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# REGIONAL CONVERGENCE AND DIVERGENCE IN POLAND

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**Abstract:** The article aims to explain whether in 2004–2015 Poland experienced economic convergence between regions and counties (Polish: *powiat*), and whether this process occurred within the regions (Polish: *województwo*). Following Poland's EU accession, the Polish policy became dominated by the polarization and diffusion concept of regional development, which may cause differences in the short term, while in the long run it may contribute not only to the increased efficiency of public funds allocation, but also to the elimination of disparities in growth levels. In the analysed period Poland experienced a process of economic divergence between the regions, only the years 2006–2008 saw a short-term reduction in regional disparities. On the other hand, a slow process of reducing economic inequalities between counties took place after 2004. It was, however, varied – a clear reduction in disparities occurred between the land counties (Polish: *powiat ziemski*) in an almost monotonic manner, whereas city counties (Polish: *miasto na prawach powiatu*) did not undergo any convergence. Within the regions, the process of economic convergence varied: in five regions,  $\beta$ -convergence was identified, and  $\sigma$ -convergence occurred in all the regions. The process of reducing disparities was significantly dependent on the development pathway of the region.

**Keywords:** regional policy; regional convergence; economic inequalities, local economic aggregated index, Poland

**JEL codes:** C20, C51, O11, O47

## 1. Introduction

It is generally acknowledged that economic growth varies from region to region. The dynamics of regional growth are variable and relate to the business cycles in a country's growth, while at the same time the skilful use of endogenous potentials

of the regions seems to be a necessary prerequisite for the socio-economic development of the whole country.

The country's regional policy involves deliberate actions of government authorities in cooperation with local government authorities, which are aimed at improving the economic competitiveness of all the regions, giving them equal development opportunities and ensuring the economic, social and territorial cohesion of the country. The policy defined in this way embraces not only government intervention in the poorest areas, but also the creation of optimal conditions for socio-economic development of the whole country. We can assume that, in the long run, the result of actions taken as part of the country's regional policy will be the economic convergence of the regions.

At the same time, regions – even when managing their development involves both state and local government – pursue their own, more or less autonomous, development policy. Its prime goal is to ensure the conditions allowing for raising the standard of living and for building the socially and territorially cohesive, sustainable growth of the region. We can, therefore, consider intraregional convergence between smaller units (subregions, counties) in particular regions.

Problems related to the spatial aspects of convergence become particularly important in view of the potential economic effects of equalizing or diversifying levels of economic growth, as well as in the face of political challenges. This is related to the implementation of the European Union's regional policy, whose main objective is to ensure economic and social cohesion within the Community by reducing territorial imbalances. The implementation of cohesion policy is assumed to result in achieving convergence by eliminating excessive developmental disparities. However, the treaty provisions do not specify at what level of the EU territorial organization inequalities in socio-economic development should be reduced – international, interregional or even intraregional. These ambiguities seem to be extremely important because, as shown by the research results in the field of new economic geography (Puga 1999; Martin & Ottaviano 2001; Brakman et al. 2005), an increase in the development dynamics of the entire spatial system is most often associated with an increase in internal differences between its constituent parts (Kisiąła 2016a; Kisiąła & Suszyńska 2017).

The effective implementation of regional policy and the rate at which convergence is achieved depends, to a significant extent, on the strategy of spatial targeting of interventions adopted by national and regional authorities. This strategy may be focused on improving efficiency or reducing disparities. The choice of the pro-efficiency option means the adoption of a polarization and diffusion development model, the assumption of which is to maximize the economic growth rate on a macroeconomic scale. This model will foster international convergence, but initially it may lead to polarization at the regional and even intraregional levels. In time, however, as the economy progresses to higher development stages, the processes involving the diffusion of growth impulses to other areas should lead to the reduction of regional and local disparities. In turn, the implementation of the compensatory option of regional policy – often identified with the balancing of development in space – is supposed to lead to intranational convergence and the reduction in the

scale of socio-economic disparities through providing support targeted at areas in the worst economic situation (Gaczek 2010; Komornicki & Silka 2011; Kisiąła *et al.* 2017).

The article aims to seek answers to the following questions:

- 1) whether Poland experienced the economic convergence of the regions, and whether after 2004 the process occurred steadily or showed significant fluctuations;
- 2) how the process of convergence progressed in the counties (NUTS4) and why and how economic convergence of land and city counties varied;
- 3) whether the regions underwent intraregional convergence and whether the process was diversified.

The study covered changes in the economy in 2004–2015, i.e. following Poland's accession to the European Union when the impact of EU cohesion policy overlapped with actions taken within the framework of national regional policy and intraregional development policy.

## 2. Convergence as a regional policy goal

The EU regional policy in the years 2000–2006 focused mainly on supporting the development of weaker regions by creating equal conditions for their economic growth. The objectives of the policy included: 1) supporting the structural adaptation of regions lagging behind in development, 2) supporting the economic and social conversion of the areas with structural problems. The initiated actions should lead to regional convergence in the EU. Conclusions included in the third report of the European Commission entitled *New partnership for cohesion. Convergence, competitiveness, cooperation* (2004) showed that the effects of the pursuit of the regional policy goals were limited and the interregional differences did not diminish. The report also confirmed the slowdown in the economic growth rate, which in many regions resulted in an increase in unemployment, a poor growth in labour productivity and a slight increase in workforce. At the same time, insufficient outlays on human resource development as well as research and development activity resulted in the insufficient innovativeness of the economy. Subsequent analyses confirmed an increase in regional disparities following the admission of new members to the EU.

The new cohesion policy (2007–2013) proposed the pursuit of three priorities:

1. Convergence – improving the conditions for economic growth and employment in the least-developed countries and regions, for example, by:
  - increasing investment in human capital and physical capital, primarily infrastructure;
  - increasing adaptability to social and economic changes<sup>1</sup>.

<sup>1</sup> Priority 1. *Convergence* embraced 100 regions, including all the regions in Poland, the regions in Czechia, Hungary and Slovakia (with the exclusion of the metropolitan areas of Prague, Budapest and Bratislava), Lithuania, Latvia, Malta and Slovenia (*Kompendium wiedzy o Unii Europejskiej* 2010).

2. Regional competitiveness and employment, i.e. increasing the competitiveness of regions.
3. European territorial cooperation, including enhanced cross-border, interregional and transnational cooperation.

Measures to eliminate differences in socio-economic development in Poland have a long tradition. The first efforts were made in the interwar period (1919–1939) due to the necessity of social and infrastructural integration of the areas after the Partitions of Poland. Despite the efforts made, however, the division of the country into Poland A (better developed areas of the Prussian Partition) and Poland B (less developed areas of the Russian Partition and part of the Austrian Partition) was remained still valid even in the last decade of the 20<sup>th</sup> century. Also, the initiatives undertaken in the centrally planned economy, although focusing on the industrialization of the less developed areas, did not produce spectacular results. In 2007, the absence of the expected effects of the steps taken by the authorities to offset regional disparities led to the adoption the *Eastern Poland Operational Program*, targeting the country's five eastern regions.

The vision of Poland's regional development from 2010 assumed an increase in the strength and cohesion, both economic and social, of Polish regions. The critical role in the implementation of the vision was given to urban areas with metropolitan functions. Regional capital cities along with functional urban areas (FUA) were – in line with the adopted assumptions – to constitute compact, internally integrated space with high growth dynamics by 2020. *The National Regional Development Strategy 2010–2020: Regions, Cities, Rural Areas* assumed that the regions would see the strengthening of functional links between central cities as regional metropolises and cities of subregional and local importance as well as between cities and their surrounding areas, which should allow for spreading development processes to less developed areas.

