ORIGINAL ARTICLE

Contact to corresponding author: roman.vavrek@vsb.cz; VŠB – Technical University of Ostrava, Faculty of Economics, Department of Public Economics, Sokolská třída 33, 702 00 Ostrava, Czech Republic

Roman Vavrek
VŠB – Technical University of Ostrava, Czech Republic
 orcid.org/0000-0002-6047-9434

Eva Kovářová
VŠB – Technical University of Ostrava, Czech Republic
 orcid.org/0000-0002-1548-6889

Assessment of the social exclusion at the regional level using multi-criteria approach: evidence from the Czech Republic

Abstract

Research background: Social services are the main social tool used for the prevention and solution of social exclusion and its risk. Services of social prevention are focused on the well-being of the whole society and they prevent it from the influence of a wide range of socio-economic phenomena related to social exclusion, understood in multidimensional terms.

Purpose of the article: The purpose of the paper is to evaluate districts of the Czech Republic with respect to selected socio-economic factors that lead or can lead to social exclusion, when the emphasis is placed on the exclusion of children and youth, and to identify the causes of differences existing among these districts within the period of years 2011–2016.

Methods: The paper focuses on multi-criterial assessment of districts of the Czech Republic using 23 indicators covering main aspects of social exclusion, which are processed with the Technique of Order Preference Similarity to the Ideal Solution (TOPSIS technique) in combination with the Coefficient of Variance method used to determine the indicators' weight. The results obtained using these methods are completed by the Moran's index, Shapiro-Wilk test, Mann-Whitney test, Kolmogorov-Smirnov test, Kendall Rank Coefficient and Levene's test.

Findings & value added: A small number of districts with very negative assessment, with the presence of social exclusion and its higher risk, respectively, are identified. Differences among regions are constant and could not be assigned to randomness or disposable changes in the structure of indicators. Higher number of children born to unmarried mothers can be considered

a typical aspect of the districts with higher risk of the social exclusion. The methods applied in the research, whose results and findings are presented in the paper, can be inspiring to further studies focusing on the social exclusion in its multidimensionality. The research is framed with the European Union discourse of social exclusion, thus the presented findings also open space for the comparisons and discussions of the factors associated with the social exclusion in other European Union Member States.

Introduction

Since the 1990s, social inclusion, elimination of the social exclusion and its risk, respectively, have been a key priority for the European Union (EU) and thus for its Member States. The Czech Republic has followed social targets related to those framed at the EU level since its entrance to the EU in the year 2004. National social policy programmes aim to achieve social cohesion, full employment and social inclusion of those individuals who suffer from social exclusion in boarder terms. However, social exclusion is not such an important problem for the Czech society as for other EU Member States, if the EU methodology is followed (Eurostat, 2019). In the year 2019, 1.306 million individuals, it means 12.5% of Czech population, lived at risk of poverty or social exclusion. It was the lowest percentage rate among all 28 EU Member States and this rate meant fulfilment of the national targets concerning reduction of the risks of both social events. Despite this optimistic result, social exclusion remains a challenge for the Czech policy-makers, because the number of people living in the conditions of income poverty has oscillated since the year 2008 around 1 million, which means in relative terms around 9–10% of the whole population. If low or insufficient incomes are seen as the most important cause of social exclusion, then it is evident that the primary cause of social exclusion has not been eliminated in the Czech society.

Numerous English-written studies have analysed factors or causes of social exclusion so far, but they were not primarily focused on the socio-economic situation in the districts of the Czech Republic. However, social exclusion is an inspiring topic to the Czech scientists as well. In their research studies, they paid great attention to the theoretical and thematic anchor of the social exclusion concept (Sirovátka *et al*., 2005; Mareš & Sirovátka, 2008; Keller, 2014) and to its main consequences at the local level (Mareš *et al*., 2008); or they dealt with this topic in relation to the supply of social services (Víšek & Průša, 2012), existence of inner peripheries (Bareš, 2006; Mertl, 2007; Musil & Müller, 2008; Bernard & Šimon, 2017) or responsibilities of public authorities (Trbola *et al*., 2015). However, no study has been focused yet on identification of the regions and districts where social exclusion of children and youth exists, or where its risk is

higher than in other territories. Thematising of the social exclusion of children and youth is an up-to-date issue for the Czech policy-makers as well. In the Czech Republic, patterns of social exclusion are multiplied and transferred between generations if any interference, for example in the form of social prevention services, is not made. Therefore, we aim to fill in the research gap with the analysis focused on the assessment of Czech regions and districts with respect to specified socio-economic factors leading or capable of leading to the social exclusion of children and youth. We want to identify, using the methods of multi-criterial assessment, not only the existence of social exclusion of children and youth there, but also to explain why differences among Czech regions and districts existed within the period of years 2011–2016. We want to find as well whether any specific socio-economic phenomena were associated with the regions and districts affected by social exclusion within the observed period of time.

The aim of the paper is to evaluate districts of the Czech Republic with respect to selected socio-economic factors that lead or can lead to social exclusion, when the emphasis is placed on exclusion of children and youth, and to identify the causes of differences existing among these districts within the period of years 2011–2016.

To meet this aim, we divide out paper into four chapters. The first chapter briefly introduces the theoretical concepts of social exclusion. The second chapter introduces the methodology. Attention is paid there to statistical indicators that cover the multi-dimensional causes of social exclusion, characteristics of the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), which is the main analytical technique we used to process the data, and calculation of weights using the Coefficient of Variance method (CV). The third chapter assesses regions and districts of the Czech Republic and interprets the differences existing among them with respect to the presence of social exclusion and its risk. Attention is also paid to identification of the indicators typical for regions and districts affected by social exclusion. The last chapter discusses and concludes the findings resulting from the analysis.

Theoretical overview

As a theoretical concept, social exclusion is related and at the same time differentiated from poverty. In general, poverty is seen as a situation of material deprivation individuals face. Poverty is usually defined as the systematic failure in the distribution of wealth, or behavioural failure of those who fail to acquire it. It is concerned with distributive issues and focuses on

a state of disadvantage (Dean & Platt, 2016). Poverty as a concept is primarily connected with income and expenditure (Room, 1995). Being poor means being identified as an individual lacking material asset (Estivill, 2003). The concept of social exclusion refers to poverty, but pays attention to the processes by which poverty or disadvantage occur. If poverty is viewed as the absence, lack or denial of advantage (Dean & Platt, 2016), then social exclusion is understood as the multidimensional disadvantage (Room, 1995).

Social exclusion is considered a concept covering a remarkably wide range of social and economic problems (Sen, 2000), because individuals may be excluded from a livelihood; secure, permanent employment; earning; property, credit or land; housing; the minimal or prevailing consumption level; education, skills and cultural capital; the benefits provided by participation in democratic process; public goods; the nation or the dominant race; the family and sociability; humane treatment, respect, personal fulfilment, understanding (Silver, 1994). Being socially excluded means suffering from a combination of linked problems such as unemployment, poor skills, low incomes, poor housing, high crime environment, bad health and family breakdown (Social Exclusion Unit, 2001); not being able to participate in basic social activities (Chakravarty & DˈAmbrosio, 2006).

Conceptually, social exclusion can affect individuals (Abello *et al*., 2016) or whole communities or localities (Barnes *et al*., 2009; Harding *et al*., 2009). Social exclusion is usually interpreted in terms of its multidimensional, dynamic and relational (Room, 1995) or collective (Milar, 2007) nature. At individual level, exclusion is related to dissatisfaction or unease felt by individuals who face situations in which they cannot achieve their objectives (Estivill, 2003). However, social exclusion is not only about individual living, but also about the collective resources (or lack of them) in the neighbourhood or community where they live (Milar, 2007).

