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Assessment of the Economic Cohesion of the Lubelskie Voivodship

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Abstract

Cohesion is one of the most fundamental objectives of European regional policy. The basic unit of the cohesion policy in Poland is a voivodship. However voivodships in a lot of cases do not have the characteristics of a definition of region — they are not uniform in economic, social and cultural terms. That is why it seems quite legitimate to question the internal consistency within a voivodship. The aim of the article is to assess the change in differences of the Gross Domestic Product per capita in the Lubelskie Voivodship, divided into four subregions. The assessment has been made by employing statistical analysis and models of convergence for the period of 1999–2012. The research indicates that starting from 2007 we can observe sigma and beta divergence in the area under study. The metropolitan subregion of Lublin has been developing faster than other much poorer subregions and is characterized by the highest growth rate. Therefore, referring to the discussion about a "two speed Europe" it is also possible to speak — of course being fully aware of the scale of problems — about a "two speed voivodship".

Keywords: divergence, convergence, Gross Domestic Product (GDP), Lubelskie Voivodship, NUTS 3

Introduction

Economic and social cohesion — as defined in the 1986 Single European Act — refers to "reducing disparities between the various regions and the backwardness of the least-favored regions". The EU's new draft treaty (the Lisbon Treaty) adds another facet to cohesion, referring to "economic, social and territorial cohesion." The Cohesion Policy has the stated aim of improving the economic well-being of regions in the EU and avoiding regional disparities (Tkaczyński and Świstak 2013, 366–367), which means regional convergence.

Initially (i.e., until the early 1980s), the policy of regional development did not play a big role in the policies of the EU (in 1980 it was allocated only 11% of the total budget). However, increasing disparities in development (caused also by the accession of new countries) triggered a need for activities aimed at preparing the less developed countries and regions for meeting the required membership conditions. In order to achieve this, in 1989 the structural funds were reformed. The changes included altering the rules for assigning funds and the allocated budget. Ultimately, the reform resulted in coordinating activities financed through three funds (the European Regional Development Fund, the European Social Fund, and the European Agriculture Guidance and Guarantee Fund) and creating a new Cohesion Fund (aimed at mitigating burdens for the countries joining the Economic and Monetary Union). After undertaking the reform, over two-thirds of the expenses of the structural funds became concentrated in the so-called regions belonging to objective 1, which dealt with reducing economic inequalities.[1] This objective covers regions whose

1. In three programming periods of the years 1988–2006 objective 1 of cohesion policy was named "promoting the development and structural adjustment of regions whose development is lagging behind," whereas in the 2007–2013 programming period the name of objective 1 was changed into „convergence."

Gross Domestic Product (GDP) per capita is below 75% of the EU average and aims at accelerating their economic development. Such a concentration of appropriations meant a substantial injection of funds for the countries covered by this aim. The number of objective 1 areas grew; in 1988 it included 44 regions (all of Greece, Portugal, Ireland, southern Italy, southwest regions of Spain, and — after the unification of Germany the former states of GDR and eastern Berlin). In the 2000–2006 programming period the number of regions grew to 167. In 2004 the regional policy of the EU met the biggest challenge since the beginning of its existence — the accession of 10 new countries (Kusideł 2013a, 147).

The basic unit of the cohesion policy in Poland is a voivodship (region). These, in their current shape were created in 1999[2] and — in a lot of cases — do not have the characteristics of a region. They are not areas of economic, social and cultural homogeneity differing from the neighboring zones in features which are natural or have been acquired over time. They are very often disintegrated and consist of smaller areas having strong internal cohesion, but greatly differing from each other. For the purposes of the European regional policy, Polish voivodships were given a status of level 2 statistical units (NTS 2 corresponding to the EU NUTS 2).[3] Level 3 statistical units were also introduced (these are NTS 3 corresponding to EU NUTS 3), but — unlike voivodships — they are not legal entities (not being administrative units). They usually cover from one (6 of the largest Polish cities) to twelve counties (in the ostrołęcko-siedlecki subregion) and have purely statistical purpose. These units, although a lot smaller than voivodships, still not always have a homogenous character. This stems from the way they were created, which in many cases did not take into account objective criteria, but certain and sometimes puzzling political aspects. Some of the decision-makers of that time voiced an opinion that the NTS 3 units had to be made in such a way as to not reconstruct the liquidated "smaller" voivodships.[4] One of the examples would be the bialsko-chełmsko-zamojski subregion; a narrow "belt" of counties in the Lubelskie Voivodship near the border of Poland with Ukraine and Belarus. This led to the creation of a subregion with areas differing significantly in nature, culture and economics (Kowerski 2003, 16). Although the unit was subsequently divided in 2007 into separate bialski and chełmsko-zamojski subregions, the second unit is still very incoherent. Poland had been divided into 44 subregions until 2007, when their number grew to 66, correcting at the same time previous errors made during the first division. Irrespectively of the previously mentioned disadvantages, the subregions have — without any doubt — at least one advantage. They are the smallest unit of a statistical division, for which — although with quite a large delay — a GDP value can be calculated. It allows us to assess the differences in development inside the voivodships and to evaluate if the local authorities conduct their own cohesion policy and aim for internal convergence of the region or if the intra-regional policy leads to an opposite phenomenon: divergence.

The aim of the article is to assess the change in differences of the GDP per capita in the four subregions of Lubelskie Voivodship since 1999. It will allow us to evaluate if the voivodship authorities care about uniform development of the whole region or if they tend to prefer some of its parts. This will answer the question of whether these authorities conduct intra-regional policy aimed at lessening the differences within the region and ensuring bigger economic and social cohesion of the voivodship. The assessment has been made by employing statistical analysis of the changes in the GDP per capita and models of convergence.

2. See: Ustawa z dnia 24 lipca 1998 r. o wprowadzeniu zasadniczego trójstopniowego podziału terytorialnego państwa [Act on the introduction of the three-tier administrative division of the country], DzU z 1998 r. nr 96 poz. 603 ze zm.

3. See: Rozporządzenie Rady Ministrów z dnia 13 lipca 2000 r. w sprawie wprowadzenia Nomenklatury Jednostek Terytorialnych do Celów Statystycznych (NTS) [The classification of territorial units created by the 13th July 2000 government decree on introducing the Nomenclature of Territorial Units for Statistical Purposes (NTS)], DzU z 200 r. nr 58 poz. 685. It corresponds to the Nomenclature of Units for Territorial Statistics (NUTS), valid in the EU countries according to the Regulation (EC) No 1059/2003 of the European Parliament and of the Council of 26 May 2003 on the establishment of a common classification of territorial units for statistics (NUTS), Official Journal of the European Union L 154, Volume 46, 21 June 2003.