The adopted polarization and diffusion model of regional development was applied to all the regions<sup>2</sup>. The assumption was to maximize the effectiveness of public intervention targeting the territories that were characterized by the highest capacity for generating economic growth and which were the most likely to achieve the expected results on an international scale. At the same time, initiatives were planned to help spread development trends to less developed areas and building their absorption potential.

The implementation instruments of regional policy have been and remain available at both national and regional levels. Accordingly, government authorities create a national regional development strategy (focusing mainly on multiregional diversity and investments of supraregional importance), and regions devise subsequent editions of regional development strategies (taking into account intraregional differences). Regional authorities formulate strategic development goals based on the assumption that the potential of the capital (regional metropolis) as a regional growth pole and endogenous development factors will be used. Such an approach should lead to reducing the differences in the level of economic growth and quality

<sup>2</sup> More on the polarization and diffusion model in development trends in Churski (2014).

of life within the region. The sources of financing the implemented regional policy came from the state budget, local government budgets and, to a substantial extent, from the EU structural funds in the form of operational programs.

### 3. Theoretical aspects of economic convergence

The issue of inequality in the distribution of goods, income and capital has long been the subject of interest to economists seeking to explain how socio-economic development processes run. The dynamics of these processes is manifested by the occurrence of business cycles, while their spatial aspects are visible as the regional and local diversification in the economic situation of territorial entities. The challenge faced by contemporary development policy is to mitigate the amplitude of the business cycle and reduce excessive differences in the level of socio-economic development in a spatial system. Counteracting temporary and spatial development inequalities plays an important role in the implementation of the European Union's cohesion policy. Its initiatives aim to achieve the outcome that can be equated with long-term socio-economic convergence across the entire European Union (Markowska-Przybyła 2010; Domański 2012).

The process of economic convergence, meaning the reduction in the economic disproportions between regions, is a controversial issue. The dispute over convergence results from different assumptions regarding theoretical concepts of economic growth and regional development, and mainly involves the neoclassical school and the advocates of the concept of endogenous growth. The researchers supporting the neoclassical theory of economic growth assume, according to the Solow (1956) model, the decreasing marginal productivity of capital, which results in the reduction of disparities between poor and rich countries in the long run. The catching-up effect originates from poorer countries achieving higher rates of economic growth than rich countries. However, this view is questioned by the proponents of endogenous growth theory and the representatives of new economic geography. They point to the possibility of the opposite consequences of economic growth – divergence. The divergence hypothesis is based mainly on the law of increasing returns, resulting from the growing marginal product of capital (which, in this approach, also means human capital). The factors favouring economic divergence also include location-related benefits, such as infrastructural facilities, proximity of customers and business partners, access to qualified workforce, and technological advancement. The concentration of these elements in specific places provides the ground for self-driven economic growth and stimulates polarization processes. The deepening disparities are further affected by the so-called leaching effect, manifested by the drainage of resources from backward areas – the outflow of labour, capital, goods and services – to privileged areas (Domański 2012; Markowska & Strahl 2012; Jabłoński 2012; Kusideł 2013).

The problem of economic convergence or divergence, despite numerous attempts at empirical verification, is still considered unresolved, and the published research results often lead to contradictory conclusions (Malaga 2004; Kusideł 2013; Pięta

2014). Numerous studies on economic convergence and the adoption of various theoretical and methodological background to verify its mechanisms led to the development of a number of terminological and classification assumptions. Most generally, economic convergence is divided into nominal<sup>3</sup> and real convergence.

Real convergence concerns real economic trends and it means the process of eliminating economic disparities between the surveyed economies of countries or regions (Malaga & Kliber 2007; Kusideł 2013). It occurs when less developed countries (regions) have faster economic growth compared to richer countries (regions).

Literature distinguishes two main types of real convergence:  $\sigma$  and  $\beta$ . Convergence  $\sigma$  means reducing the disproportions between macroeconomic indicators, such as GDP *per capita*, in the set of spatial entities in subsequent years. The verification of  $\sigma$ -convergence is carried out as the identification of changes in inequality measures, such as standard deviation, the coefficient of variation, the Theil index, and the Gini coefficient. On the other hand,  $\beta$ -convergence stems directly from the neoclassical assumption of the diminishing marginal productivity of capital and means a negative correlation between the initial level of the examined index (e.g. GDP *per capita*) and its average growth rate. The verification of  $\beta$ -convergence is conducted by means of econometric modelling. If differences in the level of development decrease independently of other conditions, the so-called absolute (unconditional) convergence occurs. In such a situation, only the initial state is adopted as the variable explaining the rate of economic growth in the estimated models. On the other hand, when the model takes into account certain control variables as additional factors determining growth, the so-called conditional convergence is estimated. In the former case, all countries and regions (regardless of initial conditions) strive for the same steady-state equilibrium, while the latter option assumes the occurrence of many different steady-state equilibrium states and describes convergence only between selected groups of regions with similar structural parameters (Malaga 2004; Wójcik 2008).

Literature also distinguishes global convergence (all regions show convergence to a common level) and the convergence of clubs (economies become similar within the so-called convergence clubs – i.e. regions with similar initial levels and similar legal, cultural and social determinants) (Jabłoński 2012). The process of economic convergence can be considered in various spatial scales. In this context, the concept of cross-national (external) convergence was introduced to account for the case when the spatial scale of a study concerns a group of countries and intranational (internal) convergence for the case when the analysis concerns changes in inequality within the economy of a given country (Kusideł 2013).

<sup>3</sup> Nominal convergence refers to the expected cross-national convergence of macroeconomic indicators and achieving the stabilization and homogeneity of national economies (inflation, interest rates, exchange rates, the ratio of public debt and budget deficit to GDP). Convergence of this type tends to be identified with the Maastricht Treaty criteria, i.e. the conditions that countries must comply with in order to join the monetary union. Such convergence is not the subject of this study.

#### 4. Research methodology for economic convergence

Research methodology for economic convergence is usually based on the classical approach popularized in the works of Barro and Sala-i-Martin (1992; 2004).

The verification of the absolute  $\beta$ -convergence hypothesis is conducted with regression modelling. Formal analysis involves the estimation and verification of the equation:

$$\ln \left( \frac{y_{i,t_0+T}}{y_{i,t_0}} \right) = \alpha_0 + \alpha_1 \ln (y_{i,t_0}) + \varepsilon_i, \text{ where:}$$

$y_{i,t_0}$  means the value of the examined variable in the  $i$ -th spatial entities ( $i=1,2,\dots,N$ ) in the initial analysis period  $t$  ( $t=0,1,\dots,T$ ),  $y_{i,t_0+T}$  – the value of this variable in the final analysis period,  $\alpha_0$  and  $\alpha_1$  – the estimated parameters of the model, and  $\varepsilon_i$  – a random component (a model error).

The statistical significance of the  $\alpha_1$  coefficient is the basis for inference about convergence or divergence. A negative estimation of the parameter indicates the occurrence of convergence, while its positive value indicates divergence (Malaga 2004; Kusideł 2013).

The statistically significant  $\alpha_1$  estimator allows for the determination of the so-called coefficient of  $\beta$ -convergence (the rate of  $\beta$ -convergence/divergence). The findings of Barro and Sala-i-Martin (1992) indicate that  $\alpha_1 = -(1 - e^{-\beta T})$ , hence  $\beta = -\ln(1 + \alpha_1)/T$  (where  $T$  is the interval between the initial and final analysis periods). The  $\beta$  parameter informs about the average rate of convergence/divergence, expressed as a percentage, within one period (according to time units adopted for the analysis). The higher the absolute value of  $|\beta|$ , the higher the rate at which the poorer entities are catching up with the richer entities ( $\beta > 0$ ) or at which inequalities are increasing ( $\beta < 0$ ).

