PAWEŁ CHURSKI
JAN HAUKE
Adam Mickiewicz University in Poznań

POLYCENTRIC DEVELOPMENT AND GROWTH AREAS

Abstract: Convergence intended to achieve economic, social and territorial cohesion (which is one of the fundamental targets of the European Union) is a significant stage on the way, widely taken today, towards sustainable development. However, most research results lead to the conclusion that the socio-economic development of European countries follows a path of widening polarisation which increases the divergence of their development despite measures taken to increase their cohesion. The situation in Poland in this respect demonstrates the same tendency: there is significant polarisation of development between Warsaw and the more uniform towns of western Poland on the one hand, or the more heterogeneous towns in economically weaker and peripheral regions, *e.g.* in eastern Poland, on the other [*cf. e.g.* Meijers *et al*. 2007].

This article seeks to give an in-depth analysis of the dynamics of polarisation of socio-economic development in Poland by examining towns at various spatial scales: national, regional (NUTS 1) and voivodeship (NUTS 2). The aim is to determine the magnitude and direction of changes shown by disparities in socio-economic development in Poland over the years 2000-2009. The research involves selected aspects of development processes which, on the basis of the results of Polish regional studies carried out to date and embracing the post-1990 period, are treated as significantly differentiating those processes. Those aspects are the demography, the labour market, and the structure of the economy. The obtained results identify the main dynamics in the level of socio-economic development polycentricity in Poland. The analysis confirms the applicability of regression models to study spatial variability of development in the context of identifying the degree of its polycentricity.
Key words: Convergence, polycentric development, growth areas, towns, Poland, regions, voivodeships.

Introduction

Polarisation is a characteristic feature of socio-economic development. It leads to spatial differences in its level. However, the growing differences in the develop-

ment of individual areas are becoming a basic problem of the contemporary economy. This situation is not favourable to the socio-economic development of the EU member states; on the contrary, it is perceived as one of the chief barriers to it, as corroborated by the recently published reports prepared for the member states, including the Green Paper on Territorial Cohesion [*cf. Green Paper* ... 2008], Barca's Report [*cf.* Barca 2009], the Fifth Progress Report on Economic and Social Cohesion of the European Union [cf. *Fifth Report* ... 2010], the Europe 2020 Strategy [*cf. Europe 2020* ... 2010], the Report on Cohesion Policy Support for Local Development [*cf. Cohesion Policy* ... 2010], or the communication concerning a Regional Policy Contributing to Sustainable Growth in Europe 2020 [*cf. Regional Policy* ... 2011]. The issue is reflected also in prerequisites to cohesion policy in the period of 2014 and 2020, where the importance of maintaining the support for sustainable development of urban and multifunctional development of rural areas is highlighted [*cf. Cohesion Po*licy… 2010]. All those documents emphasise the need to create conditions for convergence ensuring the European Union an economic, social and territorial cohesion. The results of most research, however, lead to the conclusion that the socio-economic development of the European states, despite their efforts to increase cohesion, shows a deepening process of polarisation which increases the divergence of their development. With such challenges in view, the identification of regularities underlying the polarisation of development in order to work out measures reducing spatial differences in it and ensuring regional convergence, especially through development steered by regional policy, has provided a basis for a very important stream of contemporary economic and economic-geographical inquiry [*cf. e.g.* Barro, Sala-i-Martin 2004; Baun, Marek 2008; Begg *et al*. 2008; Churski 2008; Coorado *et al*. 2009; Copus 2001; Gawlikowska-Hueckel 2003; Henley 2005; Kamps *et al*. 2009; Kistowski 2009; Malaga, Kliber 2007; Meijers *et al.* 2007; Michałek 2007; Nowińska-Łaźniewska 2004; Parr 2004; Pietrzyk 2006; Ramos *et al.* 2009; Ratajczak 2008; Royuela, Artis 2006; Sapir *et al.* 2004; Szlachta 2005; Tarajkowski, Wojtasiewicz 2008; Wójcik 2008].

A special role in the polarisation of socio-economic development, especially its spatial dimension, is played by towns. Their growth is in fact a consequence of polarisation manifesting itself in a concentration of the population, economic entities, municipal infrastructure, and fixed assets in them. Towns become poles of polarised growth. As Parysek [2011] states, by accumulating development processes in their area, it is cities that assume global responsibility for the socio-economic development of the modern world, but on the other hand, it is also cities that have the most acute experience of problems entailed by excessive concentration. As basic entities involved in global processes, they transform relations with their environment from ones based on exploitation characteristic of an industrial economy to ones leading to its marginalisation characteristic of an information economy [*cf.* Parysek 2010; Smętkowski 2001]. This change is the essence of a new approach to cohesion policy, which does not strive any more to counteract polarisation processes directly, but to create condi-

tions for the dissemination of their beneficial effects. It also brings urban policy to the fore in the structure of measures employed by contemporary development policy as one of its main streams owing to the growing concentration of the population and economic potential in towns. This leads to the conclusion that the chief growth areas of the modern economy are cities, on the one hand taking advantage of the rules of development and on the other contributing to its polarisation [*cf. e.g.* Castells 1998; Friedmann 1986; Knox 2002; Kunzmann 1998; Sassen 1991; Scott 2000].

With the above remarks in mind, this article seeks to analyse the polarisation dynamics of socio-economic development in Polish towns at various spatial scales: national, regional (NUTS 1) and voivodeship (NUTS 2). The aim of the analysis is to determine the magnitude and direction of changes that took place in the polarisation of socio-economic development in Poland in the years 2000-2009. The focus is on selected aspects of development that differentiate it significantly, as has been demonstrated by Polish regional studies to date embracing the post-1990 period. Those aspects are the demography, the labour market, and the structure of the economy.

1. Theoretical assumptions

Polycentric/polarised development and growth areas are notions inherently connected with the stream of economic-geographical inquiry based on theories explaining development processes in terms of a non-sustainable path. Its adherents assume imbalance, whether sectoral or spatial, to be the driving force of economic growth. Thus, they are in opposition to the main stream of socio-economic studies resting on general theories of development (*e.g.* A. Smith's neoclassical growth theory, D. Ricardo's comparative cost theory, the theory by J.M. Keynes and his followers, economic base theory by H. Hoyt and D.C. North, or gravity theory by J. Stewart and G. Zipf), as well as phase models (*e.g.* K. Marx's model, N.D. Kondratiev's cycles, or the theories of the product life cycle or product maturity), which all assume that a natural state of the economy is equilibrium and efforts to reach it [*cf.* Chądzyński *et al.* 2007].

