ACTA UNIVERSITATIS AGRICULTURAE ET SILVICULTURAE MENDELIANAE BRUNENSIS

Volume 66 59 Number 2, 2018
https://doi.org/10.11118/actaun201866020571

ECONOMIC DIFFERENCES OF BORDER REGIONS IN THE CZECH REPUBLIC

Jitka Svobodová[1], Ludmila Dömeová[2], Andrea Jindrová[1]

[1]Department of Statistics, Faculty of Economics and Management, Czech University of Life Sciences in Prague, Kamýcká 129, 165 21 Praha 6 – Suchdol, Czech Republic
[2]Department of Systems Engineering, Faculty of Economics and Management, Czech University of Life Sciences in Prague, Kamýcká 129, 165 21 Praha 6 – Suchdol, Czech Republic

Abstract

SVOBODOVÁ JITKA, DÖMEOVÁ LUDMILA, JINDROVÁ ANDREA. 2018. Economic Differences of Border Regions in the Czech Republic.*Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis,* 66(2): 571–582.

The article deals with the economically weak regions in the border areas of the Czech Republic (CR). The main goal is the selection and application of the most important variables, as the methodology of selection and evaluation of economically weak regions is not united. The following research question was formulated as whether the border regions are economically weaker when compared with the Czech Republic average of selected indicators. Two working hypotheses were set: whether the situation of the border regions is different from each other among the border regions and whether the economy of the neighbouring country impacts these disparities in border regions. The secondary goal of this article is to find homogenous clusters and describe these clusters of border regions. The result of the principal component analysis was determination of three components Labour market, Transnational commuters and Population migration. The variables that set up the component Labour Market was found to be the most important for economically weak border regions. The three components were used for cluster analysis and the territories were broken up into four clusters, none of which is above average of the CR with the result that the situation in the border region is dependent on the neighbouring country.

Keywords: Border regions; cluster analysis; cross-border cooperation; Czech Republic; economically weak regions; principal component analysis; regional development; regional policy

INTRODUCTION

The end of the Cold War started reintegration of the post-socialist economies into the global world market, opened space for transnational transactions, and moved part of the state power to supranational bodies (Perkmann and Sum, 2002). The regional disparities along the "old" and "new" EU borders are still significant (Knippschild, 2011). While the EU15 countries have experienced many years cross-border cooperation, the border regions in the New Member States and those on the each side of the old Iron curtain has only recently started to work together (Commission of the European Communities, 2008). There is deep concern that the recent wave of globalization has enlarged the inequality between rich and poor regions within a country (Zeng and Zhao, 2010). The EU provides grants to disadvantaged regions NUTS2 regions with a per capita GDP level below 75% of the EU average. The target NUTS2 regions are fairly large, sub-national, regional aggregates and the small areas are not distinguished (Becker *et al.*, 2010). The specifics of the smaller regions (LAU 1) are not taken into consideration. The location theories premise that a limited spatial mobility of production sources determines the creation of territory-specific economic structures; the aim of these theories is to find the main factors influencing the location of economic activities (Viturka, 2014). There are five main objectives – employment, innovation, education, social inclusion and climate/energy – to be reached by 2020 (European Commission, 2010). The Czech Republic is managing eight operational programmes under the EU Cohesion Policy in 2014–2020. There has

been allocated funding total circa € 22 billion (European Commission, 2014). The majority of the Operational Programme Research and Development for Innovation of the EU is nominally headed to other regions (NUTS2) than Prague (Srholec and Žížalová, 2014). The reason for the focus on the border regions is related to the results of the strategic documents of the Ministry of Regional Development (2013). The border regions are there often ranked among the economically weaker regions, but the indicator "border region" is not used in the Czech statistical data. (Eurostat, 2014). In our opinion, a better definition of specific factors for border regions (level LAU 1), including determination of the appropriate indicators may help in the better allocation of economic resources and faster growth and convergence of both the disadvantaged regions and the whole EU. The recent history of EU cohesion policy has shown that not all funds have been effectively utilized. The estimation is that in 36% of the recipient regions the transfer intensity exceeds the aggregate efficiency, maximizing level and in 18% of the regions a reduction of transfers would not even reduce their growth (Becker *et al.*, 2012). In Šipikal *et al.* (2013), was found that more than a third of public support in the EU regional policy programs was spent on projects which would have been realized even without this support while the investment grants have much higher deadweight than educational or employment grants. While there is not a unique methodology for selection of economically weak regions some crucial topics and indicators used by other authors are provided before the actual indicators are described. While the headline indicator for private poverty in the EU is "the number people at risk of poverty or social exclusion" (Commission of the European Communities, 2008), there might be many different indicators for the poverty of a region. A new set of goals and priorities for the regional initiatives are added with each funding period of the EU while the problems with measurement and evaluation persist (Johnson, 2009). The OECD has identified 11 topics as measures for the quality of life. Many of these factors–such as personal safety, air pollution, employment opportunities and access to services (OECD, 2015). The effect on the Local Agenda 21 which should contribute to the sustainable development at the LAU 2 level is measured by three pillars: economic, environmental, and social (Kveton *et al.*, 2014). The issue is highly complex, the main problem lies in the fact that the three pillars are in conflict (Zegras *et al.*, 2004). Martin (1999) defines the regional disparities by nominal incomes, the level of industrial agglomeration, and by the price indices including cost investment and innovation. Hassink *et al.* (1994) used R & D investments, innovation activities, share of SMEs, the share of manufacturing firms, and a number of science and technology graduates. Blažek and Uhlíř (2007) measured the scale of interregional disparities at the NUTS2 level by GDP/per capita and unemployment rate. Churski and Dominiak (2014) distinguished economically robust, a neutral and weak region in Poland uses four aspects of social and economic growth: population and settlement, the economic structure and the labour market, the technical infrastructure and spatial accessibility, and the financial situation and the level of affluence. Baumgartner *et al.* (2013) have chosen following topics for selection of non-core regions (i.e. regions far away from metropolitan areas): economic environment, natural environment, social environment, human capital, settlement, accessibility, and a spacing distance. Barjak (2001) divides the indicators into income indicators and employment indicators. Educational attainment is important both for the prosperity of persons and territories. The economically weak regions according the Ministry of Regional Development (2013) with above average unemployment rate are Liberec, Vsetín, Opava, Znojmo, Sokolov, Děčín, Most, Chomutov, Bruntál, Teplice, Hodonín, Šumperk, Karviná, Ústí nad Labem, Jeseník, Semily, Karlovy Vary, and Český Krumlov (CZSO, 2015). Many of these regions are border regions. The majority of the indicators mentioned above, including GDP are not available on the LAU 1 level, usually only on NUTS 3 and higher levels. The most frequent methods used for determining for the weaker regions in the Czech Republic are various statistical methods, especially the calculation of coefficients–relative numbers which compares the results of the region with the results of the whole republic. The Coefficient of efficiency of economic development, Coefficient of effective availability, Coefficient of efficiency of investment, construction were used in Comparison of economic development of regions in the Czech Republic, taking into account the impact of the economic crisis (Knězáčková and Pichová, 2014). The multiple criteria decision methods offer another perspective. The method of Ivanovic deviation and the Data Envelope Analysis were used for comparison of V4 (Visegrad Group) countries on the level of NUTS 2 regions (Ramík and Hančlová, 2012). A multiplicative version of the AHP (Analytic Hierarchy Process) method was applied for evaluation of the competitiveness of the NUTS 3 region in the Czech Republic (Nevima and Ramik, 2009). The Czech state, defined the disadvantaged regions (at the level of municipalities with extended powers, LAU 1, the old Czech term "okres") in the document of the Ministry of Regional Development (2013) "Strategy for Regional Development 2014–2020" (further on just "Strategy"). The regions are in two categories: Economically weak regions (Fig. 1) and Others: a) Socially disadvantaged regions (Fig. 2), b) Historical or present military areas. The economically weak regions are described as below-average using the chosen economic and social indicators. In the Strategy, all together 57 regions with 2 621 740 inhabitants (24.7% of