In order to calculate the time necessary to reduce the differences occurring in the set of surveyed entities by half (the so-called half-convergence period), the half-life index, according to the formula  $hl = (\ln 2)/\beta$ , is used.

In turn, in order to verify  $\sigma$ -convergence, it is necessary to measure the dispersion of income levels in the studied economies (national, regional, local). The most commonly used measure of variation is the standard deviation of the GDP *per capita* logarithms. Because it is an absolute measure, expressed in units of the variable under consideration, in order to obtain comparability of data between years without the need for a GDP deflator, a measure of inequality (Friedmann 1992) is used as an alternative coefficient of variation. The decrease in dispersion in the set of the examined entities over time indicates the occurrence of  $\sigma$ -convergence.

The assessment of the occurrence of  $\sigma$ -convergence is usually carried out by analysing the directions of changes in the dispersion measure applied in the chart and on the basis of the estimated regression equation in the form of:

$$V_{y_t} = \alpha_0 + \alpha_1 t + \varepsilon_t, \text{ where}$$

$V_t$  means the value of the dispersion measure of the variable  $y$  in the set of studied entities (countries, regions) in time  $t$  ( $t=0,1, \dots, T$ ),  $\alpha_0$  and  $\alpha_1$  – estimated parameters of the model, and  $\varepsilon_t$  – a random component (a model error),  $t$  – a temporal variable.

The negative estimation of the  $\alpha_1$  parameter indicates a declining trend in the value of the dispersion index. Since real changes in the level of inequality may be nonlinear and nonmonotonic changes may occur between the extreme periods of analysis, the inference of the  $\sigma$ -convergence effect should be preceded with the statistical evaluation of the model's quality (mainly with the test of the statistical significance of the  $\alpha_1$  slope coefficient) (Próchniak & Rapacki 2009; Jabłoński 2012).

The logical relationship between  $\beta$ - and  $\sigma$ -convergence exists.  $\beta$ -convergence is necessary, but insufficient for  $\sigma$ -convergence. Thus, if  $\beta$ -convergence does not implicate  $\sigma$ -convergence, conclusions from the studies conducted with the use of these two different convergence measurement methods do not have to be and very often are not the same (Malaga 2004; Kusideł 2013).

## 5. Regional and local economic growth measures and research methodology

The processes of regional convergence can be analysed on the national scale (between the regions) and on the scale of particular regions. The effect of regional convergence would be to the elimination or reduction in the differences between the regions, and the effect of convergence within the regions would be the elimination or reduction in the differences between smaller spatial entities.

The analysis of economic convergence of type  $\beta$  and  $\sigma$ , aimed at determining the direction and rate of changes in economic growth inequalities, was conducted at interregional and intercounty levels as well as at the intraregional level in the regions.

The selection of variables characterizing the economic growth of the analysed territorial units is of key importance for convergence research. The analysis at the regional level applied a measure widely used for such purposes, namely GDP *per capita*. However, due to the lack of public statistics on the value of GDP for counties<sup>4</sup>, an alternative measure was used – the local economic aggregated index (LEAI). This measure has so far been rarely used in Polish spatial and economic analyses, although as a measure of growth at the local level it was used in the Czech and Slovak literature on the subject (Hampl 2007; Korec & Polonyová 2011). Few attempts to implement this indicator in Polish research are presented in the works of Kisiała and Stepiński (2012) and Kisiała (2016b). The LEAI index is defined as the product of the number of working population and the average gross monthly remuneration in a given territorial unit. It is relative to the population (social option) or a unit's area (geographical variant).

<sup>4</sup> The lowest level for GDP data aggregation is NUTS3 – subregions.

The strength of the LEAI *per capita* index (social option) is its high correlation with the value of GDP *per capita* at the regional (NUTS2) and subregional (NUTS3) level. The Pearson linear correlation coefficients calculated based on the data for the years 2002–2014 for the regions reached the value of 0.97–0.99, while for the subregions they fluctuated between 0.94–0.98 (Table 1). The analysis of the time series revealed an even higher degree of correlation. Therefore, it was considered that this indicator can be used as a measure equivalent to GDP for units smaller than regions.

Table 1. The degree of correlation between LEAI and GDP *per capita*

Data aggregation level	Spatial series analysis		
	$\bar{r}$	$r_{\min}$	$r_{\max}$
Voivodeships (NUTS2)	0.977	0.971 (2013)	0.985 (2004)
Subregions (NUTS3)	0.962	0.943 (2011)	0.976 (2002)
Data aggregation level	Time series analysis		
	$\bar{r}$	$r_{\min}$	$r_{\max}$
Voivodeships (NUTS2)	0.994	0.987 (Pomorskie)	0.997 (Podkarpackie)
Subregions (NUTS3)	0.989	0.942 (Płocki)	0.998 (City of Łódź)

Source: own elaboration based on the Statistics Poland data

This article provides the analysis of absolute internal convergence (intranational and intraregional) of type  $\beta$  and  $\sigma$ . Regression modelling aimed at the verification of the convergence trends was carried out for three options. In the first option, a set of regions was analysed, which verified the interregional convergence hypothesis. Then, changes in local growth inequalities in Poland were analysed through the empirical verification of economic convergence between counties. Additionally, this option includes the analysis of the direction and rate of differentiation in two groups (“convergence clubs”): in the group of city counties (65) and in the group of other counties – so-called land counties (314). Finally, in third option is the analysis of the counties in particular regions, verifying the degree and direction of intraregional convergence.

## 6. Interregional convergence

The analysis of interregional convergence in Poland showed that in 2004–2015 there was divergence of regional economic growth levels (Table 2, Fig. 1).

Table 2. The estimation results of the interregional convergence regression model

Regression model	$\alpha_1$	$p$ -value	$R^2$	Convergence
$\beta$ -convergence	0.136	0.046	0.25	No
$\sigma$ -convergence	0.015	0.001	0.66	No

Source: own elaboration

The regression equation describing  $\beta$ -convergence (the positive and statistically significant value of the  $\alpha_1$  parameter) showed that the regions with higher income *per capita* obtained, on average, a higher economic growth rate in the analysed years than the regions which had a lower level of income *per capita* in the initial period. This means that since the country's accession to the European Union, the economic growth of the regions took place in accordance with the divergence hypothesis. The occurrence of divergence is implied by a positive slope of the regression function (Fig. 1). The coefficient of determination exceeding 25% indicates the moderate fit of the estimated model to empirical data. It should be noted, however, that during the  $\beta$ -convergence regression modelling, high coefficients of determination are rare.

The divergence of regional economies is confirmed by the results of the  $\sigma$ -convergence analysis. The trend function fitted to the value of volatility coefficients calculated for the years 2004–2015 assumed an increasing form, and the estimated slope coefficient ( $\alpha_1 = 0.015$ ) was statistically significant ( $p \geq 0.001$ ). Changes in the level of regional differences in economic growth in the analysed years fluctuated considerably. In 2004–2006, the dispersion of GDP *per capita* increased, while in 2006–2008 it significantly decreased. In 2008, the coefficient of variation was the lowest in the entire time series. In the following years, development differences between the regions deepened at the rate which was very high in 2008–2010 only to slow down to moderate afterwards.