4. From the research, discussions and polemics undertaken at that time by M. Kowerski.

1 Methods of measuring and verifying economic convergence

According to the neoclassic school and Solow's model convergence is a phenomenon stemming from economic growth and a symptom of decreasing disparities in measures of economic activity, for example GDP per capita between regions (Kusideł 2013a, 7–8). Intensive research into the subject of real convergence in the 1980s later led to defining its many types and different means of its verification. Initially introduced were the sigma-convergence and the beta-convergence.[5] These will be instruments used in this research. Later, the issue was extended by additional types of convergence: gamma, stochastic, social, spatial, income, technologic, sector and club (Kusideł 2013a, 15).

Using methods of verification as a criteria of division we can speak of:

- sigma-convergence, which means decreasing dispersion (diversity) in the economic growth level (GDP per capita) in different regions;
- beta-convergence, where the poorer regions develop faster than the richer regions. This type of convergence can be encountered in the literature in two variants: absolute and conditional convergence. The first one assumes that the poorer countries or regions develop faster than the richer independently of the initial conditions of growth. Additionally, the lower the initial level of GDP per capita, the bigger the increase of the real GDP per capita becomes. Owing to this fact, underdevelopments are made up. Conditional convergence happens, when this process relates to groups of countries or regions which are relatively homogenous. The outcome is that the regions or countries with comparable income or structural factors become similar to each other.[6]

In order to verify the hypothesis on the existence of sigma-convergence one has to define the measures of dispersion or concentration of the investigated phenomenon. Basic measures of descriptive statistics listed below may be used:

- measures of dispersion:
  - distance between the regions of maximum and minimum variable value (D_t)
  - coefficient of variation (V_t)
  - standard deviation of logarithm (lS_t)
  - average standard deviation (V_{at}), which makes it possible to avoid a foremost disadvantage of the first three measures, which is sensibility to outlier observations
- measures of concentration:
  - Gini coefficient (G_t), which has a range from 0 (full equality of a value) to 1 (full inequality).

In order to verify the hypothesis of beta-convergence models of regression are used. The simplest situation happens when we have available pooled data.[7] In such a case, the regression equation verifying the hypothesis is:

$$\ln\left(\frac{\mathrm{PKB}_{Ti}}{\mathrm{PKB}_{0i}}\right) = a + b\ln(\mathrm{PKB}_{0i}) + \varepsilon_i, \tag{1}$$

where:

PKB_{0i} — GDP per capita in i-th country (region) in the base year (0),

PKB_{Ti} — GDP per capita in i-th country (region) in the analyzed year (T).

For the convergence to appear, the estimated value of the coefficient b should be less than zero. Otherwise the phenomenon of divergence occurs. An estimated model allows us to calculate the coefficient:

$$\beta = -\frac{\ln(1+b)}{T}, \tag{2}$$

which is called the yearly average rate of convergence speed. After its multiplication by 100% it can inform us about the yearly average rate of the economies of the examined countries (or regions)

5. The terms sigma and beta were used for the first time in relation to income convergence by Sala-i-Martin (1990).

6. More on this subject — amongst others — in works of Barro and Sala-i-Martin (1992), Kutan and Yigit (2004).

7. The research on convergence started from this approach, which is evidenced by the works of Kormendi and Meguire (1985), Baumol (1986), Barro (1991), Barro and Sala-i-Martin (1992), Mankiw, Romer and Weil (1992).

coming close to each other.[8] The idea of the absolute beta-convergence is an inversely proportional dependence between the base value of GDP per capita and its growth rate (which means that the initially poorer regions should show higher growth rates than the originally wealthier regions).

However, it is known that besides the initial level of the GDP per capita, whose rate of growth is investigated, it also depends on a lot of other conditioning factors. These may be various social and economic variables (X_j). Their inclusion in the growth models leads to a verification of the conditional beta-convergence hypothesis. The regression equation serving to prove the hypothesis is:

$$\ln\left(\frac{\mathrm{PKB}_{Ti}}{\mathrm{PKB}_{0i}}\right) = a + b\ln(\mathrm{PKB}_{0i}) + c_1X_{1i} + c_2X_{2i} + \cdots + c_kX_{ki} + \varepsilon_i. \tag{3}$$

For estimating the models above ordinary least squares method (OLS) is most often used. However, using convergence models based on pooled data may cause loss of information concerning the diversity of the economic growth in respective regions and the variability in time of the explanatory factors. Also left aside are non-observable features of the investigated regions, which in consequence leads to not meeting the required condition of lack of correlation between the disturbance term and independent variables and the results of estimation of such regression by OLS are inconsistent and biased.

This is the reason why it is more appropriate to use panel models, allowing us to take into account non-observable features of regions, which impact the rate of their economic growth (Modranka 2012, 64).

The panel model of conditional convergence can be written as:

$$\ln\left(\frac{\mathrm{PKB}_{ti}}{\mathrm{PKB}_{t-1\,i}}\right) = a_i + a_t + b\ln(\mathrm{PKB}_{t-1i}) + c_1X_{1ti} + c_2X_{2ti} + \cdots + c_kX_{kti} + \varepsilon_{ti}. \tag{4}$$

The panel models of convergence (both absolute and conditional) are most often estimated by employing the fixed (random) effect panel least squares method (Kufel 2011, 173–180; Maddala 2006, 643–654). Quite often moving the expression $\ln(\mathrm{PKB}_{t-1\,i})$ to the right side of the previous equation transforms it to this form:

$$\ln(\mathrm{PKB}_{ti}) = a_i + a_t + (1+b)\ln(\mathrm{PKB}_{t-1i}) + c_1X_{1ti} + c_2X_{2ti} + \cdots + c_kX_{kti} + \varepsilon_{ti}. \tag{5}$$

This creates a dynamic panel model, whose coefficients are estimated by Hansen's Generalized Methods of Moments (Hansen 1982)[9], which later was developed by Arellano and Bover (1995) and Blundel and Bond (1998). In this equation beta-convergence happens, where the estimated value of the coefficient on the variable $\ln(\mathrm{PKB}_{t-1\,i})$ is less than one. Then b will be negative and $\beta > 0$.

Recently, regional models of convergence have been enhanced by spatial effects, taking into account the neighborhood effect of the regions and how it affects the rate of growth and the level of the region's GDP.

The outcome of investigating sigma- and beta-convergence does not have to be the same. It is an effect of the fact that beta-convergence is a required, but not sufficient condition for sigma-convergence to appear (shown by Sala-i-Martin 1996, 1329).

