STATISTICAL ANALYSIS OF THE REGIONAL DISPARITIES

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ABSTRACT

The socio-economic disparities between the regions of Romania represent a constant concern, both for researchers and for those who develop and implement regional development policies. Although Romania as a whole has a GDP/capita relative to purchasing power parity (PPS) of 62.6% of the 2017 EU average, only one region exceeds this average: Bucharest-Ilfov by 144%, while two of its regions of development, North-East and South-West Oltenia, are among the poorest eleven regions of the European Union. The process of mitigating regional economic and social disparities in Romania, as in all regions of the European Union, has been interrupted by the recent financial and economic crisis. This paper showcases a brief analysis of the level and dynamics of regional inequalities in Romania between 2000-2017. Various statistical methods were used to quantify regional disparities: the relative distances method, the Gini coefficient and the Theil index. The obtained results confirm the negative tendencies regarding the increase of regional development disparities in Romania and allow the highlighting of their determining factors.

KEYWORDS: disparities, regions, regional development, regional macro-indicators

INTRODUCTION

One of the main features of the contemporary world is regionalization, within which the geographical dimension is interconnected with the economic, political and security dimensions. In the last three decades, both at the level of Europe and Romania, it is considered that an essential element of the economic, social and environmental development in the 21st century is represented by the increase of the role of the regions.

The issue of regional disparities is of particular interest, both at the level of the European Union and of Romania, especially from the perspective of the Territorial Agenda 2020, the Agenda 2030, in the context in which the concept of territorial cohesion becomes operational.

The causes of the occurrence of regional disparity are analyzed extensively and explained by both institutions and specialists, noting concerns for identifying and quantifying the factors that can lead to their diminution / accentuation.

Mitigating regional disparities is a challenge for both researchers and those who implement regional development policies in practice. As a result of the structural dysfunctions of the economic and social system, there are disparities in the development of the regions, on which it must be intervened to mitigate. Economic polarization as an effect of inequality in economic development is directly related to social polarization. Territorial disparities may represent a potential source of instability and demographic decline of regions.

In 1998, within the program for accession to the European Union, in Romania were created, through the voluntary association between the county and local councils, eight development regions, specific territorial entities, without administrative status and without legal personality. They follow the Nomenclature of Territorial Units for Statistics (NUTS) and correspond to the NUTS II level, with an average population of 2.8 million.

The first basic objective of the regional development in Romania (according to the law of constituting the regions), is: "the diminution of the existing regional imbalances, by stimulating the balanced development, by the accelerated recovery of the delays in the development of the disadvantaged areas due to some historical, geographical conditions, economic, social, political, and the prevention of new imbalances" (Art. 2.a of Law 151/1998, modified by Law no. 315/2004).

The eight development regions of Romania are: North-Eastern Region, South-Eastern Region, South Muntenia Region, South-Western Oltenia Region, Western Region, North-Western Region, Center Region and Bucharest - Ilfov Region.

In 1990 Romania had, compared to other former communist states in Eastern Europe, a relatively low level of regional disparities. The evolution of the Romanian economy after the fall of communism, however, determined the accentuation of the differences between the eight development regions.

Except for the Bucharest-Ilfov region, whose situation is special, the economic growth followed a west-east direction, the proximity of the western markets acting as a diffusion factor for the growth. Although the statistical data show some variations in time, due to local factors, the economic growth had a significant geographical component, the underdeveloped areas being concentrated in the North-East, on the border with Moldova and in the South, along the Danube. Underdevelopment appears to be strictly correlated with unemployment and the predominance of rural activities, as well as with the inability to attract foreign direct investments.

The poles of regional disparity are given by the North-Eastern Region with a 5900 Euros GDP per capita, in 2017, and the Bucharest-Ilfov Region with 22000 Euros per inhabitant, which is almost four

times higher than that of the North - Eastern Region.