The results of the  $\sigma$ -convergence analysis lead to the conclusion that in the period of the economic downturn associated with the global crisis, the income differences between the Polish regions were decreasing. It can therefore be assumed that the slowdown affected mainly and to the greatest extent the richest regions, with the highest GDP *per capita*. Those were the regions whose share in foreign trade was the largest. However, in the first years after the crisis, there was an increase in the level of regional inequalities. Observations that deviate from the general tendency

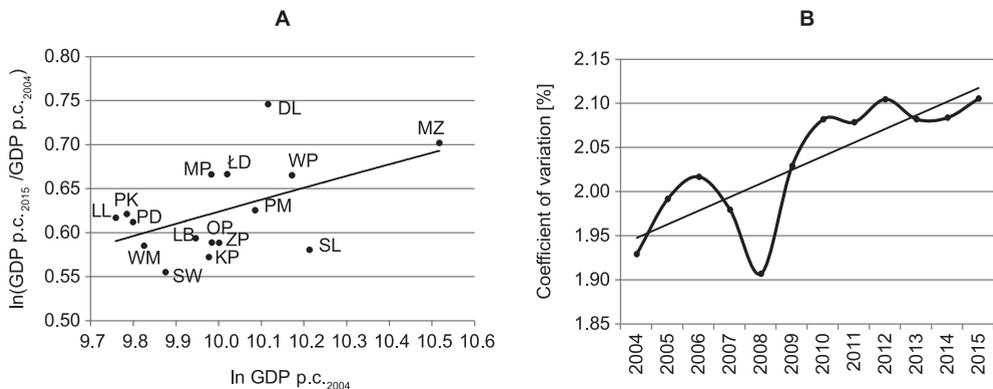


Fig. 1. Interregional convergence of type  $\beta$  (A) and  $\sigma$  (B)

Symbols: DL – Dolnośląskie; KP – Kujawsko-Pomorskie; LL – Lubelskie; LB – Lubuskie; LD – Łódzkie; MP – Małopolskie; MZ – Mazowieckie; OP – Opolskie; PK – Podkarpackie; PD – Podlaskie; PM – Pomorskie; SL – Śląskie; SW – Świętokrzyskie; WM – Warmińsko-Mazurskie; WP – Wielkopolskie; ZP – Zachodniopomorskie.

Source: own elaboration (Figures 1–11)

of growth divergence between the regions during the economic crisis cause that the quality of fit of the estimated model is relatively weak ( $R^2=0.66$ ).

The analysed years was mainly generated by the few regions with the characteristics of the so-called growth poles, in which, due to the concentration of production factors and higher work-related technologies, productivity grew and the regions in question developed faster in relation to the rest of the country. The faster growth of the strongest areas translated into spatial polarization and increasing regional inequalities. Presumably, however, over time, along with the socio-economic development of the country, the diffusion of growth impulses to other areas will occur, which will reduce regional disparities.

## 7. Intercounty convergence

The further part of the study focused on verifying economic convergence at the local level. As mentioned above, the analysis was carried out in the set of all counties and independently in two subsets: city counties<sup>5</sup> and land counties.

Table 3. The estimation results for the intercounty convergence regression equations

Type of county	$\beta$ -convergence					$\sigma$ -convergence		
	$\alpha_1$	<i>p</i> -value	$R^2$	$\beta$	<i>hl</i>	$\alpha_1$	<i>p</i> -value	$R^2$
Counties in total	-0.089	0.000	0.07	0.8%	81.68	-0.110	0.000	0.97
Land counties	-0.131	0.000	0.09	1.3%	54.09	-0.093	0.000	0.90
City counties	0.004	0.926	0.00			-0.019	0.006	0.55

Source: own elaboration based on the Statistics Poland data

Regression models together with  $\beta$ -convergence and  $\sigma$ -convergence parameters show that the years 2004–2015 saw a slow process of reducing economic inequalities between counties (Table 3, Fig. 2). Therefore, the process was different than the one between the regions. The estimated  $\beta$ -convergence regression equation for all the counties confirmed that those with the lower initial level of economic growth (measured by LEAI *per capita*) statistically achieved a higher growth rate than those whose level of development was high in the initial year of analysis (Fig. 2A). However, the low value of the  $\alpha_1$  parameter, albeit negative and statistically significant, proved that the convergence process was very slow. The current differences can be halved in around 82 years at the rate determined by  $\beta$ -convergence (0.8% per year).

The tendencies of the gradual reduction in differences are confirmed by the results of the  $\sigma$ -convergence analysis. The trend function was very well fitted to the actual course of changes in income disparities ( $R^2=0.97$ ) and its negative slope clearly indicated  $\sigma$ -convergence (Fig. 2B).

The empirical verification of  $\beta$ -convergence within the “clubs” (understood as a set of city counties and a set of land counties) showed different statistical regularities characterizing each of the groups (Fig. 3 and Fig. 4). While in the group

<sup>5</sup> City counties are cities with powiat status.

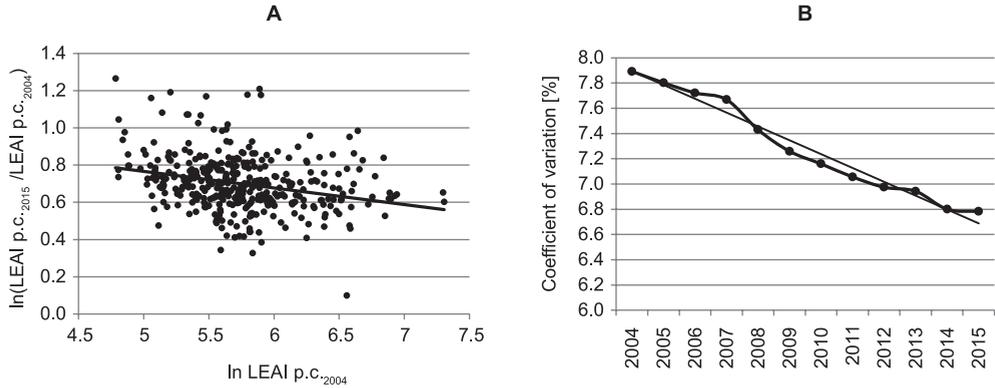


Fig. 2. Intercountry convergence of type  $\beta$  (A) and  $\sigma$  (B) – all the counties

of city counties (Fig. 3A) the lack of the statistical significance of the convergence coefficient ( $p=0.926$ ) made it impossible to confirm either the convergence or divergence hypothesis (although the  $\alpha_1$  parameter was of positive value), the set of land counties manifested characteristics similar to the results of the analysis conducted for all the counties (Fig. 3B). The regression function with a negative value of slope indicates that counties with higher LEAI *per capita* values in 2004 obtained, on average, a lower growth rate in the analysed period. The occurrence of  $\beta$ -convergence in this group is characterized by an annual rate of 1.3%, which translates into a 54-year half-convergence. This means that if the environmental conditions do not change, differences in economic growth across counties will be halved by around 2065. However, it should be noted that the estimated models have a low explanatory value. The  $R^2$  determination coefficients did not exceed 0.1, which means that the initial economic development level of the counties explains no more than 10% of the variability of its dynamics (in the group of city counties, there is basically no statistically confirmed relationship between these variables).

