DEVELOPMENT OF SOCIOECONOMIC DISPARITIES ACROSS THE EU 2004+ COUNTRIES

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Abstract: *The aim of this paper is to determine whether it is possible, in line with the purpose of the cohesion policy, to identify the elimination of disparities across the EU 2004+ countries and their cohesion regions, as measured by a relevant method of geographical analysis of disparities. The disparities were assessed, based on the indicator of gross domestic product per capita, both for each country as a whole and for individual cohesion regions. We have chosen the Theil index as the primary method of assessment, with the results then being checked using the Adjusted Geographic Concentration index (AGC). Both methods have consistently shown that, although there are disparities in the GDP per capita indicator among the countries and their cohesion regions, the disparities can be qualified as relatively low (with the exception of Hungary) based on the values gained using the two methods. Regarding the actual development of disparities, the Theil index identified a significant increase, especially after the crisis year of 2008, while the harmonized AGC index of production revealed, with regard to the different development of individual national indices (stagnation, decline and growth), that the development of discrepancies in wealth creation has not changed.*

Keywords: *Regional disparities, Theil index, Concentration of production, Adjusted Geographic Concentration index (AGC).*

JEL Classification*: O57, R11.*

Introduction

Uneven regional development within the EU is an issue of growing importance, with the elimination of socioeconomic disparities at regional level and the strengthening of the region's competitiveness, social, and territorial cohesion being the primary objectives of the EU cohesion policy. The effectiveness of this policy is assessed based on its influence on the development of regional disparities, or on the elimination, growth or stagnation of regional differences that could be identified after the intervention of regional policy. The term "disparity" is generally perceived as a discord, inequality or imbalance of various phenomena, but the concept of regional disparity is understood in different ways and so far it does not have a complete theoretical and methodological framework for accurate interpretation. For example, Hučka [18] defines disparities as "*a difference or inequality of characteristics, phenomena or processes assigned to a definite location and occurring in at least two entities of this territory structure*". OECD [26] gives the term "disparity" clear economic overtones by stating that: *"territorial disparity indicates the degree to which the intensity of a certain economic phenomenon differs between regions of the same country"*.

The causes and continuing importance of the cohesion policy can be also seen in the enlargement of the EU to include new member states of mostly lower economic performance. It is clear that its enlargement, mainly to the east, will continue in the coming years; therefore, we can anticipate in this context, among other things, an increase in regional disparities within the entire integration grouping.

Substantial volumes of funds have been spent in the context of cohesion policy to eliminate regional inequalities and disparities, and it is planned that to this important support of regional policy will continue throughout the 2014–2020 programming period[1]. It is undisputable that the aim of cohesion policy is to enhance the efficiency of the provided funds. For this reason it is necessary to know how the affected regions develop in relation to the allocated resources, i.e. for example, whether the amount of funds received into the economies sparked the necessary multiplier effect or the undesirable deadweight effect [3].

1 Statement of problem

The topical problems of economic, social and regional inequalities, and the related evaluation of the impact of regional policy interventions are not just a contemporary phenomenon - already in the 1930s the first quantitative macroeconomic models emerged, for more detail see example [31]. The mentioned evaluation is a subject of a number of empirical studies in which research is often focused on the identification of trends in regional development in terms of convergence or divergence of the EU countries and regions, such as [6]; [15]; [22]; [33].

Given the importance of conducting an evaluation of EU regional policy, the objective of the presented paper is to determine whether it is possible to identify the elimination of discrepancies across countries after them becoming Member States in 2004, 2007, and 2013 ("EU 2004+[2]"), as well as across their cohesion regions, as measured by an appropriate method of geographic disparities analysis. For this paper the following parts of the research were selected: a) a relevant approach to the measurement of regional disparities was selected based on literature search; b) the results of the measurements; c) verification of the research results using a suitable evaluation method of disparities development across analyzed regions. As the beginning of the reference period the year 2000 was chosen, i.e. the period before the largest EU enlargement to date, which resulted in significant deepening of disparities across European regions (according to achieved economic performance as measured by GDP per capita, the acceding countries were the least developed regions across the entire EU [2]; [12]. The final year of the analysis is, based on the availability of data, the year 2013.