According to Eurostat statistics, all regions in Romania have a low level of development, in 2017, two of the eight Romanian NUTS 2 regions were included in the eleven least developed regions of the European Union in terms of GDP per capita.

The paper aims to use a sample of economic indicators selected at the level of the eight development regions of Romania and statistical methods for quantifying regional disparities to provide empirical perspectives on the current situation of these territorial units in Romania.

2. LITERATURE REVIEW

The problem of regional disparities, of reducing inequalities between them has been addressed in recent years in numerous studies and specialized works. The purpose of these researches is to provide decision makers with data and information relevant to the adoption of policies and measures that will lead to narrowing differences between regions. Along with other methods, in the analyzes carried out, a special interest is manifested for the use of statistical-mathematical methods.

A number of studies, both international (Barro and Sala-i-Martin, 1992; Pritchett, 1997, Durlauf and Quah, 1999; Magrini, 2004, 1999; Rey and Janikas, 2005; Asheim and Gertler, 2005; Audretsch and Keilbach, 2005; et al.), as well as national (Iancu A., 2008; Ailenei et al., 2012; Goschin, 2014; Constantinescu and Constantin, 2010; Boboc et al., 2012) analyzed various aspects of regional disparities.

In other studies (Özyurt S. and Dees S., 2015), traditional factors that determine regional economic performance (such as investments, human capital development and innovation) have been taken into account. For the analysis of regional growth, Rodriguez-Pose and Crescenzi (2008) propose an empirical model in which the regional economic performance depends on three main factors: i) internal innovative efforts, ii) local socio-economic factors leading to innovation and iii) knowledge dissemination. related to space.

The labor market response to region-specific shocks is analyzed in many papers in the literature (Blanchard and Katz, 1992; Decressin and Fatás, 1995; Blien and Tassinopoulos, 2001; Baltagi and Li, 2004, Gimpelson et al., 2017).

Attempts to find answers regarding the occurrence, persistence and accentuation of regional inequalities have also been made in studies from other fields: geography (Gaile, 1984; Armstrong, 1995; Ianos, 2013), history (O'Connor, 2001), sociology (Sassen, 1994; Sandu D., 2010), political science (Gruber and Gaines, 2001) have been made.

Studies on the analysis of regional disparities in former communist countries of Central and Eastern Europe have shown that they have increased significantly after the transition to the market economy (Petrakos, Kallioras and Anagnostou, 2011; Brzeski and Colombatto, 1999; Römisch, 2003), but they continued over the next few years and in some cases intensified (Petrakos et al, 2000; Petrakos, 2008; Ezcurra et al, 2006; Kallioras and Petrakos, 2010). Even in these conditions, the countries of Central and Eastern Europe have smaller regional disparities than those of the regions of Western Europe (Szendi, 2013).

Even though, Romania has entered a relatively low level of regional disparities in the transition process (compared to other Member States or candidate countries), however, Romania's accession to the European Union has contributed to the deepening of regional disparities. This phenomenon can be explained on the one hand by the low rate of structural and cohesion funds (which should have supported faster development of poor regions) (Zaman and Georgescu, 2009; Goschin and Constantin, 2010) and on the other part of the fact that foreign direct investments are concentrated in the Bucharest-Ilfov Region (where, investments as a percentage of GDP are twice as high as the EU average and 1.5 times higher than the national average) (European Commission, Country Report from 2019 on Romania).

In some economic analyzes carried out at national level, territorial inequalities have been explained on the basis of differences between regions in terms of endowments with natural resources, factors of production, infrastructure and technology (Constantinescu and Constantin, 2010; Boboc et al., 2012). However, empirical evidence has shown that in the traditional analysis of regional disappearances, a number of relevant influencing factors are missing, which are highlighted by recent localization theories.