In turn, the results of the  $\sigma$ -convergence analysis for the two separate sets of counties showed that the income differences decreased in both groups, while the

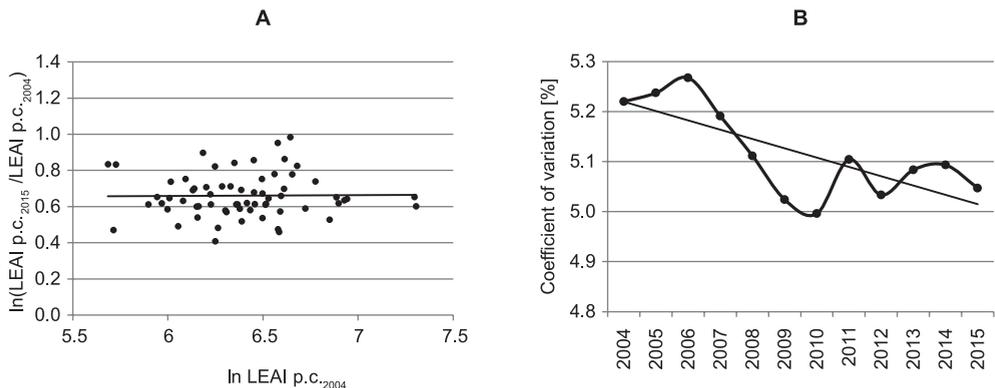


Fig. 3. Intercountry convergence of type  $\beta$  (A) and  $\sigma$  (B) – city counties

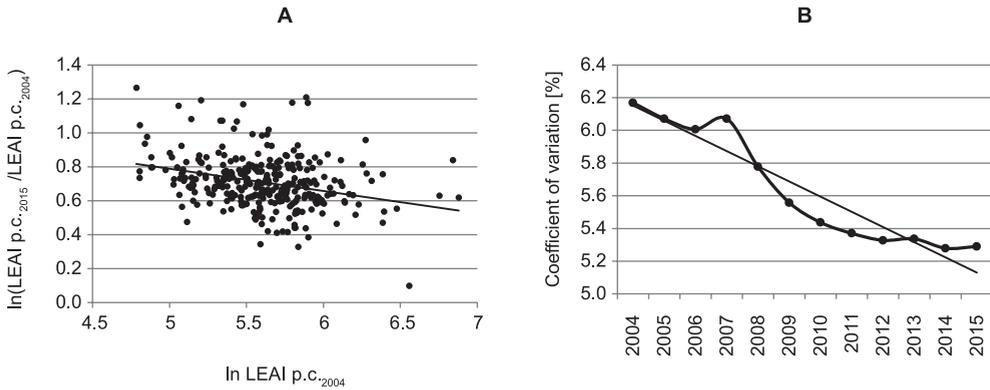


Fig. 4. Intercounty convergence of type  $\beta$  (A) and  $\sigma$  (B) – land counties

statistically significant and negative coefficients of the slope of both trend functions confirmed the existence of  $\sigma$ -convergence both among city counties and land counties. However, the trend in changes in the coefficients of variation for subsequent years was different (Fig. 3B and Fig. 4B). In the group of land counties, variation steadily decreased (with a slight exception in 2007), which confirms a good fit of the trend function ( $R^2=0.9$ ). The changes in economic inequalities in the group of city counties, however, were hardly monotonic – they followed an alternating upward and downward trend. Therefore, the trend function for this group was much less fitted ( $R^2=0.55$ ).

## 8. Intraregional convergence

The third part of the study was devoted to income disproportions in particular regions, verifying intraregional convergence. Estimated  $\beta$ -convergence and  $\sigma$ -convergence regression models confirm the differentiation of the process of equalizing differences within particular regions. It should be noted that both convergence and  $\sigma$ -convergence do not always occur in all regions. Differences in results are particularly noticeable in the Opolskie and Śląskie regions (Table 4).

The occurrence of  $\beta$ -convergence was statistically confirmed only in five regions – Wielkopolskie, Mazowieckie, Łódzkie, Kujawsko-Pomorskie, and Warmińsko-Mazurskie. In these five regions, the average growth rate in the weaker counties was higher than in the most developed counties. In the other regions, the changes were ambiguous as indicated by the low statistical significance of regression parameters and the weak fit of the models (e.g. Opolskie, Świętokrzyskie, Dolnośląskie, and Lubelskie), which means that differences between counties were not reduced in these regions after 2004.

On the other hand,  $\sigma$ -convergence occurred in all the regions – in each of them the reduction in growth disparities between counties was identified. However, the process of reducing disparities and their initial level varied from region to region (Figs 5–11).

Table 4. The estimation results for the intraregional convergence regression equations

Region	$\beta$ -convergence					$\sigma$ -convergence		
	$\alpha_1$	<i>p</i> -value	$R^2$	$\beta$	<i>hl</i>	$\alpha_1$	<i>p</i> -value	$R^2$
Dolnośląskie	-0.026	0.793	0.00	-	-	-0.027	0.013	0.48
Kujawsko-Pomorskie	-0.299	0.000	0.54	3.2%	21.45	-0.241	0.000	0.98
Lubelskie	-0.016	0.689	0.01	-	-	-0.074	0.000	0.89
Lubuskie	-0.126	0.323	0.08	-	-	-0.064	0.000	0.73
Łódzkie	-0.149	0.015	0.24	1.5%	47.11	-0.156	0.000	0.87
Małopolskie	-0.091	0.231	0.07	-	-	-0.127	0.000	0.88
Mazowieckie	-0.131	0.003	0.20	1.3%	54.48	-0.188	0.000	0.98
Opolskie	0.009	0.925	0.00	-	-	-0.042	0.000	0.81
Podkarpackie	-0.070	0.251	0.06	-	-	-0.119	0.000	0.84
Podlaskie	-0.109	0.227	0.10	-	-	-0.145	0.000	0.88
Pomorskie	-0.087	0.274	0.07	-	-	-0.081	0.000	0.89
Śląskie	0.020	0.654	0.01	-	-	-0.038	0.004	0.59
Świętokrzyskie	-0.026	0.836	0.00	-	-	-0.032	0.015	0.46
Warmińsko-mazurskie	-0.134	0.068	0.16	1.3%	53.02	-0.098	0.000	0.86
Wielkopolskie	-0.144	0.030	0.13	1.4%	48.91	-0.095	0.000	0.91
Zachodniopomorskie	-0.082	0.331	0.05	-	-	-0.068	0.000	0.82

Source: own elaboration based on the Statistics Poland data

The regions of Dolnośląskie, Wielkopolskie, Małopolskie, Mazowieckie, Łódzkie, Śląskie, and Kujawsko-Pomorskie were selected for the detailed analysis of changes in intraregional differences. The choice was dictated by the need to explain the impact of regional metropolises on their surroundings in a given region and to seek answers to the question whether metropolises affected the reduction in intraregional differences (Gaczek 2011). The analysis should also point to the advantages and disadvantages of adopting the polarization and diffusion concept of Poland's spatial development of Poland<sup>6</sup>.

Among the regions selected for detailed analysis, Wielkopolskie had the lowest level of internal differentiation between counties in 2004 and this level still diminished over 12 years<sup>7</sup>. Convergence of both type  $\beta$  and type  $\sigma$  occurred here.

The  $\sigma$ -convergence process proceeded almost monotonically (the coefficient of variation decreased from 5.75% to 4.77% in 12 years) and caused that in 2015 the regions with metropolises had the lowest differences<sup>8</sup>. The degree of linear fit of the  $\sigma$ -convergence regression model is high and confirms the monotonicity of the process

<sup>6</sup> *The National Regional Development Strategy ...* (2010, p. 7) assumed that urban areas seen as economic and social cooperation hubs, with capacity for affecting the growth of an entire region, would be of critical importance to the accomplishment of strategic priorities.

<sup>7</sup> It should be remembered that Wielkopolskie is one of the highly developed regions – invariably in the third place in Poland in terms of GDP *per capita*. At the same time, previous research confirmed smaller disparities between the subregions of Wielkopolskie than between Mazowieckie subregions (Gaczek & Komorowski 2006; Gaczek 2006).