2 Methods

To achieve the main objective and to select a suitable method for regional disparities evaluation, a literature search was conducted, where the economic diversity of regions, the potential for international comparison, and also the possibility to break down the overall identified discrepancies into their components were considered the main prerequisites for the selection. Based on these conditions the research then focused on methods based on spatial (geographic) concentration and working with the comparison of relative values[3], namely it focused on the approaches of generalized entropy that allow the break down

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[1] Based on the approved multiannual financial framework there is an intention to allocate to the cohesion policy approximately 45.7% of the EU budget during the 2014–2020 period, which is 1.25 percentage points less than in the previous programming period [7], while there is almost 18% of the total cohesion policy expenditure allocated for the countries that acceded after 2004 [8].

[2] Czech Republic (CZ), Slovak Republic (SK), Poland (PL), Hungary (HU), Slovenia (SI), Malta (MT), Cyprus (CY), Lithuania (LT), Latvia (LV), Estonia (EE), Romania (RO), Bulgaria (BG), Croatia (HR).

[3] Among the approaches based on geographic concentration most frequently belong the degree of concentration; localization quotient method; Gini coefficient; Lorenz curve; Theil index of inequality, or concentration coefficient [21].

of a particular discrepancy into an intergroup and intragroup component of the measured variability [27]; [29].

Within the approaches of generalized entropy the most commonly used methods for determining regional disparities is the so called basic rate of entropy (the formula for general entropy), which is defined in the population-weighted form by equation (1) in such a way as to capture the impact of socio-economic disparities per capita in defined areas [5]; [20]; [32]:

$$GE(\propto) = \frac{1}{\propto^2 - \propto}\left[\sum_{i=1}^{k}\frac{n_i}{n}\left(\frac{y_i}{\bar{y}}\right)^{\propto} - 1\right] \tag{1}$$

where n is the number of individuals in the sample, y_i is the income of an individual i, and $\bar{y}$ the arithmetic mean income.

The GE (α) index values fall in the $<0; \infty)$ interval and it holds true that the more the index approaches 0, the more evenly dispersed is the monitored socioeconomic variable (income) within the group, i.e. disparities across regions are eliminated; conversely, higher values give a signal of greater heterogeneity of the group. [20].

If we substitute 1 for the parameter $\propto$ in the equation (1), we get Theil's measures of inequality [30], the mean log deviation and the Theil index respectively, in the population-weighted form (2) [16]; [20]:

$$GE(1) = T_W = \left(\sum_{i=1}^{k}\frac{n_i}{n}\frac{y_i}{\bar{y}}\ln\frac{y_i}{\bar{y}}\right) \tag{2}$$

where in the symbols are as defined in (1).

The Theil index takes values from a closed interval $<0; \ln(n)>$, while again it holds true that the closer to 0 is the achieved value, the more homogenous are the regions. An indisputable advantage of this evaluation approach, compared to other methods, can especially be seen in the residue-free break down of the overall level of inequalities, i.e. when dividing groups into interregional (between-country inequality) (first summand - T_B) and intraregional components (within-country inequality) (second summand - T_w) [4] on the basis of belonging to regions:

$$GE(1) = T = \left(\sum_{i=1}^{k}\frac{n_i}{n}\frac{y_i}{\bar{y}}\ln\frac{y_i}{\bar{y}}\right) + \left(\sum_{i=1}^{k}\frac{1}{n}\frac{y_i}{\bar{y}}\sum_{j=1}^{n_i}\frac{\bar{y}_{ji}}{y_i}\right) = T_B + T_w \tag{3}$$

where $\bar{y}_{ji}$ denotes the average value of the monitored phenomenon in the jth unit in the i group; other symbols are as defined in (1).

Unlike the more frequently used methods for determining disparities across regions, such as e.g. standard deviation, coefficient of variation, or Gini coefficient, the Theil index, respectively its interregional and intraregional disparities components, can be broken down in order to assess the relative share of individual regional disparities on the overall total disparity [24].

