Convergence or Divergence?
Multidimensional Analysis of Regional Development in the New European Union Member States

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Abstract

The main aim of the paper is the multidimensional analysis of regional development in the new EU Member States in the years 2004–2014 on the background of EU regions and characterisation of the differences in their dynamics with the use of a synthetic index. The article presents an attempt to adopt a method of taxonomic measure of socio-economic development for multidimensional comparative analysis of development processes in a dynamic approach and to develop a synthetic measure reflecting the multifaceted nature of development processes and cohesion policy. The developed indicator (Regional Development Index) was used to determine the directions and paces of processes leading to the reduction of disparities in the level of regional development (β- and σ-convergence).

Keywords: cohesion policy, regional development, convergence, new EU Member States

JEL: O18, R11

Introduction

One of the main objectives of the European Union is to strengthen economic, social and territorial cohesion by supporting measures to reduce regional disparities. In practice, regional development (in the context of the effects of cohesion policy) is monitored by one indicator — GDP per capita. Despite the numerous advantages (universality, relative ease of interpretation as well as comparability in time and space), this measure does not comprehensively reflect the complex nature of cohesion policy-driven development processes, referring in reality only to its economic dimension. While attempts are being made to construct synthetic indicators that take into account the multifaceted nature of regional development, attention is directed to the readability of composition and the selection of variables. Besides, because of its structure, synthetic indicators only allow for the identification of development disparities between regions and their ranking according to a given day/year, but they are rarely used to study the dynamics of development processes and thus the convergence or divergence processes within a certain period.

The main aim of the paper is the multidimensional analysis of regional development in the EU New Member States in the years 2004–2014 and the characterisation of the differences in their dynamics with the use of a synthetic measure covering three objectives of cohesion policy, namely: smart, sustainable and inclusive growth. For this purpose, a Regional Development Index (RDI) has been developed, tested and implemented. The application of this taxonomic measure

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of socio-economic development provided a multifaceted examination of the variation in the pace of development processes of regions of the so-called new EU Member States in Central and Eastern Europe regarding convergence or divergence.

1 Research context of regional development and its measures

One of the primary objectives of the European Union is to strengthen economic, social and territorial cohesion by supporting measures to reduce regional disparities.[1] This means that cohesion policy aims at supporting the process of convergence of the EU countries and regions by aiding the development processes in the least-favoured areas.

Analyses of β-convergence in the European Union undertaken in numerous studies (Baun and Marek 2014; Borowiec 2015; Kluth 2016; Monfort 2008), popularised by Barro and Sala-i-Martin (1992) is aimed at capturing the processes of the gradual alignment of the GDP per capita levels. They are embedded in the neoclassical theory of economic growth. According to the Solow (1956) model, along with an accumulation of capital, marginal capital productivity decreases. It leads to the conclusion that the growth rate of the Gross Domestic Product (GDP) per capita of less developed regions should be higher than the growth rate of the GDP per capita of more developed regions, leading to a gradual levelling of their level of development. If β-convergence occurs, it is also very likely that σ-convergence will appear, which means decreasing differentiation in the GDP per capita levels between regions in the course of time. As Monfort notes "while β-convergence focuses on possible catching-up processes, σ-convergence simply refers to a reduction of disparities among regions in time" (2008, 5).

According to Sawicz (2012, 29–31), the process of economic convergence in the new EU Member States with the EU economy was accompanied by a growing discrepancy of the GDP per capita levels of their regions (internal divergence phenomenon or "global convergence—regional divergence" hypothesis). The speed with which particular regions of the new EU Member States were "catching up" with the average GDP per capita was diverse. The fastest paces were characteristic for the metropolitan regions (growth poles) leading to polarization or so-called "convergence of clubs" (Baumont, Ertur, and Le Gallo 2003; Sawicz 2012, 27).

Sánchez Domínguez and Ruiz Martos (2013) note that although economic and social cohesion has been the primary goal of the European Union since its inception, regional performance is defined in a purely economic sense through the size of the economy and economic growth. Traditional measures of economic development are based on the system of national or regional accounts. The most popular—GDP per capita level and the GDP per capita growth—is a monetary measure of economic activity, capturing the value of goods and services produced by an economy during a given period. As GDP measures economic results expressed in monetary value, it provides estimation of the economic situation in a given area and the level of its development. Although initially GDP per capita was not intended for this purpose, it has become a universal measure of development and living standards, as economic growth (measured with GDP per capita growth) is "usually associated with higher incomes, higher consumption and rising standards of living."[2] However, we must bear in mind the fact that GDP is a measure of production, not welfare, and is so interpreted by economists (Kubiczek 2014, 44).