<sup>8</sup> In 2015, the disparities between counties lower than in Wielkopolskie were only in Lubuskie, where the coefficient of variation reached 4.53%.

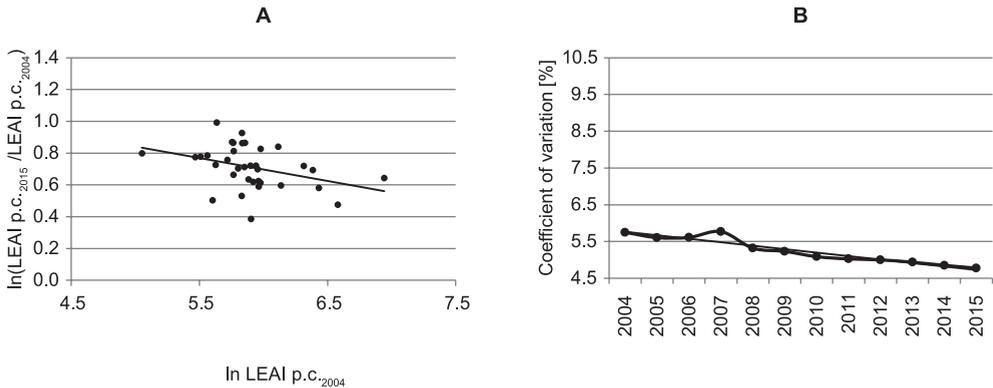


Fig. 5. Intraregional convergence of type  $\beta$  (A) and  $\sigma$  (B) in Wielkopolskie

(Fig. 5B). The impact of the Poznań metropolis on the development of surrounding areas had been identified earlier. Notably, the problematic, underdeveloped areas of the northern and eastern peripheries had been identified in Wielkopolskie as early as in the 1990's. The advantage that the Poznań metropolis had over other counties in the region in terms of growth decreased in 2004–2006, to increase slightly in 2007 (it was probably the result of increased investments in both the private and public sector), and since 2008 it has been steadily decreasing again. The counties' ability to respond to growth impulses from the hub confirms the response potential of the environment in the areas surrounding the metropolis in Wielkopolskie. This ability may result from a dense network of small and medium-sized cities, as well as traditional social capital and the significant role and high level of agriculture in the region. As a result, Wielkopolskie can be a good example of the relatively positive effects of the polarization and diffusion development model.

Internal disparities in Dolnośląskie were higher in the initial period than in Wielkopolskie, and the process of reducing differences was slower (Fig. 6). Differences between counties in Dolnośląskie declined in 12 years by only 0.16 percentage points (the coefficient of variation in 2004 – 6.93%, in 2015 – 6.77%). The

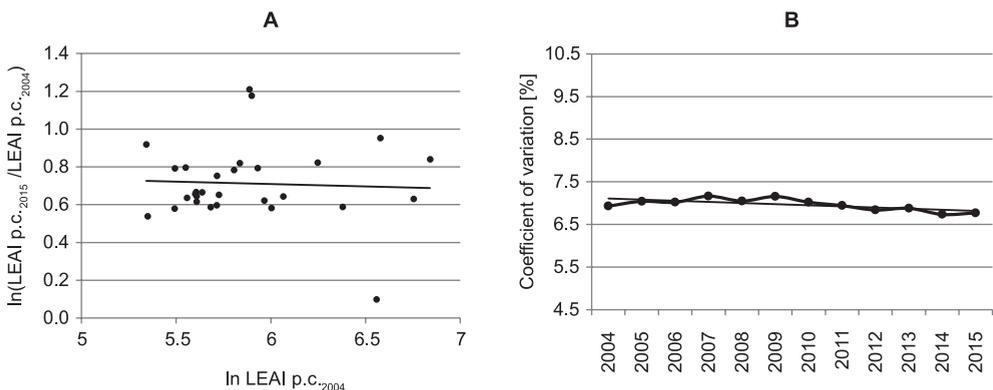


Fig. 6. Intraregional convergence of type  $\beta$  (A) and  $\sigma$  (B) in Dolnośląskie

development pathway of Dolnośląskie was specific and strongly connected with the industrial economy, while at the same time ore mining and copper metallurgy paid high income outside the Wrocław metropolis. This pathway led to the development dichotomy in the region: highly developed industrial counties (Głogów, Legnica, Lubin, and Polkowice) and the metropolis of Wrocław coexisted with underdeveloped counties. The degree of internal differentiation after almost 12 years stayed almost unchanged. By 2015,  $\beta$ -convergence in Dolnośląskie had not occurred and the degree of fit of the model is low (Fig. 6A).

The  $\sigma$ -convergence process was slow and proceeded with considerable disruptions. The advantage of the most developed counties (the Wrocław agglomeration and industrial counties) was high in 2007 and 2009, to decrease in the subsequent years, but after 2012 the trajectory of the reduction in disparities again fluctuated (Fig. 6B). This may mean that the positive impact of the Wrocław metropolis on the environment is limited.

The convergence processes in Śląskie were much more diverse. There was no  $\beta$ -convergence here (Fig. 7A), while the  $\sigma$ -convergence process went through significant fluctuations (Fig. 7B). The degree of disparities between the counties in the region in 2004 was relatively high (the coefficient of variation at 7.19%), and within 12 years it decreased by only 0.4 percentage point. The increase in internal differences took place in the years 2005–2007, while a marked decline in disparities between counties occurred again in the years 2008–2010. Thus, the trend reflecting the decline in internal differences was not clear and the degree of fit of the  $\sigma$ -convergence regression model – moderate ( $R^2=0.5895$ ).

The region's specific development pathway related to heavy and mining industries required the adaptation of the economy and space to the changing conditions in the environment. The region is gradually entering the development pathway involving knowledge-based economy and it is accepting the challenge to change its image from a mining region into a creative region (Klasik 2011). In the final period under study, the internal diversification of Śląskie was clearly larger than that of Wielkopolskie and similar to the one in Dolnośląskie. The development policy of Śląskie, including the strategy of smart specializations assuming the development

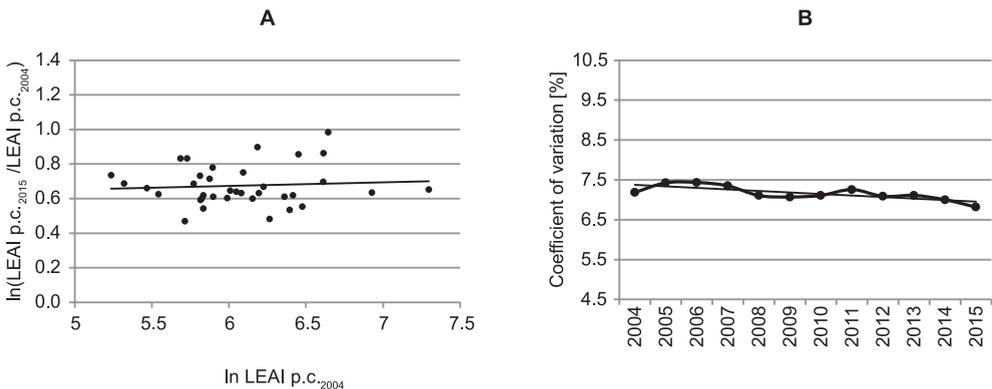


Fig. 7. Intra-regional convergence of type  $\beta$  (A) and  $\sigma$  (B) in Śląskie