the Czech population) were ranked among this group. Nearly all of them are near the borders, 11 of them are lying on the borders with Germany, 12 on the borders with Poland, 4 on the borders with Slovakia, and 2 on the borders with Austria. The categorization of these territories among the economically weaker regions is based on the following indicators: Estimation of GDP, Unemployment rate, Average debt of the municipalities and their contribution-based organizations, Sum of social allowances, Balance of migration.

The socially disadvantaged regions ranked in the point 2 a) of the Strategy include places with socially excluded localities (or localities under threat of social exclusion). The socially disadvantaged regions (2.a) are quite often identical to the economically weaker regions (1.)–see Fig. 1 and Fig. 2. The socially excluded localities are spread both near the borders and inland, including the capital city. The indicator "border or inland" locality is not used, but the closeness to the border seems to be an important risk factor.

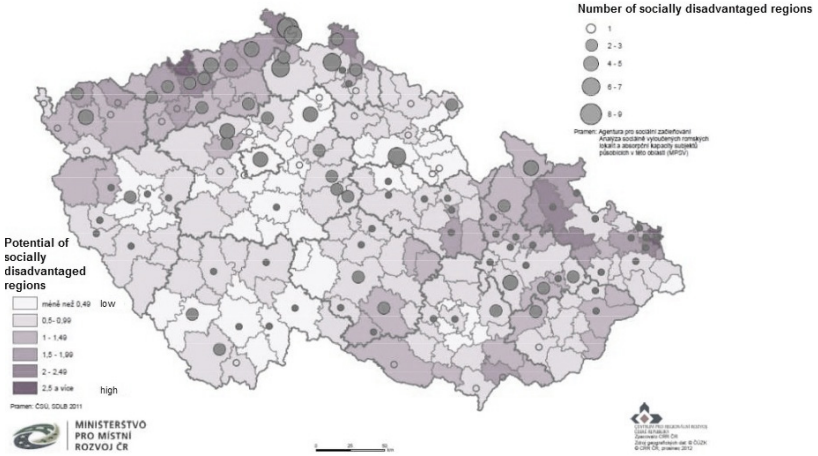
The goals of this article are as follows:

- Select and apply the most important variables, as the methodology of selection and evaluation of economically weak regions is not united. The research question 1: "Which are the most important indicators for evaluation of the economically weak border regions?"
- Using the selected components to answer research question 2: "Are the border territories economically weaker when compared with the Czech Republic average of selected indicators?"
- Find and describe homogenous clusters of the border regions with working hypothesis 1: "The economical situation of the border regions is different from each other among the border regions." and the working hypothesis 2: "The economy of the neighbouring country (Former East Germany, Former West Germany, Austria, Slovakia, Poland) impacts these disparities in border regions."

MATERIALS AND METHODS

The data were analysed using both single dimensional and multiple dimensional statistical

1: *Economically Weak Regions according to the Ministry of Regional Development in 2013*
Source: MMR (2013)



2: *Socially disadvantaged regions according to the Ministry of Regional Development in 2013*
Source: MMR (2013)