Understanding the causes of social exclusion is critical for policymakers. If the causes of social exclusion are examined, it is useful to pay attention to the specific role of social and economic phenomena that may be particularly associated with the occurrence of an excluded population (Sen, 2000) or that are able to threaten or disturb the cohesion of a society and indicate the rate of social exclusion (Bareš, 2006). Since the 1990s, the European discourse of social exclusion has been based on Silver (1994) and Levitas (1998) approaches. Therefore, at the EU Member States level, programmes of the social policies focused on reduction and elimination of the social exclusion are framed within three political discourses. It means that social exclusion is seen as the consequence of the labour market exclusion, unequal distribution of resources and behaviour of social excluded individ-

uals. The full picture of social exclusion can be thus revealed using the assessment of the existence of the combination of linked socio-economic problems that affect well-being of individuals, communities or localities and can be considered the factors or causes of social exclusion. These socio-economic problems are usually covered by standard statistical indicators.

Víšek and Průša (2012) define, in the conditions of the Czech Republic and planning of the services of social prevention, the list of indicators, whose worse values in a region in comparison to other regions can indicate threats for the social cohesion and inclusivity of a region, as follows: gross domestic product per inhabitant, rate of unemployment, long-term unemployment, mean incomes of employees, rate of illness, families receiving social benefits, number of children leaving with lone parent, early school leavers.

McCrystal *et al.* (2001) introduce, in relation to the research of social exclusion of children and youth in the United Kingdom, the factors of social exclusion similarly to Víšek and Průša (2012), when they deal with the unemployment, dependence on state benefits, debts, poor health, low educational achievement or loss of primary education, poor local authorities' services, poor community resources, poor housing, poor public transport or high levels of crime.

Oroyemi *et al.* (2009), focusing on social exclusion of the British families, find out that social exclusion can happen when people or areas suffered from a combination of linked problems, such as unemployment, discrimination, poor skills, low incomes, poor housing, high crime and family breakdown.

Research methodology

The aim of the paper is to evaluate districts of the Czech Republic with respect to selected socio-economic factors that lead or can lead to social exclusion, when the emphasis was placed on the exclusion of children and youth, and to identify the causes of differences existing among these districts within the period of years 2011–2016. The research dealt with the latest available data focusing on the selected factors affecting social exclusion of children and youth. The methodology of the research is described in three parts, when the attention is paid to the identification of the set of used statistical indicators first, then the TOPSIS technique as the main method of the multi-criterial assessment is characterized briefly, and finally weights for the TOPSIS technique are calculated using the CV method.

Set of the used indicators

Evaluation of the presence of social exclusion and its risk is based on the set of 23 statistical indicators which, in our opinion, allow to assess the complexly socio-economic situation in individual districts of the Czech Republic. The set is defined in the context of the above-introduced theoretical background. The set of used statistical indicators consists of two parts. The first part includes seven indicators that are defined at the regional level (NUT3 level). Therefore, we suppose that the indicators have the same values for all districts lying in one region (see Table 1). The second part includes 16 indicators followed at the level of districts (LAU1 level). The structure of the indicators is described in Table 2.

We used two main methods to process the data: the CV-TOPSIS technique, and Moran's index. The results obtained using these methods are completed by other mathematical and statistical methods, like the moment statistics, Shapiro-Wilk test, Mann-Whitney test, Kolmogorov-Smirnov test, Kendall Rank Coefficient and Levine's test. Dataset is taken from the public databases of the Czech Statistical Office (2019), and two Czech ministry offices — the Ministry of Education, Youth and Sports (2019) and the Ministry of Labour and Social Affairs (2019). All analyses and data processing are realized in the space of MS Excel, Statistica 13.4 and Statgraphics XVIII.

CV-TOPSIS technique as the main method of assessment

According to Zavadskas *et al*. (2014), TOPSIS is one of the frequently used MCDM methods (Multi Criteria Decision Making) that origins are referred to Yoon (1980), Hwang and Yoon (1981) who created this technique as an alternative to the method of ELECTRE. Zeleny (1975), Streimikiene *et al.* (2012) describe results of the TOPSIS technique as the shortest distance to the positive ideal solution (PIS) calculated with the use of the Euclidean distance. TOPSIS technique brings solution that is with respect to defined assumptions the closed one to the PIS, and at the same time the furthest one from the negative ideal solution (NIS) (Olson, 2004; Zavadskas *et al*., 2016). Its application can be found in the evaluation of poverty and social exclusion (Balcerzak & Pietrzak, 2017), or the evaluation of local accessibility of the homes for seniors (Vaňková & Vavrek, 2020). For other applications see also Pietrzak (2016), or Balcerzak (2020). TOPSIS technique is calculated further according to Vavrek (2019).

Determination of the indicators' weights is an important step in the application of the MCDM methods. Keršuliene *et al.* (2010) recognize four

groups of the methods how the weights can be determined. They are subjective, expert, objective and integrated (based on previous approaches combination) methods. The subjective methods reflect the personality of a decision-maker and their own preferences. The expert methods are solved by Kendall (1970), Fisher and Yates (1963). The objective methods define weights with respect to in-advance-defined mathematical model that is unique for each method and without the impact of a decision-maker on the results. The CRITIC (CRiteria Importance Through Intercriteria Correlation), MW (Mean Weight), SD (Standard Deviation), SVP (Statistical Variance Procedure) can be considered objective methods for the determination of weights. We use the method of the CV (Coefficient of Variance) calculated according to Singla *et al*. (2017) and Yalcin and Unlu (2018), when this approach was also used by Vavrek and Bečica (2020).

Weights of individual indicators according to the CV method

The Coefficient of Variance is a method applied to determine weights of indicators without the subjective influence of a decision-maker. These weights are then used in the TOPSIS technique calculations done with the aim to assess the socio-economic situation in the Czech regions and districts with respect to all followed statistical indicators (socio-economic criteria).

The criterion K3 — annual net disposable income of households per capita (in thousand CZK) is identified as the criterion with the lowest fluctuations from the set of regional criteria. Its weight oscillated around the value of 0.0569 with minimal standard deviation ($s_{K3} < 0.001$). The criterion K4 (number of users of low-threshold facilities for children and youth per 1 000 inhabitants) is the opposite case because it has very high differences in determined weights if the year 2012 is compared with the year 2011 or year 2016. Proportionality of the determined weights for individual regions of the Czech Republic are shown in Figure 1.

Based on the introduced graphical comparison, the criterion K4 mainly affects the heterogeneity of the regions' assessment, while minimal differences among regions can be expected in the assessment based on the criteria K5, K6 and K7. Two criteria O14 (number of inhabitants receiving pensions per 1 000 inhabitants) and O15 (average pension per capita per month in thousand CZK) are identified as the criteria with very low fluctuations of weights within the observed period of time. It can be documented with the use of the coefficient of variation that does not exceed 2% in both cases. The biggest differences are identified for two other criteria — O6 (number

of children born at least as the fourth child in a family per 1,000 inhabitants) and O13 (number of divorces per 1 000 inhabitants).

We can expect that the biggest differences among the districts will be identified, based on the graphical comparison of the criteria's weights in Figure 2, when the criterion O8 (average number of inhabitants with sickness insurance per 1 000 inhabitants) is followed, especially in the years 2012 and 2013. The criterion O14 (number of inhabitants receiving pensions per 1 000 inhabitants) reveals the smallest differences. This is also the criterion with the lowest variability within the observed period of time.