There is a lot of criticism towards GDP as a measure of development (Lawn 2007), especially after the global economic crisis. Despite the numerous advantages (universality, relative ease of interpretation, relative comparability in time and space), this measure does not comprehensively reflect the complex nature of cohesion policy-driven development processes, referring in reality only to its economic dimension. In this regard, it should be emphasised that GDP per capita as a measure of regional development is insufficient to capture the multidimensional nature of progress.

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1. See: Consolidated version of the Treaty on the Functioning of the European Union. OJ C 326, 26.10.2012, p. 47–390.

2. See: Beyond GDP: Regional development indicators. European Parliamentary Research Service Briefing by Agnieszka Widuto, February 2016, [@:] http://www.europarl.europa.eu/RegData/etudes/BRIE/2016/577953/EPRS_BRI(2016)577953_EN.pdf.

Numerous weaknesses of the measures based on national accounts have become the cause of the development of various index measures, developed both by academicians (Booysen 2002; Del Campo, Monteiro, and Soares 2008; Folmer and Heijman 2005; Pater, Harasym, and Skica 2015; Ram 1982) as well as various international organizations (i.e., EU, OECD, UNDP) and non-governmental organizations. The most popular measures of this kind used to measure progress and socioeconomic development are: the Human Development Index implemented by UNDP, EU Regional Competitiveness Index, OECD Better Life Index, Genuine Progress Index; Index of Sustainable Economic Welfare, Social Progress Index, Measure of Economic Welfare, Net National Welfare, Index of the Economic Aspects of Welfare, Index of Sustainable Economic Welfare, Genuine Progress Indicator (Kubiczek 2014). For the most part, however, these are measures allowing only comparisons at the level of countries, and only a few allow comparisons at the level of regional systems.

Although synthetic indicators are also not without substantial disadvantages (Booysen 2002; Permanyer 2011), their main advantage is the ability to display the complex and multi-faceted phenomena and processes, including regional development issues. The EU authorities are also aware of this, which is evidenced by the initiation of the "Beyond GDP: regional development indicators" debate aimed at reflecting on alternative measures for cohesion policy in order to better reflect the multidimensional nature of socio-economic progress and explore the possibility of using other indicators to assess regional development and even allocate European Funds.[3] Taking into consideration objectives of the European Union concerning economic, social and territorial cohesion by supporting measures to reduce regional disparities, one of the aims of this paper is to propose an alternative approach to a single criterion approach based on GDP per capita. It would provide a multidimensional observation of the regional development processes in the European Union and the verification of the convergence or divergence processes in the European space based on a synthetic measure, leading — according to the aims of the EU regional policy — to economic, social and territorial cohesion with a special focus on smart, sustainable and inclusive growth.

2 Methodological framework

On the basis of existing research results concerning processes of regional convergence in the European Union based on the classic analysis of GDP per capita (Borowiec 2015; Sawicz 2012), the two following general hypotheses were posed regarding the possibility of investigating convergence processes in the EU with the use of a multidimensional approach:

Hypothesis 1: New EU Member States experience external (general) β-convergence regarding regional development (multidimensional approach) versus the alternative hypothesis: New EU Member States experience external (general) β-divergence regarding regional development (multidimensional approach).

Hypothesis 2: New EU Member States experience internal σ-divergence regarding regional development (multidimensional approach) versus the alternative hypothesis: New EU Member States experience internal σ-convergence regarding regional development (multidimensional approach).

To determine the level and dynamics of regional development in the new EU Member States a taxonomic measure of socio-economic development called the Regional Development Index (RDI) has been developed and used.