Also, the identification and quantification of regional inequalities was achieved by various mathematical-statistical methods: Gini coefficients and Lorenz curve (Nica E et al., 2018), coefficients of variance, standard deviation, Theil index, Atkinson index, beta convergence (Pisár and Varga, (2017), "3 Sigma" rule, the principal components method (Jaba E et al., 2014), the method of distances between regions in the abstract metric space (Hančlová and Tvrdý, 2004), the Herfindahl-Hirschman index, the concentration coefficient, the coefficient of changes absolute structures (Zaman and Goschin, 2013).

3. RESEARCH METHODOLOGY, VARIABLES AND DATA
For the analysis and comparison of regional disparities it is often used as a macroeconomic indicator per capita GDP (Spieza, 2003), and as statistical methods are used, among others: the method of relative distances, the Gini coefficient and the Theil index.

➢ One of the most used techniques for performing comparisons in territorial profile and for elaborating multicriteria rankings of territorial units is the method of relative distances. The essence of this method is the use of the relative coordination sizes calculated in relation to the territorial unit with the best position (or the average level at national level). Thus, for each j characteristic (economic indicator) the region with the maximum performance X_{ij} is chosen as the reference level and the relative coordination sizes (the gap or the distance to the best performance) are calculated for the other territorial units:

$$\frac{X_{ij}}{X_{\max, j}} \qquad (1)$$

where: X_{ij} represents the value of the j indicator in the i region,

$X_{\max, j}$ is the highest value recorded by the indicator considered at the level of the regions

For each territorial unit, the average multicriteria offset (average distance to maximum performance) is calculated as a simple geometric mean of the offset determined for all the m analyzed characteristics.

$$D_i = \sqrt[m]{\prod_{j=1}^{m} \frac{X_{ij}}{X_{mas, j}}} \qquad (2)$$

The method of relative distances, when the gap is calculated based on the ratio of the average value of the characteristic j at the national level ($\overline{X}_j$), is determined on the basis of the calculation relation of the multicriteria mean disparity for each region i:

$$D_i = \sqrt[m]{\prod_{j=1}^{m} \frac{X_{ij}}{\overline{X}_j}} \qquad (3)$$

Thus, a unitary evaluation of the relative position of each development region at national level is obtained, from the perspective of the set of indicators j included in the analysis. The disparities between regions become comparable at national level, because all the calculations use as the national average size of each economic indicator used to evaluate territorial disparities. Based on the calculations performed according to this indicator, the multicriterial hierarchy of the regions is performed based on the synthetic indicator of the regional gaps.

The relative disparity values calculated for each indicator, as well as the size of the synthetic index of disparities per region, are interpreted in relation to the unitary value that expresses the national average level: the superunitarian sizes indicate the regions with a higher level of development, the highest value corresponding to the unit. territorial with the highest level of development; subunit sizes indicate the underdeveloped regions, the most unfavorable position being of the lowest calculated value.

➢ *Gini coefficient (index)* is one of the most widespread indicators of disparities, being considered a standard measure for analyzing inequality. This index is a statistical size that highlights the degree of concentration of the value of a series of statistical data.

The classical definition of G appears in the notation of the theory of relative mean difference:

$$G = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n}\left|x_i - x_j\right|}{2n\sum_{i=1}^{n} x_i} = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n}\left|x_i - x_j\right|}{2n\,\bar{x}} \qquad (4)$$

where: x_i ; x_j are the observed values in region i, respectively, j,

n is the number of values observed and

$\bar{x}$ is the mean value

If the x values are first placed in ascending order, such that each x has rank i, the some of the comparisons above can be avoided and computation is quicker:

$$G = \frac{\sum_{i=1}^{n}(2i - n - 1)x_i}{n\sum_{i=1}^{n} x_i} \qquad (5)$$

where: n is the number of values observed and

i is the rank of values in ascending order

➢ *The Lorenz curve* is a graphical method that allows to assess the degree of concentration and measurement of the Gini concentration indicator. The Lorenz-Gini curve is constructed in a square with lateral 1 (100%), and the surface between the concentration curve and the diagonal of this square represents the concentration surface, according to which the concentration level of the analyzed indicator is evaluated. The concentration is even stronger as the Lorenz curve deviates more from the

diagonal. The concentration is minimal (zero) when the overall value of the analyzed indicator is evenly distributed over the territorial units considered.