However, the Theil index has some restrictions; for example, a rather difficult interpretation of its results and the fact that the values of this break down may be affected by stochastic and contextual components of inequality (more e.g. in [20]), where the contextual component of inequality represents the part of inequality, which is in excess of stochastic inequality , i.e. inequality that can be statistically determined and that would be expected in randomly distributed regional data (e.g. based on the Central Limit Theorem, more e.g. in [19]; [24]). After clearing the total disparity results of the stochastic component

we gain the so-called geographical standardization, thus the research results are free of the regional arrangement component [23].

Besides the Theil index there is another frequently applied method for measuring production concentration, the so-called Adjusted Geographic Concentration index ("AGC"), which is a general measure of concentration based on the comparison of the distribution of two phenomena and is determined by the following equation [28]:

$$AGC = \frac{\sum_{i=1}^{N}|y_i - a_i|}{\sum_{i \neq min} a_i + 1 - a_{min}} \qquad (4)$$

where a_{min} is the area of the smallest region, y_i indicates the proportion of production level of region i at national level; a_i is the proportion of the region's area and the size of the country; N the number of regions. AGC index can be divided into two parts, the geographical concentration of population and regional disparities in wealth creation, where in the case of production the relationship is as follows:

$$y_i - a_i \equiv (y_i - p_i) + (p_i - a_i) \qquad (5)$$

where p_i represents the size of population in region i on the national level, other symbols are as defined in (4).

Due to this fact, we can adjust the AGC index for the level of production as the so-called relationship between the effect of territorial disparities in GDP per capita (first summand) and the effect of geographic concentration of population (second summand) in which the symbols used are defined as in (4) and (5) [28]:

$$AGC = \sum_{i=1}^{N} \frac{y_i - p_i}{y_i - a_i}|y_i - a_i| + \sum_{i=1}^{N} \frac{p_i - a_i}{y_i - a_i}|y_i - a_i| \qquad (6)$$

The AGC production index reaches values that fall in the interval <0; 1>, and it holds true that the higher the index, the higher the production concentration, and conversely, the lower the index, the more dispersed is the monitored phenomenon, i.e. disparities in wealth creation across regions are eliminated.

The necessity to perform an evaluation of cohesion policy is indisputable, besides other things, due to the volume of European funds that are allocated to this policy. In view of this fact and also in view of the aim of this paper we selected the Theil index as a method for evaluating the disparities development, which allows, as already mentioned, a residue-free break down of the examined socioeconomic inequality into intragroup and intergroup, respectively interregional (between-country inequality) and intraregional (within-country inequality) components of measured variability. The Theil index calculations were performed using the statistical program EasyStat.

3 Research results and discussion

The following section presents the empirical insight of defined evaluation methods of regional disparities.

3.1 Determination of regional discrepancies in the 2004+ EU countries using the Theil index

The main part of the research monitored the development of regional disparities in all cohesion regions of the 2004+ EU economies using the Theil index, i.e. in particular the fundamental regional indicator of wealth creation — the regional GDP in PPS in relation to the population size of the area, specifically for 58 NUTS II regions, which have enlarged

the EU since 2004. It follows that in this part of the research we examined the relative value of inequalities in the achieved level of production, by breaking it down into sub-components according equation (3).

Based on the research results captured in Tab. 1, which are also displayed graphically for greater clarity (Fig. 1), it can be stated that there is a relatively low level of disparities in wealth creation among these economies, since throughout the period the values of the selected index fall within 1/16 of the defined interval <0; ln (58)>.