The primary assumption for the taxonomic measure structure was the willingness to take into account the diverse nature of the development processes stimulated by the EU cohesion policy. Therefore, the selection of individual indicators was based on a set of variables dedicated to monitoring of the European Union's cohesion policy, closely aligned with the "Europe 2020" strategy which aims at promoting smart, sustainable and inclusive growth.[4] This approach provided a direct reference to the very objectives of the cohesion policy, and on the other hand, it ensured

3. See: Beyond GDP: Regional development…, op. cit.
4. See: EUROPE 2020. A strategy for smart, sustainable and inclusive growth. COM/2010/2020 final, Communication from the Commission, Brussels, 3.3.2010.

better availability of statistical data, collected and published as cohesion policy indicators in the Eurostat database.

The spatial scope of the research covered 263 European Union NUTS 2 units—i.e., all EU regions apart from: Ceuta, Melilla, Corse, Guadeloupe, Martinique, Guyane, La Reunion, Mayotte, Regiao Autonoma dos Acores, Aland, which were rejected due to significant data gaps. The time frame of the study covered the years 2004–2014, which on the one hand was conditioned by the most significant enlargement of the EU in history, while on the other side—by the availability of data. The initial set of variables consisted of 13 features divided into three objectives of cohesion policy, namely: smart, sustainable and inclusive growth (tab. 1)

Tab. 1. Cohesion Indicators

I. Smart growth	
Research and Development:	
Research & Experimental Development expenditures as percentage of GDP	X_1
Patent applications to the European Patent Office (per 1 mln of inhabitants)	X_2
Competitiveness and business environment:	
Regional GDP in Purchasing Power Standards (PPS) per capita	X_3
Regional unemployment rate (*excluded*)[a]	X_4
Regional employment rate of the age group 20–64	X_5
Education:	
Tertiary education attainment, age group 30–34 (in %)	X_6
Early leavers from education and training by sex (in %)	X_7
II. Sustainable growth	
Transport:	
Victims of road accidents (per 1 mln of inhabitants)	X_8
Freight transported by road by the region of loading (per 1000 of inhabitants) (*excluded*)	X_9
Environment:	
Population connected to wastewater collection and treatment systems (in %) (*excluded*)	X_{10}
Generation and treatment of municipal waste (t per 1000 inhabitants) (*excluded*)	X_{11}
III. Inclusive growth	
Social inclusion, poverty and health:	
People at risk of poverty or social exclusion	X_{12}
Life expectancy at birth	X_{13}

Source: Cohesion Policy Indicators, data published by Eurostat, as on 18 September 2017, http://ec.europa.eu/eurostat/web/cohesion-policy-indicators.

[a] Excluded from RDI construction—see details in the text.

The second criterion for the selection of the final set of indicators was the availability of data. For this reason, it was decided to reject the X_9 variable (available at the NUTS 3 level), X_{10}, and X_{11}. However, despite the relative completeness and coherence of the Eurostat database, the issue of the missing data and administrative changes in the period 2004–2014 for selected units and variables turned out to be a significant problem in some cases. Missing data was completed using a variety of methods—imputation, interpolation and extrapolation, each time looking for the best possible solution (Runge 2006). Some variables (i.e., X_{12}—people at risk of poverty or social exclusion) for selected countries were available only at NUTS 1 level. In these cases, the same values were adopted for all NUTS 2 units included in the NUTS 1 unit, which affected to some extent the results obtained and influenced their flattening. In the following step, a selection based on the coefficient of variation and correlation of features was used to choose indicators characterized by appropriate variability in spatial terms and a diversified information value, allowing for a comprehensive approach to the studied phenomenon. Due to the high level of correlation between X_4 (regional unemployment rate) and X_5 (regional employment rate of the age group 20–64) features, the X_4 variable was excluded, as regional employment rate of the age group 20–64 better reflects the structural features of a given labor market. Finally, for RDI construction the following variables were used: X_1, X_2, X_3, X_5, X_6, X_7, X_8, X_{12}, and X_{13}.

In the further proceedings, the normalisation of the variables was made based on the method of unitarisation. In contrast to the standard procedure, the normalisation by unitarisation (so-called min-max method) used in the study was based on the highest (max), and lowest (min) values observed among the analysed regions during the whole analysed period, not in particular years. Thanks to this, the created measure allows for direct comparisons of the results obtained both in space and time. For stimulants, formula (1) was used, and for destimulants — formula (2):

$$(1) \qquad y_{ijt} = 100 \frac{x_{ijt} - x_{i\,min}}{x_{i\,max} - x_{i\,min}},$$

$$(2) \qquad y_{ijt} = 100 \frac{x_{i\,max} - x_{ijt}}{x_{i\,max} - x_{i\,min}},$$

where:

y_{ijt} — normalised value of j-th indicator in i-th EU region in year t,

x_{ijt} — empirical value of j-th variable in i-th EU region in year t,

$x_{i\text{min}}$ — lowest value of j-th variable among EU regions in analysed period (2004–2014),

$x_{i\text{max}}$ — highest value of j-th variable among EU regions in analyzed period (2004–2014).