➢ *Theil index* (1967), defined by the relation:

$$T = \sum_{i=1}^{N} y_i \, ln \frac{y_i}{s_i} \tag{6}$$

where; y_i is the GDP share of region *i* and

s_i is the share of the region's population or employment in the total population or total employment in region *i*.

and expresses, by a synthetic size, a state of the system that can be correlated with the development of a convergence process.

1.1. RESULTS

To analyze the disparities between the eight development regions of Romania, the online database of the European Union and that of the National Institute of Statistics (TEMPO online database) were used.

The analysis of these regional disparities with the help of the GDP / capita indicator shows that since 1990 the least developed region continues to be the North-East Region, where a level of GDP/inhabitant registered with 38.54 pp below the national average in 2017 (Figure 1).

In 2017, low values of GDP/inhabitant were registered in the South-West Oltenia Region with 26.74 pp below the national net and the South-Muntenia Region (with 19.8 pp below the national net), while the Bucharest-Ilfov region exceeded by 129.2 pp this average (Figure 1).

Figure 1 Romanian Regional Gross Domestic Product (PPS per inhabitant) compared to the national average (RO=100)
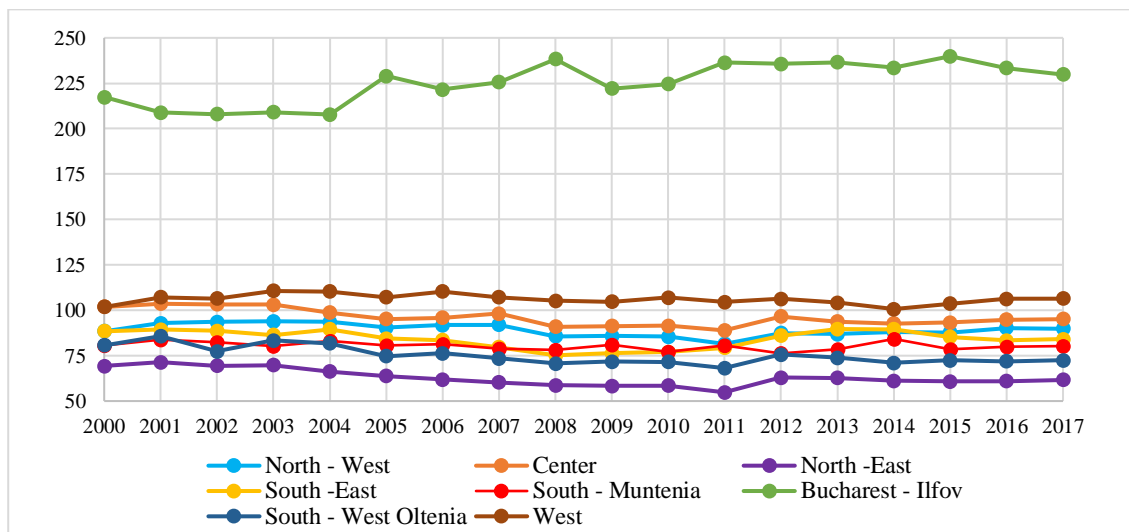
Source: Author calculations based on Eurostat statistics (online code: [nama_10r_2gdp])

Therefore, compared to the national average, the GDP/capita indicator shows that the development disparities between the eight development regions tend to be accentuated, especially between the region that includes the capital (Bucharest-Ilfov) and the other regions, but also between the east and the west. country.

