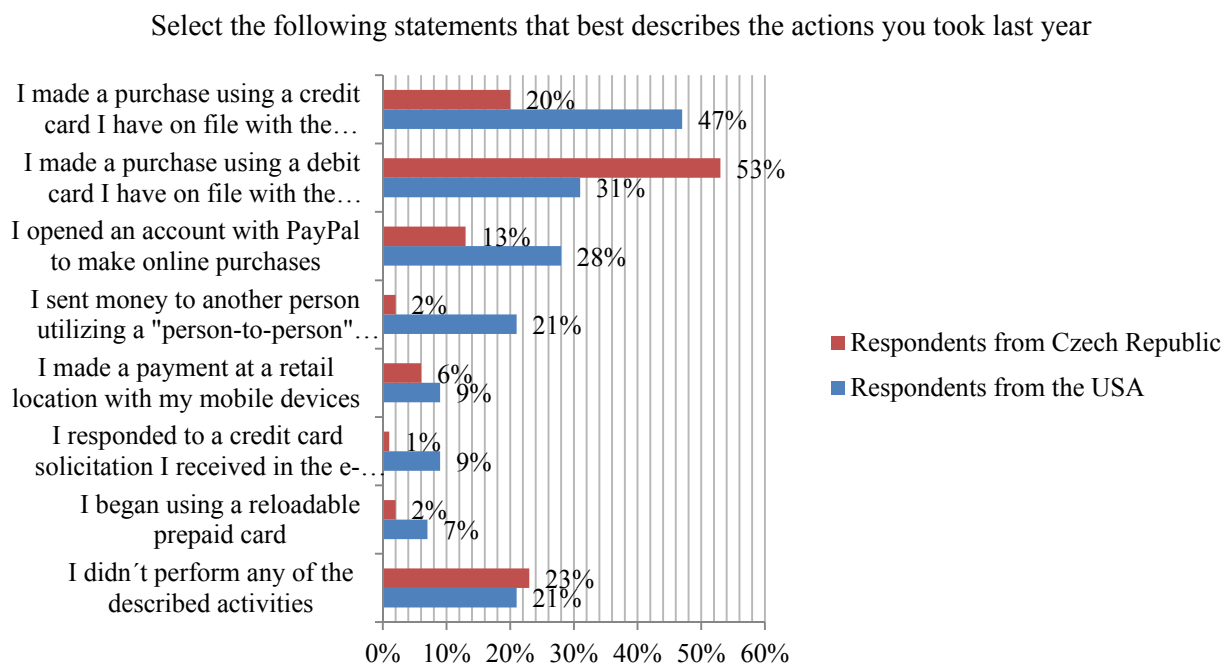
Source: Own processing, Consumer Payments Study (2016)

4 Conclusions

In this work practical usage of modern payment methods was investigated by questionnaires among respondents in the Czech Republic. We gathered and assessed their answers to 17 questions concerning the level of knowledge and experience with new technologies in the field of paying. Based on the results it was possible to set up a profile of a Czech user of these technologies. It was certified that most our citizens are in contact with most of above mentioned methods of payment. Most respondents not only confirmed knowledge of these technologies but also their active usage as well as their safety. At the same time we found out that technological level of the means used by our respondents can be compared to world´s top. In this work data from the research "2014 Consumer Payments Study" (2016) aimed at comparing the level of knowledge and technological facilities in the Czech Republic and advanced western economy (here the U.S.A.) were used. Based on the obtained data we can say that in most parametres and indices Czech respondents have a lot in common with their counterparts abroad. They use the same (in some cases even of a better quality) technologies and also their interest has the same direction. Further we can state that in a contemporary globalized society differences in people´s behaviour resulting from different citizenship diminish and the world is not divided according to the territory, but access to the Internet and technologies in general.

Thererfore we can confirm the idea that in the environment of new technologies and methods in the field of payment the Czech Republic is at the front of the development and its citizens can use most facilities offered at present.

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Enclosures: 1. charts to the description of respondents in this research (age)

- up to 24 : 194 (20.49%)
- 25 - 34 : 356 (37.59%)
- 35 - 44 : 148 (15.63%)
- 45 - 54 : 114 (12.04%)
- 55 - 64 : 87 (9.19%)
- 65 or older : 48 (5.07%)
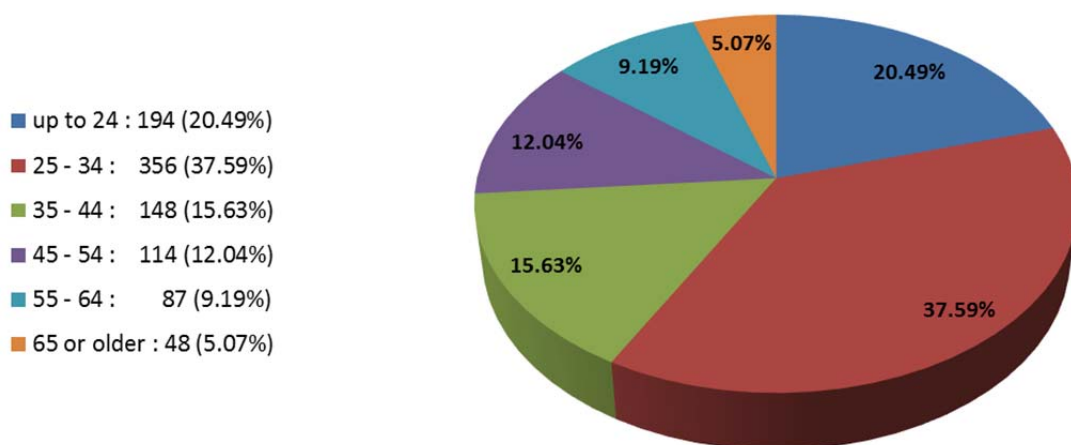
Source: Own processing

Enclosures: 1. charts to the description of respondents in this research (education)

- University : 437 (46.15%)
- Some high school : 365 (38.54%)
- Vocational certificate : 54 (5.7%)
- Some college-no degree : 50 (5.28%)
- Primary education : 41 (4.33%)
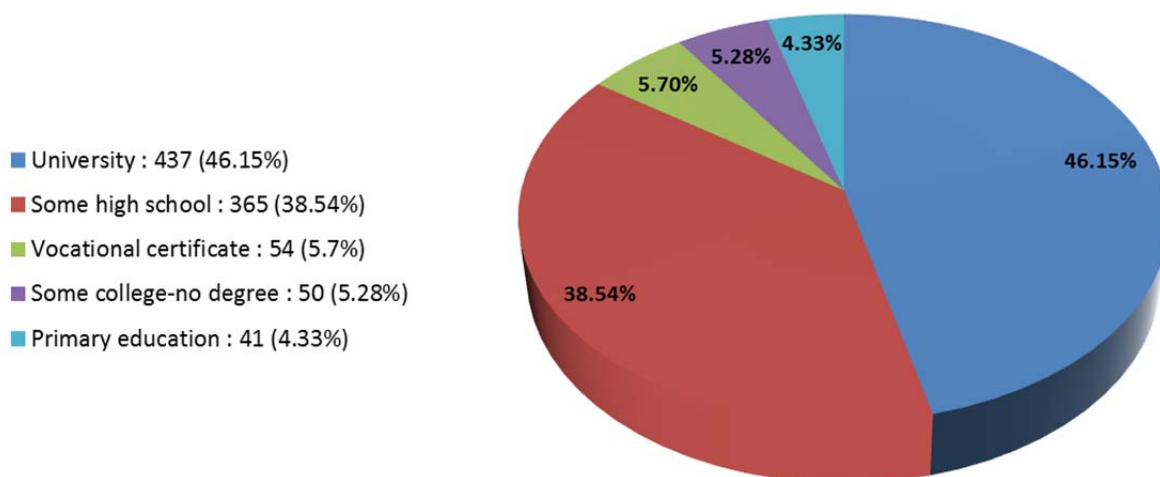
2. The questionnaire

1. Are you woman or rman? (2 groups of answers)
2. Which age (6 groups) of answers)
3. Your education (5 groups of answers)
4. Your job (6 groups of answers)
5. Do you know the diference between debit and credit payment card? (2 groups of answers)
6. Which payment method do you use often? (8 groups of answers)
7. Do you think the safety of electronic payment methods is sufficient? (2 groups of answers)
8. Do you know the term of EMV or cards with chip? (2 groups of answers)
9. Do you know the term „tokenizace"?? (2 groups of answers)
10. Do you have a chip card? (2 groups of answers)
11. How often do you pay by your payment card? (6 groups of answers)
12. How much do you pay by your payment card a month? 6 groups of answers)
13. What is the best on the debit payment card? (10 groups of answers)
14. What is the best on the credit payment card? (8 groups of answers)
15. What will do more attractive to you the using of your payment card more often? (13 groups of answers)
16. Describe please your new activity in the last year, which was new for you in the using of modern methods of payments? (10 groups of answers)
17. Which method do you prefer for the mobile payments? (4 groups of answers)

The Cash Flow Influenced by Key Factors of Debt Eliminated Hospitals in Slovakia

Andrea Masařová, Marcela Basovníková

Abstrakt: *The article is focused on a sample of 25 Slovak hospitals that were debt eliminated in 2011. The main aim of the paper is to identify the key factors that affect the cash flow of monitored hospitals in Slovakia. The partial aim is to create a simplified cash flow through the indirect method for the years 2009-2015, which has been explored in time by the rate of increase. A panel regression analysis of individual cash flow items was also performed to identify key factors. The situation of hospitals in Slovakia in 2010 was so serious that despite the received return assistance in 2009, the government decided to relieve 25 Slovak hospitals in 2011. This was a non-repayable financial assistance of approximately € 350 million. Key operating factors have been identified as earning after taxes, change of reserve status, change of short-term payables, acquisition of long-term tangible and intangible fixed assets and to a minimum, changes of supplies and changes of liabilities.*

Keywords: Hospital · Cash Flow · Debt Elimination · Contributory Organization

JEL classification: I18 · M21

1 Introduction

Cash flow, as stated in its publication Sedláček (2010), is a concept originating in the United States. From a theoretical point of view, it has been developing since the beginning of the last century, but it has become a matter of interest only in the 1960s when the cash flow statement begins to complement the company's balance sheet and profit and loss accounts. The basis for determining cash flow, namely cash flow, is primarily business accounting. Cash flow reflects the increase or decrease of the funds in the organization's activities. It is formed in 3 areas: operational, financial and investment. In the operational and financial areas, the cash flow should have a positive value, but in the investment area, it is neither a negative result nor a negative value that indicates that the company has invested its funds in long-term assets that should serve primarily to develop and grow the business. However, the overall cash flow should ultimately be positive, which means that an enterprise may only invest if it has sufficient financial means for the operation itself. The cash flow statement is therefore the primary basis for managing the company's liquidity. Liquidity management means the ability of an entity to settle outstanding payables at a given time and volume. In the context of the above, it is clear that the cash flow statement, its resulting value serves primarily to financial management of the enterprise.

The difference, however, is cash flow in contributory organizations and companies with legal form of business. The difference here is not the way of compiling or the content of individual items, but the decision about the future use of funds to finance their own activities. Contributory organizations, in the case of hospitals established by self-governing units, are not a separate entity and only operate on behalf of their founder with funds entrusted to them. It is an organization that is connected to its founder, so a notional profit - if it could be created - could only be used for the main activity if the hospital wanted the profit to be used in a different way, only if the founder's permission was granted. (Vávrová, 2007)

Hospitals with legal form of business are separate entities that are not in the case of financial management, respectively planning, limited as limited by contributory organizations. Control mechanisms in companies with legal form of business are much better set up, companies have far more opportunities to use both their own and foreign sources, which results in a balance of capital structure and therefore the possibility of deciding on future investments that in many cases are not subject to public contracts. These companies can also be considered more effective because financial decisions are based on a number of economic analysis, studies and assessments. In contributory organizations, this method is not usual, which can result in uneconomical use of funds, mainly due to lack of management responsibility. (Peková, Pilný, Jetmar, 2012)

According to the latest checks carried out by the Slovak Supreme Audit Office (Silná, 2017), the state hospital in Slovakia is basically losing to those managed by private owners. Private hospital networks are effectively managing

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resources and purchasing centrally, the weak of state hospitals are management and uneconomic management of resources. As mentioned above, public hospitals are mainly unrealistic budgets that do not rely on any economic analysis resulting from historical data, the non-binding nature of their performance, the low level of personal responsibility for the economic result and, last but not least, the inefficient purchases that the investment, or, overall, the overall cash flow of hospitals is very significant.

The aim of this article is to determine the key factors influencing the cash flow in delinquent hospitals in Slovakia, where the primary premise is that the deferred hospital should show a positive economic result in the future, since almost all liabilities from trade and supplier relations have been settled. However, the results of individual deferred hospitals in the following years, after debt relief, show the opposite, most of them in the following year again returned to the negative economic result and thus the inability to pay for their liabilities.

At the end of 2007, the health service debt amounted to more than 8 billion Slovak crowns. For this reason, the government decided to give 25 hospitals a hand in hand and provided approximately 130 million euros (Slovak crowns 3.9 billion) to debt relief, with the largest amount, approximately EUR 109 million, being dismantled by the hospitals in the establishment of the Ministry of Health of the Slovak Republic. Debt was made in the form of a repayable financial assistance granted in 2009 by the Ministry of Finance of the Slovak Republic. (The state will eliminate the debt of 25 hospital, 2009) The assumption of a one-off debt was the elaboration of so-called individual action plans, which had to include the demonstration of the ability of the healthcare facility to create no new debt within 12 months, and to pay after the two-year postponement for the state aid and to repay it within 15 years. The problem was that no systemic measures in the health care system were created with de-debt. In the following year, reality showed that most hospitals would not be able to repay financial assistance. Therefore, in 2011, the Department of Health not only forgave the hospital debt of EUR 130 million, but also approved a loan of EUR 350 million. (Zachar, 2013)

A major problem for hospitals is, above all, poor economy, mismanagement of funds. However, this is not a problem only in Slovakia or the Czech Republic. As stated by Bonenberg, Aikins, Akweongo and Wyss (2016), we are constantly witnessing that good governance can improve the performance of healthcare facilities. Key factors for inefficient practices were the lack of human resources, lack of planning and poor management of financial resources. Adelino, Lewellen, Sundaram (2015) focused on the investment potential of non-profit hospitals and found that there was a dependency between cash flow shocks caused by the performance of hospital financial assets and hospital expenses. Sensitivity in this case is higher for hospitals that are more financially restricted.

2 Methods

The monitored sample includes 19 Slovak contributory hospitals which were debt eliminated in 2011. In sum, 25 medical facilities were debt eliminated - 19 contributory, 5 non-profit companies and 1 joint-stock company. However, one non-profit organization is in liquidation, four non-profit organizations and joint-stock company have publicly available financial statements only from 2013. Financial data about hospitals will be obtained from the Balance Sheet and the Profit and Loss Statement available from Register účetných závierok (=Financial Statements Register) of Slovakia.

Table 1 Hospitals that have received a refundable financial assistance for debt elimination in 2011

Nr.	Hospital	ID	Legal form	Financial aid (EUR)	Notes
1	Trenčín University Hospital	2021254631	Contributory	9 316 831,29	
2	J.A.Reiman University Hospital with outpatients' care Prešov	2021281559	Contributory	7 533 711,45	
3	University Hospital with with outpatients' care Bratislava	2021700549	Contributory	22 659 108,19	
4	University Hospital Nitra	2021205197	Contributory	4 737 788,99	
5	Children's University Hospital with outpatients' care Bratislava	2020848368	Contributory	7 167 432,18	
6	L.Pasteura University Hospital	2021141969	Contributory	14 690 913,52	
7	F.D. Roosevelt University Hospital with outpatients' care Banská Bystrica	2021095670	Contributory	27 018 178,17	
8	Children's University Hospital Košice	2020777880	Contributory	356 098,49	
9	University Hospital Trnava	2021191084	Contributory	14 588 371,98	
10	University Hospital with outpatients' care Žilina	2020699923	Contributory	4 815 820,64	
11	Martinská University Hospital Martin	2020598019	Contributory	952 891,21	
12	Psychiatric Hospital P. P. Pezinok	2022140483	Contributory	452 620,31	
13	Hospital with outpatients' care Ilava	2021737828	Non-profit	654 210,39	data from 2013
14	Dr.Guhr Sanatorium, Tatranská Polianka	2020516630	Non-profit	118 952,80	data from 2013
15	St. James Hospital, Bardejov	2020028824	Non-profit	424 264,18	data from 2013

16	St. Svorad Specialized Hospital, Zobor	2021877792-	Non-profit	151 698,98	data from 2013
17	Štefan Kukura Hospital with outpatients' care in Michalovce	2022880134	Joint-stock	423 426,50	data from 2013
18	Kysuce Hospital with Čadca outpatients' care	2020552083	Contributory	768 418,69	
19	Hospital with outpatients' care Prievidza with seat in Bojnicie	2021163276	Contributory	1 318 079,08	
20	Hospital with outpatients' care Považská Bystrica	2020705038	Contributory	4 049 609,00	
21	Hospital with outpatients' care Vaše zdravie Zvolen	2021938589	Non-profit	593 263,13	in liquidation
22	Dolnooravská Hospital with outpatients' care of MUDr. Ladislav Nádašiho-Jége, Dolný Kubín	2020563754	Contributory	1 118 518,00	
23	Liptov Hospital with outpatients' care Liptovský Mikuláš	2020575755	Contributory	2 013 060,00	
24	Hospital with outpatients' care Myjava	2021039988	Contributory	837 915,45	
25	Central Army Hospital SNP, FN Ružomberok	2020590187	Contributory	3 416 848,47	

Source: own processing using data from Financial Statements Register

The monitored period will be years 2009-2015. The key year will be the year 2011, in which the hospitals in Slovakia were debt eliminated. In this time period, simplified cash flow will be made using the indirect method. Simplified cash flow will be compiled using the available financial statements of Slovak hospitals. In the table below (Table 2), the cash flow scheme is calculated using the indirect method. For cash flow analysis, all hospitals will be examined together using the average values of each item of the statement.

Table 2 Simplified cash flow statement - indirect method

A.1		Earning after taxes
A.2		Accounting depreciation of tangible and intangible assets
A.3		Change of reserves
A.4		Change of supplies
A.5		Change of receivables
A.6		Change of short-term liabilities
A *	A*=A.1+A.2+…+A.5	Net cash flow from operating activities
B.1		Acquisition of tangible and intangible assets
B.2		Acquisition of financial assets
B *	B*=B.1+B.2	Net cash flow from investing activities
C.1		Change of long-term liabilities
C.2		Change of bank loans
C.3		Change in equity from selected operations
C *	C*=C1+C.2+C.3+C.4	Net cash flow from financial activities
F.	F=A*+B*+C*	Net increase or decrease of cash flow

Source: own processing

Because of cash flow tracking is particularly important for this article, the items will be explored using the growth rate. The rate of increase (or rate of decrease, depending on whether or not the item increase or decrease most often) gives information about how many percentages have changed in the current period t + 1 over the base period t.

$$Rate\ of\ increase = \frac{value\ in\ current\ period - value\ in\ base\ period}{value\ in\ base\ period} \qquad (1)$$

For the correct interpretation of the results, the denominator of the fraction must be given in absolute value. If there is a negative value in the base period and if the value in the current period is positive, the increase is negative, although it should be positive. If the rate of increase is negative, then the value in the current period decreases compared to the value in the base period. On the other hand, if the growth rate is positive, the value for the current period has increased over the base period.

The data will be analysed as panel data in the quantitative part of the research and that in Gretl program. Panel data is a specific type of observation that combines cross-sectional and time-based data. Panel data allows you to increase the data file and test even more complex econometric models. (Hušek, 2003) The basic regression model of the panel data looks as follows (Greene, 2003):

$$y_{it} = \beta_1 x_{it1} + \beta_2 x_{it2} + \cdots + \beta_k x_{itk} + \propto_1 z_{i1} + \propto_2 z_{i2} + \cdots + \propto_q z_{iq} + \varepsilon_{it}, \qquad (2)$$

Where i denotes cross-sectional dimension i = 1,..., n;

t denotes the time dimension t = 1, …, T;

$x1$ to xk are explanatory variables not including unit vector;

and $z1$ to zq represent individual effects, i.e. the diversity that an individual or whole group can distinguish from other entities (this includes any entity vector).

Explained variable, which measures hospital performance, will be the net increase/decrease in cash flow. The explaining variables will be individual cash-flow items for the panel model:

- Earning after taxes
    o balance sheet item, liabilities - A.III,
- Accounting depreciation of tangible and intangible assets
    o cost item, account class 55,
- Change of reserves
    o balance sheet item, liabilities – B.I,
- Change of supplies
    o balance sheet item, assets – B.I,
- Change of receivables
    o balance sheet item, assets – short-term and long-term receivables – B.III, B.IV,
- Change of short-term liabilities
    o balance sheet item – liabilities, B.IV.,
- Acquisition of tangible and intangible assets
    o balance sheet item, assets A.I + A.II – cost item, account class 55
- Acquisition of financial assets
    o balance sheet item, assets A.III,
- Change of long-term liabilities
    o balance sheet item, liabilities B.III,
- Change of long-term bank loans
    o balance sheet item, liabilities B.V,
- Change of equity from selected operations
    o balance sheet item, liabilities – owner's equity.

3 Research results

The debt elimination of hospitals had an impact on cash flow items in 2011, as is shown in Table 3. The following table shows the cash flow generated by the indirect method in 2009-2015, expressed in terms of growth rates.

"Earning after taxes" increased compared to the previous period in 2011 and in 2013. The year 2011 is even the only year when the average value of the earning after taxes of all monitored hospitals was positive. In the remaining years, the earnings after taxes are always negative on average. The positive economic result in 2011 is due to the debt elimination of the monitored health facilities. In 2009, hospitals received long-term financial repayable assistants from public sector entities (state), which were shown in balanced sheet on the liabilities side mainly in "long-term bank loans" and, to some extent, in "short-term liabilities". The aid was mainly used to repay the supplier's liabilities. However, the situation in Slovakia was so serious in 2011 that the government decided that the assistants would be reclassified as non-repayable financial assistance, which was reflected in the profit and loss statement by increasing the item "Revenues from current transfers from other public entities" or "Other revenues from the operational activity ". The difference was only in the booking to the accounting. By increasing the revenues logically, the profit was increased. It can be seen from the table that the discharge did not have a lasting effect. In 2012 there is a decrease of Earning after taxes compared to 2011 by 150%, the absolute value is a decrease of approximately EUR 20 million. The following graph shows the development of Earning after taxes in 2009-2015.

"Accounting depreciation of tangible and intangible assets" increased by approximately 1.5% in 2011 and continues to grow until 2014, when they decrease. However, the changes are small and have a little effect on the total cash flow. The "change of reserves" item increases compared to the previous year only in 2011 and in 2015. In 2011, hospitals are making reserves for the future. The founder of the organization (in this case the state) provides a contribution to the operation of its contributory organization. If funds from grants or other forms of income are not spent before the end of the calendar year, they are transferred to the reserve fund as a source of funding in the following years and can be used for the intended purpose. This happened in 2011, as shown in Table 3, with a change of the reserve of approximately

160% between 2010 and 2011. In the other years, contributory organizations are obliged to cover the losses of the past years.

Table 3 Rate of increase of cash flow compiled by the indirect method in 2009-2015

	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015
Earning after taxes	-49,92%	361,50%	-150,02%	40,83%	-5,37%	-23,97%
Accounting depreciation of tangible and intangible assets	-1,51%	0,26%	1,87%	0,97%	-7,63%	-10,96%
Change of reserves	-437,34%	164,15%	-160,81%	-183,74%	-920,26%	98,24%
Change of supplies	225,50%	-124,82%	-50,01%	85,62%	-1390,78%	79,31%
Change of receivables	-286,80%	299,82%	-237,10%	35,90%	167,18%	-389,24%
Change of short-term liabilities	253,67%	-223,69%	186,75%	-14,02%	-2,12%	21,62%
Net cash flow from operating activities	183,08%	230,90%	-86,38%	156,48%	-16,65%	-19,69%
Acquisition of tangible and intangible assets	-21,93%	13,33%	19,35%	-20,57%	30,23%	25,35%
Acquisition of financial assets	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Net cash flow from investing activities	-21,93%	13,33%	19,35%	-20,57%	30,23%	25,35%
Change of long-term liabilities	-102,72%	-3868,72%	89,88%	92,18%	-421,66%	819,25%
Change of long-term bank loans	-99,57%	-22367,56%	100,00%	100,00%	0,00%	0,00%
Change of equity from selected operations	-183,07%	100,00%	0,00%	-93,81%	123,98%	-31,56%
Net cash flow from financial activities	-1064,61%	94,02%	21,24%	135,72%	1107,88%	-83,28%
Net increase or decrease of cash flow	-73,42%	137,61%	-494,57%	109,54%	310,61%	8,35%

Source: own processing using data from Financial Statements Register

The "change in supplies" item develops quite fluctuating between 2009 and 2015. The biggest change occurs between 2013 and 2014, by - 1 390.78%, and hospitals are probably uneconomically dealing with purchased supplies. Negative values indicate that hospitals make up supplies, most often represented by the material item. On the other hand, the largest increase occurred in 2010 when supplies grew, meaning that hospitals have earned money because of good material economy. In absolute value, the change of supplies is positive only in 2010, and for the rest part of the year the values are negative.

Figure 1 Development of the average profit before taxation of selected hospitals in 2009-2015 (EUR)
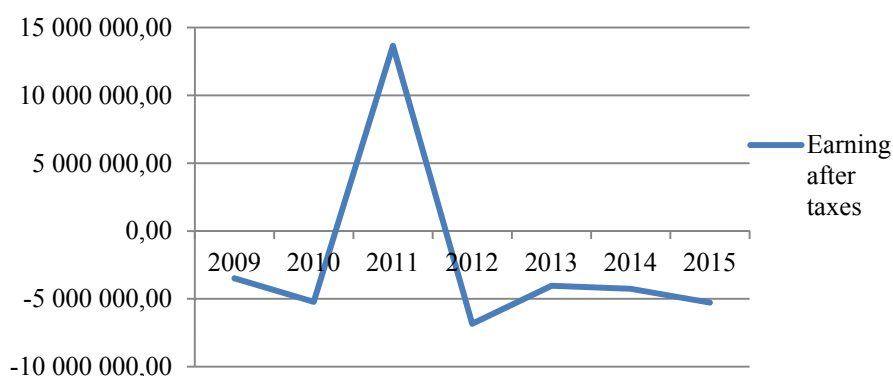
Source: own processing using data from Financial Statements Register

The largest increase of "change of receivables" is evident between 2010 and 2011. Between these years, receivables increased by almost 300%. In all hospitals, only short-term receivables are changed, long-term receivables are zero for all hospitals. Only the Faculty Hospital with Poliklinika Žilina records long-term receivables from 2010, namely other receivables, and still the same amount of 15 359 EUR. The biggest negative change occurred between 2014 and 2015, when receivables declined by 390%.

The item 'Change of short-term liabilities' recorded the largest decrease between 2010 and 2011, approximately by 223%. This decrease is due to the debt elimination of hospitals, which also affected short-term liabilities that were repaid due to financial assistance. In 2010, short-term liabilities to suppliers rose in all hospitals by almost one-third. In

particular, due to the high debt to suppliers (mainly suppliers of hospital supplies), the state decided to provide financial repayable assistance in 2009 and reclassify it as non-repayable in 2011. The rate of increase in the change of short-term liabilities between 2011 and 2012 suggests that the 2011 disinflation of hospitals was not effective. Hospitals have not improved their financial situation, as short-term liabilities increased again, averaging EUR 5,800,000. Even in the years to come, they are increasing, though not so fast.

"Acquisition financial assets" is null throughout the reporting period. None of the monitored hospitals has financial assets. "Acquisition of fixed and intangible assets" averaged around +/- 20%. The biggest decrease is evident between 2009 and 2010, when hospitals mostly purchased tangible fixed assets. The change was reflected in particular in Buildings and Separate Movables. On the other hand, the largest increase occurred between 2013 and 2014. The chart below shows the evolution of the change in the acquisition of tangible and intangible fixed assets in absolute terms for the years 2009-2015.

Figure 2 Development of acquisition of tangible and intangible fixed assets of monitored hospitals in 2009-2015 (EUR)
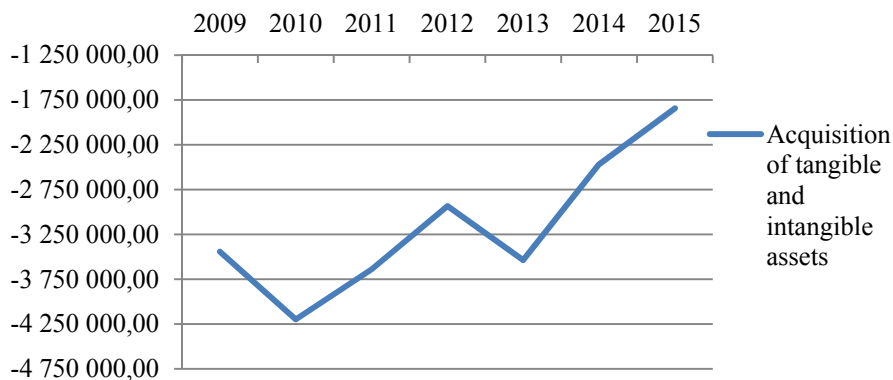
Source: own processing using data from Financial Statements Register

There is interesting view on the acquisition of tangible and intangible fixed assets and the development of the profit after tax. From 2011 to 2015, there are always conflicting changes in both items. When the earning after taxes is increased, there is a decrease in the acquisition of tangible and intangible fixed assets and vice versa. In figure 3 you can see that even if the hospital is in a loss, it most often acquires long-term tangible property. Representation of intangible fixed assets is minimal. This situation is indicative of poor hospital management.

Figure 3 Development of rate of increase of acquisition of tangible and intangible fixed assets and earning after taxes for selected hospitals in 2009-2015 (EUR)
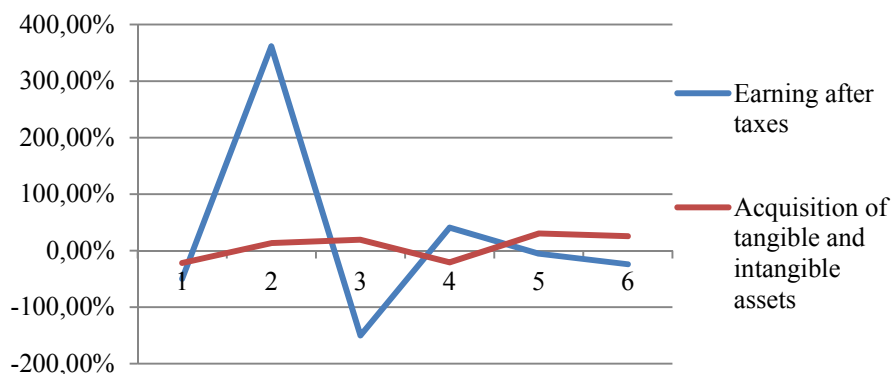
Source: own processing using data from Financial Statements Register

The "Change of long-term bank loans" corresponds to the aforementioned. In 2009, there is an increase in the change in long-term bank loans, which is not yet apparent in Table 3. The growth rate between 2010 and 2011 is significant. These years, most of the long-term bank loans are repaid, namely by repayment of repayable financial assistance. By reclassifying the repayable financial assistance into non-repayable and basically forgiven hospital debt that arose in 2009. In 2015, part of the long-term bank loans was still repaid.

Developments of growth rates "Changes of long-term liabilities" are similar to changes of long-terms bank loans. Between 2009 and 2010, and between 2010 and 2011, it is decreasing. This is the same case as for bank loans, it differs only in the accounting of financial assistance from the state. Most of hospitals booked financial assistance in the Balance Sheet on the line Received Reimbursable Financial Assistance from Public Administrations in 2009 and then in

2011 they were accounted as non-repayable in revenues on the line Revenues of Self-Government from Current Transfers from the State Budget and from Other Public Administrations. For several hospitals, however, there was a situation where the repayable financial assistance was recognized in the Balance Sheet as the other long-term liability and subsequently in revenues as Other Financial Income. Therefore, in 2011, the long-term liabilities decreased by 3 868%. Table 4 below shows for the sake of clarity the evolution of the change in the status of long-term bank loans and long-term liabilities in absolute terms.

Table 4 The development of the change of bank loans in absolute values in 2009-2015 (EUR)

	2009	2010	2011	2012	2013	2014	2015
Change of bank loans	6 382 706,31	27 747,23	-6 178 630,75	-146,02	0,00	0,00	-87 109,68
Change of long-term liabilities	318 123,91	-8 656,56	-343 554,63	-34 766,46	-2 719,09	-14 184,42	102 022,04

Source: own processing using data from Financial Statements Register

"Changes of equity from selected operations" did not have a significant impact both on the total cash flow and on the cash flow from financial activities throughout the reporting period. Although there was a decrease of 183% in the change in equity between 2009 and 2010, it is a decrease of approximately EUR 15 000 in absolute terms.

It has been shown that the appropriate panel model is (see Table VI), according to the Hausman test with a p-value of 0.999, is a random-effects model, which means that random effects in a zero hypothesis are considered to be consistent. A 95% significance level was selected. Variable Depreciation_of_tangible_and_intangible_assets was not included due to the exact collinearity of the model, the data matrix would be almost significant. As the insignificant variable, the change_of_long-term_bank_loans was excluded as the first with the highest p-value. This is logical, as hospitals showed changes in long-term bank loans only for the first three years, so there was no dependence on total cash flow. Other excluded variables due to the high p-value were the change_of_long-term_liabilities and changes_of_equity_from_selected_operations. Therefore, in order for the overall model to be significant, it was necessary to make logarithm from the variable change_of_supplies and changes_of_receivables. The model is significant at this time, but it can be assumed that the two new variables do not have a significant effect on the resulting model. According to the p-value, it can be judged that the other variables are statistically significant. Instead of the variables the acquisition_of_tangible_and_intangible_assets and changes_of_reserves, the variables are significant at a materiality level of 95%. The adjusted determination coefficient is 93.48%, i.e. the model explains exactly 93.48% of the variation in the net increase or decrease in cash. The best overall cash flow explains the variable of acquisition of tangible and intangible fixed assets.

For completeness, it has to be added that the model has been tested for the correct function form of the model (RESET test), heteroskedasticity (White test), residual normality and first order error correlation. These tests have been tested correctly for the model, and therefore can be said to meet the quality requirements of regression models.

Table 5 Panel regression

	coefficient	p-value	significance
Const	-3,16151e+07	0,0038	***
Earning_after_taxes	68631,7	0,0286	**
Change_of_reserves	-0,95864	0,0203	**
Change_of_short-term_liabilities	-0,13201	0,0219	**
Acquisition_of_tangible_and_intangible_assets	-1,14745	0,0046	***
l_change_of_supplies	1,24167e+06	0,0224	**
l_change_of_receivables	1,55536e+06	0,0021	***

Source: own processing using data from Financial Statements Register

Coefficients of individual variables indicate the increment of the explained variable (total cash flow) at the unit change of the explanatory variable and at the same time allow the predicted explanation for individual cases. According to the established statistics, we can state that there are important variables that affect the net increase / decrease in the money and thus the financial situation of the company.

If the model increased by one unit, the situation would affect the amount of the total cash flow of EUR 68 831.7. We can say that there is a direct correlation, because with the increase in earning_after_taxes, there would be an increase in the total_cash_flow. An increase in unit income will result in a change in the change_of_reserves by EUR 0.9564, with a direct correlation between these items. Increasing the change_of_short-term_liabilities per -0,132014 results in a decrease in the total cash flow of one unit, which means that there is an indirect correlation between Change_of_short-term_liabilities and total_cash_flow. As mentioned above, there is only a minimum positive dependency that is not significant for the model between the variables l_change_of_receivables status and l_change_of_supplies and the varia-

ble total_cash_flow. On the other hand, the dependence between total_cash_flow and Acquisition_of_tangible_and_intangible_assets. In a situation where the cash flow increases by one unit, the item Acquisition_of_tangible_and_intangible_assets decreases by -1.14745 EUR, therefore it is an indirect correlation.

4 Conclusions

A prerequisite for the debt elimination of Slovak hospitals in 2011 was to address the critical health situation in Slovakia by paying off the hospital's obligations to its suppliers. However, the results of the article showed that hospital debt was ineffective as it failed to improve permanently the financial situation of indebted hospitals. The aim of the article was to identify the key factors that affected the total cash flow of hospitals in Slovakia. The regression analysis showed that the key factors are: profit after tax, change in reserve position, change of short-term payables, acquisition of long-term tangible and intangible fixed assets and, to a minimum, changes in inventories and changes in receivables. The biggest problem for hospitals is poor financial management. The results showed that despite the poor economic results (negative average earning after taxes from 2012), the acquisition of tangible and intangible fixed assets increased due to inefficient purchases. It can be said that the monitored hospitals lack the right management approach, managers are not personally responsible for the economic result. It may seem that managers rely on the fact that the hospitals can not be closed. The change in short-term liabilities is also reflected in the poor economic performance. Another year after debt relief, short-term commitments in almost all hospitals increased, namely by approximately 187%. Due to the lack of specialized resources to deal with the decontamination of hospitals in Slovakia, it is not possible to compare the results. The results of the article, however, coincide with the conclusions of the Slovak Supreme Audit Office that the state hospitals are managing inefficiently. The debt elimination from 2011 did not fulfill its purpose, mainly due to the fact that no systemic measures were implemented to prevent further financial problems of hospitals and thus allow ineffective purchases of medicines, medical supplies and hospitals.

Acknowledgment

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The Importance of Institutional Quality for Economic Performance in Post-Soviet States

Radek Náplava

Abstract: *The new institutional economics explains the differences between poor and wealthy countries with instituti-ons. Institutional quality creates the right conditions for long-term economic growth and higher economic performance. The purpose of this paper is to verify this assumption on a sample of post-soviet countries. Institutional quality is repre-sented here by the concept of quality of governance according to the World Bank methodology, which allows a compre-hensive assessment of the institutional environment. The results of panel regression with fixed effects confirm the theo-retical assumption. Furthermore, they indicate the importance of political stability, government efficiency, the rule of law and the control of corruption.*

Key words: Formal Institutions · Economic Performance · Post-Soviet Countries · Panel Analysis

JEL Classification: O43 · P48

1 Introduction

25 years since the break-up of the USSR is a time long enough to carry out a successful transformation from a centrally planned economy into a market economy. However, the transformation process has only reached its end in the Baltic countries, while the remaining countries are still among the developing countries. Democracy in Estonia, Lithuania and Latvia contrasts with the authoritarian regime in Azerbaijan, Belarus, Kazakhstan, Russia, Tajikistan, Turkmenistan and Uzbekistan and the hybrid regime[32] Armenia, Kyrgyzstan and Ukraine. However, a stronger contrast can be seen in economic performance as the performance of the Baltic countries exceeds other countries, despite the absence of the natural resources the remaining post-soviet republics – apart from Moldova – have. Why have the Baltic countries "grown up" while the remaining countries are relatively in decline? The answer can be provided by the new institutional economics and its concepts of institutions.

North (1991), one of the leading representatives of the new institutional economics, defines institutions as "*humanly devised constraints that structure political, economic and social interactions*". They can be both formal (laws, property rights) and informal (customs, traditions), and this contribution focuses on the formal institutions. These can be further divided by different classification criteria, but Jütting's (2003) division into political, economic, legal and social insti-tutions is the most important. On the grounds of their character we will abstract from legal and social institutions, and we will only focus on political and economic institutions as well the main topic literature. Political institutions provide information about the political stability, the political system and the elections, while economic institutions define, in particular, property rights, their enforcement and rules defining the production and distribution of goods and services. Given the above, it is clear that institutions are changing and evolving over time.

The executive power of the state (government) is one of the representatives of formal institutions – it affects our dai-ly interactions. Its quality through specific channels is an important factor in building a growing economy. The purpose of this paper is to empirically test the quality of the institutional environment as a determinant of economic performance in post-soviet countries between 1996 and 2014. Institutional quality is represented here by the concept of quality of governance according to the World Bank methodology, which allows a comprehensive assessment of the institutional environment (World Bank, 2017b).

The importance of institutional quality for long-term economic growth and higher economic performance is demon-strated by well-known contributions, e.g. Acemoglu et al. (2005), Aron (2000), Knack and Keefer (1995); from most recent, for example, the contributions of Ahmad and Marwan (2012), Nawaz (2015) and Spreafico (2010).

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[32] Hybrid regime combines democratic and autocratic elements; it is typically a combination of free market and autocratic leader. For more informa-tion about hybrid regimes in post-soviet countries see Hale (2006) and Libman (2012).

Acemoglu et al. (2005) call institutions (especially the economic one) the fundamental factor of the economic growth. Together with them, the authors also emphasize the geographical location. These two factors answer the question of the differences of prosperity between different countries. The most important of economic institutions, as Knack and Keefer (1995) said, is the protection of property rights. Spreafico (2010) broadly defined the relationship between institutions and growth and her contribution corresponds to the title of "What do we know about the link between growth and institutions?". She says, above all, that economic performance is not just an institution. Institutions, politics and market – this combination is a determinant of performance. These factors affect each other: good institutions (not only through politics) positively influence the market and lead to growth, while growth leads back to better institutions through the market. Aron (2000) pointed out this both-sided causality.

The quality of institutions affects economic growth particularly indirectly through the investment channel (Aron, 2000), the productivity channel (Ahmad and Marwan, 2012), the accumulation of human capital (Svensson, 1998) or the reduction of transaction costs (Pitlik and Kouba, 2013).

Let us add that it is not possible to give a universal recipe for the optimal composition of institutions. Nawaz (2015) pointed out that each country needs its own set of appropriate institutions – it depends not only on the assumptions of the home environment but also on the stage of the country's development.

2 Methods

Data for the empirical model are from the World Bank (World Bank, 2017a, World Bank, 2017b). The empirical model covers the years 1996, 1998, 2000, 2002–2014. Until 2002, data on the governance quality was published every two years. The concept for measuring the governance quality is called Governance Matters. The governance matters (gm) consists of six subindexes gm1-gm6 that get values from -2.5 to 2.5; the higher the number, the higher the quality of the index. Below is a brief description of the subindexes by its creators, Kaufmann et al. (2011):

- gm1 (Voice and accountability) = "*capturing perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media*";
- gm2 (Political stability) = "*capturing perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism*";
- gm3 (Government effectiveness) = "*capturing perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies*";
- gm4 (Regulatory quality) = "*capturing perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development*";
- gm5 (Rule of law) = "*capturing perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence*";
- gm6 (Control of corruption) = "*capturing perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as capture of the state by elites and private interests*";
- gm = arithmetic mean of subindexes gm1 – gm6

Given the literature review, we expect positive effects of institutional variables on economic performance. The exception is the variable gm1 (voice and accountability) whose relation to the dependent variable is not theoretically clearly defined.[33]

A frequent problem in the econometric modeling with economic variables is the presence of endogeneity, in which an uncontrolled factor is present, which affects both the dependent and the explanatory variables. It is not possible to capture the direction of causality correctly. For better endogeneity control, it would be more appropriate to use dynamic panel analysis (e.g. GMM), but due to the low number of observations, the results would be probably distorted (Kim, 2010).

For (at least partial) elimination of endogeneity in the models control variables are engaged, inspired by Berggren et al. (2013). These include: openness ("open", expected impact +), total government expenditure ("gov", expected impact –) and government expenditure on education ("educgdp", expected impact +/–). These variables are complemented

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[33] Voice and accountability can be considered, according to its definition, as the degree of democracy. For more information about ambiguous relation see Spreafico (2010).

by one more – total expenditure on research and development ("rad", expected impact +) (Aisen and Veiga, 2013). All control variables are expressed as % of GDP.

The dependent variable which represents economic performance is GDP per capita in USD (at constant prices in 2010; "gdppercapita", (e.g. Nawaz, 2015)) and the explanatory is always a set of control variables and one variable representing a part of the governance quality (indicators gm and gm1 – gm6). In total, seven models are created.

We use static panel analysis for estimation, specifically a fixed effect method, which can well drain unobserved heterogeneity and significantly precise the results against classical linear regression with OLS. Fixed effect method is the most commonly used static panel method, see, for example, Ahmad and Marwan (2012), Jong-A-Pin (2009) and Nawaz (2015). Empirical model with fixed effects can be summarized as follows:

$$y_{it} = \alpha_i^* + \beta' x_{it} + u_{it} \, ; i = 1, 2, \dots, N, t = 1, 2, \dots, T. \tag{1}$$

where:

y_{it} is the GDP per capita in USD (at constant prices in 2010)

α_i^* is the constant which represent individual component for i observation

β' is a vector of control and institutional variables

u_{it} is the error term

Given the higher number of missing data, this is an unbalanced panel. Let us add that the results are estimated with robust standard errors that are resistant to the presence of heteroscedasticity and autocorrelation.

3 Research results

Beta coefficients of institutional variables have a positive sign in line with expectations. We remind that the relationship between the degree of democracy and economic growth and performance is not clearly defined.

Among the individual subindexes, gm2 variable (political stability) is significant at a one percent level of significance, gm3 (government efficiency) at a five percent level of significance, gm5 (rule of law) at a one percent level of significance and gm6 (control of corruption) at a five percent significance level. What is most important, however, is that the gm variable, which is capable of assessing the quality of the institutional environment comprehensively, is significant at a one percent level of significance. Thus, the theoretical assumptions are confirmed.

As far as control variables are concerned, they are significant almost across all models apart from openness, and their direction does not deviate from theoretical assumptions.[34] The negative impact of government expenditure on education is related to the "return on investment in education"; with a long delay, a positive effect occurs, see Sylwester (2000) and Chandra (2010).

It follows from the above that the models succeeded in estimating well – despite data file reduction caused by the missing data for control variables. This is confirmed by the coefficient of determination, which is around 74–80 % for all estimated models. The panel analysis results are shown in Table 1 below.

Table 1 The results of panel regression

gdppercapita	gm1	gm2	gm3	gm4	gm5	gm6	gm
open	-2.442314	-1.803746	-1.409861	-2.072019	-0.4601419	-2.774744	-0.6829536
	6.882212	6.318715	5.959711	6.446312	5.850371	5.791395	5.4425
gov	-118.9452*	-119.8829*	-115.1598**	-121.955*	-103.2343	-104.4254	-114.1934*
	61.48623	57.20567	48.92267	61.37242	58.6866	58.86109	56.77731
rad	2283.774**	2266.86**	1923.22**	2232.909**	1521.625*	1710.921**	1853.687**
	919.752	883.9351	834.0083	888.8303	852.1313	745.78	764.9082
educgdp	-387.5868*	-433.1014**	-430.5419**	-428.8232**	-319.2419*	-427.8303**	-423.405 **
	188.7875	181.2053	156.473	164.8333	164.095	152.1305	150.4029
gm1	-943.4885						

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[34] Same result as Aisen and Veiga (2013).

	688.2515						
gm2		753.783***					
		193.8168					
gm3			1867.886**				
			654.5136				
gm4				1006.409			
				655.5722			
gm5					2774.567***		
					899.2544		
gm6						2034.978**	
						709.4473	
gm							3183.822 ***
							847.3767
n	158	158	158	158	158	158	158
R2 (within)	0,746	0,755	0,766	0,747	0,792	0,776	0,777

Note: beta/standard robust errors
*, ** and *** indicate significance at the 10, 5, and 1 percent levels, respectively.
Constant is not included.

4 Conclusions

This paper focused on exploring the relation between formal institutions – epresented by the quality of governance according to the World Bank methodology – and economic performance in post-soviet countries. The panel data analysis, namely the fixed effect method, was used to evaluate the relationship. The results confirm the theoretical assumption under which institutions matter and their quality is the determinant of economic growth and economic performance. The significance of partial subindexes implies that we should focus on them for improving the institutional environment.

Significant political stability shows that it is important not only to focus on institutional quality, but also on its stability (not only political, see Berggren et al., 2013). The negative (albeit insignificant) effect of democracy means that political stability plays a more important role than the type of political regime, which confirms and refines the results of the contribution of Náplava and Kouba (2017) thanks to better methods. Political stability stems from the authoritative nature of the regimes. Until a series of three colour revolutions, the regimes remain more or less untouched, totally "deadly" stable and static. More about the issues of political (in)stability is provided by Jong-A-Pin (2009) and Aisen and Veiga (2013).

The government effectiveness (gm3) is very closely related to control of corruption (gm6). The government effectiveness includes the perception of the credibility that corruption reduces. Knack and Keefer (1995) talk about trust, or about the distrust of entrepreneurial subjects against the government. Their distrust is negatively reflected in growth and performance.

Corruption is typical in post-soviet countries except the Baltic countries. There is no socially most productive use in corruption. According to Transparency International, the average of twelve post-soviet countries is 31, while Baltic 62 (Index vnímání korupce, 2016).[35] Ethiopia or Kosovo have a better score. It is clear that the struggle against corruption there is very important; according to the regression results, this growth of anti-corruption measures would be beneficial for better performance.

The rule of law (gm5) includes enforcement of property rights particularly. Their definition and enforcement are often referred to as the prime condition for long-term growth (Acemoglu et al., 2005; Knack and Keefer, 1995; Spreafico, 2010) or their security and enforcement are referred to as the basic function of the government (North, 1991).

When considering post-soviet countries, it is necessary to separate the developed Baltic countries and the developing other twelve countries. Despite the very similar initial conditions (the differences were mainly in economic structures), we can see gigantic differences between the richest Estonia and the poorest Tajikistan. It seems that the institutional concept may explain these differences. The average value of governance quality is 0.74 for Baltic countries, while for

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[35] The corruption perception index get values of 0 to 100 within which the higher the number, the higher the quality of the index.

other twelve countries -0,68.[36] Nor the abundance of natural resources has been able to secure the prosperity for these countries. Baltic countries, poor in natural resources, have still better performance than the remaining countries, which are rich in natural resources. Zeynalov (2013) confirms that without a good institutional framework, abundance of natural resources will not lead to economic growth and better performance.

It seems that even if the USSR has already collapsed, its legacy in some of the countries under examination still survives. The current authoritarian leaders began to accumulate power before the collapse of the USSR. When the USSR collapsed, the people of the former regime emerged, who were no longer forced to answer Moscow's centralized powers, and who could begin building their own cult of personality defended by the authoritarian regime and the army. In fact, unlimited leaders live in the symbiosis with friendly oligarchs and this leads to the consolidation of power on both sides. Such a condition does not contribute to increasing institutional quality.

The disadvantage of working with many developing countries is the absence of key data. Unfortunately, this work also has a lot of missing data on the control variables side. The actual number of observations is only 158, while the maximum number of observations observed over a given period is 240. Despite the insufficient number of data, the results of this contribution cannot be dismissed; according to tests, the models are valid.

As far as research is concerned, Aron (2000) notes that not only inefficient institutions reflect growth, but also their stability. For this reason, it will be important for further research not only to address the quality of the political and institutional environment but also its stability.

Acknowledgement

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Financial Health as a Key Factor for Improving the Stability of Supply Network

Jaroslava Pražáková, Martin Pech

Abstract: *The relationships with companies in supply network provide the opportunity for the company to influence others. The network stability depends on many factors including financial health of each company. Relationships are also a force for these others to influence the company financial health and can bring financial threats. The main aim of the paper is to evaluate core part of network based on financial health of companies linked by their mutual relationships. The paper applies the TOPSIS method to company relationships description (strength and difference of relationships weighting). With respect to standard ratio financial analysis (liquidity ratios, asset management, debt management and profitability) on nodes, TOPSIS weightings on company links are developed. TOPSIS method should enhance the typical network characteristics for things like centrality, betweenness, and others. Results show the important role of companies creating the core of network for improving supply network stability.*

1 Introduction

Successful supply chain management requires many decisions relating to the flow of information, product and funds. Each decision should be made to raise the supply chain surplus. These decisions fall into some categories or phases, depending on financial health of cooperating companies and goals of management. As a result, each category must consider uncertainty over the decision horizon. If the management is to maximize a firms value, it must take advantage of the firm`s strengths and correct its weaknesses. Financial analysis involves comparing the firm`s performance to that of other firms in the same industry and evaluating trends in the firm`s financial position over time (Brigham, Houston 2015).

These ratios are commonly divided into five categories: Asset management ratios which give an idea of how efficiently the firm is using its assets. Debt management ratios indicate how the firm has financed its assets as well as the firm`s ability to repay its long-term debt. Profitability ratios combine the asset and debt management categories. Liquidity ratios give an idea of the firm`s ability to pay off debts that are maturing within a year. Market value ratios inform us about ideas of investors about the firm and its future prospects. Decision making process in supply chain or supply network management always includes several groups of categories of indicators which are relevant to the problem. That is the reason why are Multi-criteria group decision making (MCDM) problems so frequently encountered in practice. Several methods exist that can be applied to solve such problems, for example the TOPSIS method. The technique for order preference by similarity to ideal solution (TOPSIS) is classic decision making method (Jahanshahloo, Lotfi, Izadikhah 2006), which is based on idea that the best alternative should have the shortest distance from a positive ideal solution and the farthest distance from a negative ideal solution (Sang, Liu, Qin 2015).

2 Methodology

The main aim of the paper is to evaluate core part of network based on financial health of companies linked by their mutual relationships. Other aim is to find how can be the result of fuzzy TOPSIS method sensitive to used weights with respect to groups of financial ratios as criteria in the method. The Fuzzyfication helps to balance differences in financial ratios in time. Relevant financial analysis ratios are used as criteria for TOPSIS method (Figure 1):

Liquidity ratios give an idea of the firm`s ability to pay off debts that are maturing within a year. Three frequently used ratios are calculated: Quick test which is sometimes called Acid Test (QT), Current Ratio (CA), Cash ratio (CR) is calculated as total amount of cash assets to current liabilities.

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Asset management ratios - measure efficiently the firm is managing its assets. All evaluated companies met the conditions of middle sized production companies within examined time period. With respect to their production status these 8 ratios are calculated: Days Sales Outstanding (DSO) - A measure of the average number of days that a company takes to collect revenue after a sale has been made. Creditors payment period in days (CPP) - The Creditor Payment Period is a 'performance ratio' and it indicates the efficiency of a business. Efficiency and performance are linked, as efficient businesses are usually more profitable. Days in Inventory (DI), Cash Cycle (CC) is calculated as a summa of CSO and DI. Inventory Turnover Ratio (ITR), Fixed Assets Turnover Ratio (FAT), Total Assets Turnover Ratio (TAT) – ITR is calculated based on annually turnover sales as well as FAT and TAT (Brigham and Houston, 2013). The last but not least ratio of this group is Total Assets to Annual Sales (AS). Acronyms mentioned in parenthesis are used in Table 1.

Debt management ratios describe how the firm has financed its assets as well as the firm`s ability to repay its long-term debt. With respect to very low rate of indebtedness in the network, only two ratios are selected. Total Debt to Total Capital (TDTC) which measures the ratio of the firm`s capital provided by debtholders. Net Working Capital Ratio (NWC) shows the ratio of net working capital to total assets (Net Working Capital is stated as a difference between current assets and inventories.

Profitability ratios give an idea of how profitably the firm is operating and utilizing its assets (Return on Total Assets – ROA (calculated based on EBIT, ROE and ROS calculated based on EAT), Return on Common Equity - ROE, Return on Sales – ROS).

Market value ratios give an idea of what investors thin about the firm and its future prospects. This study does not deal with publicly traded firms (only 2 companies are publicly traded), so this group of indicators is not relevant.

The number of ratios calculated in every mentioned group reflects the size of the companies, their production structure and stadium of the life cycle. Data used for setting the financial analysis ratios originated form Albertina Silver Database of companies. The network was established by snowball method through last 4 years.

Figure 1 MCDM model
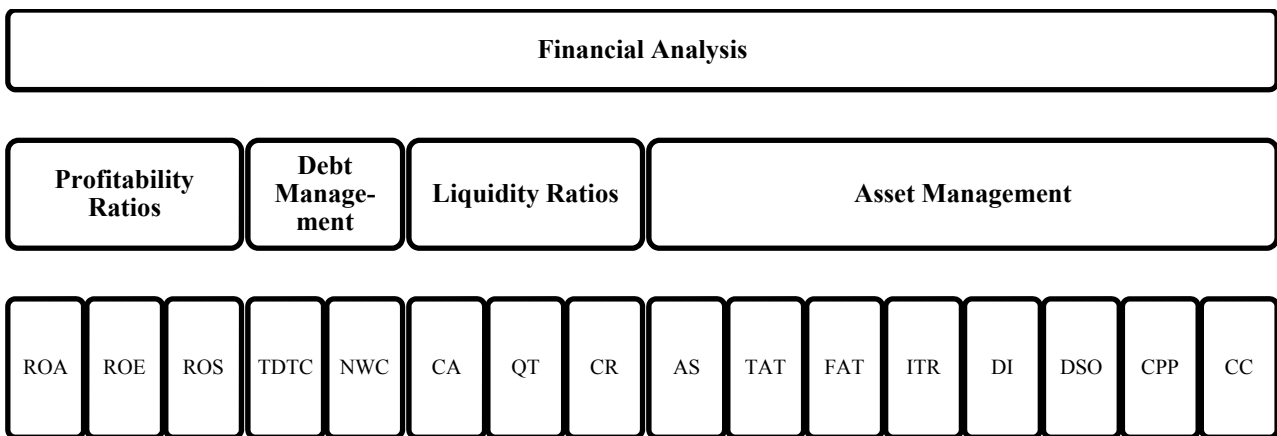
Source: authors

The TOPSIS method

The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) is a multi-criteria decision analysis method which is based on the concept, that the best chosen alternative has shortest distance from the positive ideal solution and the longest distance from the negative ideal solution. Fuzzy form of the TOPSIS method introduced uncertainty to model of human judgments which appear during multi-criteria decision making. The fuzzy concept trying to overcame problems with incomplete, unobtainable and unquantifiable information. In our case the fuzzy numbers (financial characteristics of companies from five year period are parameters of fuzzy membership functions) are used in order to determine the strength of the connections between companies. The steps of fuzzy TOPSIS developed by Chen and Hwang (1992) are given:

Step 1: Establish the Decision Matrix $D = (x_{ij}, i = 1, 2, , \dots m; j = 1, 2, \dots, n)$ which represents the utility ratings of each alternative with respect to given criteria. Assume there m alternatives (companies) A_i to be evaluated against n criteria (financial analysis ratios) C_j. Where $x_{ij}, \forall i, j$ may be crisp. If x_{ij} is fuzzy, it is represented by a triangular number $x_{ij} = (a_{ij}, b_{ij}, c_{ij})$.

Step 2: Normalization of the Decision Matrix in the TOPSIS procedure. Normalization limits each criterion value between 0 and 1, so that each criterion is comparable.

Step 3: Determine the Weighted Normalized Decision Matrix W by applying weights.

Step 4: Obtain the Ideal Solutions (the positive ideal solution FPIS and the negative ideal solution FNIS).

Step 5: Calculate the Euclidean distances of each alternative from the ideal S_i^* and the negative-ideal S_i^- solution based on the simplified method described Wang at al (2009). To aggregate calculations of metric distances for each alternative is applied Euclidean distance method.

Step 6: Calculate the index of relative closeness C_i of each alternative to the ideal solution.

Step 7: Ranking the alternatives according to the relative closeness to ideal solution. Kahraman, Büyüközkan, Ates (2005) noted that metric distances are crisp numbers, so they can be combined.

3 Results

Analyzed network is composed of 18 companies and linked by supplier customer relationships. Companies in core part of the network denoted from A_1 to A_6 and their relationships to company X are noted from *a* to *f*. It is possible to determine all members in network as middle sized or big companies (according to EU SME definition) oriented on automotive industry and very sensitive on changes caused by financial crisis. The consequences of the global financial crisis have been visible since early 2008 in the whole automotive sector, but the structure of this network remained without any change. Companies are suffered by the reduction of the demand for passenger cars and commercial vehicles too (Pražáková, Pech 2013).

Core part of network is strictly oriented on B2B customer needs. Member X is a leader of the network in case of creating business plans and innovations too. First line surrounding of the company is strictly monitored and information flow between every company in first-line (tier 1 supplier or customer) and key company reaches maximum level of observing (all important indicators are determined and evaluated). Control information flow and material flow are antagonistic oriented. If the strictly customer oriented network is presumed, it is possible to see one specific control information flow from customer to its suppliers and suppliers of the suppliers.

3.1 Data

Table 1 depicts total extremes of the network for every of 16 calculated financial analysis ratios which are used as a criteria for TOPSIS method in the next step. Full names of the criteria are mentioned in the second part of the paper. These extremes were achieved by individual companies in evaluated 5 years period for the companies in periphery and 10 years period for the core part of the network. Majority of used criteria are maximizing by their nature, only four of them are minimizing (TDTC, AS, DI, DSO). The lowest values in profitability ratios are reached by companies from periphery parts which were in red in last two years. These values partly reflect business cycle – the recession stadium of the cycle. The highest value of ROE (3.420 – for year 2007) was reached by key company which doubled its production within the observed year.

Table 1 The highest and the lowest scores in financial analysis of network

Criteria	Profitability ratios			Debt management		Liquidity ratios			Asset management							
	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}	C_{11}	C_{12}	C_{13}	C_{14}	C_{15}	C_{16}
	ROA	ROE	ROS	TDTC	NWC	CA	QT	CR	AS	TAT	FAT	ITR	DI	DSO	CPP	CC
min	-0.281	-2.621	-0.317	0.065	0.000	0.325	0.093	0.000	0.122	0.000	0.001	0.00	9.12	0.00	0.00	0.00
max	0.300	3.420	0.179	1.305	0.632	6.468	4.213	1.760	7.484	8.189	14.979	40.04	416.68	164.79	173.44	460.88

Source: authors

TDTC (C_4) is a ratio of total debt to total capital. The worst value 1.305 signifies that company covered the business loss (3 years) by the long-term debt. The company is a member of periphery and its financial results has no important impact on the network stability. The commonly suggested value for CA (Current ratio) by academics is more than 1.5. Minimal value reaches only 0.3, which is extremely low value indicating the potentially increasing problems in liquidity. The company is not probably able to pay off its debts.

Other minimal values of Liquidity Ratios were reached by this company too. Asset management is influenced by the differences in production structure of the researched companies. Minimal values of turnovers (AS, TAT, FAT, ITR) were reached by company oriented on production of customer manufacturing investment units. Where turnovers are very low and price of the unit is enormous. For this reason, the company reached the maximal values in other Asset Management criteria.

3.2   Multicriteria decision making

We examine numerical example using the fuzzy TOPSIS method. The purpose of comparison is a real application of the method to financial health of company partners.

Step 1: Establish the Decision Matrix. Let reconsider six companies as alternatives and criteria of their financial health. It should be mentioned that polling about these companies is done using triangular fuzzy numbers using as parameters minimum, mean and maximum of given criteria (financial analysis scores). Therefore we filled decision matrix of fuzzy data.

Step 2: Normalization. The decision matrix is normalized using highest and lowest criteria scores (based on Table 1) in analyzed network.

Step 3: Applying Weights. **Six core companies are also ranked from financial analysis perspective in fuzzy TOPSIS using** balanced **fuzzy weights** similar to Kahraman at al. (2008). The relative importance balanced weights of the criteria can be described using linguistic variable *medium*. The Weighted Normalized Decision Matrix is then calculated.

Step 4: Ideal Solutions. In the next step the Positive Ideal Solution (FPIS), and the Negative Ideal Solution (FNIS) are defined. Generalized mean method is used for comparison fuzzy numbers. Then values with highest and the lowest generalized mean are chosen for each alternative and the Positive Ideal Solution (FPIS), and the Negative Ideal Solution (FNIS), are obtained.

Step 5: Calculate the Distance. For distance between two triangular fuzzy numbers is parameterized metric method selected. Results are crisp numbers. Calculations of metric distances for each alternative are for each alternative aggregated into S_i^* and S_i^- based on Euclidean distance method (Eq. 11). Table 2 shows the results.

Table 2 Results of Fuzzy TOPSIS

	A_1	A_2	A_3	A_4	A_5	A_6
S_i^*	1.0037	1.1863	1.0278	1.2199	1.2303	0.7743
S_i^-	0.7342	0.5326	0.7239	0.5621	0.5255	1.0659
C_i	**0.4225**	**0.3099**	**0.4133**	**0.3154**	**0.2993**	**0.5792**
Rank	**2**	**5**	**3**	**4**	**6**	**1**

Source: own processing

Step 6: Relative closeness of each alternative to the ideal solution calculations. Then is calculated the closeness coefficient of each alternative in Table 2. In third row of Table 2, calculated closeness coefficients for all alternatives are given.

Step 6: Ranking. In the end the alternatives are ranked in descending order $A_6 > A_1 > A_3 > A_4 > A_2 > A_5$ of the C_i index. The table 2 presents results of fuzzy TOPSIS method for six core companies. Alternative A_6 achieves the best result with respect to S_i^* and S_i^- Variant too. The next alternative A_1 reaches the second position and has the totally the highest difference from S_i^- Variant. Based on the table 2, the A_5 is the worst of all evaluated companies.

3.3   Sensitivity analysis

To analyse the attitude of the alternatives under different main attribute weights, a sensitivity analysis is made. The results of sensitivity analyses of the method are given in Table 10. Closeness to positive and negative ideal is composed and ranked by using those alternatives. Each main attribute could take one of 3 fuzzy weights defined by fuzzy numbers: *low* = (0.0, 0.0, 0.2), *medium* = (0.3, 0.5, 0.7) and *high* = (0.8, 1.0, 1.0); therefore different weights combinations of main attributes (profitability, debt management, liquidity ratios, asset management) are analyzed. Each combination formed a set of fuzzy weights state (w_1, w_2, …, w_5). The first state is considered for the equal medium weights. Other

weight states are examined following: One of the main attributes has the highest possible weight whereas the other two have the minimum. For each state, normalized relative closeness to ideals (C_i) for each A_i is computed.

Results of sensitivity analysis show that A6 is preferable alternative and it is not mainly effect by weights changes. When profitability attributes are considered as more important than others, A1 become the most preferable alternative and is the ideal solution. It is clear that not only the same importance of all criteria but also the highest importance of profitability attributes are very influential to the prioritization process. This result highlights the importance of multi attribute decision making techniques.

Table 3 Sensitivity analysis

Fuzzy Weights States	Profitabil-ity	Debt manage-ment	Liquidity ratios	Asset manage-ment	Normalized C_i					
					A_1	A_2	A_3	A_4	A_5	A_6
$w1$	(0.3, 0.5, 0.7)	(0.3, 0.5, 0.7)	(0.3, 0.5, 0.7)	(0.3, 0.5, 0.7)	0.423	0.310	0.413	0.315	0.299	**0.579**
$w2$	**(0.8, 1.0, 1.0)**	(0.0, 0.0, 0.2)	(0.0, 0.0, 0.2)	(0.0, 0.0, 0.2)	**0.593**	0.142	0.345	0.088	0.179	0.561
$w3$	(0.0, 0.0, 0.2)	**(0.8, 1.0, 1.0)**	(0.0, 0.0, 0.2)	(0.0, 0.0, 0.2)	0.609	0.537	0.546	0.494	0.596	**0.795**
$w4$	(0.0, 0.0, 0.2)	(0.0, 0.0, 0.2)	**(0.8, 1.0, 1.0)**	(0.0, 0.0, 0.2)	0.433	0.333	0.383	0.303	0.327	**0.465**
$w5$	(0.0, 0.0, 0.2)	(0.0, 0.0, 0.2)	(0.0, 0.0, 0.2)	**(0.8, 1.0, 1.0)**	0.276	0.212	0.294	0.299	0.266	**0.459**

Source: own processing

4 Conclusion

The paper presents a multi-criteria group decision making for evaluation core part of network based on financial health of companies linked by their mutual relationships using fuzzy TOPSIS method. The companies are ranked in descending order $A_6 > A_1 > A_3 > A_4 > A_2 > A_5$. The analysed companies are stable members of the network and are also positional very close to key company. In cooperation with the key company, they control all financial, material and information flows in the network. Companies in the core part of the network describe the financial health of the whole network. From the functional perspective of the network, the core companies by their financial results and long-term financial health maintain the network stability in the long-term period.

With respect to financial ratio analysis that always incorporates trends in ratios development (in time period longer than 5 years), the fuzzy TOPSIS seems to be useful as a method for solving this supply network management problem: to evaluate financial health of companies linked by their mutual relationships to a one large supply network.

Though TOPSIS technique is easy to use for finding the "ideal" solution, which is composed of all best criteria values attainable, and the "negative-ideal" solution composed of all worst criteria value attainable by using the (weighted) Euclidean distance, however, this technique does not consider the interaction among the criteria, and there is only one preference order (Chen, Tzeng 2004). Solution of the problem could be focused on triads, a set of three actors and the possible ties among them. Business triad concept is very meaningful to study how relationships among companies with financial risk and treads could lead into dissolution and breaking ties (Pražáková, Pech 2014) and companies with good financial health are potential network stability drivers.

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Evaluation Methods of Development Programs Focused On Non-profit Projects

Jaroslava Rajchlová, Libor Grega, Veronika Svatošová

Abstract: *A non-profit organization is a construct. The very main defining feature of a non-profit organization, i.e. a profit-sharing ban, is defined in a negative way. How is the effectiveness of these projects identifiable? The issue of evaluation and evaluation of the effectiveness of development projects is very extensive, mainly due to the different methodology of individual development aid providers and a large number of types of evaluation. Different entities providing development assistance and involved in development projects are approaching to evaluation in a different way. United Nations Development Program distinguishes types of evaluations from the time they take place, which performs the evaluation, evaluation according to their thematic focus or according to the specific methods and procedures used. The aim of the research project is to evaluate approaches to evaluation of the development project or to evaluate the effectiveness of the development project. The evaluation of development projects, due to their nature, has its own specifics that are important in the evaluation. For development interventions, the aim is to evaluate the relevance of the project in particular, given the situation, the impact on the target groups, whether the objectives of project have been achieved, the effectiveness and efficiency and the sustainability of the benefits of project.*

Key words: Financing of Non-governmental Non-profit Projects · Comparison · Evaluation · Effectiveness

JEL Classification: G30

1 Introduction

The issue of development projects and their evaluation is very complex. In order to improve the quality of human life and sustainable development, aid to developing and transit countries needs to reflect specific needs and challenges in the given areas. Assistance in these regions is divided into humanitarian aid and development cooperation. Foreign development cooperation is an integral part of Czech foreign policy. In the case of the Czech Republic, the foreign development cooperation is based on help of transforming and developing countries. Assistance may take place in financial, material or technical terms. The common objective is to ensure the sustainable development of the country and the welfare of the population. (Jelínek, Hlavíčková, 2006, p. 4).

Donors have become more interested in the effectiveness of the assistance provided to achieve international development goals. The Rome High-Level Forum on topic "Harmonizing the Common Assistance for Aid Effectiveness" held in 2003 has drawn up an action plan to harmonize donor assistance policies, practices with their partners in developing countries. In 2005, the participants of the second "High-Level Forum" committed themselves to a practical plan to provide assistance in a more effective way and to increase accountability by monitoring the implementation of the plans. They further defined the five basic principles of effective aid: (a) designing development strategies by partner countries; (b) align donors' assistance with these strategies; (c) harmonization of donor actions; (d) results-oriented management; (e) the mutual responsibility of donors and partners. The full implementation of these principles, based on clear objectives (most of which have already been approved), is crucial to improving the quality of assistance. (Team of authors, 2007; OSN, 2016)

The authors aim to create an overview of approaches to evaluation and to make recommendations for its use. The evaluation of approaches to the evaluation of development projects is the subject of a research project in order to create an evaluation matrix that will reflect the conclusions of the documentary analysis. In particular, the method of documentary analysis of relevant sources was used to implement the research plan and to derive logical conclusions from the field of research.

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Evaluation means "an assessment that determines the quality and effectiveness of certain programs, processes, results and effects, stakeholder activities." According to Ehlers and Pawlowski (2006), the proper evaluation must meet three essential requirements:

- the evaluation must be based on robust data,
- the evaluation must be practically oriented,
- evaluation involves expression of value.

In order for the evaluation to be carried out correctly, the evaluation team must answer the following questions before the evaluation begins:

- **Who will perform the evaluation?** - The choice of the evaluating subject is particularly important in terms of transparency.
- **What is the subject of the evaluation?** - Determination of predefined results is very important given that one of the parts of the evaluation will be assessing whether these results have been achieved.
- **For whom is evaluation determined?** - Likewise, a lot of attention should also be paid to the target group as it is necessary to take into account for whom the project evaluation is intended to adapt to the method of evaluation and the form of interpretation of the results.
- **What evaluation methods will be selected?** - As part of this step, it is necessary to determine whether qualitative, quantitative methods or their combinations will be used. The choice of the project evaluation method depends mainly on the nature of the project and the volume of funds earmarked for the implementation of the project. Whether any method or combination is chosen, it is always necessary to observe the principle of so-called triangulation, which according to Jelínek and Hlavíčková (2006, p. 28) consists of a combination of information obtained from different sources and different methods.

In order to have a successful evaluation, then the evaluation must be carried out according to the basic evaluation aspects. These evaluation aspects or the principles of evaluation include relevance, effectiveness, efficiency, impact and sustainability. Primarily, it is necessary to find out the relevance of development projects to the needs of the country. Emphasis must be placed on identifying whether the development goals and objectives of the project are really in the line with the needs of the partner country and are also in the line with international development priorities. The effectiveness of the project solves whether the predefined objectives have been fulfilled and to what extent. On the other hand, the effectiveness of the project relates to the realization of individual activities. The last basic assessment aspect that the evaluation team must remain is sustainability. Sustainability is assessed in terms of the benefits of the development project, whether the benefit will be sustainable after the end of the intervention without donor support (Jelínek, Hlavíčková, 2006, p. 29).

The issue of evaluation of development projects is very extensive, mainly due to the different methodology of individual development aid providers and a large number of types of evaluation. Different entities providing development assistance and involved in development projects are approaching evaluation in a different way. United Nations Development Program (UNDP) distinguishes types of evaluations based on when they are taking place, who performs evaluation, evaluation according to their thematic focus or according to the specific methods used (United Nations Development Program, 2009, p. 130 - 137).

2 Evaluations based on when they are running

The question, when the evaluation will be carried out, is necessary to address the project from the start of the project, given that the sooner the evaluation starts, the more effective we can be to follow the process of the project and learn from the mistakes. Based on the start of the evaluation process, ex-ante, interim, final and ex-post evaluations are distinguished. Ex-ante evaluation is a preliminary assessment of the likely future effects of new initiatives and support such as policies, programs and strategies. This type of project evaluation takes place before the start of implementation of any initiatives. Another type is the ongoing evaluation, which is carried out during the implementation of the project. The objective of continuous evaluation is primarily to improve performance in the implementation. A final evaluation will be conducted by the evaluation team at the end of the project implementation phase. The purpose of this evaluation is, in particular, a global evaluation which determines to what extent the predefined objectives have been achieved. The latest version of this type of evaluation that the UN Development Program mentions is the ex-post evaluation. This evaluation is carried out only after the completion of the project, most often after the last two years since the last implementation. The ex-post evaluation mainly provides information on whether the results of the project were sustainable and how the project had an impact (United Nations Development Program, 2009, p. 137).

3 Evaluate by who is performing it

Another way to distinguish between evaluations is by who is performing the evaluation. As already mentioned, Jelínek and Hlavíčková (2009, p. 30) in this type of evaluation presents three possible variants of the entity that can conduct the evaluation, namely an independent body, semi-independent and internal. On the other hand, the United Nations Development Program publishes two options, namely an independent assessment or decentralized evaluation. Independent evaluation means an evaluation carried out by an independent entity, i.e. a body separate from the entire project implementation process. An independent evaluation is considered to be the most effective way to conduct an evaluation of a development project, given that the evaluation team has no links to the project. The decentralized type of evaluation should in any case also provide independent and transparent results, even though the evaluation is carried out by an organizational unit that is part of the entity involved in the project (United Nations Development Program, 2009).

4 Evaluation according to their focus

The first variant of the breakdown of the types of evaluation according to their focus is given by Průcha a Veteška (2014) and it is an evaluation that focuses on the process of delivering the aid or the impact of the development project. Evaluating the impacts of a development project are more costly and time-consuming, given the need to select a suitable timeframe for all impacts to be thoroughly evaluated. The United Nations Development Program (2009) also distinguishes the evaluation according to its focus, under which it understands the specific area or theme to which the project focuses. This could include, for example, focusing on the concrete impacts of the project on gender equality, democratic values, development and other cross-cutting themes. The evaluation design should in detail describe the step-by-step work plan by specifying the methods that the evaluation will use to collect the necessary information to address the evaluation criteria and to respond to evaluation questions, analyse data, interpret outputs, and process the results.

Table 2 below provides a brief description of the most commonly used methods of the data collection in the UNDP evaluation for project and outcome evaluation.

Table 1 Summary of common methods for collecting data used in UNDP evaluation

Methods	Description	Benefits	Challenges
Monitoring and evaluation systems	They use performance indicators to measure progress, especially actual results against expected outputs.	They can be a reliable, cost-effective and objective method to assess the progress of outputs and results.	It is based on the monitoring and evaluation systems that have set the baseline indicators or targets and collected the data in relation to the targets as well as the data on results indicators.
Existing reports and documents	Current documentation, including quantitative and descriptive information on the initiative, and its outcomes such as documentation on capacity of development activities, donor reports and other evidence.	Cost-effective.	Documentary evidence can be difficult to encode and analyse in response to questions. It is also difficult to verify the reliability and authenticity of the data.
Questionnaires	They provide a standardized way of collecting information on a wide range of topics from a high number of different stakeholders to their opinion, trust, attitude, level of satisfaction, etc. It takes into account the processes, input and output and context factors of the initiative.	Good for collecting descriptive data on a wide range of topics. Fast and relatively low-cost way. Simple to analyse. Anonymity for respondents is provided.	Separate ratings can lead to biased news. Data may provide general reflection, but may not be dealt with in depth. It does not provide enough information about the context. Object for collecting distorted samples or deviations.
Interviews	Requesting "person-to-person" answers to predetermined questions that aim to get in-depth information about human impressions or experiences, or learn more about his/her answers to questionnaires and surveys.	They allow more coverage, more depth of information on the subject. This can be time consuming.	They can be difficult to analyse as well as expensive. There is a high potential for interviewers to influence the respondent's response to some extent.
Direct observation on the spot	It requires the use of detailed forms to find accurate information on the spot on how the program works (ongoing activities, processes, discussions, social interactions, and observable results that are directly observed	He/she can see the operations of the program as they appear. It can adapt to events as they occur.	It may be difficult to classify or interpret the observed behaviour. Similarly, this method may be expensive and with the assumption of party-bias

			selection.
Group interviews	A small group (6-8 people) is inquired jointly to explore in-depth stakeholder views, similar or different views and reflections on a development initiative or policy as well as information on their behaviour, understanding and perception of the initiative. Collecting the information on material and inalienable changes resulting from the initiative.	Fast and reliable way to get common impressions from different stakeholders. Effective way to get a high degree of depth and in-depth of information in a short time.	It may be difficult to analyse the answers. It requires a trained mediator. This method can be difficult to plan.
Key informants	Quality in-depth interviews, often individual and with a wide range of stakeholders, who have a first-hand knowledge of the initiative and the context. These community experts can provide specific knowledge and understanding of the issues and recommend solutions.	It can provide an overview of the nature of the problems and also recommend solutions. It can provide different views on one or more questions.	High dependence on sample selection. There must be some means of verifying or supporting the truth of the information.
Panel of experts	Review or reference group composed of external experts to provide contribution to technical or other relevant topics that are subject to evaluation.	It adds credibility. It can serve as an added (expert) source of information that provides more depth. It can verify or justify information and results on topics.	The cost of advice and possible additional costs can be challenged. There must be impartiality and certainty that there are no conflicts of interest.
Case studies	It includes a comprehensive cross-domain case study to obtain detailed information for a full understanding of the operational dynamics, activities, outputs, results and interactions of the development project or program.	Useful to fully explore the factors that contribute to outputs and results.	It requires a considerable amount of time and resources that are not usually available for that rating. It can also be difficult to analyse.

Source: own processing based on Handbook on Planning, Monitoring and Evaluating for Development Results (United Nations Development Programme, 2009; United Nations Evaluation Group, 2005).

Evaluation methods should be selected for their rigor and precision in creating empirically based evidence for addressing evaluation criteria and responding to questions related to the evaluation. The report on the start of the evaluation process should include the evaluation matrix that will be displayed for each of the assessment criteria, for the individual questions and sub-points that are responsible for the evaluation, and for all the data that will be collected for the evaluation to inform about the individual issues and methods. Examples of questions for evaluators see Table 2, as perceived in terms of linking approaches to evaluation.

Table 2 Questions for the evaluators

The evaluating authority should make sure that the evaluation methods outlined in the initial report of the evaluators corresponded to each of the following questions:
What evidence is essential to address evaluation issues?
What methods of data collection will be used to correctly meet evaluation criteria and questions? Why were these methods selected? Are resources allocated enough?
Who will collect the data?
What is the sampling framework? What is the justification for this framework?
How will the program participants and other stakeholders be involved?
What data management systems will be used? What are the planned logistics (including procedures, timing, and physical structure to be used for data collection and processing)?
How will the collected information be analysed and how will the data being interpreted and reported?
What methodological issues should be considered for quality assurance?

Source: own processing

5 Conclusion

The great differentiation of the world according to the level of development achieved is a reality, however, there is no consensus on what development means and doubts its long-term sustainability. It is also common to declare the will to help unsuccessful actors at all levels of development to resolve or at least to mitigate the current problems of backward areas, globally known as the so-called third world. Development aid is a tool to alleviate just those differentiations. However, the allocation of funds alone is not effective without a proper evaluation to mitigate the problems in backward countries. In this paper, authors evaluate the evaluation procedures by creating a so-called evaluation matrix, including

evaluating approaches to collecting data that are used for evaluation. It seems to be the most transparent approach to ongoing evaluations conducted by an independent entity focusing on the impact of the development project. With regard to data collection methods, we recommend monitoring and evaluation systems, i.e. clearly defined indicators.

Acknowledgement

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Comparative Study of the Institutional Anchoring of Selected Non-profit Organizations in the UK, USA and Czech Republic

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Abstract: *The importance of non-governmental non-profit organizations and their economic strength have been steadily growing in recent decades, and in the Western countries, in the 21st century, the non-profit sector has become the real third pillar of society. Non-state non-profit organizations are a phenomenon. They are firmly connected with the three elements of civil society: the first is charity or philanthropic motivation of people, the second is the right to associate and the third volunteering. The subject of the research project was the elaboration of a comparative study of the institutional anchorage of non-profit organizations in the United Kingdom, the United States of America and the Czech Republic. The reason for choosing the subject of the research was to identify possible weaknesses in the institutional anchoring in the conditions of the Czech Republic and formulate possible measures that will improve the situation in the legal framework of non-profit organizations in the Czech Republic. Non-state non-profit organizations, associations, institutes and foundations have been selected to compile the comparison. Eleven determinants were monitored: Legal personality, Establishment, Registration, Founding Document, Organizing Document, Bodies, Extinction, Minimum Deposit, Business Activities, Tax Benefits, Other Obligations.*

Key words: Non-governmental Non-profit Organizations · Legal Framework · Comparison

JEL Classification: G30

1 Introduction

The importance of non-profit organizations and their economic power have been steadily growing in recent decades and in the Western countries, in the 21st century, the non-profit sector has become the real third pillar of society. Together with the development of the non-profit sector, its research has been developed. The more systematic scientific research on the non-profit sector has been encountered since the 1970s in the United States. After significant steps have been taken in the theoretical research of the non-profit sector, the need for comparative analyses has clearly emerged (Hyánek, 2011). The most important activities related to comparative research are associated with Helmut K. Anheier. In the early 1990s, Lester Salamon and Helmut K. Anheier (1997) realized the world's largest non-profit international research at Johns Hopkins University (the second phase of the project included 27 countries including the Czech Republic). It can be said that this research project is the widest and most systematic attempt to gather, classify and interpret non-profit sector information so far. Part of the research is also the effort to formulate a definition of a non-profit organization that would be applicable in an international context and would allow comparison of the non-profit sectors of individual countries. For example, according to Steinberg (2006, p. 118), the limitation of non-distribution of profits determines how the organization gains resources, how it is controlled, how it behaves on the market, how it is perceived by donors and clients, and how its employees are motivated. Other authors argue that this restriction is only legislative aspect and in certain situations may reduce incentives for effective action, as non-profit managers cannot participate in the profits resulting from their managerial skills and actions in accordance with the law. On the other hand, according to Weisbrode (1998a, p. 72), profit-sharing constraints provide a social advantage by enabling non-profit organizations to perform activities that do not generate financial gain but are important to society. On the other hand, Hansmann (1980), who made this restriction a centrepiece of its theories about the behaviour of non-profit organizations, argues that the limitation of profit distribution does not in itself imply a meaningful behaviour of a non-profit organization.

As far as the comparison of the forms of non-profit organizations is concerned, however, relatively less attention is devoted to this area. The United States and the United Kingdom represent different national contexts in which non-profit organizations have developed over the last century comparing to the Czech Republic. The idea of evaluating the legislative anchorage of non-profit organizations in the Czech Republic compared to selected countries, namely the

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United States of America (hereinafter referred to as "the USA") and the United Kingdom (hereinafter referred to as "the UK"), led us to formulate opinions and suggestions based on the conclusions of the comparative analysis .

2 Methods

The subject of the research project was the elaboration of a comparative study of the institutional anchoring of non-profit organizations in the United Kingdom, the United States of America and the Czech Republic. The reason for choosing the subject of the research was to identify possible weaknesses in the institutional anchoring in the conditions of the Czech Republic and formulate possible measures that will improve the situation in the legal framework of non-profit organizations in the Czech Republic. The United Kingdom and the United States of America were selected for the realization of the research project, as UK represents the cradle of the non-profit sector in Europe and the USA was selected as a representative of a non-European country with a developed national economy. The material is the legislative regulation of individual forms of non-governmental non-profit organizations in individual countries. For the comparative study, the association, the institute, the foundation have been selected. The methodology of the research plan is based on the comparison and subsequent analysis of the information that has been collected.

3 Research results

3.1 Comparative study

The specific forms of NGOs are based on the country's legislation. In terms of the Czech Republic, typology of NGOs is based on the new Civil Code Act No. 89/2012 Coll. and Act No. 90/2012 Coll., On Commercial Corporations. The recodification of these two codes represents the greatest change in private law, which also affects the functioning of non-profit organizations. Under Act No. 89/2012 Coll. and Act No. 90/2012 Coll. it is currently possible to typify these types of non-governmental non-profit organizations:

- Corporations (Society),
- Foundation (Foundation and Endowment Fund),
- Institute,
- State-registered Churches and religious societies.

