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UNBALANCED DEVELOPMENT – REGIONAL DISPARITY ANALYSIS IN SERBIA

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Abstract: The unbalanced regional development is one of the biggest socioeconomic challenges in Serbia. It is a multidimensional and multi-level regional imbalance that, according to almost all socioeconomic indicators, shows a growing trend in the first decades of the 21st century. This paper presents an analysis of the selected demographic, social, and economic indicators by using DEA methodology. The dynamic component of the studied imbalance was taken into account by calculating the Malmquist Productivity Index. The calculated index undoubtedly shows that there are differences between regions (not only between the northern and southern regions, but also within the regions themselves). The results also point out that the changes of the input usage efficiency have strongly influenced the ranks of the districts within the national territories.

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1. Introduction

The fact that regional differences exist even in the most developed world countries shows that the issue of uneven regional development (that is, the mechanisms of its emergence and harmonizing) is something that has rightfully intrigued the world scientific community for more than seventy years (Williamson, 1965, Hofer & Worgotter, 1997, Terrasi, 1999, Fujita et al., 1999, Petrakos, 2001, Yemtsov, 2003, Rodriges-Oreggia, 2005, Baddeley, 2006, Kim, 2008). In Europe, during the second half of the last century, one of the main objectives of regional development policy was to achieve more equity and sustainable growth. In the beginning, the countries that were facing substantial regional disparities (e.g. the United Kingdom, Italy, Sweden) focused on reducing the disparities in income and infrastructure, and also on the activities that are social in nature, while later the European Union made the major push through EU Cohesion Policy (Barcca, 2009). However, most of the studies showed that the regional development policy models applied during the 1980s had rather modest results, mostly because of the slow convergence of the regions lagging behind (Barro & Sala-I-Martin, 1991, Boldrin & Canova, 2001). Regional policy has changed once again within the EU during the nineties (from a short-term grants model through central government authority to a long-term model through decentralized development policies, and also from dispersed interventions to more selective investments) (Capello, 2009). The idea was to support the development of internal growth factors, and not merely the redistribution of revenue to less developed areas of a country (Camagni 2009).

Serbia is one of the European countries that had constantly faced the problem of unbalanced regional growth which started to increase at the beginning of the 21st century. Subsequently, Serbia became the country with one of the biggest regional disparities in Europe (Manić et al., 2012, Manić et al., 2017). The differences are evident at the regional level (NUTS2 level), but they are even more prominent at lower spatial levels: district level (NUTS3 level) and municipality level (LAU1 level). The differences are present when observed by numerous indicators of economic, demographic, and social development, especially in the lack of clear-cut entrepreneurial spirit ("Sit and wait for the central government initiatives" approach), lack of knowledge and expertise in using different financial instruments and mechanisms, inadequate structure of skilled labour, and misuse of local resources.

Serbia is considered a developing country, and in Europe it ranks low (in 2016, the GDP of Serbia was just around 37% of the EU-28 average, while its most developed region – the City of Belgrade – reached 61% of the EU-28 development level) (Statistical Office of the Republic of Serbia, 2018). In such a country, the differences between regions are substantial, and they become even more prominent as we observe lower spatial levels (district or municipality). Based on the example of the Autonomous Province of Vojvodina (the region considered as one of the most developed ones in Serbia) it is clear that there are numerous intra-regional differences: the District of Južna Bačka is the most developed one, with Novi Sad as the biggest city and administrative centre of the Autonomous Province of Vojvodina, while the potentials of other districts of Vojvodina are inadequately used (Molnar & Manić, 2018).

Numerous indicators are used while analysing regional differences, not only in Serbia, but in general as well. Since gross domestic product (GDP) – or gross added value (GVA) which is calculated as GDP minus net taxes plus subsidies – is most often used as the measure of economic growth, it is logical that a special attention in the scientific research literature is dedicated to investigation of the factors that impact this indicator the most. The necessity of constant improvements in efficiency is particularly emphasized – the efficiency that means achieving a greater output to input ratio. For a maximum economic growth rate, an economic system must use the available resources with minimum costs to produce an optimal mix of products and services.

The major factors that have an impact on economic growth are human capital, physical capital, natural resources, and technology (Barro & Sala-i-Martin, 1995). Each of these factors can be individually analyzed and compared through the impact that they have on economic growth. Among these, the human capital deserves a special place.

Human resources consist of skilled and unskilled labour force. A rise in quantity and quality of the labour force leads to an increased rate of economic growth. When the workforce increases in size, they produce more goods and services, whereas when there is an increase in the workforce's skills, they produce goods and services of high value. Economic growth is derived from the existing quantity and quality of human capital (labour force). Consequently, the quantity of human capital may lead to sustainable growth in economic terms only if the stock of capital increases. Otherwise, increasing the amount of the workforce used while the capital stock remains the same can lead to a less efficient use of the production factors. This, in turn, can have a negative impact on the production per capita (because of the decreasing returns). The human capital quality refers to the qualifications of the population. Increasing the amount of capital used increases the quantity of goods and services that are produced in a national economy, region, or district, in the same way as the increasing amount of labour does. Technical progress is one of the most important determinants of economic growth, and also an important source of growth and productivity (Solow, 1957).