Tab. 1: Theil index for the EU 2004+ NUTS II regions
*(regional GDP in PPS weighted by population)*

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
T	0.22667	0.21024	0.21028	0.20260	0.19503	0.19900	0.19481	0.19638
T_B	0.07343	0.06132	0.05826	0.05297	0.05087	0.04925	0.04382	0.04302
T_B (v %)	*32.39*	*29.16*	*27.70*	*26.14*	*26.08*	*24.75*	*22.49*	*21.91*
T_w	0.15324	0.14892	0.15203	0.14963	0.14416	0.14975	0.15099	0.15335
T_w (v %)	*67.61*	*70.83*	*72.30*	*73.86*	*73.92*	*75.25*	*77.51*	*78.09*

	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**change 2000-2008**	**change 2008-2013**
T	0.19353	0.20895	0.22167	0.22766	0.23191	0.23495	-0.03313	0.04142
T_B	0.03830	0.04617	0.05373	0.05780	0.06063	0.06297	-0,03513	0.02467
T_B (v %)	*19.79*	*22.10*	*24.24*	*25.39*	*26.14*	*26.80*	*-12.60*	*7.01*
T_w	0.15523	0.16278	0.16794	0.16985	0.17128	0.17198	0.00199	0.01675
T_w (v %)	*80.21*	*77.91*	*75.76*	*74.61*	*73.86*	*73.20*	*12.60*	*-7.01*

Source: the author according to data from [13]; [14]; [25].

Regarding the actual development of regional disparities, it is clear that undoubtedly the breakthrough year was 2009, when the consequences of the financial crisis began to gradually show in the form of a decline in economic performance in almost all the world economies (e.g. [17]). Therefore, in 2009 the gradual trend of elimination of disparities among the EU 2004+ countries was replaced by a different and more dynamic development of the selected indicator (already in 2011 the Theil index reached its initial value of 2000).

In the period before this significant increase in disparities, specifically in 2005, we can also identify an increase in the index value, although quite small, which was due to an increase in disparities within individual economies. This fact can be assigned to a higher level of wealth creation in metropolitan regions based on the GDP values of individual regions (this also applies when we eliminate those countries that only have one cohesion region) [12].

Fig. 1: Theil index
(regional GDP in PPS weighted by population)
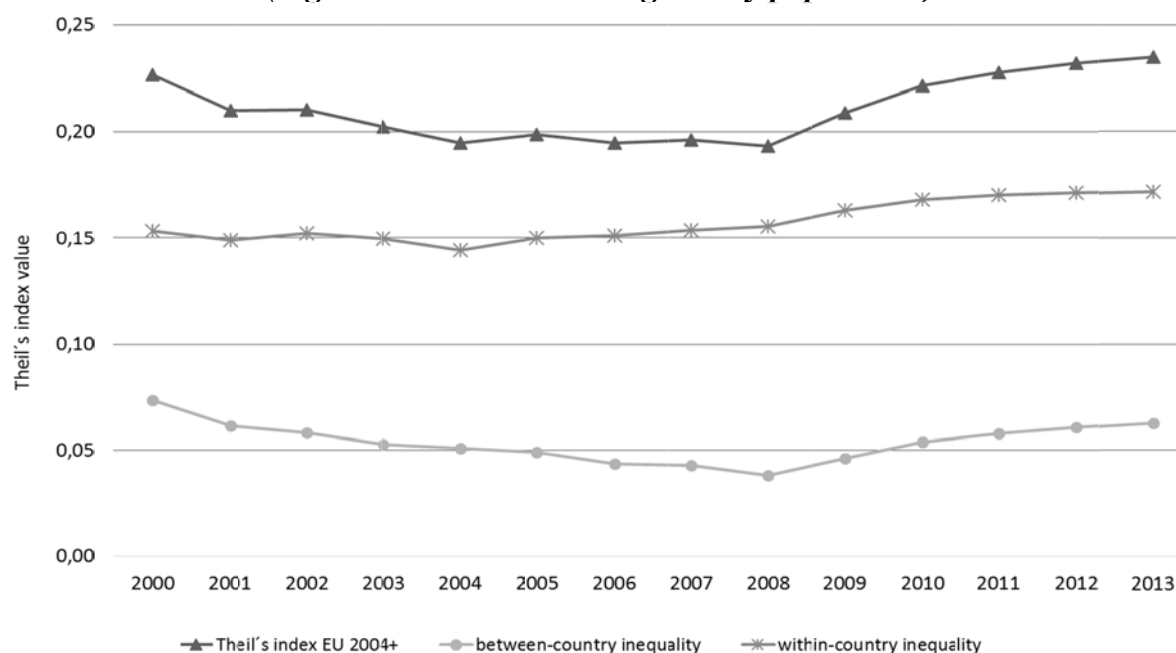
When accenting individual sub-components of the examined inequality it is apparent from the break down of the index that throughout the whole reference period these disparities were mainly caused by disparities in the achieved level of GDP weighted by population within individual economies (within-country inequality); while up to 2008 they were gradually increasing their proportion (more than 80% of the final value), subsequently they began to decline gradually (in 2013 they formed 73.2% of the index value).