The notion of a growth pole was introduced into economic literature in 1949 by F. Perroux, who considered the polycentricity of economic development in a sectoral context. In his view a growth pole was a propulsive unit, or a set of such units, based on a dynamically developing industrial plant or an industrial complex. The notion gained popularity very fast, not least because of errors in the translation from French into English, which ensured it wide use by many authors who did not always interpret Perroux's original assumptions correctly [*cf.* Grzeszczak 1978].

Further studies led to the formulation of the theory of polarised growth with its basic assumption being Perroux's [1955] statement that growth does not occur everywhere at the same time; it manifests itself with varying intensity in the form of growth points and areas, from which it then spreads by various means and produces a

variety of effects in the entire economy. This is generally considered in the literature on the subject to be the foundation of growth pole theory, also known as polarisation theory [*cf.* Grzeszczak 2007]. In the course of evolution, polarisation theory departed from the limitations of a sectoral approach and assumed a spatial dimension. As a result, a growth pole emphasising inequality or imbalance in development was no longer regarded only as a purely economic unit, but also as a suitably endowed spatial unit, such as a town, spatial agglomeration, or region. To keep things in order, they started to be called growth centres or areas to distinguish them from growth poles, while the process of development leading to the emergence of growth areas, whose linkages with the surroundings ensured growth to the entire area, was termed polycentric development. This change would not be possible without the theoretical output providing the foundation of modern polarisation theory, including the works by G. Myrdal, the author of the conception of regional polarisation; A. Hirschman, the founder of a theory combining the conceptions of sectoral and regional polarisation; J.R. Boudeville, the author of the conception of a polarised region; J. Paelnick, a forerunner of the transformation of growth pole theory into regional theory, or J. Friedmann, who proposed a general spatial theory of regional development to explain the spatial polarisation pattern. Due to those conceptions, the notions of polycentric /polarised development and growth areas are used today to explain regularities underlying the heterogeneity of development processes in space and the significance of towns, agglomerations and regions in those processes [*cf. e.g.* Coorado *et al.* 2009; Copus 2001; Higgins, Savoie 1988; Parr 2004; Royuela, Artis 2006; Simmie 2005].

The issue of measuring polycentricity employed to characterize and explain the development processes was analysed by Meijers [2008]. We will follow his idea (in fact based on proposals given in Nordregio *et al.* 2004) via constructing the log linear rank-size distribution of characters describing the demography, labour market, and the structure of the economy. We assume that the log linear rank-size distribution can be correctly (from statistical point of view) represented as a straight regression line. Its slope (quantified by the value of coefficient of regression) obtained in the model is treated as an indicator of the degree of polycentricity of the urban system. As was noted by Meijers, Waterhout and Zonneveld, 2007: "*This could be combined with other indicators such as the accessibility of urban areas and the size of service areas, where the latter is a proxy for the evenness of the spread of cities over a country's territory* (see Nordregio *et al.* 2004)". In the paper we concentrate only on analysis of values of the regression coefficients assuming that the flat line represents more polycentric national urban system (suggesting development of cities across analysed territory) while the leaning line (coefficients are bigger in absolute value) indicates rather a monocentric urban system (suggesting conservative hierarchical structures of urban centres). It is worth adding that values of regression's coefficients are negative and for its negative smaller values (but bigger in absolute values) the line is more strongly decreasing function.

The choice of two time points: 2000 and 2009 for analysis and comparison is justified by the desire to reflect changes in the rate of development of Poland during the post-1990 period (after transition). Both periods (to 2000 and 2000-2009) seem to be long enough from substantive and statistical point of view to observe diversity (if there is any).

Aspects taken into account in the analysis are represented, respectively, the demography by population of cities, the labour market by working population, and the structure of the economy by number of persons employed in services. While the first feature naturally represents demography and the second feature is connected to unemployment rate, the third feature is one of characteristics of the progress in changes of settlement network (known in Polish literature for years, *cf.* Maik [1976].

2. The national level

Meijers, Waterhout and Zonneveld, [2007] basing on data for 2000/2001 noted and observed that in Poland there is a common European tendency to significant polarisation of development between capital (Warsaw) and the more uniform towns of western Poland on the one hand, or the more heterogeneous towns in economically weaker and peripheral regions, *e.g.* in eastern Poland, on the other. Our idea is to analyse and compare the magnitude of changes for next period (after 2000). Over the years 1995-2009 all the regions recorded a marked increase in *per capita* GDP. Hence, there arises the question of whether economic development with respect to cities was accompanied by any significant changes in population, working population and in number of persons employed in services which belong (in our opinion) to basic contemporary characteristics of national urban system. We analysed the characteristics in three scales: for cities with population above 20,000, for cities with population above 50,000 and for the 10 largest cities in terms of population (according to data in 2009), in order to observe how the changes depend on a more robust selection mechanism and how the changes are influenced by provincial cities [*cf.* Meijers *et al.* 2007]. Slopes of the regression line (*represented by coefficients of regression*) of the rank-size distribution of three analysed characteristics are contained in Tables 1-3 and graphs with full information of obtained models are presented on Figures 1-3.

As can be seen, during the years 2000-2009 for Polish cities (with more than 20,000 inhabitants) was observed a movement towards polycentricity for population and working population (the character showing rather high level of monocentricity in 2000 and big decrease in 2009) and almost no difference in number of persons of employed in services (see Table 1). The identified tendency confirms the process of taking over the role of services and supplies markets and local labor markets by the city, especially medium sized, occurring in Poland. This process helps improve economic, social and spatial cohesion of areas and creates conditions for the polycentric development in Poland. The need of reinforcing thereof through interventions is reflected by

Table 1

Slope of the regression line of the rank-size distribution of population, working population and employed in services for cities in Poland with population above 20,000

Cities with population above 20,000	Slope 2000	Slope 2009
Population	-0.792	-0.746
Working population	-1.424	-0.947
Employed in services	-0.910	-0.917

Source: Own elaboration (Tables 1-8).

the prerequisites of national development policy as well as national spatial policy [*cf. Koncepcja*… 2012; *Krajowa Strategia*… 2010].

As can be seen, during the years 2000-2009 for group of cities with more than 50,000 inhabitants, almost no difference in the degree of polycentricity (an average level of polycentricity for both time points) was observed for all of three analysed characteristics (see Table 2).

The obtained result is compliant with recommendations included in most recent national strategic documents assuming that keeping the stable network of medium sized cities should provide sustainable polycentric development of the settlement pattern, while it enables the spatial continuity and persistent settlement of the whole country [*cf. Koncepcja*… 2012].