The results of the empirical studies on beta-convergence started to appear in the economic literature in the 1980s and involved comparisons between countries' economic growth. They revealed that over the last several years divergence dominated on a global scale. One of the first such studies was performed by Baumol (1986). In his analysis the author showed that the world as a whole does not develop according to the convergence hypothesis (in absolute categories). The rate of the economic growth of 72 countries in the years 1950–1980 was not correlated to their GDP per capita level of 1950. Still, inside the groups of more or less homogenous countries (developed countries or the former Eastern Bloc) convergence tendencies could be observed. Although Baumol's research was one of the first of such, its outcome is still up-to-date. Lack of absolute

8. However, when the estimated value of the b parameter is less or equal to -1, the β coefficient cannot be calculated and the results cannot be reasonably interpreted.

9. GMM was developed by Lars Peter Hansen in 1982 as a generalization of the method of moments which was introduced by Karl Pearson in 1894. Hansen shared the 2013 Nobel Prize in Economics in part for this work.

convergence on a world scale and appearance of convergence in homogenous economies are findings of many subsequent empirical studies (Próchniak 2006, 75). An analysis of 33 empirical studies on convergence of various countries performed in 1986–2006 was done by Próchniak. The following conclusions were formulated:

- Absolute beta-convergence or sigma-convergence does not appear in countries analyzed as a whole. This means that the income level around the world cannot be expected to become equal. Rich countries become richer, whereas less developed countries stay poor. Different groups of countries show only conditional β type convergence.
- Small groups of countries, tied together through different criteria, develop according to the convergence hypothesis. Less developed countries of such groups show a faster average growth rate than more developed countries of the same group (both absolute and conditional). Additionally, income disproportions tend to decrease over time. Most of the empirical studies were performed within the OECD countries, where the convergence was most often confirmed. The convergence of the EU countries was also studied quite often. The research has shown that the countries of East-Central Europe show convergence with the "old" EU countries.
- In the case of conditional convergence, very different yearly average rates of convergence speed were observed (depending on the group of studied countries and the period of the study), from the yearly 0,61% (Mankiw, Romer, and Weil 1992) to 9,09% (Nakamura 2001).[10]
- Rate of convergence speed depends also on the analysis method: results are higher when based on panel data.

Próchniak (2011) performed an analysis of the absolute and conditional convergence processes in the group of 27 countries — current EU members in the years 1993–2009, using pooled models of GDP according to purchasing power parity per capita in constant prices in USD. Estimated for EU-27 the absolute rate of convergence speed was 1,7% and from 1,6% to 2,3% for conditional convergence (average for four models: 1,9%). These estimations show a slow convergence process of the old and new members of the European Union. For example, $\beta = 1{,}7\%$ implicates that (assuming unchanged development trajectories of 1993–2009), EU countries need 41 years to reduce in half the distance to a common, theoretical state of long-term equilibrium. With $\beta = 2{,}3\%$ convergence is faster: reducing the distance in half requires 30 years. Overall, if the current rate of convergence remains unchanged, fast income equalisation within the enlarged EU is not to be expected. Even if the process of "catching up" becomes faster, income disparities between the old and the new EU members will still long exist (Próchniak 2011, 189).

Most works confirm convergence of economy between Poland and other East-Central Europe countries with the "old" EU, although the rate of the process differs. The outcome of such research show that, even with quite optimistic scenarios of further development, the period necessary to reach the level of EU-15 is still very long for most of the East-Central Europe-10 countries. In the case of Poland, at least 20 years is needed, with purchasing power parity taken into account (Próchniak 2011, 193).

The cohesion policy of the European Union lead to development of research on its regional convergence. From numerous works relating to this matter, we will name only a few chosen ones, which covered both the so-called "old" EU regions (EU-15) and the regions of the new members.

Modranka (2012) verified the rate of conditional convergence of GDP per capita of 2000–2009 basing on the Purchasing Power Standard (PPS) for 290 EU NUTS 2 regions. For describing the phenomenon of convergence she proposed the panel conditional fixed-effect spatial lag model of beta-convergence, which also takes into account the effect of the neighborhood of the analyzed regions. The estimated model confirmed conditional convergence of the economies of EU-27 regions, and the yearly average rate of convergence speed calculated based on this model was 13,7% (Modranka 2012, 70).[11]

10. [In the journal (in both Polish and English texts) 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). Furthermore in the International System of Units (SI units), fixed spaces rather than commas are used to mark off groups of three digits, both to the left and to the right of the decimal point. — Ed.]

11. As the author estimates, this rate is several times bigger than other estimations, which oscillate around 2–3%.

According to Sawicz (Sawicz n.d., 9), "even though the convergence of the GDP per capita of the EU countries has been statistically proven, the subject of the convergence of the regions of EU members raises a lot of controversial opinions."

The rate of the various regions of the new EU members "catching up" to the average level of GDP per capita, for example in the years 2000–2007, was significantly uneven. The higher rates were observed in the metropolitan areas, which were the richest in 2000. As a consequence, the great disparity of the living standards existing in 2000 in the new member states became even larger in the consecutive years. Comparing the 2000–2007 GDP per capita differences in the old and the new member states shows that the income discrepancies of the "old" Europe societies decreased, whereas in most of the regions of Central and Eastern Europe they increased (Sawicz n.d., 13). An explanation for the income divergence of the regions in the new member states of Central and Eastern Europe could be the thesis of J.G. Wiliamson (1965), who — already in 1965 — stated that the "catching up" countries are faced with two development gaps. The first one is the distance to the more developed countries. The second one is the differences within.

What is more, quite often the regional differences grow as an effect of separation the most developed areas from their regional neighborhood. As a result, the inequalities in GDP per capita grow even though the country as a whole develops fast and "catches up" to developed states. This is what is called "global convergence — local divergence". This hypothesis was confirmed, on the regions level of UE–15,[12] amongst others by J.A. Duro (2004).[13] From his research it appears that until the mid-1980s the income disproportions between the member states made up half of the disproportions between the regions. The second half was composed of the discrepancies of the regions within each country. Since then, the disproportions between the states have decreased by 25%, and yet the regional differences inside the countries have grown by 10%. As a result, most of the regional disproportions in Europe stem from the internal differences, and the regional convergence in Europe is only external (between the countries). The fact that five out of the ten most rapidly developing EU regions are metropolitan areas in the new member states further evidences this statement. Thus, regional convergence does not appear within the countries, but it can be observed within the frame of a much larger area of the whole united Europe.

Observing growing disparities in living standards of the societies in the regions of the EU, the opponents of the Cohesion Policy presume that its instruments help to converge the GDP per capita of the Central and Eastern Europe countries with the EU area, but at the same time cause the internal divergence of the GDP per capita of their regions (Sawicz n.d., 16).