  Other types of NGOs in the Czech Republic:

- The unit owners' association, the legal regulation is in § 1194-1216 Civil Code.
- Political parties and political movement - legal regulation is found in Act No. 424/1991 Coll., On association in political parties, political movements.
- Professional chambers - each professional chamber is established on the basis of its own law, which regulates the status and activities of members of the chamber and their bodies.
- Hunting communities are the legal entities governed by Act No. 449/2001 Coll., On hunting

3.1.1 Definition of non-profit organizations in Great Britain

In the United Kingdom, as in the Czech Republic, the non-profit sector began to develop more dynamically in the 1990s, when the government, called New Labour, underlined the distancing from the old socialist style of government and focused on a new interpretation of equality. This new political party has opened the way to the development of so-called positive social services and social investments. (Munková et al., 2004).

An important milestone in relation to the non-profit sector was the year 1992, when the Charities Act was introduced, which is a key law in relation to the non-governmental non-profit sector. It is necessary to add that there is no state non-profit sector within the UK resulting from the conceptualization of the British social model, which is primarily based on the liberal concept of the social state, of which the main feature is the high emphasis on the participation of an individual in the labour market and the derived social protection. Within the British social model, attention is focused primarily on preventing the occurrence of social events rather than on state social security or solving social events (Munková et al., 2004). However, it is appropriate to add that the state cooperates with the non-governmental non-profit sector on a long-term basis and, to a certain extent, supports its activities by means of contributions from government funds on the basis of a public tender.

Legal forms of non-profit organizations
Regarding individual typologies of non-governmental non-profit organizations within the United Kingdom, it is possible to distinguish from a legal point of view (Kendall, Knapp, 1993):
- Charitable trust,
- Unincorporated association,
- Company limited by guarantee (a limited liability company with a publicly beneficial non-profit mission)
- Charitable incorporated organization.

A major problem within the UK is that the non-governmental non-profit sector is relatively complex and legally anchored in legislation. For comparison, England and Wales are subject to English law, which stems from customary law. Scotland, on the other hand, is based on Scottish law, which is based on Roman law, similar to European law. Northern Ireland is then at the border between English law and Scottish law. Also, Kendall and Knapp (1993) add that there is no unified and universally recognized definition of the status of a non-profit organization in any of the United Kingdom of Great Britain and Northern Ireland countries, which also results in difficulties in the categorization of UK non-governmental organizations (Kendall, Knapp, 1993).

3.1.2 Definition of non-profit organizations in the USA

The next chapter is dedicated to the definition of NO in the United States (USA). The US is often referred to as the cradle of public benefit organizations. The concept and position of the non-profit sector in the US is a very similar to the concept in Great Britain, as both of these countries are among the countries applying the Anglo-Saxon approach to understanding the importance of the non-profit sector in the national economy. Therefore, in the United States, as in the UK, there is no state non-profit sector, but only a non-governmental non-profit sector. For the US, there is also a markedly lower participation of the state in support of the non-governmental non-profit sector. E.g. Boukal et al. (2009)says that more than 90% of the revenue received by the non-governmental non-profit sector comes from private sources such as public collections, private foundations, donor campaigns, etc. Public budgets are therefore marginally involved in supporting the non-profit sector – maximum 10 % (Boukal et al., 2009). By contrast, for the most European countries, there is a markedly higher involvement of the state sector, which in many cases is a guarantee of many activities.

In the United States, both profit and non-profit organizations are governed by the same law, and only non-profit organizations are allowed to distribute net profits among their owners or contributors who finance them. Profit must be returned to the process of organizing the organization (Salamon, Anheier, 1997). Laws dealing with non-profit organizations are a combination of a general legal order with a federal constitution and, in addition, non-profit organizations are governed by a number of separate national and national laws relating to separate foundations, fundraising, employment, volunteering and taxation within the state (Salamon, Anheier, 1997) Further details on tax, governance and corporate responsibility are provided by the US Internal Revenue Code (IRS, 2015).

Legal forms of non-profit organizations in the US can have the following legal forms:
- Non-profit corporation,
- Unincorporated non-profit association,
- Trust (fund).

Breakdown of non-profit organizations according to the IRS Tax Act

Regarding the further classification of non-profit organizations within the US, the rules for their breakdown are based on the United States Internal Revenue Code (IRC) from 1987, which includes, inter alia, provisions on federal income tax. These are broken down according to Hopkins (2013) into two classes, namely:

- Public Charities
- Private foundations,

Other types of non-profit organizations are defined in section 501 (c) (4), IRS, which defines the following organizations (IRS, 2015):
- Social welfare organizations (social care organizations, or civic societies, civic libraries) that focus on promoting social security and are not organized for profit.

3.2 Comparison of the Society

The first comparative form of organization is the society. Equivalent to the society as a voluntary association of citizens for a similar purpose, legal forms are selected for comparison:

- United Kingdom: 1) Unincorporated organization (hereinafter UO / UK) and 2) Charitable incorporated organization (hereinafter CHIO).
- USA: 1) Unincorporated Organization (hereinafter UO / USA 2) Corporation with members (hereinafter referred to as CwM).

In summary, it can be concluded from the comparison that the absence of a non-registered form of a non-profit organization in Czech legislation can be considered as a disadvantage compared to the UK and the US. The authors find advantages in unregistered forms of NGOs, which are very simple and easy to implement. In spite of the new legal anchorage, which gives the founders a free hand in organizing and managing the association, a less formal formation would be suitable for this type of NGO. However, as the comparison shows, the disadvantage of this form is the impos-

sibility of using tax benefits. In the UK, this form is limited by the amount earned from gainful business activities. On the other hand, the positive for the Czech Republic is seen in the tax benefits, which are required, compared to the other monitored countries, to be asked to prove their charitable purpose. In this respect, Czech legislation is more compact. The comparison also shows the relatively high formal relationship of the Czech society and the British Charitable incorporated organization.

Table 1 Comparison of the Institutional Anchoring of the Society in the Czech Republic, the UK and the USA.

Society	CR	UK	USA
Legal personality	Yes	1) Yes 2) Yes	1) Yes 2) Yes
Establishment	Minimum 3 persons.	1) Minimum 2 persons. 2) Minimum 1 person	Minimum 2 person
Registration	Proposal for registration with the Ministry of Justice. Officially signed signatures. Formation of an entry in the Federal Register at the competent court.	1) Without approval by authorities and registration. 2) Registration with the CC is based on the registration in the charity register.	1) No registration and approval by the authorities 2) Request to the Secretary of State.
Foundation Document	Statutes	Contract	1) Contract 2) Founding Charter
Organizing Document	Statutes	1) Constitution 2) Constitution	1) Not mandatory 2) Statutes
Bodies	Statutory body (chair, committee), highest authority (member meeting)	1) Chairman, treasurer, secretary. 2) Charity trustees, member meeting	1) There is no obligation to establish bodies. 2) Managing authority (directors) and officers - president, treasurer, secretary
Extinction	Cancellation from the Federal Register	1) The founder can choose in the constitution how an organization can be extinct. 2) Removal from the charter register.	1a) If the purpose, for which the organization was established, was achieved. 1b) The organization has no members, 1c) The organization has suspended its operations for 3 years, 1d) Based on court judgment. 2a) The founding charter is fake. 2b) The Company abuses its powers conferred by law.
Minimum Deposit	Not specified	Not specified	Not specified
Business Activities	Only in secondary activities and in support of the main activity.	1) Yes, but earnings must be used for organization purposes. 2) The same as the previous form	1) Yes, but earnings must be used for the purpose of the association. 2) The same as the previous form
Tax Benefits	Yes, income tax relief has been granted by law.	1) Yes, if it is registered with HM Revenue & Customs (2016). 2) Entitlement to tax relief, reduction of business rates on its premises, refund of taxes on concluded agreements and other gifts.	1) Need to register with the IRS. 2) The same as the previous form
Other Obligations	Publication of financial statements in the collection of documents	1) Upon exceeding the £ 5,000 or more per year earnings, registration with CC is required. 2) The obligation to send CC to check all accounting records.	1) Not found. 2) Foundation fee.

Source: Own processing based on (Charity trustees, 2016; Charitable Incorporated Organization, 2012; Duties of a director. Washington Non-profit Corporation Act., 2016; Charities Act, 2011; Community Voluntary Action, 2016; Foundation group, 2015; Institute of Fundraising, 2015; Introduction to the Voluntary Sector, 2015; Law Handbook, 2015; Legal Zoom, 2015; Neziskovky, cz, 2015; Trustee Act, 2000; US Legal, 2016; Washington nonprofit corporation act., 2000)

3.3 Comparison of the Institute

In the Czech Civil Code, the Institute is governed by the provisions of § 402 to 418; this form of non-profit organization is also covered by the general regulation of legal persons (§ 118 to 209) and the provisions on the foundation are applied accordingly.

Table 2 Comparison of the Institutional Anchoring of the Institute in the Czech Republic, the UK and the USA

Institute	CR	UK	USA
Legal personality	Yes	Yes	Yes
Establishment	natural person or legal entity, one or more persons	natural person or legal entity (older than 18 years)	natural person or legal entity
Registration	Proposal submitted to Ministry of Justice. Formation by registration in the register of institutions at the relevant court of registry	CC registration for charity status.	Registration with the Secretary of State.
Foundation Document	Founding charter in the form of a notarial record. Possibly a case of death.	Founding Charter at the appropriate court.	Founding Charter
Organizing Document	Status (optional)	Constitution	Statutes
Bodies	Director (1), Board of Directors (minimum 3)	Trustees	Directors, president, secretary, treasurer.
Extinction	The Institute has long failed to meet the purpose, for which it was founded.	Deleting from the charity register if it does not meet charity purposes.	The foundation charter of the company is fake. The company abuses its powers conferred by law
Minimum Deposit	Not specified	Not specified	Not specified
Business Activities	It may operate a business or other ancillary activity, but such activities must not be detrimental to the quality, scale and availability of services provided in the principal activity of the Institute.	It can engage in business activities, but only in the fulfilment of the purpose, for which the organization was founded	Only in the fulfilment of its purpose
Tax Benefits	Tax relief automatically.	They get automatically by registering with CC	Required registration with the IRS.
Other Obligations	Obligation to issue an annual report		Foundation fee.

    Source: Own processing based on (Charity trustees, 2016; Charitable Incorporated Organization, 2012; Duties of a director. Washington Non-profit Corporation Act., 2016; Charities Act, 2011; Community Voluntary Action, 2016; Foundation group, 2015; Institute of Fundraising, 2015; Introduction to the Voluntary Sector, 2015; Law Handbook, 2015; Legal Zoom, 2015; Neziskovky, cz, 2015; Trustee Act, 2000; US Legal, 2016; Washington nonprofit corporation act., 2000)

In summary, the largest differences between the monitored countries in the case of the Institute are found in: a) Organizational Documents (in the Czech Republic more liberal than in the UK and the USA), b) Bodies (more explicitly defined in the Czech Republic and the USA than in the UK) c) Extinction (US related to the infringement), d) Business Activities (more liberal approach in the Czech Republic than in the US and the UK).

3.4 Comparison of the Institute

Table 3 Comparison of Institutional Anchoring of the Foundation in the Czech Republic, the UK and the USA

Foundation	CR	GB	USA
Legal personality	Legal entity	Legal entity	Legal entity
Establishment	Foundation charter form of public documents - registration in a public register	Founding charter	Registration in a register.
Registration	Foundation Register of Ministry of Justice	CC	At the appropriate court
Foundation Document	Founding charter notarized / acquitted in case of death.	Statement of Confidence. Signatures must be made in the presence of a witness.	Founding charter
Organizing Document	Status	Constitution	Statutes
Bodies	Board of Directors - minimum 3 members Supervisory Board Inspector	Trustees	Board of Directors Board of management
Extinction	Delete from register: - the purpose of the foundation has been achieved	Approval of CC	It does not fulfil the purpose, it disappears by deletion from the register

	-the decision of the court		
Minimum Deposit	500,000 Czech koruna	10,000 pounds	250,000 dollars
Business Activities	It is legally permitted to participate in the business of joint-stock companies (the total range of up to 20% of the Foundation's assets)	Long-term business activity is not allowed. Income only for Foundation purposes	Revenues are only for the purpose of the foundation
Tax Benefits	It is given by law Tax benefits	It has tax benefits if it asks for charity status with the CC.	Yes, if registered with the IRS
Other Obligations	Compulsory audit. The annual report must be issued by 30 June of the following year.	Accounts must be approved by an independent auditor if the investment exceeds 500,000 pounds.	Foundation fee

Source: Own processing based on (Charity trustees, 2016; Charitable Incorporated Organization, 2012; Duties of a director. Washington Non-profit Corporation Act., 2016; Charities Act, 2011; Community Voluntary Action, 2016; Foundation group, 2015; Institute of Fundraising, 2015; Introduction to the Voluntary Sector, 2015; Law Handbook, 2015; Legal Zoom, 2015; Neziskovky, cz, 2015; Trustee Act, 2000; US Legal, 2016; Washington nonprofit corporation act., 2000)

4 Discussion

In summary, it can be concluded that the most striking differences between the countries surveyed are found in the Foundation's bodies (the more liberal approach in the UK), the business activities, the tax benefit mechanism (for both the more liberal environment in the Czech Republic) and the fact that the US Foundation Fee is set. On the basis of the evaluation of the results of a comparative study, it is possible to identify the legislative anchoring of non-governmental non-profit organizations in the Czech Republic as comparable to advanced economies. As a recommendation for legislative bodies, it is possible to formulate a requirement for the establishment of a non-profit organization like society as a legal entity, such as in the case in Great Britain and the USA. Given that the societies are primarily intended to bring together people with the same areas of interest and so-called leisure activities, we do not find it necessary to bind them by registering in the Commercial Register.

5 Conclusions

The content of the final chapter is based on a presentation of the comparison of the above-mentioned forms of non-profit organizations. For comparison, 11 criteria were defined: Legal personality, Establishment, Registration, Foundation document, Organizing Document, Bodies, Extinction, Minimum Deposit, Business Activities, Tax Benefits, Other Obligations. The most important findings from the analysis and the subsequent comparison of the above criteria are the fact that the legislation of the United Kingdom and the United States allows - unlike Czech legislation - the unregistered form of a non-profit organization (Unincorporated organization). In the UK, this form does not have legal personality, i.e. the condition for its creation is not the provision of a legal entity under the law. Furthermore, there is no need for registration or statutes (constitution), which otherwise provide the basic framework for the management of a non-profit organization. In the US, this form is designated as Unincorporated non-profit associations; it is a combination of two or more persons for a common (non-business) purpose with minimum management and accounting requirements. This form has two possible variants, of which one is a non-profit organization that is not a legal entity and is not a state registered. Other relevant results of the comparison include the following findings: a) a relatively larger liberal environment for the profit-making activity of non-profit organizations in the Czech Republic compared to the UK and the USA b) easier administration in relation to the recognition of tax benefits in the Czech Republic compared to the two remaining monitored countries; c) the possibility of establishing a non-profit organization in the form of the acquisition in case of death in the Czech Republic d) greater autonomy in establishing the bodies of a non-profit organization in the UK compared to the Czech Republic and the USA e) the extinction of a non-profit organization in the United States is primarily considered to be an illegal act f)in the USA unlike the Czech Republic and the UK, a fee for establishing a non-profit organization is required.

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The Financial Analysis of the Individual Annual Financial Statement According to IAS/IFRS

Martina Regásková

Abstract: *Financial accounting and accounting standards provide to managers, investors and other interests entities worth financial information about assets and liabilities situation of an accounting unit, as well as inform about comprehensive income. To provide true and fair view of the company, it is important to report the financial information correctly. Financial reporting plays a significant role in the management decision-making and also has got a strong influence on many other financial activities. The main source of the financial reporting represents financial statements which can be reported based on national or international standards. From global point of view and integration process in the world economy, IAS/IFRS framework represents a better opportunity for preparing the annual financial statement. In this article, we point our attention to financial statement of the selected bank in Slovakia. The main aim of the article is to analyse the financial stability of this bank according to IAS/IFRS framework. To do financial analysis, we used vertical analysis and ratios indicators.*

Key words: IFRS/IAS · Financial Accounting · Financial Analysis· Banking Sector

JEL Classification: M41 · G21

1 Introduction

The idea to write this article is to inform about an influence of financial reporting on the financial statements in banking sector. We chose this topic because of our dissertation, in which we deal with advanced financial accounting and hedge accounting of financial instruments.

The accounting standards and frameworks should be drawn in accordance to provide true and fair view about the accounting of an accounting unit. Accounting standards provide objective financial information not only to company´s management, but also to other interest parties, such as auditors, financial analysts, creditors or investors. They inform various parties about financial stability of an accounting unit, and also help to analyse, evaluate and interpret achieved financial results. The information in the financial statements also provide more detailed data about current financial position of the accounting unit, and is a key for management decision-making and strategic planning into the future. Financial analysis maintains a complex view of financial health and achieved income. Therefore, it is very important to report accounting information in the financial statements correctly.

There are national and international directives and laws which deal with financial reporting and accounting standards. For example, in the Slovak republic accounting laws are issued by Ministry of Finance. Accounting units in the European Union can decide if they publish their annual statements based on national or IAS/IFRS standards. From a global perspective and harmonization process, the better opportunity is to use international accounting standards. Between the national accounting laws and the international frameworks IAS/IFRS are significant differences, particularly in terms definitions. The main aim of IAS/IFRS is to harmonize individual national standards, to prepare and publish uniform accounting methodology of high standards and quality. There are some sectors in the economy that have an obligation to disclose the annual financial statement according IAS/IFRS. This obligation is especially related with financial institutions (banks, insurance or investment companies) because the implementation of IAS/IFRS into financial sector brings higher transparency at the market, and so maintains financial stability of accounting unit. The importance of the international accounting standards has grown particularly after the global financial crisis in 2008-09 when many financial institutions recorded problems with financial stability. Especially in banking sector the recent financial crisis has opened a discussion about fair value and requirements for capital regulation.

In this article, we will characterize vertical retrospective financial analysis based on data and financial information from the individual annual financial statement of selected Slovak bank. The data we gained from available individual statement of years 2015 and 2016. The purpose will be to evaluate the financial stability of selected bank according to various ratios, such as profitability ratios and leverage ratios.

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2 Methods

This article can be divided into two sections. The first section of the article deals with theoretical definition, presentation and disclosure of the individual annual financial statement of a bank according to IAS/IFRS framework. In this part we use method of comparing national and international accounting standards and rules. In the second section, there are analyzed annual statements of Slovak bank (ČSOB, a.s.) by using vertical economic-financial analysis, in which we will evaluate total balance (assets and liabilities), structure of profit/loss, profitability and leverage ratios. Our purpose is to point out if the financial position of the bank is stable. The financial data was obtained from individual annual statement of ČSOB, a.s. for years 2015 and 2016.

After comparing accounting rules and calculating ratios, we will briefly define differences between accounting standards for financial instruments IAS 39 and IFRS 9 that specialize in correct financial reporting of financial derivatives and hedging items. We point our attention to these accounting standards because they are key frameworks in our dissertation. By theoretical definition of differences in these two accounting frameworks, we want to emphasize the significance of changes in bank´s accounting methodology and point out an influence of financial operations with derivatives instruments on financial statements.

3.1 Literature overview in financial accounting

There are many studies about accounting research in the literature. The first studies that analysed an influence of accounting data on financial statements appeared in the early 1960s, such as Ball and Brown (1968) or Beaver (1968). Accounting research in Ball (1968) examines and evaluates a change in accounting income by creating an empirical test which examines if accounting income reflects useful information to the market.

Modern studies in accounting research are focused on analysing a relationship between financial accounting and management decision-making, government regulation, litigation, accounting frauds and accounting standards setting. A study Crawley, Wahlen (2014) describes various analytics in empirical accounting research. According to authors of this study, financial accounting is about "*the measurement and communication of financial information affects capital allocation decisions*". Another examples for modern accounting studies are Li (2010), Lim and Zheng (2014), Crawley (2013), Richardson et al. (2010), Price et al. (2011), or Armstrong et al. (2010). Li (2010) provides interesting view how managers communicate with stakeholders through numerical accounting data in the financial statement and estimates the impact of overconfidence on the future cash-flow. Lim and Zheng (2014) analyse conditional accounting conservatism at the aggregate level, what means that they investigate relation between aggregate market returns and aggregate earnings. Similar study is Crawley (2013) where is demonstrated an influence of macroeconomic consequences on firm level accounting conservatism. The result shows that "*accounting can impact social welfare by altering the measurement attributes of key macroeconomic indicators and by shaping monetary policy decisions*". Richardson et al. (2010) focus on accounting anomalies and fundamental analysis. They examine that financial statements can help investors make better portfolio allocation decisions because information in financial statements can be used for forecasting future earnings and estimating future risks. Price et al. (2011) use financial information in financial statements to detect and predict frauds. They determine what commercial developed risk model is appropriate to measure accounting misstatements. Armstrong et al. (2010) emphasize transparency of financial accounting in resolving government agency conflicts among managers and shareholders. They point their attention to government contracting and debt contracting, and focus on the role of information asymmetry in financial reporting.

If we point our attention to bank accounting reporting, then very interesting accounting research study is Beatty and Liao (2014), which is focused on financial accounting in banking industry, and links bank financial reporting with valuation and risk management. Also, there are a lot of guidance of interpreting international accounting standards, usually issued by large accounting and advisory firms, such as KPMG (2014), PwC (2017) or EY (2014). These stated studies provide an overview about new IFRS 9 framework for financial instruments. Another example for bank fiancial accounting is Ramirez (2015), which explains advanced financial accounting for derivatives instruments and hedging strategies under IFRS 9.

3 Method results

3.2 The individual annual statement according to Slovak accounting standard and IAS/IFRS

According to Slovak accounting law No. 431/2002, annual financial statement represents structural presentation of accounting operations, which are an accounting´s subject. Financial statement provides enough useful, reliable, comparable and comprehensive data for users. Slovak accounting law defines individual financial statement as a whole, taking into account a difference between financial statement in double-entry accounting system and financial statement in

simple accounting system. Also, Slovak accounting law differentiates consolidated and individual financial statement. Requirements of financial statements in double-entry accounting include statement of financial position (balance sheet), statement of profit or loss and notes. In simple accounting financial statements contain statement of revenues and expenditures, and statement of assets and liabilities. Slovak accounting law also sets the date when it has to be report financial statement.

If an accounting unit decides to report financial statement according to IAS/IFRS, it follows these accounting rules:

- IAS 1: Presentation of financial statements,
- IAS 7: Statements of cash-flow,
- IAS 10: Events after reporting period,
- IAS 27: Separate financial statement,
- IAS 34: Interim financial reporting,
- IFRS 1: First-time adoption of international financial reporting standards.

As has also been stated above, accounting rules establish standards and requirements for an accounting unit, and also determine the structure of financial statements. International standards IAS/IFRS provide more complex overview of the annual financial statement and specify content and requirements of financial statements more detailed. Differences between national and international rules lay down in defining some terms, such as who is an accounting unit, how long takes accounting period, or definition of reserve funds, impairment, assets, amortization etc.

3.3 The financial analysis of the individual annual statement of ČSOB, a.s.

The total balance of assets and liabilities reached level of 8 543.77 mil. EUR in 2016, what represents an increase by 9% (778.07 mil. EUR) on year-to-year basis, respectively 12% (966.3 mil. EUR) in comparison to year 2014. On the assets side, the most significant factor that has an influence on the bank´s balance, were provided loans to clients (6 096.7 mil. EUR). If we consider structure of provided loans, the highest volume of client´s loans are housing loans (an increase by 22%), consumer loans (24%), and the increasing trend also have loans provided to small and medium enterprises. The second most significant asset item is financial assets as held-to-maturity (16% of total assets, almost 1.3 bill. EUR). In 2016, other financial assets (financial assets through profit/loss and assets available-for-sale) represents total value of 556.2 mil. EUR (6.5%). If we compare a development of financial assets during the period, there is a clear declining trend (a drop almost 2% in 2015, from 630.74 mil. EUR; resp.4% in 2014, from 738.67 mil. EUR). Cash and balances with central bank formed a part of 3% of total assets, however there is also a downturn.

Figure 1 The structure of assets in ČSOB bank (2014-2016; in thousands EUR and %)
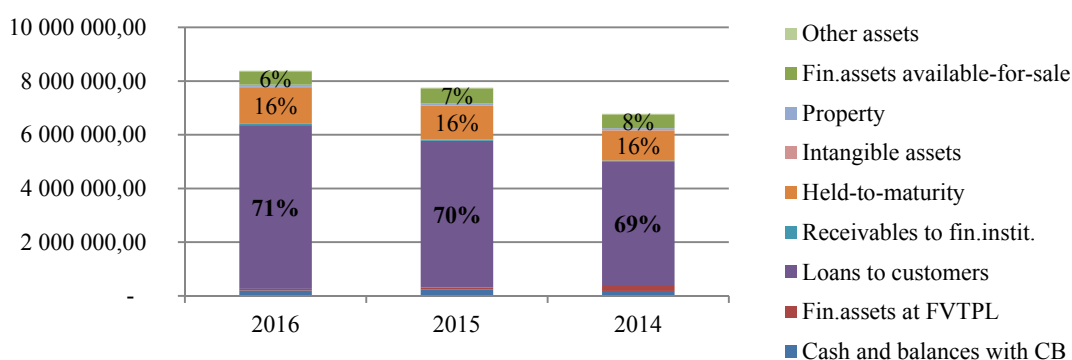
Source: Own processing

When we analyse liabilities side, the most significant volume represents current accounts and receivables from clients and financial institutions (66%, in absolute value 5 bill. EUR). In 2016, there was recorded an increasing volume of current accounts by 544.7 bill. EUR. According to financial statement (ČSOB, 2016), current deposits of clients and savings accounts increased by 15 %, what correspondents with bank strategy to cover stable financial sources. Amounts owed to other financial institutions represent 10% of the total liabilities. Important indicator on liabilities side is also issuing debt securities and obtaining financial sources at the financial market which represent 12% of total liabilities in 2016 (1 047.2 bill. EUR). In comparison to 2015, gained financial sources arose about 223.9 mil. EUR (1.7%). Bank´s equity was in 2016 at level of 701.8 bill. EUR, what means that this bank has 8% of own financial sources.

Figure 2 The structure of liabilities and equity of ČSOB bank (2014-2016; in thousands EUR and %)
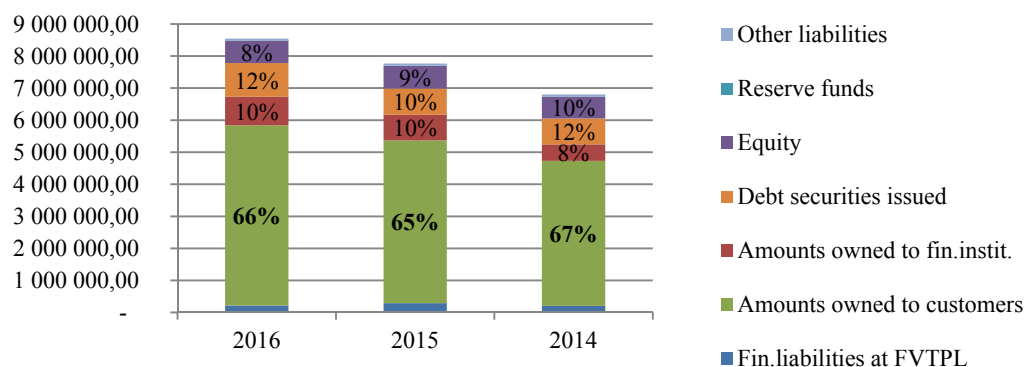
Source: Own processing

Total bank incomes in 2016 reached level of 300.5 mil. EUR, what means an increment by 3.7%. If we analysed bank revenues deeper, the most significant volume represents net interest incomes (210.1 mil. EUR in 2016, a slight increase by 0.94%, or in absolute value 208.2 mil. EUR). This raise was associated with higher volume of provided loans for small and medium enterprises, and at the same time with a drop of operating expenses. The other significant indicator of total revenues is fee and commission incomes, which have share of 18% of total net incomes, even though in 2016 incomes from fees dropped slightly (from 54.6 mil. EUR in 2015 to 53.7 mil. EUR). The main reason why total incomes has fallen, was also changes in national legislative (change in mortgage financing), as well as a change in dynamic selling of monetary funds at primary market. This growth was influenced by net realized result from available-for-sale financial assets (by 10%, from 18.1 mil. EUR to 30.9 mil. EUR), mainly thanks to the realization of VISA shares in connection with the purchase of VISA Europe Ltd. by VISA Inc. (14.3 mil. EUR before tax). (ČSOB, 2016)

Total bank´s expenses in 2016 increased by 5% (from 172.2 mil. EUR to 180.8 mil. EUR). This positive trend of operation costs was associated with investments in modern information technology for client, as well as complying regulatory requirements. Other costs, such as personal costs have a share of about 45% of total operating costs, amortization of tangible and intangible assets represent 7% of total operating costs.

When analyzing the structure of earning before taxes (EBT), there is a year-to-year increment. In 2016 EBT reached almost level of 103.86 mil. EUR, what in relative values represent an increase by 4.94% in comparison to 2015 and by 11.4% in comparison to 2014. Income tax expense, which an accounting unit has to pay to tax authority, represents 20.6 mil. EUR in 2016. Net accounting profit for 2016 was recorded at level of 83.2 mil. EUR (74.6 mil. EUR in 2015, resp. 66.2 mil. EUR in 2014). The result of achieved net profit represents an annual increase by 10% despite of economic environment when there have been low interest rates in the financial market and unfavourable legislative conditions. (ČSOB, 2016)

Figure 3 The structure net income of ČSOB bank (2014-2016; in thousands EUR and %)
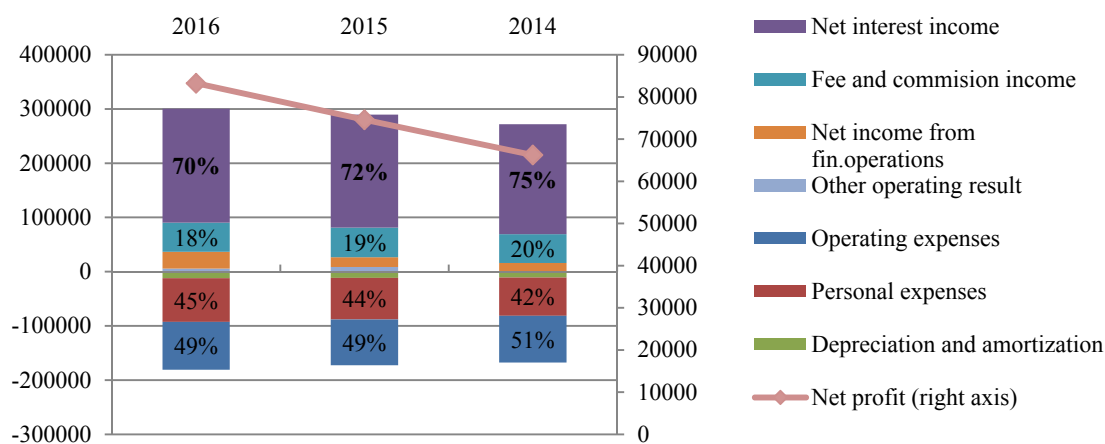
Source: Own processing

Profitability ratios measure economic efficiency of accounting unit. From investing view, the most important profitability ratio is ROE that measures profitability of equity. Value of ROE in ČSOB, a.s. reached 11.86% in 2016 what means an increase by 1.3% in comparison with 2015. The positive development of ROE ratio reflects in a positive growth of net profit during the period. Profitability of total assets (ROA) compares achieved net profit to total volume of assets. Based on financial data for ČSOB, a.s. the actual development of ROA is at level of 0.97%. Profitability of investment (ROI) expresses profitability of investment projects and compares net profit with costs interests to total equity. For the last three years, ROI has recorded a considerable development (from 0.28% in 2014 to 0.57% in 2016), because of new investment and innovation in modernization of information technologies (new application Smart Banking, and improved Internet Banking).

Table 1 Profitability ratios in ČSOB bank (2014-2016; in %)

	Profitability ratios		
	2016	**2015**	**2014**
ROI	0.5726 %	0.4424 %	0.2800 %
ROA	0.9741 %	0.9604 %	0.9739 %
ROE	11.8589 %	10.5968 %	9.7659 %

Source: Own processing

Debt ratios analyse the structure of financial sources and evaluate the share of own equity and other liabilities of the company. Debt ratios for banks indicate higher values of liabilities (in form of current accounts, amounts owed to financial institutions, reserves funds, or other liabilities to financial institutions) than values of total assets (cash and balance with central bank, receivables, provided loans). In our analysis of ČSOB, a.s. we calculate four types of debt ratios – total liabilities-to-total asset indicator (debt ratio), debt-to-equity (equity to total liabilities), financial leverage and insolvency indicator.

Debt-to-equity ratio of our analysed bank shows that the capital structure in 2016 is contained by 8% of own sources and 92% of liabilities, what correspondents with value of debt ratios in the banking industry. When we compare value of debt-to-equity ratio during period, there is a slight drop of bank´s equity (9.1% in 2015, resp. 9.97% in 2014).

Financial leverage expresses how many times the total capital is higher than equity and indirectly evaluates debt of accounting unit. Financial leverage is also called as equity multiplicator. In application on ČSOB, a.s. value of leverage ratio has slightly rising trend and moves about 11 units.

Insolvency factor expresses and describes deeply a relationship between short-term liabilities to short-term receivables. Insolvency is comparing to marginal value 1, what means payment insolvency. For ČSOB, a.s. according to insolvency ratio is not problem to meet up with liabilities from business relations. However, we have to say that in 2014 was recorded an increment in insolvency at level of 0.2 units, what should be a result of higher amounts to financial institutions, higher volume of current amounts to clients and at the same time reducing of short-term receivables to financial institutions.

Table 2 Solvency ratios in ČSOB bank (2014-2016)

	Solvency ratios		
	2016	**2015**	**2014**
Debt	0.9179	0.9094	0.9003
Debt-to-equity	0.0821	0.0906	0.0997
Financial leverage	12.1736	11.0336	10.0272
Insolvency	0.6241	0.6153	0.4367

Source: Own processing

3.4 Financial reporting in banking sector and differences between IAS 39 a IFRS 9

The necessity of financial accounting in the banking sector is associated with international agreements for monitoring and controlling bank risks, as well as providing bank supervision. These sets of banking agreements, called also as Basel Accords, set a requirement of changes in accounting recording and financial reporting of financial derivatives in balance sheet in the fair value. As it was stated above, the purpose of financial accounting is to report financial risks in financial statements objectively. This is especially important in financial statements of financial institutions which realize operations with financial instruments that are associated with higher risks.

The first significant accounting standard, which set accounting rules for derivatives, is IAS 32 that was established in 1995.The methodology of IAS 32 gives a guide for accounting units how to disclose fair value of financial assets and financial liabilities. In 1998 was adopted new framework IAS 39: Financial instruments – Recognition and measurement, which provides a classification and rules for impairment of financial instruments. The aim of IAS 39 is to report and eliminate risks in the financial statements, and to try to recognize financial derivatives and hedging operations in the balance sheet. (Petrjánošová, 2013)

However, the disadvantage and weakness of IAS 39 is complexity and difficulty of recognising financial instruments. Many critics claim that IAS 39contains too complicating accounting rules. Therefore, in 2001 it was adopted another framework, IFRS 7: Financial instruments – Disclosures, which enables to evaluate the significance of financial instruments and the nature of risks arising from financial instruments. IFRS 7 provides a "stress-test" model, which increase transparency in financial reporting of financial instruments. However, there were occurred serious problems with credit risks after global financial crisis, it was necessary to identify and evaluate market risks more. Therefore, it will be adopted new IFRS 9 (obligation to use IFRS 9 is from the first of January 2018), which use easier economic model for estimated loss from credit risks. (Hanlon et al., 2015)

Because of the fact that IFRS 9 will influence financial statements very significantly, we highlight basic changes in operations with financial instruments. New framework IFRS 9 replaces IAS 39, improves classification and measurement of financial instruments and introduces new hedge accounting requirements. IFRS 9 provides a better link between an entity´s risks and management strategy for hedging. (EY, 2014) The main changes in accounting methodology for financial instruments in IFRS 9 can be included in four parts:

- Classification and measurement of financial instruments,
- Credit risk,
- Hedge accounting,
- Disclosure. (EY, 2014)

Classification and measurement of financial instruments under IAS 39 defines financial assets as assets in fair value through profit or loss (FVTPL), assets available-for-sale, held-to-maturity and loans and receivables. IAS 39 defines financial liabilities according impairment method, that means in fair value through profit or loss and other financial liabilities measure at amortised costs. Methodology of IFRS 9 definitely cancels the original classification of financial instruments. Financial assets and liabilities under IFRS 9 represent primary financial instruments and derivative instruments. Impairment of financial assets is measured either way at fair value through profit or loss, through other comprehensive income or at amortized costs, meanwhile financial liabilities measures at amortized costs (non-derivative instruments), or at fair value.

The other change is protection against credit risks. IFRS 9 gives more emphasis on requirements of credit risk, particularly because of high losses from non-performing loans after the global financial crisis. There are three models for measuring credit risk in the new standards, meaning general model, simplified approach and adjusted approach. IAS 39 framework deals only with actual credit risk, and does not consider the development of credit risk in the future.

A change that has a very significant impact on financial statement of bank and what we will point our attention in our dissertation particularly, is hedge accounting. In IAS 39 if an operation with financial instruments happens in the balance sheet, an accounting unit has an obligation to report it. However, IFRS 9 enables to decide if an accounting entity will report derivatives during accounting period. But if accounting entity decides to report about derivatives, it will account them during whole accounting period. A difference lies also in classification derivative operations: IAS 39 differentiates speculative and hedging instruments, meanwhile IFRS 9 defines fair value hedge, cash flow hedge a hedge in net investment in a foreign operation.

4 Conclusions

The purpose of this article was to point out the financial stability and financial position of the selected bank at the Slovak market based on analysing individual financial statement which is reported according to IAS/IFRS framework. As it was stated sooner, financial reporting according to international accounting standards is more complex and provides more detailed financial information and data in notes. Based on our financial vertical analysis we can conclude that total balance of our analysed bank is stable with prosperous tendency. The structure of earning after tax on the revenue side is mainly consisted in net interest incomes (incomes from provided loans to small and medium enterprises), and on the expenses side in operation costs (especially expenses for modernizing information technologies).The analysis of profitability, debt and leverage ratios has claimed the trend in banking sector. Profitability ratio ROE positively supports growth of net income, and leverage and debt ratios have shown a typical trend how bank uses financial sources in the economy. In the last section of the article, we emphasized differences between accounting standards IAS 39 and IFRS

9, which describe financial reporting of financial instruments. We briefly described these two frameworks because they are a key accounting standards in our dissertation where we deal with financial and hedge accounting of financial derivatives. In this article, we wanted to inform about influence of financial reporting on the financial statements in banking sector.

The critics and drawback of the article can be a fact that the financial analysis describes only financial position of one bank, and includes a few analysed ratio indicators. To show effectiveness and impact of IAS/IFRS on financial statements, it would have been better to use a sectoral analysis and compare results with different financial entities which are reported their annual statement according to international accounting standards.

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Does the Harmonization of Excise Duties Lead to the Convergence of the Member States of the European Union?

Jarmila Rybová

Abstract: *The paper answers the question about whether the current harmonization process in the area of excise duties has led to convergence of the Member States of the European Union. As regards the overall tax quota, Member States are moving closer together. It can be assumed that the application of the directives on excise duties may lead to their convergence. Convergence is determined by the sigma convergence of the EU Member States' sub-tax tax quota for excise duties. The results show that there has been no convergence of excise taxes. In addition, excise rates have been approaching in the Member States. The harmonization process, including the application of minimum rates, is not a sufficient tool to bring the selected sub-tax rate indicator closer. In particular, the differences in GDP differ between countries. This causes divergence of the partial tax quota. This situation can be justified also by the different consumption patterns of goods burdened by excise duties, different cultural and historical habits, differences in the structure of the consumption of these goods and the application of differently high rates of excise duties.*

Key words: European Union · Taxation · Harmonization · Excise Duties

JEL Classification: H20

1 Introduction

Building a Single European Market leads EU Member States to harmonize consumer taxes, including excise duties. Common rules facilitate cross-border trade and prevent distortions of competition. The term harmonization in the field of excise duties involves the convergence of national legislation towards the European Union legislation. Excise duties have governed by European Council regulations, both in the area of tax administration and at minimum rates. By complying with the same rules, convergence rather than divergence may occur among the EU members. At the same time, the internal market functions, and there may be a shift in the consumption of the taxed product to another state. The rates applied are left to the Member States' competence, subject to compliance with the minimum rates. Excise duty rates are moving closer to EU members over the period. This can limit cross-border "non-commercial" purchases by consumers in order to buy the goods cheaper, at a lower excise rate and possibly even lower value added tax. This can reduce the incentive to tax evasion in the commercial area as well.

Revenues from excise duties flow to the member states' budgets and to the budget of the European Union. Excise duties can be assessed using different indicators. For international comparison, it is appropriate to apply a sub-tax rate indicator, excise duty rates, excise tax rates in the tax mix, etc. The sub-tax rate indicator can be considered as an appropriate indicator. It expresses the share of excise revenue from gross domestic product (GDP).

It can be assumed that Member States' excise duties will move closer together, mainly due to harmonization processes and trade in the internal market. However, divergence among some states may not be ruled out altogether. In the area of total taxation (total tax quote), it is found that the convergence of states occurs. Do excise duties support convergence of taxation in the member states? In connection with the harmonization process, it can be assumed that yes. Is there a convergence of Member States' excise duties? Finding Member States' convergence on excise duties could help answer the question of whether Member States are able to effectively suppress harmful tax competition and reduce tax evasion through existing rules.

2 Literature Review

The theory of convergence has been developed in conjunction with the theory of growth models. The basic source for measuring convergence is the monograph of Barro and Sala-I-Martin (1995). When examining convergence among countries over time, it is necessary to determine the point at which states approach or diverge. This point may be in the area of fiscal policy, for example, the Maastricht criteria, or it is possible to determine deviations of a selected indicator among states and their changes over time. Examining the tax burden can be done by comparing differences in tax burden ratios among states. The sigma convergence is based on the assumption that all the states converge to the same level

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of tax burden, the variation coefficient of the tax burden indicator decreases. With the prevalence of convergence, some states may show divergence.

Tax convergence authors use a tax burden to identify tax rates in a given country over a specified period. Attention has been focused on these authors, as they use to assess the tax indicators. Esteve et al. (2000) applied sigma and beta convergence to determine the convergence of states in the tax burden over the period 1967-1994. Sosvilla et al. (2001) measured sigma convergence of standard deviations and beta convergence. The convergence of the tax burden was identified in the original fifteen Member states of the European Union in the period 1965-1995. As a result, convergence was found in the two periods 1967-1974 and 1984-1995.

Ashworth and Heyndels (2002) found the convergence between OECD and EU tax systems from 1965 to 1995. They tried to answer the question of whether convergence could be expected in the future as well.

Gemmel and Kneller (2003) evaluated fiscal convergence from three perspectives. The first is the convergence of the level of taxation and the type of tax, the second is public spending and the third fiscal deficit. The authors looked at the impact of these components on economic growth in the period of 1970-1995. For the sigma convergence analysis, they used the Gini index.

Cnossen (2005) said that excise duty on tobacco, where the EU uses a specific tax rate and ad-valorem rate combination, can indirectly favor European manufacturers on the European market as opposed to others who have not adapted their production to such taxation.

Delgado (2006) used to detect the evolution of the beta mix, sigma and gamma convergence from 1965 to 2003. Strong convergence was find from 1975 to 1990.

The tax convergence results from various effects acting among the states, i.e. the mobility of tax bases, tax competition, as described by, for example, by Foltysova (2007). In the case of excise duties, the critical factors may include the role of neighboring states, international trade, harmonization processes in the EU, etc.

Tibulca (2015) measured the sigma convergence of the compound tax quota and Gini coefficient in selected EU states. This study concludes that the convergence process took place among the member states from 1980 to 1993. The study results are shown in the following figure. The author states that by 1997, the opposite trend is found, which is justified by the inclusion of more countries in the database and the start of the enlargement phase of the European Union. The convergence process is renewed in the period of 1997-2008. After 2008, there is the opposite trend again, probably due to the financial crisis in the world and in the European Union. The EU study (Eurostat, 2013) features similar justifications for the interruption of the tax convergence process. The economic recession also slows down convergence processes in other areas, as evidenced by empirical research, such as price convergence. Below are the maximum and minimum values of the variation coefficients of the compound tax quota.

The author drew up her own study on harmonization of excise duties (Rybová, 2017). The cluster analysis revealed groups of Member States that are similar in the field of excise duties. Discrimination analysis was marked by a factory that affected the similarity of states. Spirits consumption and the diesel tax rate were the main factories between 2004 and 2015. The Gini coefficient was among the statistically significant factors along with the consumption and rates of the main taxed products (alcohol, cigarettes, diesel, petrol). The lower Gini coefficient was linked to the higher importance of excise duties in the economy of the state. The importance of tariffs for classifying countries into groups has increased over time over consumption of taxed products. The study confirms the divergence between EU members. It also draws attention to the reserves in the use of the redistribution effects of these taxes and the possibility of limiting the minimum rates to the most important products.

3 Methods

Whether there is a convergence of excise duties among the member states over the period under review can be assessed using the convergence effects analysis methods that may be applied in the area of fiscal policy. Convergence can generally be understood as the approximation of levels of a particular economic area. In the case of duties, the levels of tax burden, tax rates, etc. are being approximated.

The actual examination is based on the evolution of the indicator sub-quota excise duties from the Eurostat Database and the changes in the excise duty rates from the European Commission Database. Excise duty rates are set in the years following changes in at least some minimum rates. The pricing aspects of the taxed products have not been taken into account. Convergence of the excise duties is assessed by the sigma convergence method. This method uses the

variation coefficients of the data of the Member States of the European Union. The aim is to find out the Member States' sub-tax quota of excise duties are approaching each other over the reference period.

2.1 Excise duties in the ESA Classification

The excise duties in ESA 2010 and ESA 95 are included in the account of taxes on products and import (D. 2). The revenues from these taxes are divided into two sub-accounts:

- Taxes and import duties excluding VAT (D. 212). Here is a part of the excise duties levied on imported goods. This is a sub-account marked D.2122c, which includes excise duties and special taxes on some imported products, provided that such taxes and charges on similar products of domestic origin are also payable by the manufacturer in the given field.
- The taxes on production excluding VAT and import (D. 214) consist of taxes on products and services that become payable as a result of production, export, sale, etc. Sub-account D.214a includes excise duties other than those included in taxes on imports and duties, namely on sub-account D.2122c.

2.2 Coefficient of Variation

The work itself features the variation coefficients of the sub-tax quota of twenty seven member states in the period of 2000-2015 and variation coefficients of excise rates in selected years. The data of all Member States are available in this limited period. The member states' data is obtained from the Eurostat online database

Coefficient of the variation of the tax burden (CV):

$$CV = \frac{\left[\left(\frac{1}{n} \cdot \Sigma_{i=1}^{n} (Y_i - \bar{Y})^2 \right]^{\frac{1}{2}} \right]}{\bar{Y}} \tag{1}$$

Where:

n	a number of objects (Member States)
i	each of the Member States
Y	a sub-tax excise taxes quota (or an excise duty rate)
$\bar{Y}$	an annual average a sub-tax excise taxes quota (or an excise duty rate)

4 Research Results

The Member States of the EU converge to one another in the tax area. The tax quota indicator shows this (see Figure 1). The studies above mentioned similar conclusions. The convergence among states has been identified through the development of the variation coefficient of the excise duties share on GDP identified in the period of 2000-2015 and variation coefficient of excise rates in these years 2004, 2007, 2012 and 2015. For the identification of convergence, the annual data of twenty seven EU Member States without Croatia was used. Data on excise duties for new members who joined the European Union in the years 2004 and 2007 are included in all measurements. The number of countries included in the calculation of the variation coefficients is unchanged, unlike the above-mentioned study by Tibulca (2015).

The results of the sigma convergence measuring indicate the trend of the divergence in the sub-tax quota of excise duties among the EU members. In the field of excise duties, there is no convergence of the partial tax quota in the period 2000-2015.

Table 1 Maximum and minimum values for Coefficient of Variation

	Coefficient of Variation	
	Value	**Year**
Minimum	0,178	2001
Maximum	0,274	2015

Source: Own processing

The harmonization process is obviously not a tool to support the convergence of states in the specified area. Convergence only occurs in shorter periods of time, for example after 2004, when the ten new member states joined the European Union, and during the economic recession in Europe. Excise duties on products such as fuel, tobacco, and alcoholic beverages converge in the member states at a time when consumers are forced to rather restrict their consumption.

Figure 1 Development of variation coefficients of selected tax quotas in the EU
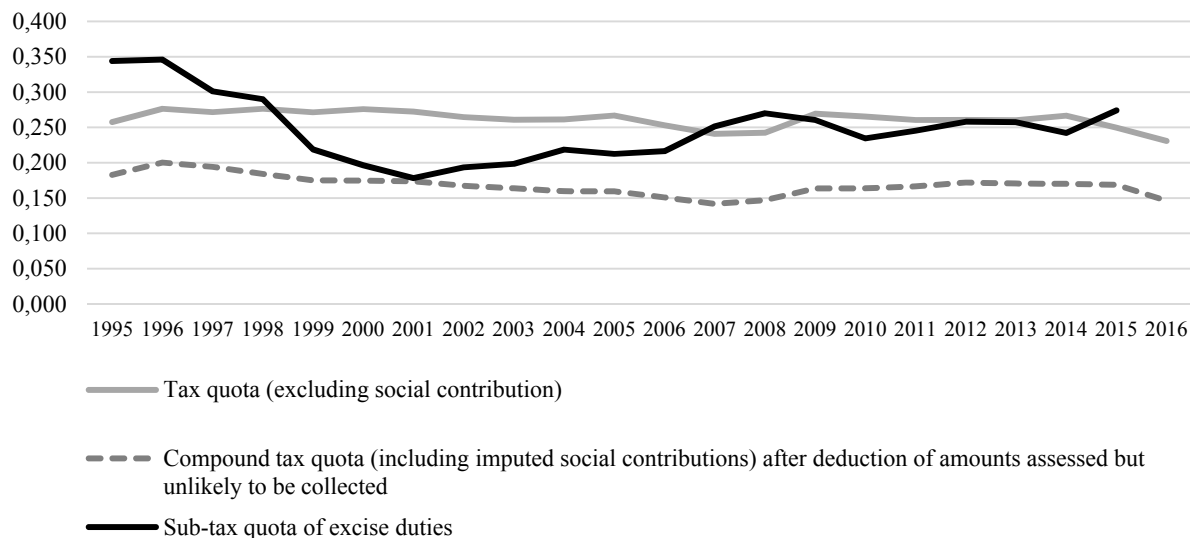
Source: Eurostat database (2017), own calculations

To explain the divergence of the partial tax quota, it is possible to monitor the development of other indicators. However, the applied rates of the main products burdened by excise duties did not provide any explanations of divergences. The most striking differences among the states are found in alcohol and cigarettes. For all the products listed above, the variation rates for excise duty rates have been decreasing since 2004. The countries' rates are increasingly similar. The tax rates data in the year 2000 includes the original 15 EU countries' data only.

Figure 2 Coefficient of Variation excise duty rates
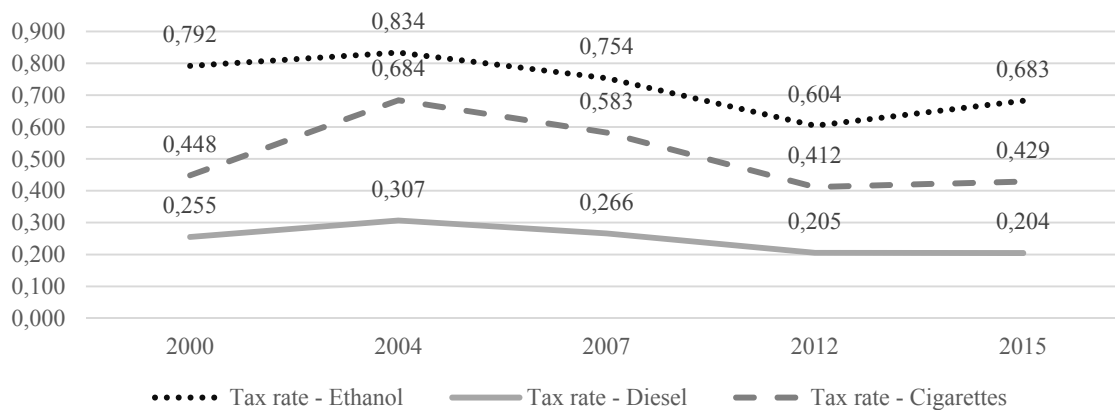
Source: European Commission

Differences in tax rates have been increasing between the EU members since 2012. Application of minimum rates is not a sufficient tool for the convergence of states in the field of excise duties. This article does not pay attention to the consumption of taxed goods. It can also affect the level of similarity between states. Author in the study Rybová (2017) shows that the differences among countries in the consumption of taxed products show a decline as well. The biggest differences among the EU members are found in cigarette consumption. The consumption shows low demand elasticity. Consumption does not explain the growing divergence of the partial tax quota of excise duties.

Figure 3 Coefficient of Variation tax revenues and GDP per capita in the selected years
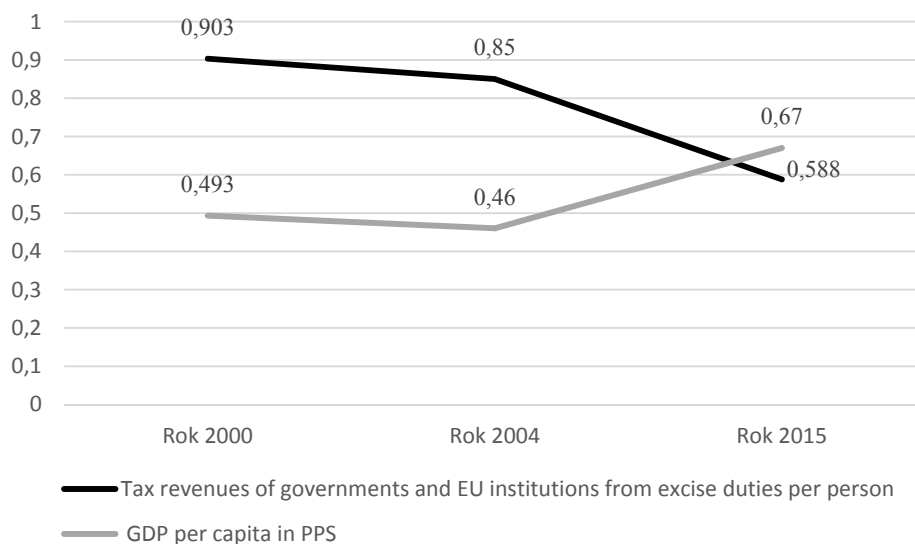
Source: Eurostat database (2017), own calculations

Excise duty revenues per person are still very different among the EU members. However, the variation coefficient decreases. A growing variation coefficient is found in GDP per capita in PPS only. The GDP indicator is used to calculate the partial tax quota. This is a possible explanation of the growth of divergences in the sub-tax excise duty quota.

5 Conclusions

The sub-tax excise duty quota evolves in a given period differently from the total tax quota where Tibulca (2015) confirmed the convergence. Excise duties account for the average of 9% of the compound tax rate in the European Union. It is evident that excise duties are not taxes that would support the convergence in taxation in the member states. Nevertheless, excise rates were approaching, similarly consumed quantities of taxed goods. The indicator of sub-tax quota is affected by gross domestic product.

The results of the work show the impact of the growing differences in GDP among the member states. In times of economic growth, more developed countries gain greater leverage than countries with lower GDP levels. At the same time, the character of these taxes can contribute to the divergences. These are specific taxes, predominantly with a fixed rate, where the rates and amounts consumed are decisive for tax revenues. Consumer consumption levels of products subject to excise duty are very different in different member states. Similarly, this is the case with rates. Although the European Council Directive sets minimum rates applicable to all the member states, the diversity of tariffs among the countries is not limited. Higher excise duty rates are generally applied in the Nordic countries and in Western Europe. By contrast, lower excise duty rates are used by the new member states.

Looking more closely at other indicators of excise duty, apart from the tax quota, it is clear that in many cases the indicators converge. This may be attributed to the impact of the harmonization process or the internal market functioning. The convergence of excise taxes could be the result if a different indicator than a partial tax quota was used for the measurement.

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Possible Impacts of Application of the New Accounting Standard IFRS 15 Revenue from Contracts with Customers: A Case Study

Marta Stárová, Helena Čermáková, Enikő Lőrinczová, Miroslava Navrátilová, Markéta Beranová

Abstract: *The new accounting standard IFRS 15, issued in 2014 and effective from 2018, brings a consistent guidance of revenue recognition and reporting. The aim of the paper is to point out the possible implications of the application of the new International Financial Reporting Standard 15 to the entities accounting and to demonstrate on case study examples the possible accounting treatment. The case study is based on the practice of a prominent joint stock company operating in the Czech Republic, where existing customer contracts were analysed and areas with need of modification were identified. The results proved that the application of IFRS 15 brings changes into the current practice as to the amount and the time of the revenue recognition in the chosen company, where the most significant changes are related to the allocation of a transaction price, to the sales with the right of return and licences with the right to use. IFRS 15 provides a more systematic view of revenue recognition, and additionally, requires a higher degree of professional judgment.*

Key words: Revenue · Contracts with Customers · Recognition · Reporting · Provision · Cost of Sales

Classification: M410

1 Introduction

International Financial Reporting Standards IFRS are currently required in over 125 jurisdictions and permitted in many more (IFRS Foundation, 2017b). Within the European Union, listed companies (those whose securities are traded on a regulated market) must prepare their consolidated and individual financial statements in accordance with IFRS instead of national accounting rules. (PWC, 2009). Research of Ipino & Parbonet (2016) shows that IFRS adoption came with the unintended consequence of certain firms substituting real earnings management for accrual-based earnings management.

In May 2014, the IASB published *IFRS 15 Revenue from Contracts with Customers* (Mazars, 2014; Deloitte, 2017). IFRS 15 was developed by the IASB in a joint project with the US Financial Accounting Standards Board FASB. This new standard establishes the principles that an entity applies when reporting information about the nature, amount, timing and uncertainty of revenue and cash flows from a contract with a customer. IFRS 15 is effective for annual reporting periods beginning on or after 1 January 2018, with earlier application permitted (IFRS Foudation, 2017, Delloite, 2017). IFRS 15 replaces the current IFRS guidance set out in two relatively old standards - *IAS 18 Revenue* and *IAS 11 Construction Contracts* which are accompanied by a number of Interpretations (BDO, 2016). The aim of the new approach is to eliminate the current inconsistencies at revenue recognition and to increase the comparability of revenues reported by various accounting entities (Dvořáková, 2015). Applying IFRS 15, an entity recognises revenue to depict the transfer of promised goods or services to the customer in an amount that reflects the consideration to which the entity expects to be entitled in exchange for those goods or services (IFRS Foudation, 2017). IFRS 15 consists of a standard (including application guidance with clarifications on a number of topics such as licensing, a sale with a right of return, customer options for additional goods or services, etc.), illustrative examples and basis for conclusions (Mazars, 2014). To recognise revenue under IFRS 15, an entity applies the following five steps:

(a) identify the contract(s) with a customer.
(b) identify the performance obligations in the contract. Performance obligations are promises in a contract to transfer to a customer goods or services that are distinct.
(c) determine the transaction price. The transaction price is the amount of consideration to which an entity expects to be entitled in exchange for transferring promised goods or services to a customer. If the consideration promised in a contract includes a variable amount, an entity must estimate the amount of consideration to which it expects to be entitled in exchange for transferring the promised goods or services to a customer.

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(d) allocate the transaction price to each performance obligation on the basis of the relative stand-alone selling prices of each distinct good or service promised in the contract.

(e) recognise revenue when a performance obligation is satisfied by transferring a promised good or service to a customer (which is when the customer obtains control of that good or service). A performance obligation may be satisfied at a point in time (typically for promises to transfer goods to a customer) or over time (typically for promises to transfer services to a customer). For a performance obligation satisfied over time, an entity would select an appropriate measure of progress to determine how much revenue should be recognised as the performance obligation is satisfied (IFRS Foundation, 2017a).

Control of an asset is defined as the ability to direct the use of and obtain substantially all of the remaining benefits from the asset (Delloitte, 2017). According to Nielson (2016), an entity must assess whether revenue should be recognized over time or at a point in time. Tong (2014) names some examples which areas will be different according to the new IFRS, recognition of revenue on long-term contracts with customers, identification of separate performance obligations, product warranties, use of estimates, accounting for costs, etc. This can include assessing whether the customer controls an asset as it is created or enhanced. According to Procházka (2016), the new rules can lead to a significant change as to the moment and/or the amount of the recognized revenue.

The purpose of the paper is to contribute to a better understanding of the complicated issue of revenue reporting (recognition); and possibly to be an inspiration for solving the outlined issues. The aim of the paper is to point out the possible implications of the application of IFRS 15 Revenue from Contracts with Customers to the entities accounting, to demonstrate on illustrative examples the possible accounting treatment, to compare them with the current guidelines of IAS 18 and IAS 11 and to point out the possible influence on the informative potential of the financial statements.

2 Methods

The paper is based on a detailed analysis of the principles of revenue recognition according to the new standard IFRS 15 *Revenue from Contracts with Customers* (hereinafter referred to as IFRS 15). The purpose of the data analysis is the reduction, synthesis and summary of information in order to interpret the results sot that the reasoning is supported by valid evidence (Hendl a Remr, 2017). The analysis is based both on the original issue of standards published by the International Accounting Standards Board IASB, respectively IFRS Foundation, and on other professional sources such as online discussions of experts. Principles identified on the basis of this analysis are subsequently compared to the previous treatment of revenues, according to IFRS - IAS 18 *Revenue* and IAS 11 *Construction Contracts* (hereinafter referred to as current IFRS guidelines). Another research method applied for the empirical research in order to gain data is an individual qualitative interview. The interview was conducted with the accounting methodologist of a significant international joint stock company operating in the Czech Republic. This company records its business transactions and reports its financial statements in accordance with IFRS. The two-hour interview took place in October 2017 with the physical participation of both parties and was audiotaped. In this guided interview the topics were specified beforehand and the interviewer determined their order. The topics focus on the specific consequences of applying IFRS 15 in the chosen company:

1. The influence of applying IFRS 15 on the existing practices in the chosen entity,

2. Specification of areas which would be affected by the transit to IFRS 15 in the chosen entity,

3. Execution of the significant general changes and of adjustments to the currently used accounting information system, which emerge from the obligation to implement the requirements of IFRS 15.

To realize a visual comparison, the method of case study was chosen. The scenario of the case study is based on the analysis of all existing customer contracts in the chosen company, and the following areas were identified for their need of modifications: *Identification of contracts and their aggregation; Sale with installation; Received advance payments, Sales of "package" (with a discount); Sales with the right of return; The financial component of the transaction and The licence with the right to use (with an expiration date).* These individual topics are compared to the current IFRS guidelines and IFRS 15 in particular, to highlight the differences in solutions. In the case of implications of a partial area on the financial statements of the entity, the transition consequences from the current IFRS guidelines to the IFRS 15 are stated and explained. The case study concludes with the assessment of suggested general changes and adjustments of the internal accounting system of the entity.

3 Research results

The issue of IFRS brings a more organised set of rules for revenue recognition on the international level, but at the same time, the companies will be required to exercise more professional judgement. The judgment will be based on a greater use of estimates to correctly define separately identifiable contracts and the allocation of the transaction price. Kubů (2015) has the same opinion, and the auditing company Ernst & Young (2014) adds that many companies will have to adjust their current accounting practices and accounting systems to comply with the new standard. According to Kubů (2015), the new standard will lead to the revenue reporting in a different time period than it is currently done and consequently, the companies will have to modify their contracts. Therefore, in Drábková´s (2014) opinion, it is im-

portant for the users of the financial statements to have the opportunity to evaluate the risk of handling accounting and they should have the tools to evaluate this risk. The application of the five-step model for revenue recognition according to IFRS 15 has a greater or lesser impact on every company reporting under IFRS. The intensity and scope of this impact depends to a large extent on the scope of business of a given company and on the current settings of their accounting system. According to BDO (2016), for many entities, the timing and profile of revenue recognition will change. In some areas, the changes will be very significant and will require careful planning.

People responsible for accounting in every entity will have to learn the new principles of revenue reporting according to IFRS 15, to compare them with the current approach of revenue reporting according to IAS 18 and IAS 11 and on the basis of this revision, they will have to draw consequences for themselves. It is up to each accounting unit to assess in which accounting areas they will have to make changes and how significantly these changes will influence their financial statements. An entity will also have to apply the requirements of the standard consistently to contracts with similar characteristics and in similar circumstances (Ernst & Young, 2014). According to Ernst & Young (2014), timely and quality preparation for the new requirements emerging from the new standard is a basic premise for a successful implementation.

Based on research, the case study characterizes the chosen company with the following illustrative situation: The accounting entity produces and sells equipment (goods generally), provides installation of equipment and provides the possibility to buy an additional service to ordinary warranty. It also sells licenses to use for the supplied technologies. It usually receives advanced payments before the delivery. It takes into account the previous sales when determining the price and it provides discount if there is a previous sale. In certain cases it negotiates a put-option, i.e. the possibility to return the goods after a certain time. To the proven customers it provides – according to their needs – a deferred payment for the delivery. The accounting entity assesses the implications of its various activities from the view point of impacts on accounting as following:

3.1 Identification of contracts and their combination

The accounting entity has to revise its contracts whose validity overlap into 2018 and longer. In the contrast to the more relaxed conception of the current IFRS guidelines, according to IFRS 15, the rights and obligations related to delivery (supply) and the payment conditions have to be clearly stated in the contract. The contract has to have a commercial character with a high probability that the customer pays the agreed amount. There must be a clear identification of particular obligations arising from the contracts, for example separation of the physical delivery of goods from the provided service. It is necessary to consider whether the contract should be disaggregated into individual parts.

If the conditions for combination are fulfilled by multiple contracts simultaneously, it is imperative that the contracts are aggregated. The combination concerns those contracts which were made with one customer in the same period of time and which serve one identical purpose.

3.2 Sales with installation

Concerning the sale of equipment with an installation service, it is, according to IFRS 15, necessary to consider whether the installation is a separate consideration, or whether it is a part of the total physical delivery. Both cases are possible. If the installation does not require significant adjustment of the physical space, and it is possible to negotiate it separately or it can be done by the customers themselves, the installation is considered to be a separate consideration.

If the installation demands an adjustment of the equipment on the site, the installation is considered to be a part of delivery and the revenue from the whole contract must be reported after a successful installation. In this case, there is no significant shift from the current IFRS guidelines and no modifications are needed in the chosen company.

3.3 Received advance payments

Under the current treatment of revenues, received advance payments for goods and services may be classified as "deferred revenues". Under IFRS 15, received advance payments are reported as liabilities. The balance sheet is not changed in this case, because in both regulations, the payment is reported as liability. A more significant change concerns the actual time of the revenue recognition. Under IFRS 15, the revenue is recognized at the time the seller gains the right to receive such payment, not at the time the seller actually receives the payment.

However, it must be sufficiently guaranteed that the payment will be received and the whole contract is going to be fulfilled. New categories will occur in the balance sheet of the chosen company, titled "contract liabilities" (and on the other side receivables from long-term contracts "contract assets").

3.4 Sales of "packages" (including a discount)

According to IFRS 15, the transaction cost can include a variable amount. The variable amount is usually related to future events, and it can depend on the discounts and volume rebates, on royalties for a timely delivery or penalties for a late delivery, on the possible refunds, etc. It is important to approach the sale in context. The sale of a "package" can be understood as a sale of goods where the prices of provided goods (and services) depend on each other. This concept is illustrated on the following example.

The accounting entity made a contract to supply two tractors for the total price of 580 currency units (CU) and one seeding machine with a three-year additional service of this machine. The sale of the seeding machine was discounted by 200 CU because of the previous tractors sale. The stand-alone selling price of the seeding machine is 960 CU and 60 CU for the three-year service. The delivery of tractors takes place in December 20x0 and the delivery of the seeding machine in January 20x1. The calculation of amounts necessary for recording transactions is shown in Table 1.

Table 1 Allocation of transaction price at sale of "package"

Performance obligation	Stand-alone selling price in CU	Allocation of transaction price in CU	Time of revenue recognition
1. Tractor 2x	580	(1,400/1,600) x 5.8 = 507,5	December 20x0
2. Seeding machine	960	0.875 x 960 = 840	January 20x1
3. Service	60	0.875 x 60 = 52,5	Share on the total individual price, in 20x1, 20x2 and 20x3
Total	1,600	1,400	/

Source: Authors' own processing according to IFRS Foundation (2017a)

Where: The stand-alone selling price is the price at which the entity would sell a promised good or service separately to a customer (Andrus, 2015).

The contract contains three performance obligations: delivery of tractors, a seeding machine and services. The price at a discount must be allocated amongst all of these performance obligations, i.e. to the tractors and the service as well. The allocated price of the two tractors is 507.5 CU, 840 CU for the seeding machine and 52.5 CU for the service. The revenue from the sale of tractors will be recognized in December 20x0, the revenue from the sale of the seeding machine in January 20x1 and the revenue from services gradually during the years 20x0, 20x1 and 20x2. If the services are provided evenly each year, then the same amount each year is recognized; if not, then the amount recognized each year would be adequate to costs (expenses) incurred.

According to the current IFRS guidelines, the discount is allocated only between the seeding machine and the service, and the revenue from the sale of tractors is recognized in full. The new solution for a discount treatment influences the amount of revenue recognized each year, reported in the income statement.

3.5 Sales with the right of return

IFRS 15 brings a new solution for situations where there is a probability of the return of sold goods to the original seller after some time. This situation can be explained on the following example.

Case study accounting entity (company X) sells goods to company Y at a price of 100 CU. Previously recognized inventories cost is 80 CU. The contract includes a put option that allows the company Y to return the goods back after one year at a price of 70 CU. According to company X' s experience, company Y exercises the put option on 20% of goods in average. The accounting treatment at the moment of the sale is shown in Table 2.

Table 2 Sale of assets with the right of return – first recognition

Transaction No.	Account	Amount in CU	Account	Amount in CU
1	Dr: Cost of sales	80	Cr: Inventories	80
2	Dr: Cash	100	Cr: Sales Revenue	100
3	Dr: Sales Revenue	14	Cr: Provision for Refunds	14
4	Dr: Other Assets	14	Cr: Cost of Sales	14

Source: Own processing according to IFRS Foundation (2017a)

where:
Dr   debit site (of an account)   Cr   credit site (of an account)

The cost of sales (Transaction 1) and the revenue from the sale (Transaction 2) are recorded as usual. Because of the high probability that company Y will return 20 % of the goods after a year, company X cannot recognise the revenue in full and has to reduce the revenue by the estimated amount of the assumed return, by creating a provision for refunds (Transaction 3). The cost of sales must be adjusted by the same amount and at the same time an estimated asset is recorded – the account "Other assets" is used (Transaction 4). This is a completely new approach based on IFRS 15. The provision in this case does not increase the expenses, as it is suggested in the current IFRS guidelines (IAS 18 and IAS 11) and as it can be expected according to IAS 37 *Provisions, Contingent Liabilities, Contingent Assets*. The example continues: After a year, company Y returns 50 % of goods. The accounting treatment is shown in Table 3.

The returned goods are received into the store and the provision for refunds is cancelled (Transaction 1 and 2).

Table 3 Sale of assets with the right of return (continued) − goods returned

Transaction No.	Account	Amount in CU	Account	Amount in CU
1	Dr: Inventories	35	Cr: Cash	35
2	Dr: Provision for Refunds	14	Cr: Other Assets	14

Source: Own processing according to IFRS Foundation (2017a)

Due to the above stated principle, new accounting entries are necessary if the company Y does not return any goods. The provision for refunds as well as estimated asset has to be cancelled, as it is shown in Table 4.

Table 4 Sale of assets with the right of return − no goods returned

Transaction No.	Account	Amount in CU	Account	Amount in CU
1	Dr: Provision for Refunds	14	Cr: Sales Revenue	14
2	Dr: Cost of Sales	14	Cr: Other Assets	14

Source: Own processing according to IFRS Foundation (2017a)

Since the creation of provision reduces the revenue directly, cancellation will increase the revenue. The structure of the income statement will be influenced in comparison to current IFRS guidelines where provisions are created by increasing the expenses. Depending on the materiality of the amount, this new treatment may have an influence on some partial indicators of a potential financial analysis.

3.6 The financial component of the transaction

It is a basic principle of IFRS, that deferred payments (payables, respectively receivables) are reported at their current value. On the basis of the effective interest rate, financial revenue and financial expense is recognized from the transaction. IFRS 15 brings simplification: in the case of deferred payment which does not exceed one year it is not necessary to recognise the financial component of transaction. Particularly in the case of low interest rates, this change is relevant and will not influence the reliability of the financial statements.

3.7 Licence with the right to use (with an expiration date)

According to current IFRS guidelines, revenue from licences with an expiration date is currently deferred. If the subject provides a licence at the value of for example 300 CU for three years, every year, 100 CU will be recognized as revenue. The application of IFRS 15 changes this rule; revenue will be recognized immediately at the point in time when the control over the intellectual property is handed over (for example handing over of the documentation). This is a fundamental change, which has an impact on revenue recognition over a period of time. Naturally, it therefore depends on the materiality of the amount.

3.8 Assessment of the changes needed in the accounting system

Each change related to the accounting treatment of the above mentioned situations has to be incorporated into the accounting system of the company. Even if the changes are frequently concerning the principle of the amount of revenue recognition over a period of time, there will be no need for a fundamental change and general readjustment of the company's accounting system for the illustrative topics discussed in this paper.

It is necessary for the entities to disclose the possible impacts of the application of IFRS 15 in the notes to their financial statements for 2017. If entities have analysed the impacts of the new standard since the date it has been issued, i.e. from 2014, it is possible that they have gradually changed their accounting system already to implement the new requirements and at the same time made sure to avoid conflict with current IFRS guidelines. In that case the changes will not be too substantial. It will always be necessary to assess the situation of each company individually. Procházka (2016) states that in some instances such as allocation of discounts in case of the change of the total transaction price, the new solution according to IFRS 15 will probably result in significant modification of the company's information system. Certain industries, such as real estate and telecommunications, may experience the most significant of the changes, given the changes required by this new standard, nearly all companies will be impacted to some degree (Yeaton, 2015). According to Tong (2014), for long-term service contracts and multiple-element arrangements, IFRS 15 could result in some changes either to the amount or timing of the revenue recognised by an entity. Procházka (2016) states that the new rules can lead to a significant change as to the moment and/or the amount of the recognized revenue.

4 Conclusions

The results of the case study proved the necessity to revise all the existing contracts whose validities overlap into 2018 and to compile an overview of the expected impacts. The most significant changes in the chosen company are related to the allocation of the transaction price considering discount in the case of *Sales of "package"*, to the accounting treatment of *Sales with the right of return*, and to the *Licences with the right to use*. Less significant changes are to be found in the area of *Sales with installation, Received advance payments* and *The financial component of the transaction*. The results are in line with findings of Tong (2014) and Procházka (2016). The changes in the accounting treatment will depend on the accurate identification of the combined or separate components of the contracts, on the particular contract specifications and on the materiality of the amounts. Companies have to inform the users of their financial statements

for the year 2017 about the possible changes related to the application of IFRS 15. IFRS 15 brings a simplified orientation within the wide range of issues of revenue recognition on one hand, but on the other hand, the new standard requires a higher degree of professional judgment.

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Application of the Statistical Method to Identify Financial Health of a Company

Martin Telecký

Abstract: *At present, there are a number of methods evaluating the financial health of a company. Among them we can find the bankruptcy and creditworthy models created by many authors. Reliability of the models, however, is never 100% reliable and credible when they are applied to the given field of business. The paper is concerned with a selection of the basic sample of financial indicators and the application of the statistical method on selected financial indicators evaluating the financial health of transport companies in the Czech Republic. The paper is aimed to classify the important financial indicators based on the submitted statistical method results.*

Key words: Transport Company · Generalized Linear Model · Financial Health of the Company

JEL classification: M40

1 Introduction

Based on regular financial analyses, the transport company may identify its specific financial situation which, in case of poor results, may result in considerable present and future problems. The goal of the financial analysis is to inform users of the company and the external persons on whether the financial situation of the company is or is not good and to highlight the areas of concern. Based on the results of applied methods of financial analysis, it is necessary to suggest the measures which would fully or partially prevent the bankruptcy of the undertaking. Bankruptcy and creditworthy models consist of the financial indicators the explanatory power of which can identify the financial health of the company. Each model, however, evaluates the company in a different way. The reason is the factors which consider the subject of business, the sector in which the company operates, etc. After application of selected bankruptcy and creditworthy models created by the the Neumaiers spouses on the transport companies in the Czech Republic, their credibility and reliability were verified (Růčková, 2010; Grünwald and Holečková, 2009; Neumaierová and Neumaier, 2002).

Most external users seeking information on the activity of transport companies use the published accounting reports as a source. The frequent mistake is that the users apply the financial analysis methods on the basis of the profit and loss account or the balance sheet and believe that they analyse the main activity only. In most cases, this is not true. In evaluation of the financial health of transport companies, the situation is negative because the transport companies providing traffic services mostly fail to reach a positive economic result. In accounting reports we can find the transport companies which generate profit. The reason is a general inclusion of the main and secondary business activity or a number of secondary business activities.

The goal of the paper is to determine (select) important financial indicators within the application of the statistical method, i. e. a generalized linear model. The results of a statistical method serve as a basis for suggesting a new model which would determine the financial health of the transport company. Before the statistical method application, the financial indicators (variables) which are included in other classification models were chosen. The author chose such a selection of financial indicators which would reflect the current situation in the examined area. The data taken from the Albertina databasis for 2016 served as another source of information. The chosen transport companies are comparable as to their size and organizational structure and both the main business activity and the secondary business activity are considered. As to the determining of the amount of provable loss, the examined entities follow the same methodology. The data includes all balance sheet items, costs and revenues, including the granted subsidies.

2 Methods

2.1 Generalized Linear Model

The generalized linear model is a statistical method which is used in common practice. Unlike the conventional linear model, the assumption of equation between the linear predictor and the model mean value is not necessary. In case of

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the generalized linear model we can assume that the linear predictor is characterized by the transformed mean value. The use of the linear model must meet the basic conditions:

- Random errors are non-systematic,
- Dispersion of residuals is constant (homoscedasticity),
- Random errors are independent,
- Random errors meet the assumption of normal distribution.

By applying the generalized linear model we can predict the systematic component by means of the selected explanatory variables and respect, at the same time, randomness of the background action. Explanatory variables are marked with a symbol X. The random component is generated by a random action which is responsible for the distribution $p(y_i)$ of the variable Y. Independent random variables Y_1 to Y_n can be expected to belong to the so-called exponential-type family with a dispersion parameter φ. Based on this characteristics, we can use the following relation:

$$f(y_i ; \theta_i ,\varphi) = \exp \{[y_i\theta_i - b(\theta_i)] /a(\varphi) + c(y_i ,\varphi)\} \tag{1}$$

where:

θ_i …… natural parameter.

$$y_i = E[Y]_i + \mathcal{E}_i = \mu_i + \mathcal{E}_i \tag{2}$$

where:

y_i	…… result of measurement,
$E[Y]_i$	…… combination of a systematic component,
$\mathcal{E}_i$	…… random component,
Y	…… observation of a random variable,
μ_i	…… systematic component.

By means of uniquely invertible and differentiable function (g), the systematic component (μ_i) is the so-called linear predictor which expresses the linear function of the model parameter. The following relation exemplifies this:

$$g (\mu_i) = \eta_i \gg \mu_i = g^{-1} (\eta_i). \tag{3}$$

Mathematically, it is apparent that the systematic component μ_i of the generalized linear model is a function of the linear predictor η_i. It can be assumed that the linear prediction function represents the transformed mean value. Within the generalized linear model, β marks the coefficients expressing the effect of individual explanatory variables on the modelled variable the values of which are searched for. The explanatory values (variables) may have both the quantitative and qualitative values. Quantitative values are also referred to as continuous and qualitative values are referred to as a categorical unit (Anděl, 2003; Pekár, 2009; Šimurda, 2007; Wonnacott, 1993).

2.2 Input Data

As the input data the author selected the basic samples of transport companies headquartered in the Czech Republic, which provide the traffic services, including the secondary traffic services. Based on the financial and accounting data for 2016 obtained from the Albertina server, the analysis for the selected transport companies was made. The results of the creditworthy model IN 99, which appeared the most credible within the analysis of the financial health of transport companies in the Czech Republic as compared to other bankruptcy and creditworthy models by the Neumaiers spouses, were selected as the explained variable.

The following financial indicators were chosen:

- Return on equity (profit/loss before taxation and interest/equity),
- Return on assets (profit/loss before taxation and interest/fixed assets),
- Activity indicator (revenues/fixed assets),
- Indebtedness indicator (fixed assets/external resources),
- Interest coverage (profit/loss before taxation and interest/interest payable),
- Interest coverage on condition of the cash flow (cash flow/interest payable),
- Return on revenues (profit/loss before taxation and interest/(revenues from the sale of own products and services + revenues from the sale of the goods),
- Monetary liquidity (short-term financial assets/(short-term liabilities + short-term bank loans),
- Fixed assets turnover (revenues/fixed assets),

_____

- Indebtedness indicator (external resources/equity).

Table 1 Input data

Carrier	Y	ROE	ROA	Revenues / assets	Assets / ER	EBIT / IP	CFLOW /IP	EBIT / Revenues	Monetary liquidity	Revenues / FA	ER / EQ
A	0.69	0.053	0.032	1.137	2.567	9.628	57.882	0.058	0.021	0.611	0.639
B	1.67	0.229	0.191	1.570	6.036	280.498	439.284	0.199	0.677	1.412	0.199
C	0.04	0.154	0.007	0.018	1.050	0.000	0.000	0.000	0.011	0.000	19.955
D	0.5	0.061	0.036	0.622	2.481	34.979	83.362	0.124	0.013	0.434	0.676
E	0.9	0.360	0.025	1.658	1.074	1.649	9.538	0.034	0.018	1.037	13.544
F	0.51	0.187	0.028	0.809	1.178	3.005	15.543	0.077	0.010	0.393	5.605
G	1.26	0.146	0.079	1.820	2.181	15.429	31.089	0.045	0.491	2.652	0.847
H	0.89	0.148	0.076	1.147	2.091	14.395	37.451	0.121	0.029	0.681	0.930
CH	0.59	0.045	0.033	0.886	4.511	436.095	1729.048	0.064	0.831	0.670	0.296
I	0.5	0.030	0.022	0.780	4.064	20.505	98.893	0.056	1.364	0.486	0.333
J	0.22	0.004	0.003	0.422	4.465	1.127	24.734	0.015	0.355	0.204	0.293
K	0.07	-0.003	-0.002	0.115	3.110	0.000	0.000	-0.020	0.636	0.198	0.475
L	0.27	0.001	0.001	0.497	6.305	0.892	105.164	0.004	1.412	0.234	0.191
M	0.22	-0.037	-0.033	0.718	10.114	-189.917	254.792	-0.063	0.459	0.583	0.112
N	0.2	0.001	0.001	0.337	12.226	0.000	0.000	0.003	2.205	0.182	0.091
O	0.3	0.017	0.011	0.465	3.161	0.000	0.000	0.050	1.145	0.538	0.468
P	0.24	-0.022	-0.018	0.625	5.781	0.000	0.000	-0.072	1.216	0.319	0.213
Q	0.44	0.013	0.012	0.692	13.999	0.000	0.000	0.035	3.060	0.450	0.078
R	0.09	-0.050	-0.033	0.493	3.033	-13.560	19.869	-0.135	0.070	0.260	0.495
S	0.21	0.001	0.001	0.349	7.784	4608.000	269578.000	0.008	2.060	0.127	0.148
T	0.34	0.000	0.000	0.547	15.101	0.000	0.000	-0.001	3.886	0.379	0.072

Source: Author´s own processing

Due to the sensitivity of economic data processing, the transport companies are marked with the letters. The author knows all economic and financial structures of individual transport companies.

The analysis will be made using the statistical model (generalized linear model) in the STATISTICA programme.

3   Research results

Upon the results of the correlation matrix, it is apparent that the fields marked in red represent the significance among individual variables with the condition that the significance is determined on the level $p = 0.05$. The table below shows the results of the correlation matrix (analysis).

Table 2 Results of the correlation analysis application

	IN 99 (Y)	ROE	ROA	REVENUES / ASSETS	ASSETS / ER	EBIT/IP	CFLOW / IP	EBIT/ REVENUES	MONETARY LIQUIDITY	REVENUES / FA	ER / EQ
IN 99 (Y)	1.000000	0.683195	0.914214	0.912854	-0.206501	-0.097140	-0.151007	0.734301	-0.210716	0.822744	-0.056353
ROE	0.683195	1.000000	0.620458	0.665021	-0.475838	-0.109309	-0.138809	0.574267	-0.418788	0.489359	0.616556

ROA	0.914214	0.620458	1.000000	0.673671	-0.215258	-0.035120	-0.101592	0.850803	-0.198437	0.630300	-0.034216
REVENUES / ASSETS	0.912854	0.665021	0.673671	1.000000	-0.240479	-0.156453	-0.188905	0.496440	-0.267750	0.863556	-0.022067
ASSETS / ER	-0.206501	-0.475838	-0.215258	-0.240479	1.000000	0.116677	0.132135	-0.206322	0.880109	-0.205204	-0.412878
EBIT / IP	-0.097140	-0.109309	-0.035120	-0.156453	0.116677	1.000000	0.993460	-0.003305	0.231161	-0.147136	-0.101749
CFLOW / IP	-0.151007	-0.138809	-0.101592	-0.188905	0.132135	0.993460	1.000000	-0.063074	0.234682	-0.173461	-0.092195
EBIT/REVENUES	0.734301	0.574267	0.850803	0.496440	-0.206322	-0.003305	-0.063074	1.000000	-0.140520	0.382755	-0.019270
MONETARY LIQUIDITY	-0.210716	-0.418788	-0.198437	-0.267750	0.880109	0.231161	0.234682	-0.140520	1.000000	-0.192970	-0.354821
REVENUES / FA	0.822744	0.489359	0.630300	0.863556	-0.205204	-0.147136	-0.173461	0.382755	-0.192970	1.000000	-0.076992
ER / EQ	-0.056353	0.616556	-0.034216	-0.022067	-0.412878	-0.101749	-0.092195	-0.019270	-0.354821	-0.076992	1.000000

Source: Author´s own processing

Table 2 shows that the variables ROE; ROA; REVENUES / ASSETS; EBIT / REVENUES; REVENUES / FA have a significant effect on the observed variable IN 99. If we apply the generalized linear model, however, we will obtain the following results (Table 3).