The applied procedure allowed for the unification of the character of variables by transforming the destimulants into stimulants. Results obtained assumed values in interval [0; 100], where 100 means the highest, while 0 the lowest value of the indicator observed in the analysed period (years 2004–2014). The taxonomy measure of socio-economic development (RDI) was calculated as

$$(3) \qquad \text{RDI}_{it} = \frac{1}{n} \sum_{j=1}^{n} y_{ijt},$$

where:

RDI_{it} — value of RDI indicator in i-th EU region in year t,

y_{ijt} — normalised value of j-th indicator in i-th EU region in year t,

n — number of variables (Kowerski 2017, 20).

In the final stage of the research analysis of the β-convergence (which occurs when less developed regions grow faster than better-developed ones) for the new EU Member States (EU12 + Croatia) and so-called old Member States (EU15) as well as σ–convergence (which refers to the reduction in the dispersion of the regional development levels across the regions) among new EU Member States (EU12 + Croatia) was conducted. For the purpose of the β-convergence analysis between two groups of the units (EU12 + Croatia vs EU15 regions), the panel graph method based on the arithmetic mean for two groups proposed by Kopczewska (2012) was used. The σ-convergence analysis was based on the changes of the coefficient of variation in 2004–2014 calculated according to the formula

$$(4) \qquad V_t = \frac{s_{\text{RDI}t}}{\bar{x}_{\text{RDI}t}},$$

where:

V_t — value of the coefficient of variation for analysed regions in year t,

$s_{\text{RDI}t}$ — standard deviation of the RDI indicator for analysed regions in year t,

$\bar{x}_{\text{RDI}t}$ — arithmetic mean of the RDI indicator for analysed regions in year t.

3 Research results

According to the results obtained, the diversification of the level of development of individual regions measured by the Regional Development Index was at the level within the ranges from 19,90 (Severozapaden, Bulgaria) do 66,83 (Helsinki-Uusimaa, Finland) in 2004 and from 27,04 (Sud-Est, Romania) to 73,93 (Stockholm, Sweden) in 2014.[5] In the analyzed period the dispersion between the maximum and the minimum value was at a diversified level — it decreased in the period

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5. [In the journal European practice of number notation is followed — for example, 36 333,33 (European style) = 36 333.33 (Canadian style) = 36,333.33 (US and British style). — Ed.]

Tab. 2. Descriptive statistics of the research results

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Mean	44,33	45,31	46,58	47,44	48,43	48,87	49,56	50,14	50,51	51,15	52,11
Median	46,65	47,22	48,50	49,14	50,02	50,27	50,59	50,97	51,47	52,24	53,11
St. dev.	10,26	10,20	10,05	9,87	9,55	9,36	9,29	9,36	9,34	9,20	8,98
Coeff. of var.	0,23	0,23	0,22	0,21	0,20	0,19	0,19	0,19	0,18	0,18	0,17
Min	19,90	20,10	20,93	22,77	25,25	26,65	26,07	26,71	25,82	27,43	27,04
Max	66,84	67,21	68,83	70,23	71,46	70,95	72,32	73,00	73,55	73,93	73,93
Range	46,94	47,10	47,90	47,46	46,20	44,30	46,25	46,29	47,73	46,50	46,89

Source: Own elaboration based on data published by Eurostat, as on 18 September 2017

2004–2009 — i.e., until the outbreak of the economic crisis, while from 2010 it increased. At the same time, a constant decrease of the coefficient of variation was observed in 2004–2014 which may confirm the σ-convergence among all of the European Union regions (tab. 2).