As can be seen, during the years 2000-2009 for the 10 greatest cities in Poland was observed a movement towards monocentricity for all of three analysed characteristics (see Table 3). The identified changes result from persisting position of the Polish metropolitan areas in national settlement pattern. Their attractiveness, driven by both agglomeration effects and better availability of services conditioning the level and quality of living, favours the further development in future. The progress of metropolistation processes having consequences in increase of employment in the biggest cities of Poland as well as spatial concentration of population and economic activity in their neighborhood will significantly hinder the polycentric development on these areas [*cf.* Kistowski 2009].

Table 2

Slope of the regression line of the rank-size distribution of population, working population and employed in services for cities in Poland with population above 50,000

Cities with population above 50,000	Slope 2000	Slope 2009
Population	-0.794	-0.791
Working population	-0.942	-0.957
Employed in services	-0.927	-0.934

Table 3

Slope of the regression line of the rank-size distribution of population, working population and employed in services for the 10 greatest cities in Poland

The 10 greatest cities in Poland	Slope 2000	Slope 2009
Population	-0.667	-0.686
Working population	-0.746	-0.801
Employed in services	-0.733	-0.842

The analysis carried out on the national level confirms the occurrence of two opposing development trends in Poland: polycentricity which is generated by medium sized cities functioning in the settlement network and monocentricity resting upon the development of the biggest agglomerations.

Comparing results for all three tables it is worth noting, that smaller and provincial cities taken into account in the analysis show their influence on the magnitude of polycentricity. As the values of coefficients of regression are more negative it means that they increase significantly the degree of polycentricity for national level.

3. The regional level

Poland is country big enough (comparing with other European countries) in order to be interested in differences and changes of the degree of polycentricity in regions and subregions (voivodeships) of Poland. This problem is particularly justified by the regional differences having historical roots (until 1918 Poland had not been existing as a country for 123 years, and was divided into three parts, each one belonged to the three neighboring countries). Some scientists believe that this is reflected in changes persisting to the present day.

Slopes of the regression line of the rank-size distribution of three analysed characteristics (including coefficients of determination and number of cities) for six Polish regions are presented in Tables 4-5, while the summary ranking comparison is contained in Table 6.

It follows from the calculations that during the years 2000-2009 for cities in six Polish regions was observed a small (generally not significant) movement towards polycentricity for all analysed characters and all six regions excluding working population in South-West region (decrease from -0.939 to -0.993) (see Table 4). The degree of polycentricity in regions is generally a little bit smaller than for Poland but still being close to an average.

The ranking of regions indicates that the highest degree of polycentricity was presented in North-Western, Eastern and South-Western regions from one side and the highest degree of monocentricity was presented in Northern, Central and Southern on

the other, with small changes in positions during the years 2000-2009 (see Table 5). The presented regularity is significantly conditioned by differences in the settlement

Table 4

Slope of the regression line of the rank-size distribution of population, working population and employed in services for cities in regions of Poland with population above 20,000

Regions	Characters	2000		2009		Number of cities
		Slope	R^2	Slope	R^2	
South	Population	-0.873	*0.972*	-0.856	*0.973*	63
	Working population	-1.027	*0.944*	-1.026	*0.963*	
	Employed in services	-1.000	*0.966*	-0.985	*0.965*	
North-West	Population	-0.756	*0.964*	-0.745	*0.965*	55
	Working population	**-0.927**	*0.972*	**-0.936**	*0.970*	
	Employed in services	-0.925	*0.972*	-0.911	*0.973*	
Central	Population	-0.922	*0.915*	-0.892	*0.907*	51
	Working population	-1.119	*0.927*	-1.048	*0.907*	
	Employed in services	-0.997	*0.908*	-0.967	*0.882*	
East	Population	-0.743	*0.972*	-0.745	*0.970*	50
	Working population	**-0.955**	*0.946*	**-0.970**	*0.941*	
	Employed in services	-0.983	*0.942*	-0.967	*0.943*	
North	Population	-0.914	*0.981*	-0.895	*0.981*	48
	Working population	-1.119	*0.979*	-1.078	*0.976*	
	Employed in services	-1.111	*0.982*	-1.074	*0.989*	
South-West	Population	-0.769	*0.955*	-0.762	*0.948*	41
	Working population	**-0.939**	*0.977*	**-0.993**	*0.977*	
	Employed in services	-0.990	*0.975*	-0.953	*0.970*	

Table 5

Ranking of regions for the values of slope of the regression line of the rank size distribution of population, working population and employed in services obtained for cities in regions of Poland with population above 20,000

Regions	Population		Working population		Employed in services	
	2000	2009	2000	2009	2000	2009
South	4	4	4	4	5	5
North-West	2	2	1	1	1	1
Central	6	5	6	5	4	4
East	1	1	3	2	2	3
North	5	6	5	6	6	6
South-West	3	3	2	3	3	2

regional network of Poland. In regions such as North-Western region is observed offset of the population in each category-sized cities, strengthening polycentric development of these areas. A different situation occurs in the North, Center, or South, where the percentage of the population of the largest cities (with more than 100 000 inhabitants) in the pattern of urban settlement network reaches over 50%, capturing monocentric nature of the development of these regions [*cf.* B. Konecka-Szydłowska 2011a].

4. The voivodeship level

Slopes of the regression line of the rank-size distribution of three analysed characteristics (including coefficients of determination and number of cities) for sixteen Polish subregions (voivodeships), ranked with respect to decreasing values of the slope, are presented in Tables 6-8.

The results of the analysis of urban population distribution performed for the towns with more than 20 000 inhabitants in years 2000 and 2009 show that the highest degree of polycentricity for population in cities was presented for Podkarpackie, Opolskie, Warmińsko-Mazurskie and Wielkopolskie voivodeships, while the highest degree of monocentricity was presented for Kujawsko-Pomorskie, Podlaskie, Lubelskie, Pomorskie

Table 6

Slope of the regression line of the rank-size distribution of population for cities in voivodeships in Poland with population above 20,000