Results

With respect to the absolute values of the assessment results that are obtained using the CV-TOPSIS, we find out negative skewness, existence of graphically identified outliers and also balanced rate of variability $v_{ci} \in \langle 14.81\%; 16.90\% \rangle$. It means that the homoscedasticity of results (LE = 0.803; p = 0.548) is identified. The results for the year 2012, which is the year with the worst assessment, differ significantly in statistical terms from the results for the years 2011 and 2016. It means the years in which the highest relative distances to PIS alternative are reached (Q = 25.728; p < 0.01). It allows us to claim that the risk of social exclusion changes over time. We confirm that time is statistically significant in our analysis. Therefore, it is necessary to consider time factor in the interpretation of the founded results (see Figure 3).

When we compare distribution function of the founded results (Table 3), we ascertain statistically significant differences especially to the results for the year 2012, for which the structure of results differs from other years. Among fifteen compared pairs of the results, seven differentiate statistically, and the major part of these differences can be assigned to the results obtained for the year 2012.

The best structure of the founded results within the whole observed period of time is identified for two years — 2014 and 2015. Both years have similar structure of the results to other years (except the year 2012). We use Figure 4 to illustrate these differences. The figure presents the results for the years 2012 and 2014, and thus reveals differences in the relative distribution. Differences between these two years are seen especially in the number of districts with better overall assessment (Figure 4).

With respect to the above-presented results, we can claim that assessments vary within the observed period of years 2011–2016. Differences are seen from the perspective of the moment characteristics of these results.

However, in our opinion, we cannot identify any time trend in the results' changes.

Comparison of the results at the level of individual regions

Changes at the level of the whole Czech Republic differentiate statistically, which reveals changes in the values of statistical indicators observed for individual districts and regions. We expect that these differences have an impact on the overall assessment of the districts/regions and their position on a scale created with respect to the assessment. Differences in regions' assessment within the observed period of time (years 2011–2016) are presented in Figure 5, which enables to identify differences in the results obtained using the CV-TOPSIS technique. We find out that they are not statistically significant (LE = 0.170; p = 0.976; Q = 7.264; p = 0.972). It means that from the perspective of the regions' assessment, time factor is not significant and is not accompanied by the changes in regions' assessment.

Therefore, we claim that the assessment of the selected aspects of social exclusion is constant over time. Changes in mean values of individual regions' results do not occur, and thus no improvement or deterioration is seen, and also time changes in differences among them are identified. These findings confirm that regions' assessment differentiates significantly within the whole observed period (Q = 70.202; p < 0.01), and at the same time it is homogenous. Except the Karlovy Vary Region, the variability expressed by the coefficient of variation (v_{410} = 11.63%). Differences among regions, in terms of the presence of social exclusion and its risk, are observed within the whole period. Therefore, we cannot assign them to randomness or disposable changes in the structure of the used statistical indicators (Figure 6).

However, the above-presented results cannot be understood only as the set of values. In our opinion, it is necessary to pay attention to the development of social exclusion risk over time, too. From this perspective, the risk of social exclusion has been increased in recent years especially in the Usti Region. On the contrary, socio-economic conditions have been improved in five regions — Central Bohemia, Plzen Region and other three regions. We claim that the risk of social exclusion of children and youth is lower there than in other regions (Table 4).

We assess individual regions with respect not only to the absolute values of their results, but we compare them with other regions' values (Figure 7). However, this analysis confirms above-presented findings concerning differences existing among regions. Zero rate of variability in regions' posi-

tion means that the same position on the scale for the whole observed peri-od is identified for the Usti Region. Minimal changes (shift by one posi-tion) are identified for four regions (Central Bohemia, Hradec Kralove Re-gion, South Moravia and Moravia-Silesia). On the contrary, the biggest shift in regions' positions is identified for the South Bohemian Region that shifted on a scale based on regions' assessment between 7th and 12th posi-tion.

Absolute year-over-year changes in the values of the regions' results are presented in Table 5. Next, Table 6 shows that the improvement or deterio-ration in absolute values of the results obtained using the CV-TOPSIS technique does not have to lead to automatic changes in regions' positions on the scale. This finding confirms that the results of an individual region have to be evaluated in the context of the results of other regions, and that the extent of a change has to be considered as well. We consider the Hradec Kralove Region a good example, because its results have had a positive trend since the year 2012, but this positive trend has not been accompanied to the shifts on a scale. This region has been the fifth best since the year 2012, which means it has the fifth lowest risk of social exclusion.

On the contrary, we identify the statistically significant linear correla-tion between the absolute results of the regions' assessment and the re-gions' position on a scale based on this assessment for all observed years. It means that the shortening relative distance to PIS is accompanied by the increasing position of a region on the regions' scale (Table 6). These find-ings confirm that only the changes in a region's assessment lead to a shift on the scale. This shift is caused directly by the results of a region or results of other regions.

Comparison of the results at the level of individual districts

Comparison of the results obtained using the CV-TOPSIS technique at the level of individual districts confirms overall results described above (Figure 5). These results do not change over time, which means that no changes for all observed years are identified (Figure 8). The results of the individual districts differentiate significantly, while changes are visible not only in the shift of the mean value, ($Q = 404.855$; $p < 0.01$), but also in their variability ($LE = 1.564$; $p < 0.01$).

We identify the smallest shifts in districts' positions for two districts — Most and Teplice (both lying in the Usti Region). The most significant shifts are identified for three districts of the South Bohemian Region — districts of Prachatice, Jindrichuv Hradec and Ceske Budejovice. For all these districts, we find out shifts over 30 positions, in terms of a difference

between the best and worst positions of the districts on a scale based on assessment of the presence of social exclusion and its risk, when the whole scale has 77 items.

Differences in districts' assessment using the CV-TOPSIS technique are statistically significant (Figure 9), which confirms the fact that the risk of social exclusion has long persisted in some districts, and vice versa, in some districts' the risk of social exclusion has been lower than in other districts (Table 7).

Table 8 shows that because of the relatively high number of observations (77 districts), for all observed years we identify negative and perfect rank correlation between the districts' assessment and their positions on a scale based on this assessment. It means that improving assessment is accompanied by adequate shifts on the scale, and vice versa (Table 8).

Identification of the causes of selected districts positions

This part of our analysis is devoted to 20 districts lying in the lower quartile defined with respect to the absolute results obtained using the CV-TOPSIS technique. We focus on identification of the social-economic phenomena that are typical for this group of districts. It means that we want to find out if the districts with the worst assessment have some socio-economic problems in common.

Within the observed period of years 2011–2016, 32 districts are identified as being part of the group of the worst assessed districts at least for one year of the observed period. In 18.75% of all cases, districts belong to this group only for one year — for example district of Olomouc for the year 2016. However, all districts from the Usti Region, three districts from the Moravian-Silesian Region and one district from the South Moravia belong to this group every year (Figure 10).

We accept subjectively defined 20% level of variability (i.e. v_x = max. 20%) to identify typical indicators for the group of worst assessed districts. Rank correlation between the relative distances to PIS for these districts (c_i) and the set of statistical indicators is tested. We consider typical indicators those ones which meet three assumptions:
− variability of the absolute results is lower than 20%,
− linear non-collinearity with CV-TOPSIS results is confirmed,
− position of the indicator is stable; it means variability of its position does not exceed 20%.

Variability of all used statistical indicators is more stable for the indicators followed at the districts' level (Figure 11). We observe the highest differences for the indicator O3 (share of inhabitants living in towns having

less than 3 000 inhabitants in total number of inhabitants) and the smallest ones exist for the indicator O15 (average pension per capita per month in thousand CZK).