If, in 2000, the employment rate in the Bucharest-Ilfov Region was (with the exception of the Center Region) below the values recorded in the other six development regions, in the following years, it registered faster increases, exceeding the values recorded in the other development regions (excepting Northeastern region, which for the whole period analyzed had the highest employment rates). Thus, the employment gaps between the development regions and the region that includes capital have increased, ranging from 0.32% to 6.78% in 2008 and 0.70% and 17.25% in 2018.

The North-Eastern region, with employment rates higher than in the Bucharest-Ilfov region, has a territorial index greater than 100 (Table no. 1).

Table no.1 Deca The regional employment gaps compared to the Bucharest-Ilfov region, in the years 2000, 2008, 2013 şi 2018

	Teriorial index (%) $i_{k/j}^{y} = \dfrac{y_k}{y_j} \cdot 100$				Relative offsets / advances (%) $\Delta_{k/j}^{y} = \dfrac{y_k - y_j}{y_j} \cdot 100$			
	2000	**2008**	**2013**	**2018**	**2000**	**2008**	**2013**	**2018**
North - West	105.67	98.11	100.48	93.97	5.67	-1.89	0.48	-6.03
Center	99.67	93.38	86.58	82.75	-0.33	-6.62	-13.42	-17.25
North -East	111.83	106.78	105.27	100.70	11.83	6.78	5.27	0.70
South -East	101.33	92.43	87.70	82.89	1.33	-7.57	-12.30	-17.11
South - Muntenia	107.83	100.47	94.89	89.76	7.83	0.47	-5.11	-10.24
South - West Oltenia	115.17	99.68	96.17	87.66	15.17	-0.32	-3.83	-12.34
West	103.67	95.58	93.61	83.73	3.67	-4.42	-6.39	-16.27

Source: Authors' calculations based on TEMPO-online data, National Institute of Statistics, www.insse.ro

With a GDP per capita (in PPS) of only 38.7% of the EU average (in 2017), the North-East Region (Iasi, Suceava, Bacau, Neamt, Botosani and Vaslui counties) is the sixth poorest EU region, however, is the region with the largest number of inhabitants and the largest area (17.95% of the population of Romania and 15.46% of the total area of the country).

The statistical data regarding the unemployment rate in the eight development regions of Romania show, in the period 2000-2018, an oscillating variation of the equation of this indicator with respect to the highest value recorded (Table no. 2).

Starting with 2013, the regional unemployment rate has shown a decreasing trend in all the development regions, with a high level in 2018, in the southern regions of Romania: South-Western Oltenia (6.8%), South-Eastern (6.2 %) and South-Muntenia (5.7%).

Table no.2 Gaps in the unemployment rate and the rate of regional vacancies relative to the region with the highest value of these indicators

|	Unemployment rate (%)				Vacancy rate (%)		
	2000	**2008**	**2013**	**2018**	**2008**	**2013**	**2018**
North - West	84.62	48.24	41.58	42.65	59.11	76.42	69.39
Center	82.42	100.00	95.05	61.76	71.66	63.21	55.10
North -East	80.22	55.29	47.52	38.24	94.33	68.87	48.98
South -East	100.00	85.88	98.02	91.18	60.73	35.85	41.33
South - Muntenia	91.21	82.35	100.00	83.82	78.54	60.38	59.18
Bucharest - Ilfov	78.02	40.00	80.20	54.41	100.00	82.08	78.06
South - West Oltenia	69.23	80.00	75.25	100.00	61.94	34.91	30.10
West	75.82	65.88	52.48	54.41	83.40	100.00	100.00

Source: Authors' calculations based on TEMPO-online data, National Institute of Statistics,www.insse.ro

Statistical data referring to the variation of vacancies in the regions of Romania (between 2008 and 2018) show that the highest level of labor market development is registered in the West and Bucharest-Ilfov regions. The analysis of the regional differences in terms of the vacancy rate, highlights another hierarchy of them (Table 2).