Voivodeships population	2000		Voivodeships population	2009		Number of cities
	Slope	R^2		Slope	R^2	
Podkarpackie	-0.671	*0.943*	Podkarpackie	-0.671	*0.944*	17
Opolskie	-0.679	*0.983*	Opolskie	-0.682	*0.981*	12
Warmińsko-Mazurskie	-0.759	*0.906*	Wielkopolskie	-0.751	*0.916*	29
Wielkopolskie	-0.775	*0.921*	Warmińsko-Mazurskie	-0.769	*0.905*	16
Małopolskie	-0.822	*0.863*	Małopolskie	-0.814	*0.859*	25
Śląskie	-0.836	*0.891*	Śląskie	-0.821	*0.890*	38
Lubuskie	-0.845	*0.920*	Lubuskie	-0.844	*0.913*	10
Dolnośląskie	-0.866	*0.940*	Dolnośląskie	-0.855	*0.931*	29
Świętokrzyskie	-0.899	*0.975*	Łódzkie	-0.885	*0.826*	18
Łódzkie	-0.909	*0.833*	Świętokrzyskie	-0.887	*0.972*	11
Zachodniopomorskie	-0.935	*0.930*	Zachodniopomorskie	-0.931	*0.930*	16
Lubelskie	-0.973	*0.924*	Mazowieckie	-0.949	*0.885*	33
Mazowieckie	-0.975	*0.891*	Pomorskie	-0.970	*0.939*	19
Pomorskie	-1.018	*0.946*	Lubelskie	-0.972	*0.924*	12
Podlaskie	-1.047	*0.895*	Podlaskie	-1.080	*0.905*	10
Kujawsko-Pomorskie	-1.245	*0.961*	Kujawsko-Pomorskie	-1.218	*0.961*	13

and Mazowieckie voivodeships, showing small changes during the period 2000-2009 (see Table 6 and Figure 1). The degree of polycentricity is in an average range. The obtained results confirm the differentiation in urban settlement regional network in Poland.

Voivodeships, where there is a large disparity between the center city and next smaller cities, such as Mazowieckie with Warsaw (the ratio of largest to smallest city is 1970), Pomorskie with the Tri-City conurbation (335), or Podlasie with Bialystok (293) are

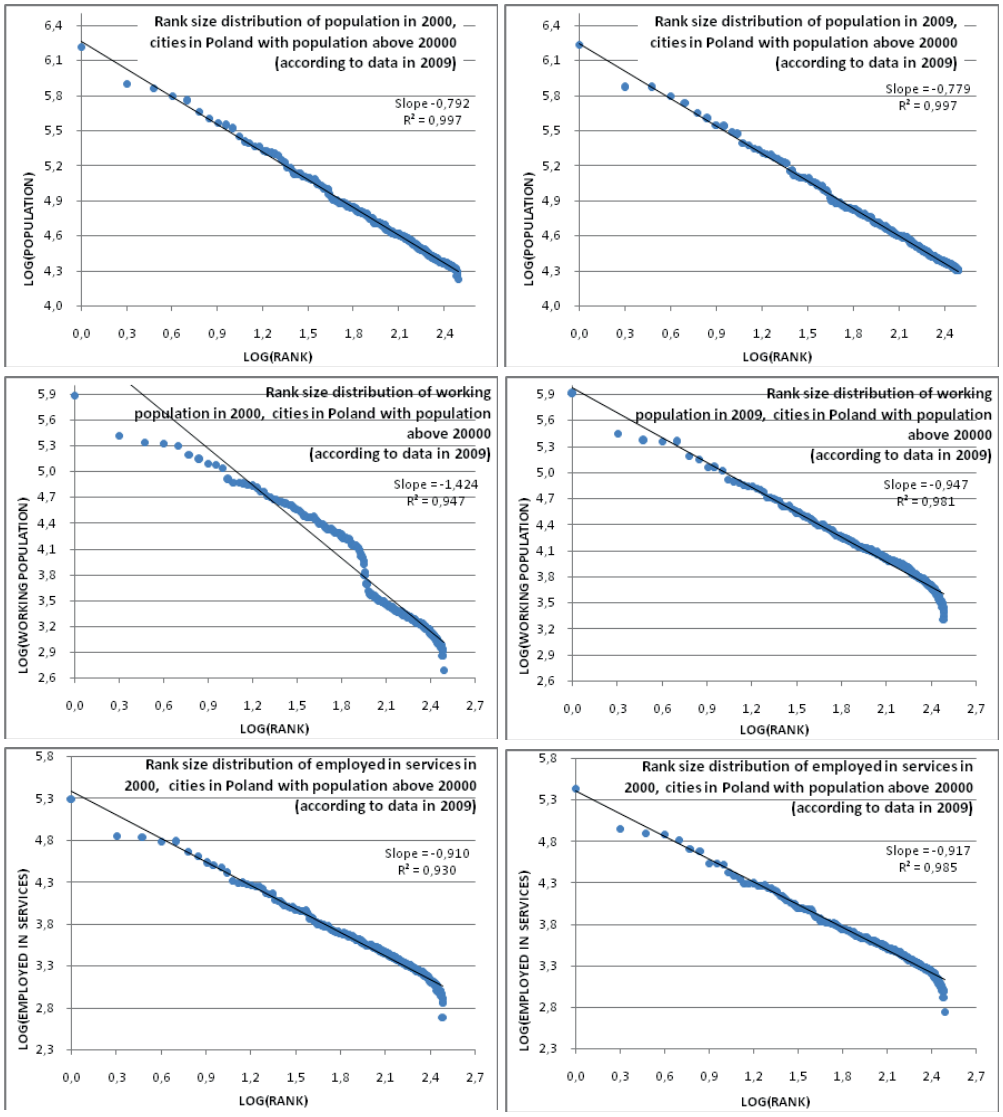

Figure 1. Rank-size distribution of population, working population and employed in services for cities in Poland with population above 20 000

characterized by high concentration of population in the capital of the voivodeship, which is a prerequisite for the monocentric development trends of these areas. Voivodeships where this kind of regularity was not developed, and the settlement pattern is marked by a very large number of cities such as Wielkopolskie (with the largest number of cities among other Polish regions – 109) are characterized by a more uniform distribution of population, which is important for the conditioning of their polycentric development.

The highest degree of polycentricity in 2000 and 2009 for working population in cities was presented for Opolskie, Wielkopolskie, Śląskie, and Warmińsko-mazurskie voivodeships while the highest degree of monocentricity in 2000 and 2009 was presented for Kujawsko-pomorskie, Pomorskie, Podlaskie, Mazowieckie, and Lubelskie voivodeships, showing small changes during the period 2000-2009 (see Table 7 and Figure 2). The degree of polycentricity is in an average range excluding the Kujawsko-pomorskie voivodeship being rather very monocentric. Also the tendencies revealed for employment level are conditioned by the structure of settlement network.

The highest level of the polycentricity development measured by the number of employed occurs in the voievodeships, which are characterized by a poorly developed urban settlement network, such as Opole or by urban network, characterized by high abundance and sustainable participation of the population of each size cities category such as Wielkopolskie.