Bal-Domańska (2011) assessed the processes of absolute and conditional beta-convergence in the years 1996–2007 between the regions of the EU states. She used panel models for all the regions together (group REG) and groups of regions established based on the average level of work efficiency (dependent variable): WYD(GDP per employee $\geq$ Me) — regions with high level of work efficiency and PO(GDP per employee $<$ Me) — regions with low level of work efficiency. The research of convergence was based on a non-balanced panel of data for 208 NUTS 2 level regions of the European Union[14] in two periods of time:

- 1996–2007 — in the range of absolute convergence
- 1999–2004 — in the range of absolute and conditional convergence

The author estimated a dynamic model of $\ln(\mathrm{PKB}_{ti})$ on $\ln(\mathrm{PKB}_{t-1\,i})$ by means of the System Generalized Methods of Moments.

The best models confirm the existence of absolute and conditional beta-convergence both for all the regions together and within the established groups. Based on regression of the conditional convergence model for the PO group, the author states that if these regions achieved a similar level of investment, human capital and increase in workforce, the rate of convergence to a long-term

12. Most of the calculations did not cover the regions of Great Britain, as it did not have NUTS 2 level areas created at that time.

13. See also Martin (2005).

14. Due to the numerous lacks of statistic data, the research excluded the regions of: Bulgaria, Denmark, Austria, Slovenia, Great Britain, Luxembourg and 3 German states: Brandenburg-Nordost, Brandenburg-Südwest, Sachsen-Anhalt.

equilibrium would be 3% yearly. A slightly higher rate of convergence is an outcome of regression assuming fixed effects of the scale. In such a case the rate of convergence would be 6,8%, which is similar to the one arising from the model of absolute convergence, assuming the same level of basic macroeconomic indicators and aiming at the common state of the long-term equilibrium (Bal-Domańska 2011, 21).

These results show that the process of convergence exists and at the same time it differs in a cross-section of regions. This statement is supported by the different rate of convergence in separate groups of regions (REG, WYD, PO). Most of the models (of absolute and conditional convergence with assumed fixed effects of scale) show that the regions with lower work efficiency develop faster towards the state of the long-term equilibrium (irrelative of the period of time). Amongst the estimated convergence models the absolute ones are of better quality. In these, the rate of pursuing the long-term equilibrium balance is between 0,6% (or 4,6% in the model relating to years 1999–2004) in the regions with high work efficiency and 10,6% (6,6% in the 1999–2004 model) in other regions. Taking into account the results from the years 1996–2007 it may be stated that the regions with high work efficiency need about 118 years in order to reach the mid-point of the distance to the long-term equilibrium. The other regions need only 6,5 years. Kusideł (2013a, 148) points out a minor decrease in diversity between the regions of the new EU member states. It has been visible since 2005 and can be a result of employing the cohesion policy in these regions. At the same time she indicates polarization processes within many countries. After the 2004 enlargement of the EU, economic disparities between the states grew considerably, but year after year they tend to drop. Meanwhile, research on internal divergence do not show its decrease (indicating lack of internal convergence) (Kusideł 2013a, 149). The author explains this phenomenon by Williamson's hypothesis: regional income differences within the countries are temporary and the internal convergence happens only on higher levels of development of certain economies (Williamson 1965). Kusideł (2013a, 50–152) verified this hypothesis by square regression of the GDP per capita dispersion for NUTS 2 regions, relative to the GDP per capita and its square (inverted U) throughout the years 1995–2009. The internal divergence of the GDP per capita in most of the analyzed countries could be shown by an inverted U-shaped curve. The data for Poland are especially interesting. The divergence of GDP per capita grows, but the values of the estimators show that soon it should reach its maximum, and then – assuming the validity of Williamson's hypothesis — it should start decreasing.

Jóźwik (2012) studied the convergence process of the 47 regions of the Central and Eastern European EU Member States in the years 1995–2009. The study indicated both sigma and beta convergence, and thus confirms the hypothesis that poorer regions in the Central and Eastern European EU Member States tend to grow faster that richer regions, which leads to income convergence. However, the convergence hypothesis was not true all of the time period under investigation. The examination indicates that in 2001–2002 and 2007–2009 — i.e., in the economic crises or just after them, there was divergence among these regions. On the other hand, regional divergence in GDP per capita in the individual Central and Eastern European EU Member States is, unfortunately, growing. This trend is confirmed by the growing standard deviation of the natural log of regional GDP per capita in each of the state.

Jóźwik and Ponikowski (2014) examined the real convergence of the GDP per capita across the EU regions in 2000–2010 and estimated the convergence of the GDP per capita across European regions following the classical approach: the absolute beta and sigma convergence model. These studies confirm the hypothesis that the poorer EU regions known as convergence regions tend to grow faster than the richer regions. In the period 2000–2010, the convergence regions achieved a significantly higher growth rate than the other strong EU regions. Additionally the results of this examination show that the process of convergence within the EU–27 during the economic crises in 2007–2009 occurred as a result of the GDP per capita growth across the convergence regions and the declined growth rate within the other regions.

Recently, several studies on the convergence of Polish voivodships have been made, whereas the subregions were investigated much more rarely. The outcome of most of the research is that the divergence between Polish regions is becoming greater.

Kliber (2007) applied absolute and conditional panel models of convergence for voivodships in the time period of 1998–2003. Although the goodness of fit for model was quite good and the variables were statistically significant, the results were unsatisfactory. The estimated values of coefficients b were lower than -1, which means it is impossible to calculate the rate of convergence. In the author's opinion there may be two reasons. Firstly, the investigated timespan could be too short for the effect of convergence to appear and the data might be "contaminated" by the effects of the business cycle. Secondly, the economies can be too close to the state of equilibrium. This would mean that the possibilities of extensive growth (via simple capital increase) were used up and further economic growth is more dependent on technological change and growth of human capital (which has not been taken into account in the presented model) (Kliber 2007, 84).

Kusideł used cross-section models for voivodships for the years 1995–2010. The test of the absolute beta-convergence for such a model did not confirm the existence of convergence in Poland. The sign of the coefficient on the independent variable is positive, which could show a divergence in GDP per capita, with its yearly average rate of 1,6% (Kusideł 2013a, 93). Additionally, in the estimated conditional convergence models the coefficients on the independent variable describing the GDP per capita in 1995 (GDP base level) were positive, but statistically insignificant. This could mean that neither divergence nor convergence happened within the analysed the period of time. The ultimate outcome of the research is lack of voivodships' GDP per capita beta-convergence, both absolute and conditional (Kusideł 2013a, 96–97).