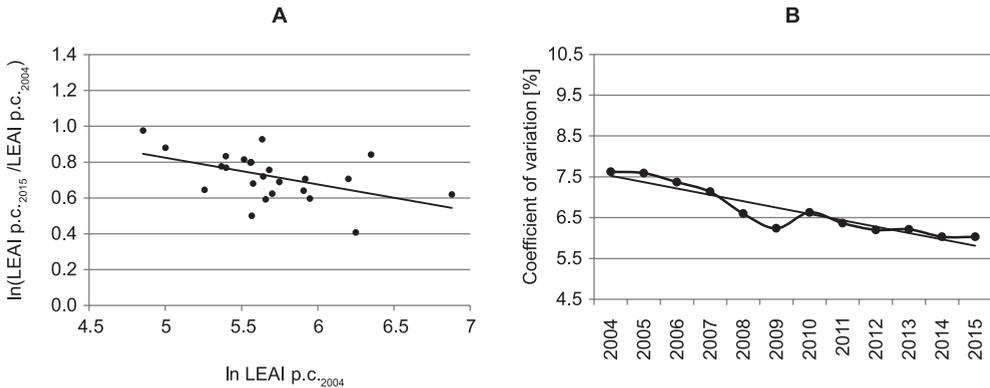


Fig. 8. Intra-regional convergence of type  $\beta$  (A) and  $\sigma$  (B) in Łódzkie

of creative sectors and increased innovation, gradually yields results – the region maintains its place in the ranking of regional competitiveness and steadily reduces internal disparities (statistically confirmed by  $\sigma$ -convergence).

The process of reducing differences between counties in the Łódzkie region was also specific. Convergence of both type  $\beta$  and type  $\sigma$  was identified there (Table 4). The annual average convergence rate was 1.5% and the reduction of internal differences by half – if the environmental conditions do not change – will take place in about 47 years (Fig. 8A). However, the fit of the  $\beta$ -convergence regression model is low.

The  $\sigma$ -convergence regression model, in turn, is well fitted to empirical data ( $R^2=0.8715$ ). The degree of initial differentiation (the coefficient of variation for 2004 was relatively high and reached 7.62%) between counties decreased by 1.5 percentage point after 12 years. The reduction of differences was clearly accelerated in 2008–2009, while in the following years it returned to the original rate of change. The obtained results, therefore, contradict the stereotypical claims about the growing and persistent advantage of the Łódź metropolis over the rest of the region. It can be added that in 2003 the spread between the subregions in Łódzkie was already lower than in other regions with regional metropolises (Gaczek & Komorowski 2006).

In Małopolskie,  $\beta$ -convergence did not occur, whereas  $\sigma$ -convergence was relatively pronounced. The lack of  $\beta$ -convergence (Fig. 9A) means that the development of the counties with low LEAI *per capita* did not progress faster than the development of the counties with the high index. There was no statistically significant relationship between the average growth rate and the initial situation in the counties. At the same time,  $\sigma$ -convergence occurred (Fig. 9B) and the regression model was very well fitted ( $R^2=0.8848$ ).

The diversification of growth of the Małopolskie counties was very high in 2004 (larger differences among the regions selected for detailed analysis occurred only in Mazowieckie), but within 12 years it decreased by 1.2 percentage points. The  $\sigma$ -convergence process proceeded in a relatively stable manner. The acceleration in reducing the differences took place in 2008–2011, while in 2012 the disparities

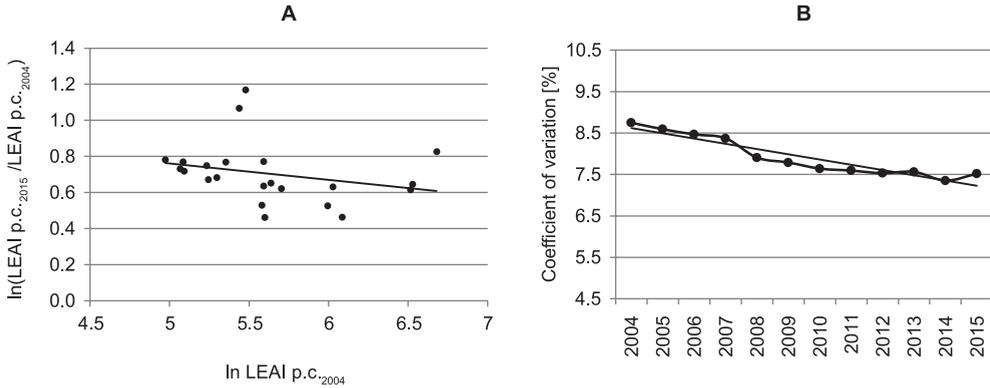


Fig. 9. Intra-regional convergence of type  $\beta$  (A) and  $\sigma$  (B) in Małopolskie

increased again. The internal diversification of the region remains relatively high, but the advantage of the Krakow metropolis over other counties is gradually decreasing. Thus, despite the lack of  $\beta$ -convergence, we can conclude that Małopolskie has enjoyed the positive effects of the polarization and diffusion model of regional development since 2008. Although the differences between the counties decreased significantly, the degree of internal diversification of Małopolskie is still high. This may be the effect of maintaining a high level of growth in the metropolis of Krakow with the gradually increasing response capacity of the surrounding counties.

In the Mazowieckie region, there was statistically significant intra-regional convergence of type  $\beta$  and  $\sigma$  (Table 4). The  $\beta$ -convergence model indicated that the average annual rate of the decline in differences between counties was 1.3%. Therefore, if external conditions do not change, the distance between the counties will be halved in about 55 years (i.e. it is slower than in Łódzkie and Wielkopolskie).

The initial level of internal differentiation in the region was very high (the LEAI *per capita* coefficient of variation between the counties in 2004 was 10.04%), while the disparities clearly decreased. This translated into statistically significant convergence of type  $\sigma$ . The fit of the  $\sigma$ -convergence regression model was very high ( $R^2=0.984$ ) and the process itself manifests an almost monotonic decrease in differences, a slight slowdown in the process occurred only in 2007. The process of  $\sigma$ -convergence within the region may suggest pushing growth impulses out of Warsaw as a result of the disadvantage of the agglomeration and the need to look for locations for new investments outside the central city. However, it can also mean that the response capacity of the surrounding areas has risen and gradually growth impulses are used more effectively in the counties distant from the central city. Nevertheless, the internal differentiation between the Mazowieckie counties in 2015 was the highest among the Polish regions (the coefficient of variation at 8.03%).

The emergence of  $\beta$ - and  $\sigma$ -convergence (Fig. 10) can be seen as the confirmation of the expected positive effects of the polarization and diffusion model of regional development, while the stereotype of the poor Mazowieckie and the rich Warsaw will gradually become obsolete.

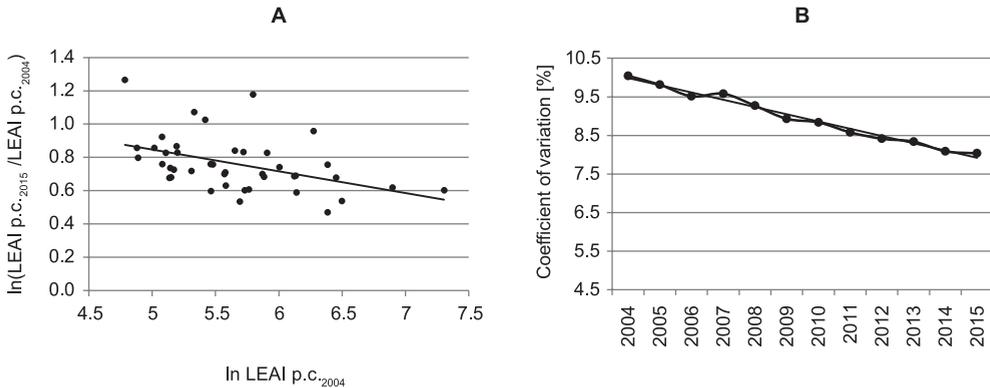


Fig. 10. Intraregional convergence of type  $\beta$  (A) and  $\sigma$  (B) in Mazowieckie

Kujawsko-Pomorskie is a region with the bipolar agglomeration of Toruń and Bydgoszcz, where statistically significant convergence of type  $\beta$  and  $\sigma$  occurred (Fig. 11). The difference in LEAI *per capita* between its counties decreased by 3.2% on an annual average, which was the highest of all the regions. Intraregional disparities will be reduced by a half in about 21 years if there are no disruptions to the current development pathway (Table 4).