On the other hand, there is an entire array of economic indicators that are important for generating economic growth and shaping economic development. Capital is one of the key economic inputs and the framework for initiating of economic growth, and this is the reason why a special attention is always paid to the investment flows, both foreign and domestic, in a particular area (Camagni, 2009). The scope of investments, as well as directing them into certain industries, are crucial for crating the mechanisms necessary to make a qualitative step forward in production and, consequently, in economic development. In this respect, investments incite and generate implementation of the new and/or advancement of the existing technologies, whereby the conditions for a more effective use of the available resources (that is, economic growth) are created.

Until now, the analysis of regional differences consisted of measuring indicators of development in individual industries and their possible comparison for a specific year or period (Popović et al., 2016, Manić et al., 2017). However, it is much more important to reveal the character of changes in the indicators (inputs) in time that generate economic growth expressed as some chosen output (e.g. GDP). This shows not only regional differences, but also the changes in efficiency of the input use, which influences economic growth and development, by showing changes in mutual relationships between the observed spatial entities (some entities advance more quickly, while others advance more slowly, that is, some lag behind when compared to the chosen time-frame results).

2. Methodology

In the literature, Malmquist productivity index (MI) represents the first example of introducing a dynamic component in the data envelopment analysis (DEA). DEA methodology is usually used for evaluation of the efficacy of the inputs used (e.g. number of workers, investments, etc.) to create certain outputs (e.g. gross domestic product). In the recent papers analyzing the regional differences in Serbia by applying DEA methodology, the efficiency coefficient and certain composite indexes of regional development were calculated for a period of one year (static DEA analysis) (Manić et al., 2017). However, in order to observe the change in the efficiency of the use of certain resources over time at the level of the observed units (that is, the change in regional development), it is necessary to apply some of the dynamic approaches of the DEA analysis that are lately more and more present in the scientific literature. One such approach is Malmquist productivity index (MI), which became the standard approach in the measurement of efficiency over time (Mitrović, 2020).

MI evaluates productivity changes for the observed units (districts) between two periods and exemplifies comparative statistical analysis (Fare et al., 1998). MI is defined as the product of the change in relative input use efficiency (catch-up effect) and the change (shift) in technological efficiency (frontier shift effect) (Fare et al., 1994). The catch-up effect shows if a country has improved its relative efficiency in the use of inputs, that is, if the country is achieving growth or regressing. The frontier shift effect measures the shift (change) in the frontiers of the production possibilities (technological limitations) over time (that is, the changes in technology), and in this paper, it shows if a country applies new information technologies (innovations) or sticks to the existing ones. Further in the text, the MI calculation, the changes in relative efficiency of input use, and the shift in the frontiers of the production possibilities are presented based on the methodological explanation given in Sánchez (2018).

Let us assume that we are observing a simplified case of labour use efficiency evaluation as a production factor in Serbia in the 2012–2017 period. It is a simplified example with one input (employment rate) and one output (GDP per capita).

Figure 1. Input and output vectors in 2012 and in 2017

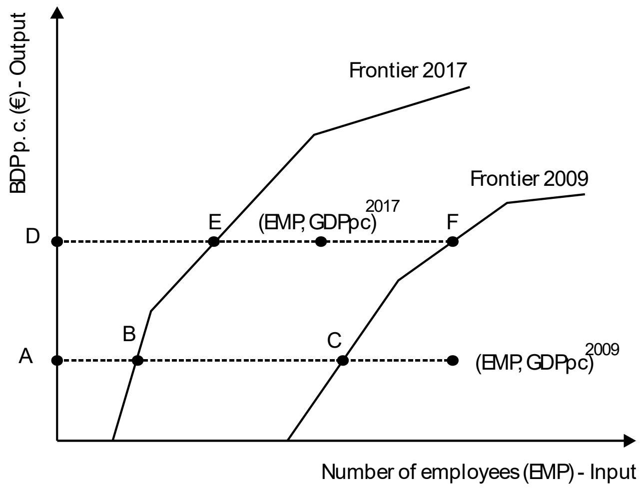


Figure 1 shows the points with the coordinates of (EMP, GDPpc)^{2009} and (EMP, GDPpc)^{2017} which represent the input–output vector for the observed country (Serbia) in 2009–2017. In this case, the catch-up effect (that is, the change in relative efficiency of input use between 2017 and 2012) is given in the following equation:

$$Catch-up\ effect = \frac{Efficiency\ (\text{EMP, GDPpc})^{2009}\ with\ respect\ to\ the\ 2009\ frontier}{Efficiency\ (\text{EMP, GDPpc})^{2017}\ with\ respect\ to\ the\ 2017\ frontier} \quad (1)$$