The development itself, i.e. the growth, stagnation, and decline of both components of the resulting inequality of GDP weighted by the population of the EU 2004+ countries is largely similar. One exception is the period 2004–2008, during which the disparities between countries were reducing (between-country inequality), but the inequalities within the EU 2004+ countries were increasing (within-country inequality), which led to fluctuations of the Theil index within the interval <0.19353; 0.19900>.

At present the countries still struggle with an unfavourable development of disparities (in the last analyzed year the initial value was already exceeded by 3.65%), but according to the expected development of the individual economies'GDP we can assume that in the next period the monitored inequalities will be eliminated [9].

3.2 Theil index vs. AGC production index

As mentioned before, the methods that are based on spatial (geographical) concentration represent very important approaches that are increasingly used to evaluate the development of socioeconomic or socio-geographic impacts of cohesion policy, with the chosen method of production concentration, the AGC index, meeting all of the requirements defined by the research.

When calculating the AGC production index, the focus is again on the NUTS II regions, but the regional GDP in PPS is replaced by the level of production, the number of individuals is replaced by the population size and the area by the area of a region.

Because of the dependence of the AGC production index on the differences in percentage shares of given indicators among various national NUST II, those economies that consist exclusively of one cohesion region had to be excluded from the research.

From Tab. (2), respectively from Fig. (2), it is clear that EU 2004+ countries form three clusters within the defined interval <0, 1>: 1. countries that fall quite considerably bellow the middle value of this interval; 2. a cluster consisting of countries that fall around the index value of 0.5; and 3. economies, where concentration of production index value is close to 1, which is HU.

*Tab. 2: AGC production index for EU 2004+ NUTS II regions*

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
BG	0.33333	0.36807	0.40326	0.41575	0.43442	0.44651	0.49656
CZ	0.49574	0.50369	0.50808	0.51951	0.53031	0.54576	0.54262
HR	0.25997	0.26765	0.27031	0.24791	0.23073	0.23983	0.24746
HU	0.70923	0.72611	0.76076	0.74158	0.74863	0.76598	0.78684
PL	0.45540	0.45419	0.45840	0.46076	0.46331	0.46595	0.47229
RO	0.43225	0.40620	0.41039	0.40932	0.41146	0.46047	0.45133
SI	0.28971	0.29551	0.29467	0.31351	0.31433	0.31610	0.32325
SK	0.45791	0.44095	0.44202	0.45541	0.46495	0.50034	0.51163
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
BG	0.54553	0.55913	0.57745	0.59483	0.60242	0.58610	0.58264
CZ	0.55402	0.56222	0.55377	0.56005	0.54978	0.54576	0.54242
HR	0.23211	0.24041	0.24584	0.24611	0.25101	0.24627	0.24627
HU	0.80268	0.81089	0.83454	0.82940	0.81611	0.81778	0.81777
PL	0.47279	0.47214	0.47836	0.48796	0.49210	0.49031	0.48946
RO	0.47064	0.51674	0.48541	0.49872	0.52949	0.52811	0.53550
SI	0.32545	0.32589	0.33562	0.33441	0.32784	0.32857	0.33102
SK	0.50943	0.48831	0.51006	0.50238	0.50879	0.50208	0.49987

Source: the author according to data from [11]; [12]; [14].