Table 3 Results of the generalized linear model application 1

Effect	Degrees of freedom	Wald. Stat.	p
Abs. member	1	1159.73	0
ROE	1	4.891	0.026991
ROA	1	44.001	0
REVENUES / ASSETS	1	379.158	0
ASSETS / ER	1	2.348	0.125423
EBIT/IP	1	8.326	0.003908
CFLOW / IP	1	9.643	0.001901
EBIT / REVENUES	1	135.767	0
MONETARY LIQUIDITY	1	16.524	0.000048
REVENUES / FA	1	9.222	0.002391
ER / EQ	1	15.848	0.000069

Source: Author´s own processing

Based on Table 3, we can observe that the variable "assets / external resources" is not significant and, therefore, it will be excluded from the model. Other explanatory variables marked in red represent the significance and dependence on the explained variable. It means that the significance level did not exceed p value of 0.05. The random variable component meets the assumptions of normal distribution, homoscedasticity and data independence. After excluding the insignificant variable (assets / external resources), the values of other variables will change in the next step.

Table 4 Results of the generalized linear model application 2

Effect	Degrees of freedom	Wald. Stat.	p
Abs. member	1	1192.898	0
ROE	1	5.43	0.019789
ROA	1	58.663	0

REVENUES / ASSETS	1	337.143	0
EBIT / IP	1	8.802	0.003009
CFLOW / IP	1	9.685	0.001858
EBIT / REVENUES	1	141.316	0
MONETARY LIQUIDITY	1	33.359	0
REVENUES / FA	1	6.131	0.01328
ER / EQ	1	15.339	0.00009

Source: Author´s own processing

After excluding the variable assets / external resources, the values of other variables will change after the application of the next step of the generalized linear model. If we compare the final values of the correlation matrix and the results of the generalized linear model, we can observe that the variables EBIT / IP; CFLOW / IP; MONETARY LIQUIDITY; ER / EQ are insignificant as per the correlation analysis and do not need to be included in the model. The fact, however, is that the above variables appear to be significant in Table 4. In this paper, it would be sufficient to apply the correlation analysis which explains the dependency of individual variables among each other. The application of the generalized linear model has proved that the significant variables within the correlation analysis are also significant in the results of the generalized linear model.

The normal distribution assumption is met.

4 Conclusions

The application of the correlation analysis and the generalized linear model results in the differences as to the significance of selected variables (financial indicators). It applies, however, that the results of the correlation analysis and its determination of significance of financial indicators appear to be identical with the generalized linear model. It means that the variables: ROE; ROA; REVENUES/ ASSETS; EBIT / REVENUES and REVENUES / FA are also significant in the generalized linear model.

Using the generalized linear model and other statistical methods, we can additionally examine the other chosen explained variable which is a part of the input data in this paper. The results (Table) of the correlation analysis are, however, the clearest.

Within the evaluation of the transport company´s financial health, it is not too important whether the company reports the amount of interest payable from the granted loans or credits but whether it can generate profit without the help in the compensation of a provable loss. The interest payable occurs very rarely, unless the transport companies invest their own money in the renewal of their rolling stock. In a simplified way, the provable loss represents a subsidy provided by the customer ordering the transportation. It is a part of revenues and revenues also serve for the calculation of the profit/loss. Even granting of the subsidy by the customer ordering transportation or other parties often fails to cover the losses from the main business activity. The transport company fails to generate the reasonable profit due to the innovation of business processes (renewal of the rolling stock, other investments). The sudden events (car crashes, fire, flood) causing the damage to the property result in other additional costs which are partly covered by the financial compensation of the customer on the basis of the reference data provided by the Police of the Czech Republic and the relevant insurance company. The compensation of the provable loss from the main business activity refers to the public service contract made by and between the customer and the carrier. This, however, does not mean that the customer is obliged to fully pay all unprofitable activities of the carrier which have occurred. This would lead to the situation when the transport companies would creatively adjust the accounting data which significantly affect determining of the provable loss amount. The transport companies, hence, attempt to cover the loss from their main activity using the profit generated from the secondary business activity. The customer is not interested in whether the transport company has any secondary business activity. The goal is to find other sources of money from the provided traffic services.

The fact is that the financial indicator with the economic result element should not be missing in the proposed model evaluating the financial health of the transport company. The results of the correlation analysis and the generalized linear model offer utilizing of the return on assets, return on equity, etc.

Another indicator is the cash flow. Its explanatory power is more credible than the calculation of the profit/loss itself. The more exact results are provided by the cash flow determined by a direct method. This method is, however, too demanding and hardly usable in the transport practice. Instead of the direct method of cash flow calculation, the indirect method is applied. It is based on the calculated profit/loss which is adjusted with the non-monetary operations, etc.

It depends on the user which financial indicators will be selected. Their application on the sample of selected companies is, however, important as much as the fact whether they reflect the real activity of the companies or not.

List of Abbreviations:

EBIT   …… earnings before interest and taxes

FA   …… fixed assets

CFLOW   …… cash flow

ROE   …… return on equity

ROA   …… return on assets

ER   …… external resources

IP   …… interest payable

EQ   …… equity

Acknowledgement

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Transformation of a Civil Association from the Accounting and Tax Point of View

Marie Vejsadová Dryjová

Abstract: *Act No. 83/1990 Coll., on Associations of Citizens, which regulated the establishment and status of civil associations, was abolished with effect from 1 January 2014 and the legislation of the associations has been moved to the new Civil Code. The civil associations were automatically transformed by the Ministery of Interior of the Czech Republic into a new legal form of registered association. Consequently, the new Civil Code enables civil associations to be transformed into newly established legal forms, institutions or social cooperatives.*

The transformation of a civil association into the new legal form has brought a series of other changes in accounting and tax areas. Act No. 563/1991 Coll., on Accountancy, allows both associations and institutions to keep accounts in a simplified manner which brings some advantages for an organisation; e.g. an organisation is not required to make provisions and adjustments, and reevaluate property at its fair value and may calculate its accounting in groups of accounts instead of particular accounts. Since these organisations are mostly financed from public resources the reporting and drawing of which requires precise bookkeeping, they usually undertake full accounting. Simplified bookkeeping would bring some administrative difficulties for the organisations. Taxation will also differ due to the choice of legal form. A registered association is taxed in accordance with Act No. 586/1992 Coll.,on Income Tax, as a publicly beneficial taxpayer with a narrow tax base, while an institution is a taxpayer with a broad tax base. The basic difference in taxation consists in the fact that a taxpayer with a broad tax base taxes all income except for investment subsidies while a taxpayer with a narrow tax base only taxes income from main activities which are profitable and income which is legally subject to taxation.

Key words: Civil Association · Registered Association · Institution · Civil Code · Transformation

JEL Classification: H71 · M41

1 Introduction

Civil associations (now registered associations) are classified as non-profit legal entities. They form a significant group of non-governmental non-profit organisations in the Czech Republic. Non-profit organisations, also called private or non-governmental, are mostly established by the citizens as formal organisations with the status of legal entity. Their existence often results from the principle of self- regulation of the civil association and the ability to mutually direct the behaviour of the community of people. (Dobrozemský, Stejskal, 2015). Non-governmental non-profit organisations can be defined as organisations which are not established to do business or other profitable activities and are not constituted by the state. Despite this, the organisations can be financed from public resources. Although the registered associations are not established as businesses, they are allowed to do business, carry out other profitable activities and generate profit or other income. The restriction of their profitable activities result from the provision paragraph 217 article 3 of the new Civil Code which enables a company to use it's profit for its own activities, including administration of the registered association.

By the end of 2013, the civil associations were regulated by the Act No. 83/1990 Coll., on the Associations of Citizens. With effect from 1 January 2014, this Act was repealed and the legal regulations of associations have been moved to the new Civil Code (Act No.89/2012 Coll., on the Civil Code). Civil associations were transformed into registered associations automatically on the basis of paragraph 3045, in Article 1 of the new Civil Code. The registered associations were registered in a new register kept by the courts while the registration into the register of associations was provided by the Ministry of Interior. Act No. 89/2012 Coll. brought about a number of changes in the legal forms of former associations. The new Civil Code sets precise principles of associations´ operations (see paragraph 212 of the Civil Code), the delimitation of their purpose (see paragraph 217 of the Civil Code) and the implemention of rules (paragraph 248 of the Civil Code). The Civil Code also regulates, for example, registered associations, charities, foundations, and others.

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The new Civil Code and the recodification of laws caused a lot of changes in the non-governmental, non-profit sector. However, far more significant changes occurred in the accounting and tax area of non-governmental, non-profit organisations. In the accounting area, for example, there has been a significant change in accounting systems. One of the major changes in the tax area was the definition of a publicly beneficial taxpayer in Act No. 586/1992 Coll., on Income Tax.

2 Methods

The transformation of a civil association in the accounting and tax area is analysed in a selected non-profit organisation – a civil association based in South Bohemia which was established by registration in the Register of the Ministery of Interior of the Czech Republic on 5 December 2005. The civil association was automatically transformed into a registered association on 1 January 2014 as a result of the new Act No 89/2012Coll., on the Civil Code.

While civil associations were transformed into registered associations automatically, the new Civil Code offers the possibility for registered societies to change their form to an institute or a social cooperative (see paragraph 3045 of the Code):

- **Institution** – a legal entity established for the purpose of running an activity that is socially or economically beneficial by using its personnel and property. An institution carries out activities the outcomes of which are available to anyone under pre-determined conditions (see par. 402 of the Code)
- **Social cooperative** – a cooperative which consistently develops community-based activities aimed at promoting social cohesion for the purpose of labour and social integration of disadvantaged persons into society. A priority is to meet local needs and the use of local resources according to the place of residence and the competence of the social cooperative especially in the area of job creation, social services and health care, education, housing and sustainable development. The social cooperative is governed by Act No. 90/2012 Coll., On Commercial Corporations in par. 758-773.

Associations, or persons responsible for bookkeeping, are obliged to become acquainted with and comply with the relevant provisions of these regulations:

- Act No. 563/1991 Coll., on Accounting, as amended;
- Decree No. 325/2015 Coll., for accounting entities with simplified bookkeeping, as amended;
- Decree No. 504/2002 Coll., which implements some provisions of Act No. 563/1991 Coll., on Accounting for entities whose main activities do not consist in business if they account in double-entry bookkeeping, as amended;
- Czech accounting standards for entities which account in accordance with Decree No. 504/2002 Coll., as amended.

Act No. 563/1991 Coll., on Accounting, enables accounting entities to undertake accounting in a full or simplified scheme. Unless otherwise stated in the Accounting Act, accounting entities are obliged to do their accounts in the full scheme (see par. 9 article 1). Accounting in the simplified form can be done by contributory organisations at their own discretion, if so decided by the founder, and by small, micro accounting entities which are not required to have audited accounts (see par.9 article3). These entities are listed in par. 4 of the Act. These include, for example, associations, trade unions, hunting organisations, charities, social cooperatives, institutions, and others. The Act on Accounting, in paragraph 13a, specifies other matters relating to this simplified form of bookkeeping. The accounting entities are not required to make reserves and adjustments, reevaluate their properties and obligations at their fair value, can combine bookkeping in their daybooks with that in the ledgers, create an account schedule where they can only list account groups and prepare simplified financial statements.

The system of one-entry bookkeeping was removed from the Act with effect from 1 January 2004. Since 2016, however, accounting entities have had the opportunity of one-entry bookkeeping again. This system is primarily used by the small or micro accounting entities which are not established to do business and mostly provide socially beneficial activities. For this group of entities, double-entry bookkeeping is financially and administratively demanding. The amendment effective from 1 January 2016 regulates the unsatisfactory situation in which some entities were allowed to operate in accordance with a previously repealed legal regulation (Pelikánová, 2016). The accounting entity can use one-entry bookkeeeping system if it meets all requirements stated in paragraph 1f article 1 of the Act on Accounting, as follows:

- The accounting entity is not a tax payer;
- Its total revenue within the last closed accounting period does not exceed 3 mil.CZK;
- Its property value does not exceed 3 mil.CZK;

- The accounting entity is at the same time an association or branch association, trade union organisation, employers´ organisation, church, religious society, ecclesiastical institution or hunting organisation.

Both governmental and non-governmental organisations keep accounts according to different implementing provisions, although the principles of income tax are the same. In order to determine the taxation regime, the non-profit organisation is first required to state if it is a so-called publicly beneficial taxpayer from the point of view of Act No. 586/1992 Coll., on Income Tax. The definition of a publicly beneficial taxpayer is stated in paragraph 17a: "a taxpayer that, in accordance with its constitutive legal action, status, statutes, law or a decision of a public authority, acts in non-business activities". Consequently, the Act determines those which are not publicly beneficial taxpayers, but are business corporations, unit owners´associations, charity foundations and professional chambers, or taxpayers established to protect and defend the business interests of their members. In the case where a non-profit organization is not a publicly beneficial taxpayer, the taxation regime is the same as for a commercial corporation, ie a non-profit organization applies a so-called broad tax base. Otherwise a non-profit organisation applies a specific regime applicable to publicly beneficial taxpayers. The Act on Income Tax divides taxpayers with a narrow and broad tax base depending on which revenue is included in the tax base.

- **Taxpayers with a narrow tax base** – for example, associations, foundations, foundation funds, church organisations and other tax payers which are not defined within the category of taxpayers with a broad tax base. The taxpayer is obliged to record credits (revenue) and debits (costs) of particular activities he provides which are broken down by the types of revenue sources. Only revenues from ads, membership fees and rents, and income from major activities which are profitable are then subject to tax.
- **Taxpayers with a broad tax base** – taxpayers defined in paragraph § 18 article 5 of the Act: – public universities, public research institutions, health care providers, publicly beneficial organisations, and institutions. All revenues except for investment subsidies are subject to tax.

3 Research results

The chapter on Results depicts the effects of legislative changes in the new Civil Code and the recodification of law applied to a selected example of a non-profit organisation – an association from the South Bohemian region -- from both the accounting and taxation points of view. This organisation was established on 5 December 2005 by the registration of the Ministery of Interior of the Czech Republic. In its beginning, the organisation provided services only for people who were in a difficult life situation as a result of drug addiction. In 2007 the range of its activities was extended to primary prevention for schools, educational istitutions and the public. Another significant extension of the organisation´s activities was in 2010 when the organisation focused on a further range of activities related to healthy lifestyles and eating disorders. The organization's last expansion of their activities was in 2013 to include helping families with children who might be at risk of endangering the children's development and placing endangered children in residential facilities. All activities listed above fall into the main activities, ie. the activities for which the organization was founded. Besides these main activities, the organization also performs ancillary activities, such as staff lecturing, lectures, or the sale of diagnostic tests.

3.1 Transformation of the selected civil association

As already mentioned in the introduction, on 1 January 2014, under Act No. 89/2012 Coll., in the new Civil Code, the selected organization became a registered association without any action on its part. This is not a new legal entity, however, only a change in terminology. At the same time, the statutory period of three years for bringing the status of the association into line with the new legislation started running.

As stated by Act No. 89/2012 Coll., in the new Civil Code, an organization can be further transformed if it is unable to adapt its statutes to the applicable legislation within a given time limit, or if it so decides.The selected organization voluntarily decided to transform into a new legal form, namely, a registered institute, on 1 June 2015 by registering in the institutes' registers. (The General Assembly decided on this on 28 February of the same year, when it defined the subject matter and purpose, and approved the charter). The reasons that made the organization transform were as follows:

1. Non-compliance with the definition of associations and the main organisation activities – an associational activity is defined in the new Civil Code in paragraph 217 as an activity aimed at protecting and satisfying the interests of the members of associations. However, the selected organisation provides a range of activities which are socially useful, which corresponds to the definition of the legal form of a registered institute in paragraph 402 of the Civil Code, which states that the institute is a legal entity established for the purpose conducting an activity which is useful socially or economically.
2. Membership – an association is based on its membership while an institute does not allow the principle of membership because, as stated in paragraph 402 of the Code, an institute is based on employment contracts.

3. Democratic decision-making of members – an association is based on democratic principles whereas an institute uses director´s decision-making in the affairs of the organisation

Since the selected organisation has long been cooperating with state administration institutions, public funds have become the dominant source of funding (90% on average of total resources). The choice of transformation of an association to the legal form of an institute or social cooperative may also influence the extent to which the organisation draws finance from subsidy or grant schemes or contributions from the EU budget. Organisations with the legal form of an institute, as well as an organisation with charitable status, can participate in more grant programmes and obtain a larger volume of grants and contributions from the EU budget. Therefore choosing the legal form of an institute for the given organisation is more advantageous than financing the legal form of a social cooperative.

3.2 The effect of transformation on accounting

A registered association, institution and social cooperative may, in accordance with the Act No. 563/1991 Coll., keep accounts in a simplified manner which brings the advantages mentioned above. This organisation, however, keeps accounts in the full scheme, as it is obliged to report its fundraising. This source of funding is crucial to the organisation and fundraising is further conditioned by proper and transparent reporting and subsequent clearance with the relevant institution. The organisation sorts the accounting operations by both sources of financing and individual activities. In practice, there may be a situation where the cost related to a specific activity will be financed from different sources, which may be caused by a lack of funds from the donor. Then the organisation finances it from other sources.

In general, organisations are recommended to choose their accounting scheme in compliance with the obligation resulting from public fund drawing and bookkeeping which must be accounted separately. In the case where an organisation gives preference to simplified accounting then it will use accounting groups instead of accounts. The separate accounting requirement will mean a complicated system of either analytic or other non-accounting evidence. Paradoxically, the simplified accounting will be administratively more complicated than when the organisation uses the full scheme accounting.

3.3 The effect of transformation on taxes

Originally, there was no legal term such as a taxpayer with a narrow or broad tax basis. The civil associations, like the other organisations, were required to keep the revenue which represented the main activity separately from the others. The same system was applied to expenditures which were asigned to a particular revenue. Only the income from main, profitable activities was subject to taxation.

A registered association is, under the Act No. 586/1992Coll., on Income Tax, a taxpayer with a narrow tax basis. It means that it is obliged to record its revenues separately with the expenditures related, according to the range of activities performed. The automatic transformation of civil associations into registered associations had no effect on the taxation in these organisations.

The subsequent transformation of an association into an institute in 2015 resulted in a form of taxpayer with a broad tax base. This organisation is not required to record revenues and expenditures of particular activities separately, as all revenues without investment grants are subject to tax. The differences between distinctive legal forms are summarised in Table 1.

Table 1 Differences in the taxation of associations and institutes

Registered association	Institute
The profit or loss are determined separately for each activity.	The profit or loss are determined together..
The subject of taxation is the income from main activities and the income which is legally subject to tax.	The subject of taxation is all income without investment grants regardless of whether the main activity is profitable or not..
Subsidies from public budgets are not subject to taxation – this income is exempted in the tax returns, l. 101 and so the costs, l. 40.	Subsidies from public budgets are subject to taxation – the items are stated in the tax returns, lines 101 and 40.
Interest – subject to withholding at source – is not a part of the tax base.	Interest is taxed – as a part of the tax base.

Source: Own processing

4 Conclusions

The selected non-governmental, non-profit organisation underwent the complete transformation from a civil association into a registered association and then, in 2015, from a registered association into an institute. The first transformation was made with no effort as it was registered automatically by the Ministery of Interior of the Czech Republic in the Register of Associations. The latter transformation into an institute resulted from the incompatibility between the definiton of an association and its activities. Some difficulty was also seen in the membership and the principle of members´ decision- making. Finally, a significant role in the transformation consisted in the opportunity to participate in a larger number of grant programmes, with a greater volume of grants and contributions from the EU budget.

Although the organication may, under the Act No. 563/1991 Coll., on Accounting, keep accounts in a simplified scheme and thereby benefit from some advantages of this type of accounting, the organisation decided for full accounting. However, the substantial reason seems to be in the resource structure of the organisation. The organisation was financed with 90% of public funds which required proper and transparent reports of the financial execution and subsequent clearance with relevant institutions. If the organisation had preferred a transition to the simplified scheme of accounting, it would had to have taken into account the necessity of fulfilling the conditions for public funding.

The automatic transformation from a civil association into a registered association had no impact on its taxation. Both a civil association and a registered association keep their revenues and their related expenditures to the activities performed separately. This transformation led to the change from a taxpayer with a narrow tax base to a taxpayer with a broad tax base where all revenues without investment grants are subject to taxation. Thus the economic result is determined for all activities together.

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Act No.83/1990 Coll.,on Association of Citizens
Act No.89/2012 Coll.,the Civil Code
Act No.563/1991 Coll.,on Accounting
Act No.586/1992 Coll., on Income Tax

Comparison of Telework in the Czech Republic and in its Neighbouring Countries

Miroslava Vlčková, Jaroslav Vrchota, Zuzana Frantíková

Abstract: *Telework, also called homeworking or home office, arose in the USA in the seventies due to the oil crisis when the costs of oil were so high that they banned the employees from commuting to work. Since then it has become an interesting alternative for companies to organize the way their employees work bringing advantages and disadvantages on both sides. It was also very suitable form of working for the EU relating to the idea that the borders over the time should be slowly eliminated and a single work and employee market should be created. The aim of this paper is to compare the use of telework with respect to the frequency in Austria, Germany and Poland against the Czech Republic and Slovakia. The comparison is carried out according to the frequency of use (usually, sometimes and never) using the selected statistical methods. From the data obtained, the wider use of telework in the category sometimes is recorded in Austria, Germany and Poland against the Czech Republic and Slovakia. In the category of usually the use of homeworking prevails in Austria, Poland whereas in Germany and Slovakia the figures are not statistically significant comparing to the Czech Republic. The results proved that on the statistical level of 0,95 telework is more often not used by the Czech Republic than by its neighbours.*

Key words: EU Members · Homeoffice · Homeworking · Telework

JEL Classification: K31 · M54

1 Introduction

In most European countries, teleworking or homeworking is used in various forms that differ from one another by its legal regulation. In the 1990's there were experts in the EU who predicted the usage of the telework by 10 million of EU citizens by the year 2000. Those experts did really a good estimation and by the year 2000 they were 10 million of European citizens using telework. Among the top users of telework with four million of users the UK and Germany were placed (Telework in Europe, 2003). According to the European Trade Union Confederation, telework is defined as a form of organizing and/or performing work, using information technology, where work, which could also be performed at the employers' premises, is carried out away from those premises on a regular basis (European Framework Agreement, 2002 or Implementation, 2006). In the Czech version of the Implementation the words on a regular basis are missing at all, that is why they are also missing in the legal regulation. It is also surprising that the regulation of telework was not made through a directive, but through the autonomous route, in 'accordance with the procedures and practices specific to management and labour in each Member State' (Telework in the European Union, 2010).

Nevertheless, despite the differences in their legal regulation, telework should always demonstrate several common features. First in the sections below the legal definition of telework in the chosen countries will be compared.

In the Czech Republic, telework is regulated in Section 317 of Act No. 262/2006 Sb., the Labor Code. It is defined as the regime of work of an employee who does not work at the employer's place of work but, under the agreed conditions and who performs a negotiated job during the working hours he/she plans. Unlike the previous regulation (Section 267 para. 2, 3 of the Labor Code 1965), it is no longer a defining feature that it should be an employee working mostly at home. Employee can do work anywhere (outside the workplace) where it suits the nature of the work being arranged and will be agreed with the employer. Sections regarding working hours, overtime, compensation of wages, spare time off in case of overtime and compensation of wages in case of some personal obstacles at the employee's side cannot be applied in case of telework. On the other hand, employers should compensate the costs paid by the distant/home employees, however this is regulated implicitly and that's why most employers do not keep the regulation and do not com-

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pensate the costs employees pay by doing their work from home. Therefore, the new novelization of Labor Code counts with the implementation of new regulation consisting in the specification of the employers' duty to compensate the costs arisen on employee's side.

Regarding the data featuring the usage of telework in the Czech Republic and in Slovakia it may be presumed that the legal regulation would be rather the same. Section 52 of the Labour Code (Act No. 311/2001 Z.z., zákonník práce) first speaks about homework defining it as "the employment relationship of an employee who performs work for an employer at home or at another agreed place, pursuant to conditions agreed in the employment contract" or about telework defining it as "the employment relationship of an employee the teleworker as a person who performs work for an employer at home or at another agreed place, pursuant to conditions agreed in the employment contract, using information technology within the working time arranged by himself/herself." Same as in case of the Czech regulation sections regarding working hours, overtime, compensation of wages, spare time off in case of overtime and compensation of wages in case of some personal obstacles at the employee's side cannot be applied in case of telework.

Polish Labour Code (Kodeks Pracy) in article 67 § 1 states that "the work may be carried out regularly outside the employer's office using electronic means of communication within the meaning of the rules on electronic provision of services (Teleworking)." § 2 of the article then states that "a teleworker is an employee who carries out work under the conditions of § 1 and delivers the employer's results of his work mainly by means of electronic means of communication." Telework is not a particular type of employment that is why the legal regulation of employment relation is normally applied. The characteristics of telework that distinguish this form of organization and performance from the typical form of employment are: the regularity of the work performed under the conditions of telework, the performance of work outside the employer's workplace, the use of electronic means of communication in the sense of the regulations on electronic provision of services and the transfer of the results of the work by employers mainly by electronic means of communication.

Due to the lack of a strong tradition of collective bargaining in Czech Republic and Slovakia and the rather low density rate of social partner organizations, the choice of legislative implementation has been seen as more suitable. Unlike Poland, where telework is defined in the labour code, nevertheless the amendment was preceded by a collective agreement at national level (Telework in the European Union, 2010).

Unlike Czech, Slovak and Polish regulation the regulation of telework in Germany and Austria is usually regulated through company agreements. "In Germany it is the first agreement at Telekom which is dating back to 1995. The role of the national social partner organizations is limited in terms of labour regulation and, therefore, they have only been involved in the provision of information. At sectoral level, social partners in the chemical industry provided recommendations for the implementation of telework at company level (Telework in the European Union, 2010, p. 28)." In Austria, they use sectoral-level collective agreements for regulating telework (Telework in the European Union, 2010).

2 Methods

Labor market statistics, including homeworking analyzes, are the priority points of many European Union policies. Homeworking statistics can be used for a range of analyzes, both macroeconomic, if we see work as one of the factors of production, as well as for analysis of productivity, or competitiveness in the labor market. Analyzes can also be carried out from the point of view of social aspects related to diverse ways of employing workers.

The aim of the paper is to analyze the use of homeworking within the European Union. The article is primarily concerned with comparing the use of homeworking in the Czech Republic, Austria, German Poland, Slovakia and comparing these partial results with the results of using homeworking across the European Union. The partial target was the comparison of the use of homeworking with respect to the gender and frequency.

The data tested for further analysis were obtained using publicly available Eurostat data (Eurostat, 2017). The comparison was based on several aspects, with the basic division being the use of homeworking in the individual countries of the European Union, the use of homeworking by gender (men, women) and the frequency of use (usually, sometimes). The survey was attended only by employed people aged 15-64. The comparison was made using the data from the period 2007 - 2016. The newer data were not available at the date of analysis.

As regards the statistical methods used, the t-test was used for the difference test. The zero hypothesis H0 was set that both groups are equal over against HA, where the two samples are different.

Test data were obtained using publicly available EUROSTAT (2017) data, compared to data for the period 2007 to 2016.

In the statistical comparison of the use of homeworking, a t-test for a random sample from a two-dimensional layout was used for research purposes, with $n \geq 2$ (Budíková, 2010; Freeman, 2017). Here we denote $\mu = \mu_1 - \mu_2$ and introduce the difference random sample $Z_1 = X_1 - Y_1, ..., Z_n = X_n - Y_n$ whose sample mean and sample variance are (Freund, 2010; Anderson, 2013):

$$M = \frac{1}{n}\sum_{i=1}^{n}. Z_i \tag{1}$$

$$S^2 = \frac{1}{n-1}\sum_{i=1}^{n}(Z_i - M)^2 \tag{2}$$

Statistically, it has always been tested at a significance level of 0.05 where:

Zero hypothesis H0: $\mu_1 - \mu_2 = 0$ against alternative hypothesis HA: $\mu_1 - \mu_2 \neq 0$.

Before testing the hypotheses, the tests of both dispersions of both samples were always performed using the F-test. The calculation is based on the difference between the means of the two samples, the variability of the observed quantity and the size of the two samples. This statistics test is distributed according to Student t-distribution with $n_1 + n_2 - 2$ degrees of freedom (Meloun, 2012). The degrees of freedom are a t-distribution parameter. Using the Statistica software, we find the exact p-value. This probability corresponds to the probability of occurrence of such or an even more extreme value of the test criterion t assuming the validity of the zero hypothesis. If it is less than 0.05, we reject the zero hypothesis. This means that the probability that the observed differences occur only by chance is less than 5%. The classical two-sample t-test, in addition to the normal distribution of the observed variable, also assumes that variances are the same in both groups. This assumption is tested by sample estimates of the standard deviations s1 and s2 by the F-test (Devore, 2015; Walker, 2010).

3 Research results

The aim of the paper to compare the approaches to homeworking between the Czech Republic and Austria, German Poland, Slovakia then to compare them with the European Union mean from 2007 to 2016. As mentioned in the methodology to test the difference between the two groups, the t-test was used. The zero hypothesis H0 was set that both groups are equal over against HA, where the two groups are different.

Table 1 "Sometimes category" in homeworking research

	Mean Group 1	Mean Group 2	Value t	sv	p	Stand. Dev. Group 1	Stand. Dev. Group 2	F-prop. Varian.	p Varian.
CZ S vs. EU S	4,32	8,44	-14,140	18	0,0000		0,3910	0,8343	0,0340
CZ S vs. DE S	4,32	8,56	-13,261	18	0,0000	0,3910	0,9324	5,6860	0,0163
CZ S vs. AU S	4,32	11,07	-28,646	18	0,0000	0,3910	0,6343	2,6315	0,1657
CZ S vs. SLV S	4,32	4,68	-1,428	18	0,1701	0,3910	0,6941	3,1512	0,1025
CZ S vs. POL S	4,32	8,41	-14,144	18	0,0000	0,3910	0,8266	4,4688	0,03608

Source: EUROSTAT (2017), own processing

Figure 1 "Sometimes category" in comparison Czech Republic, Austria and Slovakia
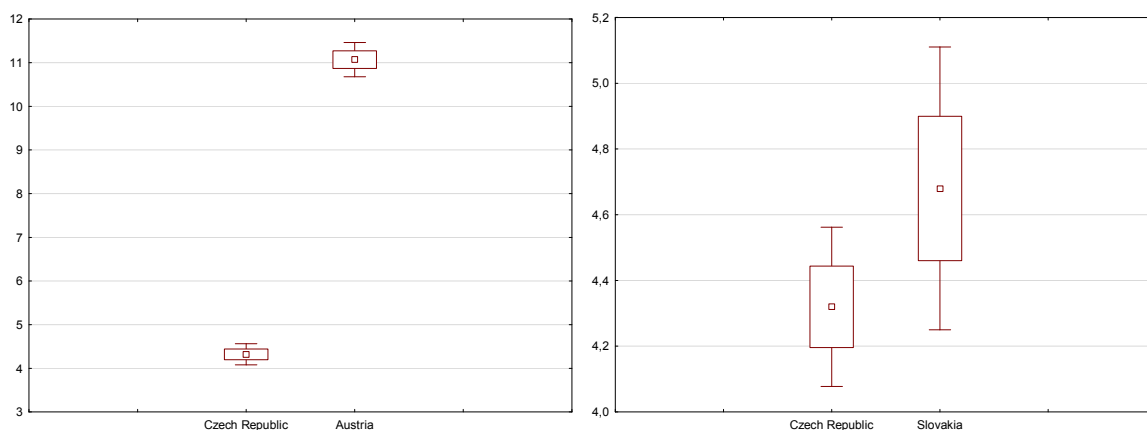
Source: EUROSTAT (2017), own processing

First the use of homeworking in the Sometimes category in the countries was tested, as it is shown in Figure 1 below, there was no statistical difference between the Czech Republic and Slovakia when p-value is 0.1701. Among other states and the Czech Republic, there was a significant difference in the use of homeworking as it is evidenced by the p-values in Figure 1.

For illustrative purposes, the Figure 1 shows a graphical distribution of the values for the Czech Republic and Austria, where the difference between 4.3 (CZ) and 11 (A) is significant. On the other hand, as the right box plot in Figure 1 shows, the differences between the Czech Republic and Slovakia can not be considered as significant.

Another comparison related to the use of homeworking shows the Usually category. In Figure 2, there are shown statistically significant differences between the Czech Republic and the EU, Austria and Poland. On the other hand, comparing the Czech Republic and Germany no significant difference was found, although the p-value of 0,0766 is very close to the alpha level of 0,05.

Table 2 "Usually category" in homeworking research

	Mean Group 1	Mean Group 2	Value t	sv	p	Stand. Dev. Group 1	Stand. Dev. Group 2	F-prop. Varian.	p Varian.
CZ U vs. EU U	3.19	4.76	-11.123	18	0.0000	0.3813	0.2319	2.7045	0.1544
CZ U vs. DE U	3.19	3.48	-1.878	18	0.0766	0.3813	0.3047	1.5657	0.5146
CZ U vs. AU U	3.19	10.28	-48.229	18	0.0000	0.3813	0.2658	2.0581	0.2972
CZ U vs. SLV U	3.19	3.47	-1.902	18	0.0733	0.3813	0.2668	2.0421	0.3024
CZ U vs. POL U	3.19	4.41	-4.419	18	0.0003	0.3813	0.7852	4.2391	0.0426

Source: EUROSTAT (2017), own processing

Comparison of the Czech Republic to Slovakia did not reject H0 in favor, so we continue to cling to the hypothesis that the use of HW in the Czech Republic and Slovakia is usually in the same mode, although the graphical representation in the left box plot indicates significant differences. In the right box plot, the difference between the Czech Republic and Poland is expressed, because the difference in mean values is significant.

Figure 2 "Usually category" in comparison Czech Republic, Slovakia and Poland
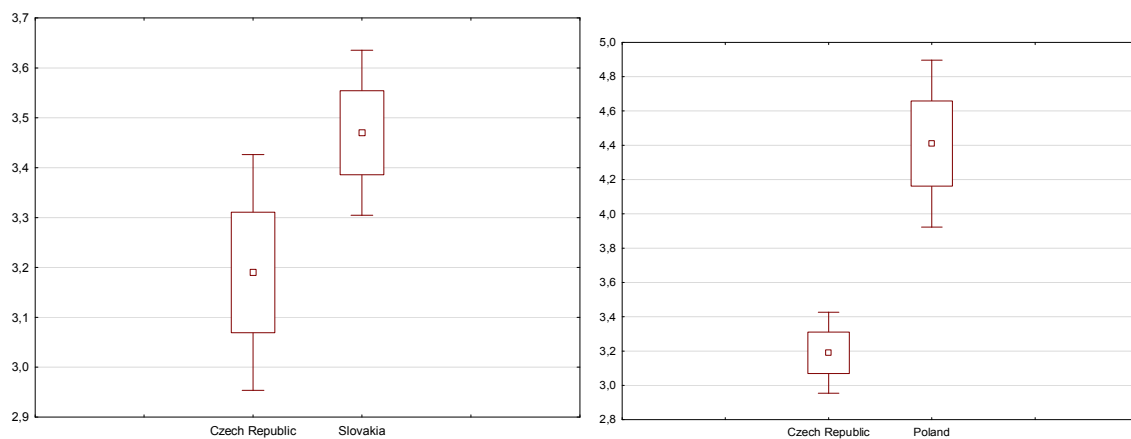
Source: EUROSTAT (2017), own processing

Finally, the HW data were compared in the Never category, which indicates the non-use of HW as you can see in the table 3. Within these data, H0 was rejected in all 5 cases in favor of an alternative hypothesis, where a p-value lower than that of the alpha was found in all neighboring countries and the EU average, and in many cases very close to zero. Therefore, it may be claimed that in the Czech Republic HW is not more often used than in the neighboring states at the significance level of 0.95.

This fact is evidenced by the chosen box plots shown in Figure 3. In the left box plot there is the Czech Republic and the EU average, in the right box plot there is the Czech Republic and Slovakia; in both cases the differences in the distribution of values are visible.

Table 3 "Never category" in homeworking research

	Mean Group 1	Mean Group 2	Value t	sv	p	Stand. Dev. Group 1	Stand. Dev. Group 2	F-prop. Varian.	p Varian.
CZ N vs. EU N	92.5	86.78	16.275	18	0.0000	0.7226	0.8443	1.3651	0.6504
CZ N vs. DE N	92.5	87.94	10.733	18	0.0000	0.7226	1.1325	2.4561	0.1968
CZ N vs. AU N	92.5	78.65	44.948	18	0.0000	0.7226	0.6536	1.2223	0.7697
CZ N vs. SLV N	92.5	91.83	2.174	18	0.0432	0.7226	0.6532	1.2236	0.7685
CZ N vs. POL N	92.5	87.19	9.997	18	0.0000	0.7226	1.5161	4.4019	0.0378

Source: EUROSTAT (2017), own processing

Figure 3 "Never category" in comparison Czech Republic, Slovakia and European Union
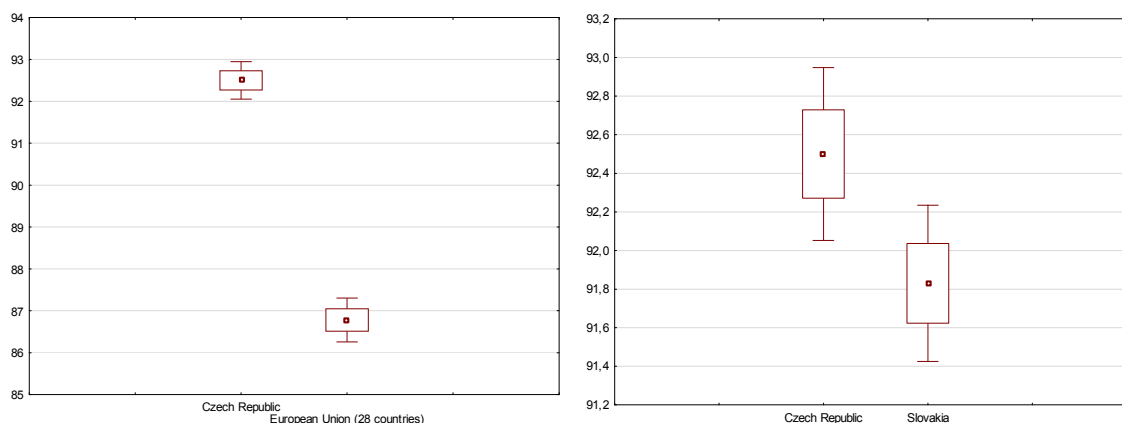
Source: EUROSTAT (2017), own processing

In practice, there are two basic telework models - complete (almost complete) and partial (sometimes). Many businesses that tested these models have concluded that when telework is complete, people are moving away from the company losing contact with colleagues and current events. Therefore, it is preferable to choose partial telework when employees work for two to three days at home and the remaining days they are at work.

The results or differences in the use of telework may be given by legislation when the Labor Code in the Czech Republic regulates this type of employment very briefly and it is therefore necessary to consider adequately and to treat the conditions under which the employee will work at home. Other aspects may include ensuring health and safety at work. The employer has the same obligations here as if the employee worked in the office. However, if we disregard legislative issues, companies are often discouraged by the limited control of its employees, lower motivation, complicated communication, or by the insufficient job discipline, as it has been described above.

4 Conclusions

Telework is more and more interesting alternatives for setting the way your employees work. It is due to the fact that it can bring many benefits, such as lowering the cost of running a job, the possibility of getting a cheaper workforce by employing people from "poorer" areas or more satisfied employees. On the other hand, this type of employment can bring about certain shortcomings, such as more demanding communication with colleagues, loss of social contacts, or difficulty in employee discipline, and the associated more demanding (Bláha, Mateicius a Kaňáková, 2005).

Nonetheless, in case of our research it is worth mentioning a few things, best of all, the differences. It is quite clear from the statistical analysis that the use of telework in the Czech Republic in the "sometimes" category is relatively comparable to its use in Slovakia. However, both countries do not reach its use to such an extent as in Germany, Austria, Poland and the average for the whole of the European Union. For the "usually" category, the development in the Czech Republic is relatively comparable to the development in Slovakia and Germany, while in case of the other countries compared and the average across the European Union, the difference is quite obvious. For the "never" category (which means not using telework), the difference between the Czech Republic and all other countries surveyed, including the average for the whole European Union, was quite evident. It means that in the Czech Republic, telework is not much used in comparison with other countries.

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Use of the Fixed Assets and Labour Productivity in Farms according to LFA

Petr Zeman, Jana Lososová, Jaroslav Svoboda

Abstract: *This work analyses the development of labour productivity, wages to sales ratio, fixed assets per worker ratio and fixed assets turnover of agricultural enterprises. Enterprises in this contribution were classified by LFA. The result shows an increase in labour productivity in all the monitored categories. Highest values of labour productivity are achieved by businesses in the NON-LFA area. For LFA enterprises, labour productivity figures are lower, but the increase in the indicator over the period under review was more pronounced. Further, the values of fixed assets turnover and fixed assets per worker ratio indicate that human labour is replaced by more intensive use of long-term assets.*

Key words: LFA · Labour Productivity · Fixed Assets · LFA

JEL Classification: Q10 · Q14 · Q18

1 Introduction

Agriculture in the EU is one of the major sectors which employ almost 30 million people. The European model of agriculture ensures not only quality food but also permanent employment in rural areas. These areas suffer from depopulation and LFA (Less Favoured Areas) have become highly vulnerable areas. In Less favoured areas the production costs are significantly higher because of problematic utilisation of the soil, e.g. high altitude areas with a short vegetation growth period caused by severe climatic conditions; sloping areas of lower altitude where no or very restricted mechanisation can be used. But farming is still important there for the environment, for the improvement of rural areas and for the tourist potential of the area or the protection of coastal areas (EC, 2013).

Disadvantaged areas are inhabited by more than 30% of the population (Střeleček et al. 2010). These areas are characterized by a number of constraints such as shorter growing season, lower average annual temperatures, poor traffic conditions, more environmental protection and more. Less favoured areas are defined in the Czech Republic to 58.9% of the territory, of which 23.6% are mountainous area. Mountain areas are defined as areas with short vegetation due to the high altitude or steep slope in the lower areas, or a combination of both criteria (average altitude of the municipality and cadastral area above 600 m above sea level or the average elevation within the municipality or the cadastral 500 and 600 m above sea level, while slopes over 15% on an area of more than 50% of the total area of land). Other less favoured areas are characterized by low fertility soils and low population density, which is dependent on agricultural activity (within the district, the average productivity of agricultural land less than 34 points in the region is the population density of less than 75 inhabitants per square km and the share of workers in agriculture , forestry and fishing on the economically active population is greater than 8%) and areas with specific handicaps are defined as those with soil with low fertility combined with higher costs of farming due to the slope of the land (MA 2010).

Criteria for LFA classification are covered in studies of Dax (2005); Štolbová et al. (2007); Eliasson et al. (2010); Štolbová, Hlavsa, & Lekešová (2010). Designation of LFA areas is applied at a rather broad level and does not necessarily guarantee that socio-economic and natural conditions at farm-level are considered. The key point is that there is a need to consider spatially differential impacts in further adjustments to policy reforms taking into account local circumstances. It becomes essential to increase funding for The Rural development programme to provide meaningful support, coordinating agricultural policy with rural and regional development policies (Gelan & Schwarz 2008). The EU countries do not apply a uniform methodology to determine the amounts of the LFA payments. The payments and the differentiation of rates should be based on the effect of the adverse soil and climate conditions to contribute to the sustainable use of farmland in the LFA and, at the same time, to avoid overcompensation (Štolbová & Hlavsa 2008).

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The analysis of enterprises in the LFA conditions shows that the significant part of companies still persist in the intensive forms of farming, whereof they achieve a relatively small economic effect. On the one hand, the intensive farms contribute to agricultural maintenance, but other hand they do not search the possibilities for innovation of the production structures (Szabo & Grznár 2008; Gabriel et al. 2009) say that a combination of environmental variables associated with a lower agricultural potential predisposes farmers to convert to organic farming.

Many factors in the national economy, outside the field of agricultural policy, have an impact on the farm revenue and income. Any changes in the macroeconomic environment are likely to have major effects on agriculture, taking as an example the latest global economic crisis (Zawojska 2009). Number of farms in Europe has continuously declined (Glauben et al. 2006; Breustedt & Glauben 2007). Farm exits accelerate the growth of the remaining farms by redistribution of production factors. The declining number of farms not only has consequences for the agricultural sector but also for rural areas as a whole (Zimmermann et al. 2009). The loss of farms may lead to a depopulation of the countryside, which in turn affects the demand for services and the infrastructure of local communities (Ballas et al. 2006; Piorr et al. 2009). Agriculture ensures the physical existence of the population and it creates a fund of basic foodstuffs. In addition, it produces non-food commodities as well as being a region forming and political element. It fulfils the function of an internal political stabilising factor and it is a requirement for an overall balanced development (Vošta 2010).

Čechura (2009) deals with the analysis of technical efficiency and the total factor productivity in Czech agriculture. The most important factors which determine both technical efficiency and total factor productivity are the factors connected with institutional and economic changes, in particular a dramatic increase in the imports of meat and increasing subsidies. Grznár et al. (2009) analyses indicate that the main cause of disparities in Slovak agriculture compared to the EU advanced countries is a low level of the cost management and wrong strategic decisions on the production intensity. Kopta (2006) elaborated analysis of farms that really went bankrupt revealed that farms are in danger due to both the long-term negative profitability and by the steep fluctuation of the profit/loss followed by the negative cash flow from operations and financial insolvency. The permanently low or negative profitability affects especially farms in the mountain and sub mountain regions. The profit/loss of such holdings was negative but without major fluctuations.

Production agriculture is heavily supported by political and economic instruments, especially in the form of grant support. It is necessary to keep analysing the effectiveness of these supports. Kroupová & Malý (2010) argues that analysed political and economic instruments of subsidy policy in the form of direct support of production has not been having a clear positive impact on improving the performance of organic farms. In the context of the CAP reform elimination of direct payments after 2013 has occurred. To what extent such changes could affect the dynamics of land use in Europe, including the impact of structural change and the environment are problems addressed, e.g. by Uthes et al. (2011). They concluded that the abolition of direct payments would be hardest for regions with less favourable conditions for agriculture, the least affected would be relatively competitive sectors and industries with highly diversified agro-tourist potential, good marketing and sales structure. Acs et al. (2010) point to a real risk of land abandonment in mountain areas and reducing cattle. Offermann et al. (2009) examines the status of organic farms. The results show that specific support for organic agriculture will continue to play an important role in the profitability of organic farms.

The analysis of enterprises operating in less-favoured areas is also addressed in their further studies (Lososová & Zdeněk 2013) where the authors highlight the higher indebtedness and lower productivity of businesses in mountain LFAs and other LFAs compared to non-LFA-based businesses.

The aim of this paper is to identify, by means of financial analysis indicators, the impact of labour productivity and technical equipment on the profitability of invested capital in enterprises operating in different production and climatic conditions.

2 Methods

This paper uses data from the Albertina database containing business and accounting data about economic subjects. Our dataset contains only agricultural enterprises, which published full financial statements during the period from 2011 to 2015 and thus only legal entities was taken into account. This dataset was divided into two basic groups, according to the area of farming. The first group contains 706 companies operating in NON-LFA and the second group 533 companies from LFA. The second group was further subdivided into next three groups: LFA M (mountain areas) is created by 130 companies; LFA O (other areas) contains 284 companies and LFA S (specific areas) with 119 companies. The location of farming for every company is determined based on the seat of the corporation.

The use of fixed assets and labour productivity were examined within defined groups of agricultural companies using financial analysis indicators and their pyramidal decomposition. The items defined in the financial statements were used for the calculation of the financial analysis indicators. Revenues are defined as the sum of sales of goods and services. Wage to sales ratio contains not only wages, but total labour cost was taken into account. The other costs are then defined for the purposes of this article as the difference between total costs and total labour costs. The information on

number of workers was also taken from the Albertina database. It should be emphasized that aggregated data for the whole group of companies was used for the calculation of financial indicators.

Individual indicators and their interrelationship are specified in the pyramidal decomposition below. The pyramidal set of indicators allows to penetrate to the essence of phenomena and better formulate follow-up measures. Pyramidal decomposition can be constructed in different ways and also synthetic indicator standing at the top of the pyramid can be chosen differently. Return on assets, return on equity or return on capital employed can be used as the synthetic indicator. The chosen construction of the pyramid system allows to analyse the impact of either the structure of revenues, costs, assets and financial resources on the synthetic indicator, or the relationships between the partial indicators, which ultimately influence the evaluation of the synthetic indicator (Živělová 2007).

The left branch of the pyramidal decomposition shows the influence of return on sales indicator on the return on assets ratio. Further, the relationships among wage cost, average wage and labour productivity are monitored in this branch. The right branch expresses the link between the total assets turnover ratio and the return on assets ratio. Furthermore, this branch describes the effect of fixed assets per worker ratio and labour productivity ratio on fixed assets turnover ratio. Labour productivity is thus captured in both branches. Growth of this indicator reduces wage costs on the left side of the diagram and also improves the use of fixed assets on the right.

Figure 1 Pyramidal decomposition
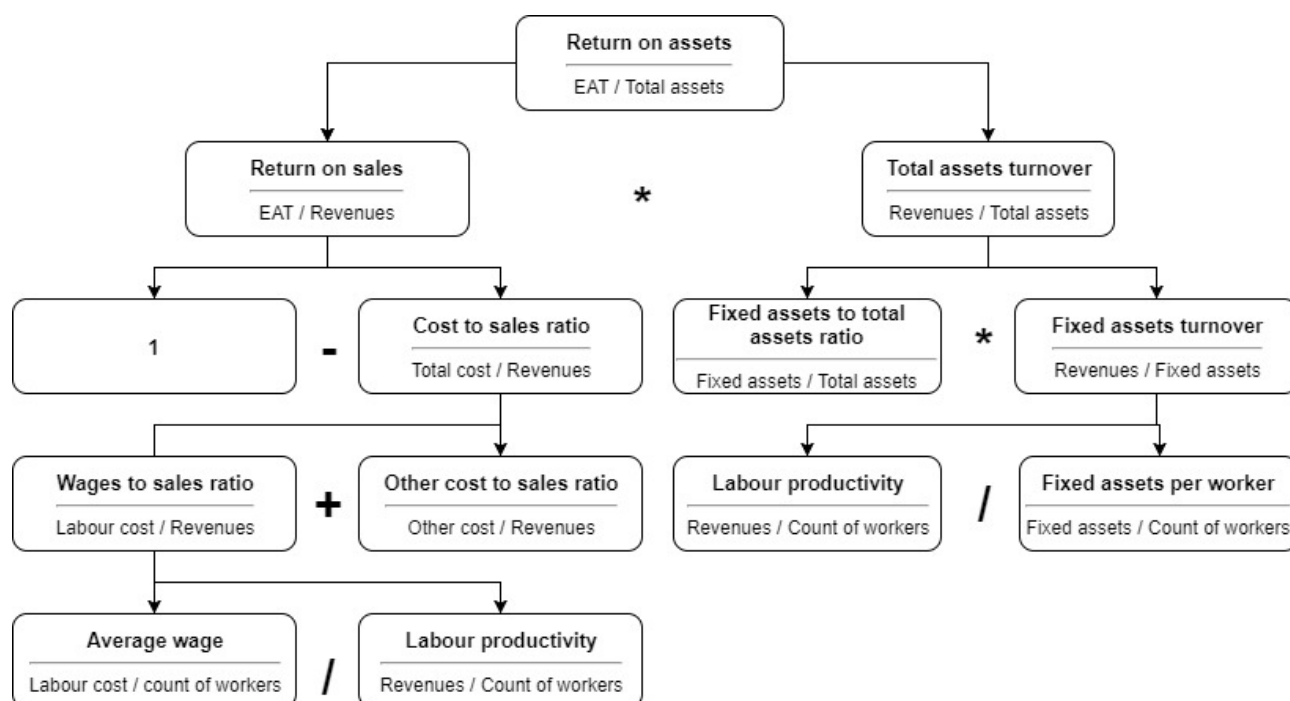
Source: Own processing

3 Research results

Table 1 shows the development of the return on total assets and the indicators directly related to it, i.e. return on sales and turnover of total assets. Return on total assets reached low levels across the agricultural sector, and didn´t exceed 6 % in any of the monitored areas between the period 2011 and 2015. Higher values of return on total assets were achieved by NON-LFA companies in comparison with LFA companies, mainly due to higher values of return on sales. On the other hand, the LFA group shows higher values of total assets turnover ratio. The effects of these indicators were compensated in such a way that the value of return on total assets is roughly the same. The lowest value of return on assets was reached by companies from LFA S group, which was caused by low efficiency of using total assets. The development of returns on sales does not show any significant trend during the reporting period. In the case of total assets turnover indicator, the level of asset utilization decreases over time.

Table 1 Development of return on total assets, return on sales and total assets turnover indicators

Indicator	Area	Year					Average	Standard deviation
		2011	**2012**	**2013**	**2014**	**2015**		
ROA	LFA M	4.32%	4.10%	4.09%	5.77%	4.08%	4.47%	0.66%
	LFA O	5.45%	4.17%	4.32%	5.16%	2.94%	4.41%	0.88%
	LFA S	3.92%	3.60%	3.60%	4.79%	2.70%	3.72%	0.67%
	LFA total	4.87%	4.02%	4.10%	5.20%	3.12%	4.26%	0.73%
	NON-LFA	4.78%	4.72%	4.50%	5.53%	3.47%	4.60%	0.66%
	Total	4.82%	4.41%	4.33%	5.39%	3.32%	4.45%	0.68%
ROS	LFA M	3.90%	3.64%	3.84%	5.40%	4.08%	4.17%	0.63%
	LFA O	4.70%	3.56%	3.81%	4.64%	2.84%	3.91%	0.70%
	LFA S	4.09%	3.72%	3.91%	5.18%	3.06%	3.99%	0.69%
	LFA total	4.42%	3.60%	3.84%	4.90%	3.14%	3.98%	0.62%
	NON-LFA	4.36%	4.41%	4.42%	5.45%	3.72%	4.47%	0.56%
	Total	4.38%	4.05%	4.16%	5.21%	3.46%	4.25%	0.57%
TAT	LFA M	1.11	1.13	1.07	1.07	1.00	1.07	0.04
	LFA O	1.16	1.17	1.13	1.11	1.04	1.12	0.05
	LFA S	0.96	0.97	0.92	0.92	0.88	0.93	0.03
	LFA total	1.10	1.12	1.07	1.06	0.99	1.07	0.04
	NON-LFA	1.10	1.07	1.02	1.01	0.93	1.03	0.06
	Total	1.10	1.09	1.04	1.03	0.96	1.04	0.05

Source: Own processing

From the pyramidal decomposition, the impact of fixed assets turnover, labour productivity and fixed assets per worker indicators on total assets turnover is evident. The values of these indicators are shown in Table 2.

Table 2 Development of fixed assets turnover, labour productivity and fixed assets per worker indicators

Indicator	Area	Year					Average	Standard deviation
		2011	**2012**	**2013**	**2014**	**2015**		
FAT	LFA M	1.78	1.78	1.67	1.70	1.59	1.70	0.07
	LFA O	1.88	1.86	1.79	1.78	1.65	1.79	0.08
	LFA S	1.61	1.62	1.52	1.54	1.44	1.54	0.07
	LFA total	1.80	1.79	1.70	1.71	1.59	1.72	0.07
	NON-LFA	1.83	1.74	1.64	1.66	1.52	1.68	0.10
	Total	1.82	1.76	1.67	1.68	1.55	1.70	0.09
LP*	LFA M	2106.9	2301.1	2452.0	2625.2	2660.7	2429.2	206.3
	LFA O	2417.8	2635.2	2811.6	2977.4	2825.5	2733.5	191.5
	LFA S	2306.2	2422.7	2615.0	2726.2	2683.3	2550.7	160.4
	LFA total	2326.3	2518.4	2692.4	2848.7	2761.5	2629.5	186.4
	NON-LFA	2464.1	2608.0	2691.4	2981.4	2876.2	2724.2	185.2
	Total	2401.8	2567.3	2691.8	2921.2	2823.9	2681.2	183.9
FAW*	LFA M	1181.7	1295.8	1465.3	1544.2	1674.5	1432.3	175.3
	LFA O	1285.4	1415.7	1571.9	1674.8	1710.5	1531.7	160.1
	LFA S	1431.2	1499.7	1725.6	1769.0	1864.3	1658.0	164.9
	LFA total	1292.7	1407.1	1580.1	1666.0	1734.7	1536.1	163.8
	NON-LFA	1344.0	1501.0	1640.3	1799.9	1886.7	1634.4	196.6
	Total	1320.8	1458.4	1613.5	1739.2	1817.5	1589.9	181.3

* In thousand. CZK
Source: Own processing

Table 2 does not contain share of fixed assets on total assets. For all monitored groups, fixed assets represent approximately 60 % of total assets, and this ratio remains roughly the same throughout the reporting period. Therefore total assets turnover is primarily affected by the fixed assets turnover ratio. This indicator, as well as in the case of total assets turnover, showed the worst results for the LFA S group. The largest decline from 1.83 to 1.68 was observed in the NON-LFA group, but downward trend was present by all monitored groups.

The values of labour productivity indicator correspond to deteriorating production conditions where NON-LFA farming companies show higher labour productivity in year 2015 compared to LFA companies, but on the other hand the higher increase in labour productivity was achieved by companies in the LFA areas, specifically from 2326.3 to 2761.5 thousands CZK per worker. The fastest growth rate (approximately by 26 %) during the monitored period was reported by the LFA M group. Returns per worker grew steadily throughout the entire period, only in year 2015 fell the revenues per worker for all groups except LFA M. This decline was the highest in LFA O group, by CZK 152 thousand per worker.

The value of fixed assets per worker is the highest in NON-LFA group at the end of the reporting period and it decreases depending on deteriorating farming conditions. This indicator grew in all categories during the monitored years, especially than in LFA H group. For this category of enterprises, the value of fixed assets per worker increased from CZK 1.182 million to CZK 1.674 million. Similarly, the value of long-term assets also increased for companies from NON LFA areas, where the amount of fixed assets per worker increased from CZK 1.344 million to CZK 1.887 million. This indicator was growing in all monitored areas with higher dynamics than the labour productivity indicator. This, in turn, leads to the decline of fixed assets turnover, which has been already mentioned above. Reducing the use of fixed assets is an unfavourable phenomenon, but it cannot be evaluated separately, without reference to labour costs. Replacement of live labour by machine can be advantageous in case of high labour costs.

Table 3 Development of wage to sales and average wage indicators

Indicator	Area	Year					Average	Standard deviation
		2011	2012	2013	2014	2015		
WS	LFA M	12.09%	11.80%	11.80%	11.46%	11.83%	11.80%	0.20%
	LFA O	11.46%	10.84%	10.82%	10.78%	11.38%	11.06%	0.30%
	LFA S	12.25%	11.89%	12.03%	12.04%	12.49%	12.14%	0.21%
	LFA total	11.75%	11.24%	11.26%	11.17%	11.69%	11.42%	0.25%
	NON-LFA	11.22%	10.95%	10.98%	10.74%	11.30%	11.04%	0.20%
	Total	11.45%	11.08%	11.11%	10.93%	11.47%	11.21%	0.22%
AW[*]	LFA M	254.7	271.6	289.3	300.9	314.8	286.3	21.2
	LFA O	277.2	285.6	304.2	321.0	321.5	301.9	18.1
	LFA S	282.6	288.1	314.5	328.3	335.1	309.7	21.0
	LFA total	273.3	283.1	303.1	318.1	322.9	300.1	19.3
	NON-LFA	276.4	285.6	295.6	320.1	325.0	300.6	19.0
	Total	275.0	284.5	298.9	319.2	324.0	300.3	19.0

* In thousand CZK
Source: Own processing

The wage to cost indicator is influenced by the average wage (or labour costs per worker) and labour productivity. Indicator values are affected both by the type of farming activity and the location of the business. Higher proportions of wage costs on sales burdened mainly companies operating in less-favoured areas (Table 3). This is particularly evident in LFA S group, which represents the group with the highest value of wage to costs ratio during the whole monitored period. The wage to cost indicator was negatively affected by the wage cost per worker indicator, which grew in the entire agricultural sector. On the other hand, labour productivity (see Table 2) had a positive effect on the wage to cost ratio, which eliminated the impact of the increase in labour costs on the worker. Wage to cost ratio showed stable values for both NON-LFA group (approx. 11 %) and LFA group (approx. 12 %).

4 Conclusions

This article compares selected ratios of financial analysis for agricultural holdings operating in the Czech Republic, which are broken down according to the areas of farming. Significant differences between LFA and NON-LFA enterprises did not occur during the reporting period. Most indicators are slightly better in NON-LFA areas. Return on total assets showed low values irrespective of the location of the holdings and ranged from 2.7 to 5.8% over the reference period. However, the results show that while LFA farms are trying to achieve higher return on total assets through better use of assets, NON-LFA farms rely on higher profit margins.

The labour productivity affects return on total assets in two ways. The growth of this indicator, on the one hand, reduces the labour costs needed to achieve 1 crown of sales, while also affects total assets turnover and thus use of company's assets. Higher labour productivity figures are achieved by NON-LFA companies and declining towards worse farming conditions. Growth of the indicator is very similar for all categories, the slightly higher growth rate was recorded only in LFA M group, but the value of the indicator in this group reaches 93 % of the NON-LFA level in 2015. Increasing labour productivity is largely influenced by the decline in the number of workers in agriculture sector. This drop in the number of employees is offset by the increase in the volume of fixed assets, which is evident mainly from the fixed assets per worker indicator. The highest value of fixed assets per worker was reported by enterprises in NON-LFA areas. The rate of growth of fixed assets per worker is decreasing and there is a gradual transition to the fund-intensive type of farming in all areas.

When comparing companies in LFA areas, LFA S companies show the highest average wage, which causes the increase in the wage to cost indicator and negatively affects the return on sales ratio. At the same time, this group of companies displays high fixed asset values per worker, which reduces fixed and total assets turnover. The effect of these factors is the lowest return on total assets within the monitored groups.

Acknowledgement

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Session 5

Market Research and Sustainable Marketing in Trade and Tourism.

Food Purchasing Behavior of Consumers on Farmers' Markets: a Case Study from the Region Dunajská Streda

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Abstract: *The purchase of foods by consumers on farmers' markets is becoming a widespread phenomenon in Slovakia. Consumers are increasingly beginning to prefer the purchase of healthy foods from farmers' markets rather than supermarkets. For this reason, the article aims to characterize the motivation of consumers to purchase goods on farmers' markets; based on selected factors. The authors have identified three hypotheses that have been verified using statistical methods. The article presents results on a sample of 435 consumers from the region Dunajská Streda. One of the results of the survey is that revenue is not a decisive factor in their willingness to purchase goods on farmers' markets.*

1 Introduction

Nowadays, there is a widespread trend of shopping for foods at farmers' markets, local markets, and marketplaces. The most popular foods there are those labelled as healthy, local and organic. Producers, or growers of fruit and vegetables, as well as big supermarket chains have embraced this trend. Chains have observed evolving changes in the consumer's behavior, which includes an increased public interest in choosing food for its local origin, its freshness, nutritional quality, and authenticity. Big supermarket chains have not only observed this significant change; they have exploited it for their benefit. Several supermarkets, such as Tesco, Kaufland, YEME and others, have already started to cooperate with local food growers. Tesco has even begun to work with local food producers in each region of their 22 branches throughout Slovakia. The cooperation lies in creating a point of sales for local producers and establishing conditions related to product ordering and distribution (SITA, 2017; Konštiak, 2007). Oths et al. (2016) have studied farmers' markets in the USA and observed their increased growth over the last period. They claim that in order to rehabilitate farmers' markets in cities, it is necessary to obtain up-to-date information about consumers' needs and customer potential in order to adapt appropriately to the local situation. The authors have chosen young adults as a target group because this group has not been studied yet. Based on the results of the research, it is evident that the most attractive farmers' markets were those organized as festivals. Oths et al. (2016) agree that making farmers' markets more attractive for future consumers could have a positive influence on future eating habits and contribute to the improved health of consumers.

Another intensely examined and interesting phenomenon is the area of sustainable consumption, which was studied by Giampetri et al. (2016). Their research was dedicated to farmers markets and their potential to promote sustainable agricultural production and consumption. Giampetri et al. offer an insight into the issue of sustainable consumption, stating that by reducing the number of participants and distances in the food chain, alternative food networks and links between farmers and consumers are supported. The research showed that consumers preferred direct contact with producers, contributing to farmer's incomes, and making environmentally responsible choices. These preferences reflect the characteristics of products that are specific to farmers' markets. Bogomolova et al. (2016) focus in their publication on global value chains which in recent years have become an increasingly rich source of traditional, as well as modern foods. Despite the fact that chains are still very popular, consumers increased their preference for local sources and food supplies as those are perceived to offer next to health also economic and community benefits. Local foods are mostly purchased in specialized stores and at farmers' markets. Supermarkets, which are interested in increasing or launch the sale of local product ranges, are also making them more affordable. The authors Kita (2016), Konštiak (2007), based on

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their own research, have found out that attempts to link theoretically available foods in traditional markets and supermarkets are different. Hanava et al. (2015) conclude that the choice of local food stores depends on a compromise between the degree of credibility of information obtained at the store and its associated costs - especially time and comfort. According to Sullivan et al. (2013), small and medium-size producers use direct marketing and farmers' markets to find customers without the use of supply chain intermediaries, which typically increase the cost of acquiring products for consumers (Kita, Konštiak, 2009). The authors in this study identified two market segments of farmers: those who traded only with farmers' markets, and those who traded foods in cross-shops. Purchase of local foods and origin of foods were taken into consideration when buying foods. The condition "to buy local foods" played an important part in differentiating the segments of farmers' markets.

2 Methods

The questionnaire survey was aimed at consumers in the region of Dunajská Streda who shop at local markets in towns Dunajská Streda, Šamorín, Veľký Meder, and Gabčíkovo. The collection of information was carried out in the form of a personal inquiry and the data collection was carried out in the period from the 18th September 2017 to 31st October 2017. In total, 435 correctly-filled questionnaires were collected in the questionnaire survey. Respondents by gender included 181 males and 254 females.

The collected data resulting from the questionnaire survey helped to establish an objective, which is to identify and characterize the motivation of consumers who shop at farmers' markets based on the chosen factors in the region of Dunajská Streda.

To achieve the set objective, the following hypotheses were established:

1. Consumers who perceive shopping at farmers' markets as an experience have a preference for shopping at farmers markets.
2. The preference for shopping at farmers' markets is significantly linked to the preference for fresh foods
3. Shopping at farmers markets depends on the individual's income.

The validity of these hypotheses was verified by statistical tests, namely the Pearson correlation coefficient, Spearman correlation coefficient (H1, H2) and the ANOVA (H3) parameter test. The Pearson correlation coefficient was used for verifying the hypotheses H1 and H2. Pearson correlation coefficient measures the degree of linear correlation in a relationship between two randomly selected variables (parameters), when they are measured at least on the interval scale. This coefficient gets the value <1;1>. In case the Pearson correlation coefficient gets the value 0, this means that there is no relationship between the selected variables. In case the value is 1, it expresses a direct linear relationship between each other, expressing the increase of one variable caused by the increase of the second variable. If it gets the value -1, it expresses a relationship that causes a decrease in the second variable if one variable is increased. Spearman correlation coefficient was used to confirm or refute the hypotheses H1 and H2. Spearman correlation coefficient belongs to non-parametric methods using sequence variables or interval variables without normal distribution. It also acquires values in the interval <-1,1>.

To verify the third hypothesis H3 ANOVA test (ANOVA-Analysis of variance) was used. This method is based on the evaluation of relationships between variations of the compared sample sets. In order to verify the influence of one random variable for a given individual, the value of a sign, which can be observed in an individual, has a statistically significant influence. The source data was collected and evaluated in Microsoft Excel. The subsequent statistical hypotheses verification was carried out in the program SPSS.

3 Research results

The questionnaire survey was carried out on the sample which was chosen randomly in the region of Dunajská Streda. Based on the collected data it is possible to define the following socio-economic information about the questionnaire respondents.

3.1 Socio-economic information about the sample of respondents

Table 1 Respondents according to the age group

Age group	%	n
Less than 18	3%	13
18 - 25	24%	103
26 - 35	20%	85
36 - 45	18%	80
46 - 59	17%	75
60 - 75	16%	68
More than 75	3%	11

Source: Own processing

The most numerous group consists of respondents between 18 and 35 years old (in total almost a half of the respondents). The results of the research show that the most frequent visitors to local markets he customers between 18 and 35 years old, which means that the whole age spectrum was represented in the questionnaire.

Table 2 Respondents according to the income

Income	%	n
up to 380€	27%	116
381€ - 500€	20%	86
501€ - 750€	23%	98
751€ - 1000€	17%	76
1001€ - 1250€	8%	35
1251€ - 1500€	3%	14
1500€ and more	2%	10

Source: Own processing

Participants of all income groups took part in the questionnaire survey, although the income groups were not represented evenly. The largest group consists of respondents with income of up to 380 euros, which means that they are low-income respondents. The second largest group is composed of the respondents with income between 500-750 euros. The least numerous group is the respondents with income above 1,500 euros.

Table 3 Respondents according to the economically active population

EAO	%	n
unemployed	4%	16
employed	57%	249
maternity/paternity leave	4%	17
pensioner	17%	75
student	18%	78

Source: Own processing

In case of putting the respondents into groups according to the economically active population, it is clear from the table that the largest group are the employed respondents followed by the group of students and pensioners, which may explain why the largest group of respondents averaged an income lower than 380 euros.

Table 4 Respondents according to the number of family members in the household

Number of family members in the household	%	n
one	8%	36
two	25%	110
three	28%	121
four	28%	122
five	9%	38
six	1%	4
seven	1%	3
thirteen	0%	1

Source: Own processing

Most of the respondents live in families with two, three or four members, which can be seen in table 4. Based on the results in table 4, it is clear that respondents tend to live with someone else, rather than alone, which also influences their behavior at local markets.

3.2 Verification of the validity of the hypotheses

In order to achieve the main goal, three hypotheses were established, and they validity was subsequently verified.

H1. Consumers who perceive shopping at farmers markets as an experience, prefer shopping at farmers' markets.

Hypothesis 1 was verified at a level of significance 0.05 by Pearson and Spearman correlation coefficient. Hypotheses H0 and H1 were accepted to verify Hypothesis 1.
H0 = The perception of the atmosphere in the agricultural markets is unrelated to the frequency of their purchase at farmers' markets.
H1 = The perception of the atmosphere at farmers' markets is related to the frequency of their purchase at farmers' markets

Table 5 Calculation of the Pearson correlation coefficient for n=435

		X	Y
X	Pearson Correlation	1,000	0,445
	Sig. (2-tailed)		0,000
	N	435	435
Y	Pearson Correlation	0,445	1,000
	Sig. (2-tailed)	0,000	
	N	435	435

Source: Own processing

Table 6 Calculation of the Spearman coefficient for n=435

			X	Y
	X	Correlation Coefficient	1,000	0,443
		Sig. (2-tailed)		0,000
		N	435	435
	Y	Correlation Coefficient	0,443	1,000
		Sig. (2-tailed)	0,000	
Spearman's rho		N	435	435

Source: Own processing

The results show that both Pearson and Spearman correlation coefficient have similar results. Pearson correlation coefficient reaches the value 0.445. Spearman correlation coefficient has the value 0.435. The importance of these coefficients is confirmed by the calculated p-value. The calculated p-value demonstrates that H0 is rejected and H1 accepted. The results show that the Hypothesis 1 was confirmed, which demonstrates that the perception of the atmosphere at farmers' markets is linked to frequency of shopping at farmers' markets.

H2. Preference of consumer purchases at farmers' markets is significantly related to preference of food freshness

Similar to Hypothesis 1, Hypothesis 2 was also verified at a level of significance 0.05. The following were determined:
H0 = The preference of consumer purchases at farmers' markets is related to the preference of food freshness.
H1 = The preference of consumer purchases at farmers' markets is not related to the preference of food freshness.

Table 7 Calculation of Pearson correlation coefficient for n=435

		X	Y
Y	Pearson Correlation	1,000	0,535
	Sig. (2-tailed)		0,000
	N	435	435
X	Pearson Correlation	0,535	1,000
	Sig. (2-tailed)	0,000	
	N	435	435

Source: Own processing

Table 8 Calculation of Spearman correlation coefficient for n=435

			X	Y
	X	Correlation Coefficient	1,000	0,422
		Sig. (2-tailed)		0,000
		N	435	435
	Y	Correlation Coefficient	0,422	1,000
		Sig. (2-tailed)	0,000	
Spearman's rho		N	435	435

Source: Own processing

Pearson correlation coefficient has the value 0.535 in Hypothesis 2 and the value of Spearman coefficient is 0.422. It can again be observed that there is no great variation in these two correlation coefficients. The importance of these correlation coefficients is confirmed by the calculated p-value. On the basis of the p-value (approximated to 3 decimals numbers is 0,000), H0 is rejected and H1 is accepted, which means that the consumers' preference at farmers' markets is significantly related to food freshness.

H3. Shopping at farmers' markets depends on the income

When verifying the H3 hypothesis, a level of significance 0.05 was determined.
H0 = People with different incomes have the same willingness to buy at farmers' markets
H1 = People with different incomes have a different willingness to buy at farmers' markets

Table 9 Calculation for median for n=435

I prefer buying foods at farmers' markets.	Mean	N	Std. Deviation	Median
Up to 380	3,06	116	1,239	3,00
381 - 500	2,79	86	1,118	3,00
501 - 750	2,81	98	1,071	3,00
751 - 1000	2,80	75	1,166	3,00
1001 - 1250	2,69	35	1,132	3,00
1251 - 1500	3,14	14	1,292	3,00
1501 and more	2,40	10	1,075	2,00
Total	2,86	435	1,158	3,00

Source: Own processing

Table 10 Calculation of the test ANOVA for n=435

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9,901	6	1,65	1,24	0,287
Within Groups	571,823	428	1,336		
Total	581,724	434			

Source: Own processing

The results of the statistical test ANOVA show that the p-value is 0.287, which is bigger than 0.05, therefore H0 must be rejected and H1 is accepted. Hypothesis 3 was not confirmed; therefore, it can be concluded that people with different incomes have the same willingness to shop at farmers' markets. The willingness to buy at farmers' markets is not related to income.

4 Conclusions

The achieved results show the importance of paying attention to the overall atmosphere at farmers' markets as it affects the frequency of shopping. An important finding of this study is that income as a factor of motivation does not influence people's willingness to shop at farmers' markets. Another surprising finding of this study was that income had no effect on the willingness of respondents to shop at farmers' markets. The finding that consumers who perceive shopping at farmers' markets as an experience, prefer shopping at such markets, has implications for farmers who in order to develop their local markets in the region Dunajská Streda should accentuate the involvement of their customers in the purchasing process. Farmers and small food producers should use this finding for the development of local and farmers' markets. That is also the reason why it is important that farmers and small producers offer besides their produce also offer a shopping experience that consumers are looking for. By offering, in addition to their produce, added value in the form of an experience, consumer's preferences to purchase products on farmers' markets increases. The same applies to the factor of food freshness, which is perceived to be higher than in traditional distribution channels and therefore constitutes a comparative advantage for farmers' selling on those markets. The authors agree that further research should be conducted in other regions in order to see if the same preferences are held also in other regions of Slovakia. The region Dunajská Streda is rapidly progressing with a potential to focus on the development of farmers' markets, since, based on the survey results, it is possible to state that consumers are interested in farmers' markets. Further research will focus on the farmers' and small food producers' viewpoint. The aim is to find out how, from their perspective, to develop farmers' markets that such earnings will make up a larger proportion of their income while maintaining constant contact with customers.

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Selected Czech and Slovak Destinations and their Life Cycle

Andrej Malachovský

Abstract: *The concept of tourist resorts´ lifecycle is derived from the theory of product life cycle. In the tourism theory we understand a destination as a point of crystallization which integrates nature, culture and services to meet the visitors´ demand and is a tourism product. The research subject of this paper is the classification of destinations depending on the development cycle. For evaluating of the impact of tourism on regional development is the measuring the tourism life cycle an important element in assessing the need for investment. This paper deals with the implementation of tourism area life cycle in selected destinations in Czech Republic and Slovak Republic (Spindleruv Mlyn and Donovaly). We examine supply, demand, residents and selected economic indicators which help us to identify phases of the life cycle of both destinations.*

Key words: Tourism · Destination · Tourism Area Life Cycle · Residents · Cconomic Indicators

JEL Classification: Z32 · Z38 · Z39

1 Introduction

Tourism represents a dynamic sector of national economy with a direct and induced effect on related industry segments. In different regions, tourism is concentrated into centers of gravity- tourist resorts, which are predominantly research object of this paper.

Tourist resort plays a key role in visitors´stay and therefore in demand for tourism services together with its transport accesibility, amenities for tourists´ demand fulfilement and attractivities in the area in question. Tourist resort as a tourism destination can not offer everything to everyone, it can only meet the expectations of a selected segment-target group of visitors, whose needs and wishes it is able to satisfy (Gúčik, 2011, p. 247). A coordination and cooperation of public and private sectors, provided by an effectively functioning destination management organization, serves to succeed in the competitive market (Marčeková 2009, Marčeková 2011, Klepek 2014). It is therefore important to ensure a precise definiton of offered partial products and coordination of different tourism subjects´ activities in the tourist resort.

The theory of the tourist resort lifecycle is not a new concept in tourism literature; it was first outlined in the 1960s by various authors (Christaller, 1963; Cohen, 1972; Plog, 1973; Doxley, 1975 In Mason, 2003, p. 33). This theory as we know it nowadays was developed and published by R.W. Butler in 1980 and almost immediately it became the subject of a number of debates. Many experts cite Butler in their publications and they use his theory in examination of the tourism development (Pompurová 2010, Pompurová – Šimočková 2014). Tourist resorts tend to follow a similar pattern. They gradually pass through various phases to eventually reach the saturation phase, leading to a decrease in visitation. If the management representatives in public and private sector want to prevent such a decrease, they necessarily have to innovate their product – the tourist resort, or to target, adjust and offer it to other groups of visitors on the basis of market segmentation. This can be achieved by selection of appropriate development and marketing strategies (Hitka, 2015). Tourist resort lifecycle is playing a significant role also in destination marketing and implementation of marketing strategy forom the viewpoint of its effectiveness (Kiráľová, 1995; Kiráľová 2003; Kiráľová – Straka 2013) A determination of the existing lifecycle phase of the tourist resort may be significantly helpful. It is obvious that each tourist resort is unique, it has its own attributes, different conditions and environment, and therefore it is not possible to create universally valid model that can predict the exact future development and which could be dogmatically followed by managers (Manete, Ceolotto, 2004). The theory of the tourist resort lifecycle is rather an effective tool, which is based on the theoretical background, empirical observations and can be used in strategic decision-making process. Its use should be aplied on the same characteristics as tourism as a whole - it is open and dynamic (Jarábková, Melichová, Majstríková, 2014)

In this paper we try to verify the lifecycle model in terms of two mountain tourist resorts, one located in Slovakia and the other one in Czech Republic. Based on primary and secondary data, we examine the offer, demand, residents and selected socio - economic factors affecting the development of tourism in mountain tourist resorts Donovaly and

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Spindleruv Mlyn. Based on selected indicators, we try to identify the phases of the resorts´ lifecycles and following the conclusions of the analysis, we formulate possible development scenarios of the examined tourist resorts profiting the standard use of recreational areas.

2 Methods

We obtained the material necessary for the analysis from secondary sources of information; we used predominantly books, journals and other information sources such as annual and financial reports of tourism organizations in examined tourist resorts and statistics of statistical offices. Primary sources of information are based on questionnaire survey conducted among visitors and residents of examined tourist resorts. Collected data were processed with the use of statistical software SPSS. This work focuses on mean values, correlation analysis, Pearson and Spearman correlation coefficient and statistical inference (extension of survey results to the population).

Based on the theory of tourist resort lifecycle we identify 11 factors using Delphi method, as followed we determine particular weight in the range from 1 (lowest importance) to 5 (most important) (Table 1).

According to Buhalis (2000, p. 105), we determined to each factor a characteristic expression for each phase of the lifecycle. Subsequently, we adjust these values with their weight, so we get the mean values of the intervals. Following their modification concrete intervals can be determined for each phase, which will help us to arrive at a theoretical basis for our calculations. We sum up the number of existing items in various phases of the lifecycle A - E. We identify the phase of tourist resort lifecycle as the highest frequency of existing items A - E. In case that the frequency for two phases is the same, we understand it as a transition from one phase to another. For further and more accurate identification we use descriptive characteristics, as well as graphical layout.

Table 1: Selected factors of tourist resorts´ development and their weights

Designation	Factor	Weight
(a)	Number of visitors	4,38
(b)	Accommodation capacity	3,88
(c)	Occupancy rate in %	4,00
(d)	Amenities of tourism facilities	4,25
(e)	Attractiveness of tourist resort	4,38
(g)	Prices of tourism services	3,50
(j)	Local taxes and fees	3,25
(n)	Crime rate	2,75
(p)	Cultural monuments protection	3,75
(r)	State of the environment	4,25
(s)	Traffic situation	3,00

Source: Own elaboration, 2016.

Research was conducted in two traditional tourist resorts in Slovakia and Czech Republic- Donovaly and Spindleruv Mlyn. We questioned 320 visitors in both resorts; from which 84 were local residents of Donovaly (on 31.12.2016, the total number of residents was 198) and 200 residents of Spindleruv Mlyn (on 1.1.2016, the total number of residents was 1 175). The representativeness of research sample was verified with the use of Chi- square test. We used stratified quota sampling. These calculations are based on data from statistical offices. The sample consists of visitors, local residents and managers of tourism enterprises in selected tourist resorts.

For the needs of this research we used two different questionnaires and a structured interview. We tend to monitor selected indicators, to which we adjusted a specific weight based on a panel discussion. Visitors evaluate the factors on a 4-point Likert scale varying from "too high" (4) the "too low" (1); respectively "completely satisfying" (4) to "not at all satisfying" (1). We calculate mean values using MS Excel for the measured data. Studied factors help us to place the tourist resort on the lifecycle curve with respect to the demand and supply side.

Structured interviews were conducted with managers of core businesses and organizations that coordinate development and participate in strategic decisions in the tourist resorts. Questionnaire for visitors focused on their perception of the product and the overall attractiveness of the tourist resorts. Questionnaire for residents focused on their perception of the tourism impact in the resort, in their place of residence. Questionnaires used in data collection are based on questionnaires used in the pre-research, which we modify and add necessary questions; revealed shortcomings in the pre-research will be removed. The obtained data are classified on the basis of individual questions in the questionnaires and are recoded in MS Excel, allowing us to use this database in a specialized statistical software SPSS. Studied factors that we examine among visitors as well as residents are statistically averaged.

Identification of the lifecycle phases of examined resorts will be used in connection with the creation of tourism development strategies with respect to a standard use of recreational areas.

3 Research results

We consider the tourist resort Donovaly as a traditional resort. It is located near the so-called mountain village, which lies at an altitude of about 960 a. s. l. Its territory lies on the boundary of the Low Tatras National Park and Velka Fatra national park. The resort consists of six indigenous settlements (Donovaly, Bully, Polianka, Mistríky, Mišúty, Hanesy, Sliačany) and four tourism sites (Centrum I, Centrum II., Vrchbáň, Pod Magurou). The area of 17.5 square kilometres is inhabited by 231 permanent residents.

The tourist resort Spindleruv Mlyn may be considered as a traditional tourist resort. It is located in Krkonoše, in the Hradec Kralove region 720 above sea level. Its total area of almost 77 km2 is inhabited by about 1,400 people.

3.1. Comparison of examined tourist resorts

Donovaly. We consider the tourist resort Donovaly as a traditional resort. It is located near the so-called mountain village, which lies at an altitude of about 960 a. s. l. Its territory lies on the boundary of the Low Tatras National Park and Velka Fatra national park. The resort consists of six indigenous settlements (Donovaly, Bully, Polianka, Mistríky, Mišúty, Hanesy, Sliačany) and four tourism sites (Centrum I, Centrum II., Vrchbáň, Pod Magurou). The area of 17.5 square kilometres is inhabited by 231 permanent residents.

The most important tourism attraction is the ski resort Park Snow. It offers to the visitors a total of 14 lifts and 2 funiculars with total capacity of 14,100 people per hour. Visitors can profit from 17 ski slopes with more than 11 km of groomed ski trails, of which more than 7 km are man-made produced snow. The resort offers 19.4 km of cross-country ski trails. Cooperation with the resort Malino Brdo resulted into the introduction of a common ski pass.

In summer period visitors can use Bike Park with bicycle rental, paragliding and Fun Arena with bobsled, climbing wall, rope center and trampolines. Dozens of kilometres of marked hiking trails can be found in wider surroundings. A fairy-tale village Habakuky, opened to the public in 2009, offers not only rich cultural program for children but as well architectural solutions for all visitors.

42 tourism businesses were included into the survey, while only 19 continued to cooperate, which represented 45.24%.

The accommodation taxes are set by the municipal regulation to 0.50 € per person per night. Within the survey we questioned 33 accommodation facilities, of which 14 responded, this represent 42.42%. In long- term view the accommodation capacity in tourist resort Donovaly increases. Currently, the number of beds in the resort Donovaly is about 8,000 and the number of rooms almost 2000. The total capacity of the hospitality facilities is about 2,000 seats.