The catch-up effect, that is, the change in the relative efficiency of input use, can be expressed as follows:

$$Catch-up\ effect = \frac{DE/_{DEMP^{2017}}}{AC/_{AEMP^{2009}}} \quad (2)$$

In Figure 1, DE is represented by the distance between the points D and E, while DEMP^{2017} represents the difference between the point D and the abscisse of the point (EMP, GDPpc)^{2017}. By analogy, AC represents the distance between the points A and C, while DEMP^{2009} represents the difference between the point A and the abscisse of the point (EMP, GDPpc)^{2009}.

The difference between the distance between the point (EMP, GDPpc)^{2009} and the frontier of the production possibilities in 2009 and the distance between that point and the frontier of the production possibilities in 2017 represents the shift in technological limitation with respect to the point (EMP, GDPpc)^{2009}, that is, the change in technology, and it is evaluated as follows:

$$\phi_{2009} = \frac{AC}{AB} \quad (3)$$

If, according to Sánchez (2018), the numerator and the denominator in the previous equation are both divided by the difference between the point A and the values of the abscise of the point (EMP, GDPpc)^{2009}, the following relation is obtained:

$$\phi_{2009} = \frac{\frac{AC}{AEMP^{2009}}}{\frac{AB}{AEMP^{2009}}} = \frac{Efficiency\ (\text{EMP, GDPpc})^{2009}\ with\ respect\ to\ the\ 2009\ frontier}{Efficiency\ (\text{EMP, GDPpc})^{2009}\ with\ respect\ to\ the\ 2017\ frontier} \quad (4)$$

Similarly, the difference between the distance between the point (EMP, GDPpc)^{2017} and the frontier of the production possibilities in 2009 and the distance between that point and the frontier of the production possibilities in 2017, represents the shift in efficiency frontier with respect to the point (EMP, GDPpc)^{2017}, and it is evaluated by the following equations:

$$\phi_{2017} = \frac{DF}{DE} \quad (5)$$

$$\phi_{2017} = \frac{\frac{DF}{DEMP^{2017}}}{\frac{DE}{DEMP^{2017}}} = \frac{Efficiency\ (\text{EMP, GDPpc})^{2017}\ with\ respect\ to\ the\ 2009\ frontier}{Efficiency\ (\text{EMP, GDPpc})^{2017}\ with\ respect\ to\ the\ 2017\ frontier} \quad (6)$$

Based on the calculated values of ϕ_{2009} and ϕ_{2017}, the effect of the shift in technological limitation is calculated by finding a geometric mean:

$$Shift\ in\ production\ possibilities = \phi = \sqrt{\phi_{2009}\phi_{2017}} \quad (7)$$

The Malmquist production index (MI) is calculated as the product of change in relative efficiency and the change in the frontier of production possibilities:

$$MI = \text{Catch} - \text{up effect} \times Change\ in\ the\ production\ possibilities frontier \quad (8)$$

Based on the previously stated equations, we observe that the Malmquist production index (MI) may be calculated by applying the following pattern:

$$MI = \frac{AEMP^{2009}}{DEMP^{2017}} \sqrt{\frac{DFDE}{ACAB}} \quad (9)$$

The left side in the above equation represents a relative performance change, while the right side represents a relative change in the frontier used for evaluation of these performances.

The above stated equations for determining the Malmquist production index (MI), the change in relative efficacy, and the change in technological limitation can also be formulated by using a common notation in the literature for expressing of efficiency coefficient of the observed units, that is, the so-called decision-making units (DMUs).

In this case, according to Zhu (2011), the change in the relative efficacy (EC) – that is, the catch-up effect – of the observed country with respect to other countries would be expressed as follows:

$$EC = \frac{\partial^{2017}(\mathrm{EMP}, \mathrm{GDPpc})^{2017}}{\partial^{2009}(\mathrm{EMP}, \mathrm{GDPpc})^{2009}} \quad (10)$$

The given equation, $\partial^{2017}(\mathrm{EMP,GDPpc})^{2017}$ shows the efficacy of the observed country in 2017 under the conditions of technological limitations in that year, while $\partial^{2009}(\mathrm{EMP,GDPpc})^{2009}$ shows the efficacy of that country in 2009 under the conditions of technological limitations in that year. In the given equation, ∂^{2009} refers to the technological limitations in 2009, while ∂^{2017} refers to the technological limitations in 2017.