For the year 2011, seven indicators have variability (expressed by the coefficient of variation) lower than 20%. Linear correlation between the result of districts' assessment (i.e. relative distance to PIS) and statistical indicators is presented in Table 9. Statistically significant rank correlation is confirmed for two indicators O13 (number of divorces per 1 000 inhabitants) and O15 (average pension per capita per month in thousand CZK). At the first sight, we consider five statistical indicators, and thus socio-economic problems, typical for the group of worst assessed districts, for instance the indicator O1 (amount of child allowances per 1 000 inhabitants in thousands CZK) and O7 (number of children born to unmarried mothers per 1 000 inhabitants).

When we consider an indicator a typical one for the worst assessed group of districts, minimal differences among these districts are necessary (in our case < 20%), not only in absolute terms, but also in the context of other districts of the Czech Republic. For the year 2011, we can consider five indicators the typical ones as they meet all above stated assumptions (see Table 10). These are:
- Amount of child allowances per 1 000 inhabitants (in thousands CZK) — O1,
- Number of children born to unmarried mothers per 1 000 inhabitants — O7,
- Total number of registered job seekers per 1 000 inhabitants — O10,
- Total number of registered job seekers under the age of 24 per 1 000 inhabitants — O11,
- Number of inhabitants receiving pensions per 1 000 inhabitants — O14.

We apply the same approach for the analysis focused on the years 2012–2016. Every year, the set of statistical indicators with the lowest variability is nearly the same. For the year 2013, we have to add one indicator to seven indicators identified for previous years (O10 — total number of registered job seekers per 1 000 inhabitants). However, this indicator correlates linearly with the districts' assessment. Therefore, we have to exclude it from further analysis. Deeper insight into our findings reveals that high differences in the positions of the selected statistical indicators exist. This fact does not enable to consider these indicators to be typical ones for the group of districts with the worst assessment. These differences exceed defined limiting value (20%). We identify one exception — indicator O7 (number of children born to unmarried mothers), but this indicator correlates significantly with the results obtained with the use of the CV-TOPSIS technique.

If the rank correlation between the indicator O7 and the districts' assessment is accepted, then we can consider this indicator a typical one for districts affected by social exclusion or its higher risk. Based on Figure 12, social exclusion and its risk are higher in districts where the number of children born to unmarried mothers per 1 thousand inhabitants ranges from 3.64 to 4.66.

Although we reveal the typical indicator for the worst assessed districts, we confirm that negative districts' assessment, in terms of higher presence of social exclusion and its risk, results from of the combination of socio-economic phenomena, coved by the statistical indicators we use in our analysis. We confirm that social exclusion and its higher risk are associated with a combination of linked socio-economic problems and do not have a few fundamental causes.

Discussion

In the Czech Republic, the research attention paid to the complex assessment of the presence of socio-economic problems related to the social exclusion and its risk is insufficient, when the level of the districts (LAU 1) is considered, although the importance of such empirical research is highlighted (Macešková *et al*., 2009) and arguments for the adoption of the common framework for the research dealing with social exclusion at local level are formulated (Mikeszová *et al*., 2010). Research studies and papers, which have been published so far, usually focused only on some specific aspects of the socio-economic disparities or socio-economic polarization existed in the Czech Republic. Maier and Franke (2015) revealed the spatial regional divergence in the Czech Republic between years 2001 and 2011. They argued that the prevailing trend in the current, and also future, spatial change would have effects on the territorial cohesion. Novák and Netrdová (2011) pointed out on the formation of the growth and decline poles and axes with respect to the LISA and indicated the absence of a simple connection between the vertical and the horizontal differentiation of a society. Bernard and Šimon (2017) showed the differences in the spatial patterns of the four types of peripheries, and indicated that different socio-spatial processes contributed to the emergence of different types of peripheries.

In our research, we followed socio-economic criteria similar to the study of GAC (2015), which evaluated socio-economic situation in the Czech Regions in the year 2014 and compared it with that one identified for the year 2006. This study showed clearly that, in terms of specified socio-

economic indicators, situation worsened in some regions of the Czech Republic, and that the number of social excluded areas increased there. The worst situation was found in the Moravian Silesian Region and Karlovy Vary Region. Our research was focused on multi-criterial assessment of the social exclusion and its risk as well. We evaluated the socio-economic situation in the Czech Republic using the CV-TOPSIS technique, when we considered 23 indicators covering various socio-economic problems related to social exclusion and its risk, and we placed the emphasis on social exclusion of children and youth. We assessed 77 districts within the period of years 2011–2016, and we described and interpreted results of the assessment with the use of various mathematical and statistical methods to evaluate them complexly.

First, we found out that only a small number of districts received very negative assessment, respectively only a small number of districts was affected seriously by the combination of the socio-economic problems having link to the social exclusion of children and youth. These findings can be demonstrated with the negative skewness of the relative distances of districts' values of ci to PIS. It means that we observed the negative skewness of the absolute results obtained using the CV-TOPSIS method. We also found the minimal differences in the group of districts with positive assessment, respectively among the districts with relatively better socio-economic situation. This structure of results revealed that the majority of districts were assessed as having the results of the assessment above the average ones. However, these findings did not reflect only the assessment of individual districts, but also the results of the districts with worse assessment.

Then, we found out that the majority of the values of used statistical indicators correlated linearly with the complex results of districts' assessment in every year of the observed periods. Therefore, we stated that the relative distances to PIS corresponded to the set of used indicators. This finding confirmed our expectations, as we had defined the set of used statistical indicators before our analysis. From the perspective of the spatial analysis, we revealed that the results of assessment were homogenous at the level of the whole Czech Republic. Differences among neighbouring districts were so significant that we did not identify, except two regions (Usti Region and Moravian-Silesian Region), local spatial autocorrelation.

When we compared the results of assessment in the individual years, we revealed that the results for the year 2012 differentiated significantly. Their structure differed from those ones identified for other years. We assigned this differing structure to higher number of districts with worse results of the assessment, which had impact on the distribution function and on the

decrease of the mean value. However, at the regional level, assessment of the selected socio-economic problems related to the social exclusion was constant, which means that within the observed period of time no improvement or deterioration was identified. Therefore, the differences which existed within the observed period of time were constant and could not be assigned to randomness or disposable changes in the structure of statistical indicators. These differences were not statistically significant, but it is necessary to add that for example Central Bohemia or the Plzen Region have improved their socio-economic conditions and thus decreased the social exclusion and its risk for children and youth within the period of years 2011–2016. However, the relative changes in the absolute results of the regions' assessment did not lead to the shifts on a scale created with respect to this assessment. It confirmed that the changes of other regions (improvement/deterioration) had to be considered as well because they could negate or boost changes of other regions.

The trend identified at the regional level was also visible when we analysed the data at the level of districts. It means that results of the districts' assessment were relatively homogenous and the differences among districts persisted within the observed period of time. The group of 20 districts with the best assessment, with respect to social exclusion and its risk, was constant, because 18 districts belonged to this group annually. The Plzen Region was represented in this group by five districts, which was the highest representation of districts lying in one region. On the contrary, all districts of the Usti Region, three districts from the Moravian-Silesian Region and one district from the South Moravian Region belonged annually to the group of the 20 worst assessed districts. We revealed that the positive or negative assessment of the districts and their socio-economic situations, did not result from a single fundamental cause, but was affected by the combination of the socio-economic problems related to the social exclusion and covered by the statistical indicators we considered. However, we identified one common phenomenon of the districts with worse assessment — a higher number of children born to unmarried mothers. This finding shows that the pro-family policies can contribute to the reduction of social exclusion and its risk for children and youth.