Table 2 Comparison of selected indicators of examined resorts

Indicator		Donovaly	Špindl. Mlýn
Number of visitors	Number of inhabitants	231	1 400
	Area suitable for construction in ha	71	130
	Number of visitors	198 293	211 000
	Share of foreign visitors	32,34%	43,10%
Accommodation facilities	Capacity of accommodation facilities	7 650	7 555
	Use of accommodation facilities	60,00%	70,37%
	Incomes from accommodation taxes	104 103 €	306 383 €
	Accommodation tax tariff	0,50 €	0,58 €
	Capacity limit (beds/ha)	80 - 100	80 – 100
	Current state	107,75	58,12
Main attraction	Ski slopes (m^2)	850 000	1 500 000
	Current max. capacity person/hour	14 100	20 543
	Limit capacity in m^2/person. - minimum	400	400
	Current state - capacity	60,28	73,02
	Current efficiency	4 450,26	6 818,18

Source: Own elaboration (2016)

Spindleruv Mlyn. The tourist resort Spindleruv Mlyn represents a mountain and predominantly a ski resort. It offers 5 funiculars and 11 ski lifts with a total capacity of more than 20,000 persons per hour. Visitors may enjoy 25 km of ski runs about 85 km of cross-country trails (85% artificially snowed if necessary), as well as three snowparks with obstacles designed for extreme skiing and snowboarding; tobogganing, snowtubing, natural ice rink and two children's parks. Additional services include ski schools and ski rentals.

70 km of marked hiking trails, bike trails, bike park, bike rent, bobsled, paragliding, golf, two rope parks, scooters, fishing, climbing wall, scenic flights by plane or tennis courts are available during the summer season.

Visitors may profit from bowling, squash, shooting, art center for children and adults, Špindl aquapark and several hotel pools all year-round.

89 tourism businesses were included into the survey, while 46 continued to cooperate, which represented 51.69%.

The obtained data, which vary significantly for individual resorts, will serve us to determine the life cycle of the individual tourist resorts and to select an appropriate development strategy. Exceeded values of recreational areas standards are highlighted

3.2. Tourism area life cycle in mountain resort Donovaly

Via the sums of the final phases, we found out that for Donovaly the most numerous phase is D (stagnation). Graphical display of development of basic indicators (number of visitors, sales, number of beds x availability) confirms that the tourist resort Donovaly is at the phase of consolidation with elements of phase stagnation. This phase is accompanied by a slight increase of the number of visitors, as well as accommodation capacities. Based on the theory of tourism area life cycle we model potential development. The rate of growth of visitors will not grow significantly, the intensity of building new accommodation facilities slows significantly, which offer is very high. Availability reaches a relatively high percentage, in the future; there could be an overall decline of the occupancy rate. Apartment houses are causing overall stagnation, as they have lower occupancy rate and also fail to provide accurate statistical information. This houses impacts on the area and on the high seasonal fluctuations. Since this is a mountain resort with a distinct winter season, management efforts to increase the performance during the summer season, which is beginning to show already. This effort can keep the accommodation capacity to maintain in favorable terms.

Figure 1 Tourism life cycle of Lourenç, Donovaly
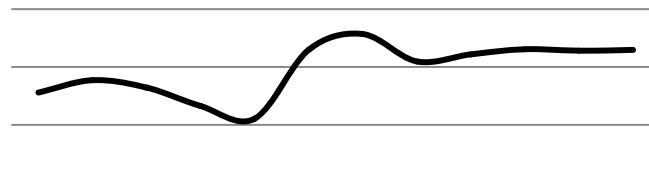
Notes: Axe A – (Period 2012 – 2016)
             Axe B – (Number of tourists – Critical Range of Element of Capacity – Phases - Exploration, Involvment, Development, Consolidation, Stagnation, Rejuvenation, Decline)
Source: Own elaboration, 2016.

The local economy depends on tourism. Because of this fact it is sensitive to changes, for example in the case of adverse development climatic conditions during stronger winter season, which in the future could lead to the imbalance. Gosling (2010) points out that climate change and economic recession in the life cycle of tourist resort can cause abortion, after which the tourist resort can continue in the previous cycle, or start a new one. Management activities of centrobaric enterprise to enhance the summer season and off-season in this case are highly desirable and justified. The unemployment rate is lower than the regional and national average, a high proportion of employment in tourism is expected also in the future. After investing to the construction of the ski lifts, as well as to new high-capacity hotel facilities and apartment houses we do not expect more significant investments. They come up to the transition to rejuvenation phase of resort. Even in the context of a potential decline in investment and a decline in the rate of growth of visitors may be fall in income of residents employed or doing business in tourism. While the profitability of the private sector should continue to be high, local government revenues will depend not only on the accommodation capacity utilization, which may decline, but also on the efficiency of tax collection and local taxes especially from apartment houses. Donovaly has the substantial increase of the facilities of this type. They are often not facilities providing accommodation services, but are registered as housing unit for which the accommodation tax is not applicable. They are also subject with a lower rate of property tax.

Local residents, especially those who do not work directly or indirectly in tourism, perceived high number of visitors with a degree of irritation, which may lead to degree of antagonism. Growth of attractiveness of resort has brought not only the influx of new employees, but also significant migration of population from other regions of Slovakia in order to purchase real estate. In the ownership structure of real estate we can find a significant share of foreign owners who gradually exceed the equilibrium state and in the demographic structure of the resort will dominate immigrants. For most of them, Donovaly is not the place of residence, but only a transitional holiday destination. This fact may be problematic in the further planning of tourism for local government and will affect the use of infrastructure.

The pressure on the environment and the landscape is growing in the resort. It is necessary to compare the high number of visitors and capacity of accommodation facilities and ski lifts, cable cars and tracks with the limit capacity of the resort. In the current situation, it appears that this capacity is very close to be exceeded; respectively some have already been exceeded. The density of construction should be driven by the current zoning plan, respectful of sustainable development. This construction in recent years took place in an uncoordinated way, what has a negative impact on experience for visitors in the resort. Traffic situation is complicated especially in winter season because of the truck transport. The further development of the resort and the growing number of visitors can lead to an overall deterioration of traffic and lack of parking places. A tunnel through Hiadeľské sedlo should help tourism, but its implementation is indefinitely pushed.

In relation to responses to market development plays a major role in addition to the municipality centrobaric enterprise, operator of ski lifts and cableways Park Snow Donovaly, company GOIMPEX BRATISLAVA, limited company. The aim of resort marketing remains to persuade existing and potential guests about advantages of their next visit. Activities should be focused on defense and maintain of market position. Marketing costs, which represent in long term about 2,5 % share of revenues, would not be changed, in the future can be expected a slight decrease, respectively, significant growth in the rejuvenation phase.

3.3. Tourism area life cycle of Spindleruv Mlyn

Via the sums of the final phases, we found out that the resort Spindleruv Mlyn is most numerous the phase C (consolidation) and is significantly represented at the phase D (stagnation). Graphical display of development of basic indicators (number of visitors, sales, number of beds x occupancy) shows that tourist resort Spindleruv Mlyn slowly leaves the phase of consolidation and enters to the phase stagnation.This stage is accompanied by a slight increase of the number of visitors, as well as accommodation facilities. Based on the theory of tourism area life cycle we model a potential development. The growth rate of the number of visitors decreases slowly. Number of beds and their utilization reaches high values, there are any significant changes, but we can expect a decrease occupancy rate. As well as Donovaly, seasonal effects are very large and dominant season is winter.

Figure 2: Tourism life cycle of Lourenç, Špindlerův Mlýn
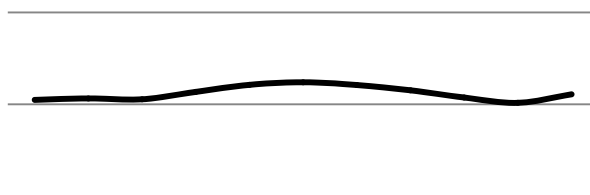
Notes: Axe A – (Period 2012 – 2016)
              Axe B – (Number of tourists – Critical Range of Element of Capacity – Phases - Exploration, Involvement, Development, Consolidation, Stagnation, Rejuvenation, Decline)
Source: Own elaboration, 2016.

The local economy depends on tourism and in case of adverse developments of tourism is vulnerable. High total employment, and a high proportion of tourism will persist. Investments are made continuously; we do not expect significant influx. Profits of private companies after reaching maximum values in the previous phase of the life cycle are still high, by moderate rate are gradually declining. Collected tax in the form of spa and recreation taxes and accommodation taxes follow similar development too. We do not expect a significant increase, rather a slight decline.

Slightly negative relationship between residents and visitors may widen by further development, particularly in the case of a negative development in the tourist resort, subsequent the outflow of funds and jobs and the increase of unemployment.

Increased requirements on the environment and on the cultural heritage, together with a decrease of the economic power of local businesses can result their significant damage. We still expect increasing the density of construction and transport.

As we already mentioned, the resort may go through several phases at the same time in connection with products or target groups, after one phase can begin the next phase or may be temporarily interrupted. A good example is the resort Spindleruv Mlyn. We have shown the development of tourism in the resort in the previous period. We outline potential opportunities of development in the coming years, in the case that the curve of the resort was maintained. In November 2013, the owner of the resort and their operator Czech Sports Association, was arguing that the revenue of the resort began to fall, and without further investment, which has Czech Sports Association funds would not be sufficient turnover realistic, rented the resort for 20 years to company Melida, limited company, which forms the two companies - Slovak Tatry mountain resorts, and Czech Snowhill. The new operator will pay an annual rent of 43,8 million CZK (approximately 1 697 000 EUR) and for the whole period of the rent is committed to invest 800 million CZK, which is about 30 990 680 EUR. The investment includes the construction of new lifts, ski trails, and other infrastructure. The rent contract is also an option for another 20 years. We can assume that the resort of its life cycle curve shifts back to growth phase, respectively, begins its existence in the new curve.

4 Conclusions

The development of tourism in the tourist resort cannot be perfectly predicted, but by using the theory of tourism area life cycle of the resort we can estimate trends and to respond timely and create correct management decisions. Based on the identified results we formulate some recommendations for management of tourism resorts.

Destination management organization should coordinate the development of tourism, integrating public and private sector, which would be responsible for these decisions. This destination, the municipality or centrobaric enterprise should anticipate and coordinate the development of the resort. Practice shows that micro- and small enterprises, that predominate in tourism, are usually not able to think and act in long-term, focusing on their economic goals at the moment (making profit, maintaining a position in the market, etc.). Often they do not have enough financial, material, organizational or personnel resources to be leaders in innovations and environmental and sustainable development. Their activity is generally uncoordinated. In this case is necessary to cooperate and promote common long-term interests at the expense of short-term individual.

It is also important that the construction and investment activities in the resort must be under spatial planning by well-developed zoning plan. The aim of spatial planning is through continuous and comprehensive settlement of the spatial arrangement of the territory and land use to create the conditions for sustainable development. Any attempts of interest groups to change the zoning plan should be carefully assessed by professionals. The limiting factor of the research was the period in which data was collected and the availability of statistical data.

In conclusion, we can say that the development of tourism at the tourist destination should be based on clearly defined strategy (following the analysis); the management must monitor the internal and external factors affecting the destination and try to predict future development in what can help using of model of the life cycle.

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Demand of Slovak Residents for Volunteer Tourism

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Abstract: *Globalization and technological changes have gradually changed the image of contemporary tourism and the way how people spend their leisure time as well. The postmodern values are reflected in the possibilities and demands of visitors, with which the theory and also the practice of tourism seek to keep pace. New, dynamically developing trends in the global environment include volunteer tourism, which, as an alternative, ecological and socially responsible form of travel, combines learning, entertainment, cultural and sporting activities with a job beneficial to a society without a financial reward. Volunteer tourism is developing slowly in Slovakia. The aim of the paper is to map out the satisfied and potential demand of Slovak residents for volunteer tourism. Based on primary research the paper examines the activities of voluntourists, motivation and barriers to engage in volunteer tourism at home country and abroad. Although the results of the qualitative research cannot be applied to Slovak residents as general yet, the paper provides valuable partial information on the current demand of Slovak residents for volunteer tourism, which the body of Slovak literature has neglected.*

Key words: Volunteer Tourism · Voluntourists · Demand of Volunteer Tourism · Motivations · Barriers

JEL Classification: L83 · O15 · Z32

1 Introduction

Volunteer tourism is a combination of two elements, volunteering and tourism. Although this combination has its history back to the 19th century when missionaries, doctors and teachers travelled to help others, the interest in volunteer tourism increased especially after a series of terrorist attacks in the USA (2001) and massive earthquakes in Indonesia that triggered tsunami (2004). Since then, the raising awareness of environmental and humanitarian issues has prompted many volunteer organisations to cooperate with travel agencies (Rattan, 2009), thereby increased the supply of tourism products including volunteering. Volunteer tourism has become the centre of attention of governmental institutions, both non-profit and profit organizations that see it as a creative solution to various social and environmental problems. Currently, it is considered to be one of the rapidly expanding markets. Volunteer tourism attracts more than 1.6 million people per year and its market value is estimated at 1.76 to 2.63 billion US dollars (Tourism Research and Marketing, 2008 In Wearing, Grabowski, 2011).

Volunteer tourism is a way of spending leisure time when people travel for various reasons in an organized way, while staying at the destination, in home country or abroad, combines the voluntary work to solve environmental, cultural or humanitarian issues with the traditional elements of travel in that destination, which is beneficial not only to local communities and the environment, but also to a voluntourists. There is a board variety of projects or activities that come under the scope of volunteer tourism. These include development and environmental projects in developing and developed countries, as well as volunteering at events organized in tourism destinations. Although the development and environmental volunteer abroad projects are the most frequently researched projects, Uriel, Reichen and Ron (2003), Holmes et al. (2010), Lyons and Wearing (2012 In Kotíková, 2013) and also Mwaruta (2012 In Taplin, Dredge, Scherrer, 2014) argue that voluntourists in domestic tourism should not be forgotten. They volunteer in the country of their usual residence. According to Holmes et al. (2010), domestic volunteer tourism include volunteering in museums and heritage attractions; in tourist information centres; parks, recreation and conservation; and event volunteering as well.

A survey in 2007 indicates that volunteers are more women than men, aged between 20 and 25 (Tourism Research and Marketing, 2008 In Wearing, Grabowski, 2011). But also seniors and families are attracted to this kind of travel. The choice of such travel is usually morally conditioned (Stebbins, Graham 2004), however, individuals participate in this form of tourism for various reasons ranging from altruism to egocentricity (Lowry, 2017). Some of them are seeking the adventure and authenticity of un-known places, others are having the intention to do something good and to compensate the negative side of travelling (such as pollution, waste and carbon emissions arisen from flying) (Kalmari, Kelola 2009 In Korkeakoski, 2012). Voluntourists, who take part in volunteer projects abroad, are attracted by the sending organisation´s offer (meaningfulness, responsibility of individual projects), the desire to get away from daily routine

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or everyday stress, the opportunity of personal development and the pursuit of fun and adventure (Wearing, 2001; Ingram, 2011; Wickens, 2011). Domestic voluntourists motivate the opportunity to meet up with new people and create new friendships, to make new expediencies, to get free tickets and access to an event, to get promotional materials or even clothing with the event's logo for free and the voluntary work perceive as the meaningful way of spending their free time (Holmes et al., 2010; Mody et. al., 2014; Held, Klerby, 2014, Smith et al., 2014).

There are few researches which has examined the barriers to participation in volunteer tourism. According to Cleave and Doherty, (2005), Holmes (2008) Trafford Council (2011) and Human and Van Graan (2013), the significant barriers include the language barriers, distance of destination, the fear of unknown diseases, some problems with cross-cultural encounters, misunderstanding each other and communication problems with receiving organisation, and limited or lacking funds. In case of event volunteering, the authors argue that potential participants fear responsibility, lack of experience and flexibility, or attractiveness of the assigned work. However, the lack of time is regarded as the most important barrier to participation.

2 Methods

Due to the growing trend of volunteer tourism as an alternative form of tourism, the aim of the paper is to map out the satisfied and the potential demand of Slovak residents for volunteer tourism. An online questionnaire was created for this research. It was divided into three sections. The first section was intended to respondents with the past volunteer experiences. They had to determine in which volunteer activities (volunteer projects abroad, domestic volunteer projects or event volunteering) they were involved. Subsequently, they were asked to indicate on a 5 point Likert scale (ranging from 1 - Disagree to 5 - Agree) motives or barriers to participate in these activities. Only questionnaires fulfilled by respondents who took part in activities that could be included in volunteer tourism´s activities were finally evaluated in this research. The second section had the similar structure as the first one, but was intended to respondents with no past volunteer experience and focused more on the potential voluntourists. The third section of the questionnaire included several demographic questions on the respondents' age, gender, marital status and educational level. Data were collected via email during September 2017.

In the first stage of data analysis the volunteer tourism activities were identified. They were divided according to the location of volunteer tourism projects and events. Thus, both the satisfied and the potential demand for international and domestic volunteer tourism´s activities were examined. The data were processed by means of a descriptive statistics. In the second stage of data analysis, the motives and barriers to participate in volunteer tourism were evaluated. The rank of factors was determined by the mean score calculated by Friedman´s test in SPSS Statistics.

The surveyed sample is composed of 96 respondents (65.6 % women and 34.4 % men) aged 15 to 60 years. Majority of respondents are those with master degree (49.0 %) and the secondary education (24.0 %). The higher number of respondents are employed (50.0 %) and students (27.0 %). The profile of respondents is represented in Table 1.

Table 1 Profile of respondents

Items		%
Gender	Male	34.4
	Female	65.6
Age	< 20 years	10.4
	20 – 29 years	46.8
	30 – 39 years	31.3
	40 – 49 years	5.2
	> 50 years	6.3
Status	Student	27.0
	Employed	50.0
	Unemployed	7.3
	Self-employed	7.3
	On maternity / parental leave	6.3
	Retired	2.1

	Primary	7.3
	Secondary	24.0
Education	Bachelor degree	13.5
	Master degree	49.0
	PhD. degree	6.3

Source: Own processing

The limitations of the research are mainly caused by the size of the surveyed sample. This research was based on period of primary investigation which represented the pre-survey phase of the study of volunteer tourism in Slovakia. The results of the pre-survey cannot be generalized on all inhabitants of Slovakia yet. Represented results are interpreted for the surveyed sample.

3 Research results

The past experience with volunteering had 62.5% of respondents (66.7% women and 33.3% men). They volunteer mostly sporadically (43.3%). 20.0 % of them reported that volunteer once a year and only 6.7 % volunteer every month. A third (33.3%) of all respondents participated in projects or activities of volunteer tourism abroad or in their home country. Although 22.3 % of respondents had no volunteer experience, 77.8 % of them were interested in volunteer tourism. They were attracted by volunteer projects abroad (50.0 %), domestic projects or activities of volunteer tourism (89.2 %) as well as event volunteering (92.8%).

3.1 Demand of Slovak residents for international volunteer tourism

Demand for international volunteer tourism is represented by those Slovak residents, who have participated (or want) in volunteer tourism projects or in events abroad. Only 12.5% of respondents had experience with volunteering abroad. Of these, 91.7% of respondents participated in the volunteer tourism project, and 16.7% of respondents reported they were volunteers at an event organized abroad.

There is a board variety of projects where respondents took part in. These include work with kids and youth (31.3 %), the work in the field of religion (31.3 %), education (6.3 %), creativity and culture (6.3 %), humanitarian projects (6.3 %), social projects (6.3 %) and others (12.5 %). Respondents travelled mainly to developed countries (87.5%), most often in the USA and the Czech Republic (18.8 %). From developing countries, respondents visited Ecuador and Uganda. A third (33.3%) of respondents participated in volunteer tourism projects abroad only once, 25.0% of respondents three times, 16.7% of respondents twice, and 8.3% of respondents reported that they participated in the projects four, seven or ten times. The events volunteering participation was more frequent and respondents attended mainly Christian events and festivals.

Those individuals who have expressed interest in volunteer tourism projects or events organized abroad are significant for volunteer tourism development. As the survey showed, 40.6% of respondents would like to volunteer abroad. About 36.5% of all respondents were interested in volunteer tourism projects and 22.9% of all interviewed respondents in the events organized abroad. More than half of them had previous volunteer experience.

Most commonly women (64.1%), respondents aged between 20 and 29 (43.6%), with high education (53.8%) and students (43.6%) would like to participate in volunteer tourism abroad.

The potential voluntourists were interested mainly in voluntary work with kids and youth (57.4 %). This type of project would be chosen more by respondents with past volunteer experience. Respondents with no volunteer experience would rather prefer environmental projects. Interest in volunteer tourism projects abroad would not change 54.3% of respondents even if they had to pay for their participation. More than a fifth (22.9%) would reconsider their intention depending on the amount of the fee, the working conditions or the current financial situation, 20% of the respondents would change their decision.

Destination preferences of potential voluntourists were different. While only 17.1% of respondents had no specific idea (they would *go anywhere/no matter where* - only respondents with volunteer experience), 82.9% of respondents would choose the country in Europe (65.7%), USA (8.6%), Asia (5.7%) or Africa (2.9%).

3.2 Demand of Slovak residents for domestic volunteer tourism

As mentioned previously, domestic voluntourist play an important role in volunteer tourism (Uriel, Reichen, Ron, 2003; Holmes et al., 2010; Lyons, Wearing, 2012 In Kotíková, 2013; Mwaruta, 2012 In Taplin, Dredge, Scherrer, 2014). They are those Slovaks who have taken part in volunteer projects or activities in museums and heritage attractions, in tourist

information centres, in camps, in parks, in recreation and conservation projects or they have volunteered at events, which were organised not in the place of their permanent residence.

The survey showed, that only 20.8% of interviewed respondents participated in domestic volunteering project or were volunteers at the event organised in Slovakia. Contrary to international volunteer tourism, there were more respondents with event volunteering experience (80.0%). Around 40.0% of respondents participated in volunteer projects or activities of volunteer tourism.

The diversification of domestic volunteer tourism projects was not varied. All respondents reported that they were volunteers at camps, only one respondent participated in the environmental project. On the other hand, the types of events were diverse. Respondents mostly volunteered at cultural events (50.0%), sport events (25.0%) and events organised in the field of community support (25.0%).

The potential demand for domestic volunteer tourism was represented by 53.1% of all interviewed respondents. They were mostly women (64.7%), respondents aged 20 to 29 (66.7%), with university education (50.9%) and employed respondents (58.8%). They were interested in volunteer projects (80.4%) as well as in event volunteering (66.7%). The past volunteer experience had 51.0% of all respondents who have expressed an interest in domestic volunteer tourism.

Because domestic volunteer tourism involves projects and activities carried out not in a place of permanent residence, the distance that respondents are willing to travel was also examined. Although most of the respondents argued that they do not care about distance and would like to participate in interesting projects or events in the whole of Slovakia (50.0% of respondents with past volunteer experience; 68.0% of respondents with no volunteer experience), 42.3% of respondents with past volunteer experience and 52.0% of respondents with no volunteer experience would travel up to 50 km. 23.0 % of respondents with past volunteer experience and 16.0% of respondents with no volunteer experience would participate in volunteer tourism projects or events organized up to 100 km from their place of residence.

3.3 Motivation for participating in volunteer tourism

Motivation is one of the most frequently examined areas not only in tourism but also in volunteering. Researchers are interested in volunteer´s motives, values or needs. The first volunteer tourism studies have explored the motives and barriers to participation, expectations and experience of voluntourists. The changes of the lifestyle and human values have also changed the view on volunteer tourism. For its further development, it is important to understand the motives of voluntourists. Only by understanding the positive and negative attitudes of voluntourists is it possible to design good practices for volunteer management and management of volunteer projects (Wearing, 2004).

Table 2 Motivation of respondents to participate in volunteer tourism

International volunteer tourism		Domestic volunteer tourism	
No.	Motive	No.	Motive
1.	Meaningful way of spending free time	1.	The desire to help others who have less fortunate life
2.	The desire to help others who have less fortunate life	1.	The desire to change the world to a better place
3.	The opportunity to gain new working skills	2.	The opportunity to gain new working skills
4.	Great experience	3.	The desire to learn new things and the environment
5.	The interest in combination of traveling and volunteering	3.	It makes me feel useful
5.	It makes me feel useful	3.	The opportunity to make new friendships
5.	The opportunity to make new friendships	4.	Meaningful way of spending free time
6.	I like traveling and discovering new areas of the world	5.	I believe that what goes around comes around
7.	I believe that what goes around comes around	6.	My friend volunteer too
8.	My friend volunteer too	7.	Great experience
9.	The enhancement of the CV	8.	The enhancement of the CV

Source: Own processing

Respondents, who took part in international volunteer tourism, were drawn to volunteer abroad for a number of reasons (Table 2). The common motive among them was the meaningful way to spend their free time and the desire to help others who have less fortunate life. On the other hand, the enhancement of their CV and the fact that their friends volun-

teer too were the least motivating factors for 55.0% of respondents. Based on respondents' replies, it could be concluded that the strongest motives of respondents who volunteered abroad were altruistic.

Motives of respondents who participated in domestic volunteer tourism were different from motives of respondents who volunteered abroad (Table 2). The motive of helping others and the desire to change the world to a better place were the most frequently stated reasons to volunteer in home country. Respondents argued that did not volunteer in order to enhance their CV´s for improved chances in the job market. With this motive disagreed 38.0% of respondents.

The most important respondent's motives are based on their value orientation. This confirms the Stebbins and Graham´s (2004) argument, that the choice of such type of travel is usually morally conditional. Respondent´s decisions are determined on the conviction of the importance to help others. The least important motive e.g. the enhancement of the CV indicates that respondents did not engage the volunteering in tourism with formal benefits for the future career. However, they realised that their volunteer work experience and skills could be beneficial to them.

The motivation to participate in events was examined separately. Due to the low representation of respondents who were volunteers at events abroad, in this paper only the motives of respondents participating in domestic events are presented (Table 3).

Table 3 Motivations of event volunteering

No.	Motive
1.	Meaningful way of spending free time
2.	Great experience
3.	I believe it is important to help others
4.	The opportunity to gain new working skills
5.	It makes me feel useful
6.	My friend volunteer too
7.	To help to make the event successful
8.	The enhancement of the CV
9.	The opportunity to make new friendships
10.	I believe that what goes around comes around
11.	To get free tickets and access to an event, to get promotional materials or clothing with the event's logo for free

Source: Own processing

All respondents considered the event volunteering as the meaningful way of spending their free time. The opportunity to make new experiences and the desire to help with organising the event were also motivated for respondents. Actually, they disagreed that their participation in the event was conditional upon the receipt of free tickets and access to an event, promotional materials or clothing with the event's logo for free.

3.4 Barriers to participation in volunteer tourism

There is a board variety of barriers that influence the participation in volunteer tourism. They could be based on personal convictions of individuals, but at the same time, they could reflect the cultural, social, economic or political influences of the external environment.

The lack of time was considerate as the most significant barrier to participate in volunteer projects abroad (71.0%). That confirmed the results of foreign surveys (for example Holmes, 2008). The second most fervently stated reason by respondents were the fear of lack of funds (52.0%) and the assumption of high financial costs of volunteer projects abroad (48.0%). On the other hand, the fear of problems with cross-cultural encounters (9.0%) and the fear of unknown disease (26.0%) were stated as the least significant barriers (Table 4).

For respondents who participated in domestic volunteer tourism, the main barrier was the lack of time, too (Table 4). 38.0% respondents were not interested in volunteering generally, 31.0 % stated that the reason is the lack of experiences, and 23.0% respondents preferred donation to volunteering. The high financial costs of participating in volunteer tourism in Slovakia or the communication problems with sending organization (46.0%) were not considerate as significant barriers to participate in volunteer tourism.

Comparing the main barriers to participate in volunteer tourism abroad and in home country, the lack of time was stated as the significant barrier for both groups. Consequently, the barriers were different. While in the case of interna-

tional volunteer tourism, respondents were more worried about the material security of the project, in the case of domestic tourism, respondents were not interested in volunteering or did not trust their own abilities.

Table 4 Barriers to participate in volunteer tourism

No.	International volunteer tourism	No.	Domestic volunteer tourism
	Barrier		Barrier
1.	The lack of time	1.	The lack of time
2.	The limited or lacking funds	2.	The limited or lacking funds
3.	The high financial costs of volunteer projects	3.	The lack of experiences
4.	The lack of information on participation opportunities	4.	Preferring donation to volunteering
5.	The distance of the destination	5.	The fear of carrying out responsible activities
6.	The communication problems with sending organization	5.	The lack of information on participation opportunities
7.	The current world situation (e.g. terrorists attacks)	6.	The communication problems with sending organization
8.	The language barriers	7.	The high financial costs of volunteer projects
9.	I am not interested in volunteering	-	-
10.	The fear of unknown disease	-	-
11.	The fear of problems with cross-cultural encounters	-	-

Source: Own processing

The barriers to participate in the events were examined separately, too (Table 5). Again the lack of time was stated as the main barrier (83.0 %). While 50.0% of respondents were not interested in event volunteering, 33.0% of respondents stated that prefer donation to volunteering. As the least significant barriers were reported the fear of the lack of experience (40.0%) and the fear of responsible activities (33.0%). The most frequent barriers concern the personal preferences of respondents rather than the beliefs in their own abilities.

Table 5 Barriers of event volunteering

No.	Barrier
1.	The lack of time
2.	I am not interested in volunteering
3.	Preferring donation to volunteering
4.	The distance of the destination
5.	The communication problems with sending organization
5.	The lack of information on participation opportunities
6.	The high financial costs
7.	The fear of carrying out the activities, which are nor interesting to me
8.	The fear of carrying out responsible activities
9.	The lack of experiences

Source: Own processing

4. Conclusions

This paper examines the satisfied and potential demand of Slovak residents for volunteer tourism. Based on primary research the paper has presented the activities of voluntourists, motivation and barriers to engage in volunteer tourism at home country and abroad.

Despite the fact that most respondents reported that they already had a past volunteer experience, only a third of all respondents took part in volunteer tourism projects at home country or abroad. The survey showed that respondents participated more in volunteer tourism projects then in the events abroad. They travelled mainly in developed countries, most often in the US and the Czech Republic. They took part in projects mostly focused on working with children and

youth. Respondents are drawn to volunteering abroad for a number of reasons. A common motive amongst them was that it is the meaningful way of spending the free time. Almost a half of respondents reflected the interest to participate in international volunteer tourism. Respondents would rather volunteer at the events organised abroad. Respondents with past volunteer experience who would like to participate in volunteer project would prefer projects focused on working with children and youth. Respondents with no volunteer experience would rather prefer environmental projects. But both would like to travel and work as volunteers in European countries. The lack of time and money was identified as the most frequent barriers to participate in volunteer tourism abroad.

Domestic volunteer tourism was attended by more respondents than international volunteer tourism. Event volunteering is perceived mainly as the meaningful way of spending the free time and the opportunity to gain new experiences. Respondents who participated in volunteer tourism projects were motivated by the desire to help others and to make the world a better place. Respondents volunteered mainly in camps and at cultural events. A half of the respondents has reflected an interest to participate in domestic volunteer tourism. Respondents would prefer volunteer projects rather than event volunteering. Although the majority of respondents reported that the distance to the place where the project is realised, is not important, half of potential respondents would travel no more than 50 km from their place of residence. The lack of time was identified as the significant barrier to participate in domestic volunteer tourism projects. The same opinion was also expressed by respondents who were interested in event volunteering. Another important barrier for both groups of respondents was the preference of other interests than volunteering.

The paper presented the results of pre-survey phase of the study of volunteer tourism in Slovakia. Although they cannot be generalized to Slovak residents yet, they provides valuable partial information on the demand of Slovak residents for volunteer tourism, which are lacking in the current Slovak literature.

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The Food Market in the Slovak Republic in Context of Nutritional Recommendations

Iveta Zentková, Elena Hošková, Martin Richter

Abstract: *The aim of the paper is to find out how the selected demand determinants positively influence changes in actual consumption of foods in Slovak republic, i.e. how individual economic determinants, such as price and income, affect the efforts to adhere the principles of healthy diet of Slovak consumers. For the price and income effects quantification Marshall's demand functions were estimated. The higher impact of consumers income, than price, on the demand was revealed by the analyses realization. The estimates of logit model pointed to a highest positive change probability due to change of consumer income and own foods prices by pork (0.98) and beef (0.96).*

Key words: Demand · Food Market · Consumption · Nutritional Recommendations

JEL classification: D03

1 Introduction

The Slovak goods and services market has overcome many changes over the last decades. Changes occurred also in the food market. The consumer foodstuff expenditures increased together with economic growth and its share on total expenditures decreased gradually in the Slovak republic. Consumers started to prefer quality before quantity with the consumers choice growth. This trend is undoubtedly a contribution of "The Quality Food Labeling" project. In this paper the fact to what extend the Slovak consumers were trying to apply the principles of healthy diet and which economic determinants could affect them in this endeavor was considered. Many domestic and foreign scientists are oriented to the food demand development, its determinants and the nutrition valuable foodstuff consumption.Vrtíková (2016) said, food consumption has been recently subject to several changes and this trend is continuing. More significant changes in volume and consumption structure of each food group occurred. The changes of food consumption were caused by many factors. Zhao (2016) considered lifestyle, purchase experience, health consciousness, income level, price and shopping convenience as significant demand determinants. Price, health and income are the major factors.

2 Methods

For selected demand determinants, in line with economic theory and the results of our recent research (Zentková, Hošková, 2010), the food price and the net income of the consumers was considered. For these reasons, we have been dealing with the Marshall's demand functions.

The positive change in the real food consumption in SR means the yearonyear development of actual food consumption towards the recommended consumption. For those foodstuffs whose actual consumption is higher than recommended, we consideredconsumption reduction as positive change. On the contrary, the positive change in foodstuffs consumption whose actual dosehaven't reached the recommended, we understand its increase. The Slovak Republic Public Health Service quantified recommended consumption true the recommended nutritional doses of food (RND). This created the basic precondition of healthy diet. The RND is expressed as annual consumption of an average consumer in kilograms.[52] For the analyses, foods whose consumption has long been different from RND, milk, card cheese, pork, beef and poultry, sugar, eggs and potatoes have been selected.

Based on available data the analyses were conducted for the period 1998-2016. The Statistical Office of The Slovak Republic and Eurostat were the data source. Before the main analyses, the demand functions estimation for chosen food products were necessary. Those provided the market situation information's.

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[52]http://www.uvzsr.sk/index.php?option=com_content&view=article&id=1014:odporuane-vyivove-davky-pre-obyvatestvo-vnslovenskej-republike&catid=66:vyiva-a-bezpenos-potravin&Itemid=72

The Marshallian demand for *x-th* chosen food product is the function of the price of the *x-th* food product and the net income of consumers.

$$q_{dx} = f(p_x, i) \tag{1}$$

The general linear model

$$y = a + \beta_1 * x_1 + \beta_2 * x_2 \tag{2}$$

The linear model of Marshallian demand has the following form:

$$q_{dx} = a + b_1 * p_x + b_2 * i \tag{3}$$

where:
q_{dx}-   demand for the *x-th* food product in the kilograms and habitants per year
a, b_i –   estimated constant of location and regression coefficients i = 1,2
p_x-   purchase price of the *x-th* food product in EUR $*kg^{-1}$
i-   average income of habitants in EUR $*year^{-1}$

The general power model:

$$y = a.x_1^{\beta 1}.x_2^{\beta 2} \tag{4}$$

The power model of Marshallian demand has the following form:

$$q_{dx} = a.p_x^{b1}.i^{b2} \tag{5}$$

where:
ditto (3)
The general exponential model

$$y = a.\beta_1^{x1}.\beta_2^{x2} \tag{6}$$

The exponential model of Marshallian demand has the following form:

$$q_{dx} = a.b_1^{px} b_2^{i} \tag{7}$$

where:
ditto (3)
For the quantification of sensitivity are estimated the price, income elasticities.

$$Epd = \frac{\%\Delta Qdx}{\%\Delta Px}, \tag{8}$$

where:
Epd – price elasticity of demand
%ΔQdx - percentage change in quantity of demand of chosen food product
%ΔPx –percentage change in price of chosen food product

$$Eid = \frac{\%\Delta Qdx}{\%\Delta I}, \tag{9}$$

where:
Eid – income elasticity of demand
%ΔQdx- percentage change in demand for chosen food product
%ΔI- percentage change in income of consumer

For the impact detection of selected demand determinants on the positive change in actual foodstuffs consumption in Slovak republic the logistic regression model was used.[53]

General logit

$$\ln\frac{p}{(1-p)} = a + \beta_1 * x_1 + \beta_2 * x_2 \tag{10}$$

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[53]<https://books.google.sk/books?id=n9a86Nb9EZ8C&pg=RA1-PA45&lpg=RA1-PA45&dq=logistick%C3%A1+regresia&source=bl&ots=10aoN7znrQ&sig=6NJffhOMRH9zSkDBvKebuco_rG8&hl=sk&sa=X&ved=0ahUKEwjq7JKbrc3XAhUHPRoKHdqZByUQ6AEIQzAE#v=onepage&q=logistick%C3%A1%20regresia&f=false>

where:
β_i – parameters
X_i – conditions

ODP logit

$$\ln \frac{p}{(1-p)} = a + b_1 * p_x + b_2 * i \qquad (11)$$

where:
a, p_x, i - ditto (3)
b_i -beta estimates

The year on year trend

The quantified changes in observed food consumption towards to RND or away RND were the logistic regression inputs:

(1) Towards to RND,
(0) Away from RND.

3 Research results

Milk, cheese card, beef and potatoes are among the foods with insufficient consumption between average Slovak consumers. The maximal consumed volume of above mentioned foods did not meet RND during the observed period (Table 1). For this reason, the average consumed volume is very deep under the recommended. Neither the development of consumption trend was negative. The most significant change in consumption was observed in beef. At the monitored period beginning (1998), the annual beef consumption was 11.8 kg per person (beef consumption decreased by 10kg between 1990 and 1998). At the end of monitored period, the annual beef consumption was 4.9kg per person. The beef consumption decline was caused by confidence loss of Slovak consumers due to numerous HACCP reports. Milk and potatoes consumption declined by 40% in the monitored period. On the one hand, decreasing milk consumption could be caused by reduced adults milk consumption due to increasing lactose intolerance. On the other hand, reduced milk consumption could be caused also by increased fermented milk products and curd consumption.

Pork, sugar, poultry and eggs consumption was higher than RND during the reference period. The minimal consumption readings of eggs and poultry were approaching the RND. However, average sugar and pork consumption were well above RND, their consumption decreased during the period under review. Poultry consumption was slightly fluctuating because of consumers beef and pork substitution.

Table 1 Descriptive Statistics ofconsumption selected food products in kg* consumer^{-1}*year^{-1} (1998-2016)

	RND in kg* con^{-1}*year^{-1}	Minimum	Maximum	Mean	Std. Deviation	Variance
Milk	91	44.40	74.40	55.45	9.43	88.95
Cardcheese	3.2	1.90	2.60	2.13	0.21	0.04
Poultry	15	14.10	22.30	18.56	2.26	5.11
Pork	22.2	28.00	36.90	32.26	2.10	4.41
Beef	17.4	3.60	11.80	6.02	2.29	5.24
Eggs	11.2	11.10	15.60	12.44	0.92	0.85
Potatoes	80.6	46.90	75.20	58.23	9.90	98.09
Sugar	22.1	26.60	34.80	30.95	2.45	6.03

Source: authors calculations

3.1 Marshall's demand functions

In order quantify the impact of the food price and the net income of the consumer on the demand of the SR consumers, selected Marshalls demand functions are estimated. Table 2 gives an overview of the individual coefficients estimates, baseline tests and calculated elasticities. Models that described the impact of price and net income on demand best are presented. Statistically significant are Marshall's demand for milk, pork, beef and potatoes. The consumers income has been proven to be a significant determinant of the demand for these foods. Considering the negative correlation of the

regression coefficient in demonstrable models, we can assume that milk, beef and potatoes are considered by Slovak consumers to be inferior. However, the results of our research in 2010 (Zentková, Hošková, 2010) have shown that aggregated food groups behave as superior goods. This indicates that, although demand for, for example liquid milk declines with an increase in intake, demand for an aggregated food group milk and dairy products is growing with increasing intake. According to the quantification of income elasticities, the 1% increase in income has the biggest impact on demand for beef, which reduced by 0.74%, less dramatically by 0.50% reduced demand for milk and potatoes.

The coefficients of price and income elasticities of the reliable models shows that food consumption is more responsive to change in income than to change in price, except for pork. If the pork price increases by one percent, the demanded amount will be reduced by 0.54 percent with the confidence of 99%. The pork demand is non-elastic (EPD = b2 = -0.54).

Table 2 Estimated Marshallian demandof selected food products

Food product	Model	adj.R^2	A	b_1 (I)	b_2 (P)	EID	EPD
Milk***	Power	0.9225	3145.1559**	-0.4986**	-0.0256	-0.50	-0.03
Card cheese	Linear	0.2486	1.9118**	0.0002	-0.6150	0.37	-0.27
Poultry	Linear	0.0614	30.1055**	-0.0002	-4.5733	-0.04	-0.58
Pork***	Power	0.5232	421.3156**	-0.2204**	-0.5418**	-0.22	-0.54
Beef***	Power	0.8685	6242.7420**	-0.7405*	-0.5757	-0.74	-0.57
Eggs	Power	0.1783	997.9334**	-0.1698*	0.0793	-0.16	0.08
Potatoes***	Power	0.8764	3353.0950**	-0.5020**	-0.0296	-0.50	-0.03
Sugar	Power	0.0498	21.3166**	0.0442	-0.0981	0.04	-0.10

Source: authors calculations, *alfa=0,05, **alfa=0,01, *** model suitable to variables relationship description
EPD – price elasticity of demand, EID – income elasticity of demand

3.2 Logit models

The probability of selected foods consumption change towards RND were estimated. Estimated logit models and their parameters significance overview were provided in Table 3. The interpreted facts can be distorted to some extend due to statistically not significant model parameters. According to our analyses, the consumption positive change likelihood is higher for beef (p = 0.96, logit = 3.14) and pork (p = 0.98, logit = 3.8). If the beef price increases by one Euro per kilogram, the positive consumption change logarithm can be reduced by 0.23. According to estimated Marshall demand function, beef demanded quantity is decreasing with price increase. This is negative in terms of RND. An annual increase in consumer income by one Euro, can cause an increase in the chance logarithm by 0.001.If the pork price increases by one Euro per kilogram, the positive consumption chance logarithm can increase by 0.008. One Euro income increase can reduce the chance logarithm by 0.0001.

Table 3 Estimated logit models of selected food products

Milk(p=0,15)		B	S.E.	Wald	df	Sig.	Exp(B)
	I	0.001	0.001	1.242	1	0.265	1.001
Step 1[a]	Pm	-11.090	9.339	1.410	1	0.235	0.000
	Constant	2.047	3.411	0.360	1	0.548	7.746
Curd cheese(p=0,51)		**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
	I	-0.001	0.002	0.471	1	0.492	0.999
Step 1[a]	Pcch	9.222	8.507	1.175	1	0.278	10112.748
	Constant	-4.966	3.414	2.115	1	0.146	0.007
Poultry(p=0,17)		**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
	I	0.0001	0.001	0.747	1	0.388	1.000
Step 1[a]	Pp	4.999	3.685	1.840	1	0.175	148.253
	Constant	-13.786	8.337	2.734	1	0.098	0.000
Pork(p=0,98)		**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Step 1[a]	I	-0.001	0.001	1.579	1	0.209	0.999

		0.008	2.122	0.000	1	0.997	1.008
	Ppr						
	Constant	4.129	11.321	0.133	1	0.715	62.114
Beef(p=0,96)		**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Step 1[a]	I	0.001	0.002	0.751	1	0.386	1.001
	Pb	-0.234	1.713	0.019	1	0.891	0.791
	Constant	-4.773	5.378	0.788	1	0.375	0.008
Eggs(p=0,35)		**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Step 1[a]	I	-0.001	0.001	1.336	1	0.248	0.999
	Peg	25.132	27.637	0.827	1	0.363	82169328688.027
	Constant	-0.033	2.186	0.000	1	0.988	0.967
Potatoes(p=0,10)		**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Step 1[a]	I	0.0001	0.001	0.015	1	0.901	1.000
	Ppo	5.860	8.203	0.510	1	0.475	350.698
	Constant	-4.584	3.121	2.157	1	0.142	0.010
Suggar(p=0,58)		**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Step 1[a]	I	0.0001	0.000	0.000	1	0.989	1.000
	Ps	-0.039	3.085	0.000	1	0.990	0.961
	Constant	0.330	2.960	0.012	1	0.911	1.391

Source: authors calculations

4 Discussion and Conclusions

According to estimated Marshall's demand curves, actual food consumption of an average Slovak consumer is greater affected by income change than by food price increase. This points to the Slovak population gradual living standard trend increase. With increasing revenues consumers are less prone to change their decision due to price change and the preferences emphasis is increasing. The pork and beef positive consumption change probability is most influenced by economic determinants.

Stranieri (2017) investigated the determinants behind the purchase of healthy convenience food products. Results confirmed positive relations with consumer food shopping habits, food-related environmental behavior, gender, income and knowledge. Aftab (2017) evaluated the welfare cost resulted from an increase in food prices in the three most populous countries of south Asia the results indicate that cereals (wheat, rice) are relatively price inelastic. However, protein-rich food items like chicken and mutton are relatively more income elastic where consumer welfare declines in all countries mainly for cereals and milk, as these food items are relatively less elastic to price fluctuations.

Hoffer (2017) identified how consumption of 12 goods-alcohol, cigarettes, fast food, items sold at vending machines, purchases of food away from home, cookies, cakes, chips, candy, donuts, bacon, and carbonated soft drinks - varies across the income distribution by calculating theirincome-expenditure elasticities. - Income had the greatest effect on expenditures for alcohol (0.314), food away from home (0.295), and fast food (0.284). Percentage of a household's discretionary budget spent on the studied goods falls substantially as income gets larger. Policies targeting the consumption of such goods will disproportionately impact lower income households. Weatherspoon (2017) assessed the role income, prices, policy, agricultural production, and market access play on how rural households purchase different food groups. Households in Rwanda are price and expenditure responsive, but prices have more impact on food group purchases. Crop production resulted in reduced household market procurement for its associated food group but had mixed effects on the purchases of all other food groups. The study of Taillie (2017) examines trends in the prevalence of price promotions among packaged food and beverage purchases, differences in prevalence by household income, and the association between price promotions and the nutritional profile of purchases. Higher-income households had greater proportions of purchases with price promotions than lower-income households. While total price-promoted packaged foodpurchases had higher mean energy, total sugar, and saturated fat densities than purchases with no price promotions, absolute differences were small. No clear associations emerged between presence of price promotions and nutritional quality of purchases.

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Session 6

Management of Small and Medium Sized Enterprises.

Kaizen as an Approach to Motivation at Workplace

Markéta Adamová, Růžena Krninská, Nikola Židová

Abstract: *Nowadays a distinctive feature is the development of new technology and the associated requirements for new approaches to production processes in companies. Due to the high competition it is need to adapt quickly and flexibly to these requirements. If the company wants to be successful, it is necessary to continuously develop ways for improving of the manufacturing processes. The improvement will be an effective toll for motivation a stimulation employees.*

One of the fundamental methods of improvement is the philosophy of Kaizen. This is an integral part of the culture of every successful company from the beginning of its development in Japan. The basic principle is the involvement of all employees in continuous improvement across the whole company, and consistently on a daily basis. The aim of this paper was analyzed this issue in conditions of organization Schwan Cosmetics CR. Data was obtained through the uncontrolled interviews with employees and their managers. The interviews were supplemented by observation.

The results of the investigation have clearly shown that the company, which belongs to the Czech and the world leaders in the production of wooden cosmetic pencils, is intensively engaged in Kaizen and the effort to continuous improvement dominates in all processes. In this effort the company shall take very specific forms within the program „Good idea", where the employees use their innovative potential themselves. Because they best understand the problems of their work and the philosophy of the company, thus they contribute to the improvement of the whole company and they are part of Kaizen activities.

Key words: Kaizen · Motivation · Improvement · Manufacturing Process · Innovation · Wooden Cosmetic Pencils · Philosophy of Company · Employees · Quality

JEL Classification: M11 · M12 · M19

1 Introduction

Kaizen originated in Japan when the management and the government sought to fix the confrontational labor-management relationship that was facing the economy (Al Smadi 2009). Kaizen is defined as the continuous improvement of an entire value stream or work processes to create more value with less waste (Haun, Mothersell and Motwani, 2015). The Japanese expression Kaizen consists of two words. Kai means "change" and zen "good, better." The combination of these words is explained as a continual improvement in small increments, whether in a personal, social or working life. The term "improvement" means understanding that everything can be improved-quality, deadlines, costs, productivity. The word "always" in turn says that nothing in the world is firmly established, everything is constantly changing and evolving markets, products, customers and their requirements. The constant improvement in the enterprise, however, institutions do not process disposable large innovative leaps, but improvement of even the smallest details (Imai, 2007).

The main motto of Kaizen is "muda" – this is the loss, its consistent removal to the smallest detail. The work is a series of steps or processes which finish in a product or service. In every process people or machines either added, or not added product value. The term "muda" refers to those activities that do not add value. This wasting is not often noticeable because it is hidden beneath the surface of everyday work. However they are eating up our profit. In many cases, wasting is accepted in terms of "this is it", "it's part of the price for business." In fact there are a few other issues that deserve such attention as waste (Lareau, 2008).

According to Imai (2007) issue of the muda can be divided into the seven categories:

- Muda over production.

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- Muda inventory.
- Muda defects.
- Muda transportation.
- Muda over processing.
- Muda of waiting.
- Muda of motion.

2 Methods

The aim of this paper is to determine the current status of the issues at the workplace of Schwan Cosmetics Company. This company is a private label manufacturer of cosmetics pencils and products worldwide. The company offers color cosmetics. It's located in Český Krumlov. An analysis of the current situation was conducted in the company and based on the results, the company presented a solution to improve the current situation. According to the results of research will be the company's proposed recommendations that should ensure a better perception of the problems of Kaizen company staff and the related compliance.

Results were gained via observation and studying and analyzing of internal documents. Research was realized between years 2015 and 2017. The case study with 6 examples was realized.

3 Research results

Schwan Cosmetics Company is intensively engaged in organization improvement process and trying to familiarize all employees with this issue. The company is therefore focus in particular on the issue of lean production, waste, 5S, Kanban, stability and overall improvement of technology. Managers learnt principles and implementation of the Kaizen in companies e.g. Škoda auto in Bratislava, Slovakia, or company Witte. Leaders had a problem with misunderstanding and unwillingness of people at the beginning of the implementation process of the improvement. But later, when employees were informed with this issue, accepted it and understand its importance. The program a Good Idea runs from the year 2011 in the company.

Into the program, you may log in good idea by the application that is freely available to all Employees. A good idea can be uploaded only someone, who is currently employed in employment in the company. The Commission shall evaluate ideas, which meets generally once a month, or as needed. Filed the idea receives its owner automatically corporate T-shirt or 100 points into account health, depending on his choice. His idea further submits to the Commission.

In Tab. 1 it is shown four the most important ideas. These ideas mean the biggest save for company. Total saving was 25 985 Euro. Total costs were 9 420 Euro. For examples it was shown one of rejected ideas, where Commitment judged that investment will not return.

The focus company has forbidden to publish the system of remuneration for submitting / accepting proposals by employees in the article.

The research showed that program Good Idea means for company significant cost savings and it is necessary to continue with this programme for future development of the company. This program it will be a significant toll for motivation of employees. This program encourages employees to take an innovative approach, independence, creativity and self-management. But it mainly shows that their opinion is important for their leadership.

Table 1 Chosen Good Ideas

Number of Idea	Name	Main idea	Save	Costs	Status
1.	Stacking table	Tensioning networks by workers	6 000 Euro	360 Euro	Received
2.	Simplify the application crash system	Exchanging the existing applicator dosing system for an easier option	6 785 Euro	4000 Euro	Received

3.	Replacing the finishing line protectors	The abolition of the existing complicated capping and replacement mechanisms is another mechanism	**0** (The investment will not return)	2 000 Euro	Rejected
4.	Editing screen printing	Changing the lifting of pencils under the first station screen	9 000 Euro	4 200 Euro	Received
5.	Storage soft orders stainless steel containers instead of plastic	Storage soft orders stainless steel containers instead of plastic	4 200 Euro	860 Euro	Received
Total			25 985 Euro		

Source: Own processing

4 Conclusions

The research results showed that, within the duration of the programme, a Good Idea was made by employees some overall ideas. According to the observation and uncontrolled interviews can be concluded, that the company is ruled by a commitment to constant and continuous improvement. Program a Good Idea was introduced with the enthusiasm and can be regarded as very good and innovative. Some employees came to the program very enthusiastically and submitted the idea even more than once. Unfortunately, over time, the interest in the program began to recede. The employees apparently are of the opinion that all rather suggestions have already been made, with which the management does not agree and within its Kaizen philosophy – a commitment to continuous improvement.

As a suggestion to improve the issue of Kaizen and specifically program a Good Idea would be necessary:

- upgrade Good Idea leaflet,
- ensure that the leaflet have enough in places well accessible to all employees,
- to carry out an information campaign for new staff,
- in the campaign once again highlight the ideas and made familiar with their benefits all employees,
- support for effective communication,
- improving the organisation and management of work,
- removal of time pressure,
- effective time management, including the necessary information.

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Holistic Approach to Motivation and Stimulation

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Abstract: *The current world-wide social changes will continue faster. It is discussed the fourth Industrial Revolution, where knowledge will be prioritized. From this point of view motivation and stimulation require a different philosophy and it is necessary to shape it with new content. It will be significantly associated with the increasing role of human capital and with the development of its creative potential, which is becoming a decisive element of innovation and competitiveness. A qualitatively higher level of leadership (connected with care for individual development) leads to a holistic approach in which we accept micro-, meso- and macro-space. The necessity of orientation in the intercultural environment of globalization might be linked to the macro-space. The functionality of an individual in working teams relates to a mesospace. The nature of a person as a subject (micro space) is determined by self-knowledge, self-development, and lifelong learning, and is associated with the process of internal self-motivation. This motivation is becoming the long-term and most effective motivational tool. Desirable state is compared with status of companies in South-Bohemia region.*

Key words: Motive · Incentive · Motivation and Stimulation · Micro-, Meso- a Macro-Space · Self-motivation

JEL Classification: M11 · M12 · M19

1 Introduction

Current worldwide global trends are bringing rapid social changes, which can be associated with the new economy and industrial revolutionary 4.0. Top managers (Gibson, 2009) state that world is entering new economy – knowledge economy which relates to using human and intellectual capital. The capital is a crucial factor of innovation and competitiveness. Armstrong & Taylor (2014) add that an importance of innovative human potential and development of human capital is increasing.

The using of motivation and stimulation terminology is necessary to fulfill the new content that corresponds to the current developmental trend of the third millennium. Human individuality is not seen as only human labor. For current and future society, it is desirable to engage in a qualitatively higher level of leadership and motivation to cultivate and develop human capital. According to Armstrong (2007), motivation can be characterized as a target-oriented behavior and divide it into two types: internal and external. Internal motivation is connected with motives – internal motives (interest) with deeper and longer effect. External motivation is associated with external incentives (requirement, challenge) with immediate effect, but usually acting for the duration of the incentives. Incentives and stimulation are the traditionally used terms in the Czech environment for external motivation (Bedrnová & Nový, 1994, 2009; Provazník & Komárková, 1996, Komárková & Provazník, 2004, Horalíková, 1995, 2004, Kleibl, Dvořáková & Hüttlová, 1997, 2004, 2012, Bělohlávek, 1996, 2016). The distinction between motivation and stimulation is important (Dvořáková, 2004) in terms of effect: The short-term is linked to the setting of objectives, their control and remuneration or sanctions. Medium-term is related to job satisfaction. Long-term is associated with the development of human capital and personal potential

2 Methods

The aim of the paper is analyzed reality of motivation Employees in South Bohemia region.

The focused model is based on description of huge field of motivation and stimulation in holistic and systematic view in theory. This model divided reality into micro, meso and macro-space. This is the new approach to motivation for the nearest future.

Practical part shows for comparison the desirable state with reality. It was chosen companies in České Budějovice. It was used the questionnaire Survey focused on approach to motivation in companies. Respondents were 802 that were

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employed in chosen companies. Total 53% of respondents were men and 47% of respondents were women. Respondents were divided into 2 categories, the first one contained managers and administrative workers, the second one contained others workers.

The questionnaire was focused on motivational factor included Maslow s hierarchy pyramid and Herzberger s theory (Armstrong & Taylor, 2014; Pauknerová, 2010).

3 Research results

Flow of discontinuous changes in global environment requires rapid reaction within using new knowledge, skills, but especially new innovative approaches. These approaches bring effective feedback on the turbulent changes. It is necessary to be oriented in overwhelming environment. For describing huge area of field of motivation and stimulation in holistic view is necessary to divide and orientate in level of micro-, meso- and macro-space.

It is not enough only having relevant information about company, workplace and relations (mesospace) for the development of human capital and its motivation in third millennium. Next step will be acceptation the same precise knowledge about human individual (microspace). Its quality is crucial for choice and innovative solution knowledge and information even for orientation in global macrospace (fig. 1).

Figure 1 Time space approach to motivation and stimulation in micro-, meso-, macrospace

	HUMAN SUBJECT *microspace*	INTERNAL ENVIRONMENT OF ORGANIZATION *mesospace*			EXTERNAL ENVIRONMENT OF ORGANIZATION *macrospace*
PAST	SELFMOTIVATION SELFMANAGEMENT	DEVELOPMENT OF HUMAN CAPITAL	MOTIVATION AND STIMULATION	CORPORATE CULTURE	CULTURE
PRESENT	SELFDEVELOPMENT SELFRECOGNITION				REGIONAL CULTURE Tacit knowledge
FUTURE	LONG-LIFE LEARNING SEBEREALIZATION				GLOBAL CULTURE Multicultural society

Source: own work

Key factor of competitiveness is human capital with added value of developmental human capital, innovative approaches for new economy. The quality of human capital could be connected with development of human potential and internal motives of individual. In case that every person is unique (everyone has different fingerprints even different brain scratching), it will be necessary selfmotivation to find uniqueness. It is important to start with selfmanagement within better motivation for using own potential. Starting selfrecognition process (face to own past) is the first condition of

internal motivation. Process of selfrecognition leads to own selfmotivation and life, direct to selfmanagement and life-long learning. It will be peak of selfrealization of human subject (fig. 1). Selfrealization is at the bottom of theory needs of A. Maslow. Even starting process of selfrecognition leads to possibility of selfmanagent and significant development of human potential, even to develop high level of innovative potential.

The current worldwide managers recruit Employees according to power of internal selfmotivation. It will be said this approach to motivation is perspective for future. But reality in our companies is different (Tab. 1).

Table 1 Results of motivational factor research (%)

Motivational factors	Managers		Other workers	
	Yes/Rather yes	Rather no/No	Yes/Rather yes	Rather no/No
Suitable workplace	81	19	58	42
Need for certainty of job	85	15	90	10
Corresponding wages	58	42	32	68
Sufficient offer of employee benefits	76	24	55	45
Satisfaction with relations at workplace	79	21	70	30
Use compliments by superiors	52	48	16	84
Awareness and optimal communication with superiors	83	17	32	68
The use of knowledge and skills in the performance of work	80	20	65	35
Possibility of career growth	78	22	20	80
Provision of further education	65	35	39	61
Personal development	15	85	3	97

Source: Own processing

Working environment is motivating for 4/5 managers. More than half of the other workers state that workplace is motivated for them. The need for employment security and maintaining work is crucial factor of motivation for them. Although low wages could be demotivating with comparison to Western European countries. Financial compensation is considered by most respondents (85-90%) as the most stimulating. his is also related to the offer of employee benefits, which is very diverse, usually accepted as a matter of course, but most of the workers' professions prefer to increase the financial rewards instead of life insurance benefit.

A good working team is more motivated for managers than the others. This may seem to be related to less awareness of other workers, to communication in general, including lower use of motivating commendations and less use of the knowledge and skills of other workers. These examples demonstrate a kind of demotivating barrier between the diversity of management companies and other staff, especially in career growth and the provision of further education. The current problem is the low motivational interest and care for personal development of all respondents, which is related to their self-motivation.

4 Conclusions

In internal motivation, which is associated with long-term period, the state of the human person's microspace has an important role. The process of knowing this space can progress on based of self-recognition which has a positive and constructive tendency and can be based on selfmotivation. As far as the individual is orientated in himself and can manage his own subject (selfmanagement), he is able to orient himself in the world around him, in addition to personality development, his professional proficiency also grows. For the future, selfmotivation associated with personality development becomes the most effective and long-term motivating factor. The results are inconsistent with desirable state. On the other side it can be concluded that managers are in the right direction.

The current motivation, or rather the stimulation, is connected with the certainty of employment and, above all, with financial compensation, which with the level respondents are generally dissatisfied. Benefits are taken for granted without incentive effect unless they are overturned in the Cafeteria system. For other workers, motivation factors related to the use of knowledge, career growth and education do not appear opposed to managers. Personality development associated with internal selfmotivation is not perceived as motivational factor. For success in a global community, it is a priority to have a generally motivated and stimulated development of human capital in its entirety, which is the most valuable asset. And investment in it is the most important for gaining competitiveness within the global environment.

Acknowledgement

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Innovation and Sustainability of Road Management System

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Abstract: *Road network of the 2nd and 3rd class roads in the Pardubický Region and other regions in the Czech Republic is in the condition requiring the financial flow reaching to 50% of its reproduction status. Other regions in the Czech Republic experience a very similar situation. This has a substantial influence on the Czech road network infrastructure quality. The quality as such is an important factor for the growth and development of the state economics and labour distribution in the European area.*

Key words: Management Innovation · Sustainability · Road Management System

JEL Classification: L20 · M12

1 Introduction

Taking in consideration the dynamics of the technical and economic development in a society, controlled objects encounter internal and external imbalance that need to be anticipated (Franková, 2011). Their growth must be regulated by means of internal structure innovation. At least, it is inevitable to reduce its negative impact. Formation of imbalance of a controlled object is a natural process that depends on science and technology development.

Innovation is a product of human creativeness and creativeness is a person´s ability to overcome the real status of the existing operations through their changes, i.e. innovations.

Valenta (Valenta, 1969), who in 1969 published the work "Tvůrčí aktivita-inovace-efekty" (Creative activity, innovations and effects) in the "Svoboda" publishing house, is considered a representative of the Czech innovation theory. He brought the Schumpeter´s theory into practice of our management. Valenta (Valenta, 1969) defines management as a transfer of one system status into another by means of changing its variables. In his words, management produces innovations. Innovations then change the internal structure of a company and the resulting effects reflect changes of the company´s behaviour within its environment (Košturiak, Chaľ, 2008). Managers should not wait until innovative idleness negatively influences the company business results. They should prevent this from happening by new decisions or by motivating innovations (Freeman, 2010). The greater the influence of his/her decision (a motivating innovation) on the controlled subject, the higher the innovation order. It is vice versa at simple partial decisions and at decisions of local significance. A good manager must not claim the right to be a single vehicle of imagination and inventiveness, despite s/he will eventually be responsible for the innovation results (Christensen, Raynor, 2003). Managers must not degrade the creativeness of his/her team members by a disdainful attitude.

Śledzik (2013), Valenta (2001) recognizes three components of creativeness:
1. The ability to overcome the current state of production or other activity in a person´s mind, i.e. the ability to imagine that things and relationships could be different,
2. The ability of invention, i.e. to resolve new state of things and relationships,
3. The ability to complete an innovative act and to take over the responsibility for its completion because it is, according to Schumpeter, a creative destruction.

Among the basic rules of an innovation process are the following:
Complexity. Exercising an incomplex innovation usually results in a reduced or even negative effect because a problem is solved in an isolated way, without considering mutual relations and without analyzing the reasons of its origin and correlation. A complex decision (an order) is reached in terms of its overall impact on the controlled object (Gruen, 2010).

That is, taking in consideration a horizontal aspect (the action radius of an innovation) and vertical aspect, an action radius of an innovation process (the innovation order).

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The trend of a complex management innovation is based on the knowledge that partial and isolated innovations can only solve a partially existing problem while reducing the effectiveness of the exercised innovation and raising imbalance of the object´s internal structure. Management is thus disintegrated and fails to solve the existing situation. The condition of complexity is fulfilled in the event that the given problem is being dealt with in all the basic aspects and taking mutual relations in consideration.

Consistence. The rule of consistence enables a manager to be informed about the effectiveness of the past and future measures within an innovation process of the controlled object (Christensen, Raynor, 2003). A tool to apply this prerequisite is an analytical attitude to measureable and non-measurable values achieved within the controlled system functioning and the attitude to the economic and social benefit hereof. A major prerequisite for an innovation process of strategic development of a particular organization should be information gained from the analysis of the recent economic development and its completion deadlines.

It is mainly respecting the complexity and synthesis, i.e. the unity of quality and quantity within the management and evaluation of economic result. The degree of synthesis depends on the level of management to which information should serve. The higher this level, the higher the level of information synthesis is required because the amount of analytical information increases. A top manager needs a synthetic view of the controlled object to be able to see it in its complexity.

On contrary, the lower management level in view of a top manager deals with the problem in a more analytical manner. However, this does not mean that they are not interested on its synthetic aspect. To be able to successfully participate in the vertical aspect of management, a good manager must know both the strategy of sub-systems and the way it participates in the system management in its whole. This is important for the employees´ motivation and also for the strategy of the supervisor to effectively stimulate the staff on the particular management level (Christensen, Raynor, McDonald, 2015). Employees need to know why they work and must be aware of the meaning of their work for the whole system and for the creation of the overall strategy.

Timeliness. The objective is to minimize the management-free period, i.e. the period of the moral wear of the first innovation is outlived and the future innovation is not yet working. This period is an unwanted factor in an innovation process because the solved problem is outside the management process. This is a negative factor, especially in view of market competition and monitoring the costs relating to the reduced function of the managed system.

We often see that this rule is neglected because the desired course of the performed innovation is not maintained, which extends the deadline for its implementation. A classical example is investment construction. It is relatively easy to observe companies failing to keep this rule. Analogical course of action with equal results is, however, the same in any other management areas. Unfortunately, its consequences are not seen immediately, they appear later depending on the type of problem and on its importance. An example is the management of the legislation process. In the interim period, an innovation process is always characterized by insufficient definition of an innovation objective and unpreparedness of partial factors of its internal structure. The rule of timeliness requires minimizing of the interim management-free period by the preparation of a new innovation already during the boom of the existing one. A timely decision is important: we have to know in advance when to start the preparation and when to start the implementation. If you do so in the period when the original innovation is still functioning, the system will encounter anarchy. However, if you let the interim / management-free period happen, it is uneconomical. To estimate the speed of the solved problem dynamics development, we can, in a certain scope, use the internal documents and records of the company. However, a good manager must not neglect opinions of experts in the given field, whether those among the company employees or those working for scientific institutions.

This is connected with effective stimulation of team work and with motivation of employees and experts from scientific institutions. An irreplaceable role and test of a person´s competence is in the manager´s hands: s/he always has to decide about the methods of team stimulation and about the period to complete an innovation and also assume the responsibility for the project success. This is why we often hear the opinion that management is an art requiring a competent personality; a person convinced about the importance of managerial ethics and responsibility.

2 Materials and methods

The research was carried out in the Pardubice Regional road network of 2nd and 3rd class, its condition, sustainability and management. The research is based on a long-term analysis enabling the participants to become acquainted with the real state. The analytical comparison was used as the main method based of the study of statistics and previous analyses of the monitored objects administered within the plan for innovative management and sustainability of the road management system.

The objective is to recommend implementation of innovative methods and procedures in the Czech Republic focusing on the reduction of financial, construction and technical debt of operators and managers of the 2nd and 3rd class roads. The research outcomes will determine the critical places and points, recommendations for the project sustainability and for the shift towards quality in this area of management.

3 Results

Among the sustainability factors in road management in the Czech Republic is the situation of the roads, in other words the problem of reproduction of the current condition. The 2nd and 3rd class roads in the Pardubický Region are on about a 50% level of their simple reproduction. The system is lacking roughly 15 billion Czech Crowns (Table and Graph N. 1)

**Table 1 and Figure 1** Overview of road property and its value

Roads			Industrial residual value	Value of roads		Value of bridges			Overall value of roads and bridges	
Class	Length (km)	Area (thousands		Input	Residual	Number (pieces)	Input	Residual	Input	Residual
2nd class	913	6 007	6,3	11 663	5 487	253	700	504	12 363	5 990
3rd class	2 222	12 656	4,2	18 951	8 692	548	465	244	19 416	8 935
Celkem	3 136	18 663	4,8	30 614	14 178	801	1 165	748	31 778	14 925
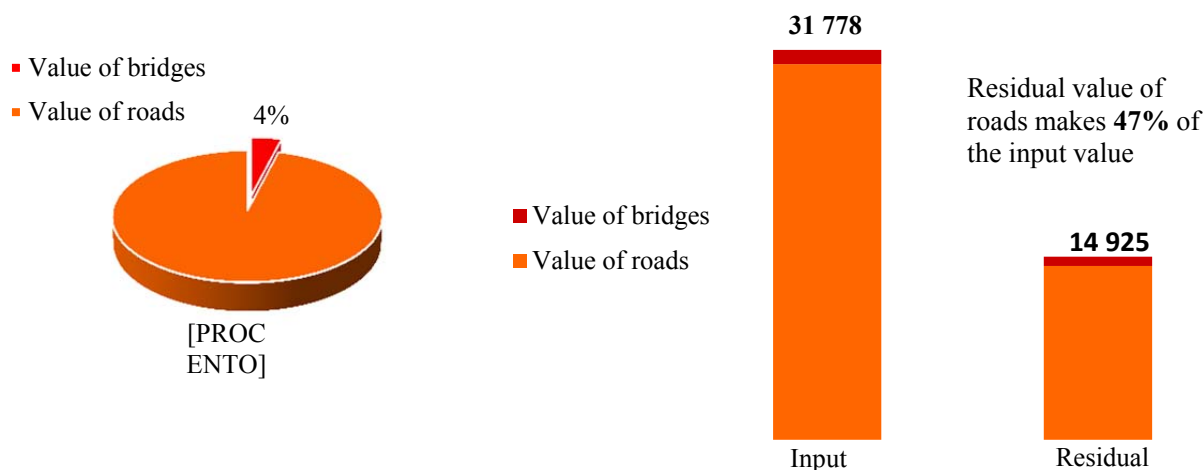
Source: authors

Detailed research of the condition of 2nd and 3rd class roads reflected in Graphs 2 and 3 shows that in 2024 to 2028, all Pardubice Region´s roads of the 2nd and 3rd class will be in the emergency or disrepair condition.

Figure 2 Expression and estimate of emergency condition percentage of 2nd and 3rd class roads in the Pardubický Region
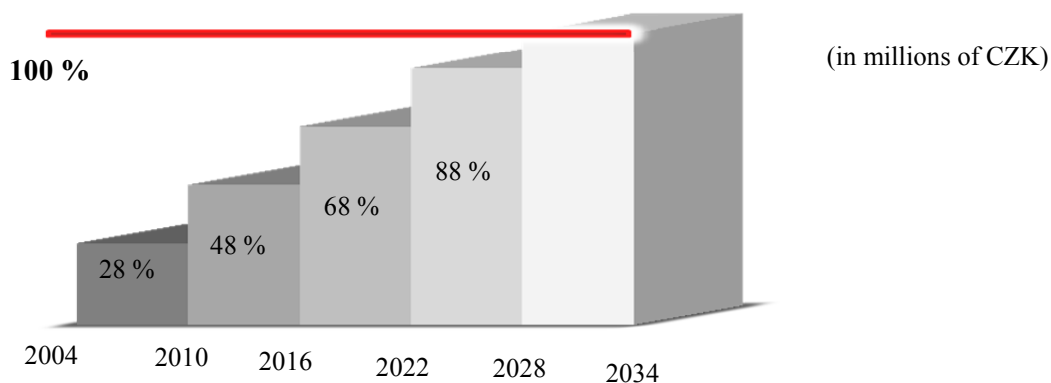
Source: authors

Similar observations show roughly the same conditions in other regions. Differences are negligible; they depend on the amount of financial expenses in individual regions

Figure 3 Expression and estimate of emergency condition percentage of 2nd and 3rd class roads in the Czech regions
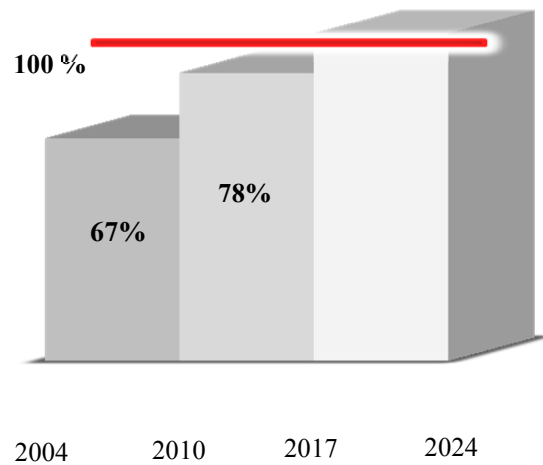
Source: authors

The impact on the Czech economy will be fatal, unless there is a change of the recent attitude.

The Pardubický Region and the Road Management of the Pardubický Region have been trying to solve the handicap through public interest declared in Memoranda of Cooperation between the state and regions. This way can help to obtain subsidies for the road infrastructure development, which cannot be obtained otherwise. The documents in question are the following: The Memorandum of D35 Highway, The Transport Node of

Pardubice and the Memorandum of the Foxconn company. The projects are a product of a high degree of management level, of the motion in the field of crisis. They represent innovation, dynamics, they support employment on the basis of responsibility, ethics and demands for high qualification of the involved labour in the hard and soft project management.

Due to this, managers of organizations providing maintenance and region-owned property administration have to create innovations and carry out activities that reduce and delay such adverse impact. Recommended innovation and activities are the following:

Additional economic activities of the involved organizations:

The purpose is to use extra capacity of the transport, mechanization, technology means, buildings, premises and human resources. This is the way to reduce operating expenses and cost of the main activities in a company, i.e. to reduce the price of individual road works by as much as one quarter.

- New technology

The use of new technology provides reduces the price of construction and maintenance works and extends service life of construction works already carried out. Its secondary effect is a real construction work completed within the new technology testing. Commonly obtained financial flows would not allow for new acquisitions or property repairs.

- Development areas

This form of innovation means administration of a regional, national or European project within public interest. The projects concern industrial zones, public logistic centres, river ports, airports, as well as sports and leisure centres and national heritage in terms of transport. These are usually investment units worth several millions up to billions of Czech Crowns.

- Intensive involvement of information technologies

Extensive use of information technology in company processes largely reduces financial expenses. It has been documented that compared with 2002, when regional organizations of property administration and road maintenance were established, the prices and scope of summer and winter maintenance remain almost the same at similar scope of the

works carried out. This is true in spite of the fact that the input prices, e.g. energy, construction material, services etc., have doubled or even tripled.

The tools to be used are Dispatcher module and the winter maintenance difficulty index. The index advises, with a twelve-hour advance, weather forecast in a 500 x 500m square. The index of difficulty determines the optimum consumption of labour, ploughing, gritting material, emergency and check drive in reality compared to the theoretical curve line.

It is recommended to process thermal maps enabling the users to differentiate among winter maintenance in open terrain, going uphill, in bends, forest sections and on bridges. This especially concerns different dozing of the gritting material.

- Media support

Its main task is to provide road users, community, regional and central politicians and industry with information that the adverse situation of the road property is caused by the discrepancy or by the deficit between social demand for maintenance, repairs, modernization, reconstruction and construction of roads covered by the disposable financial resources and the real condition of the road network. Further, marketing and advertisement support to the additional economic activities of organizations with the aim to offer free capacities of the company in benefit of the commercial demands. Last but not least, it is advisable to use the regional development planning campaigns for application of new technologies.

All of the above mentioned presents a great demand on management quality in the organizational structure and also on the hard and soft project management teams.

The teams are established for individual projects. Majority of them are management and working groups headed by a project manager. Individual members are selected in a way to provide expertise, experience and education covering the whole project requirements. The work of project teams is finalized by the project evaluation. Their work is continuous; the projects are designed, solved, completed and finally evaluated.

The activity has soft support, since the teams deal with the process ethics, monitoring the eligible needs of the teams, monitoring media reactions and social impact, among others.

Most road management organizations have established websites to inform the employees, general public and media about their activities. An integral part is the page "Responsible Organization." Companies assume social responsibility while giving a part of their excessive profit to charity, to humanitarian, environmental and other activities. The main objective is to sustain the company´s good reputation.

4 Conclusion

All of the above mentioned can be considered an innovation process which indirectly reduces the financial, construction and technical debt in road property. Such procedures help to form financial resources and construction and technical added value outside financial flows directed from the road owner onto 2nd and 3rd class roads.

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Organizational Values during the Global Economic Crisis

Martin Pech

Abstract: *The paper deals with the topic of organizational values that need to be distinguished from individual (personal) values. Organizational values are shared, enforced and maintained by the vast majority of people and determine how people behave in solving everyday work problems. Values serve as a guideline for decision-making and daily negotiation, and determine basic preferences when choosing the way the organization responds. The research was conducted during the period of the global economic crisis and its main aim was to find out the prevailing organizational values in enterprises.*

The obtained results were then analysed in terms of the impact of this crisis period. The results indicate that enterprises are focusing on ways of solving problems that are less risky, more cost-effective and more quality in times of crisis. However, their reaction to negative external factors is probably not based on experience and tradition. This situation is for enterprises rather new. Enterprises are more cautious at this time, they are not conducting experiments and do not seek confrontation with competitors. Immediate results and high performance are important to help enterprises to survive an unfavourable period. Their corporate cultures are predominantly hierarchical and market-based.

Key words: Organizational Values · Corporate Culture · Human Resource Management · Global Economic Crisis

JEL Classification: M14 · O15

1 Introduction

The global economic crisis triggered problems in the US mortgage market in 2007. This crisis also influenced the Czech Republic after the fall of Lehman Brothers. The main reason was that virtually all major banking and mortgage institutions had their owners abroad. And these enterprises have been affected by these crisis problems in their home markets. With the passing of time, the economy has fallen into recession, but the private sector has responded by timely actions and economy has gradually recovered. Other positive factors can be considered here too: the liquidity of our home banks, the lower indebtedness of Czech households versus abroad, the CNB's stabilization response etc. Crises are a natural part of the development of the economy, people's lives and the business life cycle. Their impacts are both economic and social and to a certain extent influencing market, business, and behavioural responses. Consequences of crises may also result in changes in the level of belief, attitudes and values that are preferred over these periods. The paper focuses on organizational values that affect business operations, their priorities and goals.

Values are general tendencies to prioritize certain states of reality in front of others. Because these values are acquired so early in our lives, most of them remain outside of our consciousness. Their wearers are unaware of them, and therefore they cannot be discussed, nor can a person from outside be able to observe them directly (G. Hofstede & J. G. Hofstede, 2006). Values are facts, ways of negotiation and behaviour, target states that people consider important (Dědina & Cejthamr, 2007). Values relate to what is considered best or good for the organization and what it should be. The deeper the values are rooted, the stronger, the greater they will affect the behaviour (Armstrong, 2002).

According to Posner (2010), values can be divided into individual (personal), professional, organizational or social. Organizational values hide and steer hundreds of decisions at every organizational level every day. Like individual values, they can be considered desirable as "clues" (mediators) of meaningful negotiation, behaviour and decision-making. Organizational values thus play an important role in organizing and managing organizations (Dobni & Ritchie et al., 2000). Members of an organization can perceive organizational values differently on the basis of their own interpretations or their own (individual) values (Soyer & Kabak et al., 2007).

An individual consistency between individual and organizational values is considered as a key factor of the harmony between the organization culture and the thinking and behaviour (O´Reilly III, Chatman & Caldwell in Lukášová & Nový et al., 2004). This consensus is based on the identification of the individual with the group (the subculture, the culture, the contra culture) to which it belongs. Hall et al. in Ashforth & Mael (1989, p. 23) defines this value consensus as "a process in which organizational and individual goals are increasingly integrated". The values with which employees are identified should be found in the mission of the organization. It can be said, therefore, that individual and organ-

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izational values interact with each other, but their effects on the organization may be different if they are not mutually consistent.

2 Methods

The main aim of the paper is to identify prevailing organizational values in enterprises during the global economic crisis. As research has taken place between February and August 2011 (Pech, 2011), the results are now (after global economic crisis) viewed from a new wider perspective. The paper deals with the retrospective (back to the past) analysis of preferred organizational values during the crisis. The paper is focused on connection between preferred organisational values and global economic crisis.

The questionnaire survey is attended by a total of 137 respondents. The sample consisted predominantly of managers (economics, trade, manufacturing, personnel department, etc.) and technical staff of personnel departments. A sample of 62 enterprises is obtained from the completed questionnaires, where 84% comes from the South Bohemian Region. These are predominantly limited liability companies (69.4%). According to the number of employees, these enterprises can be divided into the following groups: 4.8% to 10 employees; 51.5% enterprises up to 250 employees; 38.7% enterprises over 250 employees; 4.8% did not indicate the number of employees. Depending on the characteristics of the industry, they were mainly manufacturing (32.3%) and construction (12.9%), other branches - agriculture, energy, wholesale and transport were represented evenly (from 1 to 5%).

The importance of organizational values is determined through a questionnaire of organizational values on the Likert scale (scale 1 - 7, where 1 represents very little importance for the organization, 7 represents very important for the organization). Research has focused on values that are widely shared, held and followed by the vast majority of people in the organization. When these values are held by members of the organization, they determine how people behave in order for their work to bring satisfaction and their organization to the results. In the questionnaire, the values assumed by McDonald & Gandz (1992) are taken over. In their research, a total of 24 values are used, which for the purpose of this paper is extended to 30 values.[58] In response, respondents were asked not to decide what their personal opinion is, but how they perceived the values in their neighbourhood, i.e. to act as "observers" in their own organization.

The definitions and characteristics of the values in the questionnaire were related to the organization not to the individual. For example, adaptability is in an individual conception: flexibility and change in terms of new conditions; in organizational terms: the ability and speed of an organization to adapt to changes in light of new circumstances, developments or technological developments. Similarly, knowledge in an individual conception is: the ability of the individual to use the knowledge and experience of a particular area; in organizational terms: the importance of organizational learning and the degree of sharing transfer of knowledge, experience, knowledge and information.

The questionnaire can be formed by values organized according to organizational culture type:
- The clan culture: broad-mindedness, consideration, cooperation, courtesy, fairness, moral integrity, openness, social equality, relationships, support.
- The market culture: adaptability, autonomy, creativity, development, experimentation, knowledge.
- The hierarchy culture: cautiousness, economy, formality, logic, obedience, orderliness, thoroughness, tradition.
- The adhocracy culture: aggressiveness, diligence, initiative, results, competitive, performance.

3 Research results

Based on a questionnaire survey, the results are arranged into tables and pictures that can also be used as a value ranking. Values placed at the top are considered significant for enterprises, on the other hand, below are less significant. From the relative variability measures (quartile deviation and variation coefficient), it is clear that it is a homogeneous sample (all values <0.5).

3.1 The best rated organizational values

If we focus on the importance of the best rated organizational values from the point of view of the global economic crisis, it is clear that the values support the internal focus of enterprises. The organizational values assessed as the best are (see table 1): „results", „performance", „thoroughness", „obedience" a „economy". Half of these values are related to the focus on quality and business retention („thoroughness", „obedience", and „economy").Other values then mediate

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[58] From the original McDonald & Gandz (1992) study were removed the values "humour", "forgiveness," which can be considered as individual rather than organizational. Other values are added based on organizational culture research results in Czech enterprises (Lukášová, 2002): relationships, support, thoroughness, tradition, results, competitive, performance, and knowledge.

the achievement of "results" and good "performance" of an enterprise, as the activity in the crisis period requires additional revenue to cover all costs. In this case, there is no time for experimentation, development, research or risky investments.

Table 1 The best rated organizational values

Organizational values	Mean	Standard deviation	Sample error	Coefficient of variation	Median	Quartile deviation	Relative quartile deviation
Performance	**5.17**	1.73	0.44	0.34	**5.00**	1.25	0.25
Thoroughness	**5.12**	1.79	0.46	0.35	**6.00**	1.50	0.25
Obedience	**5.08**	1.52	0.39	0.30	**5.00**	1.00	0.20
Economy	**5.02**	1.74	0.44	0.35	**5.00**	1.00	0.20
Results	**5.20**	1.72	0.44	0.33	**6.00**	0.75	0,13

Source: Own processing

The value "performance" symbolizes the ability of enterprises to meet business goals for the benefit of all employees. This value is partly strategic in nature (it refer also to a business model) and is related to the focus on everyday work (everyone can have high performance). Equally important for enterprises is also value "results". It is crucial for them to succeed in business. The "obedience" value practically reflects the degree to which employees are organized in the enterprise. This means that employees do not have problems to submit to authority and adapt to the work rules. The effects of the hierarchical culture are obvious here and for the Czech Republic there is a typical high power distance.[59] "Thoroughness" is a value in terms of quality and precision. This means an effort to achieve flawlessness and attention to detail. Surprisingly high (probably also in connection with the global economic crisis), the organizational value of "economy" is placed, which means cost savings and overall economy of the company. The highest representation of organizational values relates predominantly to hierarchical and market culture.

3.2 The worst rated organizational values

The results show that during the crisis period, enterprises are not carrying out risky activities or implement risky projects. Experimenting with new investments and introducing new products is not usual. As their strengths have tightened to achieve immediate results and maintain their current market position, their goal is not to confront and compete with their competitors. It could be said that enterprises are rather oriented towards cooperation and the use of possible alliances to overcome the poor economic situation in the market. The organizational values (Table 2): "experimentation", "autonomy", "aggressiveness", "competitive" and "tradition" are rated as the worst.

Table 2 The worst rated organizational values

| Organizational values	Mean	Standard deviation	Sample error	Coefficient of variation	Median	Quartile deviation	Relative quartile deviation
Tradition	**4.08**	1.94	0.50	0.48	**4.00**	1.00	0.25
Competitive	**3.98**	1.83	0.47	0.46	**4.00**	1.50	0.38
Aggressiveness	**3.97**	1.58	0.40	0.40	**4.00**	1.00	0.25
Autonomy	**3.71**	1.80	0.46	0.49	**4.00**	1.50	0.38
Experimentation	**3.37**	1.72	0.44	0.50	**3.00**	1.50	0.50

Source: Own processing

The least evaluated organizational value is "experimentation". Enterprises are not used to improvising, and do not tend to be risk-prone to solving problems. Rather, tested and proven practices are used to ensure slower but longer-lasting growth. This is also related to the assessment of "autonomy" of employees for free and independent behaviour. The basic steps are rather implemented through the hierarchy. This also limits the "aggressiveness" and the ambition of some employees. Fewer competencies are delegated (lack of empowerment) and an initiative promoting of individual goals is not supported. In companies, there is little use of "competition" in the sense of trying to defeat a competitor and achieve first positions. Rather, it is more common to cooperate. The organizational value of the "tradition", which defends conventional celebrations and various ceremonies typical of clan type cultures, is surprisingly low. This organizational value could be expected to be higher in the crisis period, as it could be assumed that enterprises will rely on tradition. Based on preferred values, the crisis situation is likely to be new and unusual for enterprises.