The diagram of the differentiation of the mean RDI value for the new EU Member States (EU12 + Croatia) and so-called Old Member States (EU15) provides a test of the hypothesis about β-convergence between the two groups mentioned above. The constant approximation of the mean of the RDI for EU12 + Croatia and EU15 observed in the period 2004–2014 (fig. 1) proves that regions of the new EU Member States experienced external (general) β-convergence concerning regional development measured by the Regional Development Index value. At the same time, the negative correlation coefficient between the growth rate of the Regional Development Index and its initial value in 2004 ($r = -0,507$ with the level of statistical significance set at $p < 0,05$) also indicates the β-convergence among European regions, which means that less-developed regions (including those from the new Member States) developed faster than more developed areas, mostly from EU Old Member States (EU15).
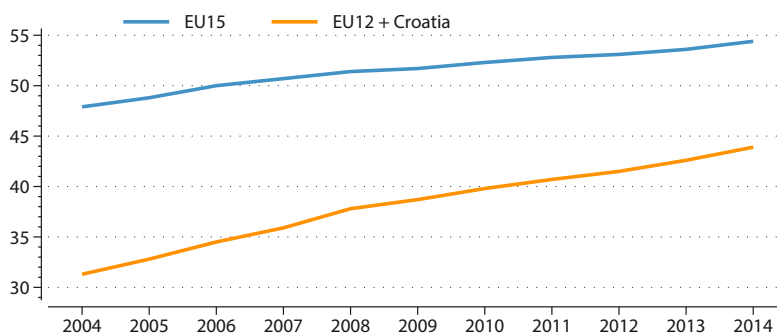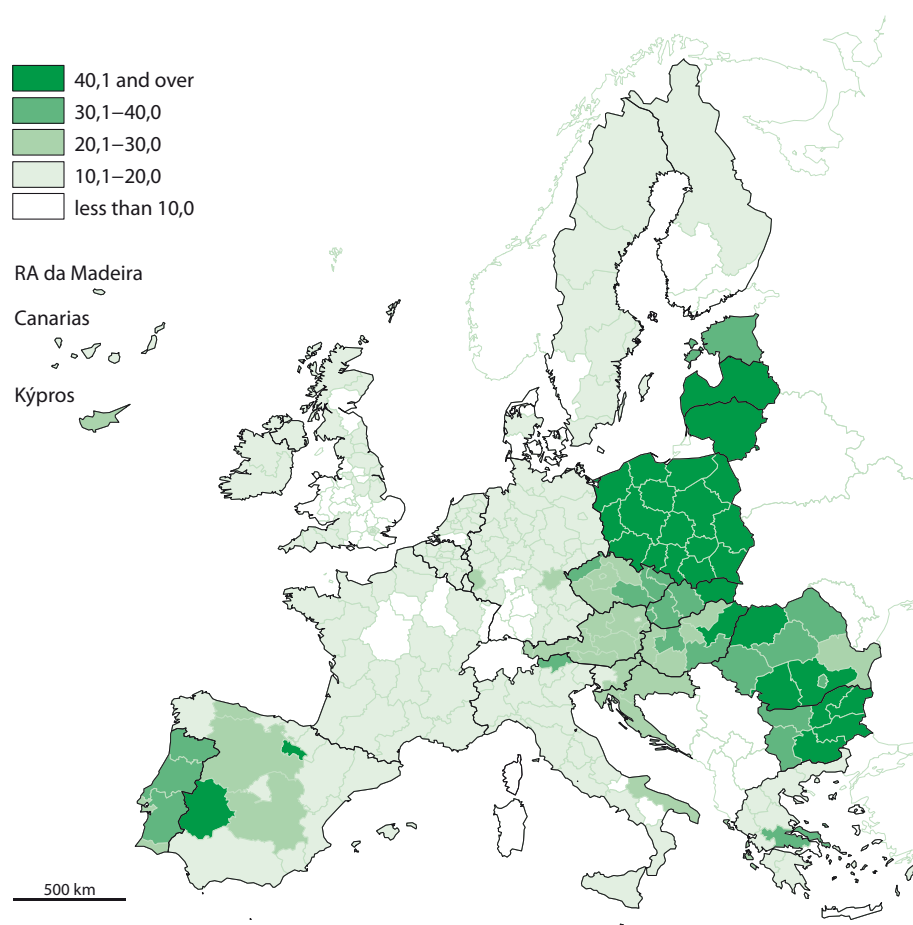

Fig. 1. Mean of the Regional Development Index for EU Old (EU15) and new EU Member States (EU12+Croatia) in the years 2004–2014