Table 7

Slope of the regression line of the rank-size distribution of working population in services for cities in voivodeships in Poland with population above 20,000

Voivodeships working populatiom	2000		Voivodeships working populatiom	2009	
	Slope	R^2		Slope	R^2
Opolskie	-0.913	*0.982*	Wielkopolskie	-0.902	*0.918*
Wielkopolskie	-0.922	*0.924*	Warmińsko-Mazurskie	-0.925	*0.946*
Śląskie	-0.943	*0.927*	Opolskie	-0.934	*0.955*
Warmińsko-Mazurskie	-0.981	*0.959*	Śląskie	-0.969	*0.928*
Świętokrzyskie	-1.023	*0.956*	Łódzkie	-0.985	*0.807*
Dolnośląskie	-1.033	*0.960*	Świętokrzyskie	-1.005	*0.948*
Łódzkie	-1.045	*0.815*	Małopolskie	-1.048	*0.876*
Podkarpackie	-1.074	*0.860*	Podkarpackie	-1.083	*0.873*
Małopolskie	-1.088	*0.880*	Dolnośląskie	-1.095	*0.959*
Lubuskie	-1.124	*0.931*	Mazowieckie	-1.139	*0.888*
Zachodniopomorskie	-1.139	*0.944*	Zachodniopomorskie	-1.141	*0.960*
Lubelskie	-1.164	*0.899*	Lubelskie	-1.146	*0.885*
Mazowieckie	-1.210	*0.911*	Pomorskie	-1.171	*0.930*
Podlaskie	-1.229	*0.939*	Lubuskie	-1.220	*0.944*
Pomorskie	-1.243	*0.964*	Podlaskie	-1.350	*0.960*
Kujawsko-Pomorskie	-1.555	*0.973*	Kujawsko-Pomorskie	-1.525	*0.979*

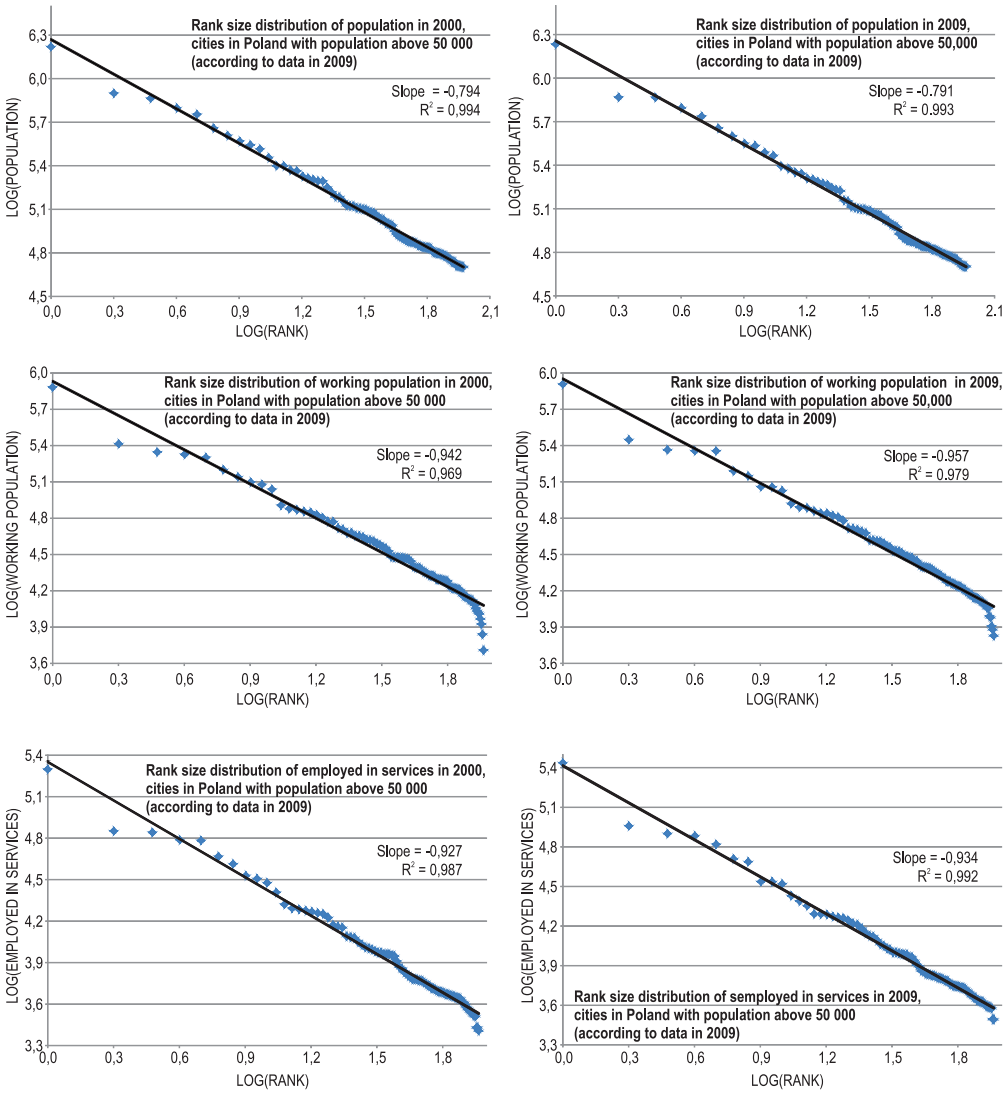

Figure 2. Rank-size distribution of population, working population and employed in services for cities in Poland with population above 50 000

In these regions the number of available jobs tends to have more equitable distribution than in regions characterized by a clear dominance of the main city such as Warsaw. Given the limited mobility of the labor market in Poland, resulting from the restrictions of the housing market, differentiation in this regard is an important developmental processes conditioning. Too large a degree of the development polarization effect the problematic situations of the main city congestion. It result from deficien-

Table 8

Slope of the regression line of the rank-size distribution of employed in services for cities in voivodeships in Poland with population above 20,000