Based on the similar development of a selected indicator the first group of countries include HR and SI, i.e. 4 NUTS II. It is clear that the inequalities of both economies, or regions, were very similar at the beginning of the monitored period, but since 2003 they have slightly grown (the AGC index values have stagnated at around 0.25 to 0.32). In the 1^{s}t group the index of production concentration reaches its peak in 2009 (0.33562 - SI).

The second cluster is the largest as it comprised of a total of 5 national economies (42 cohesion regions), whose AGC index values are in the range of <0.33334, 0.602419>. Although a gradual increase in the values of production concentration prevailed during the period, the group is characterized by similar inequalities in wealth creation.

Fig. 2: AGC production index for EU 2004+ NUTS II
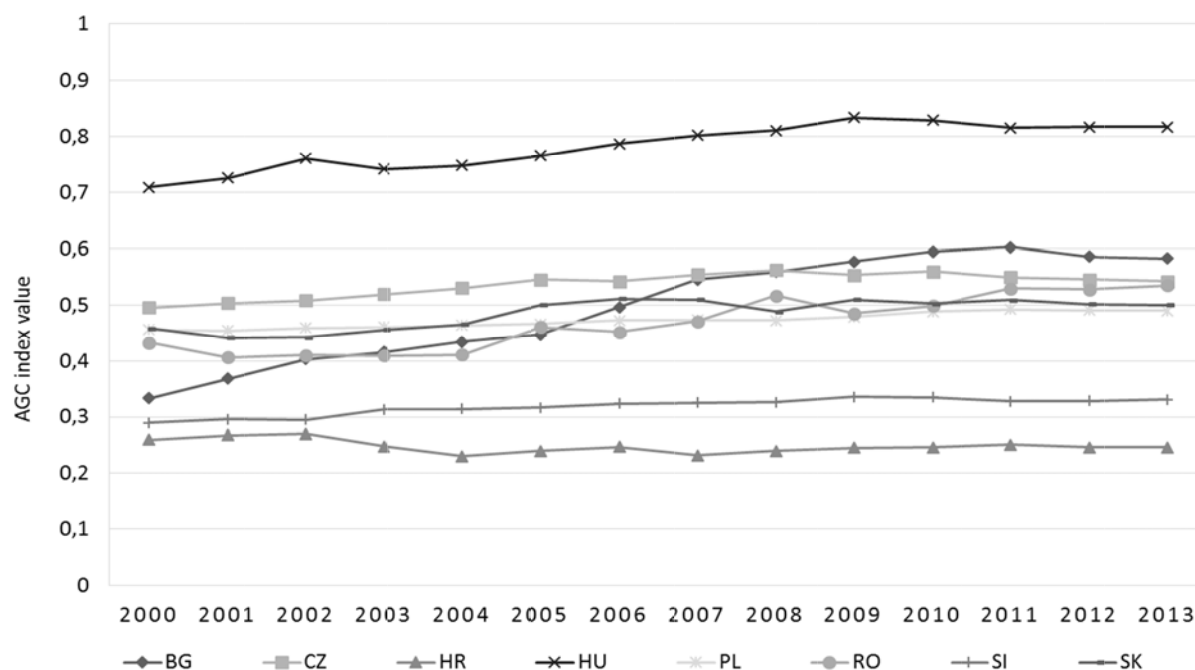
From a detailed analysis of the AGC index expressed by equation (6) it follows that, in the case of SI, BG, and RO the resulting index value was mainly due to the impact of regional disparities in GDP per capita (e.g. in SI during 2004–2007 by more than 60%, in BG during 2008–2010 by even more than 65%). In the case of SK the initially steady influence of both components was, after 2004, also replaced by the prevailing influence of regional disparities in GDP per capita. Conversely, disparities identified in PL, HU, and CZ were mainly caused by the geographic concentration of population (for the entire period in HU and CZ of more than 50%, PL of even more than 67%, the maximum was achieved in 2000 — 72%). Detailed analysis of the resulting index value of production concentration in HR revealed the major impact of this component, i.e. geographic concentration of population that made up more than 89% of the total disparities over the whole fourteen year periods, with 2004 being the only year in which there was actually recorded a negative influence of regional disparities in GDP per capita.

