Regional and Local Studies
special issue 2010
ISSN 1509-4995

Maciej Smętkowski, Piotr Wójcik***

Regional Development in Central and Eastern Europe[1]

The aim of this article is to outline growth tendencies and growth factors in the subregions (NUTS 3) of Central and Eastern Europe in the period 1998–2006. A wide range of complementary research methods has been used in order to triangulate results, starting with classical beta and sigma convergence analysis, to kernel density estimation, transition matrices, spatial autocorrelation and multi-dimensional comparisons. Some rarely discussed aspects of the influence of capital regions on growth processes have been taken into account. An additional analysis of the data in relation to country averages produced results independent of the country context. As a result, we have been able to answer the following questions: do the analysed countries experience regional convergence or rather divergence/polarisation processes? What factors determine the dynamics of regional growth? What are the main dimensions of spatial disparities in Central and Eastern Europe?

The accession of 10 Central and Eastern European (CEE) countries to the European Union provides an opportunity to prepare an opening balance sheet to show changes in the economic space of the countries across the region in the years preceding membership. It also makes it possible to investigate whether the CEE countries are undergoing convergence or polarisation of development processes regionally, and identify factors that determine the dynamic of regional development and the disparities between individual regions.

Analyses of convergence processes across the countries and regions of the European Union invite the conclusion that economic integration has helped to considerably reduce the existing national and regional disparities in per capita incomes. However, these processes progressed at varying speeds. For a long time, the rate of convergence between the regions of what was to become the European Union was quite high. Both absolute beta convergence and sigma convergence could be observed at national and regional levels of the EU. It was also visible across regions within individual countries. This process slowed down considerably in the mid-1970s, and poorer regions (mainly peripheral regions in the south of Europe) no longer benefited from it. As a result of slow convergence between EU countries in the 1980s, the disparities in the development levels between affluent and poor regions increased even further. And, even though

* Centre for European and Local Studies of the University of Warsaw (EUROREG).
** Faculty of Economic Sciences, University of Warsaw.

[1] The paper summarises the results of the research project: 'Regions in Central and Eastern Europe: Trends and Development Factors', commissioned by the Polish Ministry of Regional Development.

from the late 1980s onwards slow convergence resurfaced yet again (albeit not in all regions), these disparities did not shrink. In most European countries, the internal disparities in the regional per capita incomes are not decreasing, but increasing in many cases. Parallel to the convergence between EU countries, regional divergence is taking place, despite more and more assistance being allocated to underdeveloped regions. Convergence processes occur in regions characterised by a prominent role of the services sector or high-tech industries in the economy. A rapid increase of income in those regions leads to the diversification of income levels in countries with heterogeneous productions structures. On the other hand, regions where agriculture plays first fiddle have been and remain the poorest (e.g. Cappelen et al. 1999; Giannetti 2002). Convergence between EU countries is driven by an increasing share of value added generated by cutting-edge technologies. Therefore, the poorest regions should seek growth opportunities in increasing their potential for the absorption of new technologies and in changing their production structure. Gorzelak (2007) came to similar conclusions.

The *Fourth Report on Economic and Social Cohesion* (EC 2007) formulated a number of propositions which should be clarified and referred directly to CEE countries, including Poland. Some of these propositions are recapitulated below:

- There is an observable convergence between the Member States' levels of development;
- Polarisation of development processes is taking place regionally, notably in the new Member States, due to the dynamic development of capital city regions;
- Disparities in the regional levels of development are largely due to the dissimilarities between economic structures and employment rates;
- Economic structures of less-developed regions are dominated by low value-added activities.

Furthermore, studies on the development of the Central and Eastern European macroregion (e.g. Gorzelak 1996; Radosevic, Pavitt 1999; Bachtler et al. 2000; ESPON 2006; Gorzelak, Smętkowski 2009) justify the following conclusions:

- The capital city regions and other agglomerations grew at the fastest rate due to such factors as business start-ups, development of the service sector and concentration of FDIs, with relatively smaller disparities in the development levels across regions in individual countries;
- The role of old industrial districts – leaders in the former development model – was insignificant as they suffered during restructuring processes which involved privatisation and workforce downsizing;
- The location on the border with EU countries had a positive influence on development processes, whilst being situated on the eastern (external) border of the EU was unfavourable, partly because of the considerable distance from sources of capital and innovation (measured by transport accessibility, proximity of the western border or a big agglomeration);

- The key pro-development factors include diversification of the economic structure (such as the quality of the workforce and modern fixed assets);
- On the other hand, barriers impeding regional development included: lack of needed transport infrastructure, low-quality workforce, environmental problems and low competitiveness, which among other factors were due to the lack of capacity to implement innovation, hampered access to technologies and absence of pro-growth attitudes among the general public.

The aforementioned studies on regional development processes in the CEE countries as a rule focused on NUTS 2 regions, mainly owing to the lack of reliable and comparable data at the subregional level (NUTS 3). However, the disparities in the development level between NUTS 2 regions in a given country are in many cases considerably smaller than intraregional ones. Currently, some basic subregional data are accessible, and this offers an opportunity to verify the conclusions drawn in the above studies using that particular level of reference. The main advantage of the exercise is the possibility to exclude the capital city regions from the analysis, as these regions altogether account for some 15% of the population and 25% of the macroregion's GDP. Likewise, adopting a uniform time frame for the analysis encompassing the years 1998–2005/2006 should also produce significant results, as we take into account a relatively long period when the development paths of individual countries followed a similar pattern (cf. Gorzelak, Smętkowski 2009).