methods. The single dimensional methods were based on the exploratory analysis and contain calculations relating to location, variance, skewness, and spikiness which were used for uncovering the extreme values. The data quality was validated by the Shapiro-Wilk test. The statistical analysis may be influenced by the outlying values (Hebák *et al.*, 2005) but according to Meloun and Militký (2002) the removal of these values should not be automatic as it may impact on the validity of the data set as a whole. Even though the applied cluster analysis is extremely sensitive to the outlying values. The multiple dimensional analyses included correlation analysis, Principal Component Analysis (PCA) and Cluster Analysis (CLU). The aim of PCA method is to transform data from the original variables x_i, $i = 1, ..., m$, into a smaller number of variables and to find new variables y_j. These newly created components have more convenient properties, their number decreases, they explain almost the entire variability of the original variables and at the same time they are uncorrelated. Latent variables represent the main components and characterize linear combinations of the original variables (Meloun, 2002). These linear combinations are the principal components, which are calculated by eigenvalues and eigenvectors. In the analysis, it is common to use only the first few principal components, providing the sum of their variances is a high percentage, e.g. 80% and more of the sum of variances for all p components (Brayan, 2004). The components can be interpreted as follows: the first major component y_1 describes the largest portion of variability or scattering of the original data, the second component y_2 describes a smaller part, and the last component y_n describes the smallest portion of variables of the original variables. It can therefore be said that the components are ranked according to their importance (Meloun, 2002). The PCA was based on the correlation matrix because there were different variations and different units of measure. The Kaiser-Meyer-Olkin (KMO) value close to 0.8 are considered to be suitable. The correlation analysis and calculation of the anti-image matrix led to a reduction in the number of indicators (Hebák *et al.*, 2005). The values reported in the Main Diagonal Values (MDA) called anti-image correlation matrix (AIC) should be large (MDA $\geq$ 0.60) (Dimitrov, 2014). The PCA was used for the transformation of the original variables into fewer new variables. The new variables went through the Cluster analysis in order to classify the regions into homogeneous clusters. The aim of cluster analysis is to use the values of the variables to devise a scheme for grouping the objects into classes so the similar objects are in the same class (Brayan, 2004). The most common distance measure is Euclidean distance also called as the geometric metric, which represents the length of the rectangle of the rectangular triangle. Its calculation is based on the Pythagorean theorem. The square of Euclidean distance, which forms the basis of the Ward's clustering method, is also commonly used (Meloun, 2004). By Meloun and Militký (2002), the cluster analysis is divided into hierarchical and non-hierarchical clustering methods. The aim of hierarchical methods is to connect objects and their clusters to other larger clusters. The advantage of this method is that there is no need to know the optimal number of clusters. This number of clusters is determined additionally. For non-hierarchical clustering methods, the number of clusters is predetermined and can be changed during the calculations. These methods are divided into two basic groups: optimization methods and modal-medoids analysis. According to Martinez (2017), visualization techniques such as dendrogram (also called as tree diagram) or scatterplot for visualizing hierarchical structures are used. Tree starts at the root, which can be on top of vertical tree or left side oriented for horizontal tree. The nodes of the dendrogram represent clusters. All calculations were made using the IBM SPSS Statistics 23 software. The significance level was 0.05.

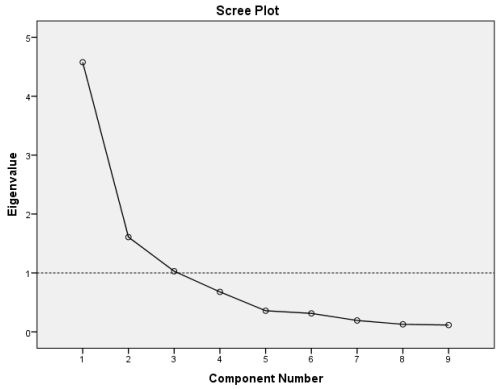
RESULTS

Even though the methodology of the "Strategy" was the starting source for this study, some of the indicators could not be used. The "Strategy" uses the indicators which are not simply available on the LAU 1 level. Especially the estimation of GDP relative to LAU 1 territories based on the information from the CZSO (Czech Statistical Office) might be inaccurate and distorted. That is why this estimation has not been taken into consideration. A new indicator Transnational commuters have been incorporated due to the focus of this study. This indicator can influence the classification of these regions as weaker regions due to the deficiencies in the labour market. The following indicators used in the statistical analysis have been chosen as a selection from other methodologies with respect to the availability of the data, logical evaluation and comparative analysis: Number of registered enterprises, Unemployment rate, Economically active population, Job vacancy rate, Population density, Migration balance, Transnational commuters, Technical infrastructure–sewage, Technical facilities in houses and households, Population aged 15 or more with at most secondary or apprentice school without GCE, Population aged 15 or more with at most secondary education with GCE, Population aged 15 or more with at most follow-up courses, Population aged 15 or more with at most tertiary professional education, Population aged 15 or more with at most higher education. The input data set containes data obtained from CZSO (2011). The prerequisite that the rank of the data matrix is higher than the number of indicators was satisfied. The indicators which are not from the Gaussian distribution were detected by the Shapiro-Wilk test of normality. The indicators which are not from the Gaussian distribution

are: Number of registered enterprises, Transnational commuters, Technical infrastructure – sewage, Job vacancy rate, Population aged 15 or more with at most secondary or apprentice school without GCE and Population density. The Exploratory Data Analysis (EDA) was carried out and the extreme and outlying values were detected. The extreme value of Population density was observed in the LAU 1 Ústí nad Labem and Teplice. This indicator contained two more extreme values so it was removed from the further analysis. Calculation of the basic data properties was applied. The lowest coefficients of variation were detected for the indicator Economically active population, 2.28%, further 5.05% for Population aged 15 or more with at most secondary or apprentice school without GCE,5.12% of Technical facilities in houses and households, and 6.41% for Population aged 15 or more with at most secondary education with GCE. These indicators probably do not account for the disparities between the regions because of their low variability. Nevertheless, they were not removed from the data set due to maintaining the completeness. It is possible to use them as constants. The data went through the correlation analysis; the degree of dependence between indicators was determined by the Spearman correlation coefficient, which was designated for the data files do not contain Gaussian distribution. On the diagonal of the inversion matrix were detected the values of Variance Inflation Factor (VIF). The values of VIF over 10 indicate high dependency between the data, i.e. multicollinearity. No values over 10 were found so that no indicators were removed due to the VIF values. The anti-image correlation matrix was constructed, i.e. the matrix of negative partial correlation coefficients, with contains measures of Kaiser-Meyer-Olkin test on the main diagonal. The more strict criterion was used for the further analysis and the following indicators with values lower than 0.649 were detected in the anti-image correlation matrix and removed from the data set: Transnational commuters, Technical infrastructure – sewage, Population aged 15 or more with at most secondary or apprentice school without GCE, and Technical facilities in houses and households. The indicator Transnational commuters were finally retained because the investigation was focused in the border regions. In the recalculated anti-image matrix the value under 0.649 was found for the indicator Economically active population and this indicator was then removed from further analysis as well. The original dataset was finally reduced from original 14 to 9 new variables used in the PCA: Number of registered enterprises, Unemployment rate, Job vacancy rate, Migration balance, Transnational commuters, Population aged 15 or more with at most secondary education with GCE, Population aged 15 or more with at most follow-up courses, Population aged 15 or more with at most tertiary professional education, Population aged 15 or more with at most higher education. The methods applied to enable to choose the variables important for the economic power of the region and make possible to compare the regions. The KMO proved that the set of indicators is applicable for the PCA. The statistic importance was proved by the Bartlett test. The PCA showed that the model can be interpreted using three variables. The three new variables (components) are able to explain 80.15% of the variance of the original variables. The number of components is depicted in the Scree-Plot diagram (Fig. 3).