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[59] Power distance Index measures the extent to which the less powerful members of organizations and institutions accept and expect that power is distributed unequally (G. Hofstede & J. G. Hofstede, 2006).

Enterprises are therefore striving to find ways of overcoming the crisis, focusing on immediate outcome, performance, or closure with a focus on quality and economy. A solution based on traditions in this case does not seem to produce the desired effects. The vast majority of low-rated organizational values reflect innovative and market-based culture (except "traditions").

The overall overview of the results for all monitored organizational values is summarized in Figure 1.

Figure 1 Organizational values
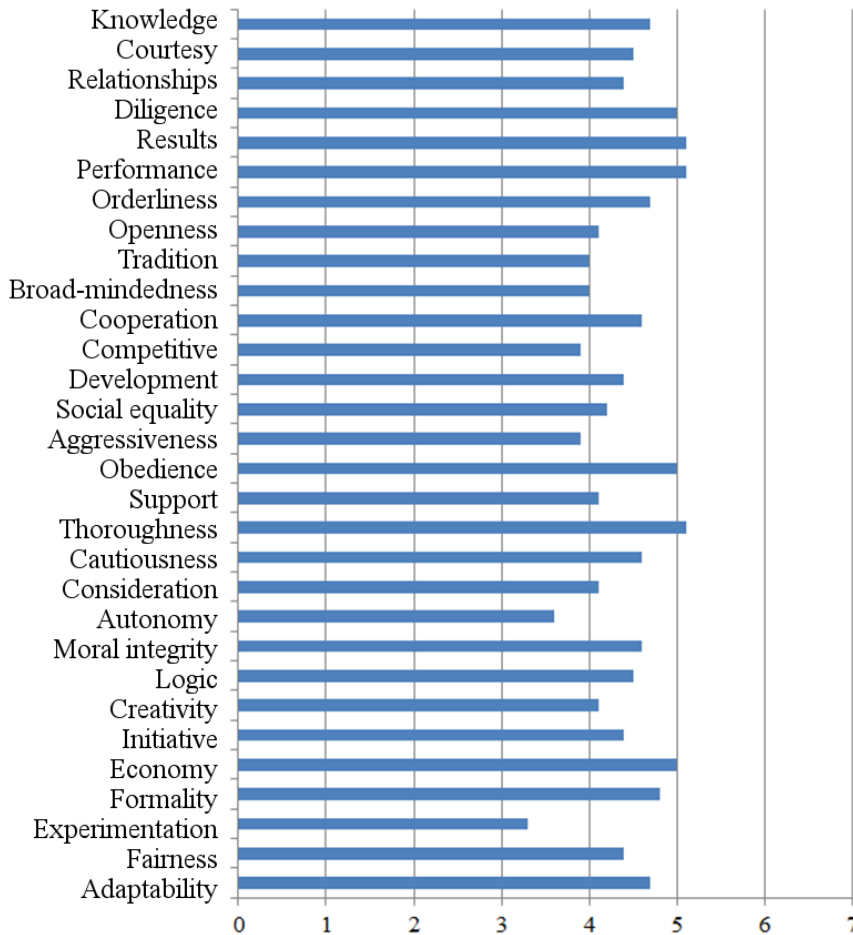
Source: Own processing

4 Conclusions

The main aim of the paper is to find out the prevailing organizational values in enterprises and to determine the extent to which the effects of the global economic crisis were reflected in the results. The survey was carried out already in 2011, when the need for companies to include the impact of crisis-threatening factors on planning and strategic management has been fully demonstrated. Although enterprise and people's value preferences change only very slowly, the goals and missions of businesses can be influenced by the effects of negative factors. Enterprises faced new challenges trying to respond and adapt their strategies and behaviours. These activities help them to survive the crisis period and succeed in the future.

The results show that in the crisis period, enterprises focus on ways to cope problems that are less risky, more cost-effective, and have higher quality. They therefore use more cost-effective procedures and activities which are not based on traditions and use new response to negative external factors. It is important in the crisis to focus on immediate achievement of results and performance, which will maintain the existing market position. In this period, enterprises tend to work rather than go into open confrontation with competitors. The results also show that in the crisis period, enterprises are more cautious and therefore they are not involving in experiments, for example the introduction of new (untested) products, risky investments or expansion. These findings are supported by the results of the preferred organizational value orientation, as well as the conclusions regarding the worst organizational values.

Summarizing the results from the point of view of the types of organizational cultures, it was found that the organizational values related mostly to the hierarchical and market culture. At the lower level in the hierarchy ranking are the

values of the innovative and market culture. In the middle of the ranking, we find mainly organizational values related to clan culture. These results more or less correspond to the prevailing types of cultures that occur in the Czech Republic according to the current research. However, as already explained, the preferences of these types of cultures are to a certain extent also related to the effects of the negative factors of the global economic crisis.

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Employee Inventor´s Remuneration: An Evidence from Great Britain

Barbora Rýdlová, Pavel Svačina

Abstract: *Nowadays, most innovations are originated as employee innovations. Therefore, the question of employee inventors' remuneration is at the focus of innovative companies. The rationale for employee remuneration varies across Europe as well as the legal framework. Since there is an economic framework absent we can witness disputes between the employee inventors and employers concerning a fair reward. This paper uses two litigation cases from Great Britain. These cases are analyzed using an employee inventor remuneration model constructed by the authors based on focus group sessions with intellectual property legal experts. The aim of this case study is to confirm or refuse several intervening factors that we suggest should be considered in the remuneration process, in what extent and how they influence the amount of the reward for the inventor. The knowledge of complex intervening factors might become a helpful tool for R&D managers to set the rules of the inventor remuneration process in innovative companies.*

Key words: Employee invention · Reward · Remuneration · Patent

JEL Classification: O31 · O34 · J33

1 Introduction

Nowadays, companies face high competition that makes them strive for innovations. Innovations are very demanding concerning resources, the leaders in innovations are mostly huge multinational companies which have available sufficient funds. Even though it is big companies that invest in R&D (research and development) and own resulting patented inventions (WIPO, 2016), it is the employees who are the originators of the innovations. The legal framework that regulates this area differs in European countries. In the Czech Republic, if there is no special contract between the employer and employee inventor, the Patent Act ensures the employer the right to acquire the employee invention within three months from the moment when the employee inventor gives out relevant materials concerning the invention to the employer. The employer is obliged to pay a fair remuneration to the employee inventor. The Patent law also defines the factors which should be considered: technical and economic significance of the invention, benefits from using the invention, material share of the employer and scope of work responsibilities of the employee. If the reward paid becomes later visibly disproportional to the future benefits from the invention, the employee should get a reasonable additional compensation. However, the Patent law is very general about the level of the reward, indicating only general factors that should be considered. Therefore, we witness litigations in the Czech Republic about the reasonable compensation. In the same time, R&D managers or IP (intellectual property) managers of the Czech innovative companies try to set some internal rules for employee inventors' remuneration and miss some complex economic theory that would help them to set the rules in practice so that they would be in harmony with the Patent law and would not be threatened by possible litigations of employee inventors. This problem is not limited to the Czech Republic, based on a case-law review (Meier, Schubert, & Jaenichen, 2005; O'Driscoll, 2009; Taplin, 2008; Wolk, 2008, 2011). The topic is problematic and controversial in many European countries. However, because the national laws and the key features of employee compensation regimes vary across Europe (Peberdy & Strowel, 2010), each country settles litigations emerging in this field within its own legal framework. Therefore, this continuing process puts some first patterns of solid foundations for answering the central question 'How much is reasonable?'.

The literature review shows that the recent research in this area is focused on quantitative methods, especially using correlation analysis to search for the relation between the volume of the employee inventor remuneration and the production of patents or licenses. The research is differentiated according to the character of the employer institution. Whereas in universities and other academic institutions the correlation shows to be strongly positive (Lach & Schankerman, 2008) and (Lach & Schankerman, 2004) or (Link & Siegel, 2005), in corporate sector the results do not seem so clear-cut (Giummo, 2010), (Onishi, 2013). For example (Zirnstein, Franca, & Ruzzier, 2010) find positive effect of the remuneration on the number of innovations in companies.

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However, if quantitative studies suggest there is a positive effect of remuneration on the origination of innovations, the implications are that the R&D managers might use it for stimulation purposes. Therefore, we would like to approach the problem from a different angle and analyze the factors that influence the amount of remuneration. Our analysis has a qualitative character and aims at finding out, which intervening factors of the remuneration are considered to be the most important in chosen litigation cases in Great Britain.

Even though we provide evidence from Great Britain we suppose the results should be relevant, or at least strongly inspiring, even in the Czech Republic since there are many features in common. In contrary to the Czech Republic, in Great Britain a compensation for employee inventor can be claimed exclusively in case of inventions with „outstanding benefits ". But in case the benefit derived from the contract of assignment is inadequate in relation to the benefit derived by the employer from the invention, it is just that the employee should be awarded compensation to be paid by employer in addition.[61] If the compensation is to be paid then it must secure for the employee a fair share (having regard to all the circumstances) of the benefit which the employer has derived or may reasonably be expected to derive. The factors that considered are (i) the nature of employee's duties, his remuneration and other advantages from the employment in relation to the invention, (ii) the effort and skill of the employee inventor, (iii) effort and skill of others, advice and other assistance of employees who are not joint inventors, (iv) contribution of the employer – making, developing and working of the invention by the provision of advice, facilities and other assistance, by the provision of opportunities and by his managerial and commercial skill and activities.

There we can see a clear parallel with the Czech Patent law factors and thus we suppose our analysis might be useful even in the Czech Republic environment with missing reasonable case history.

The results of our broader research can be used by R&D or IP managers to set internal rules for the employee inventor remuneration process.

2 Methods and Data

This paper is a part of a broader research project which is focused at estimating a reasonable financial compensation for employee innovations.

This step of the research is aimed to ground the remuneration model parameters using available data from judgments of European courts. In particular, in this paper we perform a comparative case-study analysis (Creswell, 2013; Yin, 2014) on two important contemporary British litigation cases – Kelly&Chiu v. GE Healthcare from 2009 (No. [2009] EWHC 181 (Pat)) and Shanks v. Unilever from 2017 ([2017] EWCA Civ 2), both decided by the High Court of Justice in London. A comparative case-study design is chosen because both cases were settled differently using certain reasonable economic criteria and, therefore, can explain strongly the level of 'reasonableness' of remuneration perceived in the British legal framework.

We use the intervening factors that we have identified based on our preceding research and we analyze whether they were or were not considered in the two court judgments and in what manner they affected the judge's decision. We also look for the presence of additional factors that might not be covered in our preceding research results.

Table 1 Descriptive data

Case	Ian Alexander Shanks vs. Unilever	James Duncan Kelly and Kwok Wai Chiu vs. GE Healthcare Ltd.
Court	Royal Courts of Justice - Court of Appeal, on appeal form High Court, Chancery Division, Patents Court	Royal Courts of Justice, Chancery Division, Patents Court
Case No.	A3/2014/2556	HC07C01131
Neutral Citation Number:	[2017] EWCA Civ 2	[2009] EWCA 181 (Pat)
Date	18.01.2017	11.02.2009
Subject of the patent	Reusable diagnostic testing device	A compound for use as a heart screening agent
Industry	Electrochemistry	Biochemistry (pharmaceutical)
Conclusion	No reward for the employee inventor	A fair share of 3% of the benefit of the patent for both inventors together

Source: Own processing

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[61] Great Britain Patents Act, 2004

The way of confrontation of the two cases was chosen because they are both from the same country, approximately the same time period and one of the cases results in a reward for the inventor whereas the other results in no reward. The summary of basic descriptive data of each case are presented in the table above.

3 Research results

In our preceding research we have identified several groups of intervening factors which, as our data suggest, influence the fair reward for an employee inventor. Of those, we have selected the ones applicable in this case study:

- Character of Innovation,
- Work regime,
- Employer-Employee imbalanced relations,
- Time aspects,
- Other factors.

Others either were the same for both cases (like the legal framework) or did not have any relevance in these cases (like for example the labor market or internal organizational norms).

Each of the group of factors has several subcategories or/and dimensions. We have analyzed one at a time first and tried to identify which of them were the key factors that influence the conclusion of the judge to a large extent.

3.1 The character of innovation

The summary of the analysis concerning the character of the innovation is provided in the Table 2.

In both cases, due to the British legal framework, the judges had to decide whether the invention is of outstanding benefit to the employer, because only if it is the employee inventor should be awarded compensation to be paid by employer in case the benefits derived by the employee from the contract of assignment is inadequate in relation to the benefit derived by the employer from the patent.

In both cases, there were several European Patents granted for the inventions.

In the Unilever case the invention was described as a technology that eventually appeared in most personal glucose testing products, but not as the key driver of the market. The court concluded that "it was a useful technology, that most significant players in the field were willing to pay millions of pounds for the ability to use, but not one that was vital". In the GE case the court has opined that the new compound with unique desirable features was a remarkable new solution.

Concerning quantification difficulties, in both cases the claim was raised after the exploitation of the inventions was finished which enabled quantification of the benefits from factual (rather than expected or hypothetical) numbers. However, in the Unilever case, the employee inventor suggested not only factual but also hypothetical benefits should be included. This claim was based on the fact that Unilever has held the patents for some time and did not exploit them fully. However, the court decided only the factual benefits should be considered. In the Unilever case the benefits were calculated from the income from licenses from the patents and also a purchase price of the whole company (the owner of the patents) attributable to the patents.

In GE Healthcare case the benefits were derived from the sales of the Myoview product in which the patent was applied. Also in this case the court did not prefer to use hypothetical ex-ante calculation of benefits since the factual benefits were known. The judge has calculated the difference in sales of Myoview in case it was not protected through patents and the price would go down due to competition. The judge assessed this price drop at 10% of half of the sales. The benefit of the patents was calculated as the difference between the factual sales and the sales in case of price drop. The judge has admitted that there were other benefits too but impossible to reasonable calculate so they were not included.

In the Unilever case, the court considered the fact that the inventor was employed by a daughter company of the Unilever concern which is a pure R and D company and does not produce anything itself. The court concluded that the benefits for the whole concern are applicable, not only of the R and D daughter company.

The contribution of the patent benefits to the overall "condition" of the employer company showed to be a major issue, especially in the Unilever case. The benefits of the patent were derived by licensing whereas the rest of Unilever´s income was derived from its own products. Moreover, even though the benefits from the licenses reached almost 20 million GBP, compared to the sales and income of the whole Unilever corporation it was a dwarf amount. The court stated that it is preferred to consider the benefits by a relative measure (like return, profitability) because otherwise for huge concerns like Unilever it would be almost impossible for an employee to come with an invention big enough to

reach the compensation and thus the employees of big companies would be in a worse position than employees of smaller companies. For the big companies the rule "too big to pay" would be accepted in this manner. Therefore, the court took into account that in the Unilever case the invention was created at a very modest budget for Unilever so the return in relative measures was huge. In the same time, the court stated the financial benefits of the employer are only one of the factors to consider when deciding about the compensation.

When considering other than financial benefits derived from the patents in the Unilever case the court stated that the impact of the patent for Unilever was significant, but it was not the core business of Unilever and in the company presence and future did not represent anything vital. In contrary to that, in the GE Healthcare case it was found that the patents had a strategic significance for the whole company and its' future development.

Table 2 Character of innovation

Subcategories and dimensions	Unilever	GE Healthcare
Type of the innovation (Cost saving, production process innovation, remarkable new technical solution, society-wide benefits)	New technical solution, useful, but not vital	Remarkable new bio-technical solution
Share of the benefit from the patent on the overall incomes of the employer	Yes, major issue, "too big to pay"	Yes, without the patents the company would face a crisis
Quantification difficulties	Benefits quantified ex-post	Benefits quantified ex-post, fair share quantification difficulties - settled by the court
Overlap to other companies/countries	Overlap to other companies - concern	Not an issue
Industry	Electrochemistry	Biochemistry - pharmaceuticals
Form of the intellectual property rights protection	Patents	Patents
Stage of the innovation (Raw idea, application)	Prototype of the device, not developed by the employer, licensed	Heart imaging agent molecule, high share of the employer in developing, commercializing
Ways of exploitation (internal usage, licensing, transfer, indirect ways, no usage)	Out-Licensing, not fully exploited, patents held to protect other own business, rather scarce buyers	Internal usage – production and own distribution network
Factual vs. hypothetical exploitation	Factual, hypothetical refused by the court	Factual

Source: Own processing from the judgements

A thorough attention was paid by the court to the stage of the innovation. In the Unilever case, neither Unilever, nor the employee inventor made any significant effort in further development of the device. Glucose testing was out of the main focus of Unilever and the company did not want to enter this business due to established competitors in this field. Unilever in some time preferred to license the patents. The buyers of the license were all the big companies in this field, the licenses were non-exclusive but the number of the buyers was rather small. Unilever´s main purpose of the patents was to use them to protect an actual business. Cross-licensing was of secondary importance and out-licensing of third. Unilever has negotiated the licenses but it was the licensees who approached Unilever to do so.

In the GE Healthcare case the court stated the employer had a significant contribution in the invention, besides others, the court named the development and manufacturing stages, taking the risk of the project, working the invention on and development of the market – the employer build-up a major own distribution network.

3.2 Work regime

The scope of work (work assignment) is a factor that differs in both cases. In the Unilever case, D. Shanks was a R and D employee whose focus was at biosensors for the use in process control and process engineering, rather than bio diagnostics. However, in relation to his work he realized the possible usage for blood and urine testing. He worked on this idea partly at home in his spare time, using the microscope kit of his daughter.

In the GE healthcare case, the invention was at 100% focus of the work of the employee inventors.

In both cases the judges paid attention to the benefits of the employee, in the case of GE it was discussed more deeply. Besides the regular salary and a reward upon assignment of the patent, other employee benefits were considered too. Besides the financial ones, like a benefit at the pension leave, there were also non-financial benefits considered – cars, career promotion and renown.

Table 3 Work regime

Subcategories	Unilever	GE Healthcare
Work assignment (scope of work)	100% R and D, focus at process control and process engineering, used the same idea in the field of bio diagnostics	100% scope of work
Salary and other benefits of the employee	Yes - salary	Yes – salary, cars, pension, re-nowned
Special personal contribution of the employee	No	Yes
Randomly inventing personnel	No	No
Team work	No	Yes
Cooperations	Yes, university professor personal discussions	Yes – Universities – cooperation provided by the employer
International teams	No	No
System of R&D (management)	Not an issue	One of the inventors was the manager who decided about the path to take

Source: Own processing from the judgements

Another very interesting difference in the cases is the system of R and D management. In the GE case the judge pointed out the special contribution of other employees of the company since the research in pharmacy is managed in the way that more teams work on different passes of the same problem. That means that a success of one of the paths is built on the unsuccessful ones and that means the contribution of the employer and other employees is major.

In the GE case the team members contributions were also considered. In this case there are two inventors, Dr. Kelly who was a senior researcher and the R and D manager and his assistant Dr. Chiu, who was a young unexperienced researcher. The court ruled that the fair share of the benefit should be distributed between them in such a way that Dr. Kelly receives 2/3 of the fair share and Dr. Chiu receives 1/3.

The special personal contribution of the employee showed to be one of the key factors in the GE Healthcare case. The court pinpointed that the inventors were not carrying out any routine operations. Their jobs were viewed as involving a significant thought and creativity.

In both cases there was cooperation with universities present. However, in the case of Unilever it was based merely on discussions between the inventor and his colleagues from universities whereas in the GE case a significant university cooperation was provided by the employer.

3.3 Other factors

The value of invention was mentioned by both judges. Interestingly, according to the judgment of the appeal court, the value of the invention should be for the compensation purposes perceived by the amount of benefits derived by the employer, rather than the significance or the innovativeness and creativity of the invention. There were other than financial benefits for the employer present in both cases but they were not included in the calculation of the benefits for the compensation purposes. In the GE case it was due to impossibility to reasonably estimate the value of the other employer benefits (like for example a successful acquisition where the patents plaid a major role), in the Unilever case the judge includes only the financial benefits, not the benefits from blocking the competition by holding the patents.

Table 4 Other factors

Subcategories	Unilever	GE Healthcare
Value of the innovation	yes	yes
Other than financial benefits of the employer	Yes, but not included	Yes, but not included
Taxes and other transfers	yes	no
Transparency and easiness of quantification	yes	yes
Spent investments	yes	yes

Source: Own processing from the judgements

Taxation was considered in the GE case where it was discussed whether a corporate tax rate should be used to lower the benefits that the employer derives from the patent. Since taxation is a consequence of benefits, not something inherent to benefits, the court concluded the taxation should not be considered. Another point is that it would be very difficult and not transparent to calculate the effective taxation that would lower the benefit in each year of exploitation rather than the nominal. In the overall judgments it is noticeable that an easy and transparent calculations are preferred.

The spent investments of the employer were considered in both cases. In the Unilever case the budget spent on the invention was moderate, whereas in case of GE there were much bigger as the whole contribution of the employer.

3.4 Time aspects

The employee compensation was in both cases claimed when the exploitation of the patents ended. In the Unilever case the employee inventor also claimed the time value of money between the moment when the employer derives the money from the patent and the moment of award to the inventor employee. The judge concluded that the monies received would have been employed in other activities which could be profitable as well as loss-making, but as a result unpredictable and random and could not be related to what the patent actually produced. Therefore, the time value of money allowance was not adjudged.

The benefits derived from the patents were in both cases calculated for the whole period of exploitation of the patents. Since the claims were ex-post, the compensation was calculated as one for all but the judges mention that in other cases the claim could be raised repeatedly.

3.5 Employer-employee unbalanced relations

The GE case give evidence of an intervening factor that was also identified in our preceding research – the employer – employee unbalanced relations. The claim was raised just before Dr. Kelly retired, several years after the invention was originated and exploited. This timing would confirm the employee inventors might feel constrained by the employee position, they might be afraid of losing their job or facing job obstacles if trying to raise some compensation claims.

3.6 Discussion

We have found an identifiable parallel with German remuneration system – all benefits from the invention are relevant factors for reward estimation (Harhoff & Hoisl, 2007; Trimborn, 2009). However, they differ in other substantial aspects. While German system remunerates all individual inventions (Wündisch, 2017), the British one only a small fraction of inventions with outstanding benefits. However, both systems offer employee inventors a small percentage of overall benefits and they do not limit the amount of reward by any fixed limits. This phenomenon can be found also in Japan – Japanese innovative corporations abandoned fixing of maximum amounts as a consequence of many employee-employee litigations in last two decades (Okuyama, 2017). Similarly, French courts reward in some case huge rewards, but this phenomenon is driven rather by strong French collective agreements (Declercq & Intes, 2017; Wolk, 2011). Patterns of proportionality can be seen also in Chinese litigation area (Jin, 2016).

4 Conclusions

The two-case comparison has brought a deeper insight on the intervening factors of the employee remuneration process. The above-mentioned factors confirmed to have relevance in the process of estimation of a fair reward for the inventor. These factors, if confirmed by the following research, could be recommended to R&D managers of the Czech innovative companies to be considered in the remuneration process.

However, the most interesting conclusion we can make based on this case study is that the estimation of the fair reward is a multicriteria balancing task where most of the criteria have qualitative character. Importantly, it shows to be impossible to set the weights for the intervening factors in general. The two cases show that the same criteria even though were used in both cases, in each case they were adjudged a different relevance (weight).

In the GE case, there were many factors that reflected a big contribution of the employer, most importantly the facilities, the financial funds, taking the risks, advice to the inventor and the opportunity, strong cooperation with universities, parallel ways of research and development and commercialization of the product. These factors were allowed for in the benefits calculation as well as when setting the fair percentage of the benefits for employee compensation. In the same time the invention was a 100% scope of work of the employees. On the other hand, the significance of the patent for the overall position of the company and the personal input and creativity of the inventors above common expectations were the decisive factors that lead to the conclusion that the invention was an outstanding one so the employee inventors were adjudged compensation.

The Unilever case is a case where one of the factors overwhelms the others and shows to be the decisive one. In this case there were many factors in favor of the employee inventor like a huge profitability of the invention and very small contribution of the employer, the invention was originated by the inventor partly at home in his spare time and using some basic home equipment. But still, the judge ruled that the significance of the invention for the Unilever group was limited since it was not a subject of its´ core business and it did not change the position of the company. As a result, the invention was not found outstanding and the employee did not receive any compensation for it.

Besides the differences, there were also some factors in common. Some of them are topics that were viewed as controversial by the Czech and Slovak intellectual property law experts. They can be helpful in suggesting what might be the overwhelming professional opinion. These factors are first of all the time aspects – the benefits were in both cases calculated for the full period of exploitation. Both judges preferred to use the ex-post factual benefits to hypothetical or reasonably expectable. They also based the benefits calculation on the factual benefits even though the patents might not have been exploited by the company fully. They also indicate there should be no time-value of money aspect.

Moreover, the case study revealed two new intervening factors, that is a special personal contribution of the employee inventor (even in the scope of work) in the GE Healthcare case and the share of the benefit from the patent on the overall incomes of the employer.

Since both the cases occurred in Great Britain, the judges assessed fairness through the equity principle between the employer and the employee inventor, based on the equity of benefits derived by the parties on one hand and the actions, risks and inputs of all kinds of the two parties. However, the courts decisions might not impact just the two parties. As (Normile, 2004) points out on the case of Japanese inventor of Blue LED light, who was awarded 180 mil. USD compensation from his employer by the court, the court decisions might have major consequences. On one hand large awards might pressure companies to move the R&D to other localities, on the other the positive motivating effect of such financial incentives might attract young people to start a research career.

This case study will be followed by other case studies which should gradually lead to a complex picture of the whole remuneration process including the intervening conditions.

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The Influence of Work Environment on Employee Motivation

Michaela Slabová

Abstract: *The contribution has dealt with the topic of impact of work environment on employee motivation in the selected company and its aim was to briefly literally introduce the issue of human resources and personnel management conditions, further to shed a light on the importance of ergonomics and the impact of working conditions on employees' motivation as well as their subsequent remuneration options. The methodology part includes the interviews with employees of the selected company, which were needed to determine primary information and follow-up survey, where the topic of the impact of working conditions on staff motivation and performance was specified. The outcome is to propose innovative improvement measures leading to positive changes in the area of human resource management. This ought to result in the improvement of both the physical condition of workers and their satisfaction and motivation to administer the best possible job performance; not only currently, but even henceforth. All proposals for improving are processed with an approximate cost of the realization in case of potential interest, which has been significantly shown by company Unterer Ltd.*

Key words: Working Conditions · Ergonomics · Motivation · Performance · Employee Compensations

JEL Classification: M12

1 Introduction

Human resource management is not only a philosophy in the 21st century that relies on a number of different theories and ideas of managing people in a given enterprise, but it is considered a comprehensive approach to developing human potential, organizing it, and leading the organization. Employees for the company play a key role because, thanks to their knowledge, knowledge, skills and experience, the cornerstone of all corporate activities and the unique essence of the success of the whole society is a cornerstone. It is imperative that this valuable resource takes care of and constantly adapts working conditions to its needs, development, motivation and satisfaction in such a way that the enterprise retains this exceptional human capital (Armstrong, 2007).

Globalization has brought new trends in this field. The latest findings in human resource management have seen a wave of new approaches to human capital as a unique individual being. The focus was on her physical and mental state. At this time of full new possibilities and approaches, concepts of increasing motivation and performance of employees are created by adapting the various working conditions that each organization can influence and setting them in the desired direction for both parties (Urban, 2005).

The aim of this essay is briefly according to literary research to mention the issue of human resources and the conditions of personnel management, to further elucidate the importance of ergonomics of work and the influence of working conditions on the motivation of employees and their subsequent possibility of remuneration. For this purpose, interviews will be conducted with the employees of the selected enterprise for primary information and the subsequent questionnaire survey, where the issue of the impact of working conditions on the motivation and performance of the employees will be concretized. The outcome of the work will be to propose innovative improvement measures that will lead to positive changes in the area of human resources management and improve not only the physical status of the employees, but also to increase their satisfaction and motivation to provide the best work performance not only at present but also in the following time. For this work, I chose Unterer s.r.o. (Unterer.at, 2016).

2 Methods

The main objective is to propose innovative improvement measures that will lead to positive changes in human resources management and not only improve the physical condition of employees, but also to increase their satisfaction and motivation and to provide the best work performance not only at present but also in the following time.

For the purposes of this contribution, techniques were used, such as a first-guided interview, a questionnaire survey, and an expert's expert assessment. A personalized interview was conducted with the employees of the selected company about the area of influence of the working conditions on their motivation, performance and satisfaction as well as the working conditions of their physical condition. The type of interview was unstructured, it was possible to question the questioners and correct the interview according to respondents' reactions. Through this interview, an overview of the influence of working conditions on employees was obtained, the main areas of influencing motivation were identified,

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as well as the most important problems that burden workers in a sedentary job. Based on this interview, a questionnaire survey was prepared, in which the aforementioned influencing factors were concretized (Kotler a kol., 2007).

The questionnaire survey was conducted in March 2017 with employees of the selected company. The questionnaires were created in MS Word and subsequently were personally handed to the respondents in printed form. The main importance of the questionnaire is to obtain information from respondents and to ensure a uniform template for data writing, which makes it easy to process data. The questionnaire survey was attended by 15 respondents (employees of the selected company) who answered a total of 14 questions, 1 question is open, 5 questions are half closed, 8 questions closed. Response types were only 1 correct answer or multiple responses. For question no. 12, it was necessary to assign just one order 1-7, where 1 = the strongest influence, 7 = the weakest influence. The questionnaires were prepared in order to specify the effects of working conditions on the motivation of employees, as well as to discover the appropriate form of employee remuneration that could support this motivation and, last but not least, to identify new innovative approaches from the point of view of ergonomics at the workplace. The evaluation of the questionnaire survey was carried out in Microsoft Office Excel, where the data and results are processed into clear graphs (Kozel, R. Mlynářová, L & Svobodová, H.,2011).

An expert assessment technique was used as a supplementary methodology for determining the impact of working conditions in the ergonomics field on the employees. For this expert assessment, a physiotherapist was invited to the selected company, who professionally evaluated these influences of the working environment (conditions) not only on the physical condition of the employees but also on the mental state, which is closely related to motivation, performance and satisfaction. Closer collaboration with this expert has created effective and innovative improvements.

3 Results

Questions in the questionnaire focused on the following themes: finding dissatisfaction about sedentary employment and the resulting problems arising from this issue; identifying current employee benefits and exploring new opportunities that could increase employee motivation; finding out about suggestions for improved working conditions in the field of ergonomics.

Based on the findings, one of the proposed innovative proposals to increase the motivation of the "Health Day" event was to find out where the employees of the selected company could learn trends, tips and advice on how to improve health and improve performance at work. A great advantage is the possibility of personal consultation with a physiotherapist directly at the workplace. This event would take place once a year.

In terms of increasing not only the motivation and performance of the employees, but also the improvement of their health and mental state, I propose computer software with rehabilitation exercises for a sedentary office job. I have chosen the program name "Healthy work" thematically. As a result of the questionnaire survey, almost 97% of respondents would regularly attend such rehabilitation activities and 100% of employees would appreciate the workout during their working hours.

The "Work Healthy" program would consist of two modules of rehabilitation exercises for a sedentary job. As stated in the literary research, especially when working on computers, rest periods should be followed after 2.5 hours, and this also applies when sitting on an office chair, where it is highly recommended to change the position. The first module would focus on the morning stretching of the body, the second module would be focused on the afternoon relaxation from bad posture and the correction of the pains created during the work load. These rehabilitation exercises are simple but very effective and do not take more than 5 minutes in each module. The physiotherapist Bc. et Bc. Jaroslav Zeman. There is already a whole range of recommendations and exercises suitable for the office, however the overwhelming majority of employees do not observe these activities or are justified by lack of time or incorrect practice of exercises. That's why I suggest this computer program, which would automatically alert you to the exercises and run short videos with them on the screen during work hours. This software would automatically follow the recommended break after 2.5 hours and run itself so that workers are not burdened with the idea that they have forgotten to practice. Another advantage of this program is the possibility of delaying and interrupting if the short workout at a given moment does not suit the worker, the program will then be remembered by itself. This software could be customized according to the requirements of the employees (after a discussion with a physiotherapist). Some ideas of rehabilitation exercises in the office are shown below (Slabová, 2017).

I think the "Work Healthy" program could be useful not only in Unterer s.r.o., but also in other businesses with a sedentary job with a computer job.

Other measures that employees of the company have greatly appreciated are ergonomic office aids that are recommended to workers who spend more than four hours of work on their computers. Thanks to these ergonomic aids, it is

possible to achieve a significant improvement in the health of employees and to reduce chronic illnesses. The relaxing foot pad ensures seating optimal ergonomic position and natural foot inclination. The ergonomic mouse and wrist pad helps prevent inflammation of the tendons and ligament overload and provides support for the wrists.

Figure 1 Example of rehabilitation exercises in the office

Source: Own processing

As also emerged from the questionnaire survey, employees do not currently have a sophisticated remuneration system only in the form of financial rewards. The responses mainly showed interest in non-financial benefits that employees would appreciate more, and these benefits would contribute to increasing their satisfaction and motivation to work.

Figure 2 What working conditions could improve your motivation or performance in the workplace? (For each option, assign 1-7, 1 = strongest, 7 = weakest)
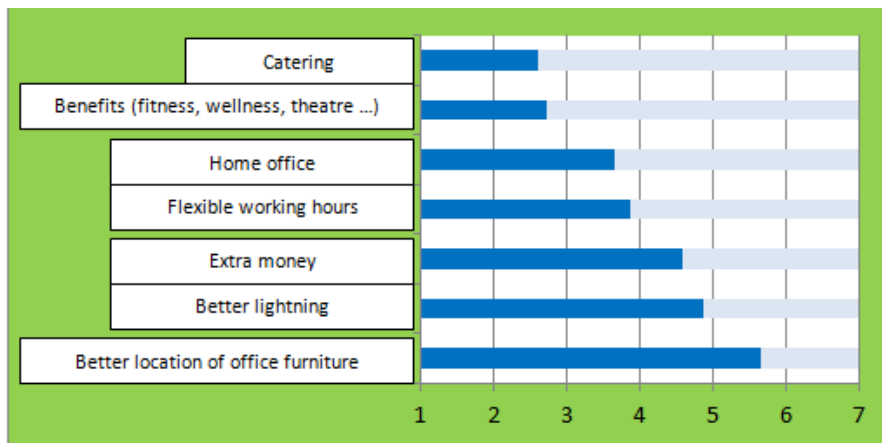
Source: Own processing

In this respect, a contribution to sport (which received the most replies) in the form of a Multisport card was designed to provide employees with unlimited access to sports and relaxation facilities throughout the Czech Republic. A great advantage can be considered as the alternation of activities and sports grounds without any restrictions. The result of the move is the elimination of stress, which leads to greater employee satisfaction and greater efficiency in performing work tasks. Another suggestion was the possibility of company membership in the fitness facility KVALITA fitness, because of the advantageous position next to the seat of the company. The proposal was also a relaxing sporting option,

a swimming ticket that would be useful for many employees due to too much time spent working on the office chair at the computer and also those who do not like sports facilities such as fitness centers (Šmejkal, 2017; Multisport.cz. , 2015); Cb.sport.cz.,2016).

The second most desirable employee benefit was the catering allowance. Deliveries are the absolute number one among benefits and for employers as well as the most advantageous option for employee catering contributions. Unterer s.r.o. can choose from two types of meals - Chèque Déjeuner, Gastro Pass. The result of preferences is seen in Figure 2 below (Cz.benefity.sodexo.com, 2017).

Table 1 Results of question: Which working conditions could improve motivation or performance of employees in the work place?

Answer	Average ranking
Other location of objects in the office	5,667
Other lighting	4,867
Financial bonus	4,6
Flexible working hours	3,867
Home office	3,667
Non-financial benefits (fitness, wellness, theathre,...)	2,733
Catering	2,6

Source: Own processing

This question is focused on the opinion of employees that could improve their work motives, performance, or satisfaction. Each of the suggested options gave respondents a meaning from 1-7, where 1 = the strongest influence, 7 = the weakest influence. The table above shows the individual average order of working conditions. With the average order smaller, the more the working condition for the questioned is the more important. As can be seen from the graphical representation, the most powerful influence on the increase of motivation should be provided by catering, the second place the employee's non-financial benefits (fitness, massages, etc.). Third place received the option of home office, the next one was the flexible working hours. The weakest impact on motivation then had options: a financial bonus, other lighting and other space use. It can therefore be assumed that the employer should offer to employees a choice of benefits that will increase their satisfaction and motivation to work (Slabová, 2017).

4 Conclusions

The essay deals with the influence of working conditions on the motivation of employees in selected company. Excessive time and competitive pressure require increasingly daring steps in the whole of personnel management, not only on the material level, but also through the inner satisfaction of the employees who make up the heart of the whole organization. Only a satisfied and motivated worker can perform the quality work required. To do this, human capital organizations need to make a lot of effort and adapt their working conditions so that they can perform the best in accordance with their convictions, corporate values and culture. In order for these working conditions to be set up properly, an enterprise needs to know the wishes and needs of its employees, only to create a synergy that will have a beneficial impact not only on individuals within society but also on the efforts that society is making to achieve its goals and mission.

Outcomes of the questionnaire survey and expert assessment have led to innovative workplace equipment changes being proposed with ergonomic aids, and the "Work Healthy" computer program, which focuses on short rehab exercises in the form of videos over the course of working hours, helps to improve both motivation, as well as the performance of the workers. As a result of very positive feedback, the "Health Day" event was held once a year to educate employees on healthy habits in a sedentary job with the possibility of personal consultation with a physiotherapist directly at the workplace. As a further measure to increase employee motivation, new employee benefits have been proposed, stemming from individual needs and wishes of employees.

Employees appreciated the introduction of the following benefits: catering, non-financial benefits (fitness, wellness, theathre,…), home office, flexible working hours, extra money, better lightning and better location of object in the office. The positive effect of mentioned proposals is increasing satisfaction, motivation to do work more effective and reducing the negative impact on the psyche and the body of employees. (Slabová, 2017).

All upgrading proposals are also processed with an approximate cost calculation for potential interest in the realization that Unterer s.r.o. she showed warmly.

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Implementation of KANBAN System for Material Flow Optimization

Radek Toušek, Martin Babka

Abstract: *The article deals with the specifics of implementing the KANBAN logistics technology, which is used in industrial production plants for material flow management. The findings are based on applied research, which was implemented in a production plant. This plant focuses on producing passive safety components for road vehicles. The aim of the research was to restructure material flow management processes through KANBAN logistics technology seeking to optimize the use of floor space in the production hall. Due to the planned increase in production capacities we needed to reduce space for material storage as well as finished products storage and provide optimal material input for the production lines.*

Key words: Logistics · KANBAN System · Material Flow Optimization

JEL Classification: M19

1 Introduction

The history of KANBAN logistics technology dates back to 1953, when Mr. Taiichi Ohno began studying the process of stock replenishment in US supermarkets and then successfully applied this concept at Toyota Motor in Japan (Mojžíš et al., 2003). Currently, KANBAN technology is used to manage material flow in the automotive industry worldwide and is an integral part of logistics systems in multinational corporations such as Robert Bosch, Škoda Auto and many others.

Automotive supply chains are, however, built on cooperation with a large number of subcontractors who provide, for example, only partial manufacturing operations or deliveries of certain sub modules. Therefore, a number of subcontractors do not have advanced logistics technologies implemented in their logistics systems, which is a limitation for production planning, input planning and keeping production deadlines. However, as soon as the volume of production increases, these limits will present barriers that hinder the production organization development towards integrated supply networks. These networks should respond flexibly to market requirements while maintaining high cost-effectiveness of production and logistics operations.

The KANBAN Production Management Technology is based on the principle of so called self-regulating control circuits, which are based on a supply and demand element in the structure of individual production processes that are linked to each other and at the end of which the final product is for sale to the customer. The customer's order enters into the production company at the end of the future process, that means at the expedition. From there the logistics process works backwards towards the raw material input. From the point of view of the material flow of the processed production, each following workplace behaves as a customer and the previous workplace as a supplier (internal customer and internal supplier). The quality of delivery is always guaranteed by the supplying segment. The relations of the individual supply and withdrawal cells are managed by the so-called pull principle, which means that only what is actually ordered is produced, in real quantity and time. In place of an order there is always a kanban card, which can be either physical or electronic (Horváth, 2007). From the point of view of introducing an electronic kanban system, increased attention must be paid to the adaptability of the information system used. From a functional point of view, the electronic Kanban system can be connected to transmitting the trigger signal to start the delivery cycle based on the reading of, for example, a specific unlicensed barcode.

The KANBAN technology is only suitable for serial production of a stable assortment with a relatively small number of product variants with stable demand without any major fluctuations in consumption. Implementing the KANBAN technology increases the flow of production, reduces the stock of incomplete production, increases the flexibility of production response to customer requirements and increases productivity.

2 Methods

The article focuses on implementing the KANBAN logistics technology, which took place from October 2016 to June 2017 and which the research is based on. The company, which has served as the subject of this research, is a major

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component supplier for the automotive industry, specializing in producing passive vehicle safety components. The aim of the applied research was to create a system of material flow organization for optimal provision of production inputs to the production lines at the required time and quantity. At the same time we wanted to reduce the volume of unfinished production and other material in the production hall because of the planned increase of production capacities. In the current situation, the company is not able to achieve the desired production capacity.

The applied research was carried out in several phases, which chronologically and factually followed one another. Initially, material flow analysis was performed at the level of the production division. We set critical factors for the new logistics processes and carried out the optimization of the production hall in terms of material flows. Then we designed an optimized supply system for the production lines, including the step-by-step process for successful implementation of the new system. To determine the critical factors, it was important to analyse the partial logistical processes (receiving material, qualitative and quantitative acceptance of the material, stockpiling, unloading the material onto the production line, removing unused material from the production line, processes connected to defective material either from the supplier or that was damaged during the production process). We also observed the supply operations including the level of logistics personnel, production operators and middle management personnel involvement into logistics activities. To collect data for later analysis we continuously recorded activity logs of the single workplaces so that we could explore the time required for each operation. This helped us identify possible time deflections. For setting the KANBAN logistics technology we applied a formula for determining the volume of kanban cards. This formula is determined for setting the partial self-regulating control circuits of the kanban card cycle time. It respects the uniform set-up of the kanban card circulation system based on triggering the signal after the first piece has been loaded to the production line from the means of transport, including the planned supply routes and supply cycles.

3 Research results

3.1 The system of material flows and its critical factors

The company we have worked with enters the supply chain of the automotive industry as a subcontractor who, in regular weekly cycles, takes a complete supply of material from the central warehouse supplier for the next production week, performs the corresponding production operations which add value and then returns the finished products back to the supplier's central warehouse according to the orders. The warehouse thus simultaneously emerges as a supplier of input material and as a customer from the logistics point of view. After qualitative and quantitative material sampling and registration into the information system and storage, the material is removed from the pallet units in production according to the production batch based on the production plan. Information on production launch is delivered to the warehouse on pallet sheets. These include the bill of material for the finished product. On the basis of an internal rule, the material must be transported onto the production line within 120 minutes from the time the warehouse first receives information to release material. Material that is not used in production is then returned from the production hall to the warehouse.

As a result of this material flow management system, the company in question has for a long time been struggling with a high degree of space occupied in the production hall. This space is occupied by the production and material, including finished products, which are transported for expedition only after the end of the whole production batch. With the current operation of eleven production lines in a production area of 271 m^2, the company is unable to meet the current demand for increased production capacities. This would mean to increase the production capacities by employing 8 new production lines. Additionally, the material flow adjustment process has a number of drawbacks, resulting in delays in the material supply to the production line, in the confusion of the type of material for the planned production and thus in the downtime and the necessary delay of production start of the planned production batch.

Table 1 Use of the production hall area before optimization

Category	Space (in m^2)	Space (in %)
Production lines	33,2	12,2
Palette racking	35,6	13,1
Palette positions	57,5	21,2
Handling lanes	35,6	13,1
Unusable space	109,1	40,4
Total	271,0	100,0

Source: Own processing

The structure of the production hall (see Table 1) shows a high proportion of unusable space due to the inappropriate location of the production lines so there is not enough space to ensure sufficient production capacity, for material storage and unfinished production. Additionally, the supply line system includes 50% empty paths due to the material loading system and finished products unloading system that is in place. These systems work with whole pallets only.

3.2 Preconditions for implementing the KANBAN technology

KANBAN technology is based on the principle of self-regulating control circuits, which are formed by a supplier and a receiver in a structure of individual production processes that are linked to each other and at the end of which the final product is ready for sale to the customer. Let us now take a look at how the system works. The customer's order enters into the production company at the end of the future process, that means at the expedition. From there the logistics process works backwards. The expedition orders the required product at the previous workplace, that is at the assembly line. The assembly line orders the necessary parts at the workstations that make these parts or at the material store. In the material flow of the production, therefore, the following workplace behaves as a customer and the previous workplace as a supplier (internal customer and internal supplier). The relations of the individual supply and receiving cells are governed by the so-called "pull principle" which means they are produced only as they are currently ordered, in real quantity and time. The order is called "a kanban card" and it can be either physical or electronic (Moses et al., 2003). The Kanban card must contain the following information: the part number to be manufactured, its name, the workplace number where it is to be manufactured, and the order quantity and may contain other information that is substantial given the nature of the production.

The KANBAN technology is only suitable for series production of a stable assortment with a relatively small number of fixed demand products without large fluctuations in consumption. This technology, on the other hand, is not suitable for piece production with a greatly varying product demand. This is because the implementation of the system and its coordination is quite demanding. However, KANBAN technology increases the flow of production, reduces inventories of incomplete production, increases the flexibility of production response to customer requirements and increases labor productivity (Horváth, 2009).

3.3 Preliminary stages of implementing the KANBAN technology

Prior to the implementation of the KANBAN system, it is necessary to make adjustments in the way the material is stored, in the way the material is stocked at the production lines, in the production planning, in the material flows onto the production lines and finished production flows out to the expedition. Before running the Kanban system with the particular company, it was important to take the following steps to make the implementation successful:

1. Change the layout of the production halls so that all the supply points are oriented to the supply handling aisle, and this aisle must stay free in one direction past all the supply points.

2. Store material on fixed positions in a controlled material storage system and mark the storage positions of the racks by the production line number and material number.

3. Store the material in FIFO mode as the component supplier performs adjustments of input material at irregular intervals according to the final manufacturer's technological requirements and identical parts of the older series may not enter the production process after setting a new standard.

4. The material supplied in bulk transport containers must be divided into smaller batches corresponding to the size of the B2 or B3 standardized transport means. This is the volume the kanban cards work with from that point on.

5. The warehouse must be equipped with an empty packaging area for finished production, which is completed with interlayers or other additional packaging material according to the customer's packaging orders.

6. Each production line must have a standardized position for the placement of transport boxes with unfinished and finished production prior to launching the system. The given position must have a specified capacity of handling units according to the stock flow planned on the production line.

7. Change the wrapping prescription for the material packed in non-returnable packages. Agree with the material supplier on changing the packaging so that the material is newly supplied in standard B2 or B3 shipping boxes. If this is not possible, the material can be repackaged into standard shipping boxes in the pre-production phase. However, this means increasing the cost of handling the material.

8. In the production hall space must be allotted for containers which the starting dose will be placed in for the start of the new production. There must be a sign above each conveyor indicating which line the material is intended for.

9. In the production hall space must be allotted for containers which the material leftover after finished production will be placed in along with kanban cards. The warehouse workers will then mark incomplete containers with the remaining amount of material and return them to the correct position in the warehouse according to those kanban cards.

10. A space must be allotted at the expedition area where empty pallets for finished production will be prepared - one piece for each production line with the pallets in a row next to each other. Each pallet must be marked with a production line number. The shipping tickets that are enclosed in the finished production crates must be clearly marked with the production line number for the expedition to run smoothly.

By modifying and reducing the area of the factory floor taken up by the material and the production according to the KANBAN logistics technology, it will be possible to double the capacity of the production hall up to a total of 22 production lines. The new layout of the production area in the production hall is shown in Table 2. The pallet racks have been replaced by the storage of the starting material and material left over from finished production, one rolltainer position for each production line. This change has resulted in a saving of 20.9 m^2. The material storage space at the production lines was reduced by 42.6 m^2. On the other hand, there was an extension of the aisles by 54.1 m^2. This happened to ensure a smooth ongoing supply to the production lines in a loop without empty paths.

Table 2 Production hall space utilization with the new system of material flows

Category	Space (v m^2)	Space (v %)
Production lines	66,3	24,4
Production starting and finishing positions	14,7	5,4
Material stocks at the production lines	14,9	5,5
Handling lanes	89,7	33,1
Unusable space	85,4	31,6
Total	271,0	100,0

Source: Own processing

3.4 Setting up processes in the new material flow management system

We need to divide the processes for implementing a material flow management system into two separate categories depending on the regularity and volume of production. KANBAN logistics technology can be used to produce regular series with an even production volume. However, a different way of managing material flows is required to produce irregular small production batches.

The production of regular series with an even weekly volume includes the following processes:

1. **Receiving material** - the sampling processes can be maintained according to the standard of the production company, however, for the FIFO system to work, each pallet must be marked with the material reception date. The material can then be deposited on a fixed position according to the division on the production line. If there is no other material of the type, it is first placed in the ground floor position. Other material of the same kind is deposited above this material. If the shelf capacity is full, the material is placed in the storage rack outside the specified storage column. Once the material from the ground level has been used up, the material with the oldest date of storage is being prepared in agreement with the FIFO principle. The material acceptance worker must report changing the packing standard to the production master for them to change the number of kanban cards for the material accordingly.

2. **Planning the production** - the production master prepares the production operations on the individual production lines, prints out the accompanying sheet for the individual orders and prints out the shipping cards for the individual handling units. According to the production plan, the kanban cards, palette accompanying tickets and dispatch cards must be placed in a visible location, e.g. on a notice board.

3. **Initial start of production** - the authorized warehouse picks up the kanban card at the first position at each production line in advance and prepares the starting batch of material for each line, placing the particular kanban card in each container including empty containers. Before starting the production line, this material is placed on the production line by the warehouse personnel. The expedition worker picks up the pallet slip sheets and attaches them above the pallet positions assigned for the appropriate production lines in the shipping area. The production master passes the dispatch list to the production operator, verifies the material and starts the production. The production operator places the materi-

al on the correct places on the production line and places the boxes for finished products as well. He or she removes the kanban cards from the boxes and puts them into the designated compartment at the production line. This procedure repeats whenever a new box with material from the storage rack at the production line is placed on the production line.

4. **Material Flow Management** - The production operator prepares boxes with finished products with a shipping ticket and puts them at the designated point at the supply lane at their production line. He or she also puts empty packaging material on a designated place. Except for the two specified production lines, the packaging of the material must not be used for storing the finished products, as it is necessary to provide these packages with interlayers and plastic inserts according to the packing regulations and the crates also have to be checked for damages or soils before storing the finished products.

If the production operator has free shipping tickets and does not have the material, he must immediately contact the production master and the authorized warehouse employee to find the reason for lack of material.

When the production operator places the last shipping ticket in the finished production box, it is a signal to stop the production. The production master changes the production process control (factory line setting for a new product) and prepares new production documentation. The warehouse employee replaces the new production components which have been prepared in the production hall in the area for the starting doses of material and he or she moves the residual material from the finished production into the space allotted for storing the material after the production stops. The worker also notes the number of remaining pieces and stores the boxes into the appropriate shelves in the warehouse and based on the kanban cards and then hands the cards over to the master of production.

The manipulating operator delivers the ordered material at regular intervals (30 minutes) with the ordered material and empty containers according to the kanban cards, loads the finished production boxes and collects the kanban cards from the designated compartments. Afterwards, they take the finished production to the expedition, where the individual boxes are sorted according to the number of the production line on the expedition ticket on the corresponding pallets, unload empty containers in the warehouse and according to the kanban cards they unload the boxes in the warehouse according to the following rule: 1 card = 1 box. This material is then transported to the production hall. This cycle is repeated at regular intervals. If the material is not in stock for a given kanban card, the manipulator stores the card at a specified location and informs the production master, who finds one of these two results:

- the remaining material is sufficient to cover the contract to the end of the planned production, the stock is not above the contract, everything is fine, or
- there is lack of material to complete the order, in which case the production master finds how this situation has occurred (e.g. discarded defective pieces of material, etc.) and reconfigures the production line for the next production order.

The authorized warehouse employee must ensure that the material in the rack cell marked with the production line number on the ground floor of the warehouse is always refilled. They must also ensure that a permanent supply of packaging materials is prepared. The expedition worker covers the top layer of the boxes with a paper layer and provides each finished pallet with the pallet accompanying sheet which is available above the pallet location for each line separately. Only fully loaded boxes with material may be allowed into production, partly loaded boxes are put into production as the last ones (otherwise there is a risk stopping the production line).

The production of irregular small batches is designed in such a way that the warehouse prepares a production batch for the production of a small order (e.g. 100, 500, 900 pieces of finished products) according to the pallet slip. This batch is stocked on the production line at the start of production. The material is not controlled by kanban cards. Once the job is completed, the warehouse is reloaded with new material and an employee takes the finished production with the pallet accompanying sheet to the expedition. In the production plan, this order is stored as a special kanban card with the product number and number of pieces produced, accompanied with a pallet slip and shipping tickets.

4 Conclusion

KANBAN logistics technology represents a distinct paradigm from within the inventory management so the implementation of this technology must be very well prepared and based on current conditions in the production organization. The stereotype that there should be full production reserves for the realization of an entire production batch on the production site area seems to be a definite waste of the production area space as well as a loss in efficiency of material flows. In the case of the particular entity where we carried out this research, the change in the material flow management system allowed the existing production area to be increased by 100% - from eleven to twenty-two production lines. The implementation cost, including the KANBAN system setting, storage facility and production facilities adjustment, is only CZK 35 thousand, in low cost version.

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Application of Ergonomic Principles at the Beginning of Industry 4.0

Drahoš Vaněček, Martin Pech

Abstract: *The article focused on the current changes related to the Industry 4.0. The main objective of the paper is whether these changes would affect the worker's relations to the environment and whether these changes may increase the interest in ergonomics. According to the questionnaire replies, ergonomics in enterprises has already fulfilled its role. Relations between a worker and their working environment have already been solved, but some limited number of tasks seems to remain. In the context of the forthcoming changes in Industry 4.0 technology will bring further impulses to development in this area. It will be especially smart technologies such as smart homes, smart factories, and smart cities, bringing the ergonomic issues to a brand new level. The advantage of using robots is shown in case study.*

Key words: Ergonomics · Industry 4.0 · Robots · Technological Changes

JEL Classification: M11 · O33

1 Introduction

Ergonomics is an interdisciplinary science, created by a combination of work hygiene, physiology and industrial anthropometry. The goal of ergonomics is to optimally adapt work activities to a person opposite to frequent theocratic practice, when a person has to adapt to the tools, machines and entire production systems. The result is human health protection, job satisfaction and high labour performance.

In the Czech Republic, ergonomics was developing in the period of the First Czechoslovak Republic. During that time, issues of performance improvement, and the improvement of working environment and working conditions (physical exertion, noise, vision conditions, etc.) were becoming important. At a later time, as the most difficult work was mechanized, the importance of ergonomics slightly diminished.

Currently, as a major change in production is expected in connection with the arrival of Industry 4.0, introducing digitization, robotization and artificial intelligence. The question arises whether these changes would affect the worker's relations to the environment, if the "living" workers will be gradually replaced by robots. May it increase the interest in ergonomics?

The current debate on robotics deals with artificial intelligence, the use of robots in war, and use of smart algorithms such as in journalism. Currently, the term "robot" is also used for types of software (Pfeiffer 2016). A frequently cited study of Frey and Osborn (2016), predicted that in the following years, 47% of US jobs will be automated through the application of new digital technologies. This means that technological development will gradually eliminate the need for human labour force. By Roblek, Mesko et al. (2016), Industry 4.0 will mean the digitization of business processes as a whole, including the procurement of materials, production and delivery of goods to the customer. In this area, the automated process will require a certain degree of "employee automation". However, people will still be able to use their brains.

Pfeiffer (2016) agrees on this, seeing the effect as advantageous, as it may replace as a result, the monotonous and physically demanding work by creative work. Okyay (2016) sees the change as a golden opportunity to overcome gender differences as manual work is most often the domain of men and, with the technological change, emphasis will be placed on flexibility, and creativity regardless of gender.

Industry 4.0 has brought major changes. In Europe, the number of industrial robots has doubled since 2004. Bahrin, Othman et al. (2016) predict that smart robots might replace people, and not only in simple, structured tasks in closed rooms. In Industry 4.0, robots and humans will work together on interconnected tasks, using smart human-machine interface. This is also proven by the results of the two-year AssistMe project, focusing on robot and human collaboration. The operator worked with a robot (robotic arm) in laboratory conditions, in the factory on the automotive line. The results suggest humans and robots working together require maintaining and adapting the pace of work (the need to introduce certain sensors) to avoid changing the speed of usual procedures that may vary in humans. The robot control

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panel had a negative impact on user experience while testing, and could have lead to a decrease in labour productivity (Weiss, Huber et al. 2016). Not surprisingly, the workers were afraid they might be replaced by a robot. For such reasons, ergonomics might be important in implementing the changes.

2 Methods

The article deals with the current changes in the context of the industry 4.0 and preferences of enterprises in terms of ergonomics. The main objective of the paper is whether these changes would affect the worker's relations to the environment. The partial objective of this survey was also to find managers' opinion on the meaning and use of ergonomics, so that future trends and recommendations in applying ergonomic principles could be derived. May all these changes increase the interest in ergonomics?

With assistance of the students of the University of South Bohemia in České Budějovice, Faculty of Economics, 90 questionnaires were obtained concerning lean production in enterprises focusing on 1) engineering and machinery, 2) electro-industry, 3) production of food products, 4) production of household supplies.

The answer were classified by the scope of the enterprises and by their size (number of workers), the owner (national or foreign), and the position of the enterprise in the supply chain (an enterprise is either a key link or a dependent link of the supply chain).

As only four enterprises of the electro-industry were in the sample, this group is not listed separately; however the data are used in the calculations.

3 Research results

In the questionnaire, the application of six different methods was assessed. However, only four of them are shown in the results. The importance of the other two was actually negligible for the enterprises (setting up workplaces to better suit women, and setting up workplaces to better suit disabled people).

Table 1 Application of ergonomic methods in enterprises

No.	Enterprise type	Number	Focused on:			
			Minimizing movement	Physical effort	Hygiene (noise, vision)	Injury reduction
1	Small	26	26.9	65.4	15.4	26.9
2	Middle-sized	34	38.2	55.9	20.6	61.8
3	Large	30	33.3	73.3	30.0	50.0
4	Machinery industry	45	24.4	73.3	24.4	55.6
5	Food production	17	29.4	70.6	11.8	29.4
6	Household supplies	24	50.0	45.8	25.0	41.7
7	Foreign owner	35	48.6	65.7	20.0	57.1
8	Czech owner	55	21.8	63.6	23.6	41.8
9	Key link	43	27.9	65.1	20.9	53.5
10	Dependent link	29	34.5	72.4	24.1	44.8

Source: Own processing

Approximately one third of the enterprises prefer such machines and workstations reducing workers´ movements. This is particularly noticeable for the enterprises producing home supplies. This is often a craft production where there is no mass production, but there are frequent changes in working practices. Companies with foreign owners also place more emphasis on minimizing movements - this is mainly mass production, characterized by great repeatability.

The greatest emphasis is put on adjusting workplaces reducing physical effort. A total of 55.9-73.3% of the enterprises found this important. It is quite surprising as it could have been assumed that difficult and physically demanding work has already been taken over by the machines. Significant importance is attributed to ergonomics in the context of injury reduction. Only a quarter of the enterprises see the ergonomics as a possibility to be protected against excessive noise and vibration.

There are no differences between the different sizes of enterprises in terms of the significance of the measures being taken, which can be appreciated positively, especially for small enterprises. On the contrary, employing ergonomics in organizing workplaces better suited to women or disabled workers or improving vision conditions, is not required at all, and therefore the results are not shown in the results of the analysis.

Ergonomics appears to be one of the few areas used to the same extent by both small and large enterprises. However, all the enterprises only focus on some issues, and there are still available resources of applying other ergonomic principles.

By the questionnaire survey, ergonomics in the enterprises seems to have already fulfilled its role. A very limited number of tasks seem to remain, as the relations between a worker and their working environment has already been solved in favour of the worker. The authors of the paper think, it is not exactly right - the forthcoming technological changes within Industry 4.0 may bring new challenges to the development in this area. Such changes might be the smart solutions that are being launched in larger units, such as smart home, smart cities, and smart factories. In all the areas, there are two main tasks to deal with through new technologies:

1) reduce the cost of electricity, heat and other resources;

2) create more favourable conditions for people.

The second point in particular is closely related to ergonomics and proves that the effort to improve the relation between humans and the environment never ends; only new technologies take on new forms.

3.1 Expected tendencies

The development of new technologies might substantially change labour in the next 10-15 years. With robot automation and robots, the number of workers will be reduced and those who stay will have to communicate with their new partners - robots. So far, robots have been allowed to work only in enclosed cages to avoid unplanned contact with humans, which could end up tragically (and has already happened abroad).

The new generation of robots might be focused not only on work performance but also on simple collaboration with humans. Such robots will be called cobots (collaborative robots). The movements of their hands should take into account the presence of a person, taking up some parts for precise assembly, and also responding to some basic voice commands. The presence of either a robot or a person in the workplace will always be driven by economic considerations, depending on which will be more beneficial.

Numbers of robots in different countries as listed by Vyhnanovský are shown in Table 2

The Czech Republic ranks among the top twenty countries of the world in terms of the share of robots in the manufacturing industry.

Table 2 Number of robots per 10,000 employees (in 2015)

South Korea	531	Spain	150
Singapore	398	Canada	136
Japan	305	Austria	128
Germany	301	France	127
Sweden	212	Finland	126
Taiwan	190	Netherlands	120
Denmark	188	Switzerland	119
USA	176	Slovenia	110
Belgium	169	Czech Republic	93
Italy	160	Australia	86

Source: Vyhnanovský (2017)

By the International Federation of Robotics (IFR), the world´s average accounts 69 robots. In the Czech Republic, there was an annual increase by 40% in 2015. The Czech Republic ranks 12th place in the EU and 19th in the world, thanks to the automotive industry as there are 399 robots per every 10,000 workers. The rise of robots influenced in a positive way by low unemployment. The Czech Republic has not been lagging behind the implementation of robots. On the other hand, it is not at the top compared to other states.

3.2 The total cost of robotics is falling sharply

Due to flexible and collaborative robotics the return on investment in logistics automation will soon be reduced to less than three years (IT Systems, 10/2016, Logistika).

The cost threshold for robot solutions becoming viable now varies from 100,000 to 110,000 Euros per unit in the most of Western European countries. The total hourly cost of the robot ranges from 18 to 20 Euros per hour, while the average cost of human service in the Euro area is 14 to 15 Euros per hour. In the long term, factors such as productivity

gains, extended robotic service life, and equipment price declines will be in favour of robotics. By contrast, the cost of human labour will continue to increase significantly.

3.3 Case study: The advantage of using robots

The advantage of using robots is shown by the following example (authors):

Traditional approach:

A machine has an investment cost of CZK 40,000; variable costs (wage 1 worker and material) per 1 piece = CZK 18

New approach:

A robot uses the same machine instead of a worker. There is an investment cost of 160,000 (200,000 together with the machine). Variable cost (material) is 10 CZK per 1 piece.

How many pieces produced is it appropriate to introduce a robot for?

$$40\ 000 + 18\ x = 200\ 000 + 10\ x$$

$$8\ x = 160\ 000$$

$$x = 20\ 000$$

It is appropriate to introduce a robot, if 40,000 pieces and more are produced.

How does it look like, if working in shifts?

Work in second and third shifts can be difficult to implement, as the workers do not like it, and in smaller towns where there are small and medium-sized enterprises, poor transport links from nearby villages the second shifts are difficult to organize. Rather, it would be possible to expand production if necessary and to take another worker's first shift and get another machine for 40,000. Another possibility can be taken into account. Since when are robots more appropriate compared to two workers and two machines in a shift?

Figure 1 Example results
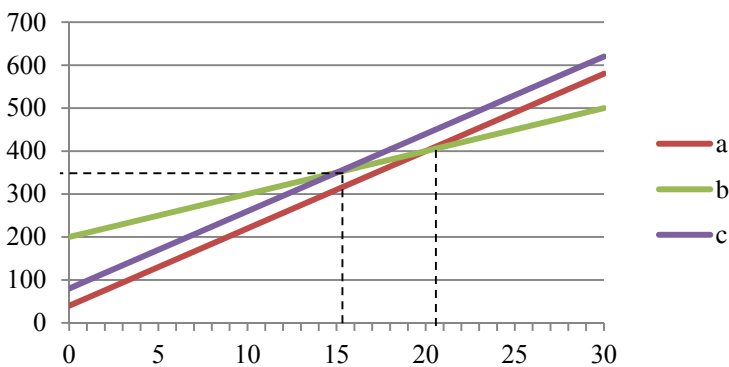
$$(40\ 000 + 40\ 000) + 18\ x = 200\ 000 + 10\ x$$

$$8\ x = 120\ 000$$

$$x = 15\ 000$$

In such case, it is when 30,000 and more pieces are produced.

4 Conclusions

The principles of ergonomics in production were commonly used in the first half of the 20th century. In that time, limited abilities of humans became a barrier to increased performance and it was also necessary to take into account the

appropriate environment for workers. Later, the managers had to deal with different issues and it seemed that ergonomics fulfilled its task and it would no longer be necessary to take it into account in an important was, as partly confirmed by our survey. However, we assume that the development of new technologies within Industry 4.0 might bring a new approach to address the relations of the workers and the working environment through Smart technologies in smart homes, smart factories, and smart cities, bringing the ergonomic issues to a brand new level.

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Prerequisites of the Czech Republic for Industry 4.0 in Human Resources

Jaroslav Vrchota, Petr Řehoř

Abstract: *When joining industry 4.0 and human resources, the greatest concern is associated with the impact of the modernization of production processes and thus the loss of jobs, especially in the case of unskilled and less skilled human resources that will be replaced by robotics. On the other hand, a whole range of other jobs can be expected to address more complex situations that may arise in the production process, its development or after-sales service. All these activities in the foreseeable future can not be assumed to have satisfactorily mastered the artificial intelligence of robots. However, these positions will have to be occupied by skilled workers, who will have both technical education and the ability of analytical thinking leading to the most effective solution of the situation. The aim of the paper is to evaluate the Czech Republic's preparedness for industry 4.0 in the field of human resources and compare the dependencies of sub-indicators that predict the greater adaptability of human capital to the emergence of new technologies and systems. Data was obtained by combining databases in EUROSTAT, the Czech Statistical Office and the OECD. For the sake of clarity, the results were summarized in the graphs and their interdependence was statistically compared.*

Key words: HRM · Czech republic · Industry 4.0

JEL Classification: O15 · O31 · O33

1 Introduction

The current society in which we live is referred to by various additional names - knowledge, information, global, or learning. If you have to succeed in it, then just working with the available information and gained knowledge, thanks to the over-average ability to learn, in which it must be better than others. Lifelong learning employees are gradually becoming a major competitive advantage that, in Industry 4.0, differentiate successful businesses from failed and can help decide a market leader or meet established business goals.

Industry plays a key role in the European Union's economy, representing 15% of added value (compared to 12% in the US). It serves as the main driver of research, innovation, productivity, job creation and export. Due to its impact on services, industry can be considered the main social and economic power of Europe. European industry has lost many jobs and jobs over the last decade and faces more fierce competition from emerging countries. The EU is quite heterogeneous in this respect, while Germany's East European industry is gaining market share and its productivity is growing rapidly; other EU countries are on the road to de-industrialization. (Gilchrist, 2016)

In terms of ensuring high quality services in the region, an innovative and creative industry is essential. Trends towards deindustrialisation put Europe at risk of losing some gainful activity. Industry is crucial to ensuring a balanced labor market where the ratio of skilled jobs is higher in industry, while service output is often characterized by a concentration of highly qualified jobs (engineering, consultancy, information technology, research, etc.) or low skilled jobs traffic, distribution, etc.). (Volek, 2016) Deindustrialisation weakens the European middle class, with the gradual erosion of middle-class jobs. Structural change causes a mismatch between supply and demand in the labor market. In a long-term horizon, the company polarizes.

Industry 4.0 marks the designation for the period of the new phase of the industrial revolution characterized by the digitization of production in professional literature (Ross, 2017; Schwab, 2017; Wang, 2016; Li, 2017). Similarly to the previous three phases of the Industrial Revolution, it is based on advancing technological progress. The first industrial revolution was started by the use of steam between 1760 and 1820 brought with it the manufactories and the use of energy from watercourses and mainly water vapor. The second stage is associated with the 1870s when the assembly lines and belt production boomed, thanks to the increasing use of electricity. The third revolution was the use of computing, microprocessors and the introduction of computers in the 1950s. The forthcoming Fourth Industrial Revolution is

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based on the use of cybernetic-physical systems, the improvement of computer and communication systems, and the development of artificial intelligence methods (Gabriel & Pessl, 2016; Roser, 2015; Korbel, 2015).

When joining industry 4.0 and human resources, the worry is associated with the impact of the modernization of production processes and thus the loss of jobs, especially in the case of unskilled and less skilled human resources that will be replaced by robotics. On the other hand, a whole range of other jobs can be expected to address more complex situations that may arise in the production process, its development or after-sales service. All these activities in the foreseeable future can not be assumed to have satisfactorily mastered the artificial intelligence of robots. However, these positions will have to be occupied by skilled workers, who will have both the technical education and the analytical thinking skills leading to the most effective solution to the emerging situations. (Lasi, 2014; Macey, 2008)

The new era of industry will also bring new opportunities in the field of distance work. As it is a matter of time when the manufacturing processes and their associated features will be fully digitized. This will make it possible for anyone with Internet access and the required level of knowledge to work on specific and narrowly targeted projects. The onset of digitization and, eventually, increased opportunities for work from home will also be beneficial for reconciling family and working life, which is certainly a good news at a time of low birth rates. (Monostori, 2014, Ungurean, 2014)

2 Methods

The aim of the paper is to evaluate the Czech Republic's preparedness for industry 4.0 in the area of human resources and to compare the dependence of partial indicators, predicting higher adaptability of human capital to the emergence of new technologies and systems. Internet accessibility and lifelong learning indicators were selected for the contribution. A lifelong learning is a prerequisite for the development of science bridges and better employee readiness for new technologies and practices. At the same time, there is a hypothetical zero hypothesis H0, which states that Internet availability does not correlate with the share of life-long education in the population and an alternative hypothesis which asserts that internet access influences the share of life-long learning.

H_0: ρ (X, Y)=0

H_A: ρ (X, Y)$\neq$0

This assumption is based on the increasing availability of the Internet for self-education.

First, the data for the Czech Republic was graphically illustrated in comparison with selected EU countries and the main differences were worded in words. Subsequently, Internet availability data on X axis and lifetime education data on the Y axis were plotted to obtain an initial idea of the shape and strength of dependence of the two variables in the point graph plotted by the graph of the regression function with the expression of the determinant coefficient. In order to obtain a comprehensive overview of analyzed data, the basic characteristics (mean, median, minimum, maximum, quartiles, standard deviation) will be given here. In order to use the Pearson and Spearman correlation coefficients, we must first verify the normality of the two variables. (Freund, 2010; Meloun, 2012) To verify (one-dimensional) normality

$$R = \frac{r}{\sqrt{1-r^2}}\sqrt{n-2} \ (1) \ (\text{Freaund, 2010})$$

we use the Shapiro-Wilko test histograms (p = value) and then the Q-Q plots. Subsequently, the data was analyzed using (Freund, 2010; Spellman, 2014, Freeman, 2017):

Pearson's correlation coefficient: $r = \frac{\sum(x_i-\overline{x})(y_i-\overline{y})}{\sqrt{\sum(x_i-\overline{x})^2\sum(y_i-\overline{y})^2}} = \frac{S_{xy}}{S_x S_y}$ (2) (Spellman, 2014)

Spearman's correlation coefficient: $r_{sp} = 1 - \frac{6\sum DIF^2}{n(n^2-1)}$ (3) (Freeman, 2017)

The data were obtained by a combination of databases in EUROSTAT, the Czech Statistical Office and the OECD. For the sake of clarity, the results were summarized in the graphs and statistically compared their interdependence in the Statistica software ver. 12.

3 Research results

Based on the hypothesis based on methodology, there are comparisons of Internet access and population share (25-64 years) of participating in education (in %).

The Internet in today's and probably in the future world will increasingly affect economic as well as social growth. At the same time, we can see it as one of the main prerequisites for the introduction of Industry 4.0. This indicator is often associated with the previous level of computer skills, but it plays a very important role in national statistics. The ICT competencies that the use of the Internet belongs to now gradually begin to rank at the level of traditional grammar that,

from the point of view of previous generations, represented reading, writing, mathematics, or basic awareness of prima-ry sciences. This indicator represents the proportion of the population in selected countries aged 16-74, which, on average, at least once a week during the last three months before the statistical survey, took advantage of the Internet no matter where. The biggest shift in Internet access was recorded by the Czech Republic between 2005 and 2007, where the number of people using the Internet was doubled, as shown in the picture below. At present, Czech republic, like other EU countries, are at levels of around 80%, among the best associated countries are Luxembourg (93%), Denmark (92%) and Scandinavian countries. On the other hand, the worst are the states like Bulgaria (54%), Romania (55%) or Greece (59%).

Figure 1 Internet availability in selected states is expressed per inhabitant
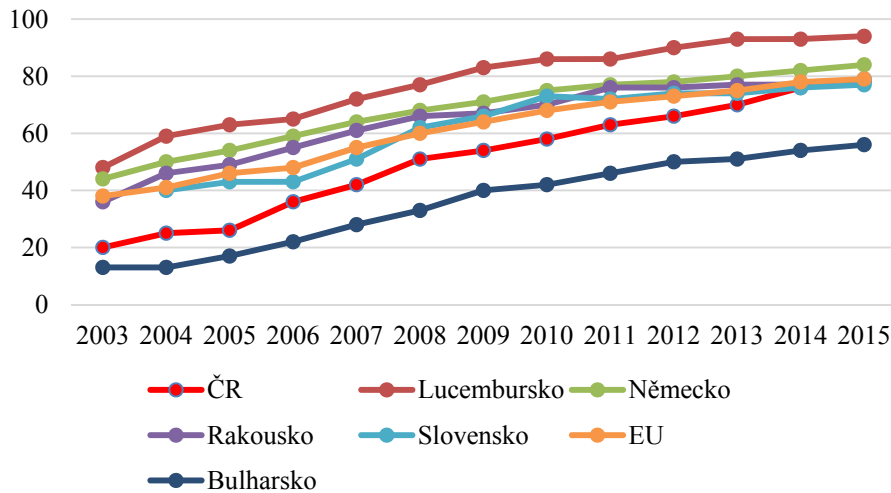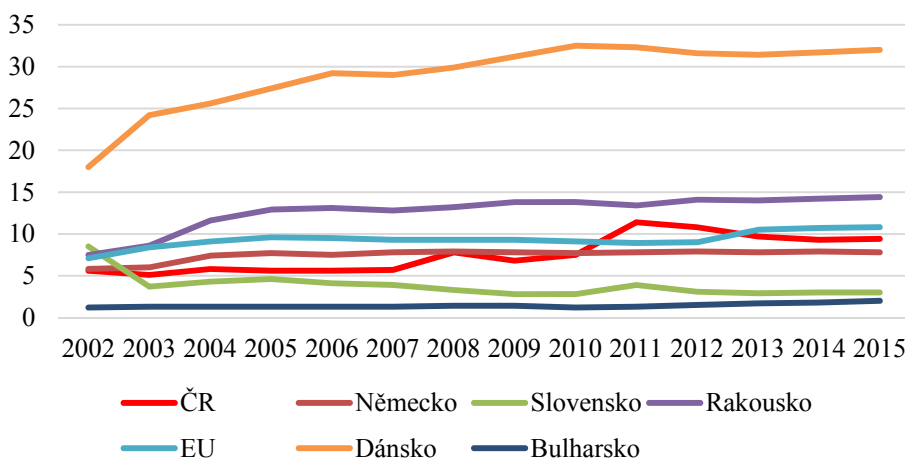

Source: Own processing

From the point of view of future development, we can expect only very modest growth. The participation of adult population in education is to a certain extent the readiness of 25+ employees for the new era of Industry 4.0, increasing their competitiveness in the labor market and, last but not least, the development of the company. Information acquired in schools, nowadays more than ever, is outdated and needs to be updated.

Lifelong learning is linked to the introduction of diversified paths that enable education to different age groups or social groups. An important role here is not only schools, but also businesses, municipalities, libraries, interest and professional organizations. The importance of this index is also evidenced by its inclusion in the Lisbon Strategy, where the EU's goal is for each member country to have a higher share of the population (25-64) than 12.5%. The data presented below shows the share of the population (25-64 years) involved in the last 4 months to formal (intention to obtain a certificate) or non-formal education (intention to educate). This information does not involve so-called informational learning, which is the acquisition of skills during day-to-day work.

Figure 2 Share of population (25-64) participating in education (%)

Source: Own processing

It is clear from the picture above that the Czech Republic has almost reached the EU average over the years, which is still lagging behind the target of 12.5% by 1.7%. The best of all are traditionally Nordic countries led by Denmark (32%), our neighbors are, and Austria is significantly better (14.4%). In general, participation in lifelong learning is much more popular among people with tertiary education, where they are expected to be more willing to learn, and at the same time, ever-increasing demands on the jobs they hold. The worst countries, which have failed to move very low levels over the years, include Bulgaria, Romania, Croatia, but also Slovakia.

Figure 3 A point diagram of Internet availability and lifelong learning
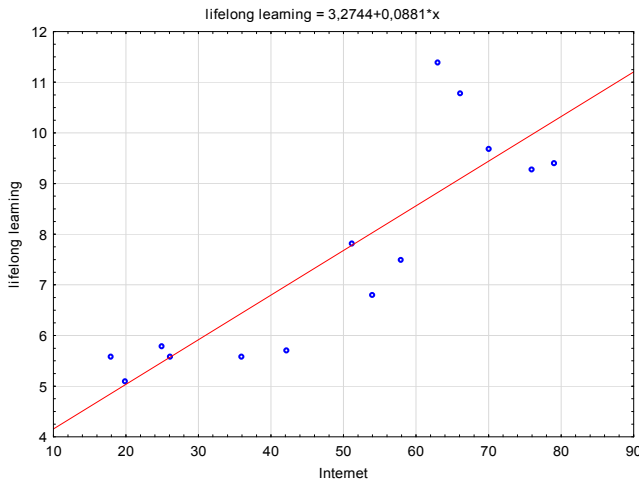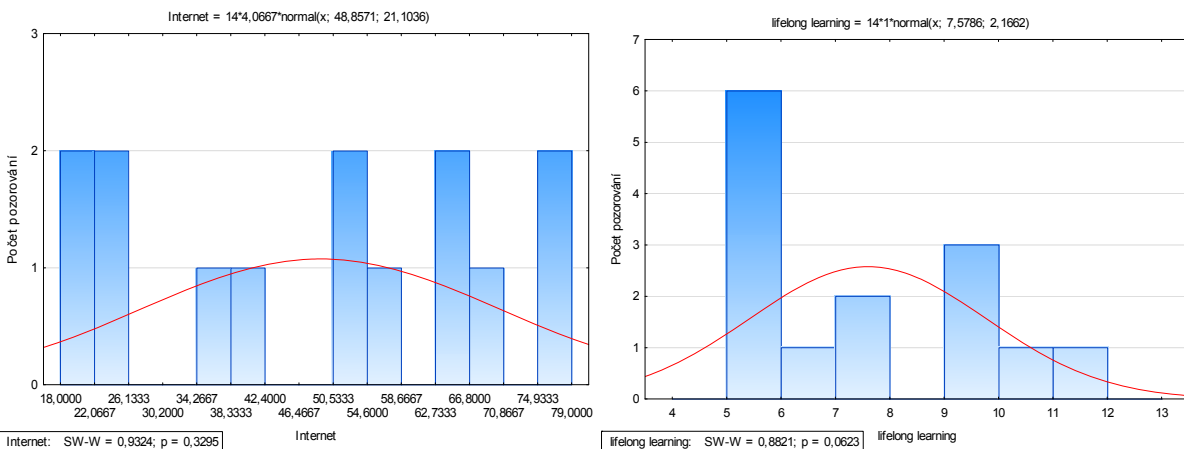

Source: Own processing

It is clear from the scorecard that there is a positive linear dependence between the availability of the internet and lifelong learning, which, according to the relatively high coefficient of determination ($R2 = 0.7366$), can be judged to be strong. Already, we can claim that by accessing the Internet we could explain less than 74% of the variance in the share of lifelong learning.

Table 1 Descriptive statistics

Variable	N valid	diameter	Median	Modus	Minimum	Maximum	Bottom quartile	Upper quartile	Standard deviation
Internet	14	48,85714	52,50000	51,00000	18,00000	79,00000	26,00000	66,00000	21,10362
lifelong learning	14	7,57857	7,15000	5,600000	5,10000	11,40000	5,60000	9,40000	2,16624

Source: Own processing

Figure 4 Histogram expression of normality of data
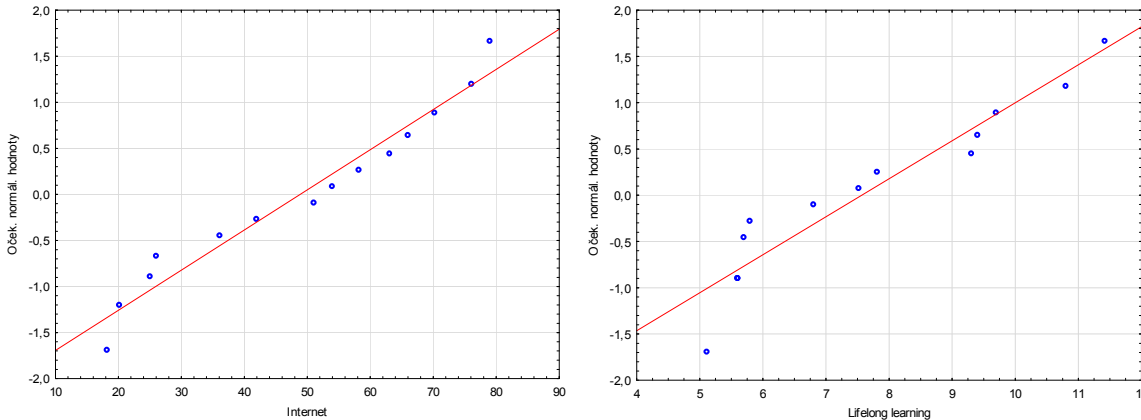

Source: Own processing

Subsequently, tests for the normality of both data groups were performed. The data were tested visually, using histograms in Figure 4 and subsequently by Shapiro-Wilko's assay. As can be seen from the graphical representation of the use of the Internet, we can talk about the normality of the data, where the normality of the data on the surface was not able to be rejected (p = 0,3295). In lifelong learning, the normality of the data is not visually noticeable, as evidenced by

the level of significance (p = 0.0623), but we can talk about the normal distribution as it reaches a determined significance level of 0.05.

To confirm both visual and numerical tests, the data were plotted in Q-Q graphs, both of which are shown in Figure 5, are linear and confirm the above.

Figure 5 Histogram expression of expected normality of data

Source: Own processing

The results of the correlation of both variables are shown in Table 2 for better clarity. Where, based on the p-value = 0,0000, we can reject the 5% neutral independence hypothesis in favor of a two-way alternative using the Pearson coefficient of significance level. We have demonstrated the existence of linear dependence, as evidenced by the positive Pearson correlation coefficient of 0.8582. At the same time, in terms of Spearman's correlation, where the p-value is very close to zero and the coefficient R = 0.8857, we can tend to reject the zero hypothesis in favor of HA.

Table 2 Corelation coeficients

Variable	Pearson			Spearman		
	Internet	lifelong leaning	p-value	Internet	lifelong leaning	p-value
Internet	1,000000	0,858248	0,000000	1,000000	0,858723	0,000000
lifelong leaning	0,858248	1,000000		0,858723	1,000000	

Source: Own processing

4 Conclusions

From the point of view of the arrival of Industry 4.0, the prepared states will differ from the unprepared mainly coverage of the Internet and its speed and stability of the connection, which needs to be gradually prepared. Employee requirements are constantly changing and evolving; for years, for example, computer skills have the advantage of a job, nowadays they are a necessity (Dessler, 2014). For this reason, it is important that employees seek their continuous training. It can be said that the Czech Republic has almost reached the EU average over the years in terms of the share of the population participating in education, but which we can generally regard as very low in the developed countries. (Mello, 2010; Greer, 2000)

As can be seen from the results, using the two correlation tests, a zero hypothesis in favor of alter- native and the correlation between internet usage and the share of the population (25-64 years) participating in education (in%) was rejected. This correlation is linear and growing, therefore, it can be expected in the future that Internet deployment will have a positive impact on the development of lifelong learning, which plays one of the key roles in adapting employees within Industry 4.0.

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Strategic Management of International Entrepreneurial Activities: The Effects of Business Strategy on International Performance

Šárka Zapletalová

Abstract: *The term internationalization of entrepreneurial activities refers to all those activities which involve cross-border transactions of goods, services, and resources between two or more nations. Entrepreneurial activities on international markets bring significant changes in strategy and strategic management of SMEs, and these are conditioned by them as well. The internationalization of entrepreneurship activities ranks among long-lasting strategic decisions; these decisions result in significant changes, running the company being the most relevant. Business strategies can be classified according to their level and types. There are various business strategy typologies.*

The paper focuses on the business strategy of Czech small and medium-sized enterprises in the context of strategic management of international entrepreneurial activities. The objective of the paper is to investigate the effect of business strategy on the international performance of Czech SMEs. The enterprises included in the study are 490 enterprises that are established in the Czech Republic. The main primary data collection instrument was a questionnaire-interview. The author found out that Czech SMEs used at the international market primarily differentiation focus strategy. The results show that the business strategies of Czech SMEs affect international performance.