Dańska-Borsiak applied dynamic panel models in order to investigate voivodships' convergence in the years 2000–2007.[15] The most important finding of this research is the absence of a convergent trend in the GDP per capita of voivodships. The obtained value of the β coefficient, determining the existence and intensity of convergence is negative: $\beta = -0{,}0323$. This evidences that the phenomenon of divergence appears in Poland. The yearly rate of the divergence is 3,2%. It is a negative trend, as it strengthens the division between the rich and the poor voivodships (Dańska-Borsiak 2011, 49–50).

Similar results for the years 1999–2007 were obtained by Markowska-Przybyła (2010), confirming on the basis of the cross-section model of absolute convergence that within that period of time beta- and sigma-divergence existed in Poland, which means that the GDP per capita dispersion between the Polish regions grew.

Herbst and Wójcik investigated the convergence processes in the years 1995–2006 in Polish subregions, according to the old division into 44 such units. They also decided to join subregions consisting solely of large cities with the subregions surrounding them. In total they obtained 39 units of observation. Besides the entire period of time, they also analyzed the convergence processes in three separate subperiods: 1995–1998, 1998–2002 and 2002–2006, in order to verify whether the changing economic situation had any impact. In order to estimate the absolute and conditional beta-convergence they used cross-section models, whose dependent variable was the GDP per working-age person (Herbst and Wójcik 2012, 181).[16] The authors specified two types of models: a cross-section one, whose coefficients were estimated by the ordinary least squares method and a spatial one, which contained spatial lags both of the dependent and independent variables. The second model is known in the literature as the Spatial Durbin Model (SDM) (Herbst and Wójcik 2012, 180). According to the research results the authors stated that the regional disparity of the GDP per person grew within the investigated period of time. This means a process of divergence (of absolute type) of the subregional economies occurred. Regardless of this fact, in the whole 1995–2006 period and two of its subperiods, conditional convergence can be observed. It appeared only after including in the model dummy variables for the size of the central town. It suggests that this type of convergence appeared only between the regions with metropolises of similar scale. Additionally, apart from Warsaw, no important spatial effect caused by the metropolises on

15. The author estimated by means of the System Generalized Methods of Moments (SGMM) of Blundell and Bond the autoregressive model of GDP per capita in the t year (not the growth rate of GDP per capita) relative to the GDP per capita in the year $t-1$.

16. Due to troubles with obtaining reliable data concerning employment, the authors assume that the number of people of working age is the measure of labour resources.

the surrounding subregions was observed (Herbst and Wójcik 2012, 198). The estimated coefficient of the yearly convergence rate, based on conditional models was between 4% and 5% (depending on the model). However in the years 1995–1998 it exceeded 12% in one of the models, in the years 1998–2002 it reached 6%, but in the years 2002–2006 it was negative, which implied divergence (Herbst and Wójcik 2012, 190–194).

2 Lubelskie Voivodship as a subject of investigating internal cohesion

Functioning since the beginning of 1999, with an area over 25,1 thousand square kilometres and 2156 thousand inhabitants, the Lubelskie Voivodship is one of the least developed regions (NUTS 2) of Poland (16th or 15th position of GDP per capita in the years 1999–2012).[17] The voivodship also has the highest factor of the risk of poverty (Wawrowski 2014, 47). This assessment cannot be changed by the fact that during its existence this administrative unit recorded significant economic growth; the GDP per capita of 2012 (in constant prices) was 53% higher than in 1999 (average yearly rate of growth: 3,3%). Still, in the same the period of time the GDP per capita of Poland grew by 63% (average yearly growth rate: 3,8%). This means that the backwardness in regard to the whole country increased and — as of 2012 — the GDP per capita of Lubelskie Voivodship was 70,3% of the Polish average. It is, however, noteworthy to state that between 2010 and 2012 the GDP per capita growth rate in the voivodship was slightly higher than the national average (in 2010 by 0,2 percentage point, in 2011–2012 by 0,6 percentage point).

At the same time the region is characterized by a substantial and increasing spatial diversity. The voivodship is divided into four NUTS 3 subregions (bialski, chełmsko-zamojski, lubelski, and puławski, see fig. 1). Subregion lubelski has a significantly higher economic growth rate. Its GDP per capita of 2012 was 31% higher than the voivodship's average. In the other subregions it was from 10 to 20% lower than the average.

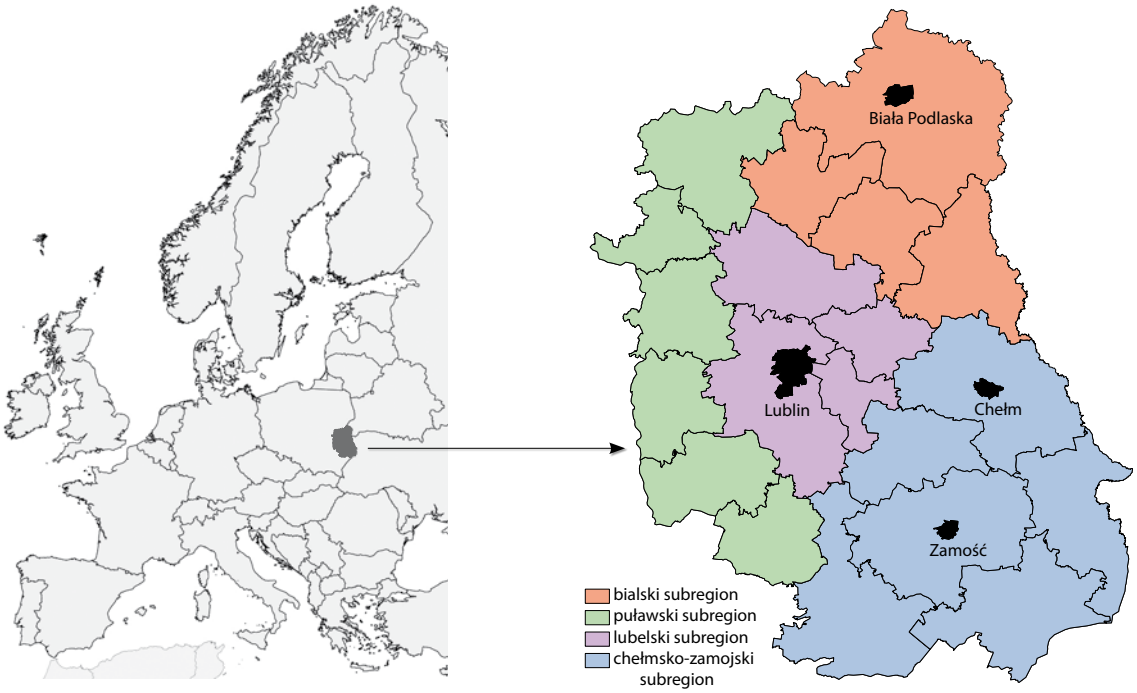

Fig. 1. Location and NUTS 3 subregions of Lubelskie Voivodship

17. Because of the specific social and economic situation the Lubelskie Voivodship together with the Podkarpackie, Podlaskie, Świętokrzyskie and Warmińsko-Mazurskie ones has become an area of particular interest of the cohesion policy, requiring additional actions making it possible to make up delays and boost growth. The example of the special approach is the document adopted by the Council of Ministers [of Poland] on 30 December 2008: Strategy for Socio-Economic Development of Eastern Poland Until 2020 — the only one such a government strategy aimed at a group of voivodships (see: Hajduga 2014, 66).