Per capita GDP and its real changes were the basic measures used to investigate the regional dynamics in analysing regional convergence. Gross domestic product expressed in EUR per capita is a reliable indicator of the development level of individual regions and helps identify their standing in the economic map of the CEE countries. It should be noted, however, that the overall level of affluence of a given country most strongly determines the regional GDP. Four groups of countries whose regions fall within similar value ranges can be distinguished, viz.: Slovenia; the Visegrad countries (Czech Republic, Poland, Slovakia, Hungary); the Baltic states (Lithuania, Latvia and Estonia), as well as Bulgaria and Romania (cf. Gorzelak, Smętkowski 2009). In consequence, using absolute measures of any kind when carrying out the comparative analysis of the development level and regional dynamics in CEE countries is more difficult, and it is necessary to use measures relativised by purchasing power parity or related to the national average. The analysis presented below employed the latter of these methods[2]. Such an approach, which allows for obtaining results independent of specific country contexts, is becoming a more and more popular method in studying socio-economic dynamics (cf. e.g. Portnov, Schwarz 2008). Other indicators used in the analysis of the main dimensions of regional disparities and development factors were relativised in a similar manner.

[2] It should be noted that, firstly, purchasing power parity is determined nationally and therefore does not address regional aspects. Secondly, GDP expressed as purchasing power parity is an index that measures the relative wealth of residents, and not necessarily reflects the economic potential or competitiveness of a given regional system.

Given the above, we can say that our analyses took account of two very pertinent aspects, which can significantly affect the results obtained: the spatial aspect, which involved exclusion of the capital city regions, and the contextual aspect, which involved relativisation of the indicators used to national average values.

Regional convergence processes

The literature of the subject uses two main concepts of convergence: sigma convergence and beta convergence (cf. Sala-i-Martin 1990). The first occurs when disparities in per capita incomes (or any other phenomenon under analysis) between regions or countries decrease over time, while beta convergence refers to the correlation between the average increase rate of GDP per capita and its initial level. The literature of the subject makes a distinction between absolute and conditional convergence. According to the former, countries (regions) tend to close the gap between each other regardless of the initial conditions. It also implies that poor countries (regions) grow faster than wealthy ones, and the lower their initial GDP per capita, the higher it increases in real terms. As a result, poorer countries or regions can make up for their backwardness. On the other hand, conditional convergence means that countries (regions) with similar structural parameters (such as the average level of education or income structure) become similar, and thereby countries (regions) with different characteristics converge to dissimilar long-term levels of income[3].

In view of the above, to analyse convergence patterns, we used both classical convergence measurement methods and alternative methods, which enable a thorough analysis of the distribution of income and its dynamic in time (Table 1). Using the latter, we can estimate the probability with which regions with different initial income levels become relatively wealthier or poorer, or to what extent the distribution of income is stable over time[4].

The occurrence of convergence among groups of regions is known as a convergence club. Such convergence cannot be verified using the classical sigma or beta convergence methodology, and therefore other tools have been developed, such as analysis of the total distribution of income. Applied to EU regions, they usually reveal a bimodal distribution of per capita GDP, with the wealthiest regions being particularly distinctive in the group encompassing all the regions. Regions which are relatively poorer are not very likely to become rich, and therefore the disparities in GDP per capita can be seen as permanent. In regions where per capita GDP is above a certain level, the disparities do not grow, which, on the one hand, leads to convergence among the wealthiest regions, and on the other means that regional income disparities become petrified (Ezcurra,

[3] The pioneering works on the concept of conditional beta convergence were: Mankiw et al. (1992); Barro i Sala-i-Martin (1992).

[4] The detailed description of the methodology used can be found in: Quah (1996) or Wójcik (2004).

Rapún 2006). What is more, as a rule, the wealthiest regions grow faster, which produces greater polarisation (Magrini 2004; Grazia Pittau 2005; Grazia Pittau, Zelli 2006).

Table 1. Disparities in the level of economic development – measurement methods

Dimension	Tendency	Methods
Difference in the level of σ convergence/β divergence		Variability coefficient, regression analysis
Modality	Unimodality Multi-modality a) polarisation b) stratification	Nuclear (one-dimensional) estimation
Mobility	Inertia (stabilisation) Mobility (mixing)	Transfer matrices, nuclear estimation (conditional density function) Mobility index (classes, ranks)
Distribution	Consolidation Fragmentation	Spatial autocorrelation

Source: prepared by the authors based on: Yamamoto (2008).

In this study, we also used spatial autocorrelation methods to determine the forms and changes of spatial structures in the countries of the macroregion.

Beta and sigma convergence

In the Central and Eastern Europe macroregion, we found a weak negative correlation between the average growth rate and the initial per capita GDP level regionally (Table 2) (positive values denote convergence, and negative – divergence). This was visible particularly after the capital city regions were removed from the analysis. This correlation was associated with a minor reduction in the disparities between regions in terms of the level of income in the period under investigation (Table 3). This means that a weak tendency towards beta convergence and sigma convergence can be observed for the group of all regions, although they were primarily visible for areas other than capital city regions. Taking into account foreign exchange differences between currencies and the related appreciation of the currencies of individual countries further strengthened beta convergence, whereas the reference to the national average indicated the lack of convergence within countries or even weak divergence.

Table 2. Results of regression analysis for beta convergence in 1998–2005 (all countries)

Division	179 regions (with cities)			169 (without capital regions)		
Aspect	N	Parameter	Significance (p-value)	N	Parameter	Significance (p-value)
Level in EUR, real change	179	–0.0040	0.071*	169	–0.0067	0.002**
Level in EUR, nominal change	179	–0.0161	0.000**	169	–0.0198	0.000**
Level and change relativised by national average	179	0.0002	0.000**	*169*	0.0000	*0.898*

*significance at the level of 10%; italics indicate statistically insignificant results

**significance at the level of 5%

Source: prepared by the authors based on EUROSTAT data.

The above is confirmed by an analysis of convergence at the level of individual countries.