The aggregation of the corresponding regional disparity indices GDP/capita and a series of labor market indicators (employment rate, unemployment rate, activity rate and vacancy rate) in an average synthetic index allows a better hierarchy of regions in terms of the disparities that exist at a certain moment, as well as their evolution over time (Figure 2a). By assigning a rank to each region, depending on the value of the synthetic index obtained, their ranking can be obtained (Figure 2b).

Figure 2

a) Evolution of the synthetic index at the level of the development regions

b) The order of the regions by the relative distances method (lowest rank = favorable situation)
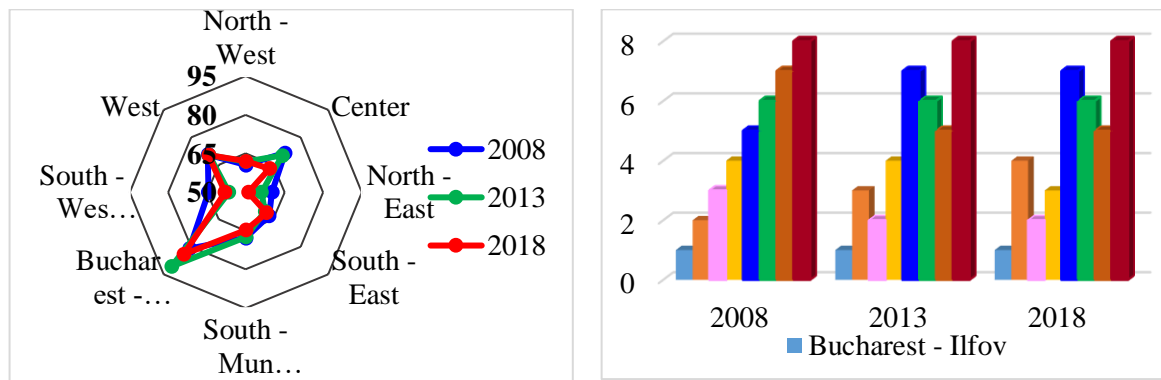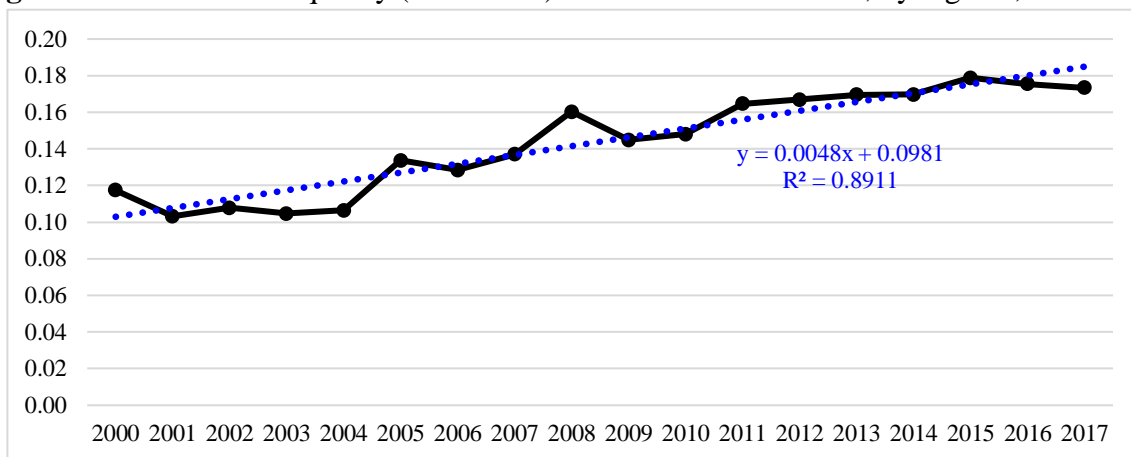
Source: Authors' calculations based on TEMPO-online data, National Institute of Statistics,www.insse.ro

The use of the Gini index to highlight the inequalities between regions in terms of the distribution of GDP allows analyzing the measures, policies developed and the efficiency of the tools put in place to reduce inter- and intra-regional differences.