The relation between the original variables and the new components are in the Principal Components Matrix (Tab. I).

The three new components can be described as follows. The first component that has arisen or the main component is able to give an explanation of 50.85% of the variability of the original variables. The first principal component correlates strongly with the: Number of registered enterprises – direct medium tightness (r = 0.604), Unemployment rate – indirect medium dependency (r = –0.737), Job vacancy rate – direct medium dependency (r = 0.709), Population aged 15 or more with at most follow-up courses – direct strong dependency (r = 0.818), Population aged 15 or more with at



3: *Scree-Plot Diagram*
Source: own

I: *Principal Component Matrix*

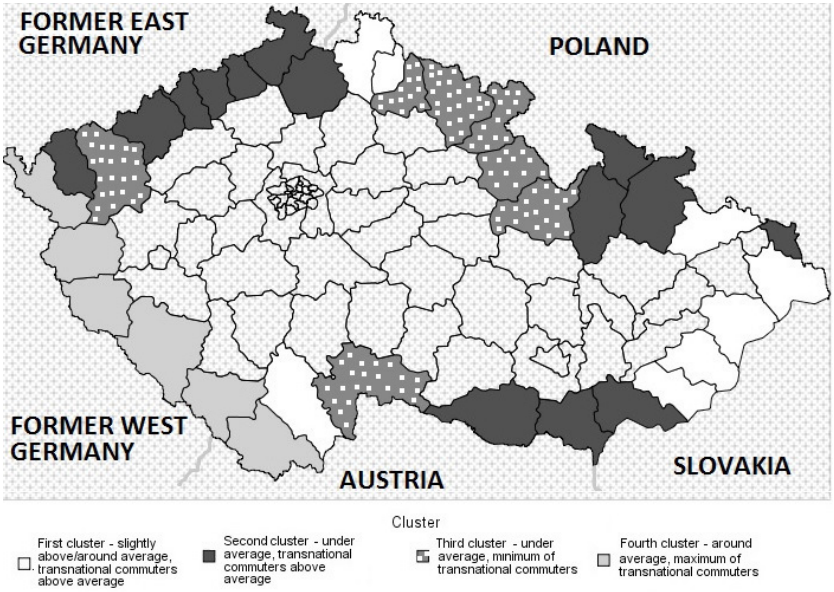
Variable	Components		
	Labour Market	Transnational commuters	Population migration
Number of registered enterprises	0.604	0.545	0.397
Transnational commuters		–0.809	0.392
Unemployment rate	–0.737	0.530	
Job vacancy rate	0.709	–0.467	
Population aged 15 or more with at most follow-up courses	0.818		–0.419
Population aged 15 or more with at most tertiary professional education	0.822		–0.392
Population aged 15 or more with at most higher education	0.830	0.332	
Population aged 15 or more with at most secondary education with GCE	0.910		
Migration balance	0.509		0.560

Source: own

most tertiary professional education – direct strong dependency (r = 0.822), Population aged 15 or more with at most higher education – direct strong dependency (r = 0.830), Population aged 15 or more with at most secondary education with GCE – direct very strong tightness (r = 0.910), Migration balance – direct medium dependency (r = 0.509). The first component has been named Labour market, according to the discovered values. This first component shows the strongest positive relation with indicators of education and the Job vacancy rate. The negative correlation is with the Unemployment rate. The first component explains the highest proportion of variability, it means the labour market may represent the most important variable to describe the variability of the analysed data. The second component named Transnational commuters is able to explain 17.87% of the original variability. There is a relation between the second component and the indicator Number of registered enterprises – direct medium tightness (r = 0.545), Transnational commuters – indirect strong dependency (r = –0.809), Unemployment rate – indirect medium dependency (r = –0.530), Job vacancy rate – indirect medium dependency (r = –0.467), Population aged 15 or more with at most higher education – direct low dependency (r = 0.332). Indicator Transnational commuters is less important in terms of describing the variability in the database. The third component named Population migration contains an explanation of 11.43% of the original variability. The relation exists between the third component and Number of registered enterprises–direct medium tightness (r = 0.397), Transnational commuters–direct medium dependency (r = 0.392), Population aged 15 or more with at most follow-up courses–indirect medium dependency (r = –0.419), Population aged 15 or more with at most tertiary professional education–indirect medium dependency (r = –0.392), Migration balance–direct medium dependency (r = 0.560). The Population migration is the least important component included in terms of describing the variability of the data. The components important for the determination of economically weak regions have been set as:

1) Principal component named Labour market with the weight 0.5085,
2) Component Transnational commuters with the weight 0.1787,
3) Component Population migration with the weight 0.1143.