We can also find another common trait within the established clusters, i.e. their response to the financial crisis: the 1st group was resistant to the financial crisis, as the AGC index value stagnated after 2008; in the 2nd and 3rd groups the crisis accentuated the slow growth of national production concentration indexes, at the same time we can identify convergence tendencies among the 2nd group's index values. In terms of partial effects of the AGC index on the production concentration the financial crisis affected economies differently: Within the 1st group in SI there was a decline in the impact of regional disparities in GDP per capita after 2009 (by almost 5 percentage points by 2013); in HR, on the contrary, the effect of regional disparities in GDP per capita grew despite the fact that the effect of geographic concentration of population continued to be dominant (with more than 89.3%). In the case of HU the financial crisis was initially reflected in a slight decrease in the effect of geographic concentration of population (of less than 1 percentage point), while in 2010 the impact of this component on the overall level of production concentration compounded (an increase of almost 2 percentage points compared to the situation before the crisis). This

effect can be also identified by analogy in the countries that belong to the 2nd cluster, i.e. specifically in CZ and PL. In the case of SK, BG, and RO the crisis caused a decline in the influence of the prevailing regional disparities in GDP per population (in the SK a decline of less than 1 percentage point by 2013, in BG a reduction of 1.5 in RO there was even a drop of 2.4 percentage points).

If we focus on the achieved extreme values, i.e. on the comparison of HR and the 3rd group formed by HU, we have no doubt that there are significant differences in wealth creation among regions, since the value of the production concentration indicator for HR reached approximately one-third the values of the AGC index for HU during the reference period, which means that production in some Hungarian regions was more concentrated.

Regarding the actual developments of achieved values of the selected production concentration index for all the relevant EU 2004+ countries and their regions, it is possible to identify in the calculation of the harmonic average of the group some common features with the results that have already been achieved through the Theil index: the prevailing stagnation in the development of disparities across countries and their cohesion regions up until 2005, which is then replaced by a significant increase in the value of the harmonic average, i.e. by an increase in inequality in wealth creation. Although the Theil index results revealed that the financial crisis caused dynamic growth of disparities in both groups after 2009, this fact has not been proved by the development of the harmonised AGC index for EU 2004+ countries, because according to the development of indexes of individual economies the crisis' negative impact was eliminated by a stagnation or even in some countries by a decline in the concentration of production in the following years.

Conclusion

In order to determine the effectiveness of cohesion policy, measured by the development of inequality across EU 2004+ countries and their cohesion regions, two survey approaches were selected: The Theil index and the so called AGC index, an evaluation method of the geographic concentration of production that was used to verify the results.

Both methods have consistently shown that although there are disparities in the relative indicator of wealth creation, respectively in his economic level, i.e. in GDP per capita, among the countries and their regions of cohesion, we can identify such inequalities as relatively low due to the achieved values of the methods used (only HU is an exception according to the AGC index value, as it comprises areas with a greater production concentration). The chosen approach of generalized entropy identified the so called inequalities within individual EU 2004+ countries (within-country inequality) as having the most significant impact on the overall level of disparities. Although since 2008 the impact of these inequalities has been decreasing slightly, in 2013 their contribution to the total value was still significant (of 73.2%). Based on the achieved values and similar development of production concentration the monitored countries can be divided into three groups, whereas a detailed analysis of individual components of the AGC index revealed heterogeneity across the groups, i.e. in individual clusters there is no apparent predominant influence of a particular concentration of production. Due to this fact it is therefore quite surprising that, according to the AGC index development, countries within the formed groups reacted to the financial crisis in a similar way in terms of developing production disparities.

The fulfilment of the objectives of the Europe 2000 strategy with the deployment of all the EU combined policies, i.e. including economic, social, and regional cohesion policies, should also help to address inequalities across the EU countries and regions of cohesion in the programming period 2014–2020

Acknowledgement

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