Convergence processes did not take the same course everywhere – in most countries, internal disparities either increased (sigma divergence) or were relatively stable (lack of convergence), which is evidenced by the values of the coefficients of variation of per capita GDP in Table 3 (the higher the value, the wider the disparity). The internal rate of disparity increased the most in Romania and Bulgaria, and the least – in Estonia and Slovenia.

Table 3. Values of the coefficients of variation weighted by the number of the population in 1998 and 2005

Country	179 regions (with cities)					169 regions (without capital cities)				
	1998	2005	Rank 1998	Rank 2005	Change	1998	2005	Rank 1998	Rank 2005	Change
In total	54.5	54.4	–	–	–0.1	46.0	40.6	–	–	–5.4
Bulgaria	26.4	40.4	7	6	14.0	19.4	18.3	4	5	–1.1
Czech Republic	22.8	28.2	8	9	5.4	5.8	6.0	10	9	0.2
Estonia	38.4	42.4	2	4	4.0	6.4	4.8	9	10	–1.6
Hungary	34.1	42.1	4	5	8.0	23.5	22.2	2	2	–1.3
Lithuania	19.1	28.8	10	8	9.7	13.3	17.7	7	6	4.4
Latvia	36.0	42.5	3	3	6.5	26.7	19.6	1	4	–7.1
Poland	31.4	37.4	5	7	6.0	17.5	21.5	5	3	4.0
Romania	28.3	43.4	6	2	15.1	21.1	26.4	3	1	5.3
Slovenia	22.1	26.6	9	10	4.5	9.4	10.6	8	8	1.2
Slovakia	42.9	52.8	1	1	9.9	14.4	17.0	6	7	2.6

Source: prepared by the authors based on EUROSTAT data.

Another regularity found was the fact that the regions which were initially poorer did not grow faster than the wealthy ones (Table 4), with no beta convergence observed; while in several countries (Lithuania, Poland, Romania, Slovenia, Slovakia) a positive correlation was observed between the rate of growth and initial income, i.e. beta divergence (visible also in Poland after the capital city region was excluded).

Table 4. Results of regression analysis for absolute beta convergence in 1998–2005

Division	179 regions (with cities)			169 regions (without capital regions)		
Country	N	Parameter	Significance (*p*-value)	N	Parameter	Significance (*p*-value)
Ogółem	179	–0.0040	0.071*	169	–0.0067	0.002**
Bułgaria	27	*–0.0154*	*0.431*	26	–0.0484	0.014**
Czechy	13	*0.0249*	*0.101*	12	*–0.0192*	*0.591*
Estonia	5	*0.0153*	*0.434*	4	*–0.0879*	*0.359*
Węgry	19	*–0.0034*	*0.838*	18	*–0.0219*	*0.249*
Litwa	10	0.0507	0.017**	9	*0.0350*	*0.137*
Łotwa	5	*0.0082*	*0.739*	4	*–0.0385*	*0.215*
Polska	39	0.0240	0.014**	38	0.0269	0.030**
Rumunia	41	0.0274	0.053*	40	*0.0158*	*0.289*
Słowenia	12	0.0302	0.055*	11	*0.0230*	*0.357*
Słowacja	8	0.0238	0.054*	7	*0.0135*	*0.620*

* significance at a level of 10%; italics – statistically insignificant

** significance at a level of 5%

Source: prepared by the authors based on EUROSTAT data.

As we can see, the above suggests that the tendency towards convergence observed at the level of the group of regions from all 10 countries resulted from the fact that the analysis covered regions situated in countries at dissimilar stages of economic transformation, and was not the consequence of similar processes that took place in individual countries.

Density functions

This is also corroborated by the results of the analysis of total distribution dynamic, showing a strong stability of relative income within individual countries (Fig. 1a), which is in turn evidenced by the concentration of the density chart along the diagonal. The wealthy and the wealthiest regions stand out (separate distribution vertices of c. 150% and 250% of average GDP per capita); in fact, they make up separate groups, although the tendencies of these regions to assimilate are rather weak. Instead, they represent distinctive 'islands of affluence', which, through their rapid development, make the internal disparities

even wider. The tendency towards convergence within countries is only visible in the group of the poorest regions (the fragment of the diagram lower than 60% runs parallel to the horizontal axis).

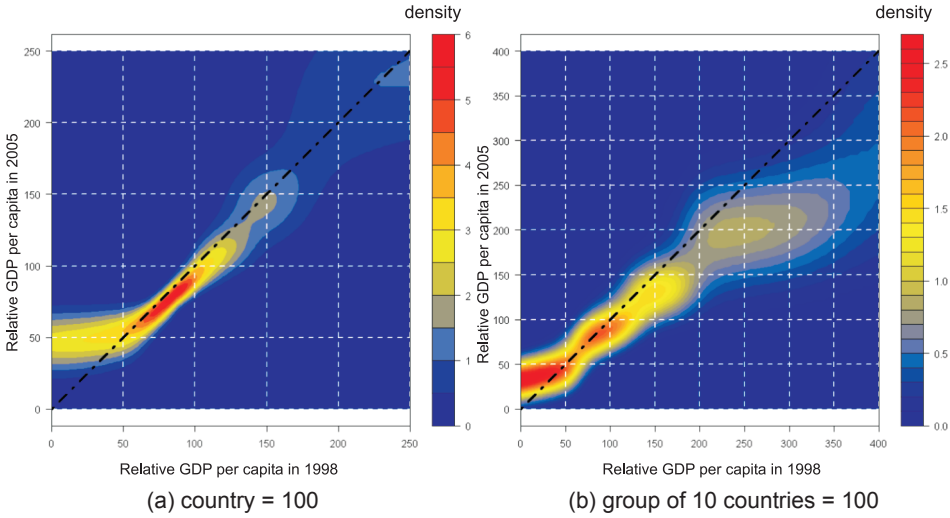


Figure 1. The dynamic of relative distriction of per capita GDP in 1998–2005 (nuclear estimator, 179 regions).