Furthermore, according to Zhu (2011), for the purpose of application of the DEA analysis, the shift in the frontier of production possibilities – that is, technological changes (TC) – can be expressed in the following equation:

$$TC = \sqrt{\left[\frac{\partial^{2012}(\mathrm{EMP}, \mathrm{GDPpc})^{2009}}{\partial^{2017}(\mathrm{EMP}, \mathrm{GDPpc})^{2009}} \times \frac{\partial^{2012}(\mathrm{EMP}, \mathrm{GDPpc})^{2017}}{\partial^{2017}(\mathrm{EMP}, \mathrm{GDPpc})^{2017}}\right]} \quad (11)$$

Finally, Malmquist production index (MI) may be calculated as MI = EC × TC, that is:

$$MI = \frac{\partial^{2017}(\mathrm{EMP}, \mathrm{GDPpc})^{2017}}{\partial^{2009}(\mathrm{EMP}, \mathrm{GDPpc})^{2009}} \times \sqrt{\left[\frac{\partial^{2009}(\mathrm{EMP}, \mathrm{GDPpc})^{2009}}{\partial^{2017}(\mathrm{EMP}, \mathrm{GDPpc})^{2009}} \times \frac{\partial^{2009}(\mathrm{EMP}, \mathrm{GDPpc})^{2017}}{\partial^{2017}(\mathrm{EMP}, \mathrm{GDPpc})^{2017}}\right]} \quad (12)$$

After reducing the fractions in the above equation, we obtain the following:

$$MI = \sqrt{\left[\frac{\partial^{2012}(\mathrm{EMP}, \mathrm{GDPpc})^{2017}}{\partial^{2012}(\mathrm{EMP}, \mathrm{GDPpc})^{2009}} \times \frac{\partial^{2017}(\mathrm{EMP}, \mathrm{GDPpc})^{2017}}{\partial^{2017}(\mathrm{EMP}, \mathrm{GDPpc})^{2009}}\right]} \quad (13)$$

Unlike the previously described simplified model with one input and one output, in the following text, the authors will present the procedure for calculating the MI by applying DEA methodology in general. In calculating MI, the value θ is obtained by DEA model and linear programming (Cook et al., 2014) by applying the following equation (where s is the number of production possibility frontiers and takes the values of 1 and 2, while t is the number of periods observed and takes the values of 1 and 2, which are the symbols for the periods compared):

$$\delta^s(x_0, y_0)^t = \min_{\theta,\lambda} \theta \quad (14)$$

where

$$\delta^s x_0^t \geq X^s \lambda_i$$
$$y_0^t \leq Y^s \lambda_i$$
$$L \leq e\lambda_i \leq U$$
$$\lambda_i > 0$$
$$i = 0, 1, 2, \dots, N$$

The stated DEA model is input oriented because it searches for the combination of the least possible quantities of input which can produce the given output. Unlike the DEA model, the output oriented MI calculation model starts with the assumption that is necessary to determine the potential output which the observed country can achieve by the given inputs if it used the given inputs in the same way that the countries at the very frontier of the production possibilities (the most efficient countries) use them (Fare et al., 1994).

In the output-oriented model, the MI and the value of θ would be calculated by applying linear programming though the following equation and the set limitations:

$$(x_0, y_0)^t = \min_{\theta,\lambda} \theta \quad (15)$$

where

$$x_0^t \geq X^s \lambda_i$$
$$\left(\frac{1}{\theta}\right) y_0^t \leq Y^s \lambda_i$$
$$L \leq e\lambda_i \leq U$$
$$\lambda_i > 0$$
$$i = 0, 1, 2, \dots, N$$

In our previous simplified example, this model – that is, the linear programming problem – would consist of four equations. Vector $\lambda=(\lambda_1, \lambda_2,\dots, \lambda_N)$ represents a series of N variables λ_i which construct the efficiency frontier (that is, production possibility frontier), while e represents the vector e=(1, 1, …, 1) with the size of 1×N. **X** is the input matrix, and **Y** is the matrix of output values for each observed country, that is, the DMU (the number of rows in the X and Y matrices corresponds to the number of inputs and outputs, respectively, and the number of columns corresponds to the number of the observed units, that is, countries). For each pair of values (s, t), the model is calculated N times, where N is the number of observed DMUs.

If (L,U)=(1,1), then it is a model which calculates the efficiency of the observed units with variable returns (BCC model). This model is suitable if DMUs are of different sizes. If (L,U)=(0,∞), then it is a model which calculates the efficiency of the observed units with constant returns (CRS model). This model is suitable if DMUs are of similar sizes.

As previously stated, the Malmquist production index (MI) is calculated as MI = EC × TC. The first component (EC) shows the magnitude of the change in technological efficiency (that is, the relative efficiency of the input use between two time periods), and it shows if the efficiency is increasing, decreasing, or remaining unchanged. The second component (TC) shows the shift in production possibilities frontier, that is, the changes in the applied technology between two time periods. Table 1 indicates the possible values of MI and its components, as well as their interpretation.