Conclusions

In the theoretical European discourse, social exclusion is regarded as a wider concept than income poverty, as it is considered to cover a wide range of socio-economic problems. It reflects the fact that socially excluded

individuals suffer not only from low or insufficient incomes, but also from other deprivations and low participation. However, low or insufficient incomes are amongst the main causes of social exclusion. Social exclusion is also an issue that has to be addressed at the individual, community or regional level and with respect to its specific characteristics. Theoretical concepts of the social exclusion highlight especially its multidimensional, relative and dynamic nature. Because of its multidimensionality, several dimensions of the social exclusion are recognized, when the economic, social, political and spatial dimensions are the most common ones (Mareš & Sirovátka, 2008). The spatial dimension of social exclusion, usually interpreted as the concentration of socially excluded individuals to certain areas affected by many socio-economic problems, is thus closely related to the social exclusion interpreted at the community and regional level. At the community level, social exclusion is seen as a social polarization or disruption of the community's social cohesion, and the transfer of social exclusion inter-generations is one of its main attributes. Transfer of the social exclusion between generations is one of the reasons why the special attention should be paid to children and youth living in areas affected by linked socio-economic problems related to the social exclusion and its risk.

The EU Member States in accordance with the European Commission agenda on poverty and social exclusion (framed with the Strategy Europe 2020) use various programmes of public policies and tools of the social policy that contribute to the reduction of the number of socially excluded individuals. The most emphasized programmes are related to the labour market and education policies when the prevention of social exclusion is considered, and to the services of social prevention and social benefits when the emergency help provided to the socially excluded individuals is emphasized. Above-presented findings of our research can be regarded as the basis for the planning of the appropriate programmes and tools to address the social exclusion in the Czech Republic. With respect to our findings, we strongly recommend to the Czech policy-makers and other public authorities to open expert discussions to redesign the tools of social policy used to reduce the number of socially excluded individuals, because it seems that social exclusion and its risk is higher in some districts of the Czech Republic than in others, and these districts are located especially in two regions (Usti Region and Moravian-Silesian Region). Social exclusion persisted there regardless of the applied tools of the social policy. In our opinion, standard tools of social policy should be redesigned to be more targeted on individual and specific needs of socially excluded individuals. Special attention also has to be paid to the tools dealing with the inter-generation transfer of social exclusion as it seems that current socio-

economic problems existed in affected districts predominate the future possibilities of socially excluded children and youth to develop their full potential and valuable lives. Without any changes, the current socio-economics problems will have impact on future social cohesion and stability of the Czech society.

References

Abello, A., Cassells, R., Daly, A., D'Souza, G., & Miranti, R. (2016). Youth social exclusion in Australian communities: a new index. *Social Indicators Research*, *128*(2), 635–660. doi: 10.1007/s11205-015-1048-9.

Balcerzak, A. P. (2020). Quality of institutions in the European Union countries. Application of TOPSIS based on entropy measure for objective weighting. *Acta Polytechnica Hungarica*, *17*(1), 101–122. doi: 10.12700/APH.17.1.2020.1.6.

Balcerzak, A. P., & Pietrzak, M. B. (2017). TOPSIS with Generalized Distance Measure GDM in assessing poverty and social exclusion at regional level in Visegrad countries. In P. Pražák (Ed.). *35th International conference mathematical methods in economics MME 2017 conference proceedings*. Hradec Králové: University of Hradec Králové, 18–23.

Bareš, P. (2006). *Přiměřenost sociálních služeb aktuálním potřebám*. Prague: Research Institute for Labour and Social Affairs.

Barnes, H., Noble, M., Wright, G., & Dawes, A. (2009). A geographical profile of child deprivation in South Africa. *Child Indicators Research*, *2*(2), 181–99. doi: 10.1007/s12187-008-9026-2.

Bernard, J., & Šimon, M. (2017). Inner peripheries in the Czech Republic: the multidimensional nature of social exclusion in rural areas. *Czech Sociological Review*, *53*(1), 3–28. doi: 10.13060/00380288.2017.53.1.299.

Chakravarty, R. S., & D'Ambrosio, C. (2006). The measurement of social exclusion. *Review of Income and Wealth*, *52*(3), 377–98. doi: 10.1111/j.14754991.2006.00195.x.

Czech Statistical Office (2019). Public database Retrieved from https://vdb.czso.cz/vdbvo2/faces/en/index.jsf (16.11.2020).

Dean, H., & Platt, L. (2016). *Poverty and social exclusion*. Oxford: Social Advantage and Disadvantage.

Estivill, J. (2003). Concepts and strategies for combating social exclusion: an overview. Retrieved from https://www.ilo.org/public/english/protection/socsec/step/download/96p1.pdf (01.10.2020).

European Commission (2019). Eurostat data. Retrieved from https://ec.europa.eu/eurostat/data/database (05.09.2020).

Fisher, R. A., & Yates, F. (1963). *Statistical tables for biological, agricultural and medical research*. London: Oliver and Boyd.

GAC (2015). Analýza sociálně vyloučených lokalit v ČR. Retrieved from https://www.esfcr.cz/docments/21802/791224/Anal%C3%BDza+soci%C3%A1 ln%C4%9B+vylou%C4%8Den%C3%BDch+lokalit+v+%C4%8CR/65125f3c-3cd9-4591-882b-fd3935458464 (12.03.2020).

Harding, A., Daly, A., McNamara, J., & Yap, M. (2009). Australian children at risk of social exclusion: a spatial index for gauging relative disadvantage. *Population, Space and Place*, *16*(2), 135–150. doi: 10.1002/psp.531.

Hwang, C. L., & Yoon, K. (1981). *Multiple attributes decision making methods and applications*. Berlin: Springer.

Keller, J. (2014). *Exclusion as a social problem and a methodological issue*. Ostrava: University of Ostrava.

Kendall, M. G. (1970). *Rank correlation methods*. London: Griffin.

Keršuliene, V., Zavadskas, E. K., & Turskis, Z. (2010). Selection of rational dispute resolution method by applying new step-wise weight assessment ratio analysis (SWARA). *Journal of Business Economics and Management*, *11*(2*)*, 243–258. doi: 10.3846/jbem.2010.12.

Levitas, R. (1998). *The inclusive society? Social exclusion and new labour*. Basingstoke: Palgrave Macmillan.

Maier, K., & Franke, D. (2015). Trends in spatial socio-economic polarisation in the Czech Republic 2001–2011. *Czech Sociological Review*, *51*(1), 89–123. doi: 10.13060/00380288.2015.51.1.155.

Macešková, M., Ouředníček, M., & Temelová, J. (2009). Socio-spatial differentiation in the Czech Republic: implications for public (regional) policy. *Ekonomický časopis*, *57*(7), 700–715.

Mareš, P., & Sirovátka, T. (2008). Social exclusion and social inclusion - concepts, discourse, agenda. *Czech Sociological Review*, *44*(2), 271–94.

Mareš, P., Horáková, M., & Rákoczová, M. (2008). *Sociální exkluze na lokální úrovni*. Prague: Research Institute for Labour and Social Affairs.

McCrystal, P., Higgins K., & Percy, A. (2001). Measuring social exclusion: a lifespan approach. *Radical Statistics*, *76*.

Mertl, J. (2007). *Přístupy k hodnocení efektivnosti sociálních služeb v národním hospodářství*. Prague: Research Institute for Labour and Socual Affairs.