Source: prepared by the authors based on EUROSTAT data.

As regards the level of GDP per capita for the whole group of countries (Fig. 1b), there is a clearly observable alignment between regions of the same group. The tendencies towards income convergence are primarily visible among the wealthiest regions (more than 200% of average income) and, separately, among the poorest regions (the extreme fragments of the diagram run parallel to the horizontal axis). Therefore, if there is observable convergence, it is a convergence of clubs.

The internal distribution within countries (Fig. 1a) shows much more stability and lesser opportunities for regional mobility than when it is related to all the analysed countries (Fig. 1b).

Transfer matrices

An analysis of the mobility of regions regarding the relative GDP per capita using transfer matrices confirmed the conclusions from the density functions analysis. The probabilities on the diagonal of the transfer matrix (Table 5) indicate stability of individual groups, which is the greatest in the poorest regions (80–90% of them remain poor), and among the richest regions.

As regards the whole macroregion (Table 5a), the process of reducing disparities and the regions' assimilation to one another in terms of income levels can be

observed (high degree of probability in the ergodic vector for close-to-average income brackets). This is, however, a process whereby broadly understood average regions become similar, which is associated with relative pauperisation ('levelling downwards'). This is because there is a small but relatively stable group of the wealthiest regions, which grow at the fastest rate. At the other extreme, there is an even more stable group of the poorest regions which, in a similar vein, do not take part in this assimilation process. Therefore, whilst the distribution of per capita GDP becomes more homogeneous for the majority of regions, owing to the stability of the group of most affluent regions and, separately, of the poorest regions, we can only talk about convergence of clubs for the CEE regions.

Table 5. Dynamic of relative GDP per capita distribution in 1998–2005 (% denotes the probability of classifying a given region in a given income group)

a) group of 10 countries = 100 (N = 179)

Target Initial	Group 1 (<=48%)	Group 2 (48%; 63%]	Group 3 (63%; 84%]	Group 4 (84%; 182%]	Group 5 (>182%)
group 1 (54)	83	15	2	0	0
group 2 (16)	19	44	38	0	0
group 3 (22)	0	14	64	23	0
group 4 (71)	0	3	20	76	1
group 5 (16)	0	0	0	31	69
ergodic	16	14	34	34	2

b) country = 100 (N = 179)

Target Initial	Group 1 (<=71%)	Group 2 (71%; 84%]	Group 3 (84%; 101%]	Group 4 (101%; 114%]	Group 5 (>114%)
group 1 (21)	90	10	0	0	0
group 2 (61)	41	49	8	0	2
group 3 (55)	9	38	51	2	0
group 4 (17)	0	12	29	47	12
group 5 (25)	0	0	16	16	68
ergodic	78	17	3	0	1

Source: prepared by the authors based on EUROSTAT data.

On the other hand, within individual countries (Table 5b), owing to the fast development, mainly of the wealthiest capital city regions, but also of the relatively affluent metropolitan regions, the disparities are growing much faster than those across countries, which leads to a strong regional polarisation in terms of per capita GDP (extremely asymmetric distribution in the ergodic vector and concentration of probability in the group of poorest regions).

Spatial autocorrelation

Spatial autocorrelation is another method used to analyse convergence processes (cf. e.g. ESPON 2005; Janc 2006). In simple terms, this method relates the intensity of a given phenomenon in a given unit to its surroundings, which allows to identify regularities concerning the distribution of a given indicator in space (cf. Kopczewska 2006). This method employs global Moran's I, which can assume values from –1 to 1. Positive values indicate the tendency for spatial concentration of units with similar values of the indicator under analysis. On the other hand, Moran's I values lower than 0 mean that units with different indicator values border on one another, which could be equated with a greater dispersion and polycentricity of a given phenomenon. Moran's I approximating 0 means that the phenomenon in question has a random distribution, i.e. is a case of spatial entropy. To identify the major clusters of units, local indicators of spatial association (LISA) are used. In effect, we can distinguish crucial areas both with a positive autocorrelation of the HH type (clusters of high-value units) and the LL type (clusters of low-value units), and with a negative autocorrelation of the HL type (the so-called hot spots) and the LH type (the so-called cold spots, namely units that stand in contrast to their direct surroundings in terms of high or low values of a given indicator).

The research results (Table 6) point out to a decreasing spatial correlation relating to the development level of regions expressed in GDP per capita in EUR for the entire macroregion, which can be explained by the fast rate of growth of the Baltic states, Romania and Bulgaria, coupled by an appreciation of their national currencies. It should also be noted that the level of spatial concentration was still very high and the division into highly-developed and underdeveloped areas very wide. On the other hand, the data relativised with the national average prove a considerable polycentricity of the CEE macroregion, since the growth centres in individual countries were separated from one another with less-developed areas, which resulted in the lack of statistical significance of Moran's index, suggesting a random distribution of the growth poles.

Table 6. Global Moran's I values – spatial autocorrelation (for k = 6)

Index	Real values (EUR; %)	Rea values (national average = 100)
GDP per capita in 1998	0.8281**	*–0.0035*
GDP per capita in 2005	0.6364**	*0.0171*
Change of GDP in 1998–2005	0.1723**	0.0729*
Change of GDP in 1998–2005 relative to GDP per capita in 1998	*–0.0402*	*0.0369*

* significance at a level of 0.05; italics – statistically insignificant

** significance at a level of 0.01

Source: prepared by the authors.