Voivodeships employed in services	2000		Voivodeships employed in services	2009	
	Slope	R^2		Slope	R^2
Wielkopolskie	-0.895	*0.910*	Wielkopolskie	-0.876	*0.888*
Śląskie	-0.960	*0.926*	Warmińsko-Mazurskie	-0.929	*0.948*
Warmińsko-Mazurskie	-0.989	*0.959*	Śląskie	-0.954	*0.906*
Opolskie	-0.993	*0.956*	Łódzkie	-0.968	*0.799*
Łódzkie	-1.010	*0.849*	Opolskie	-0.975	*0.960*
Małopolskie	-1.028	*0.892*	Małopolskie	-1.011	*0.884*
Podkarpackie	-1.058	*0.842*	Podkarpackie	-1.024	*0.860*
Mazowieckie	-1.065	*0.886*	Mazowieckie	-1.031	*0.862*
Dolnośląskie	-1.076	*0.960*	Dolnośląskie	-1.031	*0.954*
Lubuskie	-1.104	*0.922*	Lubuskie	-1.070	*0.931*
Świętokrzyskie	-1.111	*0.957*	Świętokrzyskie	-1.142	*0.965*
Lubelskie	-1.188	*0.947*	Lubelskie	-1.152	*0.931*
Zachodniopomorskie	-1.195	*0.971*	Zachodniopomorskie	-1.169	*0.967*
Pomorskie	-1.230	*0.961*	Pomorskie	-1.180	*0.960*
Podlaskie	-1.333	*0.939*	Podlaskie	-1.316	*0.955*
Kujawsko-Pomorskie	-1.537	*0.971*	Kujawsko-Pomorskie	-1.465	*0.969*

cies in infrastructure, which in conditions of limited territorial cohesion, prevents increasing the impact of central authority in their environment and stimulate the migration flows [*cf.* B. Konecka-Szydłowska 2011b].

Analysis of the distribution of the share employed in services in cities of over 20 000 people in the regional Polish shows that the highest degree of polycentricity in 2000 and 2009 for employed in services in cities was presented for Wielkopolskie, Śląskie, and Warmińsko-mazurskie voivodeships while the highest degree of monocentricity in 2000 and 2009 was presented for Kujawsko-pomorskie, Podlaskie, and Pomorskie voivodeships, showing small changes during the period 2000-2009 (see Figure 3 and Table 3). The degree of polycentricity is in an average range excluding the Kujawsko-pomorskie voivodeship being rather very monocentric. These results confirm the relationship between the identified tendencies for the polycentric development and the regional character of the urban settlement network.

Comparing results for all three Tables 6-8 it is worth noting, that degree of polycentricity is going down for characteristics: working population and employed in services compared with the degree of polycentricity for population of cities. However the changes for all three characteristics present almost the same order of changes during period 2000-2009 and the position of voievodeships with respect to degree is only slightly modified.

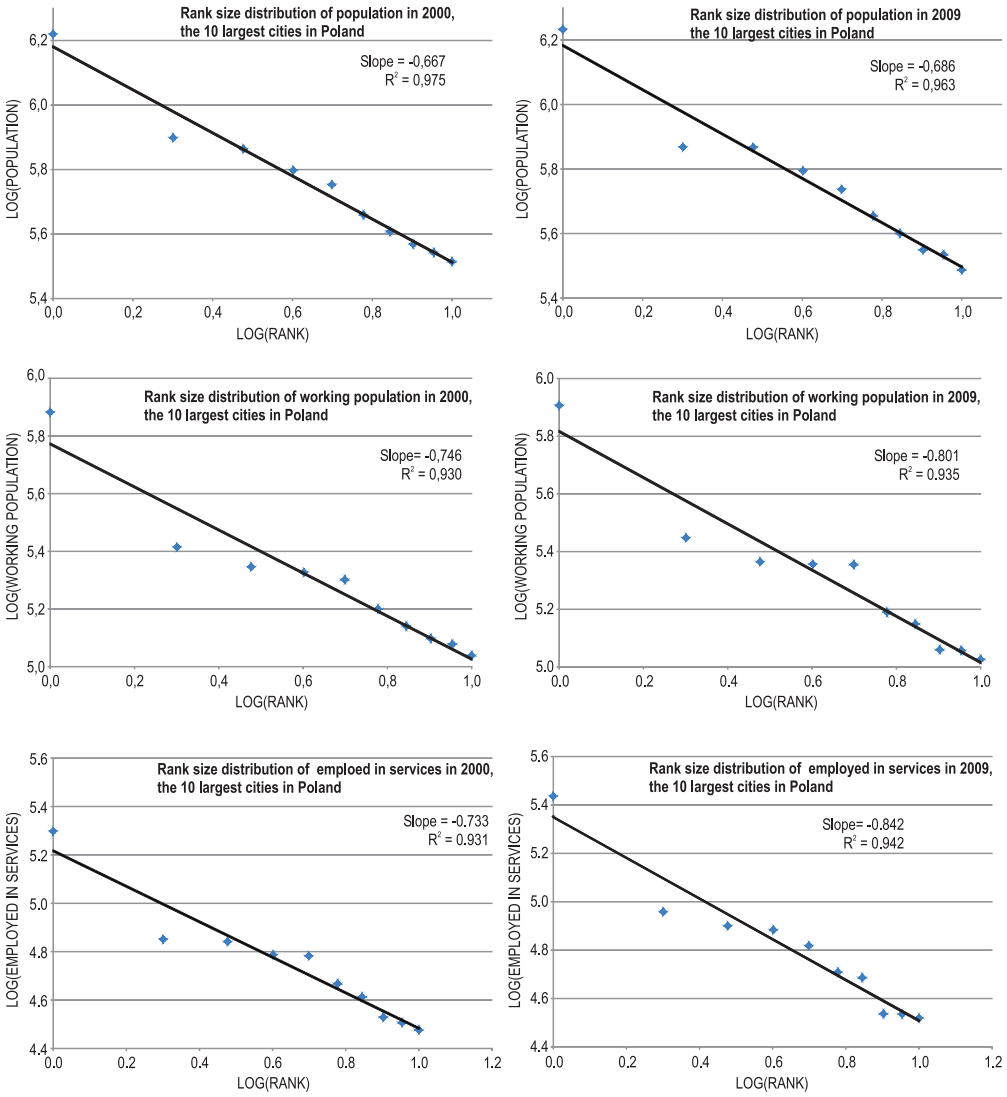

Figure 3. Rank-size distribution of population, working population and employed in services for the 10 largest cities in Poland

Summary and conclusions

1. The regression models employed in the rank size distribution of characteristics were applied to present the degree of changes in polycentricity at each level of spatial scale are adequate and fulfil all statistical assumptions with very high value of coefficient of determination showing correct fitting of the model.