The internal differences in Kujawsko-Pomorskie was relatively high in the initial period (the coefficient of variation exceeded 8.1%). Within 12 years, the diversification decreased by as much as 2.8 percentage points and was the fastest among all the regions. The process of reducing the differences was almost monotonic and the degree of fit of the  $\sigma$ -convergence regression model was very high ( $R^2=0.9771$ ). The discussion of the process probably requires more detailed internal analyses. It is notable, however, that this may be the effect of the polycentric growth pole of Bydgoszcz–Toruń. The counties outside the agglomeration are likely to have the capacity to use not only their own endogenous resources, but also the growth impulses generated by the growth pole.

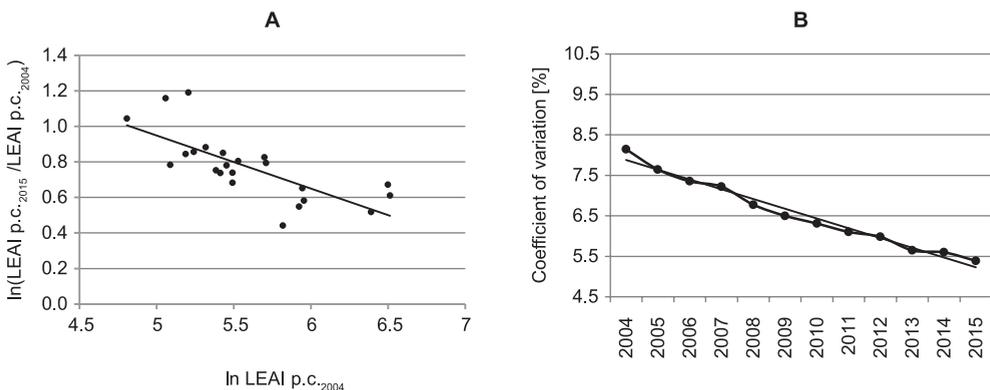


Fig. 11. Intraregional convergence of type  $\beta$  (A) and  $\sigma$  (B) in Kujawsko-Pomorskie

## 9. Conclusion

The article aimed to explain whether Poland, after the accession to the European Union, experienced economic convergence at the interregional and intraregional level. It should be noted that it is difficult to make normative assessments of the changes occurring in internal disparities when the country is still catching up with highly developed Western European countries. Certain theoretical concepts propose that when a country sets out on a dynamic development pathway, it may initially experience an increase in internal disparities, and only in the longer term the internal development gap will diminish and the country will achieve regional cohesion (Williamson 1965). Thus, the identified divergence trends within the country may be a temporary side effect of dynamic growth processes, and it is only a matter of time when convergence processes will launch in the economic structure, labour productivity and income *per capita* (Domański 1990; Gawlikowska-Hueckel & Zielińska-Głębocka 2004). The interpretation of the results of the study based on the data from the relatively short period that has passed since the accession requires caution, especially while expressing the final assessment of the process involving changes in the level of disparities. We should remember that the economy responds to growth impulses with a certain delay and equilibrium is achieved in the long run.

The analysis showed that in the years 2004–2015 the regions diverged economically, while only in the period 2006–2008 there was a reduction in regional differences in economic growth. The lack of convergence may stem from the need to improve the efficiency of public intervention measures. In addition, regional divergence in Poland can be explained based on the post-Keynesian concepts popularized by Myrdal (1957). According to these concepts, economic growth is a spatially cumulative process, which means that rich regions, thanks to accumulated capital and access to resources, attract more economic activity and limit the growth opportunities of less developed areas through the so-called leaching effects (negative effects such as the drainage of labour resources, capital, goods and services to privileged areas). In terms of regional policy, it is therefore important to create conditions for the diffusion of growth impulses from the growth poles to the surrounding areas and to achieve positive dissemination effects.

Different results were obtained by analysing economic convergence through the prism of counties. The analysis revealed that in the years under study inequalities in the level of economic development of the counties in Poland were decreasing. The process of economic convergence at the local level resulted, however, from the progressive alignment of the land counties with the simultaneous lack of statistically significant regularities leading towards changes in inequality in the set of city counties.

This may be caused by the fact that the group of land counties is more homogeneous in terms of population potential, economic structure or their place in the hierarchy of territorial units than the group of city counties. This homogeneity largely favours the impact of countervailing forces, and thus the achievement of economic convergence. In addition, land counties made better use of access to external

financial resources than city counties. These were not only the EU funds within the framework of the Common Agricultural Policy, i.e. direct subsidies for farmers, but also funds from the sectoral operational program *Restructuring and Modernization of the Food Sector and Rural Development* (2004–2006) and various operational programs of the horizontal objective *The Equalization of Development Opportunities and Supporting Structural Changes in Rural Areas* (2007–2013). Access to these funds probably contributed to the higher rate of reducing development disparities.

In the internally diversified group of city counties, compensatory tendencies, stemming from the fact that less developed entities attract investment with lower costs, co-exist with polarizing forces. Increased inequalities may be also caused by the presence of the entities that are the cores of metropolitan areas and perform administrative capital functions. These functions may trigger a multiplier effect affecting other elements of the local economy and thus become the basis for further development of these counties with simultaneous stagnation and development problems of the counties located peripherally and deprived of growth factors.

The results of the study on intraregional convergence revealed more or less pronounced pro-convergence tendencies in all the regions. Divergence at the interregional level with simultaneous intraregional convergence may imply that the polarization and diffusion model adopted as part of the implementation of the regional development policy brings the expected results. The obtained results, however, lead to the conclusion that in the modern phase of development, the diffusion of growth impulses has a local dimension and manifests itself mainly at the intraregional level.

Emerging intraregional convergence provides further arguments to the discussion unfolding in literature on regional policy and, in particular, on the use of financial instruments of the EU cohesion policy. Kisiąła et al. (2017) argue that the Polish regions predominantly adopted the EU funds allocation strategy that was clearly linked with the polarization model – financial support from regional operational programs was concentrated in the capitals of the regions, their suburban zones and the centres of subregional importance. The study results showed that despite this tendency convergence processes emerged in each region, which may indicate that the growth impulses induced by the growth centres were successfully absorbed by the environment. However, the convergence process varied from region to region. The methods used to evaluate the effects of the regional policy implementation so far have not been sufficiently developed and the conclusions drawn based on these methods are often ambiguous (Malik 2011).

Surveys of local government authorities, however, proved that the majority of self-governments allocating the EU funds within the intraregional policy framework were in favour of reducing spatial differences in the level of development, favouring support for peripheral and rural areas (Kisiąła & Stępiński 2013). It is difficult to determine the dominance of the compensation model over the polarization and diffusion one and vice versa. In the light of the research results, it is possible to positively assess the effects of the regional policy in the form of convergence within the regions. At the same time, the increasing dispersion of economic growth levels between the regions may be the source of concern. Authorities responsible for shaping regional policy should ensure that the observed divergence is only a temporary

process resulting from the need to use the available factors and growth resources effectively, and not to maintain excessive spatial polarization of the country.

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