At the same time, polarisation processes were visible in the CEE macroregion, manifested by a spatial concentration of the development dynamic, which meant that regions which were surrounded by faster-developing areas would grow faster themselves (a considerable impact from the Baltic states' regions) and, conversely, slow development rate of neighbouring regions, led to the emergence of macroregions with a low dynamic of growth (particularly in Romania and Bulgaria). This could prove that the regional hinterland does have some, rather weak, influence on development processes. In parallel, however, examples clearly contradicting this hypothesis could be found. They testify to barriers in the diffusion of development processes. This is best exemplified by the coastal areas of Bulgaria and Romania, which grew much faster than the belt of regions directly bordering on them. A similar situation could be observed in the eastern parts of Hungary and Poland, with the growth centres in the form of larger cities being surrounded by areas with a low growth dynamic.

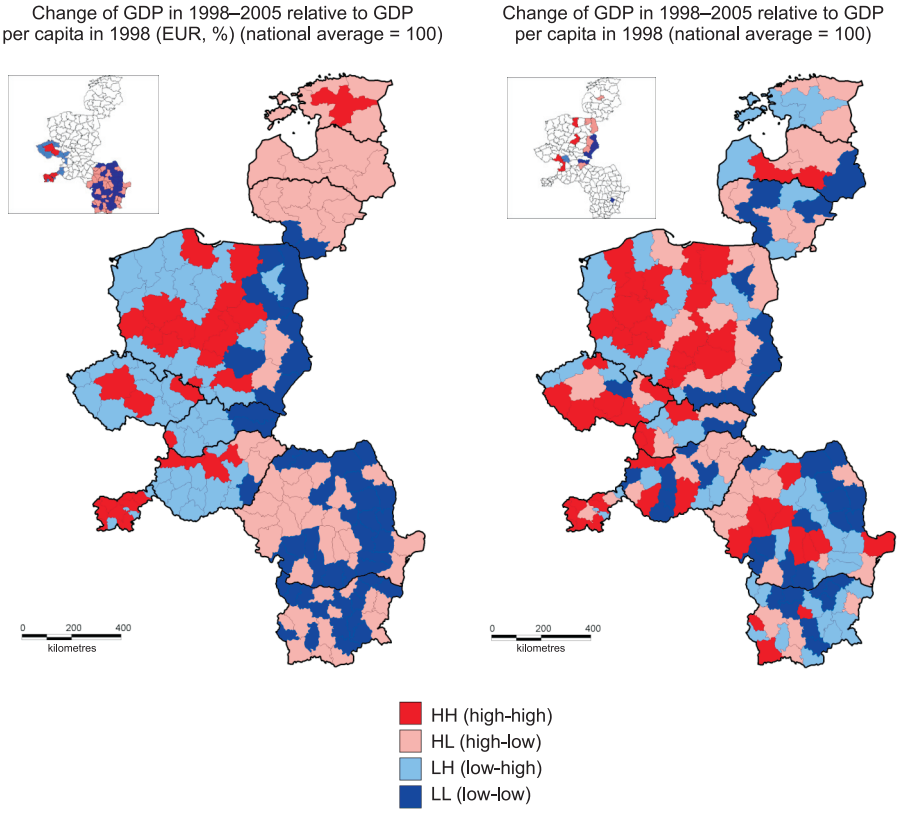


Figure 2. Local indicator of spatial association (LISA) – development dynamic and the development level.

The top left-hand part of the map shows regions with significance higher than 0.05.

Source: prepared by the authors.

On the other hand, the impact of the development level of the regional hinterland on the growth dynamic of individual regions in terms of the entire CEE macroregion was not statistically significant. The absence of such an influence could be observed at the local level (Fig. 2) in Bulgaria and Romania: in those countries, some regions were growing fast despite their low level of development. Some of the poorly developed regions reported a very low dynamic of growth, which increased the polarisation of socio-economic space in those countries. A similar situation could be observed in eastern Poland. No impact of regional hinterland was also visible in the Czech Republic, Poland, Slovakia, Hungary and Slovenia, due to the rapid growth of metropolitan centres, particularly when compared with the low development level of their regional hinterlands. In the case of the Baltic states, this was not as manifest due to a very high rate of growth nationally, further strengthened by the low base effect, although less-developed regions with a lower rate of growth could also be found in those countries.

Factors of regional development and dimensions of regional disparities

The key phenomena associated with the economic restructuring of the Central and Eastern European countries include a dynamic development of services, increasing role of the SME sector and ownership transformations supported by an influx of foreign capital. In addition, the changes taking place in the organisation of production processes were coupled with a greater role of human capital resources and innovation, both having critical significance in contemporary information economy. A challenge that the CEE countries are still facing is how to improve employment figures. It should be noted at this point that in the 2004–2008 period, structural development considerably decreased in scope, mainly owing to a favourable economic climate and a gradual opening of the EU-15 labour markets for the citizens of the CEE countries.

These issues, associated with economic transformation processes and economic development in global information economy, determined the choice of variables for analysis. According to our assumptions, in addition to being a quantitative measurement of the level of economic development (expressed as per capita GDP), the selected set of indicators aimed to illustrate the role of structural and qualitative factors in development processes. As a result, and depending on the availability of data[5], we selected indicators and measures which illustrated such factors as: economic structure, labour productivity, labour market situation, condition of enterprises, role of the R&D sector, human capital stock, condition of infrastructure and external attractiveness (tourism and migration). All of these variables were relativised, and their values were related to

[5] Certain key aspects of growth processes could not be shown on this spatial scale due to the lack of data or their incomparability, e.g. transport infrastructure, social capital or institutional capacity.

the number of the population (e.g. indicators relating to the enterprise sector), number of people in work (e.g. productivity) or expressed as a percentage (e.g. economic structure). In some cases, the data which were not available at the subregional level were replaced by estimates for the NUTS 2 level. The values of most indicators were shown for 2006, but, owing to delays caused by the mode of operation of the public statistics systems, the data concerning GDP, economic structure and productivity came from 2005, while the data on the education structure were obtained from national censuses, carried out in these countries between 2000 and 2002.