The cluster analysis discovered the difference inside the group of border regions and made possible to create and characterize the clusters of regions. The assumption of the cluster analysis is the lowest possible correlation between the variables. That is why the Ward linkage method was applied. This method chooses the clusters in which the sum of squares is minimal. The section was made in the value 10 of the Euclidean distance. By this way four relatively homogenous clusters were constructed. The first cluster (Fig. 4) contains regions (LAU 1) Liberec, Frýdek Místek, Zlín, České Budějovice, Jablonec nad Nisou, Vsetín, Uherské Hradiště, and Opava. The Labour market is slightly above the average of the Czech Republic. The Unemployment rate and the Population aged 15 or more with at most follow-up courses are nearly equal to the average. In many cases the regions are close to middle sized cities and that is the reason for the lower unemployment rate in comparison with other border regions. The Number of registered enterprises, the Job vacancy rate and the Population aged 15 or more with at most secondary education with GCE are above the Czech average. The Number of persons with tertiary and higher education is below an average. The below average values of these indicators have been monitored in the all border regions. The Transnational commuters indicator is more likely above the average of the whole republic. The Migration balance showed that in the regions Liberec, Jablonec nad Nisou, and Frýdek Místek the number of persons who moved in is higher than the number of those moved out because the Number of job vacancies is there higher that in other regions. The second cluster (Fig. 4) contains regions Břeclav, Znojmo, Sokolov, Děčín, Most,



4: *Clusters of the regions in border area*
Source: own

Chomutov, Česká Lípa, Bruntál, Teplice, Hodonín, Šumperk, Karviná, Ústí nad Labem, and Jeseník. The Labour market of this group is below average. The Unemployment rate is significantly higher, the Number of registered enterprises is lower and the Number of vacant jobs is significantly below an average of the Czech Republic. Due to the bad condition of the labour market, many persons have found employment abroad and they commute regularly. The Migration balance is negative what means that the inhabitants not only commute, but also change permanently their place of residence to other regions or even countries. The exclusion has been found for the regions Břeclav, Most, and Teplice. The people are likely to move into these regions. The reason is probably low prices of estates and lower living costs. The regions Semily, Ústí nad Orlicí, Rychnov nad Kněžnou, Karlovy Vary, Trutnov, Náchod, and Jindřichův Hradec belong to the third cluster (Fig. 4). These regions are more or less under the average. In these regions there used to be an intensive textile industry, which declined in its importance nowadays. Considering the Labour market component the unemployment rate is not very high because the people can find jobs in the big cities. The Number of registered enterprises is lower and the Number of vacant jobs is slightly below the average for the Czech Republic. The educational level is slightly below an average; only the indicator Population aged 15 or more with the highest education follow-up courses is above the average. The component of Transnational commuters is below the average because the regions are on the borders with Poland, where the economic situation is not better and the wages are not higher. The inhabitants of Karlovy Vary and Jindřichův Hradec on the other hand commute abroad (to Germany and Austria) more frequently. The Migration balance is negative what means that the residents prefer moving out. The reason is higher unemployment and generally worse situation in the labour market. The last fourth cluster (Fig. 4) contains regions Klatovy, Cheb, Český Krumlov, Tachov, Prachatice, and Domažlice. The component Labour market in these border regions is more or less average. The Migration balance is slightly lower and the Number of vacant jobs is higher even though the Number of registered enterprises is low. The education level is poorer especially the number of university graduates is low. The Migration balance is negative as for the second and third clusters. The component of Transnational commuters is the highest of all because of the location close to the German and Austrian borders (research question 2).

DISCUSSION

The research was concerned with the main problems of the border regions of the Czech Republic. The goal was to select the most important indicators which are able to identify the economically weak regions (research question 1). After application of the selected indicators it was clear that there are important differences among the border regions and it was necessary to confirm both the hypotheses 1 and 2, it means there are remarkable differences among border regions and four clusters were constructed on the borders with other countries. These conclusions are in line with Leick and Lang (2018) acknowledged a growing heterogeneity among non-core regions. It follows from the data of the Ministry of Regional Development (MMR, 2013) that many border regions of the Czech Republic have economic problems (see Fig. 1). On the other

hand the places in the threat of a social exclusion are spread in the whole territory not only in the border regions (see Fig. 2). Similar problems can be seen also on other borders inside of the EU. In particular in Central and Eastern Europe, there is a risk that spatial development is further concentrated in a smaller number of regions, whereas more and more other regions might be affected by processes of peripheralisation (Lang, 2015). The peripherization have been neglected for a long time, but as Meyer *et al.* (2016) proved the peripherization leads to moving out of the home region, especially in the case of young people what makes the situation even worse. The removal of borders as barriers to the movement of people and goods is often highlighted as a rather smooth development in a "borderless Europe" inscribed in discourses of globalization and contrasted with the regime of increased control at the EU's external borders of "Fortress Europe" (Follis, 2012). Cities of the former East German-Polish border region are marked by structural problems of deindustrialization, unemployment and depopulation (Sandberg, 2016) as well as the regions of the German–Czech and Poland-Czech borders. The regional issues received in the only limited attention from the Czech policy-makers (Blažek and Uhlíř, 2007). The reasons were in relatively small regional disparities and low unemployment rate till 2008. The key problems in the weak regions of the Czech Republic defined by Blažek and Uhlíř 2007 as: deficiencies in the general business environment, underestimation of the human capital, lack of awareness of the real strengths of the regions, and lack of cooperation among relevant partners. These findings are in accordance with the results of this study.