Key words: Business Strategy · International Performance · International Activities · Strategic Management

JEL Classification: F23 · M16

1 Introduction

Internationalization of entrepreneurial activities is the necessity for the majority of entrepreneurial subjects. The term internationalization of entrepreneurial activities refers to all those entrepreneurial activities which involve cross-border transactions of goods, services, and resources between two or more nations. Transactions of economic resources include capital, skills, people, etc. for international production of physical goods and services such as finance, banking, insurance, or construction, etc. The internationalization of entrepreneurial activities is represented by the geographic expansion of entrepreneurial activities cross national borders (Lopez et al., 2009). Companies go international for a variety of reasons, but the typical goal is company growth or expansion. When a company hires international employees or searches for new markets abroad, an international strategy can help diversify and expand a business (Twarowska a Kakol, 2013). If the company operates internationally, the corporate strategy will be an international corporate strategy which will incorporate the choice of regions and countries in the company portfolio (Lasserre, 2007). A business strategy is then used as an umbrella term to denote the broad range of strategic options open to the company, including both organizational and functional management strategy, product/market strategies, and diversification strategies (Barringer and Greening, 1998). It consists of integrated decisions, actions or plans that will help to achieve target goals. The organization sets e ective strategies by considering where the organization has come from, what it has learned, and where it is going. The includes consideration of the context in which it operates, knowledge of customer groups and market segments, past performance, discharge of legal responsibilities and minimisation of harm. Companies practically apply the strategy seriously as a tool. The can be utilized to fast track their performances. The strategy is a process that can allow an organization to concentrate its resources on the optimal opportunities with the objectives of increasing sales and achieving a sustainable competitive advantage (Kotler, 2012). Greenley (1986) noted that strategic planning has potential advantages and intrinsic values that eventually, translate into improved company performance. According to Kotter (1996), the strategy can be used as a means of repositioning and transforming the organization. The essence of optimal strategy making is to build a market position strong enough and an organization capable enough to produce successful performance despite potent competition and internal difficulties (Manev et al., 2015). Porter (1996) has defined strategy as a creation of a unique and vulnerable position of trade-offs in competing, involving a set of activities that neatly fit together, that are simply consistent, reinforce each other and ensure optimization of effort. Company performance refers to the metrics relating to how a particular request is handled, or the act of performing; of doing something successfully; using knowledge as distinguished from merely possessing it. It is the outcome of all of the company´s operations and strategies (Aaltonen and Ikåvalko, 2002).

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In the competitive strategy framework, a successful business is the one, which sustains an attractive relative position for the company. The success of the process of internationalization of company depends in large part on the formulation and implementation of the competitive strategy (Knight, 2000). According to Sliwiński (2012), a permanent competitive strategy is obtained through synergy. When a company has the permanent competitive advantage, its resources and capabilities are durable, hard to identify and hard to copy. The organization of domestic economic activity and the integration of the company in the domestic markets (Dunning, 2000) is an important factor for the definition and success of an internationally competitive business strategy (Feio, 1998). For companies seeking benefits from international markets, the type of competitive strategies they choose may represent a primary vehicle by which they build a unique business position at the international level and achieve superior financial returns (Allred and Swan, 2004; Luo and Zhao, 2004). Business strategies can be classified according to their level and types. There are various competitive business typologies. This research study focuses on Porter's typology of competitive strategies. Michael Porter has described a category scheme consisting of three general types of strategies that are commonly used by business to achieve and maintain the competitive advantage. Porter (1980, 1985, 1991) suggests two approaches, but fundamentally different ways to creating and sustaining a competitive advantage: lower cost than its competition and differentiation about its rivals. These competitive advantages lead to three generic business strategies: cost leadership strategy, differentiation strategy, and focus strategy. These three generic strategies defined by two dimensions: strategic scope and strategic strength. Strategic scope is a demand-side dimension and looks at the size and composition of the market to which company intends to concentrate. Strategic strength is a supply-side dimension and looks at the strength or core competency of the company. In particular, Porter identified two competencies that he felt were most important: product differentiation and product cost (Tanwar 2013). The two basic types of competitive advantage (differentiation and lower cost) combined with the scope of activities on international markets for which a company seeks to achieve them lead to four generic strategies for achieving above average performance in an industry: cost leadership, cost focus, differentiation, and differentiation focus (Porter, 1985).

However, the research on international entrepreneurship and internationalization processes in Czech professional and business literature is relatively scarce; there are only a few studies exploring and monitoring internationalization processes of Czech SMEs. Due to the absence of substantial research, the author of the present study carried out a research survey among Czech SMEs to determine the effect of the business strategies of Czech SMEs on international performance in international markets. We focused on enterprises from post-transition economies, specifically from the Czech Republic. The growing interest in doing business in foreign markets gives rise to interests in internationalization in a broader context. The main research question of the paper is: how the business strategy of a company affect the international performance on the international markets? The objective of this paper is to find and present the effect of business strategies of the selected Czech SMEs on international performance in international markets. The paper is organized into three parts. The first part of the paper outlines selected theories dealing with the internationalization strategy and business strategy of enterprises. The second part of the paper aims to present and then interpret results of the survey carried out among Czech entrepreneurial subjects. Finally, the last section provides the conclusion of the research and offers a discussion of most important implications. This paper offers several contributions to international business research and attempts to answer calls for studies that span across the disciplines. In particular, the paper pays attention to the key role of the effect of business strategy on performance of entrepreneurial activities. Although we use a single small country, the Czech Republic, as a laboratory to test our theoretical propositions, our study is situated within the domain of international business studies. We offer a new angle on an international business theory by focusing on the process of decision-making on foreign activities. Although the author does not develop a new theory, the work builds on prior works in the field of international business towards a theory of the internationalization of company. The results of this work contribute new insights on the internationalization process of companies in the post-communist country. In the country, where were held significant changes in the economic system 25 years ago and where the majority of companies have a history shorter than 25 years.

2 Methods

The analysis is based on data from a standardized empirical study, which comprises of many questions on entrepreneurial activities of Czech SMEs in international markets. The paper is concentrated on various aspects of international activities, only a few questions from the survey we analyzed in this paper. The objective of the paper is to investigate the effect of business strategy on the international performance of Czech SMEs. Therefore, in the context mentioned above author proposes the *Hypothesis 1: Business strategy is positively related to the international performance.*

The sample consists of the internationally experienced small and medium-sized enterprises in the Czech Republic. Selection of enterprises under research was based on the method of non-probability purposive sampling, by assumption and occasional selection. The researched companies have already started their internationalization operations, all of

them were founded in the Czech Republic, and all of them are private subjects. This delimitation on companies with the international experience was made to enable on-site data collection. First, telephone calls were made with general managers or CEOs of the Czech SMEs to explain the purpose of the study and to ask for their participation. A high level of personal involvement consisting of telephone calls and personal delivery and pickup of questionnaires was necessary because of the relatively low response rate in mail surveys in the Czech Republic, and sensitivity to Czech managers' concerns about industrial espionage. Moreover, by the first telephone, we excluded those no representative of the population, such as sister companies within their corporations. After the step, the sample consisted of 800 companies from the Czech Republic that met the criteria mentioned above. In a second step, we hand-distributed questionnaires to the top managers and CEOs. Trained research assistants helped the top managers and CEOs complete the questionnaire, and explained any items that the respondents wished to have clarified. This procedure resulted in 600 matched questionnaires, out of which 110 we eliminated due to the incompleteness of responses. Thus 490 (a response rate of 81.7%) questionnaires were used in the subsequent data analysis and statistical processing. The final sample consisted of companies with an average age of 22 years (minimum one; maximum 188), an average size of 54 employees (minimum one; maximum 27000). The sample comes from a variety of industries: about 57.2% in manufacturing, and 60.3% in services. The method of the oral questioning and a questionnaire as the principal instrument applied for researching the relationship between strategy and performance of entrepreneurial activities. The instrument used in the survey, a structured questionnaire, contains five fields of varying degrees of complexity relating to the area of entrepreneurial activities. The questionnaire consists of closed, semi-closed and open questions. The questions were designed while based on the information gained from experts from business and universities and previous research. In some questions, particularly those related to the entry mode choice and market choice, simple and complex scales were used, mostly the Likert-type scale (5 = strongly agree to 1 = strongly disagree). Also, the questionnaire also included four questions related to the company background (the type of a business sector; the size of the company measured by the number of employees; the year of company foundation;). The questionnaire was pre-tested for the instrument validity by 20 managers. In interviews, the managers were asked to respond to the items measuring the theoretical construct. They were also asked to identify any ambiguities revealed in the questionnaire draft. Based on the feedback some minor changes of wording were made.

The international performance is dependent variables. International PERFORMANCE comprises traditional measures of the money-making activities of the company. Consistent with previous research (e.g., Uhlenbruck and DeCastro 2000; Keupp and Gassmann 2009; etc.) we used as the indicator of the international performance financial indicator. As the financial indicator of the performance of international activities, we used foreign turnover (as the proportion of turnover outside of the Czech Republic in the company's total turnover). The interviewed CEOs were asked to state their foreign turnover to total turnover of the previous year. In a comparison of different measures, Weinzimmer et al. (1998) recommend this as the most appropriate indicator. We can see, in Table 1, that the mean foreign turnover is 51.63 percent. Business strategies can be classified according to their level and types. There are various business strategy typologies. This research study focuses on Porter's typology of business strategies. The business STRATEGY is independent variable. A business strategy is a set of fundamental choices which define its long-term objectives, its value proposition to the market, how it intends to build and sustain a competitive business system and how it organizes itself. These competitive advantages lead to three generic competitive strategies: cost leadership strategy, differentiation strategy, and focus strategy (Tanwar, 2013). Interviewers presented to respondents a list of nine possible strategic approaches to establishing the business strategy in international markets. Respondents indicated their approach used. Questions on business strategy were presented in the form of five-point scales (5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, and 1 = strongly disagree) to ensure maximal respondent specificity. All multi-item measures achieved superior or adequate reliability scores in tests using Cronbach's alpha. The alpha values range from 0.73 to 0.80.The majority of respondents used the strategic differentiation approach. Guided by previous literature and empirical evidence, we have included several control variables. Among the company-level determinants of company performance, the company's size and company age are the two widely used demographic characteristics of companies. Therefore, we include company SIZE (natural logarithm of the number of employees) and company AGE (in years). In addition to the company-level determinants, we also include INDUSTRY level of the company: whether the company operates in the manufacturing or service sector. We included a dummy variable for industry level, as Acquaah and Yasai-Ardekani (2007), did because the distinction between manufacturing and services obviously has a considerable effect on company performance. The data we processed in the SPSS.

3 Research results

The descriptive statistics we described in Table 1. Table 1 illustrated the intercorrelations among the variables were obtained from the Pearson Correlations Matrix. The Pearson Correlation Matrix helps to uncover the relationships between the variables of quantitative nature using correlation coefficients. Pearson's correlation coefficient expresses

the strength of the relationship between the variables. The values indicating intercorrelations among the predictor's variables were low, ranging from 0.19 to 0.38 ($p < 0.01$), thus indicating the independence of the variables used for measuring the predictors. As the descriptive data revealed a promising variation as well as correlation among the variables included in the model, we have reason to believe that it would find support for the hypothesis.

Table 1 Descriptive statistics and Pearson correlation

	Mean	SD	1	2	3	4	5
Performance	51.63	28.52	1				
Strategy	2.38	0.78	-0.023	1			
Size	53.98	60.53	0.272**	-0.109*	1		
Age	21.53	27.86	0.326**	0.064	0.388**	1	
Industry	2.26	1.64	-0.209**	-0.050	-0.121*	-0.106*	1

Significance level: *$p<0.05$; **$p<0.01$
Source: own research

The competitive strategies of Czech SMEs on international markets were monitored regarding Porter´s competitive strategy (generic strategies). The author found out that Czech SMEs used at the international market primarily differentiation focus strategy.

Cost leadership strategy was most frequently reported by medium-sized enterprises (55%) from the manufacturing industry. Companies with cost leadership strategy have declared their dominant tangible resources and below common knowledge about international markets by their management. About half of the companies with cost leadership strategy reported that their managers had no experience with international activities, while the remaining managers had experience ranging from 5 to 18 of years. The average number of years of experience with the international activities of managers in these companies is ten years.

Cost focus strategy was most frequently reported by medium-sized enterprises (67 %) from agriculture, manufacturing and retail trade. Companies with cost focus strategy have declared their dominant intangible resources (specialized knowledge and knowledge of markets) and below average level of knowledge about international markets by their management. Approximately one-third of the sample reported that their managers had no experience with international activities, while the remaining managers had experience ranging from 12 to 15 of years. The average number of years of experience with the international activities of managers in these companies is 14 years.

Differentiation strategy was most frequently reported by small (34 %) enterprises from manufacturing. Companies with differentiation strategies have declared their dominant tangible and intangible resources (specialized knowledge and international contacts), and above average level of knowledge about international markets by their management. About 30 % of the sample reported that their managers had no experience with international activities, while the remaining managers had experience ranging from 1 to 23 of years. The average number of years of experience with the international activities of managers in these companies is nine years.

Mostly, microenterprises and small enterprises (34 %) from manufacturing used differentiation focus strategy. Companies with differentiation focus strategy have declared their dominant intangible resources (specialized knowledge and international contacts) and the average level of knowledge about international markets by their management. Approximately 40 % of the sample reported that their managers had no experience with international activities. Moreover, the remaining managers had experience ranging from 2 to 60 of years. The average number of years of experience with the international activities of managers in these companies is 13 years.

We used hierarchical moderated regression analysis (ordinary least-square OLS regression techniques) to test hypotheses. Before testing the hypotheses, multicollinearity in the dataset we controlled. For this purpose, the VIF values for the independent variables we calculated. In our analysis, the VIF values were all below 1.4, which is a relatively low and acceptable level. Consequently, there is no reason to believe that there is any major multicollinearity in the regression that could lead to misinterpreting or overestimating the final model and its predictive ability. Table 2 present results.

The first model (Model 1) is a baseline model that shows the effects of control variables on the performance. In the second model (Model 2) the main terms of the independent variable – business strategy is entered into the regression.

Table 2 Determinants of Business Strategy

	Effects of Business Strategy on Performance Dependent Variables (standardized regression coefficients)	
	Model 1	Model 2
Size	0.156**	0.141**
Age	0.248**	0.250**
Industry	-0.164**	-0.164**
Strategy H1		0.094*
R^2	0.16	0.17
ΔR^2	0.15	0.16
Adj. R^2	0.16	0.01
F	21.85	17.41

Significance level: *$p<0.05$; **$p<0.01$
Source: own research

Overall, the control variables explain little of the variance. Model 1 indicates that SIZE, AGE, and INDUSTRY have a positive and significant effect on the performance. As indicated in Model 2, business strategy positive influenced performance, supporting Hypothesis.

4 Conclusions

Internationalization is the most complex strategy that any company can undertake. This strategy is likely to become increasingly necessary (Gloet and Samson, 2017). This paper examines the effects of business strategy on the performance of international activities of Czech SMEs. The primary objective of the paper was to investigate the effect business strategy on the performance of international activities of Czech small and medium-sized enterprises. The results show that the business strategy of Czech enterprises in international markets has a positive effect on the performance of companies in international markets. All business strategies in themselves appear to be sensible, logical and coherent, highlighting the advantages and benefits that a company could gain by using either approach.

Paper has some contributions, including theoretical contributions and managerial implications. It has provided some theoretical contributions as follows: It gives additional insight into the relationship between business strategy and performance of international activities. Furthermore, we also provide some implications for managers and owners of Czech enterprises. The paper helps the managers to understand how the business strategy affect the performance of international activities. Managers and owners should give more attention to the development of business knowledge and international experience of own managers and employees.

The research study also has some limitations. First, this study has been conducted only in one small country, in the Czech Republic. Indeed, this will affect the generalizability issue. It only examined the relationship between selected characteristics of business strategy and performance of international activities. Hence, the researcher cannot justify it as a generalization for all European countries. Due to time and cost limitations, this study employed a cross-sectional study. Thus, it only portrays the phenomena at a single point in time, and it will not be able to reflect the long-term effects of the change.

This research study suggests several recommendations for future study. It might be extended to multiple countries in Europe. The future study might use the longitudinal study which describes phenomena in the long-term. The longitudinal study may lead practitioners and academicians to understand the causal relationship between business strategy and performance of international activities.

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Session 7

Criminal Aspects of Entrepreneurship in the European Context.

Class Action Lawsuits as a Procedural Instrument of Consumer Protection

Zuzana Frantíková

Abstract: *Class action lawsuits as a procedural instrument of consumer protection has become a principle topic of discussion after the publication of a bill prepared by the Ministry of Justice. The fundamental aim of the bill is to introduce a comprehensive and complete collective protection of individual rights that is absent in the existing legal Czech system. The procedural instrument called a class action enables to have one effective procedure where a larger number of claims based on the same or similar factual and legal basis are concentrated. This procedural concentration brings facilitation on both court and plaintiff's sides consisting mainly in time and financial savings. For the present the legal procedural system did not have any means at its disposal and that is the reason why every single claim is being considered and ruled separately. The motif of the new legal regulation is founded in the need of finding a new way how to weaken company's resistance in the acceptance for its responsibility while doing business. The aim of this article is to summarize the legal changes, the intention of this regulation and the consequences of it and to describe pros and cons with respect to the consumer protection.*

Key words: Class Action · Lawsuits · Procedural Instrument · Consumer Protection

JEL Classification: K1· K13

1 Introduction

The constantly growing mass of people, the significant increase in the standard of living and the prolonged life expectancy have caused an intense pressure on the business corporations to increase their production to meet the growing needs of consumer demands. These companies have begun to produce as many products as possible, whether food, everyday consumer goods or cars, in the shortest possible time. To be able to do so, the companies started to control the world's production; both national and multinational giants can get huge funds that they accumulate in the hands of several people. With the decisive role of business corporations and by making huge profits from industrial development, some associate certain responsibilities. This is a special institute of corporate social responsibility, known as corporate social responsibility. Consumers may demand their rights to be protected in the court civil proceedings, nevertheless their often suffer from apathy because their single claims are not big enough to be enforced by courts in single civic proceedings that bring financial expenses (Věcný záměr, 2017). That is the reason why the EU has been trying to appeal on the member states to regulate a collective protection of private rights. In many European countries have been already accepted legal regulation of the collective protection. In the Czech Republic the Ministry of Justice has prepared a bill on the class actions. The aim of this paper is to describe the current and future regulation on class actions.

In the Czech law, the class action is not regulated. Nevertheless, it is possible to find in the Civil Procedure Code at least a remote analogy of a class action, namely in Section 159a par. 2, of the Civil Procedure Code according to which the final judgments which have been decided on in the cases pursuant to Section 83 par. 2 of the Civil Procedure Code are binding not only for the parties, but also for other persons entitled against the defendant for the same claims in the same act or condition. Section 83 par. 2 of the Civil Procedure Code are: (a) to refrain from offending or to remedy a defective state of affairs in the protection of rights infringed or threatened by unfair competition; (b) to refrain from committing infringements in the matter of the protection of consumers' rights; (c) to compensate for or to compensate for the amount of performance according to the act on bids on takeovers and in matters of controlling of performance for the purchase of subscribed securities, d) other matters regulated by special legal regulations. In addition, the opening of proceedings in these cases prevents other proceedings against the same defendant in actions brought by other claimants.

Consumers are weaker contractual party of an obligation concluded between businessmen and consumers and that is the reason why they are according to the private law protected through the regulation or legal institutes such as consumer law, protection against unfair competition and general liability for damages or special types of liability. All these institutes can, indirectly, moderate the natural behaviour of the stronger party if they are enforced and applied in court. However, applying consumer claims is not economically advantageous in most cases. As mentioned above, today's consumer society is based on the production of the same items at relatively low prices. Defects or damage caused to the products may not be significant. Damage up to a certain amount simply is not worth being enforced through civil procedure.

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Except the private law protection, the public law provides some instruments how to protect consumers on the basis of public law. Especially, except state authorities, non-profit organizations are involved in the protection against the systematic harm to an individual. This process is regulated in Section 25 et seq. of Act No. 636/1992 Sb., on the consumer protection, as amended. According to the Section consumer organizations are allowed to file an action to refrain an acting causing harm to consumers. This regulation is an implementation of Directive 2009/22/ES of the European Parliament and of the Council of 23 April of 2009 on injunctions   for the protection of consumers' interests. According to Article 2 of the Directive 2009/22/ES the qualified entity may bring an action that will seek cessation or prohibition of any infringement This is a form of civic society implementation where individuals associate themselves to collectively defend the rights of certain groups. It works either in individual cases of ex-post (free legal assistance to people who have already suffered) or tries to prevent violations in the selected areas (media pressure on selected corporations, trade union activities, etc.). Again, however, it can handle only the selected excesses. There is no uniform regulation of class actions at EU level. On16 February 2011, the Commission called for a public consultation based on the document entitled "Towards a Coherent European Approach to Bulk Action." The consultation resulted in the adoption of non-binding recommendations such as Commission Recommendation of 11 June 2013 on common principles for injunctive and compensatory collective redress mechanisms in the Member States concerning violations of rights granted under Union Law.

In Green paper on Collective Consumer Redress of 27 November 2008 the class action in order to seek financial redress was mentioned. The two systems – opt-out and opt-in – were introduced there:

Opt-in systems could be burdensome and cost-intensive for consumer organizations which have to do preparatory work such as identifying consumers, establishing the facts of each case, as well as running the case and communicating with each plaintiff. They also may face difficulties in obtaining a sufficiently high number of consumers opting-in in the case of very low value damage, where consumers are less likely to act. However, they do not involve the risk of promoting excessive or unmeritorious claims. Opt-out solutions might mitigate some of the difficulties of the opt-in systems. However, they are often viewed negatively in Europe due to the perceived risk of encouraging the excessive litigation experienced in some non-European jurisdictions. Any collective redress system should be designed to avoid such a risk. In any case, the issue of information dissemination across borders remains relevant. Lack of information could lead to a situation where consumers would be bound by a judgement without their knowledge or without having been able to contest the management of the case. In addition, in opt-out scenarios consumer organizations may face a burden when they have to identify the victims and distribute the compensation. (Green Paper, p. 13-14)

However, according to Tomáš Palla,

consumer organizations do not have enough power to protect consumers well and class action for damages of consumers will be a convenient instrument how to protect them. From the point of view of preserving certain basic procedural principles of the continental law, the so-called opt-in model would be preferable to the opt-out model that is inappropriate both from the point of view of the protection of the rights of the persons concerned and, secondly, from the point of view of the redistribution of possible redress. (epravo.cz, 2009, para 11)

Similarly to Tomáš Palla's opinion, regarding to the type of the system, on which the class action shall be based in the Czech Republic, Alexander J. Bělohlávek says that

such systems and institutes should be based exclusively on the principle of opt-in, which means that only those entities expressly consenting to it will participate, not the opt-out principle in the context of US collective proceedings. Indeed, I maintain that the opt-out principle runs counter to the fundamental principles of domestic law. Moreover, according to the Commission, Member States should adopt procedural safeguards to prevent abuse of these instruments, in particular to prevent the remuneration of lawyers depending on the amount of compensation awarded and punitive damages in many countries (particularly civilian states law) are considered to be contrary to public policy (order public), and I also hold that view. (Bělohlávek, 2016, p. 469)

Despite the above-mentioned opinions expressed by Tomáš Palla and Alexander J. Bělohlávek the bill is based on the opt-out system with a possibility to change it into an opt-in system in cases where it is necessary and upon a court decision.

2 Methods

In this paper there is an emphasis put on analytical method of logical deduction and on method of legal comparison. The purpose of this paper is to achieve by means of interpretation and scientific methods reliable description of a class action lawsuits and its regulation de lege lata y de lege ferenda in the Czech legal order.

3 New regulation

3.1 Content of the new regulation

The bill (Věcný záměr, 2017, p. 43-48) counts with the creation of the separate act on class actions. The system of the class action in the Czech Republic shall be based on so called opt-out principle, which means that all possible consumers will be included unless they show their will that they do not want to be part of the process. Except the opt-out principle there is the possibility of opt-in principle, which means that consumers shall be included upon their application. According to the text of the bill on pages where the bill settles with the possible objections put forward by the critiques, the court will be able to change it upon the decision into an opt-in system depending mainly on the required amount. In the act there shall be also regulated which court shall be competent to act and rule this class action matter, how the representative shall be designated or disengaged, which are the special conditions of proceedings. It shall also include regulation on how the participant can apply or the succession of another participant. There will be a public database of the class actions lawsuits. The proceeding is divided into two parts. The first part of the proceeding shall be ended in the decision, also called a certification. The court shall perform surveillance how through the decision the obtained amount will be distributed. The representative will be responsible for the distribution of through the decision obtained amount among the consumers. According to the bill there is a huge responsibility put on the representative where the representative will be paid only in the case of success. This is obviously against the right to fair procedure.

3.2 Objections to the new regulation

In the bill there is a list of objections that are usually used against the institute of *class action* such as:

- *The claim is discussed and ruled against consumer′s will.*
  This does not have to be entirely truth because by withdrawing from the proceedings, his/her claim is separated from the entire group and it depends on him/her whether he/she will continue to enforce individually or not. So again, there is no violation of his/her procedural rights.
- *A member of the group would assert his claim in individual management and better.*
  Everyone has a right of access to the court, i. e. to be able to enforce their claim in a separate procedure, and of course better. In the cases where claims are already relatively high, it can be expected that members of the group will act individually, counting the opt-in intent intention. The court will decide in a certification resolution that it will be dealt collectively in the procedure in accordance with the opt-in principle – i.e. only the claim of those who sign up. The task of the court is to ensure whether also that the interests of inactive members of the group are properly enforced. If he does not, he will be able to appoint a new lawyer or not to approve an individual procedural act, which is really an innovation brought into a Czech law. Something similar is known only from the insolvency proceedings where insolvency administrator administrates the bankruptcy of a debtor and can be disengaged from the function by the decision of the creditors. However, the representative can be disengaged by the court so there is no client-representative relation, therefore it seems that the representative does not proceed on the basis of its clients' instructions.
- *The rights of a member of the group who is not in the position of a group representative are not fully secured in the proceedings (inconsistency with the right to access the court).* The full rights in the proceedings are only enjoyed by the member of the group who initiated the proceedings and is a representative of the group. It is impossible to think that each member of the class action will be able to dispose with the matter of the class action.
- *Possible abuse of the institute and its ability to damage the reputation of the competitor.*
  Many legal institutes can be abused. The court control the whole course of the proceeding. In the case of reconciliation, the court examines not only compliance with the law but also compliance with the interests of the whole group. There is the mandatory legal representation and the court fee will be very high to discourage potential misuse of the institute. A special phase, the so-called certification phase, should help to avoid the situation when the only purpose of the action is to bully.
- *A member of the group does not know about the proceeding.* The bill designs that the court will oblige the lawyer as the representative of the group to make an appropriate publication of the case so that each member of the group can learn about it. It means that the attorney will be for example forced to set up a website, expand information on ongoing social media, mass media and local daily newspapers. In addition, there will be a central database set up by the ministry, where courts will be required to publish information on ongoing collective proceedings. (Věcný záměr, p. 9-15)

With respect to what have already been said there are many objections related to the opt-out system known from the non-European jurisdictions relevant to the fact that a case is lead without the knowledge of the harmed consumer, which is considered in the law as contra the legal principle *nemo iudex sine actore*. In my opinion there must be a combination of the two above-mentioned systems similarly to the insolvency proceeding where creditors are supposed to be able to watch their rights whereas some receivables can be included after the application period and even without the application. For their ability to be paid it is enough that their origin and existence arise from the book keeping.

4 Conclusion

As it was described above, current economic situation may create situations in which consumers can be harmed by the illegal practices relating to the violation of rights granted under Union law by one or more traders or other persons. They may therefore have cause to seek the cessation of such practices or to claim damage. To fulfil to requirements, the EU seeks for remedies how to find balance between the businessmen and consumers through legal instruments, however, simultaneously, the national collective redress mechanisms should contain the fundamental safeguards to avoid abusive search for collective redress.

The Czech law with respect to the consumer protection from the perspective of procedural law try to fulfil all Union law requirements such alternative dispute resolution or online dispute resolution, or the possibility of a group action filed by an entitled person or consumer organization to seek cessation or prohibition of any infringement. However, in case of a claim damage there is no possibility to file a group action where the entitled person will represent all customers to enforce the damage caused to them. Therefore, it could be said that the current legislation is inadequate, and it requires a change because it does not provide sufficient protection for consumers and can not be guaranteed by a consumer organization whose legal status is relatively weak. From the point of view of Czech law, of course, it is necessary to proceed with caution and to consider what impacts the adoption of the institute of a full-scale collective claim, including the institute of collective compensation, could have on Czech procedural law. In my opinion this bill would not be accepted because there are still many issues to be solved except the main decision whether the class actions institute shall be based on opt-out or opt-in system or the combination of both of them.

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Administrative Law Sanctioning after Recodification and its Influence on the Entrepreneur's Responsibility

Martin Slobodník, Rudolf Hrubý

Abstract: *The new Infringement Act (Act No. 250/2016 Coll.) introduces with effect from 01.07.2017 a uniform legal regulation of the basic principles of administrative liability of natural persons, legal entities and entrepreneurial individuals, including the rules governing the exercise of this responsibility.*
The significant tendency of the new regulation is the increase of penalties for offenses, for example, the tightening of the fine from CZK 15,000 to CZK 50,000, for trespassing, hindering or threatening the provision of health service from CZK 10,000 to CZK 100,000 etc. Criminal behaviour is newly an offense or defamation of an official up to CZK 15,000.

The reform of administrative sanctioning has brought about a number of changes not only from the point of view of the terminology and systematics but also from the basics of substantive and procedural law-making. The author of the propounded article is concerned among other things with questions whether the legislator has taken the right legislative course.

Key words: Businessman · Administrative Punishment · Recodification

JEL Classification: K00 · K20 · K22

1 Introduction

The authors of the submitted contribution attempts to bring its readers closer to the selected changes in the criminal administrative law in the Czech Republic, which among other things represents the continuing tendencies of comprehensive changes in the Czech legal order, that we can be witnesses in recent years. After the all-embracing recodification of substantive criminal law, a relatively recent legislative change in the field of private law followed in a relatively short period. The recodification of private substantive law was implemented in the Czech Republic by several legal regulations, namely the new Civil Code, ie Act No. 89/2012 Coll., The Civil Code ("NOZ"), the Act on Commercial Corporations, ie Act No. 90/2012 (ZOK) and, last but not least, the Act on Private International Law, ie Act No. 91/2012 Coll., On Private International Law ("the Law on Private International Law"). These are the legal norms promulgated in the Collection of Laws on 22 st March 2012 and which came into force on 1 st January 2014. An essential part of the recodification is also a number of accompanying laws, however many of them are still in the legislative process, which is still not finished.[70]

However, the legislature did not limited its focus only to the changes in the field of private substantive law, but its efforts to conceptually modify the treatment of misdemeanours and administrative offenses reached the statutory regulation in the collection of laws, and became valid on 3 rd August with number 250/2016 Coll., about Liability for administrative Infringements and Proceedings, and came into effect on 1 st July 2017 ("the Law on Liability for administrative Offenses"). It is the source of criminal administrative law, which is an integral part of administrative law. Administrative law is a relatively broad sector of public law that governs a wide range of relationships. It consists of a set of legal norms of various legal forces governing the entire area of public administration, in particular legal relations between public authorities on the one hand and natural and legal persons on the other.

It is an indisputable fact, that a key regulation of general administrative law is the Act No. 500/2004 Coll., The Administrative Code, in its later valid and effective wording. It is a legal regulation which generally defines an administrative procedure, whose purpose is to issue a decision which in the particular case establishes, alters or abrogates the rights or obligations of a particular person or which in a particular case declares in a binding manner that a particular person has such rights or whether this person has the duty.

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[70] Hrubý, R. New Institutions of Civil Law in Practice. The International Scientific Conference INPROFORUM 2016, November 3 - 4, 2016, České Budějovice.

The narrower area of administrative criminal law is closely dealing with the definition of administratitve offenses of natural persons and administrative offenses of legal entities and entrepreneurs - natural persons (the terminological changes are also examined in the article below), ie the offenses whose social harm does not reach the intensity of the criminal offense according to the principle of subsidiarity of criminal repression,[71] which states that criminal liability and criminality of the offender can be applied only in cases of socially harmful ones in which the enforcement of liability under another regulation (in different less harmful field of law) is not sufficient.[72]

Special attention has been dedicated to this legislation which came into effect from 1 st July 2017. The new Law on Liability for administrative Offenses and Proceedings brought a number of innovations, which are briefly discussed below.

In addition to the Act on Liability for administratitve Offenses as the Basic Administrative Code of Laws on Offenses, it is necessary to refer to the related statute. ie to Act No. 251/2016 Coll., The Act on Some Misdemeanors, which also came into effect on 1 st July 2017 ("Act on some Misdemeanors "). It is a legal regulation that does not regulate the facts of cases of all offenses, but only those that have not been embodied in special laws. A special part of the Law on Liability for administrative Offenses is not covered in a single statue and is not part of this Act. The Act on Some Misdemeanors includes for example misdemeanors against property or misdemeanors in the field of unlawful business.

In the introduction of this paper the authors mentioned only the Act on Certain Misdemeanors and the Act on Liability for Offenses, however, within the framework of a conceptual change in the legal regulation of administrative offenses, the Parliament of the Czech Republic also approved a so-called changeover act. This statute is a necessary related legal regulation, which includes the amendment of approximately 250 legislative acts with the administrative sanctioning related, as the consequential regulations have to be brought in compliance with the Law on Liability for Offenses. The legislator has opted for a variant according to which certain special administrative regulations will contain an arrangement which excludes the applicability of selected provisions of the main Act on Liability for Offenses, alternatively also special legislation in relation to the Law on Liability for Offenses which will be followed in accordance with the general principle *lex specialis derogat legi generali*.[73]

This paper deals with the new legal regulation of administrative offenses and related legal institutes, with particular emphasis on the derogations and modifications to the previously existing Act No. 200/1990 Coll., The Act on Offenses, as later amended (the "Infringement Act"). In the following chapters, the authors briefly focus on questions how to update the reader so that the provided information and novelty is given in a comprehensive way.

2 Recodification of administrative criminal law

2.1. The current amendment to the Act of the Infringement Act

The existing legal regulation of administrative punishments has been considerably fragmented in several statutes. Because of such bad arrangement there were numerous problems of effective and proportionate sanctioning of administrative offenders, as well as because of high amount of amendments to the 1990 Misdemeanors Act and the related increasing number of special laws defining other facts of the case and deviating procedural rules. Certain difficulties arose in practice as a result of the incomplete regulation of certain field of administrative offenses, in concreto administrative offenses of enterpreneurs. This was in many respects demanding in terms of application and did not correspond to the requirements for faster and simpler administrative criminal proceedings. In addition, individual offenses of natural persons and administrative offenses of enterpreneurs could have been and were often solved in practice by officials without specific legal education on the faculties of law. Naturally, it was difficult to grasp the intricated legislation in combination with a lack of legal education of administrative authorities, that result in impossibility to effectively penalize illegal behaviour in the form of administrative offenses.

According to the previous legal regulation, the administrative offenses of natural persons were terminologically defined in a different way than the so-called other administrative offenses of natural persons - enterpreneurs, administrative delicts of legal persons, administrative disciplinary offenses, administrative orderly offenses and torts against payment discipline. Depending on the particular facts of the case, administrative offense could have been committed by the natural persons or legal person or even both of them. The existing doctrine has divided these concepts into two basic categories, namely administrative offenses and other administrative offenses (administrative offenses in the narrower sense).

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[71] Article 12 (2) of Act No. 40/2009 Coll., Penal Code, as amended.
[72] E.g. Act No. 251/2016 Coll., Act on Some Misdemeanors.
[73] See more in GERLOCH, Aleš. Teorie práva. 5., upravené vyd. Plzeň : Vydavatelství a nakladatelství Aleš Čeněk, s.r.o., 2009, a HENDRYCH, Dušan. Právnický slovník. 3., podstatně rozš. vyd. V Praze: C.H. Beck, 2009. Beckovy odborné slovníky.

The administrative offenses were incorporated into the Misdemeanors Act, which contained not only the part of substantive law but also procedural provisions. Some of the facts of the case of the administrative offenses were explicitly mentioned in a spceial part of the Misdemeanors Act, whereas the other facts of the case were enshrined by the legislator in special legislation (several statutes). Concerning other administrative offenses of enterpreneurs, there was no such general statute, nor procedural, neither substantive. Such general regulation absented in the Czech legal system. The definition of the facts of case of the so-called other administrative offenses of enterpreneurs could be found in almost all legal provisions affecting the subject of administrative law.

The fact that the regulation of other administrative offenses of enterpreneurs was different in different statutes without any objective criterion, it was considered to be completely inadequate, not only from the point of view of theory of law, but also from the point of view of practice.[74]

2.2. Offenders according to the previous legislation

If the offender of administrative offense under another law than Misdemeanors Act has been a natural person, he has been held responsible for his unlawful conduct under the previous Misdemeanors Act. If the perpetrator of an administrative offense is a legal person, its liability has been assessed in accordance with the provisions of another law from which its liability was assumed and the Misdemeanors Act was not taken into account.

The same procedure was followed if another administrative offense was perpetrated by a natural person, typically in cases where such offense was committed by an entrepreneur in connection with his business or directly in the course of his business. These persons were referred to as "business entrepreneurs" as perpetrators.

The substantial difference between the liability of natural persons for their administrative offenses and legal entities and natural persons enterpreneurs for other administrative delicts was a differently fault to their misconduct, since in the case of natural persons, the liability was basically based on the culpable behavior of the natural person, ie the subjective responsibility for the offense, persons and entrepreneurial individuals, on the other hand, were assumed responsible in objective way, so-called cases of liability arising regardless of the fault. However, a legal person or an entrepreneur may be exempted from his liability under certain circumstances. These were cases of so-called liberation reasons, which gave these subject possibility to avoid the liability.

Up to now inconsistency and disunity of these forms of administratitve offenses could, in the extreme case, have different effects in cases of offenses committed by natural persons and different effects in cases of offenses committed by legal persons and entrepreneurs - individuals. The question remains whether such an arrangement was eligible to succeed in the light of the principle *nullum crimen sine lege, nulla poena sine lege*, as well as with other fundamental principles of administrative criminal law, such as the principles of equality before the law and principles of equal access by the administrative authorities.

There was, in principle, a general consensus that a new law should remedy this conditions by making the statute on liability for all administrative offenses.

2.3. Legislative process

The factual intent of the Act on Liability for Offenses and Proceedings was approved by Government Resolution No. 229 of 3 April 2013.[75] The Legislative Council of the Government recommended the preparation of a separate "Act on Some Misdemeanors", which would contain the facts of the case of the remaining offenses and which can be included in another statute. According to this concept, the laws that substantially changed the area of offense proceedings were drafted and subsequently approved with effect from 1 st July 2017. The main idea, which is evident from the amendment to the Act No. 250/2016 Coll., On the liability for offenses and the proceedings, as well as the related Act No. 251/2016 Coll., On some offenses, is the codification. This idea was only partially fulfilled, but it should be noted that this is the first modern codification of the criminal administrative law process, which includes both adminitstrative offenses of natural persons and administrative delicts of enterpreneurs (both legal person and individuals). This codification brought a fundamental approximation of the system of administrative punishments to the criminal law punishments and to the substantive and procedural criminal law institutes. This we considere important especially from the point of legal certainty.

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[74] Typical examples that can be mentioned in this area are the amount of sanctions or different lengths of objective time limits for liability. Such derogations are not desirable from the point of view of legal certainty and equality before the law, because the legal regulation should be mainly coherent (internally consistent).

[75] The above stated government's resolution approved the factual intention but did not contain a specific term assignment for the drafting of the paragraph of the Act, because the government no longer considered it real that the proposal would be completed by the end of its term - leaving the issue of drafting the bill to the new government .

3 Modification after recodification

The Law on Liability for administratitve Offenses brings a more comprehensive concept of administratitve offenses of individuals and administrative offenses of enterpreneurs (natural or legal persons) by unifying these concept by doing so not only from the point of view of only substantive law, but also from the point of view of procedural law. Even without further examination of the new regulation, it is obvious that this was significantly inspired mainly by the legal provisions of the criminal substantive law, as well as the criminal procedural law. With the Codes of Criminal Law, ie the Criminal Code and the Criminal Procedure Code[76], this law does not only applies to similar systematics but also to the approximation and naming of a number of fundamental institutes.

Some authors even say that "in the Law on Liability for Offenses, we find a comprehensive regulation of so-called administrative criminal law. However, it should not be forgotten that the Act on Liability for Offenses does not regulate the specific facts of the case of all administrative offenses and that special laws may contain different arrangements, which exclude the applicability of certain provisions of the Law on Liability for Offenses to Specific Offenses."[77]

3.1. Legislative news

The Act on Liability for Offenses has terminologically changed the legal regulations of the so-called administrative offenses, the so-called other administrative offenses of legal persons and administrative offenses of entrepreneurial individuals, and brought the only category of administrative offenses in the area of administrative law, namely administrative offenses[78].

Approaching the field of criminal law means anchoring the institute of an indirect perpetrator who acts through a so-called „live instrument".[79] In § 24 of Act 40/2009 Coll., the legislator found the inspiration for cases of punishment of participation in an accomplished offense or its attempt if the indirect perpetrator is punishable under the law. Therefore the organizer, guide, or assistant may also be a participants to the administrative offense. According to the current law, it may happen that the responsibility for the offense arises to the legal representative of a natural person or his guardian.

"The important novelties introduced by the Law on Liability for Offenses include the transfer of responsibility to the legal successor of a legal person and to a natural person in the event of his death, to a person who continues his business. The question of succession will have to be solved according to the rules of private law, especially the Civil Code and Act. No. 125/2008 Coll., on the transformation of companies and cooperatives, as amended. The specific amount of sanction for legal successors is to reflect the extent to which one of them has passed the proceeds, benefits and other benefits, and whether one of them continues the activity in which the offense was committed [Section 37 h) of the Act]. "[80]Another change is the modification of factual and legal errors of perpetrators, which are applied analogously to criminal law.

We also deem helpful, that the legislator decided to explicitly state other circumstances excluding illegality. The existing legislation, similarly to the previous legislation of criminal law, provided only the „necessary defense" and „extreme urgency". Newly, the circumstances excluding illegality are supplemented by the consent of the injured person, the legitimate use of the weapon and the permissible risk.

The terminological and content variation did not avoid the term of administrative sanction, when the law newly talks about so-called administrative punishments. The sanction of the ban on residence has completely disappeared and has remained enshrined only in the regulation of criminal law. However, the new "Code" introduces a new administrative penalty - the publication of a decision on a misdemeanor. The existing sanction of the ban on residence was rather controversial and its enforcement was difficult. So it is not the issue, when the legislator decide about its release. Major changes have avoided protective measures where beyond the existing regulation the perpetrator is possible to cut the substitute value.

It is advisable to draw attention to the fact that enterpreneurs bears the burden of responsibility for the actions of its employees and certain other natural persons in connection with their business. It is therefore advisable to reflect on the

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[76] See also Act No. 141/1961 Coll., On Criminal Procedure (Criminal Procedure Code) and Act 40/2009 Coll., Criminal Code.

[77] Kateřina Staňková, Michala Hengalová. Komplexní kodifikace správního práva trestního? Zdroj: Právní rádce (5/2017) dostupný na webové stránce https://pravniradce.ihned.cz/c1-65714650-komplexni-kodifikace-spravniho-prava-trestniho

[78] The previous administrative offense law defines an administrative offense as a culpable act that violates or threatens the interest of society and is expressly identified as an administrative offense in an administrative offense statute or other law unless another administrative offense is punishable under special legal regulations or a criminal offense. In order to fulfill the legal requirements, it is essential that both the material and the formal aspects of the offense are fulfilled and at the same time that the offense is committed by the responsible person.

[79] See more in Mates Pavel: Some procedural provisions of the Law on Liability for Offenses, Work and Wages No. 3/2017, p. 77.

[80] Mates Pavel: Nad některými oblastmi nového zákona o odpovědnosti za přestupky a řízení o nich, Bulletin advokacie č. 12/2016,str.25. Dostupné online na http://www.bulletin-advokacie.cz/nad-nekterymi-oblastmi-noveho-zakona-o-odpovednosti-za-prestupky-a-rizeni-o-nich#ftn20

possibility that the program could be incorporated into the business of such a natural or legal person, since only in such case it will be possible to state that the individual has made every effort that could fairly be required to prevent him from committing the misdemeanor. His responsibility for committing misdemeanors passes after his death to a person who continues his business. In such a case, it is usually appropriate to examine the legacy audit of the legal predecessor's business as an heir.

3.2. Rejected institutes

During the preparation of the new codification, a number of solutions were considered, but they were not part of the material intention or were rejected during the legislative discussion. One such example is an institute known from the field of criminal law, which is free legal aid. Within the framework of the recodified legal regulation of the offender's rights, one of the possibilities was the fulfillment of certain conditions with free legal assistance in the case of so-called extraordinary offenses, ie cases of an offense, for which the law sets a fine within the limit of the rate, at least 500,000 CZK. The necessary conditions for a defense, as in criminal law, could be that the defendant does not have sufficient means to cover the costs of the defense, and that such a defense is necessary for the legal guardian to protect his or her subjective rights. At the request of the accused, an administrative body could appoint him to the lawyer, with the costs of the defense being fully or partially reimbursed by the state. With the possibility of free legal assistance, however, the Legislative Council of the Government disagreed. We deem that this solution was not accepted to the detriment of the accused's rights.

4 Conclusions

The new administrative criminal law recodification brought a substantial shift in the regulation of liability for administrative law infringements, as well as a significant qualitative shift in the procedure for dealing with these administrative offenses. We consider it absolutely crucial that these statutes brings (harmonizes) the regulation with the field of criminal law that has undergone complex modern recodification in 2009. The criminal law recodification is deemed as succesfull except for some partial issues.

The new Code also takes into account some international standards, which are basically based on the concept that all public-law punishment should be considered as a whole. It is also inspired by the existing case law of domestic and international courts, which we consider highly usefull because of previous experience. It is possible to built more case law and it is not necessary to make a thick line behind the existing practice. For futuro we hope that the authorities will not ignore the new institutes in their decision-making practice and will apply them properly. From the point of view of the coherence of the legal order, as well as from our point of view, the new legislative instruments provide a qualitative shift forward.

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Session 8

Mathematical-Statistical Methods and Optimization in Practice.

Modelling E-Commerce Processes in the Presence of a Price Comparison Site

Ladislav Beránek, Radim Remeš

Abstract: *Simultaneously with the development of e-business, related business applications have been developed. Price comparison sites that allow comparison of prices in different online stores belong to the most successful. These sites are also known as price comparisons, shopbots, or internet buying agents. Online buyers use them to obtain information about the price or the relevant stores. They reduce buyer search costs and help them in their decision making by providing comparison of price of for example some product in various e-shops. Such information is rarely found in the context of physical retail purchases. Compare pricing pages were mainly surveyed in terms of the impact of price comparison pages on the price of products and services and the sensitivity of online shoppers to the price. In this paper, however, we want to look at online shopping processes with network analysis optics. In our model, we use weighted network-based inference as a basic, and we suggest further a model of relationships in the presence of price comparators sites. The goal of our model is to predict what e-shop a customer chooses when buying a particular product.*

Key words: E-commerce · Network-based Inference · Model · Price Comparison Site

JEL Classification: D85 · L81

1 Introduction

A price comparison website is one of successful e-commerce applications. They offer to users (e.g., Heureka.cz or Zbozi.cz) a possibility to find some e-shop that sells a particular product or service at a good price compared to other e-shops. These price comparison sites help users to search for some products, provide them with insight into prices, and influence consumers' perceptions of the risks associated with online shopping.

Simultaneously with the development of e-business, related business applications have been developed and many new approaches have been widely used as for example recommendation systems or other. Price comparisons that allow comparison of prices in different online stores are the most successful. These sites are also known as price comparisons, shopbots, or internet buying agents. Buyers online use them to obtain information about the price or the relevant stores. They reduce buyer search costs and help them make decisions by providing price comparison information that is rarely found in the context of physical retail purchases (Brynjolfsson & Smith, 2000). Compare pricing pages were mainly surveyed in terms of the impact of price comparison pages on the price of products and services and the sensitivity of online shoppers to the price (Takayuki, Tsutomu, 2013; Pathak, 2012). Degeratu et al. (2001) states that the existence of price comparison sites increases price competition and buyer price sensitivity.

We can look at e-commerce also as a network. Social and business networks are increasingly important areas of research in many disciplines (Borgatti & Halgin, 2011; Easley & Kleinberg, 2010; Lamanauskas et al., 2013). However, stable equilibrium and models have focused primarily on this, while their dynamics and productivity have gained limited attention on research. One of the main tasks is to better understand, anticipate and control their dynamics, including how they form, develop and shape their behaviors and performances (Rauch, 2010; Schweitzer, Fagiolo & Sornette, 2009). Enough progress has been made in e-commerce applications so far, and e-commerce plays a very important role in the economy. A large number of buyers and sellers cooperate with each other via web site transactions (Beranek & Nydl, 2013; Beranek, Tlusty & Remes). These interactions support development and shape complex e-commerce market structures. Getting a deep look at e-commerce research has a deep and lasting significance.

Our paper presents a model that would outline the basic processes of online shopping if the user uses one of the price comparators. The aim of our model is to predict customers' behavior and their preferences when using price comparison sites. This means customers' product selection and e-shop selection. The product is recommended based on a recommendation system (or mostly based on peers recommendation or other), and e-shop based on customer recommendations and a price of some product which are presented on the respective price comparison site. We use data col-

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lected from performed experiment to verify our model. It follows from a comparison that the model has good predictive abilities.

The aim of our research is to develop a model for exploring online shopping processes with the existence of a comparison page. We look at the relationship between shoppers and e-shops as a tripartite network. Then we use belief function theory to express user preferences. The objectives of this study are therefore twofold:

1. Creating a basic theoretical model to explain how buyers use price comparison sites pages when purchasing.

2. Performing empirical research to investigate validity and explaining the strength of this model.

For this purpose, we use simulation data and compare results with data from other sources.

The article is structured as follows: Section 2 briefly reviews related work on recommended systems. Section 3 defines some definitions that we use throughout this article. Algorithmic details can be found in Chapter 4. Section 5 describes the experimental procedure and results, followed by further discussion in Chapter 6. Finally, conclusions are made in Section 7.

2 Methods

In this section, we present a network analysis framework for e-commerce market. Nodes and links between these nodes (edges) constitute the network. Nodes represent the elements in a complex system, and the edges represent the interaction between system elements. E-commerce market is a complex network, and its complexity reflects in the following areas:

- The system has a huge number of nodes, and its network structure is complex and presents a variety of different characteristics. There are the generation and disappearance of nodes or edges. The emergence and demise of elements that have the life-cycle characteristic is very common. The relationships among elements are also dynamic changed.
- Networks are no governance structures. There is not one dominant organization to control and organize the other members in the network. Rather, the network concept is a way to visualize and understand the way firms and organizations are interconnected directly and indirectly through relationships. Networks are not under the control of individual nodes.
- Networks are formed in a self-organizing way through the actions and interactions of actions and interactions of actors involved, as they occur over time. They are continually being made and remade (or not) through ongoing structuring and restructuring processes. The multiple interactions and feedback effects continually taking place in networks lead to a complexity that makes it very difficult to control and predict for any individual actor.
- Time plays a central role in explaining and understanding exchange. Business relations develop over time and they are path-dependent. Buyers and sellers actively take into account what has happened before and they form plans and have expectations of what is likely to happen in the future, both of which affect their decisions in the present. The state of the network subject (person or organization) changes over time.

From a mathematical point of view, network can be described by set N={V, E} composed with nodes set V={v_1, v_2, …, v_n} and edges set E={e_1, e_2, …, e_m}. Network analysis framework for e-commerce market is as the following Figure. 1. From the graph we can see that, there are three steps for analyzing on e-commerce market from a network point of view—definition of network, analysis of network topology and analysis of network environment.

In the following paragraph, we give a brief introduction to the basic notions of the Dempster-Shafer theory (frequently called theory of belief functions or theory of evidence) which we use for the customers' preference prediction.

Considering a finite set referred to as *the frame of discernment* Ω, a *basic belief assignment (BBA)* is a function $m:\ 2^{\Omega} \rightarrow [0,1]$ so that

$$\sum_{A \subseteq \Omega} m(A) = 1 , \qquad (2)$$

where $m(\varnothing) = 0$, see (Shafer, 1976). The subsets of 2^{Ω} that are associated with non-zero values of m are known as *focal elements* and the union of the focal elements is called *the core*. The value of $m(A)$ expresses the proportion of all relevant and available evidence that supports the claim that a particular element of Ω belongs to the set A but not to a particular subset of A. This value pertains only to the set A and makes no additional claims about any subsets of A. We denote this value also as a *degree of belief* (or *basic belief mass - BBM*).

Shafer further defined the concepts of *belief* and *plausibility* [24] as two measures over the subsets of Ω as follows:

$$Bel(A) = \sum_{B \subseteq A} m(B), \qquad Pl(A) = \sum_{B \cap A = \phi} m(B) \qquad (3)$$

A *bba* can also be viewed as determining a set of probability distributions P over Ω so that $Bel(A) \leq P(A) \leq Pl(A)$. It can be easily seen that these two measures are related to each other as *Pl(A) = 1 − Bel(¬A). Moreover, both of them are equivalent to m.* Thus, one needs to know only one of the three functions m, Bel, or Pl to derive the other two. Hence, we can speak about belief function using corresponding *bba*s in fact.

Dempster's rule of combination can be used for pooling evidence represented by two belief functions Bel_1 and Bel_2 over the same frame of discernment coming from independent sources of information. The Dempster's rule of combination for combining two belief functions Bel_1 and Bel_2 defined by (equivalent to) *bba*s m_1 and m_2 is defined as follows (the symbol $\oplus$ is used to denote this operation):

$$(m_1 \oplus m_2)(A) = \frac{1}{1-k} \sum_{B \cap C = A} m_1(B) \cdot m_2(C), \qquad (4)$$

where

$$k = \sum_{B \cap C = \varnothing} m_1(B) \cdot m_2(C).$$

Here k is frequently considered a *conflict measure* between two belief functions m_1 and m_2 or a measure of conflict between m_1 and m_2 (Shafer, 1976). Unfortunately this interpretation of k is not correct, as it includes also internal conflict of individual belief functions m_1 and m_2 (Daniel, 2013). Demspter's rule is not defined when $k = 1$, i.e. when cores of m_1 and m_2 are disjoint. This rule is commutative and associative; as the rule serves for the cumulating of beliefs, it is not idempotent.

We will express belief functions for the price parameter and for the reputation of e-shop.

2.1 The design of our model

The problem description is as follows. The customer is looking for a specific product (such as a robotic vacuum cleaner) he has heard from acquaintances, from social networking friends, etc. A specific product can also be recommended to him/her by a recommendation system on a website or on a specific e-shop site. The customer gets a certain idea of the products he has at his disposal. He/she may also have a preference of a certain brand, for example iRobot when he/she buy robotic vacuum cleaner. He/she wants to buy this product at the lowest price. He therefore clicks on the website of a price comparison site (Heureka.cz). He/she selects chosen product and finds a range of e-shops selling the product. Offers of e-shops are sorted by price, lowest to highest. For each e-shop, ratings of previous customers are displayed. The customer chooses now e-shop according the price and rating of this e-shop and then buys the chosen product in this e-shop. We can model the before mentioned e-commerce processes with the existence price comparison sites as a tripartite network. In general, tripartite networks are the networks whose vertices are composed of three disjoint sets. Nodes in these tripartite networks are different in each layer (see Figure 1). Here, the set U are buyers, the set P are products and nodes in the set C present e-shops presented by price comparison site. However, in this paper, we will describe the process of e-shop selection, i.e., the relationship of U and C set, we suppose that user have chosen some concrete product. The reason we limit our model in this manner is to simplify the problems. Then, we can use bipartite network for the description of U and C relationship.

Suppose there are some categories of products (e.g., robotic vacuum cleaners that are manufactured by different companies and may have different functions). Let's denote the set of users $U = \{U_1, U_2, ..., U_m\}$, we suppose that these users have some referrals from friends, from recommendation systems from various information sources, or they prefer different brands of seeking item (robotic vacuum cleaner).

We further expect that this product be sold in various e-shops (the number of e-shops is m) at a price p_i. The price of delivery may also be important for users. It may vary depending on the price of the product. We include the price of delivery to the price of a product. Customers rate each e-shop after performed previous transactions with a certain number of points. This rating is available for other users to decide whether they will buy products in certain e-shop or not. We can express these rating (preferences of e-shops) using a matrix $R = (r_{ij})_{n \times m}$ where r_{ij} represents user' (j) preferences (expressed by a certain number of points, for example in range 1 - 5) given to this e-shop (j).

Figure 1 Example of a tripartite network as a model for e-commerce process in the presence of price comparison site
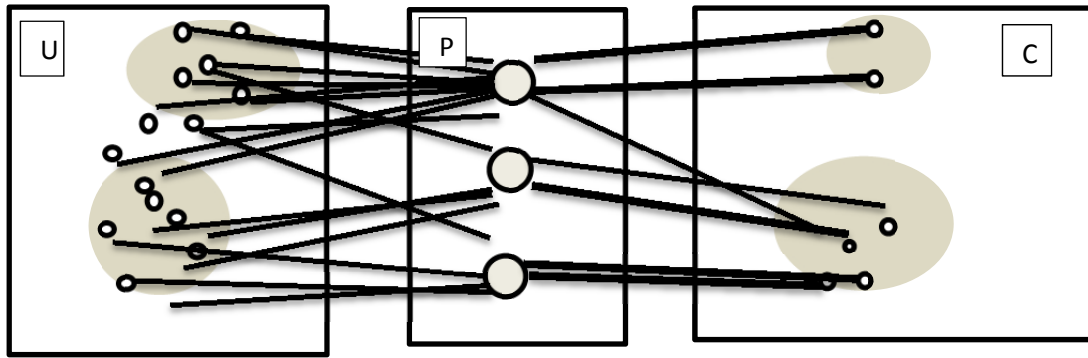
Source: authors

The total number of point each for each of m e-shops is:

$$d_j = \sum_{i=1}^{n} r_{ij} \tag{1}$$

We have two parameters influencing the shopping behavior: the price of product and the reputation of e-shop expressed by the number of points obtained by various customers after previous transaction. We will combine these two parameters with the help of Dempster-Shafer theory (Shafer, 1976).

Price parameter

This parameter shows how the shopping behavior of customers is influenced by the price. The respective belief functions have the following form:

$$m_p(\{buy_i\}) = \alpha \frac{p_{\min}}{p_i}$$

$$m_p(\{\neg buy_i\}) = 0 \tag{5}$$

$$m_p(\Theta_i) = 1 - \alpha \frac{p_{\min}}{p_i},$$

where α is the weight of this evidence. We can intuitively read this weight as a reliability of this evidence; p_i is the price in the i-th e-shop; $p_{\min}$ is the minimal price at which the product is sold in respective e-shops. With this equation, we have expressed the tendency to purchase the product based on the price. Usually, the lower the price the higher the temptation to buy the product in the i-th e-shop. At the same time, we assume that the equation is reflecting the temptation to buy the product, it does not show the reluctance to buy goods from the i-th e-shop, i.e. $m_p(\{\neg buy_i\}) = 0$.

Reputation parameter

This parameter shows how is the affection of customers to buy goods in the i-th e-shop is influenced by the reputation of respective e-shop. The belief functions have the following form:

$$m_R(\{buy_i\}) = \beta \frac{d_i}{d_{\max}}$$

$$m_R(\{\neg buy_i\}) = 0 \tag{6}$$

$$m_R(\Theta_i) = 1 - \beta \frac{d_i}{d_{\max}},$$

where d_i is the total number of point each for each of m e-shops, $d_{\max}$ is the maximum pints assigned to some e-shop, and β is the weight of this evidence. With this equation, we have expressed the tendency to buy the product in a particular e-shop based on the good reputation of this e-shop. Usually, the better the reputation of the e-shop expressed by the number of points assigned to this e-shop by customers according their satisfaction with previous transactions. At the same time, we assume that the equation is reflecting the tendency to buy the product in certain e-shop. It does not show some reluctance to the buying goods from the i-th e-shop, i.e. $m_R(\{\neg buy_i\}) = 0$.

The selection of e-shops

Once we obtain the belief functions, we combine them in a consistent manner to get a more complete assessment of what the whole group of signs indicates. The combination of belief functions is done with the help of the Dempster's combination rule, see equation (4). We express the assumption that customer will buy certain product chosen by him/her in previous stage belief functions $m(\{buy_i\})$ in some e-shop i. We calculate the value $m(\{buy_i\})$ using the combination (see equation 4) of single belief functions expressing appropriate evidence for every of i e-shop:

$$m(\{buy_i\})=(m_p \oplus m_R)(\{buy_i\}) \tag{7}$$

We obtained the vector of $m(\{buy_i\})$ values as recommendation for user U to by certain product in m e-shops. In order to evaluate the accuracy and efficiency of recommendation algorithm we defined an evaluation criterion as follows:

$$AC = \frac{1}{n}\sum_{i=1}^{n}\frac{N}{L}, \tag{8}$$

where n is the number of customers, L is the length of list LE of e-shops taking into consideration in experiments (less than the total number of e-shops available) and N is the number of correctly determined e-shops in the list LE.

3 Research results

3.1 Data set description

In this paper, we used data obtained by experiments with the group of 20 students. They were told to buy certain product with the use of price comparison site Heureka.cz for this purchase. They had to proceed like in real situation, to consider price and reputation of e-shops. Then, they had to written a list of e-shops in the order in which they would wanted to buy certain product from these e-shops.

On Heureka.cz, users grade e-shops using integers from one to five, which one stands for "extremely don't like" and five stands for "extremely like." We randomly divided the data set into two parts: 80% is the training set, and 20% is the testing set. To ensure the experimental results are accurate, all experiments were carried out with a fivefold cross validation test.

3.2 Experiment results

Taking reality into consideration, we could also assume the length L of the list of e-shops to be 5. We used the training set and the testing set to measure α and β by varying them from 0.0 to 1.0 step by 0.1 to see the values of AC. The aim was to determine optimal values of α and β.

Figure 2 Value of AC criterion by varied α and β
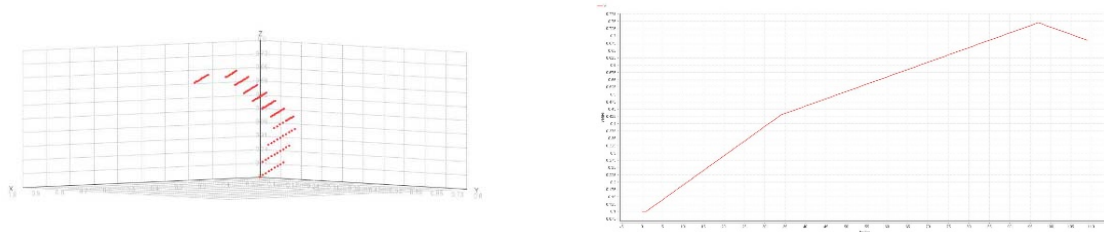
Source: Own processing

We determined the best values α and β as following: $\alpha = 0.98$, $\beta = 0.89$ (see Figure 2).

4 Conclusions

We have suggested a model of e-commerce processes in the presence of a price comparison site. Experimental results on the group of students show accuracies of the proposed method. The accuracy of our model is sensitive to both amount of data and the length of list of e-shops. Our model can be useful at prediction of shopping behavior of customers in the presence of a price comparison site. In this paper, we focused mainly on the last part of the modeling process, where we used the belief function theory. However, it is clear that the graph approach brings advantages over other methods as it also allows the expression of relationships between individual actors in the field of e-commerce. Therefore, we want to focus on the use of network methods in the presented model in our next work.

A significant challenge for inference with networks is the available information is only an approximation of people's relationships and preferences. For use of social networks in e-commerce, the network information could be incomplete and out of date, that is, noisy. Thus, in practice, evaluating the usefulness of network-based inference for e-commerce requires understanding the consequence of errors in the data. Fortunately, mechanisms relying on aggregated information from social networks are somewhat robust: performance degrades gradually rather than abruptly with noise. In such cases, estimates of consumer interests based on approximate network information is beneficial compared to not using the information at all. Evaluating the amount of noise in online networks and its effects on mechanisms relying on those networks is an important direction for future work.

A further challenge arises from the using real networks data about e-commerce. While available online networks can include thousands or millions of users, and thus give strong statistical correlations, detailed information on why users form links is usually lacking. Thus, it is difficult to distinguish links arising from prior similarity from influence of linked individuals creating similar preferences. In our future work, we want to explore further insight into the network of interest and make a more dynamic analysis of the network possible.

Acknowledgement

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Clustering of Companies in an Inhomogeneous Space

Ilona Berková, Tomáš Mrkvička

Abstract: *Locations of companies are modelled by inhomogeneous point process where inhomogeneity was solved by local scaling. As the scaling factor population was chosen because the hypothesis that the population in unevenly distributed and companies' choose their locations according to the number of the local population. To study relationships of companies the locally scaled L-function and global envelope test were used. The companies are located in three regions in the Czech Republic (Plzensky, Jihocesky and Vysocina) and contains information from the year 2013. The main aim of this paper is revealing whether positions of companies are spatially dependent or independent. It was found out that the companies tend to cluster even when the population is taken into account.*

Key words: Local scaling · Inhomogeneous point process · L-function · Global envelope test · Spatial statistics · Spatial clusters · Agglomeration

JEL Classification: C21· L60 · O18 · R12

1 Introduction

Location of companies has been solved in economy for many years. This is the most important decision of companies. This fact has led to the development of location theory that are one of the oldest theories dealing with regional economics (Alonso, 1972). Localization theory is focused on the geographic location of economic activities and it tries to answer the question why and where economic activities are placed. Further these theories try to define location factors which can explain the decisions of firms (North, 1955).

The first localization theories focused on agriculture activities (e.g. Alonso, 1972; Berry, 1970) which were then expanded to industry (e.g. Weber, 1929; Krugman, 1993). The further development of localization theories has expanded since the second half of the 20th century with the use of multi-criteria approach and modelling (Rumpel, 2008).

There is much research dealing with cluster modelling of economics activities. A popular tool used for the recognition of spatial behaviour has become K-function (Dixon, 2002). This field is the interest of for example Espa et al. (2010), Marcon and Puech (2003) and Arbia et al. (2008) who popularized the use of K-function when analysing companies' locations.

The main aim of this paper is to reveal whether the positions of companies are spatially dependent or independent. We tackle the problem of spatial heterogeneity with the population given in observed window, because homogeneity leads to unreality. Thus we test if the data can be modelled using locally scaled point process with inhomogeneity governed by population. Lots of empirical studies have tried to develop suitable indices and statistical tests which can measure the degree of spatial behaviour of points. The measurement can be performed by traditional methods by indices, for example by Aggregation Clark-Evens index (Dixon, 2002). However, more popular are distance methods (J-function, D-function and g-function) and nearest neighbours methods (L-function and K-function). These methods identify interaction of points through summary characteristics of point pattern (Illian et al., 2008). An important issue of point process statistic is simulation of point processes, where recent research of Myllymäki et al. (2017) introduced new methods for comparing a summary characteristics estimated from data and estimations from its simulations.

This paper is organized as follows. First of all in Section 2, we introduce methodological statistical framework, especially methodology of Ripley's K-function (Ripley, 1976), in empirical analysis preferred Besag's L-function (Besag, 1977), inhomogeneous spatial point processes and Global Envelopes. Chapter 3 contains data description and empirical application of the methodology in inhomogeneous case. At the end of paper in Section 4 there are the conclusion of research and our next steps in future studies in this field.

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2 Methods

The main aim of point process statistics is to understand and describe interactions among points that explain the mutual positions of points. Spatial statistics is applied in economy where you can reveal economical interactions which typically lead to clustering and repulsion among points (Illian et al., 2008).

Point process statistics analyses geometrical structures of patterns formed by objects which are randomly distributed in space and can be used for classification and identification of structural changes. Objects are represented by points or marks where points describe their locations and marks provide additional information, thus characterising the objects further, e.g. size, shape, type and so on. Point pattern is a collection of points in an area or set and is interpreted as a sample from a point process. Point processes are denoted by N and it means a random set of points x_1, x_2,…, i.e. $N=\{x_1, x_2, …\}$. The set N can be finite or infinite (Illian et al., 2008).

It is possible to apply statistical models on point patterns´ data. These models can be used for data summarization and making predictions. Also they can be simulated, it means, random pattern can be generated by model. The importance of statistical modelling can be identified as the best and the most effective form of data analysis. An analysis without statistical modelling leads to less informative results. Statistical model of point pattern is denoted as point process (Baddeley et al., 2010). It was considered that position of the companies forms a point process.

The most popular method of spatial statistic is Ripley´s K-function. It is a tool to analyse complete data of spatial point processes. In the analysis there is considered two dimensional space. Data contain locations of each point in defined observation window. This function can be used to summarize point patterns, test hypotheses, estimate parameters and fit model. K-function provides more information and more sensitive analysis than traditional methods. Ripley´s K function is the mean number of points other than the typical point in a ball of radius r centred at the typical point. The aim is testing deviations from complete spatial randomness (CSR). The empirical homogeneous Ripley´s K-function is defined as:

$$\hat{K}(r) = \frac{|W|}{n(n-1)} \sum_{i=1}^{n} \sum_{\substack{j=1 \\ j \neq i}}^{n} 1\{d_{ij} \leq r\}$$

Let $|W|$ be total study area, d_{ij} Euclidean spatial distance between the ith and jth observed points within a distance r of an arbitrary point of the process. Usually L-function is defined instead because of its linear form:

$$L(h) = \sqrt{\frac{K(h)}{\pi}} \; for \; r \geq 0.$$

Sometimes L-function is called Ripley´s L-function because it is just standardized version of Ripley´s K-function. If $K(h)>\pi h^2$ or $L(h)>h$ for small h, in the pattern there are clusters. If we can define $K(h)<\pi h^2$ or $L(h)<h$ for small h, points in the pattern are regular. Results of L-function leads to better interpretation due to its linear form.

Figure 1 Population density
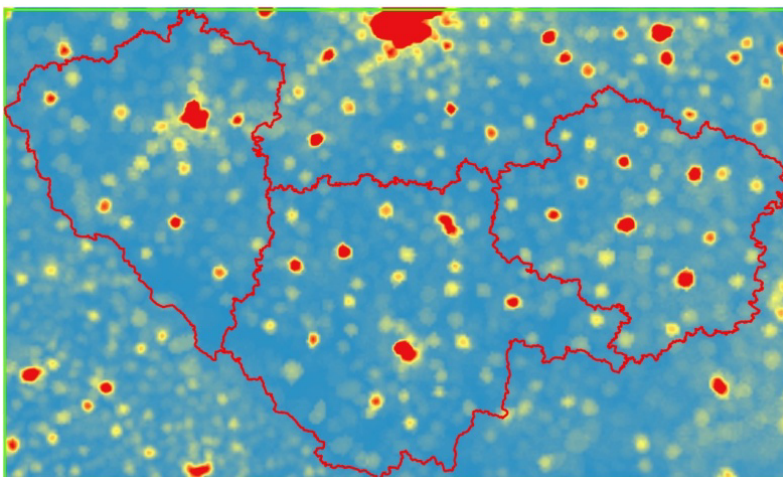
Source: Authors

We cannot consider that the density of companies is the same in the whole observation window so we suppose that the location of the companies depends on the population (Figure 1). This approach is more realistic in large observation

areas and areas with geographical features like mountains where concentration of companies is not as common. From this reason, it was necessary to use tools for inhomogeneous analysis.

The population density in the given area is depicted in Figure 1. The observation area is highlighted with the red curve. The values with low population density are blue and with high population density are displayed in red. The population was generated by Geographic Information system for the year 2011.

For inhomogeneous point processes various models differing in the specification of how the interactions between points depend on the local intensity of points have been suggested. We will use approach of local scaling for modelling the inhomogeneity because of its propreties. This approach yields models for patterns adapted to variable point density by a mechanism that rescales distances relative to local point density. This may be of particular value for a point pattern where the hard-core distance varies with point density. The inhomogeneity is obtained by local scaling the template process with a location-dependent scaling factor (in our study it is the population). If scaling factor is constant then the point process behaves like a template (Hanh et al., 2003).

The main aim is to find global summary characteristics which are adapted to variable point density by a mechanism of rescaling distances relative to local point density. This is achieved by replacing distance measures used in the density with locally scaled analogues defined by a location dependent scaling function (Hanh et al., 2003). Due to local scaling pattern, distances become shorter in the regions with low population density and longer in the regions with high population density.

Locally scaled version of K-function modifies distances for each pair of points xi, xj by rescaling factor s(x_i,x_j). The rescaled distance for each pair of data points xi, xj is defined as $d_{ij}^* = \frac{\|x_i - x_j\|}{s(x_i, x_j)}$ where the rescaling factor is computed as $s(x_i, x_j) = \frac{1}{2}\left(\frac{1}{\sqrt{\hat{\lambda}(x_i)}} + \frac{1}{\sqrt{\hat{\lambda}(x_j)}} \right)$ (Baddeley et al., 2010).

For a comparison of empirical functions and their counterpart, which is simulated from null hypothesis, should be applied Envelope tests. Myllymäki et al. (2017) introduced new global Envelope tests which provide graphic illustration and exact p-value. Tests present distances where behaviour of function leads to rejection (if the function is lying outside the envelopes) or confirmation (if the function is lying inside the envelopes) of null hypothesis. It is used for better understanding and suggestion more suitable models. Global envelope tests offers two approaches depending on a number of simulations, i.e. Global rank envelope test (necessary to use an appropriate number of simulations) and Global scaled maximum absolute difference (SMAD) envelope test (doesn't need a large number of simulation but it is not as accurate).

In case of Global SMAD envelope test (Myllymäki et al., 2017), the critical bounds were calculated as follows

$$T_{low}^u(r) = T_0(r) - u \times \left| \underline{T}(r) - T_0(r) \right| \text{ and } T_{upp}^u(r) = T_0(r) - u \times \left| \overline{T}(r) - T_0(r) \right|,$$

where $\overline{T}$ and $\underline{T}$ denote the r-wise 2.5% lower and upper quantiles of the distribution of T(r) under null hypotheses. T(r) denotes functional statistics in our case $L^*(r)$, i.e. the locally scaled version of L-function. The critical bounds are parametrized with respect to u, where u is found to correspond to required global level of significance α. In this paper, we used Global SMAD envelope test, concretely Direction quantile MAD envelope test with 99 simulations because of a time limitation. The value of significance level is 5 %.

3 Research results

The research will focus on spatial dependences of corporations settled in Zapadocesky, Jihocesky and Vysocina region. These regions were chosen because of comparatively homogeny conditions of regions and their position makes the suitable observation window. It contains more than 10 000 companies. The data set was collected in 2015 by database Albertina Gold and contains information from the financial reports of the companies from the year 2013. The classification of the companies into the given sectors was selected using the CZ-NACE methodology according to the core business that is the main product of the companies. We analysed all the sectors in the observed area but in this paper, we introduce results only for the sector of agriculture, forestry and fishing which has 746 companies.

The spatial distribution of the companies in this sector is displayed in Figure 2. In the first visual inspection, it is clear that the companies tend to make clusters by concentration on some specific positions in the observation window.

Figure 2 Positions of companies belonging to sector agriculture, forestry and fishing
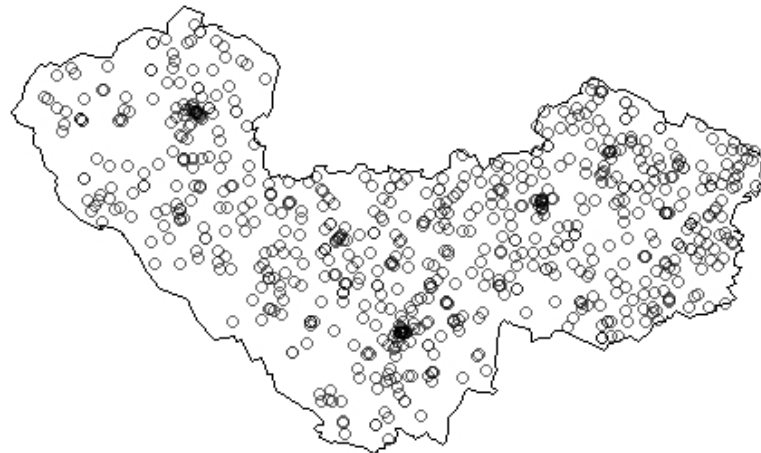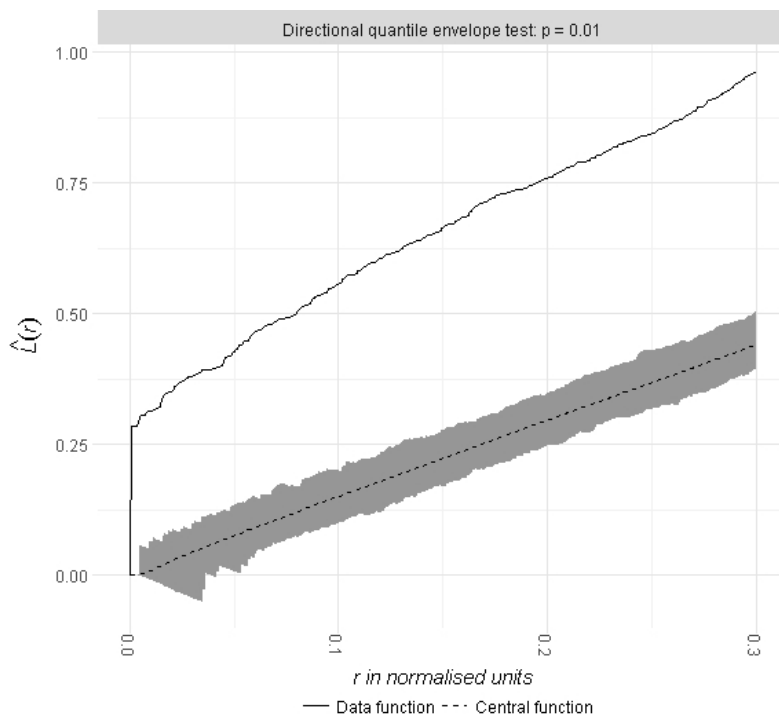

Source: Authors

In the Figure 2 we can see that companies tend to formation of clusters. For objective evaluation statistics methods must be used to confirm the statement. The observed area is characterized by variant natural features like mountains, rivers, forests etc. At the first glance we can see that companies are more concentrated in areas of towns. From that reason, we tested spatial behaviour of the companies in inhomogeneous case where inhomogeneity was given by population density.

The main tool for point processes analysis is Ripley´s locally scaled L-function which is illustrated in Figure 3. Generally, values of locally scaled L function outside the envelopes represent the distance where the spatial concentration or dispersion is significant. It is obvious that the pattern generates clusters. The result of Directional quantile MAD envelope test is shown in Figure 3. At first glance, we can reveal a strong phenomenon of spatial clustering in each distance *r*.

Figure 3 Directional quantile MAD global envelope test computed using 99 simulated realizations of inhomogeneous Poisson process with intensity equal to the intensity of population in Figure 1

Source: Authors

It is necessary to reject (p-value = 0.01) the hypothesis that companies are completely spatially random when the population is taken into account (Figure 3). Spatial concentration cannot be explained by the population given in the observed area.

4 Conclusions

The choice of a suitable location for a company and its economic activities is one of the most important decisions in the company. For this reason, the approach to location had been solved in deep history when a settlement was dependent on accessible livelihoods and suitable climatic conditions and was focused on the choice of location for economic activities with optimal resources. These theories are considered as the starting point for regional science that is based on discovering specific characteristics that affect the location of activities.

The aim of this paper was to find out if companies are spatially independent or if there is some spatial dependence between them. We assumed that the location of companies could be caused by the clustering of firms in towns where a higher population exists. To remove this circumstance we put population as a variable into our analysis. Due to the application of population we tried to explain the clustering of firms. We have shown that the clustering of firms is not completely driven by population and there has to be an influence of other factors

In the next research there will be implemented another variable: size of company. We want found out if after implementing population density and size of companies in the model, the companies of the studied sector still tend to make clusters in the space. Then we would like to add marks to the point process, especially health of companies. Adding the health of companies as marks to the point process, we would like to find out if the health of a firm is influenced by the health of neighbouring companies.

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On the differences between DEA and selected MCDM methods

Markéta Dvořáková, Jana Klicnarová

Abstract: *In many economic applications, it is necessary to compare some units, to choose the best one or to identify good ones. Many ways how to handle this problem exist. In this paper, we are interested in DEA and MCDM methods. Data envelopment analysis methods (DEA) are focused on productive efficiency of decision making units with respect to the values of their inputs and outputs. The aim of the DEA model is to identify a set of efficient and inefficient units. Multiple-criteria decision-making methods (MCDM) typically search for the "best" alternative from a set of avaible alternatives or for a small group of "optimal" alternatives. However, in these problems the solution depends on decision-maker's preferences. It is known inputs of DEA are in fact costs criteria and outputs are profits criteria. Hence, it seems the aims of these methods are very similar. The aim of this paper is to discuss if it is possible to compare results of DEA and MCDM methods.*

Key words: DEA · Multiple Criteria Decision Making

JEL Classification: C14 · C44 · C61

1 Introduction

In many economic applications, or solving economic, business, marketing, or other issues, it is necessary to compare some units (alternatives), to choose the best one or to identify good ones. Many ways how to handle this problem exist. In this paper, we are interested in DEA and MCDM methods.

Comparison of DEA analysis and specific methods of multiple-criteria decision-making or problems in the implementation of these methods has already been studied by many authors. For example, Stewart (1996) examines these relaionships between Data Envelopment Analysis and Multiple-criteria Decision-making Analysis. He compares and applies the different approaches of DEA and MCDM to similar problems. He compares concepts of efficiency and Pareto optimality in these methods. Opricovic and Tzeng (2003) compare DEA and a particular model of MCDM – VIKOR. They showed that the results may not match (they showed that DEA resembles MCDM, but the results differ). Li and Reeves (1998) use a multiple-criteria approach to data envelopment analysis. Specifically, they present a Multiple Criteria Data Envelopment Analysis (MCDEA) model which can be used to improve discriminating power (one of the problems of DEA methods). Sarkis (1997) shows a comparative analysis of DEA as a discrete alternative multiple-criteria decision tool. In his research, DEA has been applied as an MCDM tool and compared to other MCDM models and their structures, especially those that are based on multiple objective linear programming approaches. The same theme is dealt with by Bouyssou (1999) who attached his some remarks.

However, the aim of this paper is to compare the results of these methods - Data Envelopment Analysis (DEA) and Multiple-criteria decision-making (MCDM) methods. Both of these methods were developed independently of each other. The ideas and aims of these methods are very similar; cost criteria in MCDM can be viewed as inputs and benefit criteria as outputs. DEA methods were developed to measure productive efficiency of decision making units (DMUs). MCDM methods were developed to compare DMUs, to rank them and to choose the best of them. More precisely, we are interested in the question whether the weights detected by DEA analysis for efficient units and subsequently used in multi-criteria decision-making methods generate these efficient units as the best alternatives.

It is well-known, that it is possible to run MCDM to get the inefficient unit as a compromise solution (Stewart, 1996). However, what about the weights which we get only by normalisation of weights from DEA methods? And what about the weights which we can get as a convex combination of normalised weights of DEA efficient units?

2 Methods

First, we choose an example, we apply DEA and identify efficient units. Then we use the weights under which the units are efficient, we discuss possible normalisation of these weights and use them in MCDM methods and we discuss the results. In this paper, we choose for comparision Weighted Sum Approach (WSA) and TOPSIS.

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Other, we discusse a general formulation of this problem and discuss possible results. DEA and MCDM methods were developed independently, but their aims are similar. So, first we introduce what are DEA and MCDM.

DEA

Let us start this part with a few remarks on Data Envelepment Analysis (DEA). DEA is a technique uses to determine the relative efficiency of decision making units (DMUs), with respect to the multiple inputs that they consume and multiple outputs that they produce. DEA was established by Charnes, Cooper and Rhodes (1978). They formulated data envelopment analysis (DEA) in 1978 as an extension of the result given by Farrel (1957). Later it has been developed by many authors. A standard DEA problem can be formulated as a linear programming model, which is done for each DMU. In such model, the weights associated with inputs and outputs are variables. It is possible to construct so called input or output-oriented model (it depends on the conditions for the weights).

As was written above, DEA identify efficient DMUs and it is also a good tool for identifying weak points, because it can identify where the inefficiency of the DMUs is based. In the case of an input-oriented model and an inefficient DMU, we can define, how this unit should reduce its inputs to become efficient. On the other hand, in the case of an output-oriented model and an inefficient DMU, we can define, how this unit should increase its outputs to become efficient. We can define it because of pattern unit, which is actually an efficient unit.

Simply, DEA tells us for which weights (at this time, they are variable for us) the unit is efficient. It will provide us both the efficient units and the weights in which this unit is efficient.

In the basic DEA model, the efficiency of the unit is supposed to be the ration of weithed outputs divided by weighted inputs. The aim of DEA model is to find such weights under which the examineted unit has maximum possible efficiency (in comparision with the other units). Here we introduce the basic model for linear optimization, the reason is that this formulation is close to the formulation of MCDM methods. As was mentioned above, our aim is to maximize a relatively efficiency, what is a ratio of weighted outputs and weighted inputs. Hence, in case when we fix weighted inputs to be equal to one, it is enough to maximize the weithed sum of outputs. So, if we suppose n DMUs (DMUs are indexed by j), s outputs (indexed by r) and m inputs (indexed by i), we can write the following model:

$$\max h_0 = \sum_{r=1}^{s} u_r y_{r j_0}$$

$$subject\ to: \qquad \sum_{i=1}^{m} v_i x_{i j_0} = 1$$

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \leq 0, \quad j = 1, \dots, n,$$

$$u_r, v_i \geq 0, \quad for\ all\ r = 1, \dots, s\ and\ i = 1, \dots, m, \qquad (1)$$

Where y_{rj} is the value of the *r-th* output of the *jth* DMU, x_{ij} is the value of the *i-th* input of the *j-th* DMU, u_r is the weight of the *r-th* output, v_i is the weight of the *ith* input, and h_0 is the relative efficiency of DMU_0. The DMU_0 is efficient if and only if $h_0 = 1$.