Tab. 1. Selected data of the Lubelskie Voivodship and its subregions (of 2013—if not stated otherwise)

Specification	Lubelskie Voivodship	Subregion			
		bialski	chełmsko-zamojski	lubelski	puławski
Area (in thousands of km^2)	25,1	6,0	9,3	4,2	5,6
Population (in thousands)	2 156,2	307,5	644,0	713,7	491,4
Population density (in person per km^2)	86	51	69	169	87
Birth rate per 1000 of a population	−1,4	−1,5	−2,7	−0,1	−1,7
Registered unemployed (in thousands)	134,0	21,1	45,0	38,0	30,4
Registered unemployment rate (in %)	14,4	16,9	16,2	11,9	14,2
The unemployed per 100 people of working age	9,9	10,9	11,0	8,4	10,0
Job offers per 1000 unemployed	8	6	3	15	10
Number of flats per 1000 people	349	345	341	373	325
GDP (in millions PLN) [a]	63 929	7 858	15 294	27 759	13 018
GDP per capita, Poland = 100 (in %) [a]	70,3	60,6	56,3	92,3	62,8
GDP per capita, voivodship = 100 (in %) [a]	100,0	86,2	80,1	131,3	89,3
Average gross salary per month (in PLN)	3 488,61	3 198,96	3 130,9	3 799,31	3 236,43
Average gross salary per month, Poland = 100 (in %)	90,0	82,5	80,7	98	83,5
The risk of poverty factor. The percentage of people in poor household in relation to the total amount of population (in %) [b]	31,3	35,2	34,7	24,0	35,4
Business entities registered in REGON per 10 000 people	787	683	701	963	710
Sold production of industry per person (in thousands PLN) [a]	13,0	6,7	6,1	20,3	15,5

Source: data published by Central Statistical Office of Poland (Główny Urząd Statystyczny) at Local Data Bank (Bank Danych Lokalnych) base, http://stat.gov.pl/bdl/.

[a] For year 2012.

[b] It is the so-called crude rate, calculated based on a sample survey. Its accuracy decreases with lowering the sample. Indicators taking into account the size of the sample are from 4,5 to 6 percentage points lower (Wawrowski 2014, 52).

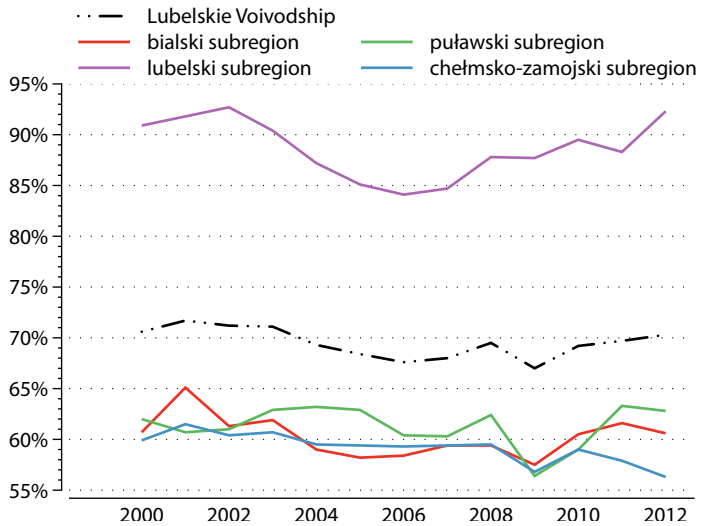

Fig. 2. The relations of the GDP per capita in the Lubelskie Voivodship and its subregions to the Polish average (GDP per capita in Poland = 100)

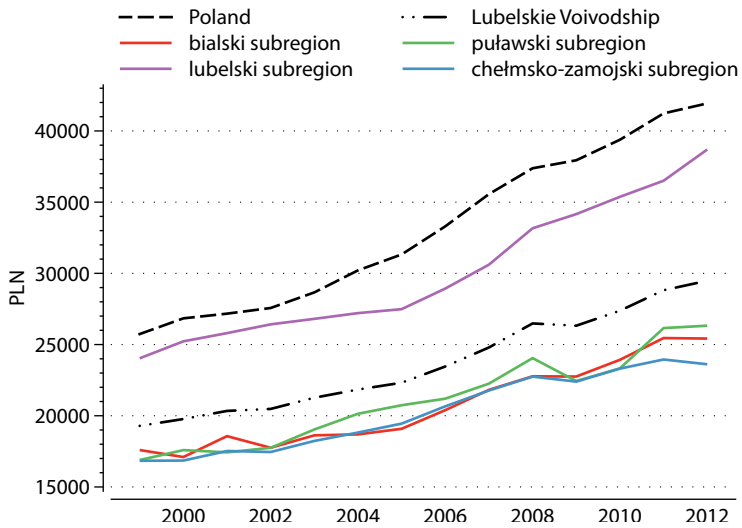

Fig. 3. Changes of GDP per capita in subregions with relation to the Lubelskie Voivodship and Poland in years 1999–2012

While the lubelski subregion can be placed around the twentieth position in Poland, the rest of the subregions belong to the worst in the country and are usually found above the sixtieth place. The chełmsko-zamojski subregion in the years 2010–2012 took the sixty-fifth place out of sixty-six. Whereas the GDP per capita of the lubelski subregion in the years 2000–2012 oscillated between 85% and 95% of the Polish average, in the other subregions it was lower than 65% of the Polish average. The three subregions: bialski, puławski and chełmsko-zamojski are the poorest in Poland and took the disgraceful first three places of the risk of poverty factor list (Wawrowski 2014, 52–53).