Table 1. Malmquist productivity index and its components

Index (indicator) Value	**Malmquist productivity index (MPI)**	**Catch-up effect (EC) – changes in relative efficiency**	**Technological Efficiency (TC) – shift in production possibilities frontier**
More than 1	productivity increases	relative efficiency increases	technological efficiency increases
Less than 1	productivity decreases	relative efficiency decreases	technological efficiency decreases
Equal to 1	productivity is unchanged	relative efficiency is unchanged	technological efficiency is unchanged

Source: Fare, R. et al., 1994

3. The results and discussion

Starting with the previously researched topics related to the regional development of Serbia and the issues of its disbalance, the following question arose: which factors influence this disbalance the most, what indicators describe them properly, and how the changes in these factors can perhaps be monitored in time? However, by applying different methodologies in the research of the nature of regional differences, the authors concluded that the reasons for lagging of some areas behind others are often related to the fact that the former do not adequately and completely use the resources, not even the ones that are available to them. On the other hand, how and to what extent have certain technological advances been made in the overall development (economy and society) which additionally accelerate or slow down the development of a particular area, is also an important question.

Various indicators have been used for the purpose of investigating into regional differences in Serbia. For the needs of the analysis in this particular paper, three indicators were chosen as the inputs (the share of highly educated people in the total population older than 15 year of age, employment rate, and investment rate), and they were set in a relationship with the output (gross value added – GVA). Bearing in mind the disparity between the northern and the southern regions, we assumed that these disparities are also present within the regions and that they are more and more prominent when lower spatial levels are observed. By applying the DEA analysis, we made a step forward towards a different analysis of regional differences in Serbia, with the aim of proving the nature of these differences in specific time intervals (2009 with respect to 2002, and 2017 with respect to 2009). The year of 2009 was set as a dividing year (turning-point) because this was the year when Serbia felt the consequences of the world economic crisis the most. The periods observed were presented through individual indexes of relative efficacy (EC) and technological change (TC), each of them explaining the changes in the three chosen indicators, and calculating Malmquist productivity index (Table 2):

EC – explains if the available resources were used better in the given period (educated work force, real employment, investments),

TC – explains if a technological advancement happened in the observed period (educated work force quality, employees' productiveness, investments in propulsive industries)

MI – Malmquist productivity index for the observed period is actually the product of individual indexes and it represents the total advancement in an industry.

When observed by the districts, we may conclude that in the 2002–2009 period, only the City of Belgrade had some real progress (1.368), while the four districts that had MIs with values of somewhat greater than 1 were practically in stagnation (Braničevo District with 1.001, Kolubara District with 1.083, Zlatibor District with 1.058, and District of Severni Banat with 1.022). When we analyze the components (EC and TC), we may conclude that the efficiency of the available resources' use was low in almost all districts, and that possible inflows of new investments directed toward technological progress in the use of the observed inputs were actually what caused the belief that there had been some developments in these districts with respect to the year 2002. Braničevo and Kolubara Districts are specific in the level of energetics development (the largest thermo-electric power plants are at their territories, which are under the reconstruction and improvement), while the City of Belgrade is absolutely the most developed spatial entity in the entire Serbia and it is still attracting the migrations of the workers, particularly the educated ones, from other parts of the country, as well as investments in production sector, and even more in the construction and services sectors.

Table 2. Calculated Malmquist productivity indexes (2009/2002 and 2017/2009)

District	2002-2009			2009-2017		
	MI	**EC**	**TC**	**MI**	**EC**	**TC**
Bor District	0.610	0.905	0.673	1.574	1.365	1.153
Braničevo District	1.001	0.883	1.133	1.134	1.098	1.033
City of Belgrade	1.368	1.068	1.281	1.431	1.000	1.431
Jablanica District	0.498	0.750	0.665	1.522	1.848	0.824
District of Južna Bačka	0.659	0.548	1.202	2.951	2.433	1.213
District of Južni Banat	0.661	0.713	0.928	1.620	1.493	1.085
Kolubara District	1.083	0.887	1.222	1.583	1.597	0.991
Mačva District	0.419	0.632	0.663	1.693	1.576	1.075
Moravica District	0.597	0.737	0.810	1.565	1.669	0.938
Nišava District	0.658	0.661	0.996	1.966	1.557	1.262
Pčinja District	0.706	1.021	0.691	1.268	1.425	0.890
Pirot District	0.509	0.664	0.767	1.527	1.452	1.052
Podunavlje District	0.569	0.850	0.669	1.349	1.242	1.086
Pomoravlje District	0.489	0.752	0.650	1.346	1.169	1.151
Rasina District	0.464	0.701	0.661	2.470	2.416	1.022
Raška District	0.396	0.593	0.668	1.477	1.385	1.067
District of Severna Bačka	0.577	0.591	0.976	1.882	1.774	1.061
District of Severni Banat	1.022	1.000	1.022	1.058	0.995	1.064
District of Centralni Banat	0.496	0.613	0.810	1.674	1.496	1.119
Srem District	0.609	0.774	0.786	1.595	1.584	1.007
Šumadija District	0.485	0.724	0.670	1.718	1.385	1.240
Toplica District	0.518	1.000	0.518	0.933	1.000	0.933
Zaječar District	0.841	1.339	0.628	0.735	0.833	0.882
District of Zapadna Bačka	0.882	0.971	0.908	1.036	0.988	1.049
Zlatibor District	1.058	1.078	0.982	1.584	1.463	1.083