Source: Own elaboration based on data published by Eurostat, as on 18 September 2017

In general, the largest increases in the value of the Regional Development Index in 2004–2014 were recorded in statistical units at the NUTS 2 level located in the new EU Member States from Central and Eastern Europe. In the case of Latvia, the increase in the value of the RDI amounted to 74,2%, in the case of Warmińsko-Mazurskie Voivodship, Poland — 71,5%, while in the case of Lubuskie Voivodship, Poland — 66,3%. The increase in RDI value at the level exceeding 40% was recorded in all Polish voivodships (16 entities), 4 from 6 Bulgarian regions (Yugoiztochen, Severen Tsentralen, Yuzhen Tsentralen and Severoiztochen), 3 from 8 Romanian regions (Nord-Vest, Sud-Vest Oltenia, and Sud-Muntenia), as well as in Východné Slovensko region in Slovakia, Észak-Alföldregion region in Hungary, and Lithuania. At the same time, only one of the EU15 regions — Extramadura in Spain — recorded RDI growth exceeding 40% in the analysed period. The detailed results of the change in the value of the RDI for 2004–2014 are presented in figure 2.

The analysed results allow us to state that in Europe we observe a gradual alignment of the level of socio-economic development (multidimensional approach) of the regions of the EU new
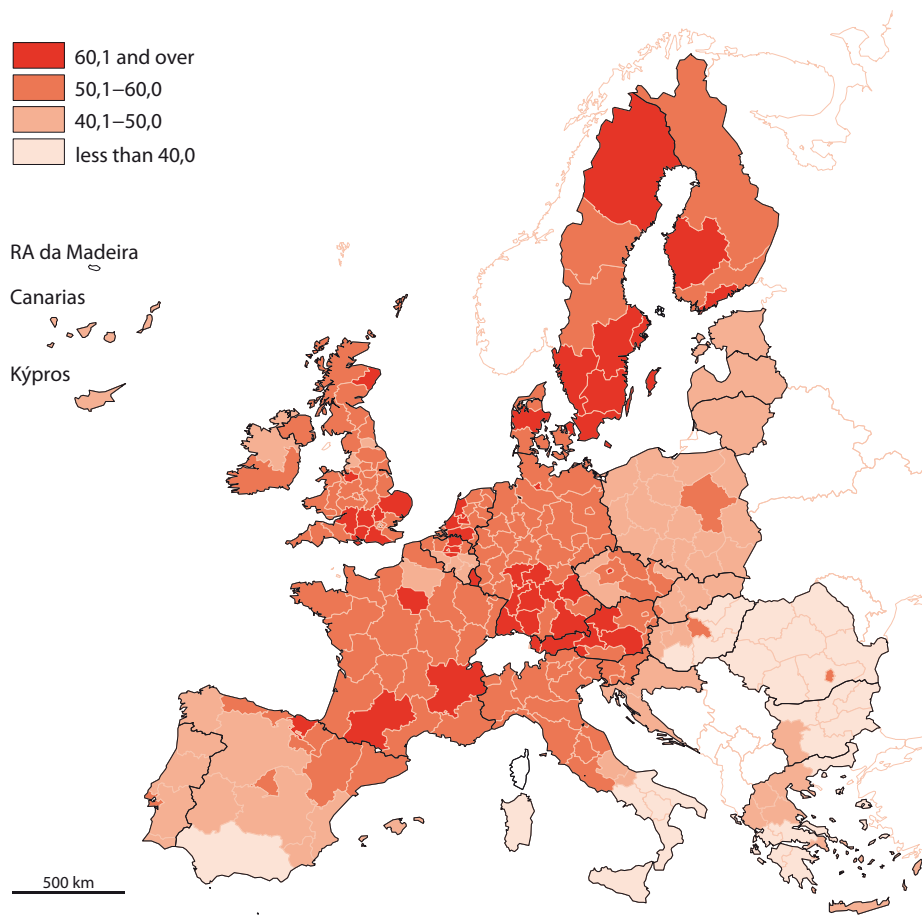
Fig. 2. Regional Development Index growth in the years 2004–2014 by NUTS 2 units

Source: Own elaboration based on data published by Eurostat, as on 18 September 2017

Member States with the EU15 regions. The vast majority of Central and Eastern European regions are relatively quickly filling the development gap in relation to highly developed regions of Western European countries in broadly understood regional development, which takes into account — in line with the Europe 2020 Strategy goals — smart, sustainable and inclusive growth. However, despite this fact, disproportions in the area of regional development measured with RDI are still significant (fig. 3). What is more, convergence processes were influenced to a certain extent by the economic crisis of 2008, which affected the slowdown of development processes throughout Europe, but its impact was more visible in the regions of the new EU Member States (fig. 1).