Mikeszová, M., Sládek, J., Lux, M., Česelský, J., Šmídak, V., & Kadlecová, M. (2010). Mapování skupin obyvatel akutně ohrožených sociálním vyloučením ve vybraných čtyřech krajích (v Praze, Středočeském kraji, Jihomoravském kraji a Moravskoslezském kraji) v souvislosti s nedostupností bydlení. Retrieved from https://www.esfcr.cz/docments/21802/791290/46_Mapov%C3%A1n%C3 %AD+skupin+obyvatel+akutn%C4%9B+ohro%C5%BEen%C3%BDch+soci% C3%A1ln%C3%ADm+vylou%C4%8Den%C3%ADm+v+soivislosti+s+bydlen %C3%ADm.pdf/342c8466-2505-408d-b3dd-1891ee953e82?version=1.0&prev iewFileIndex= (15.03.2020).

Milar, J. (2007). Social exclusion and social policy research: defining exclusion. In D. Abrams, J. Christian & D. Gordon (Eds.). *Multidisciplinary handbook of social exclusion research*. Chichester: Wiley, 1–15.

Ministry of Education, Youth and Sports, Czech Republic (2019). Národní statistiky. Retrieved from http://www.msmt.cz/vzdelavani/skolstvi-v-cr/statistikaskolstvi/narodni-statistiky (20.06.2020).

Ministry of Labour and Social Affairs, Czech Republic (2019). Výsledky. Retrieved from https://portal.mpsv.cz/sz/stat/vydelky (20.06.2020).

Musil, J., & Müller, J. (2008). Inner peripheries of the Czech Republic as a mechanism of social exclusion. *Czech Sociological Review*, *44*(2), 321–348.

Novák, J., & Netrdová, P. (2011). Spatial patterns of socioeconomic differentiation in the Czech Republic at the level of municipalities. *Czech Sociological Review*, *47*(4), 297–323.

Olson, D. L. (2004). Comparison of weights in TOPSIS models. *Mathematical and Computer Modelling, 40*(7-8), 721–727. doi: 10.1016/j.mcm.2004.10.003.

Oroyemi, P., Damioli, G., Barnes, M., & Crosier T. (2019). Understanding the risks of social exclusion across the life course: families with children, Research. Retrieved from http://www.bristol.ac.uk/poverty/downloads/keyoff icialdocuments/SEU_Risks_Families_and_Children.pdf (20.10.2020).

Pietrzak, M. B. (2016). The problem of the inclusion of spatial dependence within the TOPSIS method. *Montenegrin Journal of Economics*, *12*(3), 69–86. doi: 10.14254/1800-5845.2016/12-3/5.

Room, G. (1995). Poverty and social exclusion: the new European agenda for policy and research. In Room, G. (Ed.). *Beyond the threshold: the measurement and analysis of social exclusion*. Bristol: Policy Press, 1–9.

Sen, A. (2000). Social exclusion: concept, application, and scrutiny. Retrieved from https://www.adb.org/sites/default/files/publication/29778/social-exclusi on.pdf (21.10.2020).

Silver, H. (1994). Social exclusion and social solidarity: three paradigms. *International Labour Review*, *133*(5-6), 531–578.

Singla, A., Sing Ahuja, I., & Sing Sethi, A. (2017). Comparative analysis of technology push strategies influencing sustainable development in manufacturing industries using TOPSIS and VIKOR technique. *International Journal for Quality Research*, *12*(1), 129–146. doi: 10.18421/IJQR12.01-08.

Sirovátka, T., Kofroň, P., Rákoczyová, M., Hora, O., & Trbola R. (2005). *Příjmová chudoba, materiální deprivace a sociální vyloučení v České republice a srovnání se zeměmi EU (výzkumná zpráva z projektu Monitorování chudoby).* Prague: Research Institute for Labour and Social Affairs.

Social Exclusion Unit (2001). Preventing social exclusion. Retrieved from http://www.bris.ac.uk/poverty/downloads/keyofficialdocuments/Preventing%20 Social%20Exclusion.pdf (21.10.2020).

Streimikiene, D., Balezentis, T., Krisciukaitiene, I., & Balezentis, A. (2012). Prioritizing sustainable electricity production technologies: MCDM approach. *Renewable & Sustainable Energy Reviews*, *16*(2), 3302–3311. doi: 10.1016/j.rser. 2012.02.067.

Trbola, R., Nečasová, M., & Rákoczyová, M. (2015). *Role lokálních vlád při řešení problémů sociálních začleňování*. Prague: Research Institute for Labour and Social Affairs.

Vaňková, I., & Vavrek, R. (2020) Evaluation of local accessibility of homes for seniors using multi-criteria approach – evidence from the Czech Republic. *Health and Social Care in the Community*, *106*, 105519. doi: 10.1111/hsc .13231.

Vavrek, R. (2019). Evaluation of the impact of selected weighting methods on the results of the TOPSIS technique. *International Journal of Information Technology & Decision Making*, *18*(6), 1821–1843. doi: 10.1142/S021962201950 041X.

Vavrek, R., & Bečica, J. (2020). Capital city as a factor of multi-criteria decision analysis – application on transport companies in the Czech Republic. *Mathematics*, *8*(10), 1765. doi: 10.3390/math8101765.

Víšek, P., & Průša, L. (2012). *Optimalizace sociálních služeb*. Prague: Research Institute for Labour and Social Affairs.

Yalcin, E., & Unlu, U. (2018). A multi-criteria performance analysis of initial public offering (IPO) firms using critic and Vikor methods. *Technological and Economic Development of Economy*, *24*(2), 534–560. doi: 10.3846/20294913.2 016.1213201.

Yoon, K. (1980). *Systems selection by multiple attribute decision making*. Kansas: Kansas State University.

Zavadskas, E. K., Mardani, A., Turskis, Z., Jusoh, A., & Nor, K. (2016). Development of TOPSIS method to solve complicated decision-making problems: an overview on developments from 2000 to 2015. *International Journal of Information Technology & Decision Making*, *15*(3), 645–648. doi: 10.1142/S02196 22016300019.

Zavadskas, E. K., Turskis, Z., & Kildiene, S. (2014). State of art surveys of overviews on MCDM/MADM methods. *Technological and Economic Development of Economy*, *20*(1), 165–179. doi: 10.3846/20294913.2014.892037.

Zeleny, M. (1975). MCDM – state and future of arts. *Operations Research*, *23*(2), B413–B413.

Annex

Table 1. Set of indicators followed at a level NUT3 Czech Republic (K1 – K7)

Criterion	Description
K1	Annual GDP per capita (in thousand CZK)
K2	Median of gross wages in private sector per capita, per one month (in thousand CZK)
K3	Annual net disposable income of households per capita (in thousand CZK)
K4	Number of users of low-threshold facilities for children and youth per 1,000 inhabitants
K5	Number of persons under the age of 18 being prosecuted or investigated per 1,000 inhabitants
K6	Number of the university graduates (living in a region) in defined year per 1,000 inhabitants
K7	Number of early school leavers in defined year per 1,000 inhabitants

Table 2. Set of indicators followed at a level of LAU 1 Czech Republic (O1 – O16)

Criterion	Description
O1	Amount of child allowances per 1 000 inhabitants (in thousands CZK)
O2	Amount of housing allowances per 1 000 inhabitants (in thousands CZK)
O3	Share of inhabitants living in towns having less than 3 000 inhabitants in the total number of inhabitants
O4	Share of inhabitants living in towns having more than 20 000 inhabitants in the total number of inhabitants
O5	Number of children born to mothers under the age of 19 per 1 000 inhabitants
O6	Number of children born at least as the fourth child in a family per 1 000 inhabitants
O7	Number of children born to unmarried mothers per 1 000 inhabitants
O8	Average number of inhabitants with sickness insurance per 1 000 inhabitants
O9	Number of calendar days of temporary incapacity to work per 1 000 inhabitants
O10	Total number of registered job seekers per 1 000 inhabitants
O11	Total number of registered job seekers under the age of 24 per 1 000 inhabitants
O12	Total number of job seekers registered for more than 12 months per 1 000 inhabitants
O13	Number of divorces per 1 000 inhabitants
O14	Number of inhabitants receiving pensions per 1 000 inhabitants
O15	Average pension per capita per month (in thousand CZK)
O16	Number of registered crimes per 1 000 inhabitants