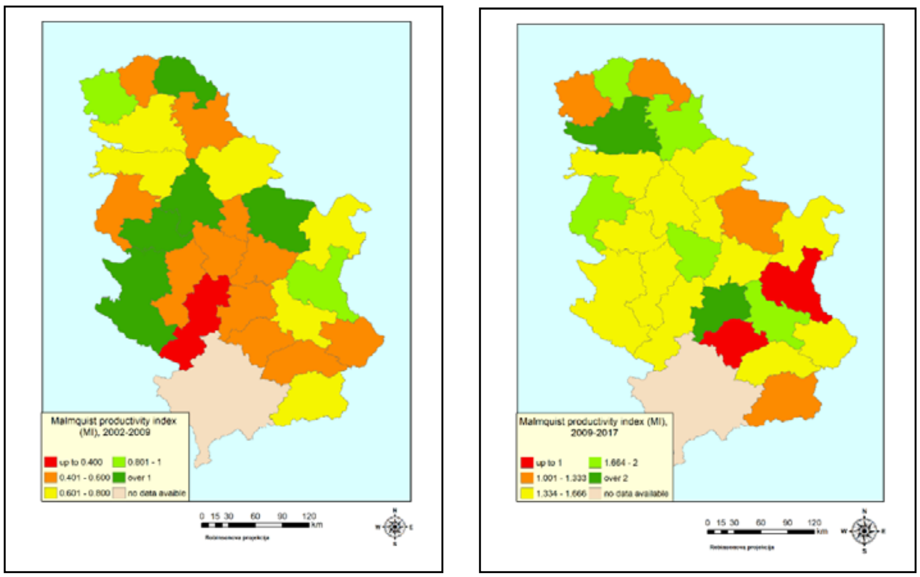
Source: Authors' calculations based on data from
(Statistical office of the Republic of Serbia 2003, 2010, 2018)

All other districts had shown the value of MI lower than 1 during the period 2002-2009, which means that all of them had regressed in the observed period: they either did not use the available resources efficiently [EC] (a low employment rate of the already low share of higher educated workers, wrongfully directed investments, and the like), or the technological development was small and insignificant [TC] (constant outflow of young and educated people, the public sector employees make up the largest share in the employment structure, decreasing investments).

However, in the period 2009–2017, it is noticeable that the values of MI are above 1 in almost all districts, which leads to the conclusion that all the districts had achieved certain improvements. The explanation for this has to do with the fact that the period observed is actually the period after the year (2009) in which Serbia felt the strongest „hit" of the world economic crisis, and in which Serbian economy was in a stronger decline and recession. After that, the period of recovery of Serbian economy began, and this is why all the indicators of economic development had positive values when compared to the year 2009.

However, what the MI actually reveals through its values is not just whether the Serbian districts had progressed of regressed, but it also reveals the speed of these processes. By using the options enabled by ArcGIS 10.2 software package, the districts of Serbia according to the Malmquist productivity index (MI) for the two stated periods have been mapped and ranked (Figure 2).

Figure 2. Malmquist productivity index for the periods 2002-2009 and 2009-2017



Source: Authors

When we observe each period individually and comparing them at the same time by simply looking at the maps (Figure 2). During the period 2002–2009, only five districts had the MI values of more than 1 – but practically only the City of Belgrade had made a substantial progress. However, in the period 2009–2017, the situation is reversed: only two districts had the MI values lower than 1 – Zaječar and Toplica Districts. Therefore, the conclusion is that the period of the last 8 years was the period in which the most parts of Serbia achieved some progress in economic development, but the rankings of the speed of this progress (MI values) tell us that some districts, that had a faster progress before, progressed more slowly in this period, and vice versa. The slower progress in a number of districts may be explained by interpretation of the values of the index components (EC and TC) – they either poorly used the available resources (such as highly educated work force, the possibilities for their hiring at adequate job positions in the economy, or investments in a more propulsive industries), or they lagged behind in technological progress when compared to other districts.