According to the adopted assumption, the research was also supposed to verify the hypothesis about the occurrence of the so-called internal σ-divergence, referring to the increase in the dispersion of the regional development levels across the regions. The occurrence of the σ-convergence or divergence — considered by Quah (1993) or Wójcik (2008) as the only one worthy of interest because of its importance for the study of income homogenization or polarization processes — is shown by the decrease or the increase in the level of the coefficient of variation. According to the results obtained presented in figure 4, in the period 2004–2014, the coefficient of variation for the RDI value gradually decreased in the group of regions of the new EU Member States. This process was relatively dynamic in the years 2004–2008, in the period 2009–2012 it was stopped as a result of the economic crisis, and then reactivated again. These results allow us to reject the hypothesis about the occurrence of the internal σ-divergence in the new UE Member States. Reduction in the dispersion of the RDI among new EU Member States (EU12 + Croatia) can be considered as confirmation that the regions of the new EU Member States are gradually becoming similar to each other regarding the level of regional development, and thus they undergo σ-convergence processes. At the same time, the value of the coefficient of variation for the GDP per capita decreased only

Fig. 3. Regional Development Index in 2014 by NUTS 2 units

Source: Own elaboration based on data published by Eurostat, as on 18 September 2017
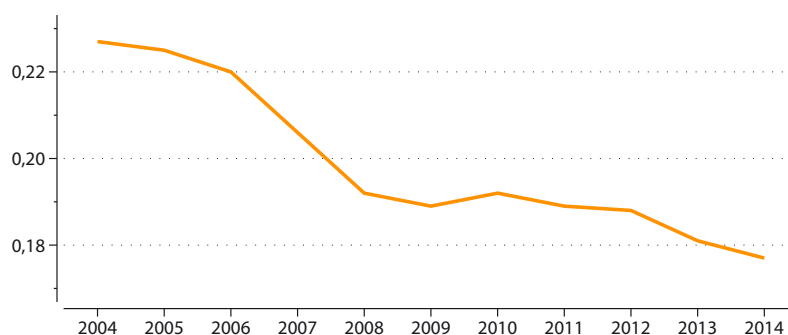
Fig. 4. Coefficient of Variation of the Regional Development Index for EU New Member States (EU12+Croatia) in the years 2004–2014

Source: Own elaboration based on data published by Eurostat, as on 18 September 2017

slightly — from 0,464 to 0,437 — which proves that cohesion policy leads to an increase in economic, social and territorial cohesion which is consistent with the Europe 2020 strategy objectives, despite the fact that cohesion of the new EU Member States measured by GDP per capita, in fact, does not increase.

Conclusions

Despite the fact that the European Union aims at economic and social cohesion, current measures of regional development are defined in a strictly economic sense. Taking into account all limitations of GDP per capita, which is commonly used as a measure of development, it seems to be

reasonable to develop a Regional Development Index, providing a multidimensional analysis of development processes, taking into account their economic and social dimensions. The application of the aforementioned method provided a multifaceted examination of the variation in the pace of development processes of regions of the so-called new EU Member States in Central and Eastern Europe regarding convergence or divergence.

According to results obtained among EU28 regions we observe absolute β-convergence — growth dynamics decreases with approaching the high level of regional development (measured with RDI). It means that we may accept the hypothesis 1. On the other hand, according to the results of the coefficient of variation for the RDI value, we may reject the hypothesis 2. Disparities in regional development level measured by RDI are decreasing, both in global (all regions of the EU) and internal (regions of the new EU Member States) dimensions, although the pace of change remains varied, which applies to both better and less developed areas. These results can be associated with the amount of the expenditures from the EU funds, which confirms the overall effectiveness of cohesion policy regarding equalising development disparities measured by the multidimensional measure (RDI).

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