2. The degree of polycentricity analyzed at each level of spatial scale proved to be similar for 2000 and 2009 (mostly showing small decrease) for chosen characteristics separately, but for the characteristics: working population and the number of persons employed in services was observed smaller degree of polycentricity compared with its degree for population in cities.
3. For national level was observed a small movement towards polycentricity for characteristics: population and working population in cities comparing 2000 with 2009. However it is due to smaller and provincial towns, because such movement was not observed for the analysis performed for cities with population above 50,000 and for the 10 greatest cities.
4. For regional and voivodeships level were observed a smaller (in percent) movement towards polycentricity than for national level for all characteristics comparing 2000 with 2009. The positions (in degree of polycentricity of regions and voivodeships were only slightly changed for compared points in time, what suggest conservation of difference of degree of polycentricity for regions and smaller voivodeships during the analysed period and probably at least in the near future. The magnitude of differences of degree of polycentricity is also conserved for regions and voivodeships for all characteristics comparing 2000 with 2009.
5. The outcomes of analysis confirm the occurrence of a significant relationship between the character of the urban settlement network and a shape of polycentric development. The bigger the differentiation scale of national, regional, intraregional settlement patterns, and hegemony of the local center, the smaller tendency towards polycentric development. Intervention of development policy and spatial policy fostering the development of medium sized cities hinders the polarization of development and favours policentricity.

References

Barca F., 2009, *An Agenda for a Reformed Cohesion Policy.* A place-based approach to meeting European Union challenges and expectations, Independent Report.

Barro R., Sala-i-Martin X., 2004, *Economic Growth.* 2nd edn, MIT Press, Boston MA.

Baun M., Marek D., 2008, *EU Cohesion Policy after Enlargement.* Series Palgrave studies in European Union politics, Palgrave Macmillan, Basingstoke.

Begg I., De Michelis N., Esposti R., 2008, *Cohesion in the EU.* CESifo Forum 2008, Vol. 9, No. 1, Spring, pp. 3-34.

Castells M., 1998, *The Information Age: Economy, Society and Culture – The Rise of Network Society.* Vol. 2, Oxford: Blackwell.

Chądzyński J., Nowakowska A., Przygodzki Z., 2007, *Region i jego rozwój w warunkach globalizacji*. CEDEWU.PL, Warsaw, pp. 54-63.

Churski P., 2008, *Czynniki rozwoju regionalnego i polityka regionalna w Polsce w okresie integracji europejskiej,* Wyd. Naukowe UAM, Poznań.

Cohesion Policy Support for Local Development, Best Practice and Future Policy Options, Final Report, April 2010, Brussels.

Coorado L., Martin R., Weeks M., 2009, *Identifying and Interpreting Regional Convergence Clusters across Europe.* The Economic Journal, Vol. 115 (2005), Issue 502 (03), School of Economics and Finance University of St. Andrews, St. Andrews.

Copus A. K., 2001, *From Core-periphery to Polycentric Development: Concept of Spatial and Aspatial Peripherality.* European Planning Studies, Vol. 9 (4), pp. 539-552.

Europa 2020, Strategia na rzecz inteligentnego i zrównoważonego rozwoju sprzyjającego włączeniu społecznemu, Komunikat Komisji, COM (2005) 2020, 3.03.2010, Brussels.

Fifth Report of Economic, Social and Territorial Cohesion, Investing in Europe's Future, Report from the Commision, European Union, Regional Policy, European Commision, Luxembourg, 2010.

Friedmann J., 1986, *The World City Hypothesis.* Development and Change, No. 17(1).

Gawlikowska-Hueckel K., 2003, *Procesy rozwoju regionalnego w Unii Europejskiej. Konwergencja czy polaryzacja?* Wyd. UGd., Gdańsk.

Green Paper on Territorial Cohesion, *Turning Territorial Diversity into an Asset*, European Commission, October, 2008, Brussels.

Grzeszczak T. (Ed.), 1978, *Teoria biegunów wzrostu*. Przegląd Zagranicznej Literatury Geograficznej, IGiPZ PAN, Warsaw.

Grzeszczak T., 2007, *Teoria biegunów wzrostu w warunkach polskich: przeszłość i teraźniejszość,* [in:] *Procesy transformacji społeczno-ekonomicznych i przyrodniczych struktur przestrzennych*, J. Lach, M. Borowice, T. Rachwał (Eds.). Instytut Geografii Akademii Pedagogicznej im. Komisji Edukacji Narodowej w Krakowie, Cracow, pp. 120-129.

Henley A., 2005, *On Regional Growth Convergence in Great Britain*. Regional Studies, Vol. 39, No. 9, pp. 1245-1260.

Higgins B., Savoie D.J. (Eds.), 1988, *Regional Economic Development. Essays in Honour of Francois Perroux.* Un. Hyman, Boston.

Kamps C., Leiner-Killinger N., Martin R., 2009, *The Cyclical Impact of EU Cohesion Policy in Fast Growing* EU Countries. Intereconomics, Vol. 44, No. 1, January/February, pp. 23-29.

Kistowski M. (Eds.), 2009, *Ekspercki Projekt Koncepcji Przestrzennego Zagospodarowania Kraju w świetle zasad zrównoważonego rozwoju i ochrony środowiska w perspektywie krajowej, regionalnej i lokalnej*. Biuletyn KPZK PAN, No. 240, Warsaw.

Knox P. L., 2002, *World Cities and the Organization of Global Space,* [in:] *Geographies of Global Change*, R. J. Johnston, P. J. Taylor, M. J. Watts. Remapping the World, Blackwell, pp. 328-339.

Koncepcja Przestrzennego Zagospodarowania Kraju 2030. MRR, marzec 2012, Warsaw.

Konecka-Szydłowska B., 2011a, *Znaczenie małych miast w rozwoju regionalnych układów osadniczych,* [in:] *Przekształcenia regionalnych struktur funkcjonalno-przestrzennych*, B. Namyślak (Ed.), Vol. 2, *Zmiany funkcjonalno-przestrzenne miast i obszarów wiejskich*. Rozprawy Naukowe IGiRR UW, No. 20, UWr, Wrocław, pp. 41-53.

Konecka-Szydłowska B. 2011b, *Małe miasta nowo utworzone w procesie urbanizacji,* [in:] *Przemiany przestrzeni i potencjału małych miast w wybranych regionach Polski – z perspektywy 20 lat transformacji,* B. Bartosiewicz, T. Marszał (Eds.). Wyd. UŁ, Lodz, pp. 9-25.

Kossowski T., 2009, *Konwergencja przestrzenna – aspekty teoretyczne,* [in:] *Praktyczne aspekty badań regionalnych – varia,* P. Churski (Ed.). Vol. II, Biuletyn Instytutu Geografii

Społeczno-Ekonomicznej i Gospodarki Przestrzennej UAM w Poznaniu, Seria Rozwój Regionalny i Polityka Regionalna, No. 9, Bogucki Wyd. Naukowe, Poznań, pp. 7-20.