Between 2000-2017, the Gini index has an oscillating variation (Figure 3). The general trend of the Gini index is slightly increasing, which can be considered by some specialists as a negative phenomenon, and for others as a normal phenomenon for an emerging economy, such as tha of Romania.
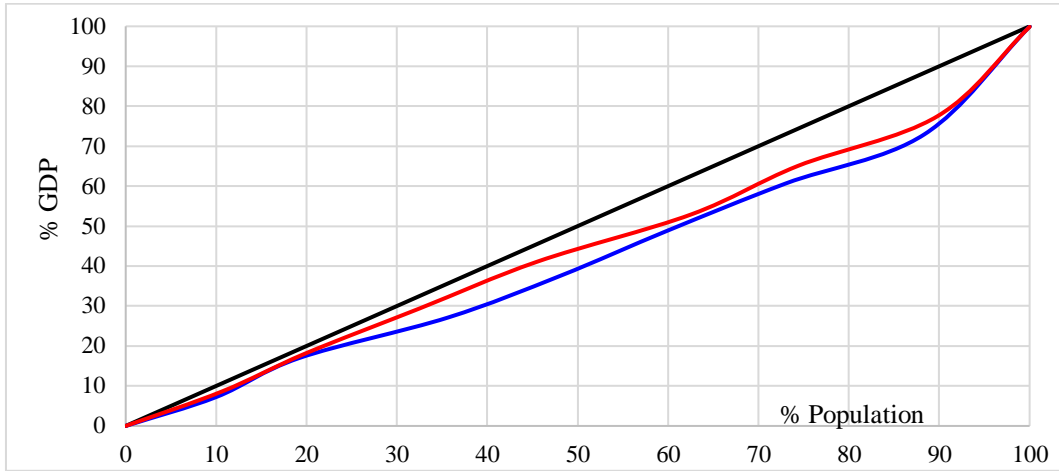
Figure 3 The level of inequality (Gini index) of the GDP distribution, by regions, 2000-2017

$$y = 0.0048x + 0.0981$$
$$R^2 = 0.8911$$

Source: Author calculations based on Eurostat statistics, (online code: [nama_10r_2gdp])

At the level of NUTS 2 regions of Romania, in the last 20 years, there is a tendency to increase the degree of GDP concentration, as evidenced by the Lorenz concentration curves for the years 2000 and 2017 (Figure 4).

**Figure 4** Lorenz curve regarding GDP concentration by regions, 2000 and 2017

Source: Authors' calculations based on Eurostat statistics, (online code: [nama_10r_2gdp]) and online TEMPO database, National Institute of Statistics of Romania

For the calculation of the Theil index, GDP, population and employed population at the level of each region were considered as variables. The results obtained from the application of the relation (6) and graphically represented in Figure 5 show an oscillating evolution of Theil index between 2000-2017. During the periods when the level obtained for the Theil index decreases, approaching zero, the degree of divergence (in the sense of gaps, diversity level of development) decreases, so it can be said that the regions converge to close values regarding the variables considered.