The 53% growth of GDP per capita in the voivodship during 2000–2012 consisted of 61% growth in the lubelski subregion (3,7% yearly average), 56% in the puławski subregion (3,5% yearly average), 45% in the bialski subregion (2,9% yearly average) and only 40% in the chełmsko-zamojski subregion (2,6% yearly average).

3 From convergence to divergence

A simple analysis of the growth rates in Lubelskie Voivodship subregions may suggest that a process of divergence existed (the wealthiest lubelski subregion grew the most). Still, a question arises as to whether this phenomenon happened within the whole analyzed period of time and — most important — if the variations in growth rates were so large that they can be accepted as statistically significant.

The analysis started with studying whether the Lubelskie Voivodship experienced sigma-convergence (or divergence) between 1999 and 2012. The measures of dispersion and concentration listed earlier were designated. Based on the changes in values of the calculated indicators over time, a decision was made to divide the analyzed period of time into two subperiods: 1999–2007 and 2008–2012.

The verification of the hypothesis on existing sigma-convergence (divergence) was performed by analyzing linear trends and assessing the slope of the model's equations.[18] For the years 2000–2007[19] statistically significant negative slopes were obtained in the trend equations. This

18. Due to a very small sample (4 subregions) the verification of the hypothesis on the existence of sigma-convergence (divergence) with testing significance of differences between the indicators in the first and last year of the analysed period of time was abandoned. Optional possibility of using T, T2 and T3 statistic was taken into consideration (see: Kusideł 2013a, 60–63).

19. The values of the indicators of 1999 were not taken into consideration in the models as the decrease of the dispersion measures has been happening only since 2000. It is worthy to note, however, that the values of these measures are still lower in 2007 than in 1999.

confirms the existence of the sigma-convergence within the analyzed the period of time. For the years 2008–2012[20] statistically significant positive slopes were obtained in the trend equations. This confirms the existence of sigma-divergence in the analysed period of time (see tab. 2 and fig. 4). What is more, it is visible that the rate of subregions "moving away" after 2007 was two times higher than the rate of them "catching up" in the first subperiod.

Tab. 2. Slopes for the linear trends of the dispersion and concentration measures

	2000–2007		2008–2012	
Indicator	a_1	p	a_1	p
$\text{Max}_{it}/\text{Min}_{it}$ (D_t)	−0,014	0,0012	0,039	0,0080
Coefficient of variation (V_t)	−0,005	0,0060	0,009	0,0752
Standard deviation of the logarithm (lS_t)	−0,003	0,0046	0,005	0,0613
Average standard deviation (V_{at})	−0,004	0,0086	0,007	0,0964
Gini coefficient (G_t)	−0,003	0,0006	0,007	0,0130

Notice: a_1 is slope of the equation $y = a_0 + a_1 t$.

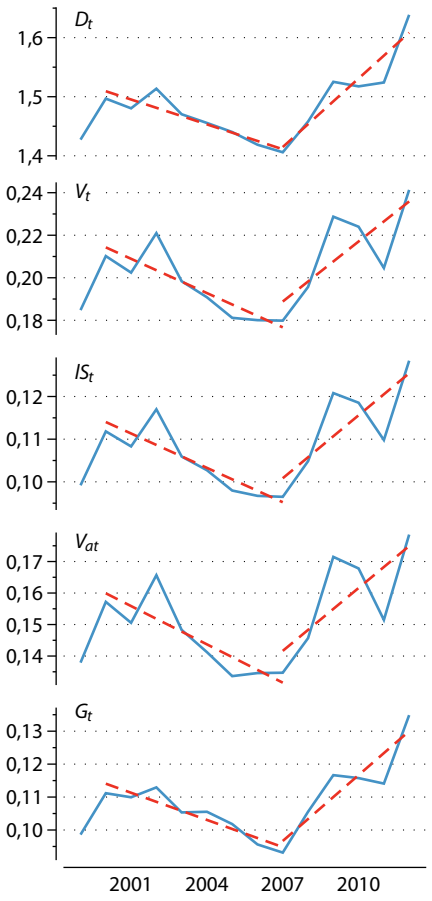

Fig. 4. Trends for the measures of dispersion and concentration with the analyzed periods of time taken into account

These results show that in further analysis it is worth retaining the division of the analyzed period of time into two subperiods: 2000–2007 and 2008–2012. The year 2008 as the starting point of the second subperiod is not coincidental. This year was the beginning of the economic slowdown, which in Poland continues today.[21] Furthermore, what is even more important in regard to the conducted analysis it was the first year of undertaking tasks (spending funds) of the 2007–2013 programming period.

Just a simple comparison of the GDP per capita in 2000 and the average yearly growth rate in the years 2001–2007 shows that the subregions having a higher base of GDP per capita experienced a lower growth rate (the lowest growth rate happened in the lubelski subregion, which had the highest GDP per capita in 2000, and the highest rate of growth — in the chełmsko-zamojski subregion, which had the lowest GDP per capita in the same year). These reflections lead to a hypothesis that in the years 2001–2007 the voivodship experienced beta-convergence — i.e., its subregions were coming together in terms of their economic growth levels. An opposite situation happened in the second of the analyzed subperiods. In the years 2008–2012 the highest average yearly growth of GDP per capita (4,8%) was experienced in the lubelski subregion, which had had the highest level of GDP per capita in 2007. The lowest growth took place in the chełmsko-zamojski subregion (1,6%), which in 2007 had the lowest growth level. These relations were especially visible in 2012, when the lubelski subregion experienced a 6% growth, while the chełsko-zamojski subregion — a decrease of GDP per capita by 1,4%. This allows us to formulate a hypothesis, that in the years 2008–2012 appeared beta-divergence.

20. In the linear models the values of indicators from 2007 were also taken into consideration.
21. In 2009 the voivodship experienced even a decrease of GDP (by 0,8%).

Tab. 3. GDP per capita and the yearly growth rate in subregions in years 2000–2012

Specification	Subregion			
	lubelski	**puławski**	**bialski**	**chełmsko-zamojski**
GDP per capita in 2000 in constant prices (2012) (PLN)	25 225	17 587	17 101	16 853
GDP per capita in 2007 in constant prices (2012) (PLN)	30 611	22 256	21 819	21 773
Average yearly growth rate 2001-2007 (%)	2,8	3,4	3,5	3,7
GDP per capita in 2011 in constant prices (2012) (PLN)	36 503	26 156	25 455	23 951
Average yearly growth rate 2008–2011 (%)	4,5	4,1	3,9	2,4
GDP per capita in 2012 in constant prices (2012) (PLN)	38 697	26 325	25 421	23 615
Average yearly growth rate 2012 (%)	6,0	0,6	−0,1	−1,4
Average yearly growth rate 2008–2012 (%)	4,8	3,4	3,1	1,6

The statistical analysis shown above does not allow us to assess the significance of the analyzed phenomena, as well as to calculate the rate of convergence (divergence). This may be estimated by means of convergence models. Regardless of the very small number of observations, the assessment started with cross-section models of absolute beta-convergence.