The first cluster has the best economic results of all clusters; slightly around the average of the Czech Republic. It contains several well-functioning middle sized cities with four quite important public regional universities (MŠMT, 2015). The regional universities improve the educational level and may cause the better situation in the labour market. The Liberec and Jablonec LAUs are on the Poland borders. These regions are mountainous regions what might be a development challenge (CEC, 2008) but this factor is partially compensated by intensive tourism. Similarly, in Poland the disparities among regions even intensified in the post-socialist transition and they have not been diminished by the regional policy of the EU (Stryjakiewicz, 2017). Other regions of the cluster are on the border with Slovakia. The cross border cooperation is the strongest there because these borders did not exist before 1993 when the Czech Republic and Slovakia were in one state. The second cluster contains territories with long lasting both economic and social problems (e.g. Ústí nad Labem). There are also remote areas as Šumperk and Jeseník with poor transport connections. Only one regional public university is located in Ústí nad Labem (MŠMT, 2015) The labour market is weak and commuting abroad is sometimes the only solution for many inhabitants, especially for those with some qualification. The borders are located on the former Iron curtain and the cross border cooperation started only recently (CEC, 2008). The high unemployment rate causes moving out of the region and the remarkable decline of the prices of estates. These factors lead to even more social problems and creation of troubled localities. The third cluster is slightly below an average. Some regions are on the borders with Poland, where the commuting is not very attractive, so they have to rely on their own improvements. In 2000–2012 the employment rate in the Czech Republic was higher than in Poland, while the economic situation in the border region was below an average in both countries.(Gajdová and Tuleja, 2015; Barjak, 2001).Some industrial enterprises have been closed but there is a potential for restructuring and starting new businesses. There are some middle sized cities, but without regional public universities. The cross-border cooperation is quite important for the regions of the fourth cluster. There are many commuting people (most of all clusters) to Germany and Austria. There are also job opportunities in the tourism services. There is no regional public university. According to Geenhuizen, Knaap and Nijkamp (1996) the most significant factors of well-being in the border regions are: if the borders are inner within the EU, the type of former barrier (Iron curtain), and the regional economies on either side of the borders (innovation potential, transport level, etc.). A great deal of investment was and is targeted to the most dynamic territories. The differences on the borders are given not only by the economic strength, but by many socio-cultural determinants (Dołzbłasz and Raczyk, 2010). The EU funding of new innovative infrastructure was mainly established in the Central Bohemia Region (around Prague) and to the city of Brno, which is considered to be a part of the NUTS3 South Moravia. The region is eligible for the support even though the Brno is over the 75% GDP per capita threshold as well as Prague that is not egligible due to high GDP (Srholec and Žížalová, 2014). The substantial part of these investments are not targeted to the regions which are considered as poor (MMR, 2013). On the other hand the effective investments to the R & D must be based on a certain level of existing infrastructures, availability of qualified working, etc. The differenciation between the clusters led to important findings: the situation in the border region is highly dependent on which country is behind the borders. The reasons lie in the historical development and in the focus of the regional policy of the EU. The less problematic are the regions on the Slovak borders (the first cluster) where in fact were no borders in the period 1918–1992; both territories were parts of the Czechoslovak social republic. The existing problems are caused by the same factors as in the inner regions and the level of well-being is similar. The economically strong neighbours

bring benefits, e.g. for commuting, even though if the former borders were strict (the second and the fourth clusters). The region on the former EU eastern boundary takes the advantages, mainly from the possibility of migration of workers, cooperation in trade and services, and from EU structural funds and other common policy measures (Krätke, 2002). The cooperation across the Czech-German borders is partly motivated by a sense of opportunity and believes that the common work can be more successful than the competition. According to Johnson (2009), the Germans, especially those living on the borders, perceive the Czechs as having the same work ethic, job skills and dependability. Across the border, there are highly advanced regions of Bavaria and the Czech border regions registered a large amount of cross-border direct investments which unfortunately led to low value added activities (Žížalová, 2006). Areas of low R & D concentration are along the south-western borders with Germany and Austria (Srholec and Žížalová, 2014). It is probable result of the former Iron Curtain and of the older history connected with the resettlement of the German population from the so-called Sudetenland after the WWII. Comparing the economical structure of Czech and Austria, there is a remarkable difference in the portion of SME's: 99% of all companies in Austria and about 50% in the Czech Republic (Novotný *et al.*, 2016). The lack of SME's is especially important in the places with geographical disadvantage. The abolition of borders with EU15 has a negative impact on the economic performance and the border regions have little potential for preserving their economic performance (Topaloglou *et al.*, 2005). The Poland-Czech borderland is determined by mountainous terrain with protected areas. By Dołzbłasz and Raczyk (2015), the mountain may become a significant barrier to cooperation (transport problems) but it is at the same time an impulse to cooperate in the tourism. Our results are in line with Dołzbłasz and Raczyk (2015) who stated that the regions on the both sides of the Poland-Czech borders are in similar situations in many aspects. So for the third cluster regions, there is no rich neighbour to buck up the economical situation. Two of three resp. four economically weak regions identified by Churski and Dominiak (2014) in Poland (both in the investigation from 2002 and 2009) are in the Czech-Poland borders. It follows, that the weak regions are on the both sides of the borders and the reasons are deep and long lasting. Topaloglou et al (2005) stated that these regions seem to remain in a situation of economic isolation. There are three regions on the Poland border belonging to the less problematic firts cluster. All these regions Liberec, Jablonec, and Opava have strong regional center with industrial capacities and local universities. The same situation is in the neighbouring regions of Liberec and Jablonec in Poland which were characterized by Barjak (2001) as region with average economic capability, human capital stock and technical progress.

CONCLUSION

The main goal of the study was to find the most important variables which would be able to divide the border regions into the homogeneous clusters. The fourteen original variables were reduced using correlation analysis and anti-image matrix into the nine variables. The principal component analysis, then transferred these variables into the three components: Labour market, Transnational commuters and Population migration, while the most important is the component Labour market. This component includes primarly variables such as number of registered enterprises, unemployment rate, job vacancy rate, age and educational structures. Using selected components four clusters of regions were constructed while the most important differentiation factor was detected as the neighbouring country. It was detected that the group of border regions is not united and needs an individual approach. The economical situation of the border regions is different from each other among the border LAU 1 regions and these differences are affected mainly by the neighbouring country (Former East Germany, Former West Germany, Austria, Slovakia, Poland). The four cluster have been identified as follows:

First cluster: Mainly on Slovak borders + 3 industrialized regions on Poland borders, Second cluster: Mainly on the borders with Austria and former East Germany + Poland, Third cluster: Borders with Poland (with one exception), Fourth cluster: Border with former West Germany (one with Austria close to German borders). Based on these results the working hypotheses 1 and 2 were confirmed. The discovered disparities can be used for better allocation of the state and European support. The most important indicators are correlated with the labour market, but not only with the unemployment rate. As the border regions are not united in the planning and policy, the measures should be individualized. Many indicators important for the definition of the economically weak regions are found out only once in ten years in the census. The variables connected with the job vacancies, migration, and commuting are highly dynamic. The annual surveys focused on selected variables in the border regions would be helpful. The average values calculated for several years will be then more reliable than the census values. The local policy makers should be involved in getting relevant data and providing information on the consequences and local perceptions. According to the results it can be recommended to collect the data yearly on the following indicators: structure of

education according to age, job vacancy rate, population migration and transnational commuters. The goal of the further research might be the development of a methodology of collecting data and calculations designed especially for the border regions. The goals, their measures, and criteria should be more properly defined. Coordination with neighbouring countries could bring even deeper insight into the problems and their evolution. The border regions should be recognized as an opportunity which allows new approaches and alternative solutions.