Figure 5 Theil index evolution at regional level
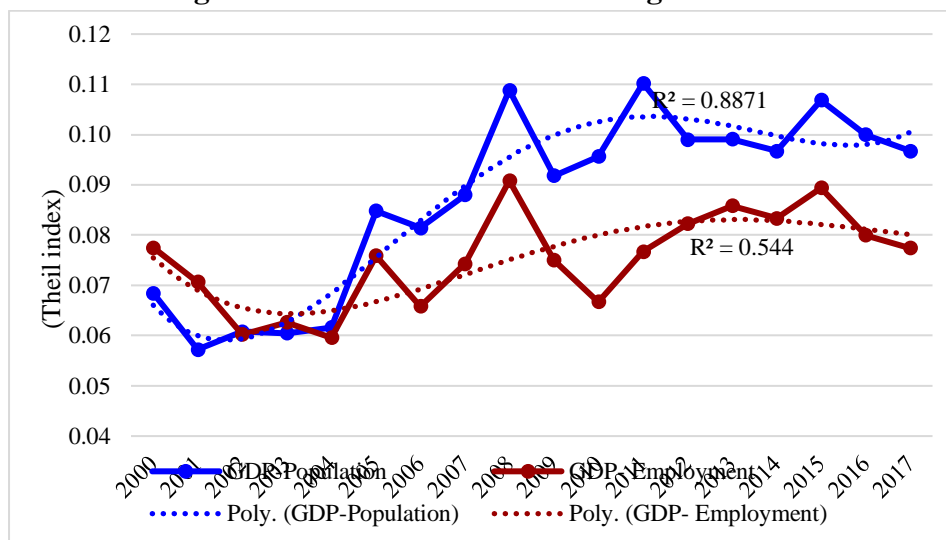
Source: Authors' calculations based on Eurostat statistics, (online code: [nama_10r_2gdp])

The maintening and sometimes the deepening of the disparities between the regions of Romania are determined by the action of multiple, interdependent factors, among which can be mentioned: education, poverty level, aging population, emigration (in general and of young people in particular), health of the population, infrastructure, etc.

CONCLUSION

The results of the different statistical methods applied for estimating the disparities in the development regions of Romania, indicate the same tendency of increasing territorial inequalities in the period 2000-2017, with some deviations on subperiods, depending on the evolution of the national economy as a whole and the consequences of the economic crisis. financial.

According to Eurostat statistics, North-East, South-West Oltenia regions rank among the eleven poorest regions of the European Union. These continue to face the lowest economic performance, dependence on agriculture, a large number of emigrants for work / studies / definitive, with a low level of investments and low qualification of the labor force.

The main features of the Romanian development regions are:

- between the West and the East of the country there is an unbalanced economic development;
- concentration of underdevelopment in the North-East South-West Oltenia, South-Muntenia and South-East regions;
- territorial economic inequalities have generated significant differences in the structure and size of human resources, in the structure of the regional labor market, in the size and structure of migration flows, etc;
- the resilience to the external shocks of the crisis and the accommodation in the economic and social context of the community was relatively higher in the regions with higher level of economic and social development than in those with relatively low levels;
- The Bucharest-Ilfov region has a high level of socio-economic development compared to the other development regions.

With a GDP / capita (in PPS) of only 38.7% of the EU average (in 2017), the North-East region) is the sixth poorest region in the EU, but it is the region with the highest number of inhabitants, as well as the largest area (17.95% of the population of Romania and 15.46% of the total area of the country). Between 2000-2017, in all the development regions of Romania, the activity rate had an oscillating evolution and the year 2014 meant its re-launch.

In the eight regions of development there are significant differences in the labor market. The regions that had the employment rate above the national average in 2018 are North-East with 71.8%, Bucharest-Ilfov with 71.3%, North-West with 67%.

In 2018, the North-East Region, with a higher employment rate than in the Bucharest-Ilfov region,

had a territorial index of 111.83%

Starting with 2013, the regional unemployment rate showed a decreasing trend in all the development regions, with a high level of this indicator, in 2018, in the regions of southern Romania: South-West Oltenia (6.8%), South-East (6.2%) and South Muntenia (5.7%).

The application of the different statistical methods for estimating the territorial disparities over a longer period of time, including the period of the last economic-financial crisis, has allowed a better multidimensional hierarchy of the regions regarding the inequalities exists at a certain time, as well as their evolution over time.

The process of reducing the gaps between the developed and the remaining areas is a long one and is carried out in small steps. Even though in the last two in each of the development regions of Romania there have been slight economic growths, nevertheless the gaps between them continue to have high values.

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