Table 3. Comparisons of the results' structures for all observed years

year/year	2011	2012	2013	2014	2015	2016
2011		X	X			
2012	X		X	X	X	X
2013	X	X				X
2014		X				
2015		X				
2016		X	X			

X – significant differences at the significance level α = 0,05

Table 4. Year-over-year index of the regions' results

region/year	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016
100	-	+	+	+	+
200	-	+	+	+	+
310	+	+	-	-	+
320	-	+	+	+	+
410	-	-	+	+	+
420	-	+	-	-	-
510	-	+	+	-	+
520	-	+	+	+	+
530	-	+	+	+	+
630	-	+	+	+	+
640	-	+	+	-	+
710	-	+	+	-	+
720	-	+	+	-	+
800	-	+	+	-	+

Table 5. Year-over-year index of the regions' results

region/year	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016
100	NA	-	+	+	-
200	-	NA	NA	NA	NA
310	+	-	-	-	NA
320	NA	NA	+	NA	-
410	-	-	NA	+	-
420	NA	NA	NA	NA	NA
510	-	+	+	+	-
520	+	NA	NA	NA	NA
530	+	-	+	NA	+
630	+	-	-	NA	+
640	-	+	NA	NA	-
710	-	NA	+	-	+
720	+	+	-	NA	+
800	NA	+	NA	-	NA

NA – No shift in individual region position in regions' scales based on regions' assessment is observed

Table 6. Rank correlation between the regions' assessment results and regions' positions for the years 2011–2016

	2011	2012	2013	2014	2015	2016
r_K	-0.9978	-0.9989	-0.9989	-0.9989	-1	-0.9989
p			< 0.01			

Table 7. Mean values of the districts' results and their positions on a scale for the observed period of time

	District	$\overline{x_{ct}}$	District	$\overline{x_{por}}$
1.	Pelhrimov	0.672	Pelhrimov	2.17
2.	Plzen-South	0.669	Plzen-South	3.00
3.	Rokycany	0.667	Rokycany	3.33
4.	Prague-East	0.662	Prague-East	4.83
5.	Uherske Hradiste	0.658	Uherské Hradiste	5.50
…	….	….	….	….
73.	Chomutov	0.374	Chomutov	73.17
74.	Usti nad Labem	0.358	Ostrava-City	74.17
75.	Ostrava-City	0.346	Usti nad Labem	74.33
76.	Karvina	0.310	Karvina	76.00
77.	Most	0.279	Most	76.67

$\overline{x_{ct}}$ – average assessment of a districts for the observed period of time

$\overline{x_{por}}$ – average rank of a districts for the observed period of time

Table 8. Rank correlation between the results of the regions' assessment and regions' positions for the years 2011–2016

	2011	2012	2013	2014	2015	2016
r_K			-1			
p			< 0.01			

Table 9. Rank correlation between assessment results and selected statistical indicators for the group of the worst assessed districts for the year 2011

	O1	O7	O10	O11	O13	O14	O15
r_K	-0.200	-0.054	-0.309	-0.163	-0.563	-0.018	-0.477
p	0.391	0.815	0.185	0.483	0.015	0.937	0.043

Table 10. Position of selected indicators for the group of districts with the worst assessment for the year 2011

	O1	O7	O10	O11	O14
Decin	74	73	69	71	58
Chomutov	68	74	70	72	2
Litomerice	40	63	52	58	44
Louny	59	72	68	69	38
Most	75	77	75	75	19
Teplice	71	71	65	70	60
Usti nad Labem	64	69	73	73	26
Brno-City	15	44	39	28	45
Bruntal	77	68	77	77	67
Karvina	72	55	72	63	77
Ostrava-City	61	60	60	51	54
v_x	18%	9%	11%	14%	22%

Table 11. Indictors with the variability lower than 20 % for the group of the worst assessed districts for the years 2012–2016

year	indicators
2012	O1, O7, O10, O11, O13, O14, O15
2013	O7, O10, O11, O13, O14, O15
2014	O7, O10*, O11, O13, O14, O15
2015	O7, O10*, O11*, O13, O14, O15
2016	O7*, O10, O11*, O13, O14, O15

* indicator correlates significantly with results of the CV-TOPSIS technique

Table 12. Variability of the positions selected indicators for the group of the worst assessed districts for the years 2012–2016

	O7	O13	O14	O15
2012	18%	36%	46%	84%
2013	15%	52%	46%	81%
2014	14%	26%	46%	79%
2015	17%	50%	47%	78%
2016	NA	43%	49%	77%

Figure 1. Comparison of the weights determined to criteria K1 – K7 within the observed period of time
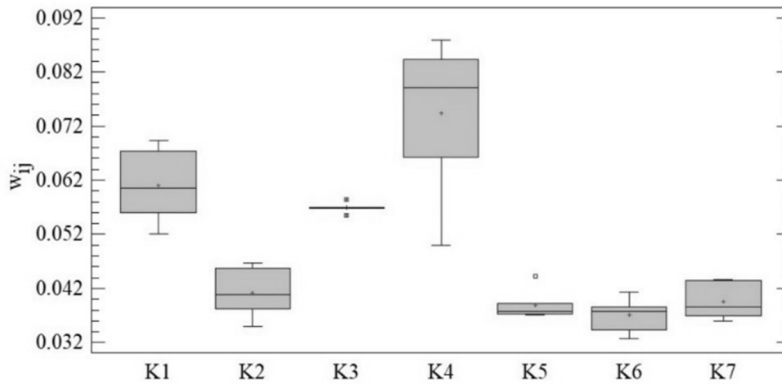
Figure 2. Comparison of the weights determined to criteria O1 – O16 within the observed period of time
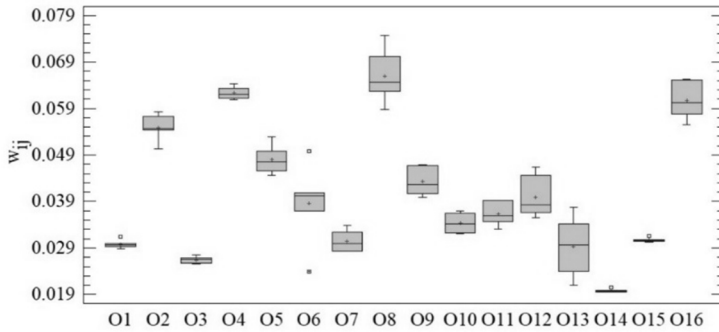
Figure 3. Results of districts' assessment using the CV-TOPSIS technique for the observed period of time
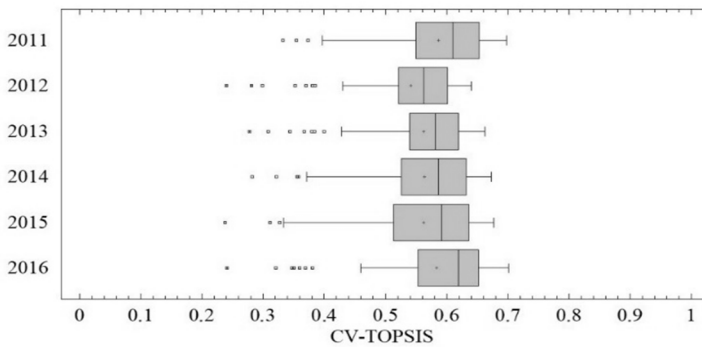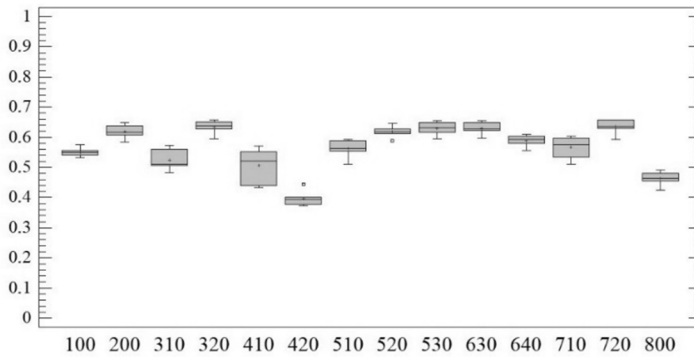