Table 7. Correlation coefficients of GDP per capita in 2005 and values of other variables in 2005/2006 (country = 100)

Index (value for 2005 or 2006)	Correlation with GDP per capita for 2005 (N = 179)	Correlation with GDP per capita for 2005 without capital regions (N = 169)
Capital expenditure of enterprises per capita	0.834	0.699
Share of population with higher education	0.827	0.638
People in work – market services [%]	0.783	0.663
R&D expenditure per capita	0.768	0.372
Companies with foreign shareholdings per 1000 population	0.724	0.422
Labour productivity – industry	0.693	0.685
Share of population employed in R&D	0.657	0.323
Number of university students per 1000 population	0.623	0.493
Share of population using sewage network	0.619	0.563
Natural persons running businesses per 1000 population	0.606	0.522
Gross value added – market services [%]	0.603	0.273
Labour productivity – market services	0.589	0.363
Migration balance in ‰	0.569	0.463
Labour productivity – non-market services	0.563	0.278
Employment rate [%]	0.545	0.455
Tourists using accommodation per 1000 population	0.392	0.438
Share of population using water supply network	0.310	*0.053*
Share of population with secondary education	0.257	0.231
Labour productivity – agriculture	0.150	0.172
People in work – industry [%]	*0.123*	0.479
People in work – non-market services [%]	*0.081*	*–0.023*

Gross value added – industry	*0.072*	0.458
Share of women among people in work	*–0.089*	–0.307
Share of long-term unemployed	–0.339	–0.296
Gross value added – non-market services [%]	–0.448	–0.647
Registered unemployment rate	–0.497	–0.429
Employment in agriculture [%]	–0.568	–0.544
Gross value added – agriculture [%]	–0.609	–0.585

Source: prepared by the authors.

We set out to identify factors which underpin the development of regions by defining the correlation between the volume of GDP per capita and other analysed variables for 2005, which helped us find those factors which stimulate or impede growth processes. In effect, it turned out (Table 7) that, as a rule, the highly-developed regions of the CEE countries are characterised by a whole gamut of features which reflect the relatively modern character and attractiveness of their economies. They include in particular a well-developed and highly productive market services sector and a huge R&D potential. In addition, those regions boast an efficient industrial sector, with a relatively small share both in the labour market and in gross value added (GVA). The sector of non-market (public services) is also efficient, and the basic technical infrastructure is well-developed. Human capital resources, expressed as the percentage of the population with higher education and the number of university students, are substantial, just as enterprise development indicators and the volumes of capital expenditure are. These regions are also interesting for foreign capital; they attract both tourists and new residents. The situation on their labour markets is good, with high employment figures and low registered unemployment. At the same time, the role of agriculture in their economies is marginal, both with regard to the labour market and GVA. Moreover, the significance of agriculture is strongly negatively correlated with the level of economic development, which can be viewed as proof of development barriers existing in agricultural regions.

What is interesting is the role of industry in development processes. The significance of industry (share in the number of people in work and gross value added) is positively correlated with GDP only after capital city regions are excluded from analysis. This indicates that the previous development paradigm still has a strong presence, which is manifested among other things by the important role of old industrial districts in the economic space of the CEE macroregion.

To some extent, this observation is corroborated by the analysis of correlations between changes in per capita GDP in 2002–2005 and the dynamic of the remaining indicators. The factors which most distinctly influenced changes in the regions' ranking in the recent period (Table 8) include:

- Increased productivity of industry and, to a lesser extent, increased productivity in the marker services sector;
- Increased capital expenditure and influx of foreign capital (poor correlation).

Table 8. The coefficient of correlation between changes in GDP per capita in 2002–2005 and changes of other variables in 2002–2005/2006*

Index (national average = 100) in 2002–2005/2006	Correlation with GDP per capita for 2005 (N = 179)	Correlation with GDP per capita for 2005 without capital regions (N = 169)
Change – labour productivity in industry	0.53	0.55
Change – labour productivity in market services	0.28	0.30
Change in the number of employed in agriculture	0.24	0.25
Change in the number of companies with foreign shareholdings	0.24	0.23
Change in gross value added in industry	0.22	0.25
Change in investment expenditure of enterprises	0.16	0.16
Change in the number of natural persons running businesses	*–0.12*	–0.16
Change in the registered unemployment rate	–0.15	*–0.14*
Change in the number of people using sewage network	–0.18	–0.17
Change in labour productivity in agriculture	–0.20	–0.20
Change in the number of employed in market services	–0.24	–0.24
Change in the number of gross value added in market services	–0.25	–0.24
Change in gross value added in market services	–0.30	–0.29
Change in the number of people in work in non-market services	–0.49	–0.49

* statistically insignificant correlation coefficient was omitted (level of significance at 5%)

Source: prepared by the authors.

Another phenomenon correlated with GDP per capita increase (although with a borderline significance) was the improved labour market situation associated with falling unemployment. In addition, there was an observable, and difficult to explain, correlation between GDP growth and an increased number of people

employed in agriculture. In parallel, an increased share of the services sector was negatively correlated with GDP growth, particularly the share of non-market services in gross value added and the labour market.

Factor analysis was conducted to determine the main dimensions of disparities existing in the space of the CEE countries at the NUTS 3 level. This method is exploratory in character, and involves a reduction in the number of variables, which are replaced by the poorly correlated principal components. In the factor analysis, we used all the variables where the values of intercorrelation and the correlation coefficient (0.1)[6] were not very strictly defined (0.9) (for more information see Gorzelak 1979).