The b coefficient for the whole analyzed period is positive, but insignificant on the 0,05 significance level, which — with an orthodox statistical approach — means it is impossible to draw any conclusions. If we, however, were to reject the orthodox approach, it would be possible to state that in the whole analyzed period of time we experienced a divergence of 1,1% per year. The insignificance of the b coefficient arises at least partially from multidirectional changes in GDP per capita in the two specified periods of time. The estimated b coefficient for the years 2000–2007 is statistically significant and negative, which supports the earlier stated hypothesis of beta-convergence during these years with a 2,1% average yearly rate of regions converging. The estimated b coefficient for the years 2007–2012 became positive, which means that within this period we experienced beta-divergence with a 5,4% yearly rate of regions diverging. This conclusion, however, has a bias of the b insignificance. It is noteworthy to take a look at the model for the years 2011–2012. The b coefficient is positive and statistically significant with the divergence rate of 15,5%. It leads to an assumption that it is the last analyzed year which had a decisive impact on the increase of divergence.[22] And it is important to note that the year 2012 was the first one, when the projects from the 2007–2013 programming period were finalized on a grand scale. Most of these were realized in the lubelski subregion, especially in the city of Lublin, and — to a smaller extent — in the puławski subregion. This process will be continued in the years 2013–2014. This is why the authors believe that, irrespective of the insignificance of the b coefficient in the model for the years 2007–2012, the last year prompts us to accept the hypothesis of increasing economic disparity (divergence) of the voivodship in the programming period 2007–2013. This happens, while the GDP per capita growth rate of the voivodship is higher by 0,2 percentage point than the national average. This means we experience both external convergence and internal divergence of the voivodship.

Tab. 4. The results of the estimations of cross-section absolute beta-convergence models

Base year (0)	Analyzed year (T)	b	p	R^2	Adjusted R^2	$\beta \cdot 100\%$
2000	2012	0,138	0,3082	0,479	0,218	−1,07
2000	2007	−0,137	0,0270	0,947	0,920	2,10
2007	2011	0,124	0,4182	0,339	0,008	−2,92
2011	2012	0,168	0,0029	0,994	0,991	−15,49
2007	2012	0,310	0,1777	0,676	0,514	−5,40

22. The parameter for the model from the previous years (2007–2011) is also positive, which could evidence divergence with a rate of 2,9%, but it is insignificant.

Assuming that some specific characteristics of the subregions may have impact on the rate of growth, to assess cohesion the panel models of absolute and conditional convergence were also used. These models were estimated separately for two subperiods of time, stated earlier.[23] The coefficients of the models were estimated with fixed time effects, with and without numerous condition variables.[24] The results are shown in table 5. It was not possible to obtain models with b coefficient on 0,05 significance level, which greatly reduces the interpretation value.

Tab. 5. Results of the absolute and conditional beta-convergence panel models estimations

Years	b	p	R^2	Adjusted R^2	$\beta \cdot 100\%$
Absolute convergence					
2001–2007	−0,029	0,326	0,46	0,27	2,9
2008–2012	0,045	0,299	0,57	0,42	−4,4
Conditional convergence					
2001–2007 [a]	−0,042	0,143	0,55	0,36	4,3
2008–2012 [b]	0,037	0,450	0,57	0,38	−3,5

[a] Additional variable: change in the number of job offers
[b] Additional variable: change in the number of the registered unemployed

Notwithstanding, the results deserve some attention. The signs of the estimated coefficients (although insignificant) are the same as the ones in the cross-section models. In this way the fact of beta-convergence in the years 2001–2007 and beta-divergence in the years 2008–2012 is supported. Of course, the yearly average rates of convergence speed differ, although these differences never exceed 2,2 percentage points. Another observation is that panel models give higher β values, but only in the case of convergence; for divergence the situation is the opposite.

Conclusions

The realisation of the cohesion policy since 2004, the main aim of which was to decrease the regional disparities has not yet caused the convergence of voivodships. The divergence has slightly decreased, though. There are no doubts that without the cohesion policy the disproportions would be even greater (Kusideł 2013a, 193). This also applies to the Lubelskie Voivodship, where the growth rate in the years 2010–2012 was slightly higher than the national average. Conducted researches indicate, however, that this growth arises mostly from the metropolitan subregion of Lublin, characterized by the highest growth rate and the highest GDP per capita level. The other subregions, which are much poorer, experience a lower growth rate, which causes beta- and sigma-divergence. Therefore, referring to the discussion about the "two speed Europe" it is possible to speak — of course being fully aware of the different problems — about a "two speed voivodship." While the first positive symptoms of the cohesion policy regarding the Lubelskie Voivodship (realized mostly through the Strategy for Socio-Economic Development of Eastern Poland Until 2020[25] and the development strategy of the Lubelskie Voivodship for the years 2006–2020[26] (Kawałko 2009)), the internal cohesion policy of the region has to be evaluated in a negative way. According to Krystyna Iglicka-Okólska: "Poland shall be strong only when the rule of balanced development of all the regions will be introduced. Meanwhile, there are efforts to artificially create centers and peripheral areas. Eastern Poland has become the latter. Without any reflections, the polarization-

23. Due to the one year lag of the variables in the model (see above) it was necessary to use the observation values from the previous years: 2000 and 2007 respectively.

24. The number of unemployed, business entities, salary rates and production rates amongst others.

25. Op. cit.

26. See: Urząd Marszałkowski Województwa Lubelskiego w Lublinie. 2005. Strategia Rozwoju Województwa Lubelskiego na lata 2006–2020, t. 1, Uwarunkowania i diagnoza stanu wyjściowego. Lublin: Departament Rozwoju Regionalnego; Urząd Marszałkowski Województwa Lubelskiego w Lublinie. 2009. Strategia Rozwoju Województwa Lubelskiego na lata 2006–2020, t. 2, Cele i priorytety strategii oraz system wdrażania. Lublin: Departament Rozwoju Regionalnego.

diffusion model is promoted. It means stimulating development of large centers and leaving the rest to themselves." (Mazur 2014). This conclusion has to be extended over the intra-regional policy, which is also characterized by high polarization. Of course, one could formulate a thesis following Williamson — internal convergence will happen only on higher levels of the economic development of the region. But, in the opinion of the authors, without an intra-regional policy directed clearly toward internal cohesion, this will be very difficult or even impossible.

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