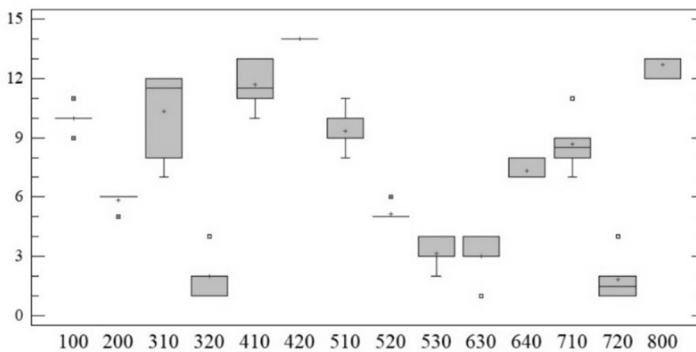**Figure 4.** Comparison of the results' structures for the years 2012 and 2014
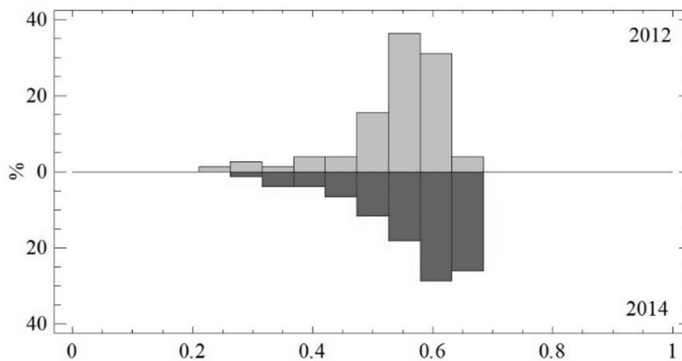
Figure 5. Average results for the regions within the observed period of time
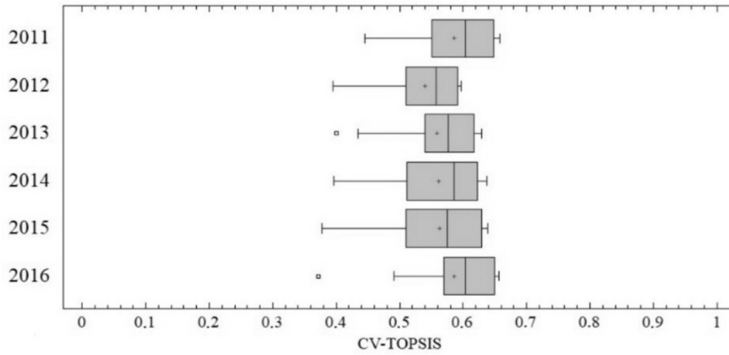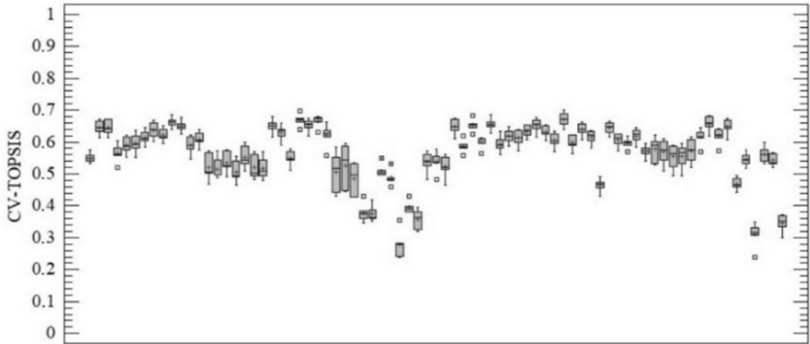

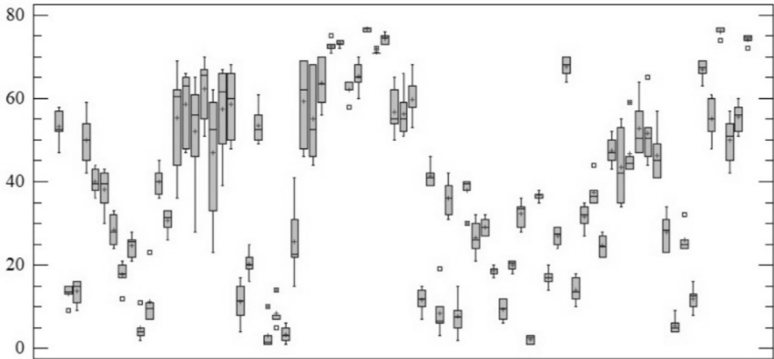**Figure 6.** Comparison of the regions' results for the observed period of time

**Figure 7.** Comparison of the regions' positions for the observed period of time

Figure 8. Comparison of the results for individual districts for the observed period of time
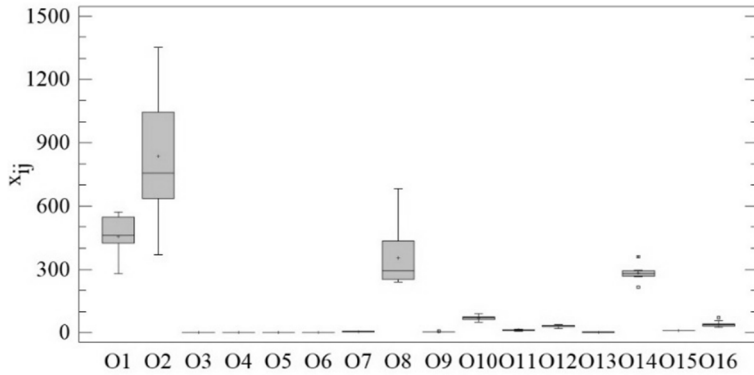

Figure 9. Comparison of districts' rankings for the whole observed period of time

Figure 10. Spatial distribution of districts with the worst assessment in every year of the observed period of time
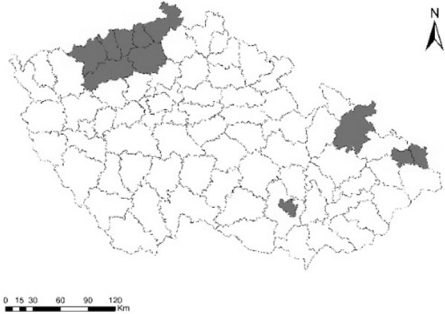
Figure 11. Variability of districts' indicator with the group of districts with the worst assessment for the year 2011

Figure 12. Development of the indicator O7 for the group of the worst assessed districts for the years 2011–2016