Acknowledgements

The paper was elaborated in frame of solution of the research intention Methodological Approaches to Identify Economically Weak Regions in The Border Areas of The Czech Republic. The authors gratefully acknowledge the support from the Faculty of Economic and Management, Czech University of Life Sciences, via IGA grant (Project No. 20151035).

REFERENCES

BARJAK, F. 2001. Regional Disparities in Transition Economies: A Typology for East Germany and Poland. *Post-Communist Economies*, 13(3): 289–311.

BAUMGARTNER, D., PÜTZ, M. and SEIDL, I. 2013. What kind of entrepreneurship drives regional development in European non-core regions? A literature review on empirical entrepreneurship research. *European Planning Studies*, 21(8): 1095–1127.

BECKER, S. O., EGGER, P. H. and EHRLICH, M. 2010. Going NUTS: the effect of EU structural funds on regional performance. *Journal of Public Economics*, 94(9): 578–590.

BECKER, S. O., EGGER, P. H. and EHRLICH, M. 2012. Too much of a good thing? On the growth effects of the EU's regional policy. *European Economic Review*, 56(4): 648–668.

BLAŽEK, J. and UHLÍŘ, D. 2007. Regional innovation policies in the Czech Republic and the case of Prague: An emerging role of a regional level? *European Planning Studies*, 15(7): 871–888.

MANLY, B. F. J. 2004. *Multivariate Statistical Methods: A primer*. 3rd Edition. London: Chapman and Hall/CRC Press.

COMMISSION OF THE EUROPEAN COMMUNITIES. 2008. *Green Paper on Territorial Cohesion, Turning territorial diversity into strength.* [Online]. Available at: http://ec.europa.eu/regional_policy/archive/consultation/terco/paper_terco_en.pdf [Accessed: 2015, October 2].

CZSO. 2011. *Czech statistical office*. [Online]. Available at: https://www.czso.cz/ [Accessed: 2016, June 4].

CZSO. 2015. Podíl nezaměstnaných na obyvatelstvu podle okresů České republiky k 30. 9. 2015. Český statistický úřad. [Online]. Available at: https://www.czso.cz/csu/xl/151008nezamestnanost-v-libereckem-kraji-k-30-9-2015 [Accessed: 2015, October 2].

DOŁZBŁASZ, S. and RACZYK, A. 2015. Different Bordera – Different Cooperation? Transborder Cooperation in Poland. *Geographical Review*, 105(3): 360–376.

DOŁZBŁASZ, S. and RACZYK, A. 2010. The Role of the Integrating Factor in the Shaping of Trasborder Cooperation: The Case of Poland. *Questiones Geographicae*, 29(4): 65–73.

DIMITROV, D. M. 2014. *Statistical methods for validation of assessment scale data in counseling and related fields*. Alexandria, VA: American Counseling Association.

EUROPEAN COMMISSION. 2007. *Cohesion Policy 2007–13:Commentaries and Official Texts, Luxembourg Office for Official Publications of the European Communities.* [Online]. Available at: http://ec.europa.eu/regional_policy/sources/docoffic/official/regulation/pdf/2007/publications/guide2007_en.pdf [Accessed: 2017, February 15].

EUROPEAN COMMISSION. 2010. *Europe 2020.* [Online]. Available at: http://ec.europa.eu/europe2020/index_en.htm [Accessed: 2016, September 20].

EUROPEAN COMMISSION. 2014. *Cohesion Policy and the Czech Republic*. [Online]. Available at: http://ec.europa.eu/regional_policy/index.cfm/en/information/publications/factsheets/2014/cohesion-policy-and-the-czech-republic [Accessed: 2016, October 5].

EUROSTAT 2014. *Europe 2020 indicators - poverty and social exclusion.* [Online]. Available at: http://ec.europa.eu/eurostat/statistics-explained/index.php/Europe_2020_indicators_-_poverty_and_social_exclusion#Which_groups_are_at_greater_risk_of_poverty_or_social_exclusion.3 [Accessed: 2016, September 6].

FOLLIS, K. S. 2012. *Building Fortress Europe: The Polish-Ukrainian Frontier.* Philadelphia: University of Pennsylvania Press.

GAJDOVÁ, K. and TULEJA, P. 2015. Analysis of the Economically Active Population in the Czech-Polish Border Regions. *International Journal of Information and Education Technology*, 5(3): 237-241.

GEENHUIZEN, M. V., KNAAP, B. V. D. and NIJKAMP, P. 1996. Trans-border European networking: Shifts in corporate strategy? *European Planning Studies*, 4(6): 671–682.

HASSINK, R., DANKBAAR, B. and CORVERS, F. 1994. *Cross-border technology networks in border regions? The case of the Euroregion Maas-Rhine*. MERIT Research Memorandum 2/94-018. [Online]. Available at: http://collections.unu.edu/eserv/UNU:999/rm1994-018.pdf [Accessed: 2016, September 20].