Krajowa Strategia Rozwoju Regionalnego 2010-2020. Regiony, miasta, obszary wiejskie, MRR, Lipiec 2010, Warsaw.

Kunzmann K. R., 1998, *World City Regions in Europe: Structural Change Future Challenges,* [in:] *Globalisation and World Large Cities,* F. Lo, Y. Yeung (Ed.). UN University Press, Tokyo–New York–Paris.

Maik W., 1976, *Analiza funkcjonalna sieci osadniczej podregionu kalisko-ostrowskiego.* UAM w Poznaniu, Seria Geografia, No. 11, Poznań.

Malaga K., Kliber P., 2007, *Konwergencja i nierówności regionalne w Polsce w świetle neoklasycznych modeli wzrostu.* Wyd. AE, Poznań.

Meijers E. J., 2008, *Measuring Polycentricity and its Promises.* European Planning Studies, Vol. 16, No. 9, pp. 1313-1323.

Meijers E. J., Waterhout B.**,** Zonneveld W. A. M., 2007, *Closing the Gap: Territorial Cohesion through Polycentric Development.* European Journal of Spatial Development, No. 24, Nordic Centre for Spatial Development, OTB Research Institute, Delft University of Technology, pp. 1-24.

Michałek J. J., (Ed.), 2007, *Polska w Unii Europejskiej, Dynamika konwergencji ekonomicznej.* Wyd. Naukowe PWN, Warsaw.

Nowińska-Łaźniewska E., 2004, *Relacje przestrzenne w Polsce w okresie transformacji w świetle teorii rozwoju regionalnego.* Prace habilitacyjne, No. 13, Wyd. AE, Poznań.

Nordregio (Lead partner) (Ed) (2004) ESPON 1.1.1: *Potentials for polycentric development in Europe,* Project Report, Stockholm/Luxembourg: Nordregio/ESPON Monitoring Committee. Available at: http://www.espon.eu/mmp/online/website/content/projects/259/648/index_EN.html, (accessed 2 January 2008).

Parr J. B., 2004, *The Polycentric Urban Region: A Closer Inspection.* Regional Studies, Vol. 38, No. 3, pp. 231-240.

Parysek J. J., 2010, *Rozwój miast a polityka miejska w Polsce po 1989 roku*, [in:] *Przekształcenia struktur regionalnych: aspekty społeczne, ekonomiczne i przyrodnicze,* S. Ciok, P. Migoń (Eds.). Instytut Geografii i Rozwoju Regionalnego UWr., Wrocław, pp. 117-132.

Parysek J. J., 2011, *Współczesna polska suburbanizacja i polityka miejsca (aktualność hipotez C. Colby'egopo 80 latach),* [in:] *Koncepcje i problemy badawcze geografii,* K. Marciniak, K. Sikora, D. Sokołowski (Eds.). Wyższa Szkoła Gospodarki w Bydgoszczy, Bydgoszcz, pp. 313-329.

Perroux F., 1955, *Note sur la nation de „pole de croissancie.* Economie Appliquee, Vol. 8, No. 1-2, pp. 307-320[1].

Perroux F., 1978, *Uwagi o pojęciu" biegun wzrostu*, [in:] *Teoria biegunów wzrostu*, T. Grzeszczak (Ed.). Przegląd Zagranicznej Literatury Geograficznej, IGiPZ PAN, Warsaw, pp. 26-40.

Pietrzyk I., 2006, *Regionalne implikacje europejskiej integracji gospodarczej dla Polski.* Zeszyty Naukowe, No. 721, AE, Cracow.

Polityka spójności 2014-2020. Inwestycje w rozwój gospodarczy i wzrost zatrudnienia, Propozycja Komisji Europejskiej, październik 2011, Bruksela. http://ec.europa.eu/regio-

[1] Polish translation was printed in 1978 [*c.f.* Perroux 1978].

nal_policy/sources/docoffic/official/regulation/pdf/2014/proposals/regulation2014_leaflet_pl.pdf.

Ramos R., Surinach J., Artis M., 2009, *Human Capital Spillovers, Productivity and Regional Convergence in Spain*. Xarxa de Referència en Economia Aplicada, Working Papers, Universitat de Barcelona, Barcelona.

Ratajczak W., 2008, *Modele ekonometrii przestrzennej w analizie regionalnej*, [in:] *O nowy kształt badań w geografii i gospodarce przestrzennej*, T. Stryjakiewicz, T. Czyż (Eds.). Biuletyn KPZK PAN, No. 237, Warsaw, pp. 186-202.

Regional Policy Contributing to Sustainable Growth in Europe 2020, Communication from the Commision to the European Parliament, the Council, The Economic and Social Committee and The Committee of the Regions, European Commission, SEC (2011) 92 final, COM (2011) 17 final, 26.01.2011, Brussels.

Royuela V., Artis M., 2006, *Convergence Analysis in Terms of Quality of Life in the Urban System of Barcelona Province, 1991-2000.* Regional Studies, Vol. 40, No. 5, pp. 485-492.

Sassen S., 1991, *The Global City.* Princetown University Press, Princetown.

Sapir A. *et al.,* 2004, *An Agenda for a Growing Europe: The Sapir Report.* Oxford University Press, Oxford.

Scott A. J. (Ed.), 2000, *Global City-Regions: Trends, Theory, Policy.* Oxford University Press, Oxford.

Simmie J., 2005, *Innovation and Space: a Critical Review of the Literature.* Regional Studies, Vol. 39, No. 6, pp. 789-804.

Smętkowski M., 2001, *Nowe relacje między metropolią i regionem w gospodarce informacyjnej.* Studia Regionalne i Lokalne, No. 4(7)/2001, UW, Warsaw, pp. 83-101.

Szlachta J., 2005. *Polska ścieżka rozwoju regionalnego w poszerzonej Unii Europejskiej*, [in:] *Region Bałtycki w nowej Europie,* T. Parteka, J. Szlachta, W. Szydarowski (Eds.). Biuletyn KPZK PAN, No. 217, Warsaw, pp. 7-42.

Tarajkowski J., Wojtasiewicz L. (Eds.), 2008, *Przestrzeń w polityce gospodarczej.* Katedra Polityki Gospodarczej i Planowania Rozwoju, AE, Poznań.

Wójcik P., 2008, *Dywergencja czy konwergencja: dynamika rozwoju polskich regionów.* Studia Regionalne i Lokalne (2) 32, Warsaw, pp. 41-60.