Severna Bačka, Južna Bačka, Centralna Bačka, Mačva, Šumadija, Rasina, and Nišava Districts have a better rank, that is they have achieved a faster progress. This may be explained by observing the activities that took place in the said spaces in the observed period which had already shown some true effects (e.g. the proximity of the neighbouring country of Bosnia and Herzegovina and the trade development influenced the overall development of Mačva District, strengthening of university centres in Novi Sad, Kragujevac, and Niš still attracts the most part of young people and creates a higher share of highly educated in the total populations of their respective districts comparing to the other ones, etc.). On the other hand, the investments inflow based on the investment in public works (such as construction of high-ways) are still to show effects in the following period (e.g. construction of the Miloš the Great Motorway, over the past three years, has not yet shown the expected positive effects on the economic growth of the districts through which it runs (Kolubara and Zlatibor Districts), but the completion of the Corridor X had already shown positive effects on the particular areas (e.g. Pirot and Jablanica Districts).

If we compare the positions of the districts in the two observed periods, we may conclude that the regional differences (which are also revealed by the MI) change over time. It is noticeable that the areas of the West and Central Serbia have become more balanced with respect to differences between individual districts (Figure 2) and also that, on the other hand, the regional differences in South Serbia became even more profound (Toplica and Zaječar Districts regressed in the period 2009–2017, and due to this, the slower progress of other districts also became more prominent). When observed according to the values of the MI, the entire area of West and Central Serbia had made progress. Some districts progressed faster, while others progressed more slowly, which is mostly the consequence of a better use of the available resources (EC component), and less often the consequence of a significant technological progress.

4. Conclusion

The issue of regional development and regional policies is one of the most important issues for Serbia, even though it still does not have an adequate position in the set developmental goals of the country. This is not just due to the fact that Serbia is at the very top in Europe when regional disparities are concerned, but it is also due to the possibility that in the process of accession to the European Union, which Serbia has started, it might gain access to large structural funds from which it can receive (by delegating its projects) significant help in defining and implementing different regional models. For this purpose, Serbia must meet some minimum requirements (resources) at the local and regional levels, but it must also have options to use these resources in the best way possible. So far, it has been obvious that Serbia did not manage to build neither an adequate regional policy, nor the mechanisms at the local and regional levels that would enable the respective levels to achieve better performances and start the economic growth. Lack of human capital is often stated as one of the main reasons for this, along with an inadequate administrative infrastructure which should prepare the projects that would bring financial assets and which would properly channel the received assets and enable the implementation of the projects. Investments are crucial to start the economic growth, but it seems that the existence of capacities which would manage the investments in the best possible way and at the same time use the available resources to the maximum is even more important.

Starting from the assumption that there are prominent regional differences in Serbia and that these differences change over time, the applied DEA analysis shows what consequences the change in the input use efficiency brings (in the particular case, the usage of the available highly educated workers, improvement of workers' quality, real employment and employees' productivity growth, use of investments for development of propulsive industries). The obtained Malmquist productivity index (MI) enable us to, in a specific time period for which it was calculated, observe the speed of changes in economic growth expressed through the GDP growth, that is, to determine the character of these differences and the mutual relationship between spatial units observed. This dynamic component of the DEA analysis practically opens up the possibilities for the decision-makers in the regional policies to observe the trends and the generators of change and, at the same time, to assess where the development should be directed at in order to decrease the existing regional differences.

References

Baddeley, M. (2006). Convergence or Divergence? The Impacts of Globalisation on Growth and Inequality in Less Developed Countries. *International Review of Applied Economics, Vol. 20, No. 3,* 391-410.

Banker, R. D., Charnes, A., & Cooper, W. W. (1984). Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis. *Management Science, 30(9),* 1078–1092, https://doi.org/10.1287/mnsc.30.9.1078

Barca, F. (2009). *An agenda for a reformed cohesion policy, a place-based approach to meeting European Union Challenges and Expectations.* Independent Report prepared at the request of European Commissioner for Regional Policy.

Barro, R.J., Sala – I – Martin, X. (1991). Convergence across States and regions. *Brookings papers on Economic Activity*, 107-182

Barro, R.J., Sala – i- Martin, X. (1995). *Economic Growth*. Singapore, McGraw-Hill.

Boldrin, M., Canova, F. (2001). Europe's regions: Income disparities and regional policies. *Economic Policy, CEPR, CES, MSH*, 207-253.

Camagni, R. (2009). Territorial Capital and Regional Development. In: Capello R., Nijkamp P. (Eds), *Handbook of Regional Growth and Development Theories* (pp. 118-132). Cheltenham: Edward Elgar.

Capello, R. (2009). Space, growth and development. In: Capello R., Nijkamp P. (Eds), *Handbook of Regional Growth and Development Theories* (pp. 33-52). Cheltenham: Edward Elgar.

Cook, W. D., Tone, K., Zhu, J. (2014). Data envelopment analysis: Prior to choosing a model. *Omega*, *Vol. 44 (April 2014)*, 1–4, https://doi.org/10.1016/j.omega.2013.09.004

Fare, R. et al. (1994). Productivity Growth, Technical Progress, and Efficiency Change in Industrialized Countries. *American Economic Review*, *84(1),* 66–83.