Let us remark, that we can alternatively use as a optimization function a following one (under the same conditions):

$$max \left(\sum_{r=1}^{s} u_r y_{r j_0} - \sum_{i=1}^{m} v_i x_{i j_0}. \right) \qquad (2)$$

MCDM

Multiple-criteria decision-making methods (MCDM) have been developed from 1970s. The aim of MCDM is to identify the "optimal" (compromise) alternative or to rank the alternatives or to identify a small number of "efficient" alternatives under decision-maker preferences. So, the first step in these methods is to find weights for all criteria, or to evaluate how the criteria are important for us.

In MCDM, it is assumed that a small finite number of feasible alternatives evaluated under several criteria exists and a decision-maker has the "best" alternative (for him). However, the terms criteria is often confused. We can define a criterion as a specific point of view according to which alternatives may be judged and compared, an attribute as a

special feature of the alternatve with which a numerical measure can be associated, and an objective as a specific direction of preference defined in terms of an attribute. The aim of MCDM is to provide support to the decision-maker in the process of making the choice among alternatives. It includes the selecting of the best alternatives or / and sorting of the alternatives.

There are many methods of multiple-criteria decision-making. In this paper, we chose Weighted sum approach (WSA) and TOPSIS methods. Two of the basic MCDM methods, which take into account the weighs of the criteria, for more details see Triantaphyllou (2000) .

The main difference between these two methods is in normalization. For the WSA method, linear normalization is applied, whereas in the TOPSIS method the normalisation by Euclidian metrics is used.

WSA

The WSA method compares the weighted benefit of each alternative and it is based on the ratio of difference between the value of criterion of each alternative and the worst possible value in this criterion and the difference between the best possible value in this criterion and the worst possible value in this criterion. As you can see, the minimization criterion is not a problem here.

$$u_{ik} = \frac{y_{ik} - d_k}{h_k - d_k}$$

(3)

Where:

d_k is the lower limit of *k-th* criterion (the worst possible value in this criterion)

h_k the upper limit of *k-th* criterion (the best possible value in this criterion)

We compare the alternatives according to the function:

$$\sum_{k=1}^{m} v_k u_{ik},$$

(4)

Where:

v_k are weights of *k-th* criterion

u_{ik} are normalised utilities from aech alternative under each criterion.

TOPSIS

In the TOPSIS, the normalisation by Euclidian metric is used. An important step in this method is the convertion of all minimization criteria on the benefit type ones. It is well-known that this conversion (the way how the conversion is done) can affect the result of the method (for more details see The conversion of cost and benefit criteria in the TOPSIS method by Houska, Domeova and Berankova (2012)).

The formula for normalisation is as follows:

$$r_{ik} = \frac{y_{ik}}{\sqrt{\sum_j y_{jk}^2}}.$$

(5)

3 Results

First, let us introduce our numerical experiment, then we conclude some general results.

Numerical experiment

For the purposes of this research, five marketing campaigns values were found. These campaigns were rated with four inputs and three outputs. Inputs are Campaign costs (in CZK); Number of marketing channels; Number of involved employees and Campaign Duration (in Days). The outputs are Number of acquired leads; Number of received contracts and Number of customers after 1 year. The obtained data are shown in the table below.

Table 1 Obtained data of the inputs and outputs of the individual alternatives (real company data)

	Inputs				Outputs		
	Compaign costs (in CZK)	Number of marketing channels	Number of involved employees	Campaign Duration (in days)	Number of acquired leads	Number of received contracts	Number of customers after 1 year
K1	38 745	1	2	15	539	74	70
K2	74 350	2	4	18	2 389	379	377
K3	97 640	2	7	10	37 301	604	566
K4	65 385	1	3	72	4 476	87	69
K5	242 890	3	16	30	12 651	2 123	1 987

Source: authors

DEA analysis has identified two efficient campaigns, namely the K3 and K5 campaigns. The weights under which these campaigns are efficient can be seen in the table below

Table 2 The weights under which campaigns K3 and K5 are efficient

K3	0.0000102417	0	0	0	0.0000268089	0	0
K5	0.0000041171	0	0	0	0	0.0004710316	0

Source: authors

These "weights" were subsequently standardized using the sum of found weights and the subsequent dividing these weights by this sum. It is because the sum of weights must be equal to 1. The standardized weights under which campaigns K3 and K5 are efficient can be seen in the table below.

Table 3 Standardized weights under which campaigns K3 and K5 are efficient

K3	0.276424511	0	0	0	0.723575489	0	0
K5	0.008664846	0	0	0	0	0.991335154	0

Source: authors

Then, WSA and TOPSIS method using the standardized weights was used. Only two criteria are considered in the results, because the others have zero weight. By both methods, the campaign K3 was evaluated as the best one for the first set of weights and the K5 campaign for the second set of weights. Calculations were performed in program excel. Weighted utility of the individual alternatives for the first and second set of weights and relative distance indicator of the individual alternatives for the first and second set of weights can be seen in the tables below (gray fill is the best option).

Table 4 Weighted utility of the individual alternatives for the first and second set of weights (WSA method)

K1	0.27642
K2	0.26463
K3	0.92025
K4	0.31784
K5	0.23840

K1	0.00866
K2	0.15472
K3	0.26259
K4	0.01382
K5	0.99134

Source: authors

Table 5 Relative distance indicator of the individual alternatives for the first and second set of weights (TOPSIS method)

K1	0.193907966
K2	0.177307543
K3	0.935975598
K4	0.208238365
K5	0.316238066

K1	0.00554433
K2	0.14891357
K3	0.258684858
K4	0.007971509
K5	0.99445567

Source: authors

This procedure has been applied to further examples and it has always been true that the weights determined by the DEA analysis for efficient units and subsequently used in MCDM, they have generated as the best units just these efficient units (DEAu = MCDMu). The reason is that the DEA linear model and WSA model are very close in fact. The objective functions in both methods are weighted sums of inputs and outputs (with negative inputs weights), which are in WSA methods lineary normalised. However, it does not ensure the same results. Typically, the results are the same, but in some special cases, the results can differ due to the normalisation.

For this reason, it is necessary to realize that DEA and MCDM are very similar methods. As you can see, the objective functions of both methods differ only in normalization:

$$\text{DEA: } \sum v_i y_i \quad \text{WSA: } \sum v_i \frac{y_i - d_i}{h_i - d_i}$$

(6)

Further, we tried to move with these weights differently. It was true that if the weights moved somewhere in the space (defined by the relationship below) between the weights found for the K3 and K5 campaigns these campaigns were evaluated as the best by multiple-criteria decision-making. However, if we use other weights, more precisely weights outside of the space of convex combination, i.e. for example weights which are positive for criteria with zero weights in previous cases, then other campaigns are evaluated as the best. For example, if we apply WSA with weights (0;0.2;0.2;0.2;0.2;0;0.2) the the campaign K4 is choosen as the best one. By the convex combination of the weiths we understand weights in the following form (for k between 0 and 1).

$$k * v_1 + (1 - k) * v_2 \tag{7}$$

On the other hand, both of these methods (WSA and TOPSIS) also heavily depend on the dominated alternatives. Adding of a dominated alternative does not affect the result of DEA but it affects the result of the WSA and TOPSIS methods. Let us try to add a dominated alternative into our example and let us see how it affects the result of WSA.

Table 6 New dominated campaign K6 in comparison with campaign K3

	Inputs				Outputs		
	Compaign costs (in CZK)	Number of marketing channels	Number of involved employees	Campaign Duration (in days)	Number of acquired leads	Number of received contracts	Number of customers after 1 year
K6	385 620	2	7	11	35 997	545	522
K3	97 640	2	7	10	37 301	604	566

Source: authors

If the alternative A dominates the alternative B, then the alternative A is ranked according to all criteria equally or better than the alternative B and at least at one criterion it is better than the alternative B. Hence, in our case, the campaign K3 dominates the campaign K6, in other words, the campaign K6 is dominated by the campaign K3.

The weights detected by DEA model for efficient K3 were used. Adding a dominated alternative therefore affected the rank of the alernatives. As an example, we listed the WSA method. In the table below you can see this rank for the previous WSA result (WSA1) and WSA result with the alternative K6 included (WSA2).

Table 7 Weighted utility and sequence of the individual alternatives for the WSA1 and WSA2 results

WSA1		
K1	0.27642	3
K2	0.26463	4
K3	0.92025	**1**
K4	0.31784	2
K5	0.23840	5

WSA2		
K1	0.27642	6
K2	0.28446	5
K3	0.95307	**1**
K4	0.33269	4
K5	0.35214	3
K5	0.69791	2

Source: authors

The alternative K3 is still the first one. The K4 campaign was the second one, but now the dominated K6 campaign is the second one and the K4 campaign fell to the 4th place. The K1 was in the previous result in the 3rd place, but now K1 is the last one and K5 is now in the 3rd place. The K2 was the fourth place, now K2 is fifth. The K5 campaign was last one. K6 was dominated only by the K3 campaigns, but the sequence of the individual variants and their weighted benefits changed completely - K5 overtakes K4 and K2 overtakes K1.

4 Conclusions

As it was mentioned in the previous part, the results given by DEA and MCDM methods are close together, but they need not coincide.

DEA has been applied to a wide range of managerial and economic problems in both the public and private sectors, as evidenced in Seiford (1994). However, there are two interrelated problems. It is weak discriminating power and unrealistic weight distribution. The problem of weak discriminating power happens when the number of DMU's under evaluation is not large enough in comparison with the total number of inputs and outputs. DEA often brings solutions that identify too many DMUs as efficient, which is problem, when we need to select only one unit as the best of all. The problem of unrealistic weight distribution concerns to the situation where some DMUs can be evaluated as efficient simply because they have extremely large weights in a single output and/or extremely small weights in a single input while these extreme weights are practically disproportionate, or even totally unattainable. Or even - very often it can happen some DMUs can be rated as efficient by classical DEA model simply because they have zero weight in one or even several inputs or outputs, which means that these inputs and outputs are not taken into account at all.

A lot of efforts have been made to overcome these problems. To improve discriminating power, Sexton et al. (1986) construct a cross-efficiency matrix which contains not only a DMU's usual DEA efficiency (called self-rated efficiency), but also a DMU's cross-efficiencies rated by each of other DMU's within the group. Since the cross-efficiency matrix has been extensively used technique, especially when the number of DMU's is relatively small and discrimination between DMU's is a main problem. The applications and extensions of the cross-efficiency matrix can be found for example in Doyle and Green (1993), Shang and Sueyoshi (1995) and Green et al. (1996). There is also a Multiple Criteria Data Envelopment Analysis model (MCDEA) which can be used to improve discriminating power of classical DEA method. The problem of unrealistic weights has been tackled mainly by the techniques of weights restriction.

So, on the basis of the above, when all the criteria are at least of a little importance for the decision maker or if the decision maker can accurately and specifically determine the weights of these criteria, then it is better to use one of the multiple-criteria decision-making methods.

The weights and their convex combinations determined by the DEA analysis for efficient units and subsequently used in MCDM very often generate as the best units just these efficient units. Typically, if the weights move in the space between the weights found for the DEA efficient units, these units are evaluated as the best by multiple-criteria decision-making, too. However, if other weights are used, the weights outside of the convex combination, it is not guaranteed that the same best units will be found.

The dominated alternative fundamentally affect the result of the WSA and TOPSIS method (the rank is changed), despite it does not affect the result of DEA. This is important in situations where we are interested in a rank of variants.

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Comparison of Discrete and Continuous Model of Planned Cash-Flow in ERP Systems

Petr Hanzal, Petr Chládek

Abstract: *The aim of this paper is to compare continuous and discrete mathematical models for calculating of the planned cash flow, based on the planned accounting data obtained from ERP systems of business companies. By the mathematical models (defined in this way) it is possible to predict the figures of the required statements. The difference between continuous and discrete case is discussed with emphasizing their advantages and disadvantages. The paper should be considered as a contribution to the application of numerical methods in enterprise resource planning systems in a general context.*

Key words: Enterprise Resource Planning · Accounting Data · Mathematical Modelling · Interpolating Polynomial

JEL Classification: C02 · M41 · C88

1 Introduction

Accounting data are an essential element of every ERP system. They are carriers of recorded facts related to the activities of the company and can also be transmitted, interpreted and processed. They include all knowledge about the micro and macro environment of the organisation, such as recorded data of economic facts and other factors affecting the value chain of a company (Sodomka, 2010).

The basic function of financial accounting is to provide all its users with reliable information about the economic situation of the company. Accounts are required to provide, in particular, information on the assets and financial position (in the form of a balance sheet) and on performance (in the form of a profit and loss statement) over the relevant period of time. This serves not only to assess what use has the company's management made of the funds entrusted to it over the past period, but recently there has been ever increasing interest in forecasting the financial situation, whether and to what extent the company will be able to achieve favourable financial results in the future. Accounting information is intended for managers as well as for various external users who are interested in the company for a variety of reasons (Kovanicová, 2005).

Accounting operations should always comply with the general accounting principles. The basic legal framework in Czech accounting is the Act on Accounting, implementing decrees to this Act and the Czech Accounting Standards. In Europe and the Czech Republic, financial and tax accounting systems intertwine. In addition, tax rules and laws have a significant impact on practices in financial accounting, whose results they in some cases distort significantly (Šteker, 2010).

Financial accounting data are derived from the state of assets, receivables from customers, payables to suppliers, and at the same time monitor revenues and costs from the point of view of the accounting entity as a whole. They record all business cases relating to the purchase and sale of goods, materials, own products and services, including master data of suppliers and customers (Hanzal, 2009).

ERP systems that work with financial data usually work on a monthly basis, so these data are discrete. In many (and not only economic) cases, it is common for discrete data to be represented in a continuous manner. For example, let's say modeling of exchange rates (Erdemlioglu, 2015) or marketing analysis of consumer behavior (Dong, 2014). The article deals with the specific problem of a continuous model for the ERP system and its comparison with the usual discrete approach. The advantage of a continuous model is the ability to work with data at any point in the timeline. Chapter 2 contains a description of the model including a block diagram. The main part is Chapter 3, containing an example showing the practical use of a mathematical model for specific data.

Accounting Information Systems

The financial management module provides a comprehensive view of the state of finances throughout the organisation, including the management of financial operations. The module is linked to financial accounting, cost accounting, financial controlling, records of tangible and intangible assets and generally provides the following functions:

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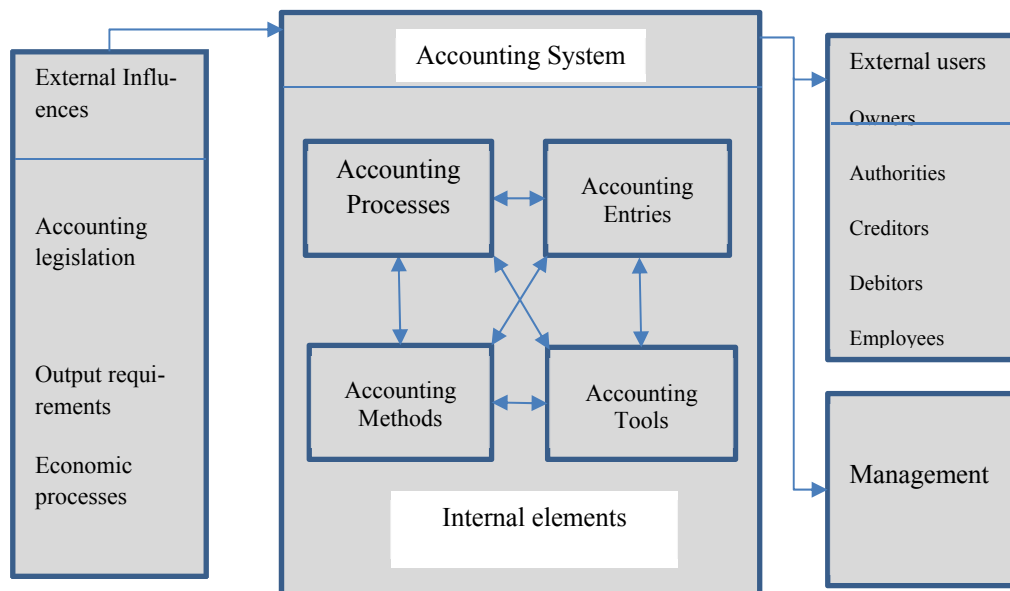
- financial accounting,
- receivables management,
- payables management,
- telebanking,
- cost accounting,
- financial controlling,
- cash office,
- tangible and intangible assets.

Financial accounting serves to record financial operations in the accounting journal, which information is later transferred to the main ledgers, the source of printed accounting and financial statements. Financial accounting usually does not deal with management issues, it only has a record function. The main ledger is the basis of the company's financial management and often plays a central role in the whole ERP system.

Figure 1 shows the accounting part of the ERP system, which consists of the following elements (Křížová, 2005):

- Accounting Processes – are economic transactions in an enterprise, such as purchasing materials, selling products, paying taxes, wages, and so on.
- Accounting Entries – defined as providers of information about accounting processes, such as accounting documents, accounting records in accounting books, inventory cards.
- Accounting Methods – modify how certain accounting information is generated; an example would be stock valuation upon release, depreciation of fixed assets, etc.
- Accounting Tools – can be defined as procedures and techniques or tools for recording, summarizing and presenting accounting information - the most typical example would be the way of making entries in accounting books.
- External influences acting upon the accounting system – external influences affect the accounting system - its structure, size, function, etc. These stimuli can be divided into those coming from either outside or inside the enterprise. A typical example would be the legal regulation of accounting and business as a whole, or individual requirements of external and internal users of accounting information as to its manner, form and frequency.
- Accountants and their work – as an element of this system they participate in acquiring information about accounting processes and ensure maintaining of accounting records.

Figure 1 Diagram of the accounting system

Source: Křížová, 2005

While financial accounting is often managed by an accounting manager, a position of a controller has been established for the management of managerial accounting. These were the developments in Anglo-Saxon countries. European countries have responded to the emergence of managerial accounting in two ways. Some adopted the concept and developed it further according to their needs, other invented the term "controlling" after the appellation for the controller to describe the job content of this worker and ultimately a whole new discipline of management theory. The content of managerial accounting is richer than that of financial accounting, mainly because there is a strong emphasis not only on

operational but above all on strategic controlling. In corporate practice, controlling has gone through an evolution and has become an integral part of every modern enterprise. Yet there are considerable differences of opinion between the theory and practice on the notion controlling. The Czech language even lacks a definite one-word equivalent to „controlling", therefore it is usually left untranslated.

According to J. Fibírová (2011), controlling fulfills the following main functions:

- planning (creating various plans),
- securing and documentary (providing needed and quality information),
- control and analytical (control of company processes, their analysis and determination of possible deviations),
- reporting (a comprehensive system of indicators and information, often in the form of specific statements).

2 Methods

The method of the research is based on mathematical modelling shown on the block diagram in Figure 2. The explanation of the model is as follows: The accountant continuously enters the records of accounting cases into the information system. The manager, or an accountant in the management accounting department, enters the necessary planned values into the information system.

The module of mathematical modelling processes the values from both accounts. The output is the planned cash flow, which is calculated continuously. Thus, in short, it can be said that the output is a formula where the only input parameter is time and the result is the value of the cash flow line as a function of time.

The algorithm proceeds in the following steps. There are given discrete values representing the system of plans from Managerial Accounting of Figure 2. We understand these data as the input parameters of the entire process. ERP calculates the planned cash-flow values from these data (in a discrete way). Next, the mathematical module P(t) calculating planned cash-flow values is based on numerical interpolation. The output of the process is a continuous curve, modelling the planned cash-flow values.

Figure 2 Diagram of mathematical modelling
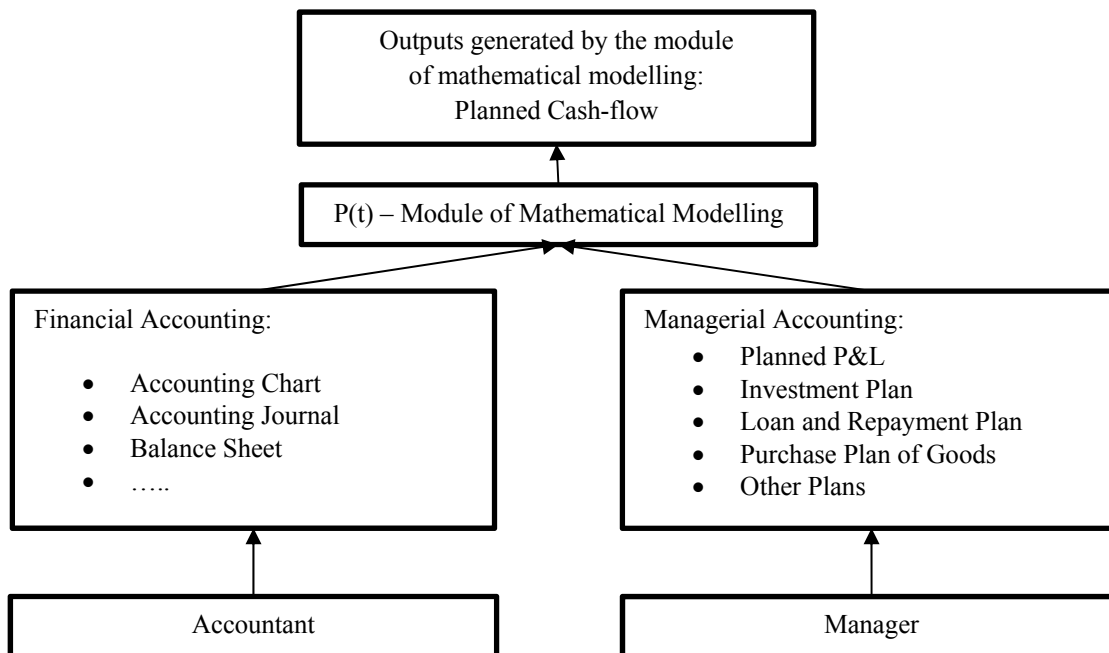
source: authors

For continuous modelling of the planned cash flows, we create an interpolation polynomial defined (unlike in the case of a discrete model) for any value of the timeline. I.e. the mathematical module embedded in the block diagram (Figure 2) corresponds to the construction of the interpolation polynomial according to the following algorithm.

Construction of Lagrange interpolation polynomial: For given nodes (x_i, f_i), $i=0,1,...,n$ we find a polynomial P with the property that $P(x_i) = f_i$ for $i=0,1,...,n$. We construct auxiliary polynomials l_i, $i=0,1,...,n$ with the two properties

l_i is a polynomial of degree n, whose roots are numbers $x_0, x_1, ..., x_{i-1}, x_{i+1}, ..., x_n$ and

$l_i(x_i) = 1$.

The interpolation polynomial P is obtained immediately from the polynomials l_i in the following way,

$$P(x) = f_0 l_0(x) + f_1 l_1(x) + \cdots + f_n l_n(x).$$

For given nodes (x_i, f_i), $i=0,1,...,n$ there is exactly one interpolation polynomial P, for which $P(x_i) = f_i$, $i=0,1,...,n$. This can be easily verified. The existence of such a polynomial is obvious, because we have just constructed it. All that remains is to prove uniqueness. We therefore assume that there are two different interpolation polynomials P,Q, for which $P(x_i) = f_i$, $Q(x_i) = f_i$, $i=0,1,...,n$. Let $R(x) = P(x) - Q(x)$. Since $R(x)$ is the difference between two different polynomials of at most n-th degree, then $R(x)$ must also be a (non-zero) polynomial of at most n-th degree. But on the other hand $R(x) = 0$, $i=0,1,...,n$. i.e. R has at least $n+1$ roots, which constitutes a contradiction (Horová, 1999), (Ascher, 2011).

3 Research results

We start with the example of planned cash flow, which is represented in ERP systems as usual output. We describe this situation in two miscellaneous ways. First, the classical discrete case is introduced. Second, the enhanced countinuos model is derived from previous one. Suggesting the discrete cumulative cash flow on Figure 3 shows the practical part of this work used an example that is very close to reality. Both the planned revenues and costs show seasonality, i.e. different values in individual months of the year. This can be typical for example for the construction industry where winter and summer working conditions may be very different.

Figure 3 shows discrete data derived from block modules of financial and managerial accounting (Figure 2). The module of mathematical modelling is then used for these derived data. The result is a continuous curve representing the planned cash flow (Figure 4).

Figure 3 discrete model of the cumulative planned cash flow

source: authors
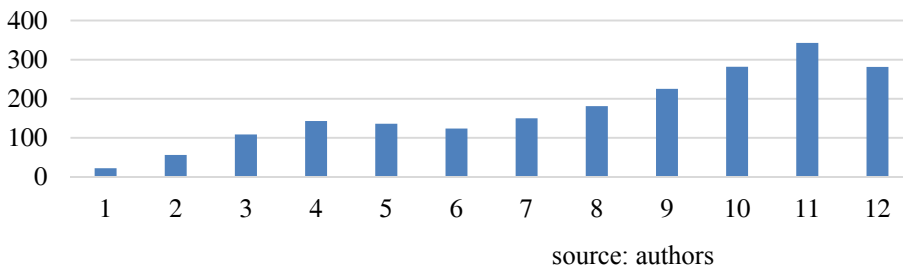
Using the discrete values in Figure 3, we construct the interpolation polynomial according to the method from Chapter 2. For each month from 1 to 12, the nodes for construction is given in Figure 3, first node is $(1; 22)$, ... , the last node is $(12, 281.2)$. We obtain the corresponding interpolation polynomial from chosen nodes

$$P(x) = 15 - 39.74x + 63.29x^2 - 18.53x^3 + 2.06x^4 - 0.08x^5.$$

Figure 4 Continuous model of the cumulative planned cash flow

source: authors
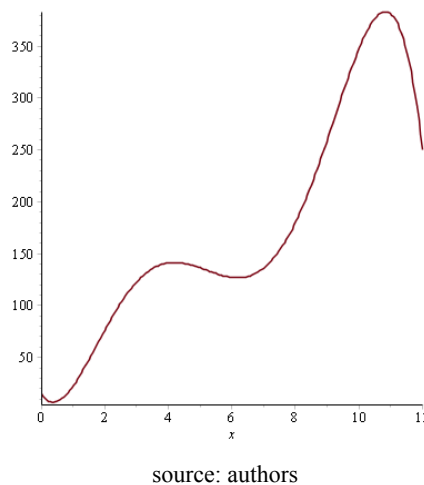
The Figure 4 shows the graph of interpolation polynomial P. We can see that the continuous curve P mirrors the structure of the column discrete graph from the Figure 3. In the case of polynomial interpolation, as with all numerical methods, there is a certain inaccuracy in calculation; nevertheless, the values from the continuous model can be considered as a suitable estimate of the monitored economic quantities, in this case the cumulative cash flow.

For clearness, we compare the discrete values (Figure 3) with continuous case (Figure 4). The continuous approximation seems to be accurate enough. Only results for 10th and 11th node are less satisfactory.

1st node (1; 22)   *P(1)=22*

2nd node (2; 56.3)   *P(2)=70.89*

3rd node (3, 108.5)   *P(3)=113.05*

4th node (4, 143)   *P(4)=130.89*

5th node (5, 135.9)   *P(5)=128.72*

6th node (6, 123.55)   *P(6)=123.55*

…….

…….

11th node (11, 342.9)   *P(12)=386.89*

12th node (12, 281.2)   *P(12)=281.2*

4 Conclusions

Planned cash flow is an important part of the accounting and controlling of majority of enterprises. Most enterprises calculate it in a discrete way, that is a common attitude in ERP systems. A continuous approach can be used to express cash flow at any point in time, which is impossible with discrete model, which usually works on a monthly basis. The reason why it is advisable to represent typically discrete data as a continuous values is, that it is possible to use differential and integral calculus and obtain more precise informations of behavior of observed statement. Thus, for example, it is easy to determine whether a cash-flow value has an increasing or decreasing character by calculating the tangent line at any point. The disadvantage of a continuous model may be inaccuracy resulting from the approximation process. However, with the appropriate construction of the curve, these inaccuracies could be considered negligible. This model has been validated in selected cases during the implementation of enterprise resource planning systems in business entities in the Czech and Slovak Republics.

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Risks of IT Projects Analysed in Cases of DMS Implementation and their Generalization

Jiří Homan

Abstract: *Technology becomes more and more developed at the present time. However, information technology projects are becoming more ambitious and more complicated.IT projects very often also affect the entire organization. Processes changes, technologies changes, changes in data processing can occur within these projects. When the difficulty for the project increases, there is also a bigger chance that the IT project will fail. To prevent IT project's failure, the IT project management methodologies have been developed. A large part of existing literature builds on the underlying assumption that if we pay attention to defined success factors, we will prevent the IT project from failing.*

In this article, we focused on projects that have been implemented to replace an existing substandard document management system with a new system based on more advanced technology. We have acquired a unique source of information regarding implementation of document management systems in several organization from the sector ofsmall and medium-sized enterprises. Based on the interview with respective team projects members, we have detected several factors that which occurred during the projects and threatened the success of respective project. At the same time, we have also analysed ways to solve these problems. The main benefit of our paper is the analysis of specific factors to that relevant project teams paid more attention from the beginning of the projects implementation based on their long-term experience. Then, we compare this factors with factors of success in the literature. The paper generalizes the experience of several IT projects and brings a further research view in the field of IT projects risk.

Keywords: Document Management System · Implementation Risks · Project Management · IS/IT Project · Failure

JEL Classification: D89 · M00 · Y80

1 Introduction

In developed countries, the fastest growing industry is information technology. Each year, the number of information technology projects is increasing. This creates a demand for project managers. To remain organizations competitive, IT departments need to work efficiently. This leads academics workers and experts to research issues aimed at successful IT project management. While IT has been applied in many disciplines, the actual implementation of the information system does not consider all the critical factors affecting the success of the project. Despite efforts to deploy project management methods, project management was not fully successful. Information systems projects often exceed budgets and timeframes. Furthermore, these projects show a high volume of rework or are unsuccessful due to non-compliance requirements.

In this paper, we will use the unique data on projects implementation DMS systems, we will analyse these projects and their success and compare it with literature data. The reason is that DMS systems are now becoming a standard part of enterprise IS. Enterprise Content Management (ECM) tools have been developed that incorporate tools for the comprehensive handling of enterprise content. An integral part of these systems is the Document Management System (DMS) component, which is designed to work with basic documents in electronic form. If we consider the past, the forerunner of today's DMS systems was mainly a card file and library systems that address the processing of documents using paper catalogues and indexes. Another example of predecessors can be systems of paper archives and file services. These systems handled documents in paper form, but they contained essentially the same functionality implemented by current Document Management Systems.

Many organizations have implemented some DMS system and others plan to implement to help them cope with ever-increasing number of documents and requirements to their processing and archiving. However, the success of the project implementation of information technology environment is not too high. This is illustrated by an article published by KPMG. According to the above information, most projects over the past 10 years have ended unsuccessfully. Almost 40% of the projects do not meet their targets, approximately half of them are delivered late, and approximately 15% of

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projects are failing to finish at all. The article is also interesting statement, which says that successful projects have in common is that directors are an economic interest in ensuring that the project succeeds. (KPMG Česká republika, s.r.o., 2017)

Our paper deals with factors that may arise and jeopardize project implementation of Document Management System and discuss these factors and gives some recommendations to avoid failure of projects. These factors and recommendations were based on an analysis of real projects.

2 Literature review

This section reviews briefly the Critical Success Factors (CSF) and Critical Failure Factors (CFF). The CFS approach aims at identifying and measuring project performance. This was investigated by Rockhart and further developed by various researchers. Most existing project methodologies concentrate on a general base that is based on a high-level view. There is a growing recognition that research on factors influencing the success of information systems projects requires that specific cases be investigated. To identify the CFSs for information systems projects, both successful and unsuccessful projects need to be addressed. Understanding unsuccessful projects can lead to identifying the pitfalls that are important to the success of the project. In addition to success factors, many studies also include a list of failure factors that contribute to the failure of the project. Chow and Cao propose four major dimensions for success factors and failure factors and project success factors, as shown in Table 1.

Table 2 Success Factors and Failure Factors

Dimension	Success Factors	Failure Factors
Organizational	1. Strong executive support 2. Committed sponsor or manager 3. Cooperative organizational culture instead of hierarchal 4. Oral culture placing high value on face-to-face communication 5. Organizations where agile methodology is universally accepted 6. Collocation of the whole team 7. Facility with proper agile-style work environment 8. Reward system appropriate for agile	1. Lack of executive sponsorship 2. Lack of management commitment 3. Organizational culture too traditional 4. Organizational culture too political 5. Organizational size too large 6. Lack of agile logistical arrangements
People	9. Team members with high competence and expertise 10. Team members with great motivation 11. Managers knowledgeable in agile process 12. Managers who have light-touch or adaptive management style 13. Coherent, self-organizing teamwork 14. Good customer relationship	7. Lack of necessary skill-set 8. Lack of project management competence 9. Lack of ream work 10. Resistance from groups or individuals 11. Bad customer relationship
Process	15. Following agile-oriented requirement management process 16. Following agile-oriented project management process 17. Following agile-oriented configuration management process 18. Strong communication focus with daily face-to-face meetings 19. Honouring regular working schedule – no overtime 20. Strong customer commitment and presence 21. Customer having full authority	12. Ill-defined project scope 13. Ill-defined project requirements 14. Ill-defined project planning 15. Lack of agile progress tracking mechanism 16. Lack of customer presence 17. Ill-defined customer role
Technical	22. Well-defined coding standards up front 23. Pursuing simple design 24. Rigorous refactoring activities 25. Right amount of documentation 26. Regular delivery of software 27. Delivering most important features first 28. Correct integration testing 29. Appropriate technical training to team	18. Lack of complete set of correct agile practices 19. Inappropriateness of technology and tools
Project	30. Project nature being non-life-critical 31. Project type being of variable scope with emergent requirement 32. Projects with dynamic, accelerated schedule 33. Projects with small ream 34. Projects with no multiple independent teams 35. Project with up-front cost evaluation done 36. Projects with up-front risk analysis done	

Source: Chow and Cao (2008)

3 Research questions

This research attempts to explore the critical success factors for project management. Based on literature, critical success factors have been identified. Specifically, these are the factors: project definition process, project management process, customer involvement, team capability and management commitment. Then, the following questions were asked:

1. Are these five factors truly the CSFs of the DMS systems?
2. If so, what is the relative importance of each factor when compared to the other factors?

4 Research results

When processing interview results, we used the qualitative research methodology, a phase called "open encoding". (Hendl, 2008) Its aim was to capture the essence of the phenomenon we analysed, i.e. the risks of IS implementation projects, and to analyse the concepts that are inductively embedded in the data, the results of the interviews expressing experience from IS implementation projects. The results are risks that negatively affected the individual projects. Individual risks are often related and not occurring separately. The following paragraphs do not describe all risks, but only those that have affected most projects.

4.1 Communication

On the project is necessary to solve several problems related to communications. Document Management System deployment projects are long-lasting and require close cooperation between sponsors, end-users and solvers. From this perspective, it is necessary to solve the correct form of communication toward the sponsor and end users. It is also necessary to choose the appropriate method for communication within the project team, especially if the situation arises, the project team alternate workers. Communication as a project failure factor also provides an article focusing on taxonomy of project failure factors in IS / IT. (Dwivedi, 2013)

4.1.1 Communication with end users and sponsor

Not only in information technology projects, it is important to create a stable communication channel when communicating with both the sponsor and the end users. Already Walid Belassi and Oya Lemeli Tukel, in their article, state that a well-established communication channel between the project manager, the organization and the client are necessary for the acceptance of the project outcome by the client. (Belassi & Tukel, 1996) The project manager should have good communication skills. In addition, he should consider that the customer is not a specialist in the subject and should be able to deal with these situations, for example:

- users use different naming of one functionality
- different functionalities call the same names
- do not accept the differences between terms
- they often do not know that one term can refer to different facts in different links

It is important to handle communication towards users and sponsors not only from the point of view of technical expressions relating to technology but also in terms of business processes. The Project Manager must appropriately communicate all information to current business processes. In addition, it must appropriately communicate the change in processes that are forced by technology or the design of architecture. From this perspective, Khim Teck Yeo has identified communication as one of the top five project failure factors. (Yeo, 2002)

We reduce the problem of terminology by establishing a common terminology right at the beginning of the project. Additionally, meetings are organized to prepare for communication with the client. During these meetings, most often fall questions like "What do you mean?" or "Can you explain this to me?". With this preparation does not happen that the client got incomprehensible or incomplete information.

4.1.2 Communication in the project team

Communication within the team can be accompanied by problems stemming not only from workers' mutual disagreement but also from other causes. Ulf Eriksson gives an example of a decrease in team performance. This will occur when some team member is not kept in the communication loop. It might happen that you are close to deadline and senior team members communicate more often – side-lining the junior resources. When a team member does not feel as an important part of team, he might lose motivation which eventually affects his performance. (Eriksson, 2017)

Another type of communication problem is reported by Cynthia K. West. Most project teams use email to communicate about their projects and tasks. The biggest complaint here is that project communication resides in everyone's email box. So, if a new resource joins the project, there is no centralized view of the project history. (West, nedatováno)

As stated in the article "What factor lead to software project failure?", communication on the project is greatly affected by the size of project team. In a small project team, communication is tighter, and problems are easily dealt with. (Verner, Sampson, & Cerpa, 2008)

Within the company, we have good experience with project sites. Each project has its own web page. This site contains all the information about the project, for example:

- Project manager
- Project name
- Project team
- Gantt diagram with stages and staff
- Project calendar
- Individual tasks with responsible staff
- All documents
- Chat

The unified structure of all project sites enables quick orientation on project, access to all important information to new team members, and helps manage the flow of information within the team.

4.2 Risks related to analysis and assignment

Today, there are still more popular agile software development methodologies. Agile methodologies undoubtedly have their place and are sometimes the right solution. However, in cases where a system is developed / implemented in a company that has more than 100 employees, there is a risk that the software will be developed repeatedly. Each user would eventually have devised a way to modify the implementation. Such a procedure would greatly rise the cost of entire project or even cause the failure.

For the implementation project of an information system across the entire organization, it is important not to underestimate the analysis phase. Based on the analysis, the target concept of the solution can be quite well and precisely designed. Sometimes it is difficult to set the target concept, especially because users do not provide complete information or adjust their requirements additionally.

These factors are also reported by other authors. According to the article "Project management practices: the criteria for success or failure", three top factors that impacted on not completed projects are lack of user input, incomplete requirements and specifications, and changing requirements and specifications. (Attazadeh & Ow, 2008) The article "Identifying software project risks: An international Delphi study" also lists risks related to system requirements. This article divides them into three categories (Schmidt, Lyytinen, & Paul, 2001):

- Lack of frozen requirements. Because the need of the users changes, the requirements change.
- Misunderstanding the requirements. Not thoroughly defining the requirements of the new system before starting.
- New and / or unfamiliar subject matter for both users and developers. Lack of domain knowledge leads to poor requirements definition.

The importance of clearly defined goals based on a thorough analysis is also demonstrated by other authors in their articles, for example in the article "A Taxonomy of an IT Project Failure: Root Causes". (Al-Ahmad, a další, 2009)

4.3 Risk connected with technology

Technology is a key element of all information systems. Technology includes both hardware and software. The technology used in the development or implementation of the information system also determine the actual capabilities of the system. The technologies used in content management systems are still evolving. This place demands on the project team in terms of coping with new technologies and the selection of a technology for a project. A well-chosen technology should be able to fully support all the processes in the organization. The selected technology:

- Should be sufficiently robust and stable
- Allow communication with other systems
- Should be sufficiently customizable
- Should be user friendly

- Should be compatible with existing systems
- Should be scalable enough

The article "IS/IT Project Failures: A Review of the Extant Literature for Deriving a Taxonomy of Failure Factors" records several factors associated with technology leading to project failure. These factors are (Dwivedi, 2013):

- Technological high risk leads to restrict choices
- Technology gap
- Inappropriate technology, Ignorance of IT
- Technology focusses over human relations
- Technology Illiteracy
- Chosen technology changes
- New Technology failure

On the other hand, some authors argue that if failure occurs, it will not be for the sake of the chosen technology. According to these authors, the factors associated with the users themselves and the processes that will manifest themselves as problems of the technology will lead to failure. (Kappelman, McKeeman, & Zhang, 2008)

This statement is supported by the article " IT Project Management: Infamous Failures, Classic Mistakes, and Best Practices". This article states that none of the top ten failure factors is in any way associated with technology. The article listed categories, leading to failure and their percentages. Problems caused by technology only occur in 4% of cases. (Nelson, 2007)

4.4 Risk of bad planning

Most authors agree that each project is unique and unrepeatable. Since the same project was never implemented before, it is difficult at the initial planning stage to identify all activities leading to the successful completion of the project. The progress of the project is linked not only to the list of activities, but also their time demands and costs. Since some activities depend on the results of previous activities, some workers may conclude that planning is unnecessary or even undesirable. (Andersen, 1996)

Specifically, in projects aimed at the implementation of content management systems in larger organizations can not apply the approach of the big bang. If the whole project takes sometimes up to one year, this approach would be very risky and would most likely not work. During implementation, both old and new applications run at the same time. Phases include gradual migration of functionality from the old application to the new one. In this approach, we are therefore very dependent on the outputs of the individual phases, and it is rarely possible that we can proceed without the previous stage being successfully completed.

Anderson and Turner proposes to replace the standard planning with milestone planning. If a milestone is defined as the result that must be achieved, we have a clearly defined goal. We are not too limited in this approach because we only plan the goals to be achieved and not the path to the goal. This approach directs us to result-oriented thinking. (Anderson, Grude, & Haug, 2009) (Turner, 2008)

5 Conclusions

The article gives an overview of the four factors that have manifested most in the individual projects implemented. According to the literature, these factories are not only for projects focused on the implementation of content management systems, but to a certain extent on all projects implementing some information technology.

According to the course of our projects, only a few CFSs of the total enumeration were spotted in our projects.

- The most significant impact on the project involved the risks associated with technology. With technology-related risks, the lack of qualified resources was the biggest obstacle.
- The second biggest impact was noted for the risks associated with the analysis and assignment. Customers are often not able to define their requirements right from the start of the project.
- The risks associated with poor planning are consequently associated with the previous two areas. It is impossible to accurately plan the course of the project with staff who are unfamiliar with the technologies used and the inaccurate objectives.
- By contrast, communication risks did not have almost any impact on the success of the project. With communication problems, some parts of the project may be delayed, but managers do not let communication problems compromise the project.

Another view of the problem is given in the article "Project management: cost, time and quality, two best guesses and a phenomenon, it is time to accept other success criteria". Atkinson argued that even after 50 years of research into Project Management, failure factors are still limited to the Iron Triangle elements of cost, time and quality. (Atkinson, 1999)

Finally, it should be remembered that there is no single benchmark to determine whether the project is successful or unsuccessful. What is a successful project for a single organization can be a failure in the eyes of other businesses. Whether the project ends with success or failure should be smooth with the full support of stakeholders, otherwise an apparently successful project can be deemed a failure.

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Data Envelopment Analysis within Evaluation of the Efficiency of Firm Productivity

Miechal Houda

Abstract: *The paper deals with evaluating the efficiency of the use of production factors using methods of data envelopment analysis (DEA). We provide a first look on the problem investigated: the goal is to analyze accessible methods based on principles of data envelopment analysis and usable for evaluating the efficiency of the use of production factors, in static framework. We apply the selected method to accessible firm data from the food sector from a chosen year and perform a simple statistical inference of these results.*

Key words: Data Envelopment Analysis · Constant Returns to Scale · Productivity in the Food Industry

JEL Classification: C44 · C61

1 Introduction

Data Envelopment Analysis (DEA) is known as a non-parametric mathematical technique to evaluate relative efficiency of *decision-making units* (DMUs) based on the transformation to mathematical optimization problems. The idea of evaluating entities, for which the *efficiency* is stated in a form of the ratio

$$efficiency = \frac{output}{input}, \tag{1}$$

by a piecewise-linear convex hull of input–output pairs goes back to Farrell (1957). The idea is well developed later, especially by Charnes, Cooper, and Rhodes (1978), and Banker, Charnes, and Copper (1984); the first introduced a methodology for comparing efficiency of the units characterized by several inputs and outputs with constant returns-to-scale property, the later extended the model to variable returns-to-scale. In both cases, the efficient units are found by solving linear optimization problems, and for the inefficient ones, we are able to prescribe a way to improve inputs (or outputs) of every inefficient unit. Additional details, methods and extensions to these basic DEA models can be found in the books Cooper, Seiford, Zhu (2011), Coeli (2005), or Cooper, Seiford, Tone (2007).

To evaluate efficiency across different time points, Caves, Christensen, and Diewert (1982) introduced a productivity index as the ratio of two input distance functions, and give it a name after Malmquist (1953) exploring his concept of index numbers to evaluate price changes in the consumer context. They define the ratio as input-based Malmquist productivity index; if the overall efficiency is calculated using Farrell's idea, then the input distances are calculated as inverse of DEA efficiency scores. Färe, Grosskopf et al. (1992) extended this idea and defined the Malmquist productivity index as the geometric mean of two indexes defined in Caves, Christensen, Diewert sense. They also succeeded to decompose the index into two multiplicative components: efficiency change (the change of the efficiency of the DMU), and technical change (the shift of the technology), without additional assumptions. Many further studies extended this idea using different DEA models and under different settings to apply them in various economical areas (see e. g. Pastor, Lovell, 2005, Boussemart et al., 2009, Arabi, Munisamy, Emrouznejad. 2015 and many others).

Our intention is to analyze available data of the Czech food industry with the means of data envelopment analysis and subsequent Malmquist productivity indexes. This contribution is a very first insight into this area. We illustrate numerical issues, which are to be taken into account when developing a suitable model for the problem considered.

2 DEA Models, Returns to Scale and Production Possibility Sets

Let DMU_k denote a k-th decision making unit, $k = 1, ..., K$ where K is the number of units in question. The input matrix is denoted $X = (x_{ik}) \in \mathbb{R}^{m \times K}$ and its rows $x_{.k}$ the inputs of k-th decision making unit. Analogously, the output matrix is denoted $Y = (y_{jk}) \in \mathbb{R}^{n \times K}$ and its rows $y_{.k}$ the outputs of k-th decision making unit. The unit under efficiency investigation is denoted DMU_0 through the paper.

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The central object of DEA methodology is the identification of the *production possibility sets* (PPS), in economic terms also called the *technology*. It is a set of input-output pairs, which are attainable, at least theoretically, by the production unit. For example, the simplest production possibility set is the set

$$PPS_I := \{(x, y) \mid x = X\lambda, y = Y\lambda, \lambda \in \{0, 1\}^K, \textstyle\sum_k \lambda_k = 1\}. \tag{2}$$

It is not hard to see that, due to the last two conditions on λ (i. e., having the binary components summing to unity), it coincides with the set $\{(x_1, y_1); \ldots; (x_K, y_K)\}$ enumerating all the input-output pairs in question. Let us also characterize an efficient unit in Pareto–Koopmans dominance sense.

Definition 1. DMU_0 is *efficient* with respect to PPS if there is no other pair $(x, y) \in PPS$ dominating DMU_0, that is, having $x \leq x_{.0}$ and $y \geq y_{.0}$ with at least one (one-dimensional) inequality strict.

The set PPS_I was introduced in Bowlin et al. (1984) as the *discrete (integer) production possibility set*. The reason to choose the formulation in (2) is the associated optimization model constructed to find efficient units. Let s^- be the slack for the inequality $X\lambda \leq x_{.0}$ and s^+ the slack (surplus) for $Y\lambda \geq y_{.0}$. DMU_0 is an efficient unit if the optimal solution of the *additive (mixed integer) linear optimization problem*

$$\begin{aligned} &\text{minimize } \textstyle\sum_i s_i^- + \sum_j s_j^+ \text{ subject to} \\ &X\lambda + s^- = x_{.0}, Y\lambda - s^+ = y_{.0}, \\ &\lambda \in \{0, 1\}^K, \textstyle\sum_k \lambda_k = 1, \ s^-, s^+ \geq 0 \end{aligned} \tag{3}$$

has no slack greater than zero. If the unit is not found to be efficient, the only unity element of λ is pointing to the peer unit of DMU_0.

Relaxing the integer condition of (3), we define the *continuous convex production possibility set* of the form

$$PPS_C := \{(x, y) \mid x = X\lambda, y = Y\lambda, \ \lambda \geq 0, \ \textstyle\sum_k \lambda_k = 1\}. \tag{4}$$

The set was introduced by Banker, Charnes, and Cooper (1984) in order to build a DEA model under *variable returns to scale*. They construct the (output oriented) BCC optimization model to verify the efficiency of DMU_0 as

$$\begin{aligned} &\text{maximize } \phi + \epsilon\left(\textstyle\sum_i s_i^- + \sum_j s_j^+\right) \text{ subject to} \\ &X\lambda + s^- = x_{.0}, Y\lambda - s^+ = \phi y_{.0}, \\ &\lambda \geq 0, \textstyle\sum_k \lambda_k = 1, \ s^-, s^+ \geq 0, \phi \text{ unconstrained,} \end{aligned} \tag{5}$$

where ϵ is Archimedean infinitesimal (smaller than any positive real number). DMU_0 is found to be efficient if $\phi^* = 1$ and no slack is greater than zero. We can see from (5) that the investigated unit is compared to convex combinations (convex hull) of inputs and outputs of the units in question, exactly as PPS_C is constructed.

Removing further the convexity condition, we obtain

$$PPS_L := \{(x, y) \mid x = X\lambda, y = Y\lambda, \ \lambda \geq 0\}, \tag{6}$$

the *linear production possibility set* of Charnes, Cooper, and Rhodes (1978) corresponding to *constant returns to scale*. DMU_0 is found to be efficient solving the (output oriented) CCR optimization model

$$\begin{aligned} &\text{maximize } \phi + \epsilon\left(\textstyle\sum_i s_i^- + \sum_j s_j^+\right) \text{ subject to} \\ &X\lambda + s^- = x_{.0}, Y\lambda - s^+ = \phi y_{.0}, \\ &\lambda \geq 0, \ \ s^-, s^+ \geq 0, \phi \text{ unconstrained,} \end{aligned} \tag{7}$$

under the same conditions as in the BCC case. We now compare the inputs and the outputs of DMU_0 to linear combinations (linear hull) of inputs and outputs of the units in question. The input oriented variants are constructed similarly, for example the input oriented CCR model is formulated by

$$\begin{aligned} &\text{minimize } \theta - \epsilon\left(\textstyle\sum_i s_i^- + \sum_j s_j^+\right) \text{ subject to} \\ &X\lambda + s^- = \theta x_{.0}, Y\lambda - s^+ = y_{.0}, \\ &\lambda \geq 0, \ \ s^-, s^+ \geq 0, \theta \text{ unconstrained.} \end{aligned} \tag{8}$$

3 Application in Food Industry

We have considered annual accounts of 380 Czech companies from the food industry (belonging to NACE C.10 group) from the year 2014. We have chosen, for the purpose of this paper, to evaluate the companies using the input oriented model with constant returns to scale.

3.1 Grouping the companies

We provide the results for the whole C.10 group. For each company, we also have an indicator of the subgroup; the number of companies in each subgroup is given in Table 1. We have not recalculated the model for each subgroup for the purpose of this paper; rather we provide simple statistical observations based on the overall model.

Table 1 Number of companies considered according to NACE classification

C.10.1	Processing and preserving of meat and production of meat products	78
C.10.2	Processing and preserving of fish, crustaceans and molluscs	3
C.10.3	Processing and preserving of fruit and vegetables	18
C.10.4	Manufacture of vegetable and animal oils and fats	5
C.10.5	Manufacture of dairy products	28
C.10.6	Manufacture of grain mill products, starches and starch products	15
C.10.7	Manufacture of bakery and farinaceous products	109
C.10.8	Manufacture of other food products	83
C.10.9	Manufacture of prepared animal feeds	40

Source: Own processing

3.2 Considered Inputs and Outputs

As inputs of the decision-making units, we have taken these company characteristics:

- SPMAAEN: material and energy consumption. Out of 380 companies considered, 89 (23 %) reported no such costs;
- ON: personnel costs;
- STALAA: fixed assets (including buildings and equipment);
- POSN: percentage of the personnel costs.

Aside from this we have also in mind other inputs as production consumption, depreciations, tangible and intangible fixed assets, or cost of the capital.

As outputs, we have taken

- VYKONY: business performance;
- ROA: return on assets (earnings before interest and taxes per total assets). Out of 380 companies considered, 70 (18 %) have negative value of this characteristic and have to be removed from the computations.

We plan to include additional outputs to the further studies, in particular the value of sales of goods and services, operating income, EBIT (earnings before interest and taxes), or value added.

In our current application, the computation carries, after removing the above-mentioned companies, 244 companies in total. Some of the removed companies exhibit both of the two mentioned issues. Another option to work with negative data is using more evolved directional DEA model, see e. g. Silva Portela, Thanassoulis, and Simpson (2004).

4 Numerical Results and Discussion

Among the 244 companies, 22 has been found efficient using the DEA model with constant returns to scale, that amounts to 9 % of evaluated (feasible) companies. Further, additional three companies exhibit the efficiency score larger than 0.95. The distribution of the efficiency scores of the companies is provided by means of histogram in Figure 1 (left). Eight of the efficient companies make part of C.10.1 group (processing and preserving of meat and production of meat products) and five of C.10.2 (manufacture of other food products). The biggest group C.10.7 (manufacture of bakery and farinaceous products) counts only two efficient companies; histogram of efficiency scores in this particular group is provided in Figure 1 (right).

Figure 1 Histogram of efficiency scores for all companies (left), and for companies from C.10.7 group (right).
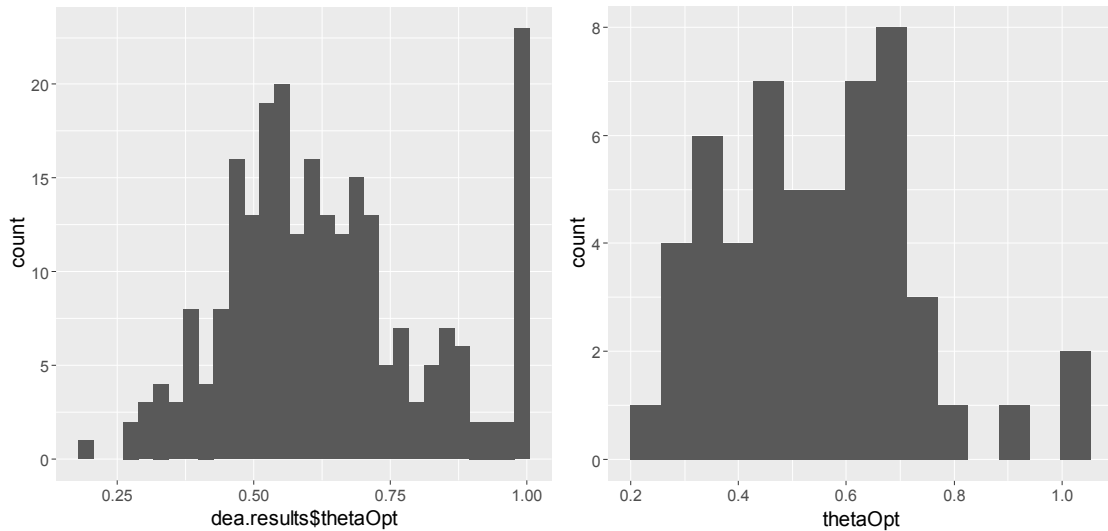
Source: Own processing.

Looking for a relationship between the number of efficient units and the size of the group, we prepared the overview given in Figure 2. The small groups (C.10.2 and C.10.4) have one efficient company each, hence resulting high percentage of efficient companies. There is no visible relationship between the group size and the number of efficient units among the other groups. (Notice also the logarithmic scale of the horizontal axis.)

Figure 2 Relationship between the size of the group and the relative number of efficient units.
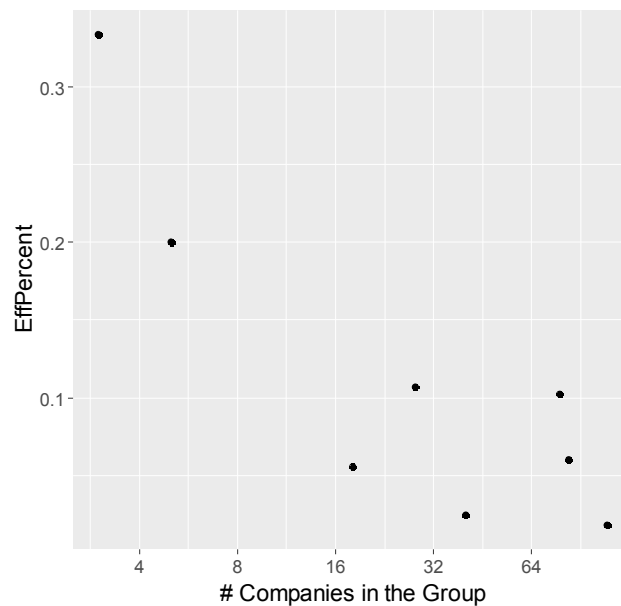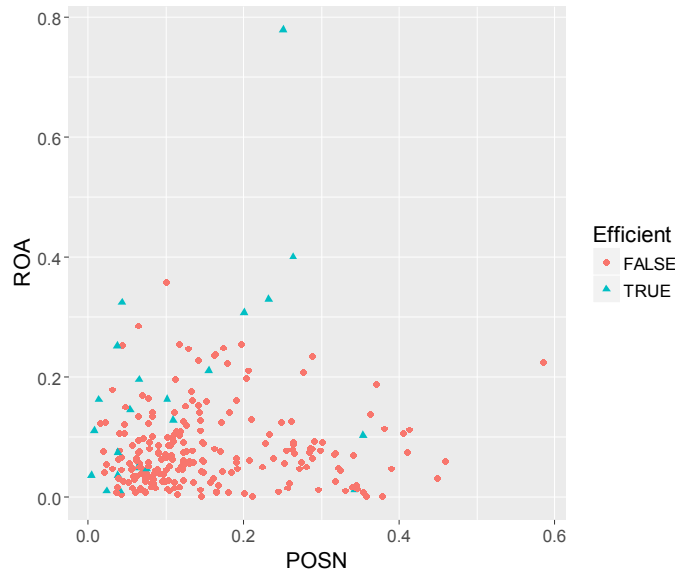

Source: Own processing.

Finally, we considered a behavior of selected inputs and outputs, in particular the percentage of the personnel costs (POSN) and return on assets (ROA). The empirical distributions of these two variables with respect to the efficiency result is provided in Figure 3. The shift to the left for POSN (input variable), and to the right for ROA (output variable) is noticeable but not expressive. This can be confirmed by the scatter plot (in Figure 4) of these two variables pointing the efficiency of each unit—many units with the small output ROA are designated to be efficient while many similar units not. The similar conclusion may be made for the input variable POSN. Also notice several "extremal" efficient companies having a high input value and/or a low output value. The efficiency of these examples rely on different variables than these particular ones. Apparently, other factors included in our DEA analysis play an important role when deciding about the efficiency of decision-making units. It is necessary to be very diligent when deciding about what factors should be included into consideration.

Figure 3 Empirical distribution for values of personnel cost percentage (left) and return on assets (right).
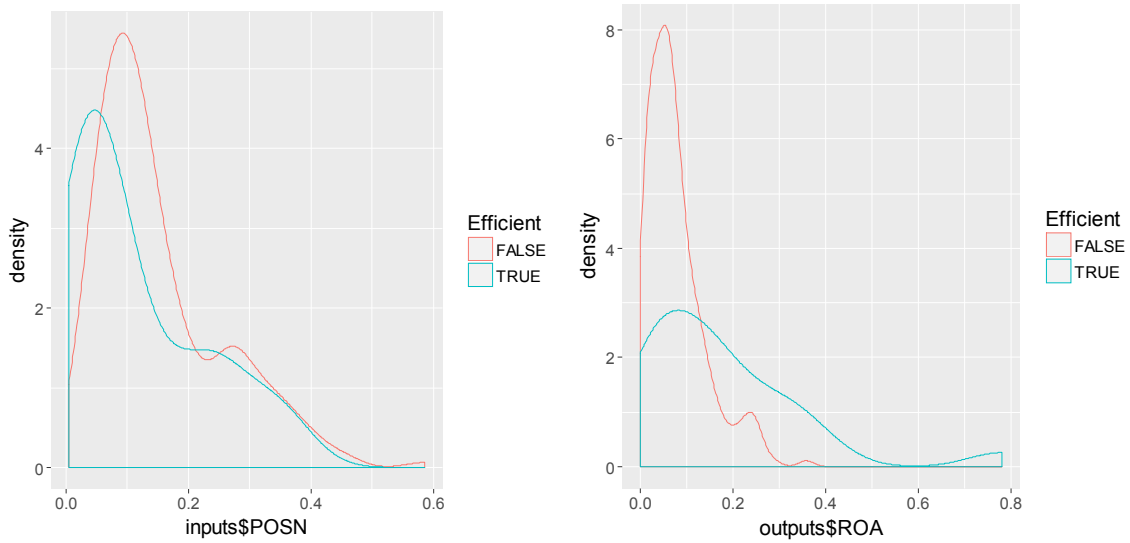
Source: Own processing.

Figure 4 Relationship between the personnel cost percentage and return on assets

Source: Own processing

5 Conclusion

In this paper we have discussed several issues based on numerical investigation of a simple DEA model with constant returns to scale applied to the comparison of the Czech companies from the food industry. As noticed, the results are sensitive to the variable selection, which has to be done with maximal care. As more than one third of the companies was removed from the investigation due to presence of zero/negative input/outputs, it is clear that a more elaborated DEA method able to deal with such kind of the data has to be employed—the simplest CCR or BCC model will not suffice to analyze these companies. We will also consider variants of the model with different returns to scale; it is known that efficiency factors of the units is increased when moving from the constant to variable returns to scale.

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Various Approaches to Szroeter's Test for Regression Quantiles

Jan Kalina, Barbora Peštová

Abstract: *Regression quantiles represent an important tool for regression analysis popular in econometric applications, for example for the task of detecting heteroscedasticity in the data. Nevertheless, they need to be accompanied by diagnostic tools for verifying their assumptions. The paper is devoted to heteroscedasticity testing for regression quantiles, while their most important special case is commonly denoted as the regression median. Szroeter's test, which is one of available heteroscedasticity tests for the least squares, is modified here for the regression median in three different ways: (1) asymptotic test based on the asymptotic representation for regression quantiles, (2) permutation test based on residuals, and (3) exact approximate test, which has a permutation character and represents an approximation to an exact test. All three approaches can be computed in a straightforward way and their principles can be extended also to other heteroscedasticity tests. The theoretical results are expected to be extended to other regression quantiles and mainly to multivariate quantiles.*

Key words: Heteroscedasticity · Regression Median · Diagnostic Tools · Asymptotics

JEL Classification: C14 · C12 · C13

1 Introduction

Throughout this paper, the standard linear regression model

$$Y_i = \beta_0 + \beta_1 X_{i1} + \cdots + \beta_p X_{ip} + e_i, \ \ i = 1, \ldots, n, \tag{1}$$

is considered, where $Y_1, \ldots, Y_n$ are values of a continuous response variable and $e = (e_1, \ldots, e_n)^T$ is the vector of random errors (disturbances). The task is to estimate the regression parameters $\beta = (\beta_0, \beta_1, \ldots, \beta_p)^T$. The least squares estimator assumes homoscedasticity, which is defined as a constant variance across observations, formally $var\ e_i = \sigma^2 > 0$ for each i. While the least squares estimate of β is sensitive to outliers as well as heteroscedasticity, there are numerous other estimates more suitable for non-standard situations (Matloff, 2017).

Regression quantiles represent a natural generalization of sample quantiles to the linear regression model. Their theory is studied by Koenker (2005). The estimator depends on a parameter α in the interval $(0,1)$, which corresponds to dividing the disturbances to $\alpha \cdot 100\ \%$ values below the regression quantile and the remaining $(1 - \alpha) \cdot 100\ \%$ values above the regression quantile. In general, regression quantiles represent an important tool of regression methodology, which is popular in economic applications (Harrell, 2015; Vašaničová et al., 2017).

While the regression median (L1-estimator or least absolute deviation estimator) is much older than the methodology of regression quantiles, it can be defined as the regression quantile with $\alpha = 1/2$. The regression median has been at the same time investigated in the context of robust statistics because of its resistance against outlying values present in the response, which is an increasingly important property in econometrics (Kreinovich et al., 2017; Kalina, 2017).

The regression median, just like the least squares, requires to be accompanied by diagnostic tools for verifying its statistical assumptions. If homoscedasticity is violated, the confidence intervals and hypothesis tests for the regression median are namely misleading. In this work, we are interested in testing the null hypothesis (H_0) of homosceasticity against the alternative hypothesis (H_1) that the null hypothesis does not hold. In our previous work (Kalina, 2012), we derived an asymptotic test of heteroscedasticity for the least weighted squares (LWS) estimator of Víšek (2011).

This paper has the following structure. Section 2 recalls the Szroeter's test, which is one of available heteroscedasticity tests for the least squares. Further, three novel versions of the Szroeter's test are proposed for the regression median. These include an asymptotic test in Section 3, a permutation test in Section 4, and an (approximate) attempt for an exact test assuming normal errors in Section 5. An example with economic data is presented in Section 6 together with a proposal of an alternative model for the situation with a significant Szroeter's test. Finally, Section 7 concludes the paper and discusses future research topics including extension to other regression quantiles.

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2 Szroeter's test for the least squares

Szroeter (1978) proposed a class of suitable tests of heteroscedasticity for the least squares estimator. The null hypothesis of homoscedasticity is tested against the alternative hypothesis

$$H_1: var\ e_i \leq var\ e_{i-1} \text{ with at least one sharp inequality, where } i = 2, \dots, n. \tag{2}$$

In this setup, the test is commonly used as a one-sided test. The user is required to select constants $h_1, \dots, h_n$ satisfying $h_i < h_j$ for $i < j$. The test statistic S is defined as the ratio of two quadratic forms

$$S = \frac{\sum_{i=1}^{n} h_i u_i^2}{\sum_{i=1}^{n} u_i^2} = u^T B u / u^T u, \tag{3}$$

where $(u_1, \dots, u_n)^T$ are residuals of the least squares fit and $B = diag\{h_1, \dots, h_n\}$. The test statistic S is scale-invariant, which is the crucial idea allowing the considerations in the next sections. The one-sided test rejects the null hypothesis of homoscedasticity in case $S > c$, where the critical value c depends on the particular choice of the constants $h_1, \dots, h_n$.

A popular choice for $h_1, \dots, h_n$ is to take

$$h_i = 2\left[1 - \cos\left(\frac{i\pi}{n+1}\right)\right], \quad i = 1, \dots, n, \tag{4}$$

leads to such form of the test, which has the same critical values as the Durbin-Watson test of independence of the disturbances e, as explained already in the original paper by Szroeter (1978). Values (4) are always strictly increasing, lie in (0,4) and are illustrated in Figure 1 for $n = 30$. A less frequent possibility is to choose $h_1, \dots, h_n$ as indicators assigning data to groups similarly with the Goldfeld-Quandt test (Greene, 2011).

The Szroeter's test can be computed in a straightforward way and it is actually not needed to use the upper and lower bounds tabulated for the Durbin-Watson test. A critical value or a p-value for the least squares can be namely obtained directly, which is convenient because the test is not implemented e.g. in the popular R software.

Figure 1 Values of constants (4) for the Szroeter's test evaluated for $n = 30$. Horizontal axis: index 1,…,30. Vertical axis: values of h_i evaluated for $i = 1, \dots, 30$.
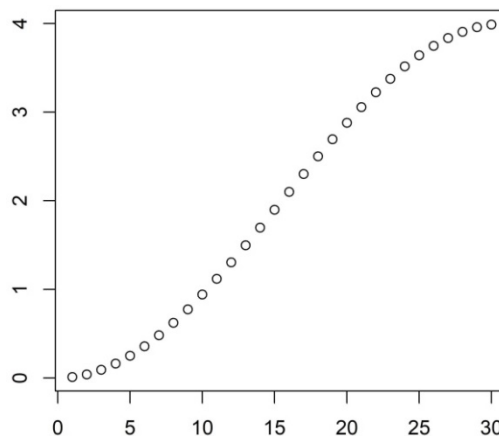
Source: Own processing

3 Asymptotic Szroeter's test for the regression median

As a first novel result, we describe an asymptotic Szroeter's test for the regression median. We formulate a theorem on the asymptotic behavior of the test statistic under H_0 and normally distributed errors e. Technical assumptions of Knight (1998), needed for the asymptotic representation of the regression median, will be denoted as Assumptions A. The asymptotic representation of Knight (1998) can be described as a special case of a more general representation for M-estimators derived by Jurečková et al. (2012). We will need the notation $M = I - X(X^T X)^{-1} X^T$, where I stands for the unit matrix with dimension $n x n$.

Theorem 1. Let us assume the errors e in (1) to follow a $N(0, \sigma^2)$ distribution with a constant variance $\sigma^2 > 0$. Let Assumptions A be fulfilled. Then the test statistic S evaluated for residuals of the regression median is asymptotically equivalent in probability with

$$e^T M B M e / e^T M e. \tag{5}$$

The proof follows from Kalina & Vlčková (2014), who proved the asymptotic equivalence of the Durbin-Watson test statistic computed with residuals of the LWS regression with the Durbin-Watson test statistic computed with residuals of the least squares regression. We note that (5) is the Szroeter's test statistic computed for residuals of the least squares

estimator. In other words, the test is computed for the regression median in the same way as for the least squares, but such test holds exactly for the least squares and only asymptotically for the regression median.

4 Permutation Szroeter's test for the regression median

Next, we describe a test based on random permutations of residuals. The methodology of permutation tests for the least squares was summarized by Nyblom (2015). Here, we are interested in performing the total number of K permutations of residuals of the regression median.

For the k-th permutation ($k = 1, \dots, K$), the regression median is computed and the vector of its residuals is denoted as $\tilde{u}_k$. In addition, the test statistic

$$\tilde{u}_k^T B \tilde{u}_k / \tilde{u}_k^T \tilde{u}_k \tag{6}$$

is computed for each k. The empirical distribution over all K permutations is now considered to find the quantile c so that

$$\frac{1}{K} \sum_{k=1}^{K} I \left(\frac{\tilde{u}_k^T B \tilde{u}_k}{\tilde{u}_k^T \tilde{u}_k} > c \right) = 0.05, \tag{7}$$

where I denotes an indicator function. Then, the test rejects H_0 if the statistic S evaluated from residuals of the regression median is larger than the quantile c.

Permutation tests were proposed already by R.A. Fisher in 1930s. In general, not many theoretical results can be derived concerning properties of permutation tests (Pesarin & Salmaso, 2010). The test of this section is ensured to keep the level on the 5 % value and can be described as a nonparametric method, because it does not need any distributional assumption on the errors in the model (1). In other words, normality of residuals is not required.

5 Exact approximate approach to Szroeter's test for the regression median

Finally, we present an approximation to an exact Szroeter's test. Here, in contrary to a permutation test, random variables with the same distribution as the errors are repeatedly randomly generated. The idea here is to approximate directly the exact p-value of the test with an arbitrary precision assuming that the vector e comes from the normal distribution with zero expectation. By repeated random generating of mutually independent random variables $E_i \sim N(0,1)$ for $i = 1, \dots, n$, the exact p-value of the test against the one-sided alternative can be approximated by an empirical probability as evaluated in the following theorem.

Theorem 2. Let us assume (1) with independent identically distributed (i.i.d.) errors $e_1, \dots, e_n$ following $N(0, \sigma^2)$ distribution with a specific $\sigma^2 > 0$. Let S denote the test statistic computed with residuals of the regression median and let $S_1^*, S_2^*, \dots$ denote values of (3) for independent realizations of independent random variables $E_1, \dots, E_n$ following $N(0,1)$ distribution. Then, it holds for $m \to \infty$ that

$$P \left(\frac{1}{m} \sum_{j=1}^{m} S_j^* \leq x \right) \to P(S \leq x) \quad \forall x \geq 0. \tag{8}$$

This aproximation, which states that the p-value can be approximated with an arbitrary precision, does not rely on the asymptotic behavior of the regression median. In other words, the empirical distribution obtained by the simulation allows to approximate the distribution of the Szroeter's test statistic S and theoretical probabilities can be estimated by their empirical counterparts. Here, the unit variance matrix of each E_i may be used valid without loss of generality thanks to the independence of the Szroeter's test statistic on β.

Finally, the next approximation between the p-value of the exact approximate test and the p-value of the least squares relies on the asymptotic results of Section 3 of this paper and represents a bridge connecting the exact testing with the asymptotic approach.

Theorem 3. The approximate p-value of the Szroeter's test for the regression median assuming errors $e_1, \dots, e_n$ following a $N(0, \sigma^2)$ distribution with a certain $\sigma^2 > 0$ converges with probability one to the p-value of the exact test for the regression median for $n \to \infty$ under Assumptions A.

6 Example

The performance of the novel tests will be now illustrated on a real economic data set. In this section, we also discuss a suitable estimation in the situation with a significantly heteroscedastic result of the regression median.

A gross domestic product (GDP) data set is analyzed which contains quarterly data from the first quarter of 1995 to the third quarter of 2007 measured in the USA in 10^9 USD, i.e. with $n = 50$. The data set was downloaded from website of the Federal Reserve Bank of St. Louis. The linear regression model has the form

$$Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_{i3} + \beta_4 X_{i4} + e_i, \quad i = 1, \dots, n, \tag{9}$$

where Y is the GDP considered as a response of four regressors. Particularly, X_1 represents consumption, X_2 government expenditures, X_3 investments, and X_4 represents the difference between import and export.

Table 1 Estimated values of parameters in the example of Section 6

	β_0	β_1	β_2	β_3
Least squares estimator				
Linear regression model (11)	−3183	1.72	1.27	−8.24
Heteroscedastic model (12)	−52	0.35	0.24	−2.01
Regression median				
Linear regression model (11)	−2402	1.94	0.58	−10.68
Heteroscedastic model (12)	−56	0.39	0.18	−2.23

Source: Own processing

Table 2 Results of the Szroeter's test for the regression median

Linear regression model (11)	
Asymptotic test	$p = 0.0010$
Permutation test	$p = 0.0009$
Approx. exact test	$p = 0.0009$
Heteroscedastic model (12)	
Asymptotic test	$p = 0.07$
Permutation test	$p = 0.08$
Approx. exact test	$p = 0.08$

Source: Own processing

We estimate parameters of the model (10) by means of the least squares and the regression median. Tests of significance for both estimators reveal β_4 not to be significantly different from zero. Therefore, we reduce the model (9) to

$$Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_{i3} + e_i, \;\; i = 1, \dots, n. \tag{10}$$

Estimates of parameters obtained by the least squares and the regression median are shown in Table 1. Residuals of the least squares do not contain severe outliers but their distribution is far from unimodal. Moreover, the Shapiro-Wilk test of normality is rejected. Let us also check the assumption of homoscedasticity of the random errors. Let us now perform all three possible versions of the Szroeter's test with the choice (4). All these versions are significant, while approximate exact test and the permutation test yield a very similar result and the asymptotic test is slightly different from them.

Because the heteroscedasticity turns out to be significant, the question is how to find a more suitable model for explaining the response based on the regressors. While we have found no solution in references for the Szroeter' test, it remains possible (although not optimal) to consider the following model as a replacement of (10). The model

$$\frac{Y_i}{\sqrt{k_i}} = \frac{\beta_0}{\sqrt{k_i}} + \frac{\beta_1 X_{i1}}{\sqrt{k_i}} \dots + \frac{\beta_p X_{ip}}{\sqrt{k_i}} + \frac{e_i}{\sqrt{k_i}}, \;\; i = 1, \dots, n, \tag{11}$$

is used with the choice $k_i = \hat{u}_i^2$ exploiting estimated values $u_1^2, \dots, u_n^2$ from an auxiliary model

$$u_i^2 = \gamma_0 + \gamma_1 X_{i1} + \cdots + \gamma_p X_{ip} + v_i, \;\;\;\; i = 1, \dots, n, \tag{12}$$

where $u_1, \dots, u_n$ are residuals computed in (10). Such heteroscedastic model (11) is an analogy of a so-called heteroscedastic regression (Greene, 2011) for models with a significant result of the Goldfeld-Quandt or Breusch-Pagan test.

We estimated parameters in this heteroscedastic model and the results are shown again in Table 1. Further, all versions of the Szroeter's test are performed again. The results are not significant any more. Such positive result (definitely not theoretically guaranteed) allows us to claim that parameters can be estimated better in the model (11) compared to model (10). We can say again that the approximate exact test and the permutation test yield a very similar result, while the asymptotic test is slightly different from them.

To summarize the computations, the standard linear regression model is not adequate due to a severe heteroscedasticity of the random regression errors. Only in a specific model tailor-made for heteroscedastic errors, the assumption of homoscedasticity of the errors is fulfilled by means of all versions of the Szroeter's test. The final model (11) considers weighted values of the response as well as regressors and therefore the interpretation of its parameters remains uncomparable to that of the original models (9) or (10).

7 Conclusions

This paper is devoted to testing heteroscedasticity for the regression median. While this estimator as a special case of regression quantiles is commonly used for analyzing heteroscedastic data, it itself requires to be accompanied by a test of heteroscedasticity.

We propose three different tests for the regression median in Sections 3, 4 and 5. Surprisingly, although the asymptotic representation for the regression median has been derived already in 1998, our asymptotic test for the regression median is novel. We are also not aware of any other approaches to the Szroeter's test for the regression median. The

novel tests can be characterized as modifications of the basic Szroeter's test statistic, which has in the standard form the same critical values as the Durbin-Watson test of autocorrelated residuals, which is very popular in econometrics. The asymptotic test as well as the approximate exact test require to assume normally distributed errors, which is not the case of the (nonparametric) permutation test.

In an example, we illustrate the performance of various versions of the Szroeter's test for the regression median. In addition, the example shows that an attempt for an alternative estimation procedure in the form of a heteroscedastic regression allows to give a reasonable solution, preferable to a standard linear regression model.

Heteroscedasticity can be also revealed by regression quantiles. The methodology of regression quantiles, which may be used not only for a subjective detection but also for rigorous testing of heteroscedasticity by means of regression rank scores. While our attempt was to investigate diagnostic tools for regression quantiles from a more general perspective, the proposed tests cannot be directly applied to regression quantiles because the distribution of residuals would be (perhaps highly) asymmetric for a regression α-quantile with $\alpha \neq 1/2$.

As a future research, an intensive simulation study is needed to investigate the speed of asymptotics. Other simulations are needed to study the performance of the tests under H_0 (also for non-normal errors) and also under various forms of heteroscedasticity, i.e. under the alternative hypothesis. It would be also possible to extend the novel approaches to tests for other regression estimates, e.g. for linear regression with a multivariate response, for which there seem no diagnostic tools available.

On the whole, the approaches of the current paper can be interpreted as a preparation for a generalization to the context of elliptical quantiles. Such generalization of the Szroeter's test to elliptical quantiles may be performed in a rather straightforward way. Such future tests may find applications in testing heteroscedasticity for linear regression models with a multivariate response, which have recently penetrated to econometric modelling. The use of any form of multivariate quantiles seems a promising tool as the quantiles are heavily influenced by a possible heteroscedasticity. Such idea may be especially valuable if elliptical quantiles studied by Hlubinka and Šiman (2013) are used and volume of the constructed ellipses is used to build statistical decision rules for detecting heteroscedasticity and its subsequent modelling.

Acknowledgement

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Differentiated Demographic Rural Development?

Renata Klufová

Abstract: *It is known that particular parts of the Czech countryside differ. In the Czech Republic, different types of countryside were identified by different authors. The characteristics of the different rural types identified in different studies are in many respects similar. The aim of the paper is to describe changes in population size of municipalities and their development in various parts of the country, preferably in a broader context.*

Key words: Czech Rural · Demographic Development · Spatial Analysis

JEL Classification: J11 · J19 · O18

1 Introduction

Policies and rural development strategies have come out, in the recent decades, more and more from local specifics (Ambrosio-Albalá and Bastiansen, 2010). The perception of the rural space and approaches to it differ significantly according to the state development. In the last 20 years, there has been a shift in the rural development paradigm. The migration from rural areas, mainly the outflow of young people, the ageing of the rural population, and the general decline of agricultural activities connected with the decline of labour productivity represents dominant consequences in the current general conditions of the rural areas (OECD, 2006). Therefore, a new approach to rural development tries to create processes of deep structural changes in the rural areas (Delgado, 2004 cited in Ambrosio-Albalá and Bastiansen, 2010). The core of this approach is a conviction about the necessity of a significant role of local actors in the management of social, economic and political changes in a particular area.

There are discussions about the so called new paradigm of rural development which is closely connected with the territorial approach. Regarding this, the territory has no predefined borders (neither administrative, nor physical), but it arises from an aggregation of a group of people with similar problems and opportunities. The territory is, in this sense, connected with a system integrating various endogenous sources and their mutual relationships. Every element of this system may become a potential trigger for structural change.

If we are to view the rural development questions in the context of the regional development theories, it is necessary to mention some of them. The first group consists of the "core-periphery" theories which are examples of the contradiction in the understanding of divergent or convergent tendencies (see, for instance, Blažek, 2011). "Core-periphery" theories represent a certain opposite to the neoclassical theories of regional development. The neoclassical models were in their simplified form and because they contradicted the reality were quite quickly abandoned. In the 1990s, they were brought back to life using neoliberal theories (Blažek, 1999). The group of neoliberal models of regional growth consists of theories of New Economic Geography (path dependence, theory of endogenous growth, New Trade Theory) and New Growth Theory. It is possible to identify characteristics of exogenous, but is more an endogenous approach to development. Neoliberal theories, according to Ševčíková (2010), already work with human resources with an important development potential of the region. Initiative and participation of citizens are more connected with the rural space. Various research pieces show that activities such as membership in local societies, participation in social events etc. are very important in rural municipalities, where the participation rate of some indicators increases the smaller the municipality size is.

Considering the fact that rural regions are usually characterised by low population density and a dwelling system with small or medium-sized towns, while urban areas evince high population density within big cities, we could assume that the differences in the density of actors and economic activities indicate a more advantageous status of town and city companies regarding the possibilities of the use of agglomeration savings (Malecki, 1997). However, it is also necessary to mention the ongoing processes of de-concentration of economic activities. The excessive concentration of activities in urban regions and its negative consequences make companies place their activities outside these regions. As an example, we can mention ongoing sub-urban process, which result not only in residential but also commercial sub-urbanisation. The sub-urbanisation under Czech conditions is described, for example, by Sýkora (2002) or by Ouředníček (2001, 2003, 2013). So we can pose a question on whether it is possible and appropriate to apply the same theories to both the urban and the rural space.

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Local environment models and endogenous growth models are connected with clusters of small and medium-sized companies both in the urban and rural. The theory coming out from changes of labour organisation do not distinguish between the urban and rural environment, as the dynamics of the system come out from push and pull companies initiated by concrete local conditions. According to Terluin (2001), it is possible to consider the creative destruction model of community development as a local environment model – a specific application of these models for the rural. The population's desire to experience the rural idyll led to a creation of villages selling cultural heritage. This is connected with consequent problems of excessive use of the rural idyll in these villages resulting in their destruction. Mitchell (1998) talks about five development phases in these villages and indicates in which phase it is possible to prevent the destruction.

Regarding the rural, we should also mention so called institutional directions of regional development (theory of production districts, flexible specialisation, theory of leasing regions), which emphasise the meaning of the sources of regional development bounded to a inhabitant (knowledge, institution, normative culture, ability to create cooperation among business and citizen networks). This is, clearly, the endogenous approach which could be usefully beneficial to rural areas. Its significance lies in the support of small business companies whose share of the total number of companies is higher in the countryside.

2 Methods

When evaluating the number of the population and distribution changes of the population, spatial statistics tools were used – LISA analysis. This analysis (Anselin, 1994) serves for the identification of spatial clusters with similar values in the case of a positive spatial autocorrelation. Global characteristics of spatial autocorrelation always represents one statistic characterising the total spatial which can, in extreme cases, indicate clustering or a chess pattern. When calculating the statistics, we assume homogeneity. If this assumption is not met, the use of just one global statistic for the whole observed territory is senseless, as the statistic may change in space. It could happen that there is not a proven global spatial autocorrelation or clustering in particular data and still be possible to find clusters in some areas. Then it is suitable local statistics which are bounded to a particular place. Local indicators of the spatial autocorrelation are usually denoted, in scientific papers, with LISA. LISA statistics serve, according to Anselin (1994), two purposes: on one hand, it is possible to interpret them as indicators of local foci of non-stationarity or "problematic" (so called hot spots); on the other hand, it is possible to use them for the assessment of the influence of particular locations on global statistics and the identification of "remote values". Anselin (1994) defines local indicators of the spatial association LISA as a statistic which meet the following two requirements:

- LISA indicates, for every location (observation), a range of significant spatial clustering of similar values around this location;

- sum of LISA values is for all observations proportional to the global indicator spatial association value.

Local Moran's index I:

$$I_i = \frac{z_i}{m_2} \sum_j w_{ij} z_j, \tag{1}$$

where z_i are values of the observed variable, w_{ij} are the so called spatial weights expressing the influence of the location of particular municipalities, $m_2 = \sum_i z_i^2$ does not change with i, and so it is true that $\sum_i I_i = n \cdot I, I = \frac{1}{n} \sum_i I_i$, i. e. making the average of the local, we obtain global.

Selected indicators from the censuses in 1991, 2001 and 2011 were used in the analysis.

The population development can be expressed using simple methods derived from development index values. As the first step, the indices of the number of population calculated in the period 1991–2001 (variable IO91_01), in the decade 2001–2011 (variable IO01_11) and the whole period 1991-2011 (variable IO91_11). So we have approximate information about population development in municipalities after the Velvet Revolution. Does the differentiation in the demographic development of municipalities deepening after the Census 2011?

3 Research results and discussion

In the model commuting zones, 1,322 municipalities of suburban character were identified by a spatial query. The data were converted to the territorial structure of 2011. It is necessary to note, however, that the model is therefore a simplified expression of reality. The set of rural municipalities, defined as municipalities of up to 3,000 inhabitants outside the suburban area, is then composed of 4,561 municipalities, without military training areas of 4,557 municipalities. The rural area defined like that covers almost 65% of the Czech Republic.