Following the analysis, we distinguished 4 principal components[7], which explained 66.9% of the total variance (after rotation) in the investigated group of subregions. These include (see Annex 1):

- Factor 1 (8.1: 31%) 'metropolitanism', which is most strongly correlated with the R&D potential and human capital resources, expressed as the level of educational attainment of the population, number of university students, capital expenditure, as well as employment in the market services sector and GDP per capita. In addition, this component is rather strongly correlated with the employment and self-employment indices, density of the water and sewage networks, as well as productivity of the public services sector, and more weakly correlated with the productivity of labour in market services. At the same time, regions with high values of this factor are characterised by a lower than average unemployment rate, but also lower than average labour productivity in agriculture.
- Factor 2 (3.5: 14%) 'market services', which is quite strongly correlated with the share of market services in gross value added and high productivity of labour in this sector, coupled with relatively high employment, also in tourist traffic services. By parallel, regions with high values of this factor are characterised by a low share of agriculture in the number of people in work and gross value added, with relatively high GDP figures. To some extent, this factor is correlated with metropolitanism, and it is most strongly determined by the number of tourists using accommodation, low employment in agriculture and high productivity of market services.
- Factor 3 (3.1: 12%) 'industrialisation', which is very strongly correlated with the share of industry in gross value added and high employment in this sector, with high productivity of labour. On the other hand, the sector of services, mostly public but also marketed, is of lesser importance in regions with high values of this factor.

[6] In consequence, we did not use such indices as the share of the population with secondary education, share of women among people in work and the migration balance, as they were all characterised by low variability, which could lead to their random distribution in space, particularly in view of the fact that the data in question are not easily comparable across countries.

[7] Further in the paper, the term 'factor' is used to denote the principal component.

- Factor 4 (2.1: 10.2%) 'public sector and productive agriculture', which is strongly correlated with high employment in the non-market services sector and high productivity of agricultural production, coupled with low employment in agriculture. At the same time, in regions with low values of this factor, the share of people employed in unproductive agriculture is high, which keeps the registered unemployment rate at a low level, but also testifies to the so-called hidden unemployment. Moreover, the role of non-market services in these regions is low, which can be seen as proof of very modest budget transfers.

Maps showing the distribution of these regions in space enable a more precise assessment of the diagnostic value of these factors (Fig. 3). The factor defined as 'metropolitanism' reaches the highest values in regions with big cities. These are mainly capital city regions of the analysed countries, as well as other large cities such as: Kraków, Poznań, Tricity (Gdańsk-Gdynia-Sopot), Wrocław, Łódź and Lublin (Poland), Cluj and Timişoara (Romania), and, to a lesser extent, selected medium-sized cities such as for instance Varna (Bulgaria), Iaşi (Romania), Kaunas (Lithuania), Tartu (Estonia), Brno (Czech Republic), Pécs (Hungary), in addition to several other major cities in Poland.

In addition to the capital city regions, high values of the factor illustrating the development level of the market services sector are particularly well visible in the coastal regions: on the Black Sea in Bulgaria and Romania, the Adriatic Sea in Slovenia, less so on the Baltic Sea in Poland's regions of Szczecin, Koszalin and Tricity, as well as Lithuanian Klaipeda. They are also present in the mountain regions of the Carpathians (Poland and Slovakia) and the Ore Mountains (Czech Republic – Karlove Vary), the Sudeten (Liberec), as well as around Lake Balaton (Hungary). The value of this factor is also high in many regions of Romania, mostly those situated in Transylvania, which can imply that medium-sized cities play a role in the provision of services to their regional hinterlands. On the other hand, its low values are characteristic of Latvia and Estonia (the dominant role of Tallinn and Riga), as well as eastern Poland (the role of Warsaw), and, to a lesser extent, the eastern and southern parts of Hungary (the dominance of Budapest).

Regions with high values of the 'industrialisation' factor show the tendency to evolve into spatial clusters. The most heavily industrialised areas of the CEE countries include the western parts of Slovakia and Hungary, Czech Republic and south-western Poland (mainly Silesia, the Legnica Basin and Greater Poland – Wielkopolska), as well as the central parts of Slovenia, Romania and Bulgaria. On the other hand, low values of this factor are most frequently observed in the peripheral border regions, particularly in the east of Poland, in the Romanian part of Moldavia, at the border between Romania and Bulgaria and in the southern and eastern parts of Hungary.

Highly productive agriculture, with a relatively significant role of the public services sector, is characteristic of the western and northern regions of Poland, the eastern parts of Slovakia and Hungary, the northern part of Bulgaria, the