HEBÁK, P., HUSTOPECKÝ, J. and MALÁ, I. 2005. *Vícerozměrné statistické metody (2)*. Prague: Informatorium.
CHURSKI, P. and DOMINIAK, J. 2014. The impact of innovations on growth and stagnation regions in Poland. *European Planning Studies*, 22(6): 1143–1164.
JOHNSON, C. M. 2009. Cross-border regions and territorial restructuring in central Europe room for more transboundary SPACE. *European Urban and Regional Studies*, 16(2): 177–191.
KNĚZÁČKOVÁ, R. and PICHOVÁ, S. 2014. Comparison of economic development of regions in the Czech Republic, taking into account the impact of the economic crisis. In: *Meeting of Proceedings of the Multidisciplinary Academic Conference*. Prague: MAC Prague consulting Ltd.
KNIPPSCHILD, R. 2011. Cross-border spatial planning: Understanding, designing and managing cooperation processes in the German–Polish–Czech Borderland. *European Planning Studies*, 19(4): 629–645.
KRÄTKE, S. 2002. The regional impact of EU Eastern enlargement: A view from Germany. *European Planning Studies*, 10(5): 651–664.
KVETON, V., LOUDA, J., SLAVIK, J. AND PELUCHA, M. 2014. Contribution of Local Agenda 21 to practical implementation of sustainable development: the case of the Czech Republic. *European Planning Studies*, 22(3), 515–536.
LEICK, B. and LANG, T. 2018. Re-thinking non-core regions: planning strategies and practices beyond growth. *European Planning Studies,* 26(2): 213–228.
LANG, T. 2015. Socio-economic and political responses to regional polarisation and socio-spatial peripheralisation in Central and Eastern Europe: a research agenda. *Hungarian Geographical Bulletin*, 64(3): 171–185.
MEYER, F., MIGGELBRINK, J. and SCHWARZENBERG, T. 2016. Reflecting on the margins: socio-spatial stigmatisation among adolescents in a peripheralised region. *Comparative Population Studies-Zeitschrift für Bevölkerungswissenschaft*, 41(3–4): 285–320.
MARTIN, P. 1999. Public policies, regional inequalities and growth. *Journal of public economics*, 79: 85–105.
MARTINEZ, W. L., MARTINEZ, A. R. and SOLKA, J. 2017. *Exploratory Data Analysis with MATLAB*. 3rd Edition. London: Chapman and Hall/CRC Press.
MELOUN, M. and MILITKÝ, J. 2002. *Kompendium statistického zpracování dat*. Prague: Academia.
MMR. 2013. *Strategie regionálního rozvoje ČR 2014-2020*. [Online]. Available at: http://www.mmr.cz/getmedia/08e2e8d8-4c18-4e15-a7e2-0fa481336016/SRR-2014-2020.pdf?ext=.pdf [Accessed: 2017, April 3].
MŠMT. 2015. *Přehled vysokých škol v ČR*. [Online]. Available at: http://www.msmt.cz/vzdelavani/vysoke-skolstvi/prehled-vysokych-skol-v-cr-3?highlightWords=seznam+vysok%C3%BDch+%C5%A1kol [Accessed: 2016, April 3].
NEVIMA, J. and RAMÍK, J. 2009. Application of multicriteria decision making for evaluation of regional competitiveness. In: *Proceedings of the 27th international conference Mathematical methods in economics*. Opava: Silesian University, pp. 239–344.
NOVOTNÝ, J., BLAŽEK, J. and KVĚTOŇ, V. 2016. The anatomy of difference: comprehending the evolutionary dynamics of economic and spatial structure in the Austrian and Czech economies. *European Planning Studies*, 24(4): 788–808.
OECD. 2015. *How's Life? Measuring Well-being*. Paris: OECD Publishing.
PERKMANN, M., and SUM, N. L. 2002. *Globalization, regionalization and cross-border regions: scales, discourses and governance.* Bas-ingstoke: Palgrave Macmillan.
RAMÍK, J. and HANČLOVÁ, J. 2012. Multicriteria methods for evaluating competitiveness of regions in V4 countries. In: TRZASKALIK, T. and WACHOWICZ, T. (Eds.). *Multiple Criteria Decision Making ´12*. University of Economics in Katowice, pp. 169-178. [Online]. Available at: http://mcdm.ue.katowice.pl/files/mcdm12.pdf#page=169 [Accessed: 2016, June 3].
SANDBERG, M. 2016. Restructuring locality: practice, identity and place-making on the German-Polish border. *Identities*, 23(1): 66–83.
STRYJAKIEWICZ, T., KUDŁAK, R., CIESIÓŁKA, P. et. al. 2017. Urban regeneration in Poland's non-core regions [Special issue]. *European Planning Studies*, 26(2): 316—341.
ŠIPIKAL, M., PISÁR, P. and LABUDOVÁ, V. 2013. Are subsidies really needed? The case of EU regional policy in the Czech and Slovak Republics. *E+M Ekonomie a Management*, 16(4): 30–41.
SRHOLEC, M. and ŽÍŽALOVÁ, P. 2014. Mapping the Geography of R&D: What Can We Learn for Regional Innovation Policy in the Czech Republic and Beyond?. *European planning studies*, 22(9): 1862–1878.
TOPALOGLOU, L., KALLIORAS, D., MANETOS, P. and PETRAKOS, G. 2005. Towards a border region typology in the enlarged EU. *Discussion Paper Series*, 11(16): 303–330.
VITURKA, M. 2014. Integrative model for evaluation of development potentials of regions and its application on an example of the Czech Republic. *E+M Ekonomie a Management*, 17(4): 4–19.
ZEGRAS, P. C., PODUJE, I., FOUTZ, W., BEN-JOSEPH, E. and FIGUEROA, O. 2004. Indicators for sustainable urban development. In: *From understanding to action*. Springer Netherlands, pp. 157–189.
ZENG, D. Z. and ZHAO, L. 2010. Globalization, interregional and international inequalities. *Journal of Urban Economics*, 67(3): 352–361.

ŽÍŽALOVÁ, P. 2006. Foreign direct investment in the Czech Republic. [in Czech: Přímé zahraniční investice v Česku]. *Geografie – Sborník* ČGS, 111(2): 186–197.

Contact information

Jitka Svobodová: svobodovaj@pef.czu.cz
Ludmila Dömeová: domeova@pef.czu.cz
Andrea Jindrová: jindrova@pef.czu.cz