3.4 Population development and changes in population distribution

The number of the population is, in a long-term perspective, given by the changes in natural population changes and migration. To understand the development of the last 10 year, it is necessary to perceive the demographic development with respect of a longer time period. Natural increases are influenced mainly by two basic factors: the change of strong and weak birth-years entering the fertility period and the natality intensity. In the last 20 years the changes have taken place.

Since 1989, the demographic behaviour of the young population has changed significantly. Instead of the previous effort to get married and to have one or two children as soon as possible and so be entitled to get a flat, young people have preferred travelling and studying and therefore they have postponed their marriage and giving birth to their children. It resulted in very weak natality in the 1990s (a combination of weak birth-years, low natality and postponing of children) and still the weak natality in the first five years of the 21st century (a combination of the strong birth-years but low natality and the continuous postponing of children). Pavlík (2002, p. 3) states other causes of low fertility such as unemployment and the financial inaccessibility of flats. At the end of this period, the factor of the biological clock started to be active when strong birth-year women could not, due to their age, postpone their fertility any longer and for this reason, the fertility has been slowly increasing since 2000, the period of the highest fertility culminated in 2008.

In the 1990s, the trends of inner moving changed radically because of economic and social changes, the steep decline of massive house and flat construction, and developing flat and house market (Pavlík, 2002). There was a decline of migration mobility (evident already in 1970s and 1980s when there moving to longer distances was ceasing and area units got closed at district levels), and the population concentration process stopped. The migration activities of municipalities up to 5,000 inhabitants as increasing and small towns became gradually loss-making regarding migration. Big towns and cities had deconcentration tendencies. Temporary commutation (daily commuting) and temporary accommodation in rented flats in towns were more and more common. Bartoňová (2009, p. 77) thinks that the increasing share of internal migration is caused by suburbanisation. She claims that since 2005, there has been a visible shift of the highest intensity in the age group 25-49 years. This is connected with a longer education period and later entry of the young people in the labour market and also with the increasing number of labour mobilities.

Since 1989, new factors have had an impact on the distribution and the size development of municipalities. One of the factors is the turning of the traditional since 1995 (Müller, 2010). The so called contra-urbanisation – moving of people from towns to the remote countryside, i. e. outside the close surroundings of towns and cities – this turn has been studied, mainly in western countries, since 1970s. This is discussed in the Czech scientific works of (Šimon, Ouředníček, 2010, Šimon, 2012). Other authors deal with concrete topics connected with migration to rural areas, for example, the social integration of immigrants (Bernard, 2006). Also discussed is the so called amenity migration (Bartoš, 2011, Loquenz, Šimon, 2013). Selective migration contributes to the increasing social spatial differentiation in the Czech Republic (Puldová, Ouředníček, 2006, Novák, Netrdová, 2011). However, it is necessary to point out that the majority of migration movements did not have economic reasons and the share of labour reasons, in the transformation period, decreased. This idea is supported by today's biggest migration flows in the Czech Republic, which are related mostly to accommodation reasons (http://csugeo.i-server.cz/csu/2005edicniplan.nsf/p/4029-05). Migration motivations to live in the countryside are even more orientated to family reasons (Maříková, Tuček, 2005). On the contrary, the willingness to move due to work in the Czech Republic is relatively low and to a significant extent substituted with daily or non-daily commuting or other adaptive strategies (Lux, Sunega, 2007). Shuttle migration, i .e. return migration activities of rural population is outline by Kříž (2003), who perceive them as a specific adaptation of rural populations to industrial and urbanisation processes.

Because of its increasing significance, it is not possible to omit international migration. Important milestones, after the Velvet Revolution, were the split of Czechoslovakia and the establishment of the Czech Republic on 1st January 1993 and its admission to the European Union on 1st May 2004, which led to a great increase of immigration. During the first half of the 1990s, the Czech Republic became a transit country with dominant flows from the East to the West. Gradually, it became a target country. While at the beginning of the new migration era in1990 foreigners represented about 0.3% of the total population of former Czechoslovakia (Drbohlav, 2010), on 31st December 2012, there were 438,213 foreigner registered in the Czech Republic[89], who represented 4.2% of the total population. Except for the year 2001, the Czech Republic had in the period 2001-2011 a positive migration saldo. The highest values were reached in 2007 and 2008 due to the favourable economic situation and methodology changes in recording foreigners. In 2011, the

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[89] http://www.czso.cz/csu/2013edicniplan.nsf/kapitola/0001-13-r_2013-0400

total of foreign migration reached the lowest value within the observed period. The immigrants were mostly people in the productive age, about half of the immigrants in 2011 were people aged 20-34 years, mostly from Slovakia, Vietnam, Ukraine and Russia (Kačerová, Němečková, 2012). Drbohlav (2010) claims that when comparing the Czech population with foreign immigrants the distribution of the foreigners in the Czech Republic is more uneven. The preference of the so called urban districts (Praha, Brno, Ostrava) and their surroundings and on the contrary, the non-reference of rural or regions of the so called inner peripherals (more in, e. g., Čermák, Janská, 2011) belongs among the basic features of today's distribution of foreigners.

Figure 2 Spatial clusters of the population development index 1991– 2011
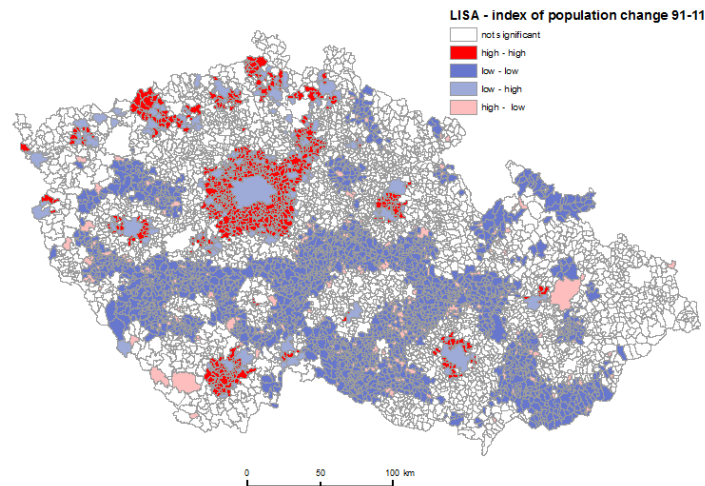
Source: author´s own processing in GeoDa and ArcGIS SW.

The size development of municipalities in the period 1991-2011 expressed by a development index can be assessed also using LISA analysis, i.e using local Moran *I*. Population development index in the years 1991-2011 shows a significant spatial autocorrelation (*I=0.270, p*-value=*0.001*). The local indicator of spatial autocorrelation used should indicate areas which are, in the given period, profitable and unprofitable. The results are presented in Figure 2. Algorithm of the LISA analysis leads to the identification of four types of clusters according to mutually neighbouring values, as it reveals clusters where there are municipalities with low values together with high values and vice versa. It enables us to identify municipality groups with a statistically significant increase of the number of population in town surroundings recording a significant statistical decrease in the given period (surroundings of Prague, Brno, Plzeň, Liberec, Pardubice, Hradec Králové, Chomutov, partially Olomouc).

Figure 3 Spatial clusters of the population development index 2011 - 2016
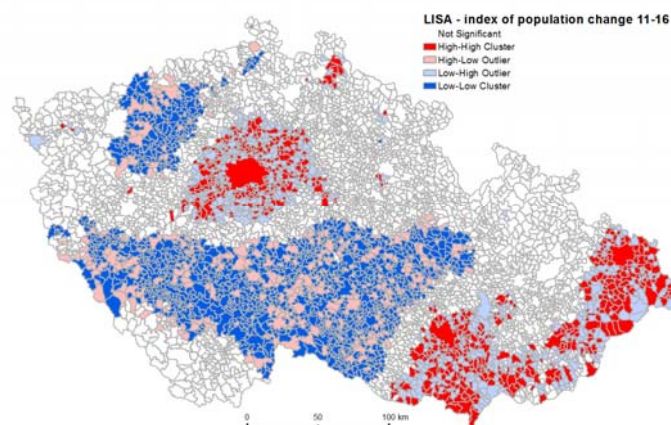
Source: author´s own processing in GeoDa and ArcGIS SW.

This is supported by the differential development of different sized groups of municipalities presented in (Müller, 2009, Čermák, et. al., 2009, Müller, 2010, Ouředníček, et. al., 2011). The figure shows there are also evident clusters of unprofitable municipalities around the municipalities which, for some reason, increased (marked with pink colour in the figure) – these are mainly rural municipalities with a population up to 1,000 inhabitants.

Figure 3 shows LISA results of Index of population change for the period 2011 – 2016. The results indicate the on-going differentiation of the size structure of municipalities. While in the period 1991 - 2011, compact areas with slow, resp. high dynamics of population growth have increased, in the last five years there has been some diversification. Its proof is the growing number of spatial outliers. However, it is important to note that we compare unevenly long periods here. Whether the demographic development of the municipalities really differs is to be proved by a detailed analysis.

4 Conclusions

In the Czech Republic, there are 6,253 municipalities. Together with this high amount of municipalities (as the lowest administration units), the Czech Republic evinces a much crumbled municipality structure and has a different settlement structure from other member states of the European Union. Municipalities in the Czech Republic have the lowest average number of population (1,682 inhabitants per municipality on 31st December 2014) and at the same time the municipalities are some of the smallest (the average area is 12.6 km^2). Size categories of the municipalities are connected significantly with the generational structure of the municipality's population – the smallest municipalities (up to 100 inhabitants) evince the lowest share of population in productive age (66.5 %), the increasing municipality size presents an increasing share of the population in productive ages reaching almost 70 %. Generally speaking, the age structure of the rural areas is, in its nature, similar to the structure of town areas. Both evince an ageing population. The share of the youngest (0–14 years) and the middle-aged (15–64 years) groups gradually decreases and, on the other hand, the share of the oldest age group (65 years and more) increases. The population ageing together with the moving trend of young people to towns and cities has become a long-term problem of rural depopulation.

According to statistical figures, the depopulation of the countryside has slowed down significantly, but it is caused mainly by the massive suburban house construction in the surroundings of big towns and cities and consequent dense house development in these areas. In inter-located remote areas, the depopulation is still prevailing, above all in border areas in the Region of Vysočina and the regions with a higher unemployment rate. These are also very often the smallest municipalities (up to 200–500 inhabitants). The countryside has been facing the work migration of young people to town and cities. However, the lack of work opportunities is, in recent years, because of the economic decline a significant negative phenomenon not only for rural areas but also for towns and cities. In 2008 there were 3.9 work applicants per vacancy. Gradually, the number has increased to 17 applicants in 2013; the highest number of these applicants are young people aged 21–30 years. The general unemployment rate in the Czech Republic was 6% in the second quarter of 2014 and was higher for women than for men, especially in the countryside. However, it is important to consider the unemployment in the Czech Republic as relatively low, when compared with the average in the EU (about 2 % lower).

Perlín et. al. (2010) states that, when assessing possibilities and the risks of rural development, theories of regional development from the core-periphery group are most commonly considered. These theories were originally inspired by Keynesian understanding of the economy. The countryside is, in this case, identified as periphery. The differentiation of the Czech Republic with respect to the periphery rate was conducted by Müller (2006, 2008). When they compared the newly defined periphery with the peripheries from the end of the 1980s, they found out that the periphery rate measured by a set of socio-economic indicators (age structure, migration, new construction etc.) deepens and the significance of the geographical location increases. Considerations about the typology of the rural environment cannot omit newer approaches to regional development (institutional theories, concepts of integrated rural development of endogenous character, rural development within knowledge economics and others). It is not possible to omit the approach of administration authorities to the countryside and its development potential, when the original sector approach to the countryside, as an area with dominant agricultural production, has been changing to the spatial approach, when the countryside is perceived as places for living of its inhabitants. (Perlín, 2010, Woods, 2011). This change in the understanding of countryside position is also evident in the newly defined rural paradigm, which stresses the transfer from subsidies given to particular areas to the support of strategic and effective projects in the countryside. The new rural paradigm assumes a strengthening of the position of local actors. These approaches are used when forming Pillar II of the Common Agriculture Policy of the EU and LEADER Programme.

The countryside is a complexly structured system, both spatial and social. Generally, the rural development possibilities derive from internal sources and external influences and trends. There is no homogeneous countryside but different types of the countryside space which differentiate one from each other not only regarding their historic, social, and cultural development but also by their development potential. Despite all the press about the countryside in the last decades, today's dynamic changes and increasing demands in all developing areas, the countryside is generally a space with a high vitality and deep internal power which enables it to overcome difficult periods. One of the key factors for the rural development potential is the local population. Besides the population development and its distribution, it is

also necessary to analyse its structure. More and more attention has been paid, in recent decades, to the significance of internal factors of the development potential. This is corroborated by developing theories of regional development and the developmental policies of the EU and its member states.

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Solving Resource Allocation by Using Spreadsheet

Radim Remeš

Abstract: *The aim of this article is to introduce a solver environment by using the spreadsheet Microsoft Excel. How to use this tool is demonstrated on the example using the constraint programming solver.The solution is found by using the spreadsheet processor with Solver Foundation add-on, which can be used for mathematical simulation, optimization, and modeling. The example solution is demonstrated inside Microsoft Excel environment. The main benefits of using this tool for economics and mathematics include easy usage, wider abilities than built-in processor functions, and there is no need to initial knowledge of programming.*

Key words: Resource Allocation · Solver Foundation Services · Optimization · Constraint programming · Microsoft Excel

JEL Classification: C61 · C63

1 Introduction

This article introduces a solver environment by using the spreadsheet. How to use this tool is demonstrated on the solving resource allocation example. Resources allocation issues are used in different industries. We can find application such as in economics, in project management (Houda, 2016), in strategic planning, in computer science (Drlik, and Beranek, 2015), in algorithmic or in wireless networks (Tsiropoulou, Vamvakas, and Papavassiliou, 2017; Wali, N, and Das, 2017) and other hardware (Ejarque, Álvarez, Sirvent, and Badia, 2007), in food industry (Ditl, Beranek, and Rieger, 1990), or even in medicine (Kluger, 2007).

The authors of the above-referenced articles do not mention the software used for their calculations, but many softwares are currently being used for solving resource allocation problems, of the most important ones, let us mention at least these tools: ILOG CPLEX (IBM, 2018), LINGO (Lindo, 2018), lp_solve (Eikland, Notebaert, 2018), XPRESS-MP (Fico, 2018), or Gurobi (Gurobi Optimization, 2018).

The example is demonstrated in the Microsoft Excel environment (Microsoft, 2017b) by using the methods of constraint programming. The solution is found by using the Microsoft Solver Foundation tool (Microsoft, 2017a), which can be used for mathematical optimization, simulation and modeling.
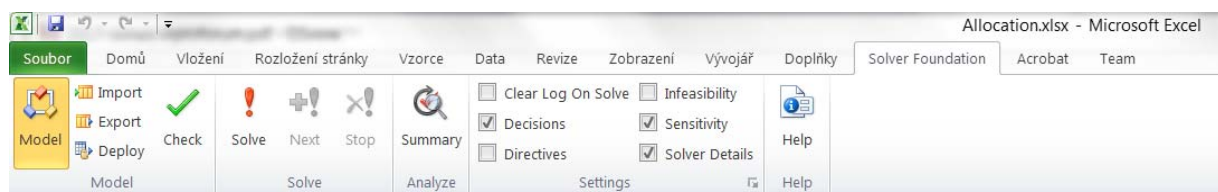
2 Resource allocation example

Let's assume we have three machines represented by computers with different capabilities. We also have the required services that we need to operate on our machines. The capabilities of our machines are limited by the metric. Similarly, the services we want to deploy on our machines have certain minimum requirements that we must adhere to.

Our goal is to find an appropriate way to deploy services on our available machines.

3 Solving the example in Microsoft Excel

For solution of our example we utilize the tool for mathematic programming and optimization Microsoft Solver Foundation (Microsoft, 2017a). We use this tool alongside with Microsoft Excel (Microsoft, 2017b) as its add-on. This tool is available as a new tab in the spreadsheet (figure 1).

Figure 1 Solver Foundation tab on the Excel ribbon

Source: Own processing

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Microsoft Solver Foundation libraries Express edition is distributed for free, it is possible to download it from the Microsoft website.

3.1 Preparing data

First we need to prepare a table of data with a list of available machines and their capabilities.

The capabilities we are interested in are availability of web server Apache, availability of database server SQL. We are also interested in core number of processor, whether it has two cores or four of them. Further we pursue redundant array of independent disks (RAID). And finally we seek if a network controllers support a notional transfer rate speed of 1000 Mbit/s. The whole list of computers with their capabilities is shown in the figure 1. The Smasher has all the capabilities, the Stock has no RAID, and the Crate has no RAID too and does not have quad core processor.

Table 1 Definition of the computer capabilities

Existing Computer Capabilities		MachineCapabilities
Machine	**Capability**	
Smasher	IsApacheEnabled	1
Smasher	IsSQLEnabled	0
Smasher	HasDualProc	1
Smasher	HasQuadProc	1
Smasher	HasRAID	1
Smasher	HasGigEther	1
Stock	IsApacheEnabled	1
Stock	IsSQLEnabled	1
Stock	HasDualProc	1
Stock	HasQuadProc	1
Stock	HasRAID	0
Stock	HasGigEther	1
Crate	IsApacheEnabled	1
Crate	IsSQLEnabled	1
Crate	HasDualProc	1
Crate	HasQuadProc	0
Crate	HasRAID	0
Crate	HasGigEther	1

Source: Own processing

The second data table will include a list of required services and their requirements for the ability of the machine to be deployed.

We have a total of four required services: DNS, WWW, DBS and game server. The DNS (Domain Name System) is a naming system for nodes or other resources connected to the Internet. As the WWW service we understand the service which function is to store, process and deliver web pages to clients using the Hypertext Transfer Protocol. The DBS means a service offered by a database management system which interacts with the user's other applications and the database itself to manage and analyze data. Finally, as a game server we understand the service for dedicated server designed for gaming platforms, the sufficiently powerful server to allow its connected clients to maintain their own accurate version of the game world. The whole list of services with their requirements is shown in the table 2.

The last two tables that need to be compiled are metric data tables. We must provide an available metric for the machines, the parameters of each of the computers. For our example, it's just about specifying the amount of operating memory available (RAM) and the number of processor cores (CPUs), details are given in tab. 3.

The last table describes the required service metrics, the parameters (RAM and CPUs) that must be met for successful deployment of the service to the corresponding machine. Full data is shown in tab. 4.

Table 2 Definition of the services and their requirements

Service Minimum Requirements (Capabilities)		
Service	**Capability**	**ServiceCapabilities**
DNS	IsApacheEnabled	0
DNS	IsSQLEnabled	0
DNS	HasDualProc	0
DNS	HasQuadProc	0
DNS	HasRAID	0
DNS	HasGigEther	1
WWW	IsApacheEnabled	1
WWW	IsSQLEnabled	0
WWW	HasDualProc	0
WWW	HasQuadProc	0

WWW	HasRAID	0
WWW	HasGigEther	0
DBS	IsApacheEnabled	0
DBS	IsSQLEnabled	1
DBS	HasDualProc	0
DBS	HasQuadProc	0
DBS	HasRAID	0
DBS	HasGigEther	0
GameServer	IsApacheEnabled	0
GameServer	IsSQLEnabled	0
GameServer	HasDualProc	0
GameServer	HasQuadProc	1
GameServer	HasRAID	0
GameServer	HasGigEther	0

Source: Own processing

Table 3 Definition of the computers parameters metric

Existing Computer Metric		
Machine	**Metric**	**MachineMetric**
Smasher	RAM	32768
Smasher	CPU	16
Stock	RAM	8192
Stock	CPU	8
Crate	RAM	4096
Crate	CPU	4

Source: Own processing

Table 4 Definition of the minimum requirements for services

Service Minimum Requirements (Metric)		
Service	**Metric**	**ServiceMetric**
DNS	RAM	2048
DNS	CPU	1
WWW	RAM	1024
WWW	CPU	1
DBS	RAM	2048
DBS	CPU	1
GameServer	RAM	8192
GameServer	CPU	8

Source: Own processing

3.2 Data binding

First, we need to define decision variables:

se　　available services,
ma　　available computers (machines),
ca　　the capabilities,
me　　the metric,

Next we define parameters:

CC_{ij}　　computer capability, the *j*-th capability for the *i*-th computer,

SC_{ij}　　service capability, the *j*-th capability for the *i*-th service,

CM_{ij}　　existing computer metric, the *j*-th metric for the *i*-th computer,

SM_{ij}　　minimal service metric, the *j*-th metric for the *i*-th service,

Now we can formulate the objective function:

$$\max C = \sum_{i=1}^{ma} D_{ij} \tag{1}$$

where:
C　　the total services deployed,
D_{ij}　　deployment of the *j*-th service on the *i*-th computer,

For objective function we have to define the set of constraint:

$$\sum_{k=1}^{ma}\left(D_{jk}\cdot MC_{ki}\right)\geq SC_{ji} \tag{2}$$

$$\sum_{j=1}^{se}\left(D_{jk}\cdot SM_{ji}\right)\leq CM_{ki} \tag{2}$$

$$\sum_{k=1}^{ma}D_{jk}=1 \tag{3}$$

And the different computers for the DNS and the WWW services constraint:

$$!D_{DNS,k}=1\,|\,D_{WWW,k}=0 \tag{4}$$

Finally, overall formulation:

$$\max C=\sum_{i=1}^{ma}D_{ij} \tag{5}$$

subject to:

$$\sum_{k=1}^{ma}\left(D_{jk}\cdot MC_{ki}\right)\geq SC_{ji} \text{ for all } j=\langle1..se\rangle, \text{ for all } i=\langle1..ca\rangle \qquad \text{(constraint to satisfy machine capabilities)}$$

$$\sum_{j=1}^{se}\left(D_{jk}\cdot SM_{ji}\right)\leq CM_{ki} \text{ for all } k=\langle1..ma\rangle, \text{ for all } i=\langle1..me\rangle \qquad \text{(constraint to satisfy service capabilities)}$$

$$\sum_{k=1}^{ma}D_{jk}=1 \text{ for all } j=\langle1..se\rangle \qquad \text{(constraint for one service on one machine)}$$

$$!D_{DNS,k}=1\,|\,D_{WWW,k}=0 \text{ for all } k=\langle1..ma\rangle \qquad \text{(constraint the DNS service and the WWW ser-}$$
vice not on the same machine)

Table 5 Deploying the services on the appropriate computers

Deploy Result		
Service	**Machine**	**Deploy**
DBS	Crate	0
DBS	Smasher	0
DBS	Stock	1
DNS	Crate	1
DNS	Smasher	0
DNS	Stock	0
GameServer	Crate	0
GameServer	Smasher	1
GameServer	Stock	0
WWW	Crate	0
WWW	Smasher	1
WWW	Stock	0

Source: Own processing

Now we have to prepare a model for calculation. In the model we will use the Optimization Modeling Language (OML). For every of previous tables we need to declare parameter in the model. We will gradually create four parameters for which we set the binding to corresponding table:

1) MachineCapabilities with domain of integer numbers range set to binary values only, binding set to cells from tab. 1;
2) ServiceCapabilities with domain of integer numbers range set to binary values only, binding set to cells from tab. 2;
3) MachineMetric with domain of integer numbers, binding set to cells from tab. 3; and finally
4) ServiceMetric with domain of integer numbers, binding set to cells from tab. 4.

Finally, we will prepare the last table where the requested data will be calculated (tab. 5). We will call this table Deploy and we configure it in our model as decision. We need to set domain to integer numbers range with boundaries set to

binary values only. The value zero means that the service for given machine is not used, and the value one means that the service is deployed on corresponding machine.

3.3 Defining constraints

The last part in the model designing is to determine the constraints. In the example, we have set four constraints (listing 1):

- for each service, the minimum capabilities should be no less than the summation of capabilities of all the machines that the service is deployed upon;
- on each machine, the minimum service metric requested from all services should be no more than the maximal amount a machine can provide for that metric kind;
- a service can only be deployed on one machine;
- DNS and DBS services can't be deployed on the same machine.

In this part, at least the basic OML syntax knowledge is necessary so that we can establish constraints.

Listing 1 Constraints definitions for the resource allocation example in OML

```
Constraints[
  Constraint1 -> Annotation[Foreach[
    {iter1, Services},
    Foreach[
      {iter2, Capabilities},
      ServiceCapabilities[iter1, iter2] <= Sum[
        {iter3, Machines},
        Deploy[iter1, iter3] * MachineCapabilities[iter3, iter2]
      ]
    ]
  ],
  Constraint2 -> Annotation[Foreach[
    {iter4, Machines},
    Foreach[
      {iter5, Metric},
      Sum[
        {iter6, Services},
        Deploy[iter6, iter4] * ServiceMetric[iter6, iter5]
      ] <= MachineMetric[iter4, iter5]
    ]
  ],
  Constraint3 -> Annotation[Foreach[
    {iter7, Services},
    Sum[
      {iter8, Machines},
      Deploy[iter7, iter8]
    ] == 1
  ],
  Constraint4 -> Annotation[Foreach[
    {iter9, Machines},
    Deploy["DNS", iter9] != Deploy["DBS", iter9]
  ]]]
]
```

Source: Own processing

4 Results

Now we have everything set up and we can run the calculation. We see the result in tab. 5, where the values for deploying services are counted.

The calculation shows that we will place the DBS service on the Stock computer, the DNS service we will deploy on the Crate computer, and the GameServer and WWW services we will deploy to the Smasher computer.

As mentioned above, there are more editions of the solver foundation software, free edition is Microsoft Solver Foundation Express. Other editions, Standard, Enterprise, and Academic, are paid. Each edition has its limitations on usable system resources and the size of the mathematical model. Enterprise and academic editions have no limitations, but express and standard editions can only use 4 CPUs and 8 processor cores. Usable memory size is limited to 1 TB. There are also limitations according to the used solver. Linear or quadratic programming has a limit of 50,000 non-zero, Mixed integer programming has a limit of 1,000 variables, 1,000 constraints, and 5,000 non-zero for Express edition.

The Standard Edition has double the limits. For Constraint programming, we can use the 5,000 total terms for the Express edition, respectively 25,000 total terms for Standard edition. Non-linear programming has no restrictions on any editions.

The standard add-on Excel Solver also enables solving of the optimization tasks. However, the problems are described differently there. In Excel Solver, goals and constraints are described in a table in the formulas. The Solver Foundation uses for described them the Optimization Modeling Language (OML). The primary strength of the Solver Foundation is focused on solving large linear, mixed integer and constraint models.

5 Conclusions

The article showed the use of the Microsoft Solver Foundation library tool to solve optimization tasks where the solution model and data were specified using the Microsoft Excel spreadsheet.

A spreadsheet solution is beneficial for non-programmers who need to use a computing environment that is familiar to them and they can control it well.

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Estimation of the Elasticity of the Substitution in the Czech Economy Using the Low-Pass Filter Model

Karol Szomolányi, Martin Lukáčik, Adriana Lukáčiková

Abstract: *The value of the elasticity of substitution in the Czech economy is substantially below one. It follows from the estimation of the coefficient using Czech data and low-pass filter model. The estimation form comes from the first order condition of the representative firm. The relationship corresponds to the capital demand. Unit elasticity of substitution is assumed by the Cobb-Douglas production function. The estimation rejects this assumption.*

Key words: Elasticity of the Substitution · Low-pass Filter Model · Czech Economy · Capital Demand

JEL Classification: C13 · E23 · P44

1 Introduction

Contemporary economic issues focus in the importance of the production function parameters. Chirinko et al. (2014) highlight the importance with the rich literature review.

There are many approaches of the estimation of production function coefficients. We refer Klump et al. (2012) and Chirinko (2008) for the short surveys. All approaches use three econometric forms derived from the CES production function linearization, capital demand of the firm maximizing its profit and finally labour demand of the firm maximizing its profit. However, modern theoretical claims highlight the importance of the production function normalization (see Klump et al. 2012 or Chirinko et al. 2014 for more discussion).

The other claims are econometric. Studying many approaches, we have to highlight a stationarity problem. It is well known that corresponding data series are not stationary in general. If the stationarity of estimated residuals does not hold, the regression may be spurious. An elegant possibility solving the stationarity problem is the use of Error correction model (ECM) to estimate long-run coefficients of the mentioned estimation forms. However, as Chirinko et al. (2011) state, this modification has some theoretical problems[92].

Considering the theoretic and econometric claims and after enormous study of all approaches we acknowledge only two of them; Klump et al. (2007) and Chirinko et al. (2014). Klump et al. (2007) estimated the system of equations consisting of the CES production function linearization and two first-order conditions of a firm maximising its profit. Authors accentuate the production function normalisation and a biased technological change concept.

Chirinko et al. (2014) propose an approach of the coefficient of the elasticity of the substitution estimation dealing with the first-order condition of the firm maximising its profit corresponding to the capital. Authors modify their data series by the low-pass filter to abstract them from the business cycles and the short-term effects driven by different underlying processes. They prove that the approach meets the production function normalisation and they observe that considering a biased technological change does not affect the result elasticity of substitution estimate. Finally they observe that the method can be used for aggregate data.

Both studies estimate low value of the elasticity of substitution in the U.S. economy: 0.60 by Klump et al. (2007) and 0.40 by Chirinko et al. (2014). The literature review of the past empirical studies estimating the production function coefficients is provided by Chirinko (2008) or Klump et al. (2012).

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[92] See Chirinko et al. (2014) as well for the discussion. Authors estimated the production funtion coefficients using vector ECM in Szomolányi, et al. (2013). In Szomolányi, et al. (2016), authors used the ECM and capital-demand estimation form to estimate short-run elasticity of substitution. However, as Chirinko et al. (2014) believe, the first order condition of the firm (i.e. capital and labour demand) hold only in the long-run.

In the paper, we choose the approach of Chirinko et al. (2014) to estimate elasticity of substitution in Czech economy. According to our knowledge of literature, there is not a paper estimating Czech (or Slovak) production function coefficients which satisfies the mentioned theoretic as well as econometric claims.

2 Model

Consider the constant elasticity of substitution production function in the form:

$$Y_t = A_t \left[\alpha \left(\kappa K_t \right)^{\frac{\sigma-1}{\sigma}} + \left(1-\alpha\right)\left(\nu N_t\right)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \tag{1}$$

where inputs are capital and labour, K_t and N_t, the symbol $0 < \alpha < 1$ is the share parameter, by symbol $\sigma > 0$, we denote the elasticity of substitution and A_t is the total factor productivity parameter. The parameters κ and ν are normalisation parameters (see Klump et al.; 2012). The special cases of the production function are if $\sigma \to 0$, the inputs are not substitutable, if $\sigma \to 1$, then the production function is Cob-Douglass, if $\sigma \to \infty$, then the production function is linear and the inputs are perfectly substitutable.

To derive the estimation form describing the capital demand we derive the relationships between (logs of) marginal and average products (MPK_t and APK_t) of the capital in the form:

$$\log\left(MPK_t\right) = \log\left(1-\alpha\right) + \frac{\sigma-1}{\sigma}\log\left(\kappa\right) + \frac{\sigma-1}{\sigma}\log\left(A_t\right) + \frac{1}{\sigma}\log\left(APK_t\right) \tag{2}$$

The firm is maximizing its profit, if his marginal product of capital equals to the capital price/output price ratio. The estimation form derived from the first-order condition of the firm can be written as follows:

$$y_t = \beta_0 + \beta_1 x_t + f\left(t\right) + u_t \tag{3}$$

where y_t corresponds to the capital/output ratio, x_t corresponds to its relative prices (capital price/output price ratio). To fit the formula with the first-order condition of the firm, both variables are measured by their natural logarithms. To eliminate the effects of different underlying economic processes, ensuring the exogeneity of the price ratio x_t, both variables are measured by the proper long-run values. Function $f(t)$ is properly chosen trend function and stochastic term is u_t. The trend term replaces the total factor productivity A_t. As Chirinko et al. (2014) argue, these values can be reached using Low-Pass filter. The elasticity of substitution is the negative value of the β_1 coefficient, i.e. $\sigma = -\beta_1$.

Note that the elasticity of substitution is independent on the normalisation parameters κ and ν. Considering the first-order condition of the firm we have solved the normalisation problem.

3 Data and Methodology

In every analysis concerning the business cycle analyst still face the same basic issue: how should one isolate the cyclical component of an economic time series? In particular, how should one separate business-cycle elements from slowly evolving long-term trends and rapidly varying seasonal or random components? Empirical macroeconomists employ a variety of detrending techniques to carry out trend-cycle decompositions. These decompositions are according to Baxter and King (1999) "ad hoc" in the sense that the researcher only requires that the detrending procedure produce a stationary business-cycle component, but does not otherwise explicitly specify the statistical characteristics of business cycles. Typical techniques in common use are: application of moving averages, first-differencing method, removal of linear or another function of time trends and application of the Hodrick-Prescott (1997) filter.

The analysis of how a typical macroeconomic time series behaves over the business cycle is complicated by the fact that its movements may contain low-frequency trends and high-frequency noise. Various methods are available to extract the business cycle component of a given time series variable. These methods differ in their handling of trends and noise, and in their assumptions about the time-series properties of a business cycle component. Mechanical use of these filters without careful consideration of the characteristics of the particular problem or setting may lead to inferior results. The ideal band pass filter can be used to isolate the component of a time series that lies within a particular band of frequencies. However, applying this filter requires a dataset of infinite length. In practice, some sort of approximation is needed.

Baxter and King (1999) made detailed comparisons of their band-pass filter with other commonly used filters and found that linear detrending and first differencing the data are not desirable filters. Deviations from an equally-weighted moving-average and Hodrick-Prescott filtering can, in some cases, produce reasonable approximations to an ideal filter. But their band-pass filter is more flexible and easier to implement than these filters, while producing a better approxi-

mations to the ideal filter. Baxter and King also made some recommendations to their filter for annual macroeconomic data, which we applied in our analysis.

For our study, we used annual data in the range 1993-2014. Data are gathered from the Penn World Tables Database (Feenstra et al, 2015), World Development Indicators, World Bank and Czech National Bank database ARAD. Real output (*GDP*) and capital in national currency units are measured by the data-series gathered from the Penn World Tables Database. The GDP deflator gathered from the World Development Indicators, World Bank measures output price. Capital price is measured as the sum of the interest rate and capital depreciation, where interest rate is *PRIBOR* interest rate data-series gathered from the Czech National Bank database ARAD and depreciation rate is gathered from the Penn World Tables.

Capital/output ratio and its relative prices are modified by low-pass filter suggested by Baxter and King (1999). We used the frequency respond function and experiments with various selections of lags and leads (*m*) and periodicity to find that Baxter and King's suggested selection of 3 year length (*m*), 2 year low and 8 year high cycle period is proper. After filtering we lost the first *m* and the last *m* (6 totals) observations.

Under exogeneity assumption on the price ratio, the *OLS* estimator is suitable to estimate the form (3). The unit root of residuals was tested by the augmented Dickey and Fuller and Phillips and Peron tests stating that residuals are stationary. We would prefer the later test, if many autoregressive terms solved autocorrelation in the test specification.

4 Research results

We started our analysis with the looking for the right combination of Baxter-King filter settings and the appropriate functional shape of a trend function that would lead to a consistent estimate of equation (3).

The final estimate is described with the equation in the form:

$$\hat{y}_t = 2.243 - 0.23x_t + f(t)$$
$$(0.047) \ (0.012)$$

(4)

where standard errors are in the brackets. The augmented Dickey-Fuller test statistics is -4.46. Since many autoregressive terms (4) solved autocorrelation in the test specification, we used the Phillips and Peron test of stationarity. The corresponding Phillips-Perron test statistics is -7.04. Therefore we state that the residuals of (4) are stationary.

As it follows from the model (3), the estimated value of the elasticity of substitution is 0.23 and it is profoundly below 1. As we have mentioned in the Introduction, the acknowledged estimates of the U.S. elasticity of substitution is 0.60 or 0.40 suggested by Klump et al. (2007) or Chirinko et al. (2014) respectively. Our estimated value 0.23 is markedly bellow these two referenced values.

5 Conclusions

Comparing our results with the novel estimates around the world, the Czech elasticity of substitution is relatively low. However, the reviews of other empirical papers provided by Chirinko (2008) and Klump et al. (2012) admit such low values.

Jürgen (2009) provide a possible explanation of low Czech elasticity of substitution. Using a theoretical model with micro-foundations he assumes a lower elasticity of substitution in transition economy. We assume that Slovakia has been the transition state in the study period. Using neoclassical growth conceptual schema, all events like the transition from central planned economy to the market economy, opening to the western European markets, entrancing to the European monetary Union, labour tax reforms have changed the Slovak steady state and have started Slovak transition move to its new steady state. Another empirical confirmation of this theory comes from our previous estimation of elasticity of substitution, i.e. Szomolányi et al. (2017a) and (2017b). The estimated value of Slovak elasticity of substitution is relatively too low as well.

The Czech elasticity of substitution is relatively small. This information is surely helpful for Czech policymakers. As Chirinko et al. (2014) state, low value of the elasticity of substitution suggests that "the convenient and all too often conventional assumption of a Cobb-Douglas production function used in many areas of economic analysis needs to be abandoned. DSGE models that maintain (the unit elasticity of substitution, note of the authors) amplify the true effect of price movements – including the traditional channel of monetary policy – relative to a model based on a lower value of this elasticity. Tax simulation models using Cobb-Douglas production functions impart a similar upward bias to the effects of tax cuts. A departure from a Cobb-Douglas production function will force an expansion of the neoclassical growth model to include, among other factors, a central role for directed technical change that affects factor shares and balances growth."

Our study opens other questions. Is Jürgen's (2009) hypothesis of the dual elasticity of substitution in transition and steady state relevant? Can this concept re-explain the neoclassical growth theory? Answering these questions would be helpful for the policymakers in Czech Republic and other post-communist countries in transition state.

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Yield Models of Supplementary Pension Insurance (Transformed Funds)

Klára Vocetková, Marek Šulista

Abstract: *This paper deals with the third pension pillar in the Czech Republic and presents models of yield calculations of transformed funds with respect to monthly deposits, firstly, with the optimal deposits attracting the highest state contributions and income tax refunds, and secondly, with the average deposits which participants in the third pension scheme pay into the scheme in reality. The annual yield is then discussed regarding investments into other securities, together with the amount the participants may withdraw from their total savings for the period of fifteen years afterwards.*

Key words: Supplementary Pension Insurance · Supplementary Pension Savings · Yield · Pension Modelling · Third Pension Pillar

JEL Classification: C63 · G17

1 Introduction

In recent years, successive Czech governments have been trying to reform the pension scheme, to support the citizens of the Czech Republic to be more responsible for their future when they retire and to promote supplementary pension schemes in which citizens could make savings for their retirement. This is so that they would not be dependent solely on the state guaranteed pensions which are supposed to decrease significantly in future years as the Czech society is getting gradually older and the pay-as-you-go pension system will probably suffer from a lack of capital to keep the current level of paid out pensions. (Český důchodový systém, 2012; Jaký je vývoj reálných důchodů?, 2018).

At the moment, there are two pension pillars in the Czech Republic. The first pillar is the mandatory basic pension insurance, defined by benefits and funded on a running basis (pay-as-you-go). The system is universal and provides for all economically active individuals; legal regulation is the same for all insured persons, and there are no industry-specific schemes etc. Only in the area of organizational and administrative provision are there some variations, in the so-called power sectors (e.g. soldiers, policemen, customs officers, firefighters). According to the analysis presented by the Ministry of Labour and Social Affairs, the pension from the basic pension insurance is drawn by more than 99 % of the population whose age is higher than the retirement age. (Proč se prodlužuje věk pro odchod do důchodu?, 2018). In addition, there is the latter pillar, which contains two financial products: supplementary pension insurance and supplementary pension savings, both with state contributions, capital funded.

- The supplementary pension insurance has been on the market since 1994, established by Act 42/1994 Col. (Zákon č. 42/1994 Sb.), and then in 2013 transformed into transformed funds. It had 3,976,000 participants in 2016 (Asociace penzijních společností ČR, 2016). This scheme is currently closed to new clients and the insurance companies have to invest, in accordance with Act 427/2011 Col. (Zákon č. 427/2011 Sb.), new deposits only in conservative securities as their annual yield must be non-negative.

- The supplementary pension savings, established in 2013 by Act 427/2011 Col., is open to new clients and the insurance companies may invest the deposited money under no restrictions. There were about 542,000 participants in 2016 in the supplementary pension savings scheme (Asociace penzijních společností ČR, 2016). There are no restrictions concerning the annual yield.

The average monthly deposit made in 2016 by participants of both schemes is, according to the Association of Pension Funds of the Czech Republic (2017b), 741 CZK. These pension schemes are, according to EU terminology, considered to be the third pillar of the pension system. The third pillar is represented by products offered by commercial insurance companies together with life insurance products. Pensions granted from the third pillar so far represent only a negligible

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portion of the incomes of the retired. The state supports this pillar by contributions and income tax deductions. The participation in the third pillar is voluntary and it is possible for the participants to leave this pension scheme. However, if the participants leave the scheme before their retirement age, they are not entitled to the contributions and the income tax refunds.

It is necessary to mention that the second pillar, which is usual in EU member states (employer pension schemes), is absent in the Czech pension insurance system. This pillar existed for two years but the last government cancelled it without any substitution for it (Ministerstvo financí České republiky, 2016). The aim of this paper is to model development on third pension pillar accounts considering state support, to calculate particular yields and to discuss its favourableness for potential clients with regard to their age and the amount of their monthly deposits into the pension scheme.

2 Methods

As has been mentioned above, the third pension pillar is supported by the state in the form of state contributions and income tax deductions (see Table 1).

Table1 State contributions and income tax refund with respect to monthly deposits (in CZK)

monthly deposit (y)	state contribution	income tax refund
0-299	0	0
300-999	90 + 20% of (y-300)	0
1000-2999	230	15% of ($12y$-12000)
3 000 and more	230	3600

Source: Association of Pension Funds of the Czech Republic – own processing

State support makes this saving product attractive for potential clients and insurance companies which offer supplementary pension saving products, highlighting these features (Asociace penzijních společností, 2017a):

- state contributions up to 230 CZK per month;
- deductibles from income tax up to 24,000 CZK per year (= tax refund of 3,600 CZK per year).

Even though these features may be perceived as very attractive and persuasive for prospective clients, these products also have some disadvantages. These are mainly:

- the fixed period to retirement age,
- very careful investment of the capital by insurance companies into secure securities, such as state and municipal bonds, which bring only a limited, but secure yield.

The presented models calculate a particular final balance on the pension accounts including clients' deposits, state contributions, and a monthly compounded interest of 1.5 % p.a. This interest rate has been chosen for the models as it reflects the real situation, according to the Association of Pension Funds of the Czech Republic, regarding yields of insurance companies in the years 2013-2016 (see Table 2) provides by the Association of Pension Funds of the Czech Republic (Asociace penzijních společností ČR, 2017b). The average mean of the presented yields is 1.23 % p.a., but there is a prognosis that yields of conservative securities will be increasing slightly in the coming years (Česká národní banka, 2017).

Table 2 Yearly yields gained by insurance companies in 2013–2016 (in % p.a.)

	2013	2014	2015	2016
Conseq PS	2.2	0.7	0.4	0.5
Allianz penzijní společnost, a.s.	1.6	1.6	1.4	1.0
AXA penzijní společnost, a.s.	2.3	1.5	1.1	1.0
ČSOB Penzijní společnost, a.s.	1.7	1.4	1.2	0.7
PS České pojišťovny, a.s.	2.1	1.7	1.4	1.0
NN Penzijní společnost, a.s. (former ING)	1.4	1.1	0.9	0.7
Česká spořitelna - penzijní společnost, a.s.	1.3	1.4	0.9	0.7
KB Penzijní společnost, a.s.	1.4	1.4	1.2	0.7

Source: Association of Pension Funds of the Czech Republic

One of the models also includes the maximum deductible income tax and reinvests its refunds which attract an interest rate of 1 % p.a., as that reflects the prospective interest rate gained on saving accounts of commercial banks. At the moment, the average mean of the interest rate gained on savings accounts of the biggest commercial banks is 0.45 % p.a. (Přehledné srovnání spořících účtů 2017, 2017). However, it is expected that the interest rate will   in the coming years (Urbánek, 2017).

Then, the annual yield is calculated as an effective annual interest rate together with the real interest rate considering the average yearly inflation of 2 % which is predicted by the Czech National Bank (Česká národní banka, 2017; Český statistický úřad, 2017). The calculated final balances are then considered to be present values for future monthly withdrawals, serving as enrichment of the first pillar pension provided by the state. All the calculations are executed in MS Excel using the implemented financial functions.

Table 3 Average old age pension in 2017 and it percentage shares (in CZK)

	2017	**10%**	**20%**	**30%**	**40%**
total average	11 807	1 181	2 361	3 542	4 723
men	13 033	1 303	2 607	3 910	5 213
women	10 728	1 073	2 146	3 218	4 291

Source: Czech Social Security Administration

It was predicted by Government Information Centre (icv.vlada.cz) that in the future there will be a certain decrease (up to 50%) in real pensions paid out from the first pillar. The average pensions in the Czech Republic are presented in Table 3, which also presents percentage share of those pensions. The calculations provided in the following tables were executed in the application MS Excel using functions: FV (Future Value), Rate (Interest Rate), and Effect (Effective Annual Interest Rate).

3 Research Results

To model the annual yield of the third pension pillar products, it is necessary to declare the inputs for the particular models. The presented models reflect the fact that state contributions are always credited and cumulated at the end of every quarter. The income tax refunds are returned to the subscribers during April and therefore these are reinvested at the end of April in the presented models and their yield is taxed by 15% income tax at the source. If the subscribers decide to withdraw money from their account gradually when they retire, as it is the main purpose of this product, the yield from their deposits and state contribution is taxed by 15% income tax. Otherwise, if the total balance is withdrawn in a lump sum, the yield is taxed by 25%.

Model 1 – maximum deductibles

- clients' monthly deposits equal 3,000 CZK;
- maximum state monthly contributions paid out quarterly equal (3 x 230 CZK) 690 CZK;
- maximum income tax deductibles equal 24,000 CZK per year (= tax refund of 3,600 CZK per year);
- investment of clients' monthly deposits and quarterly state contributions at 1.5 % p.a. compounded monthly, 15% income tax is taken out at the end of the saving period;
- reinvestment of the income tax refund at 1.0 % p.a. compounded monthly excluding 15% income tax at source.

Table 4 Model 1 – maximum state contributions and deductions (in CZK)

year	monthly deposits	state contri-butions	interest on deposits and con-tributions	pension account balance	rein-vested income tax refund	total ex-cluding 15% in-come tax on yield	yield (p.a.)	real yield (p.a.) consider-ing 2% inflation	monthly with-drawals for 15 years	with-drawals in to-day's prices
1	36 000	2 760	264	39 024	0	38 984	18.92%	16.59%	242	237
2	72 000	5 520	1 118	78 638	3 620	82 090	14.54%	12.30%	510	490
3	108 000	8 280	2 569	118 849	7 272	125 736	10.92%	8.74%	780	735
4	144 000	11 040	4 629	159 669	10 954	169 929	8.79%	6.65%	1 055	974
5	180 000	13 800	7 304	201 104	14 668	214 677	7.42%	5.31%	1 333	1207
10	360 000	27 600	30 261	417 861	33 719	447 041	4.51%	2.46%	2 775	2276

15	540 000	41 400	70 089	651 489	53 596	694 572	3.49%	1.46%	4 312	3204
20	720 000	55 200	128 101	903 301	74 336	958 422	2.97%	0.95%	5 949	4004
25	900 000	69 000	205 713	1 174 713	95 976	1 239 832	2.66%	0.65%	7 696	4691
30	1 080 000	82 800	304 450	1 467 250	118 555	1 540 137	2.45%	0.44%	9 560	5278
35	1 260 000	96 600	425 955	1 782 555	142 114	1 860 776	2.30%	0.30%	11 551	5776
40	1 440 000	110 400	572 002	2 122 402	166 696	2 203 298	2.19%	0.19%	13 677	6194
45	1 620 000	124 200	744 501	2 488 701	192 344	2 569 370	2.10%	0.10%	15 949	6542

Source: authors

Model 2 – average clients' deposit

- clients' monthly deposits equal 741 CZK;
- state monthly contributions paid out quarterly equal (3 x 178,20 CZK) 534,60 CZK;
- no income tax deductibles as the total savings per year do not exceed 12,000 CZK;
- investment of clients' monthly deposits and quarterly state contributions at 1.5 % p.a. compounded monthly, 15% income tax is taken out at the end of the saving period.

Table 5 Model 2 – average monthly deposits (in CZK)

year	total of month-ly depos-its	total of state contribu-tions	interest on deposits and con-tributions	pension account balance	balance exclud-ing 15% income tax	yield (p.a.)	real yield (p.a.)	monthly withdraw-als for 15 years	withdraw-als in today's prices
1	8 892	2 138	73	11 104	11093	59.23%	56.11%	69	68
2	17 784	4 277	315	22 375	22328	25.92%	23.45%	139	134
3	26 676	6 415	726	33 817	33708	16.93%	14.63%	210	198
4	35 568	8 554	1 310	45 432	45235	12.76%	10.55%	282	261
5	44 460	10 692	2 070	57 222	56911	10.36%	8.19%	355	322
10	88 920	21 384	8 594	118 898	117609	5.76%	3.68%	738	605
15	133 380	32 076	19 918	185 374	182386	4.28%	2.24%	1 151	855
20	177 840	42 768	36 416	257 024	251562	3.56%	1.53%	1 595	1074
25	222 300	53 460	58 491	334 251	325477	3.12%	1.10%	2 075	1265
30	266 760	64 152	86 577	417 489	404502	2.84%	0.82%	2 592	1431
35	311 220	74 844	121 141	507 205	489034	2.64%	0.62%	3 148	1574
40	355 680	85 536	162 689	603 905	579502	2.48%	0.47%	3 749	1698
45	400 140	96 228	211 763	708 131	676 367	2.37%	0.36%	4 396	1803

Source: authors

4 Conclusion

It is important to say that the presented models are rigid and we may presume that the participants as they get older would increase their deposits into the third pillar schemes, or they can withdraw up to 50% of the balance after 15 years of saving, which is in accordance with the pension policy. However, if we consider that the participants will stay in the scheme to their retirement, which is the main purpose of this financial product, and the deposits are fixed for the whole saving period, the models bring some interesting findings.

It is easy to observe in Tables 4 and 5 that the yearly yield decreases dramatically with the increase of savings time in both models. Regarding the supplementary pension insurance, the expected real yield is very small, because the insurance companies participating in the scheme, as has been already mentioned, usually invest the deposit capital into very safe securities, so as not to risk the profit from the investment becoming negative. The state contributions and income tax refunds are not able, in the longer term perspective (20 and more years), to substitute the low yield gained by the investment into securities. In Model 2, we can also see that the potential withdrawals would cover only a 15% decrease of the state pension.

For this reason, the supplementary pension insurance could be considered as quite profitable only for older participants who are going to stay in the scheme up to 15 years. Then, the expected yield is about 1% p.a. For younger savers, this product only, more or less, covers the expected future inflation level. Therefore, it would sound more reasonable if the younger savers quit the system and if they were still interested in this type of product, they should invest their money into the other pension scheme, that is, the supplementary pension savings. The providing insurance companies may risk more and invest the deposit capital not only into state or municipal bonds but also into shares, which should, in the long term perspective, bring much higher yields.

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The Main Effects of Space Weather on the Earth´s Economy

Tomáš R. Zeithamer, Jiří Pospíšil

Abstract: *The work examines space weather phenomena that affect the transfer of mass, momentum, jerk, energy and charge of heliospheric magnetized plasma into the geosphere and its sub-spheres. In addition to phenomena involving transfers between individual parts of the geosphere, space weather also affects biological and technological systems found both in the heliosphere and below the Kármán line, as well as biological and technological systems on the ground. The economic implications of the transfer mechanisms for space business are also discussed.*

Key words: Cognitive Informatics · Physical Economics · Space Economics · Space Geodesy · Space Weather

JEL Classification: A12 · B41 · D12

1 Introduction

The current age of the Sun is estimated on 4.6 billion Earth´s years (Bonanno, Schlattl & Paternò, 2002), while its lifetime in the main sequence of the Hertzsprung-Russell diagram is estimated at 10 billion Earth´s years (Adams, Bodenheimer & Laughlin, 2005). In a time interval of five billion Earth´s years it will be necessary for people to find a new home on another body of the Solar System or outside the Solar System. The Apollo Research Program has created the conditions for launching intensive preparatory work for the colonization of the Moon and other bodies of the Solar System.

Analysis of satellite data and remote sensing of the Moon have provided indications of the presence of water on lunar surface (e.g. in lunar pyroclastic deposits) (Milliken & Shuai Li, 2017), (Pieters, C. M. & 28 coauthors, 2009). The lunar crust is composed primarily of oxygen, silicon, magnesium, iron, calcium, and aluminium, but important minor and trace elements such as titanium, uranium, thorium, potassium, and hydrogen are present as well. Based on geophysical techniques, the crust is estimated to be on average about 50 km thick (Wieczorek & 15 coauthors, 2006). It means for example from the chemical point of view that the combination of chemical elements mentined above will allow the production of fuel directly on the Moon.

2 Informal background of finitary relations theory

In this paper a relational concept is expressed as the set. An n –ary finitary relation ρ over the sets $S_1, S_2,...,S_n$ is a subset P of their Cartesian product, i.e. $P \subseteq S_1 \times S_2 \times ... \times S_n$. Finitary relations are classified according to the number of sets in the Cartesian product, i.e. ρx_1 denotes a unary relation, where $x_1 \in S_1$; $\rho x_1 x_2$; or $x_1 \rho x_2$ denote a binary relation, where $x_1 \in S_1, x_2 \in S_2$; $\rho x_1 x_2 x_3$ denotes a ternary relation, where $x_1 \in S_1, x_2 \in S_2, x_3 \in S_3$; $\rho x_1 x_2 x_3 x_4$ denotes quaternary relation, where $x_1 \in S_1, x_2 \in S_2, x_3 \in S_3, x_4 \in S_4$. Finitary relations with more than four terms are usually referred to as n –ary (e.g. 7 –ary relation). It means that a n –ary finitary relation is simply a set of n –tuples (Fraissé, 2000).

The principle of correspondence that for two different scientific fields may also be called the binary principle of correspondence is a simple representation that assigns quantifiable variables from one scientific field to a quantifiable variable of a second scientific field based on the same qualitative importance of mechanisms of transfer of mass, momentum, jerk, energy and charge describing the development of systems states in two different scientific fields. Finding a principle of correspondence requires a high degree of understanding of the two different scientific fields. If a principle of correspondence is derived between n scientific fields, then this principle of correspondence is called the n – ary principle of correspondence.

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3 Results

3.1 Binary principle of correspondence in space weather

The Lausanne School of Economics and the Cambridge School of Economics were among the first schools of economics to systematically describe and analyze economic processes using methods and models of non-relativistic theoretical physics, especially those of mechanics and thermodynamics (Zeithamer 2012, a), (Zeithamer 2012, b). Both of these schools of economics laid the foundations for a new field of science that incorporates the current state of knowledge of basic research in the areas of physics, economics, sociology, neurophysiology, biophysics and cognitive informatics and is known as physical economics. The term physical economics is used in the book title "Econophysics and Physical Economics", authored by Peter Richmond, Jürgen Mimkes and Stefan Hutzler (Richmond, Mimkes & Hutzler, 2013).

In heliosphere the Sun generates space weather phenomena that physically involve the transfer of mass, momentum, jerk, energy and charge in heliospheric magnetized plasma that interacts with the geosphere and its sub-spheres. Quantifying future states of magnetized heliospheric plasma sub-systems in space weather is analogous to developing methods for meteorological forecasts (Siscoe, 2007). One approach to quantifying the size of storm systems in terrestrial meteorology is to classify them into three basic categories in descending order based on the extent of the Earth's surface that is affected: extratropic cyclones, hurricanes and tornadoes. Storms in cosmic weather can also be classified in descending order into three basic sizes: M-region storm, coronal mass ejection, super auroral electrojet. The correspondence principle for forecasting space weather and terrestrial weather can be formulated as follows: extratropical cyclone (corresponds with) ↔ M-region storm; hurricane ↔ coronal mass ejection; tornado ↔ super auroral electrojet (Siscoe, 2007).

3.2 Binary principle of correspondence in price theory

A comparison of the analytical structure of economics and the analytical structure of non-relativistic theoretical mechanics has led to the following conclusion: path s traveled by a body over time t corresponds with price n of the commodity at time t, i.e. n(t) ↔ s(t) for $t \in \langle 0, +\infty)$. There is a fundamental difference between the real functions of real variable t "commodity price" n(t) and "the path traveled by the body" s(t). The path traveled by the body is a non-decreasing real function of time, but the commodity price may over certain time intervals increase or decrease as a function of time. The first derivative of path s according to time t, i.e. $\frac{ds}{dt}(t)$, is the path traveled by the body over a unit of time, called the instantaneous magnitude of velocity of the body. A change in commodity price over a unit of time is the first derivative of commodity price n over time t, i.e. $\frac{dn}{dt}(t)$. For the time being in this work, a change in commodity price over a unit of time is called the "tempo of commodity price change" or "price tempo". The change in commodity price over a unit of time may be positive, zero or negative, while a change in the path per unit of time is nonnegative (positive or zero). The second derivative of the path of the body over time means the first derivative of the velocity of the body is a change in the velocity of the body over a unit of time, called the acceleration of the body. The second derivative of commodity price over time means the first derivative of price tempo over time and in this work is called "acceleration of commodity price", or price acceleration, or "velocity of price tempo". The third derivative of the path of the body over time, i.e. the first derivative of the acceleration of the body over time is the instantaneous magnitude of jerk of the body (body jerk). The third derivative of the commodity price over time means the first derivative of the price acceleration, or price jerk (Zeithamer, 2015 a). The economic significance of price jerk is the change of price acceleration over a unit of time. The fourth derivative of the path of the body over time is,from a physical perspective, the change in magnitude of jerk of the body over a unit of time (i.e. also the speed with which body jerk changes). There is no established Czech term for this, but in electrical engineering the fourth derivative of a signal is often called the signal vibration. The fourth derivative of commodity price over time, $\frac{d^4 n}{dt^4}(t)$, that expresses the change in commodity price jerk over a unit of time is the tempo of price jerk, or price vibration (quake) or commodity pricequake. The fifth derivative of the path of the body over time means the physical change in speed of body jerk over a unit of time, or the acceleration of the body jerk. The fifth derivative of commodity price over time is the economic change in tempo of commodity price jerk over a unit of time, or price crackle.

In this section of the work it is necessary to mention the following notes:

1) In physics the quantities of velocity, acceleration and jerk are vector quantities. For example this pertains to railway engineering, construction of machinery, civil engineering and aviation engineering.
2) This work uses the scalar meaning of price. An article devoted to the vector meaning of price is being prepared for publication.

3.3 Axiomatic approach to the stationary field of retail gravitation

This work assumes that preferences exhibit the characteristics given by the following axioms: I.1. Axiom of reflexivity; I.2. Axiom of completeness; I.3. Axiom of transitivity; I.4. Axiom of continuity; I.5. Axiom of convexity; II. 1. Axiom of non-satiation (Never Get Enough); III: 1. Axiom of continuity of the retail gravitation field.

This work uses an ECEF Cartesian frame of reference $\sum_3$, the origin of which is located at the gravitational center of the Earth with axes fixed to the geoid (Earth-Centered, Earth-Fixed frame of reference). For the description of retail gravitation this coordinate system is a sufficiently accurate approximation of the inertial coordinate system (see references (Burša & Kostelecký, 1999), (Leick, 2004).

Let A be a city on the geoid with population P_a. Because retail flows are realized in three-dimensional space and time, we define the stationary potential of retail gravitation of city A by the relation

$$\varphi(x, y, z) = \varphi(D_a) = \alpha(A, E_A) \frac{N_a}{D_a}, \tag{1}$$

where D_a is the distance of the observation point from city A measured along the geoid. If the distance measured along the geoid is such that the geoid curvature can be neglected, then the distance of the observation point from city A is given by the relation $D_a = \sqrt{(x - x_A)^2 + (y - y_A)^2 + (z - z_A)^2}$, where x, y, z are the coordinates of the observation point and x_A, y_A and z_A are the coordinates of city A; $\vec{D}_a = (x - x_A, y - y_A, z - z_A)$, i.e. $\vec{D}_a = (x - x_A)\vec{\imath} + (y - y_A)\vec{\jmath} + (z - z_A)\vec{k}$ is the position vector of the observation point, from which retail trade is attracted along the geoid in the direction of city A, or to mass point A; $\vec{\imath}, \vec{\jmath}$ and $\vec{k}$ are orthogonal unit vectors. Proportionality constant $\alpha(A, E_A)$ is expressed in units $[\alpha] = c.u.\ m^2\ pers.^{-2}$, where $c.u.$ = currency unit, m^2 = square meter, pers.= person; A is mass point with coordinates x_A, y_A and z_A, i.e. mass point $A = [x_A, y_A, z_A]$ depicts city A; E_A- is an economic facility of city A; N_a- is the number of long-term economically active adult inhabitants in city A at time t. Vector field $\vec{K}_a$ of the intensity of retail gravitation is determined by the negative gradient of potential of retail gravitation φ, i.e.

$$\vec{K}_a = \left(-\frac{\partial \varphi}{\partial x}(D_a), -\frac{\partial \varphi}{\partial y}(D_a), -\frac{\partial \varphi}{\partial z}(D_a) \right). \tag{2}$$

This means that the magnitude K_a of the intensity vector of retail gravitation is given by the relation $K_a = |\vec{K}_a| = \alpha(A, E_A)\frac{N_{Aa}}{D_a^2}$. For the intensity vector of retail gravitation the following relations apply $iv\,\vec{K}_a = 0$, $rot\,\vec{K}_a = \vec{0}$, and the potential of retail gravitation is obtained by solving the Laplace homogeneous partial differential equation $\Delta\varphi = 0$. Any vector field of retail gravitation $\vec{M}_a$ can be considered the superposition of two fields, one of which is determined by scalar potential while the second is determined by vector potential $\vec{A}$. Let us designate the field of retail gravitation determined by scalar potential φ as $\vec{K}_a$ and the field of retail gravitation determined by vector potential $\vec{A}$ as $\vec{L}_a$, then $\vec{M}_a = \vec{K}_a + \vec{L}_a$, it means that the vector of retail gravitation at the observation point is expressed by the relation

$$\vec{M}_a = -grad\,\varphi + rot\,\vec{A} \tag{3}$$

The first summand in relation (3) determines the amount of retail trade that can be attracted to city A by a single inhabitant who is at the observation point. The second summand in relation (3) determines the amount of retail trade that can be relocated from city A to the observation point per single inhabitant found at the observation point. The presented theory of a stationary field of retail gravitation implicitly contains axiom III: 1, which concerns the continuity of the field of retail gravitation, i.e. the scalar and vector stationary potentials are continuous functions of spatial coordinates and time.

4 Conclusion

Basic Czech research into the principle of correspondence between physics and economics began in the early 1970s. Pioneers of this basic research in the Czech school of economics included prof. Dr. Ing. Pavel Hrubý and his co-worker Ing. Jaromír Kálal. With periodic breaks of varying length, the research have continued to the present day and is steadi-

ly incorporating current findings obtained in the field of Sun-Earth relations. The experimental work has resulting in numerous studies, the most important of which are cited in this work; study authors are prof. Dr. Ing. Pavel Hrubý, Ing. Jaromír Kálal, doc. Ing. František Drozen, CSc. (VŠE in Prague), prof. Ing. Jiří Pospíšil, CSc. (ČVUT in Prague), Ing. Tomáš Zeithamer, Ph.D. (VŠE in Prague) (Hrubý & Kálal, 1974), (Drozen, 2008), (Pospíšil, 2013), (Zeithamer, 1986, 1988, 1990, 2012 a, 2012 b, 2013, 2014 a, 2014 b, 2015 a, 2015 b, 2016 a, 2016 b), (Zeithamer & Pospíšil, 2015, 2016 a, 2016 b).

The transfer of mass, momentum, jerk, energy and charge in Sun-Earth relations is the fundamental process that affects the majority of communication technologies we encounter on dynamically changing markets. Therefore, it is essential for the scientific community to understand the axioms of market dynamics in its basic research, and based on this understanding play an active and independent role in the changing business environment.

Acknowledgements

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Special

Plenary Session Paper

Some Comments on Overcoming the Gap between New and Old Member States in the EU Framework Programme

Vladimír Albrecht

Abstract: *The New Member States (NMS) started to massively participate in the EU Framework Programmes (FP) for research and innovation in 1999 when the fifth FP was launched. However, despite of this long-term experience their participation in the FP remains continuously low: in the current HORIZON 2020 (H2020) programme they receive some 4.4% of the totally distributed financial support.*

The article shows that the financial support which the EU Member states receive from the European Commission (EC) for their participation in the EU FP is highly correlated with both their EU membership fees and Gross Expenditures for Research and Development (GERD). Thus, increasing participation of the NMS in the FP can be hardly achieved without increasing their EU membership fees, which depend on their economic performance, and their GERDs. However, the GERD dynamic of the NMS is usually slow and its increased level might bring an effect only after some time lag. The elevation of the NMS participation can be also achieved by implementing measures on both sides, the EC and the NMS, aimed at intensifying their collaboration with the excellent European institutions already in project proposals preparation.

Key words: EU Framework Programme · Research and Development Funding · Participation Success Rate

JEL Classification: O30 · I10 · Y10

1 Introduction

The Interim evaluation of HORIZON 2020 (European Commission, 2017, page 91) characterizes the low participation of the NMS by the following statistical numbers, which pertain to the period 2014 – 2016: "Participants from NMS represent 8.5 % of the participations in Horizon 2020 and receive 4.4 % of the overall funding, which is slightly more than under FP 7 (4,2%)". If we take into consideration that the NMS have some 20% of the EU28 population, then we easily grasp, that their participation in the FPs has fallen short of their expectations.

However, the trap of low participation might be even more problematic when considering the socio-economic impact of the FP. Let us first recall that the budget of the former FP7 programme was EUR 54 billion and the European Commission estimates its longer-term impact by the following prospect: "on the average, the GDP gain (due to FP7) is estimated to amount to EUR 22,4 billion (in 2014 prices) per year during the period 2007 – 2023. Thus over the period of 17 years, the total GDP gain is EUR 380 billion: each EUR of FP7 direct budget brought an estimated increase in GDP of about EUR 9." – see (European Commission, 2017, page 230). Similarly, the current H2020 programme, the budget of which amounts to EUR 77 billion, is characterised by the following forecast: "over the period 2014 – 2030 the GDP gain (due to H2020) is estimated between EUR 400 and EUR 600 billion, each EUR of HORIZON 2020 investment brings a GDP increase between EUR 6 and 8.5", (European Commission, 2016, page 181). When considering these huge prospects one would expect that the countries will discuss how to maximize their gain resulting from participation of their teams in the FP. However, the current discussion is more frequently focused on the distribution of the FP budget than on sharing the economic assets resulting from the realised projects. Namely, many member states request that distribution of the FP budget should follow the "juste retour" principle (fair reward), i.e. the member states expect that the total support which their teams contract from the FP budget will correspond to the member state contribution to the FP budget (i.e. the aliquot part of the EU membership fee).

2 Methods

The article shows that the financial support which the EU Member states receive from the European Commission (EC) for their participation in the EU FP is highly correlated with both their EU membership fees and Gross Expenditures for Research and Development (GERD). The analysis and synthesis of the European Commission's previous findings has been used in the research.

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3 Results

3.1 Increasing the participation in the FP via collaboration with the excellent European institutions

Dependence of the total member state support received to participate in FP7 on the summary EU membership fee in years 2007 – 2013 is visualized in figure 1. This data is extracted from the "Budget in figures" web page (European Commission, 2016). The regression line explains 88 % of the variation of the distributed FP7 budget received by the country (as indicated by the R2 coefficient) Thus the EU membership fee is an acceptable predictor of the support the member states receive from the FP7 budget. The NMS are in the cluster in the left lower corner in the graph, they all are bellow the regression line. Remark that the low level of the NMS membership fees corresponds to the level of their respective GDP.

Hence we can conclude that allocation of the FP7 support to the EU member states satisfies statistically (i.e. with individual deviations) the juste retour principle.

Needless to emphasize that successful country participation in the highly competitive environment of the FP assumes high quality thus high investment into national R&D&I system. However, there are great differences among the member states regarding investments into their R&D&I systems. For instance, the GERDs of Nordic states are for a long time close (or even above) 3% of their respective GDP while the GERDs of some NMS are constantly bellow 1.5% of the respective GDP. Thus, it is clear that the member states have different potential to effectively participate in the excellence driven FP. This also indicates that the juste retour is ill-considered principle which should be rather abolished than required. The relevant question thus concerns to the relationship between the received support and the level of the GERD.

Figure 1 The dependence of member state support received from the FP7 budget on its EU memberships fee
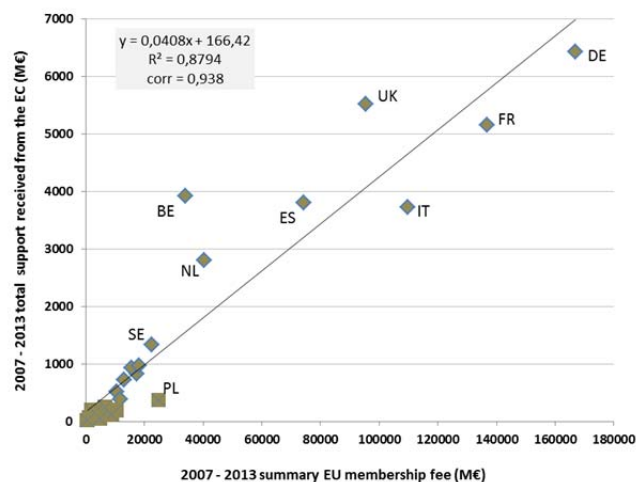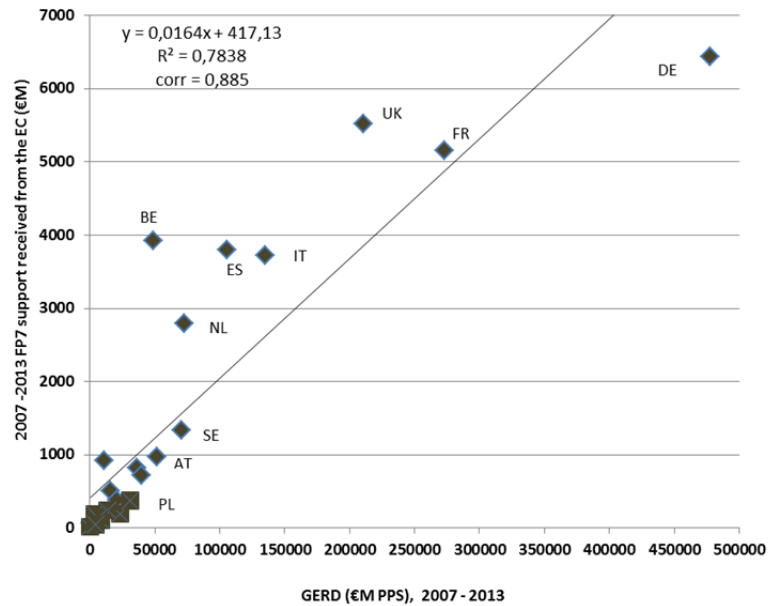

Source: European Commission (2016)

Note: The diamonds indicate the Old Member States, squares indicate the NMS

The scatter plot in figure 2 shows that the total FP7 support received by the member states is very highly correlated with their GERD totally invested in the period 2007 – 2013. The GERD explains some 78% of the variation of the distributed FP7 budget received by the country (as indicated by the R2 coefficient). Thus we could say that the country support from the FP7 depends linearly on the country GERD, in other words we can conclude that the FP7 budget was distributed efficiently (in the sense that "the value of support that the country received from FP7 is proportional to the country GERD"). The value 0,0164 of the slope coefficient of the regression line indicates that one million EUR invested into GERD generates the country potential to receive support EUR 16 400 from the FP7 budget.

However, the countries are more or less deviated from the indicated linear regression, i.e. the slope coefficient of the regression line is a characteristics of the whole FP7 but not of the individual countries. Thus we shall consider the ratio as one of the most important indicators characterizing the efficiency of the country participation in the FP. We shall calculate ratio (1) for the EU27 in the FP7 and also in the first three years (2014 – 2016) of the H2020 programme.

Figure 2 The dependence of member state support received from the FP7 budget on its GERD


Source: Received from the FP7 / GERD (European Commission, 2016)

Note: The diamonds indicate the Old Member States, squares indicate the NMS

   In figure 3 the member states are ranked according the sum of coefficients (1) for FP7 and H2020.We immediately see that the Czech Republic gained per 1M€ GERD the smallest support from the both FP7 and H2020.

Figure 3 Ratio "received € from FP (FP7 and/or H2020) per M€ of GERD"
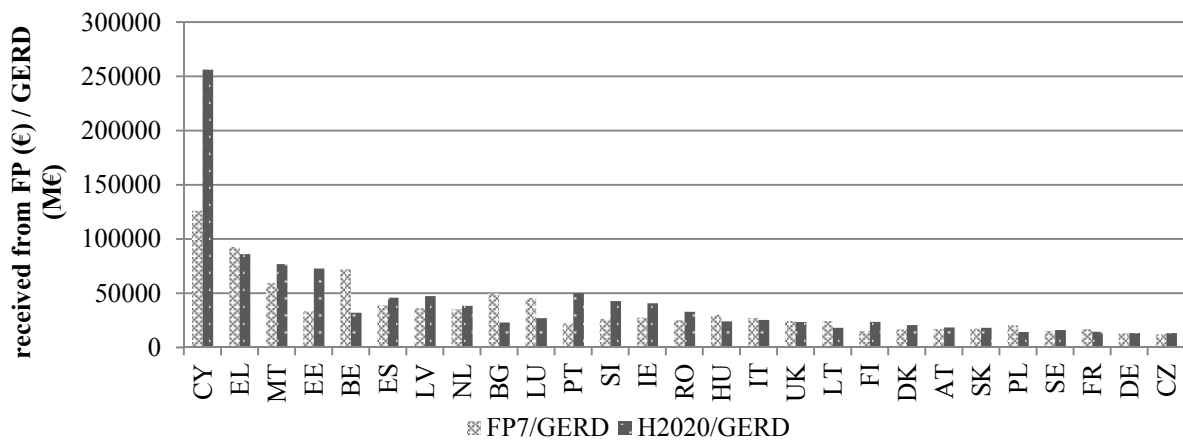
Source: Own computation for FP7

Note: for H2020 data are taken from the Interim evaluation of H2020 report

   The two main reasons for the last position of the CZ in the graph in figure 3 are:

- the CZ institutions participate in preparation of only small number of project proposals per 1000 FTE of the research capacity.

- The CZ GERD is quite high due to high (structural funds) investment into building new research infrastructures. (GERD per capita amounted (in Power Purchasing Standard) to € 390 in 2013 or € 429 in 2015, which are the second highest values among the NMS).

   Among the NMS the Czech republic had in the FP7 the smallest number of participations in preparing project proposals per 1 M€ GERD (Frank, & Albrecht, 2017). The low activity of the CZ teams in the proposal preparation is a chronical problem of the CZ R&D&I, it was detected already in FP6, continued in FP7 and does not improve in the current H2020. This indicates a failure of the Czech R&D&I system. Namely, we have shown in (Vanecek, Pecha, & Albrecht, 2017), that scientific articles resulting from the FP projects are more than twice frequently cited than other

articles with Czech co-authorship. The Czech Republic should not neglect this effect, which measurably elevates the recognition of national institutions by scientific community.

3.2 Increasing the participation in the FP via collaboration with the excellent European institutions

We know from regression in figure 2 that increasing GERD might increase the country potential to gain higher support from the FP. The GERD dynamics is rather slow particularly in most NMS and simultaneously it is not clear how long the national R&D system must run with higher GERD to arrive at higher participation in the very competitive environment of the FP. Likely quicker effect might be achieved by increasing the success rate of project proposals.

Although there are thousands of participants in every FP, there is also a small group of institutions that participate in a very substantial part of the FP projects. They can be found among the institutions to which the EC allocated the highest support. Let TOPN denotes the group of the N highly supported institutions that participate in projects to which the EC allocated 51% of the distributed support. We have shown in (Albrecht, & Frank, 2017) that there were 15 institutions in the FP7, i.e.TOP15[97], which participated in the FP7 projects to which the EC allocated 51% of the totally distributed support. Preparing project proposals in collaboration with TOP15 considerably increases the participation success rate. In the column graph in figure 4 every member state is characterized by two participation success rates: in proposals prepared without collaboration with the teams from TOP15 and in proposals prepared jointly with some team of the TOP15 institutions. It is evident that preparing project proposals in collaboration with the TOP15 teams increases considerably the participation success rate of teams from any member state. The increase is almost 8% with the NMS (from 15.6% to 23.5%) and 6% with the OMS (from 19.3% to 25.6%). However, collaboration with TOP15 teams in proposals preparation not only considerably increases the participation success rate but also contributes to closing the success rate gap between NMS and OMS.

Figure 4 FP7 success rates of the EU member states in projects
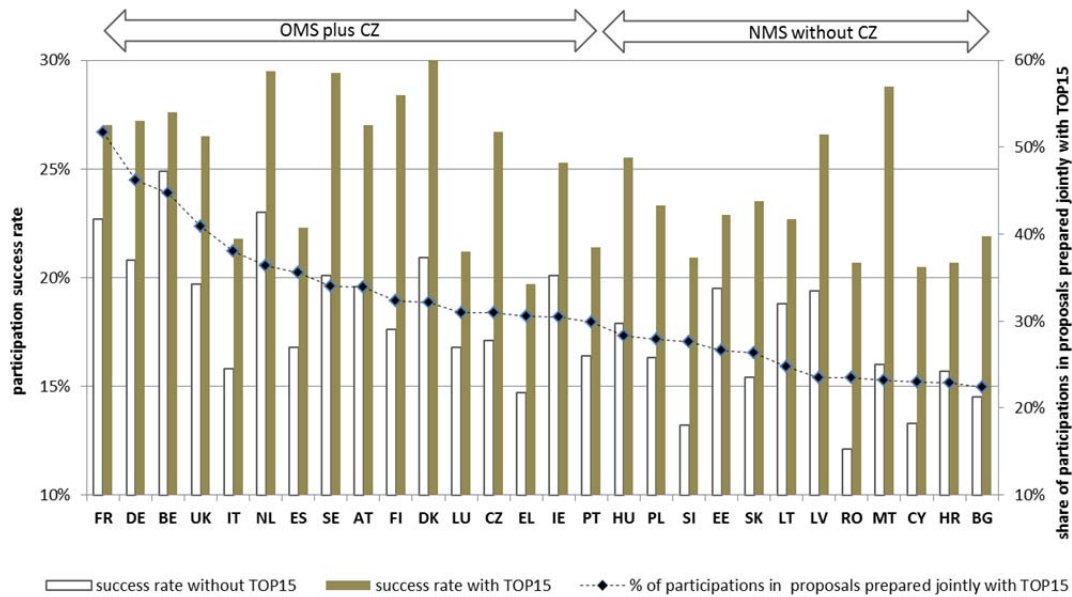
Source: European Commission (2017)

Note: Projects prepared without collaboration with TOP15 institutions – white columns - and in projects prepared in collaboration with TOP15 institutions – grey columns. The countries are ranked according to the percentage of participation jointly with TOP15 institutions - point graph with scale on the right vertical axis.

In figure 4 the countries are ranked according to the percentage of proposals that were prepared in collaboration with the TOP15. This percentage is, of course, highest in countries, which the TOP15 institutions are located in. For the "no TOP15 countries" the percentage ranges from 20 to 40%. In spite of this narrow range the percentage almost precisely discriminates between the NMS and OMS: except for the Czech Republic the other NMS have the percentage bellow 30% while OMS are above this value. Consequently both the EC and the NMS should consider implementing suitable

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[97] TOP15 of the FP7 are: Centre National de la Recherche Scientifique, Fraunhofer Gesellschaft, Oxford University, Cambridge University, Commissariat a l Energie Atomique, MaxPlanck Gesellschaft, University College London, Eidgenössische Technische Hochshule Zürich, Imperial College of Science, Technology and medicine, Ecole PolytechniqueFederale de Laussane, Institute National de la Recherche Medicale, Katholieke Universiteit Leuven, Agencia Estatal Consejo, Superior de Investigaciones Cientificas, University of Edinburgh, Consiglio Nazionale delle Ricerche.

measure to increase the NMS collaboration in preparing the FP (collaborative) projects. Increasing the participation success rate via intensifying collaboration with TOP15 might quickly lead to enhancing the participation in the FP.

The position of the Czech Rep in the graph in figure 4 indicates the that the Czech teams are able slightly more than other NMS contact teams from the excellent European institutions and prepare project proposals jointly with them, which might be read as a sign of the quality of the Czech research.

When implementing the same method of detection TOPN institutions in the first three years of H2020 data, we arrive at the conclusion that there are 20 institutions participating in H2020 projects to which the EC allocated 51% of the hitherto distributed support. There is a great overlap of FP7 TOP15 and H2020 TOP20, for details see (Albrecht, & Frank, 2017).

Table 1 TOP15 institutions that participate in the projects of the H2020 societal challenge SOCIETY to which the EC allocated 51% of the distributed support in the period 2014 – 2016

TOP15 in the SOCIETY social challenge of the H2020, 2014 - 2016	Country	Participations
FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E. V.	DE	85
KATHOLIEKE UNIVERSITEIT LEUVEN	BE	71
ALMA MATER STUDIORUM - UNIVERSITA DI BOLOGNA	IT	55
TECHNISCHE UNIVERSITEIT DELFT	NL	42
UNIVERSITEIT UTRECHT	NL	40
THE CHANCELLOR, MASTERS AND SCHOLARS OF THE UNIVERSITY OF OXFORD	UK	39
UNIVERSITETET I OSLO	NO	38
THE UNIVERSITY OF MANCHESTER	UK	37
ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS	EL	36
DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	DE	18
OESTERREICHISCHE FORSCHUNGSFOERDERUNGSGESELLSCHAFT MBH	AT	11
JRC -JOINT RESEARCH CENTRE- EUROPEAN COMMISSION	EU	6
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT	EU	6
DUEDIL LIMITED	UK	2
WITHLOCALS BV	EU	1

Source: Albrecht, V., & Frank, D. (2017)

Note that preparing project proposals in collaboration with TOP15 increases the participation success rate more than 4times in nine member states (AT, EL, IE, PT, PL, HR, LV, BG MT). The average participation success rate of the OMS has grown from 5% in proposals prepared without collaboration with TOP15 to 14.1% in proposals prepared jointly with TOP15. With the NMS the average participation success rate has grown from 4.7% to 14.0%.

Figure 5 H2020 success rates of the EU member states in the societal challenge SOCIETY
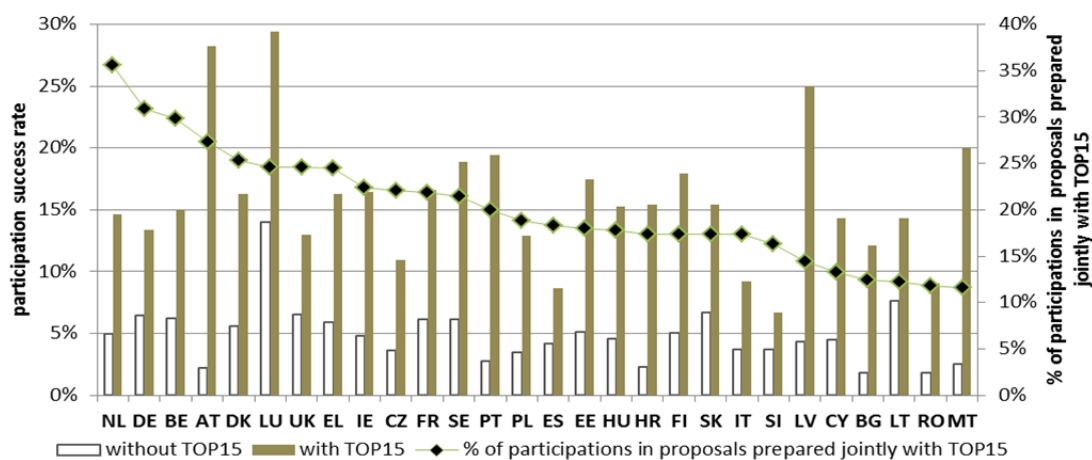
Source: European Commission (2017)

Note: White columns display success rate in projects prepared without collaboration with TOP15 institutions, grey columns then in projects prepared jointly with TOP15 institutions. The countries are ranked according to the percentage of project proposals jointly prepared with TOP15 institutions - point graph with scale on the right vertical axis.

The participation success rate of CZ teams is one of the lowest among the EU28, it is only 3.7% (in proposals prepared without collaboration with TOP15) and 10.9% in proposals prepared jointly with TOP15. The Czech republic has again among the NMS the highest portion of project proposals prepared jointly with TOP15 institutions, however, it has also very low participation success rate, which is has not been increased either by the collaboration with the TOP15 institutions. The low participation success rate indicates low competitiveness of the Czech research teams in the research focused on social sciences.

4 Conclusions

The low participation of the NMS in the EU framework programme is a stiff problem persisting since the FP6. The EC introduced in the current H2020 the priority "Spreading excellence and widening participation". With the budget totalling to 1% of the total H2020 budget this priority can effectively increase the research competitiveness of some institutions in the low performing countries; however, it can hardly elevate the hitherto low level of the research systems in 13 NMS with almost 100 million populations.

Some discussions and even published communications recommend that the NMS should improve their research administration structures, particularly the system of the National Contact Points for the FP (see e.g. Schuch, 2014). Unlike of these communications we argue that the participation in the FP is ruled by statistical laws which make a strong coupling between country participation on the one side and its economic performance and investments into research and development on the other side. Hence, increasing the GDP and GERD will increase the country potential to more successfully participate in the FP.

We have demonstrated by a simple statistical analysis that preparing project proposals in collaboration with the excellent European institutions considerably increases the participation success rate of the NMS, thus widens the NMS participation in the FP projects. The excellent European institutions research practice influencing the research practices of the NMS might also have the effect of spreading excellence, which certainly will not be as strong as that in the above mentioned priority, however, it might be evoked in hundreds of FP projects. The NMS should thus organize events (e.g. workshops, webinaries etc.) aimed at increasing the collaboration with the excellent institutions in project preparation. Simultaneously the EC can modify the project proposal evaluation to strengthen the excellence of the consortia submitting the project proposals while simultaneously increasing involvement of the NMS teams.

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