Fare, R. et al. (1998). Malmquist Productivity Indexes: A Survey of Theory and Practice. In Fare R. et al. (Eds), *Index Numbers: Essays in Honour of Sten Malmquist* (pp. 127–190). Springer.

Fujita, M., Krugman, P., Venables, A.J. (1999). *Spatial Economy: cities, regions, and international trade*. Cambridge, MA, MIT Press.

Hofer, H., Worgotter, A. (1997). Regional Per Capita Income Convergence in Austria. *Regional Studies, Vol. 31(1),* 1-12.

Kim, S. (2008). Spatial Inequality and Economic Development: Theories, Facts, and Policies. Working Paper No. 16, Commission on Growth and Development, *Washington D.C.*

Manić, E., Mitrović, Popović, S. (2017). Regional disparities analysis of Busines conditions: A Case of Serbia. *Ekonomika preduzeća, 65 (3-4)*, 275-293, doi:10.5937/EKOPRE1704275M

Manić, E, Popović S., Molnar, D. (2012). Regional Disparities and Regional Development: The Case of Serbia. *Mittelungen der Osterreichishen Geographischen Gesellschaft*, Band 154, Wien, pp.191 – 210.

Mitrović, Đ. (2020). Measuring the efficiency of digital convergence. *Economics Letters,* 188, *doi: https://doi.org/10.1016/j.econlet.2020.108982.*

Molnar, D., Manić, E. (2018). Nova subregionalizacija za novu regionalnu politiku Srbije [New Subregionalization for New Regional Policy in Serbia]. *ANALI Ekonomskog fakulteta u Subotici, Univerzitet u Novom Sadu Ekonomski fakultet u Subotici, Vol. 54, br. 40*, 3-19 (In Serbian with English summary).

Petrakos, G. (2001). Patterns of Regional Inequality in Transition Economies. *European Planning Studies, Vol. 9, No.3*, 359-383.

Popović, S., Manić, E., Mitrović, Đ. (2016). The Republic of Serbia in the region: Analysis of socio-economic performances. In International Scientific Conference: The Priority Directions of National Economy Development, *Proceedings of the International Scientific Conference: The Priority Directions of National Economy Development*, 161-171, Niš, Serbia.

Statistical Office of the Republic of Serbia. (2018). *Regionalni bruto domaći proizvod*. Beograd.

Statistical Office of the Republic of Serbia. (2003). *Opštine u Srbiji 2002.* Beograd.

Statistical office of the Republic of Serbia. (2010). *Opštine u Srbiji 2009.* Beograd.

Statistical office of the Republic of Serbia. (2018). *Regioni i opštine u Srbiji 2017.* Beograd.

Rodrigez-Oreggia, E. (2005). Regional disparities and determinants of growth in Mexico. *The Annals of Regional Science, 39*, 207-220.

Sánchez, J. J. V. (2018). "Malmquist Index with Time Series to Data Envelopment Analysis," http://dx.doi.org/10.5772/intechopen.74571

Solow, R. M. (1957). Technical Change and the Aggregate Production Function. *The Review of Economics and Statistics, Vol. 39, No. 3 (Aug. 1957*), 312-320.

Terrasi, M. (1999). Convergence and divergence across Italian regions. *The Annals of Regional Science, 33*, 491-510.

Williamson, J. G. (1965). Regional inequality and the process of national development: A description of the patterns. *Economic Development and Cultural Change 13(2)*, 3-84.

Yemitsov, R. (2003). *Quo Vadis? Inequality and Poverty Dynamics across Russian Regions.* Discussion Paper No. 2003/67, World Institute for Economic Development Research. Helsinki.

Zhu, J. (2011). *Manual DEA Frontier—DEA Add-In for Microsoft Excel.* Available online: http://www.deafrontier.net (accessed on December 2019).

NERAVNOMERAN RAZVOJ – ANALIZA REGIONALNIH RAZLIKA U SRBIJI

Rezime: Neravnomeran regionalni razvoj je danas jedan od najvećih društvenih izazova u Srbiji. Reč je o višedimenzionalnoj i višeslojnoj regionalnoj neuravnoteženosti koja, sudeći prema većini socioekonomskih pokazatelja, ima rastući trend u prvim decenijama 21. veka. U radu su analizirani odabrani demografski, socijalni i ekonomski indikatori upotrebom DEA metodologije. Uzeta je u obzir dinamička komponenta proučavane neuravnoteženosti primenom Malmkvistovog indeksa produktivnosti. Rezultati su nedvosmisleno ukazali na postojanje regionalnih razlika (ne samo između severnih i južnih oblasti, već i unutar samih oblasti), kao i na činjenicu da promene u efikasnosti upotrebe inputa utiču na rangiranje oblasti unutar nacionalne teritorije.

Ključne reči: regionalna neuravnoteženost, regionalni razvoj, DEA analiza, Malmkvistov indeks produktivnosti

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