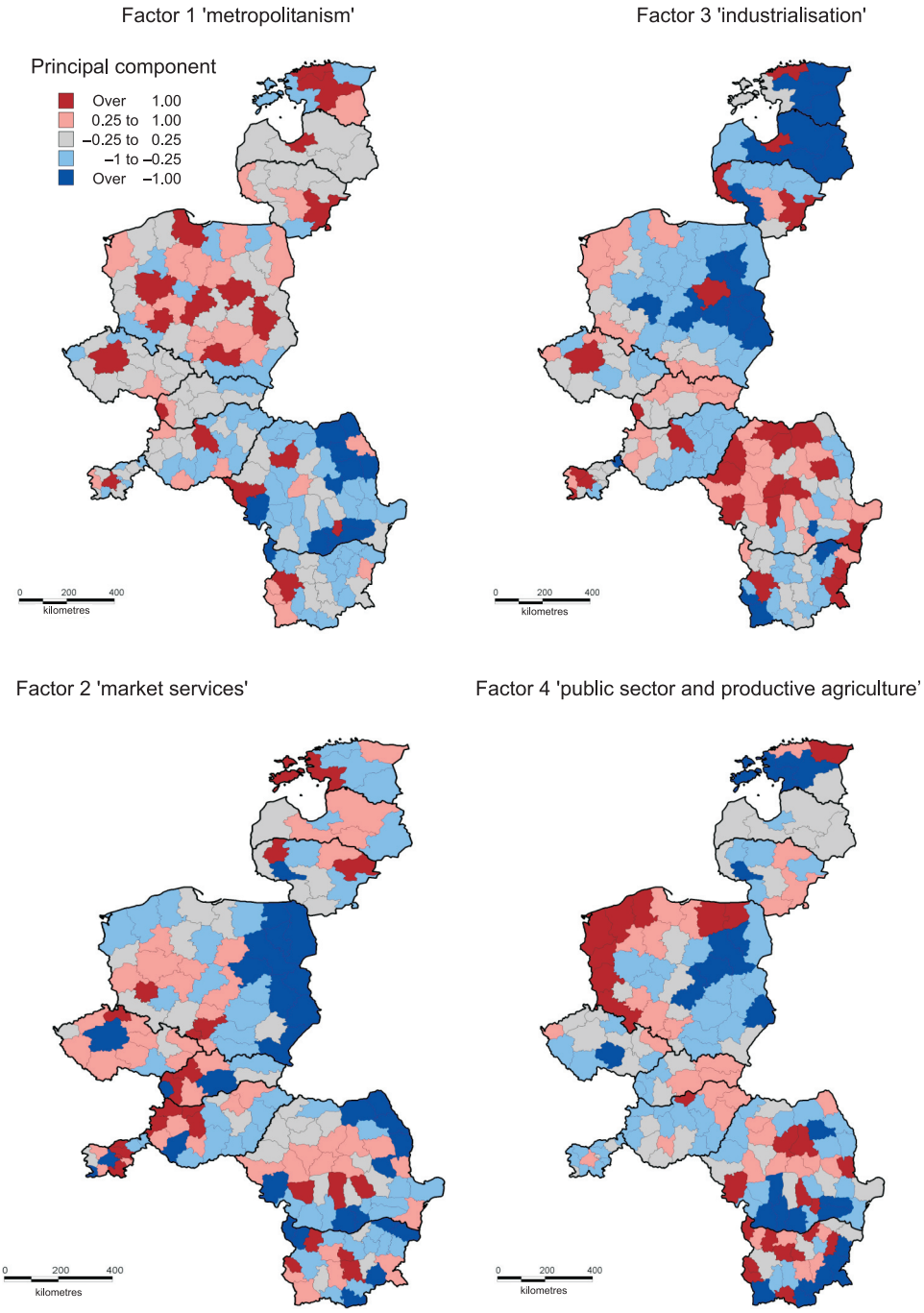


Figure 3. Spatial distribution of factor values in 2005/2006; (N = 179).

Source: prepared by the authors.

central part of Transylvania in Romania, and the eastern part of Lithuania. Low values of this factor indicate unproductive agriculture and underdeveloped public services (which could be due to poorly developed urban network) in the eastern part of Poland (in what once made up the Congress Kingdom), but also in Wielkopolska (more prominent role of industry), in Romania's Walachia and Moldavia and in the mountain regions of southern Bulgaria.

It should be observed that the above components can only partly explain the total variance of the regions of the CEE countries (66.9%), particularly after we exclude the capital city regions (59.7%), and use the dynamic approach (45.1%). This means that also other factors play an important role in regional development processes – ones that were not taken into account in the selected set of variables, including possibly some associated with qualitative phenomena which are difficult to measure, such as efficient institutional environment, pro-growth attitudes of the populace or social capital stock.

The principal components of the variance in the economic space of CEE countries listed above were then used to draw a typology of regions[8]. The classification tree produced as a result shows a number of distinct clusters of regions (Annex 2). On this basis, we identified four basic types of regions, largely associated with the above components of disparities, namely metropolitan regions, as well as agricultural, industrial and service regions characterized by different economic structures. Each of them can be divided into further subtypes (Table 9 and Fig. 4)[9].

Table 9. Factor values in the distinguished types of regions

Type and subtypes	Factor 1 – 'metropolitanism'	Factor 2 – 'market services'	Factor 3 – 'industrialisation'	Factor 4 – 'public services and productive agriculture
Metropolises – diversified	2.3	0.3	–0.4	0.1
Metropolises – market services	0.8	2.4	–0.6	–0.3
Agricultural – weakly industrialised	–1.0	0.0	–1.1	–1.0
Agricultural – insignificant role of services	0.1	–1.0	–0.4	–0.6
Industrial-agricultural	–0.1	–0.1	1.5	–0.7

[8] We used hierarchical complete linkage clustering, a method which is similar to the so-called Wrocław taxonomy in terms of the hierarchical clustering of items (cf. Młodak 2006, pp. 66-74). Similar results were obtained using the optimization method formulated by Ward.

[9] This analysis also produced the type 'Others', which included 4 regions with very specific socio-economic profiles: Vidin and Vratsa in Bulgaria, Caras-Severin in Romania and Narva in Estonia. Also distinctive was the capital city region of Bucharest, mainly due to its relatively small area, given Romania's administrative division (ultimately, it was included in the group of metropolitan regions with diversified economy.)

Industrial-strongly industrialised	0.2	–0.5	1.3	0.8
Service/industrial	–0.2	0.8	0.6	–0.3
Public services and productive agriculture	–0.5	–0.1	–0.1	0.8
Service/agricultural – weakly industrialised	–0.4	0.2	–1.1	0.6

Source: prepared by the authors.

Metropolitan regions proved to be the most distinctive type. They may be divided into two subtypes: those associated with a diversified economic structure, and those characterised by an important role of efficient public services sector, including tourist traffic services. Typical examples of the former group were subregions of smaller metropolitan centres, e.g. Poznań and Wrocław in Poland, Cluj and Timişoara in Romania, Kaunas in Lithuania and Brno in the Czech Republic. This group also included Warsaw, Bratislava and Sofia, as well as Bucharest (the latter being unique due to the small area of its metropolitan district, which is due to the country's specific administrative division). The latter subtype included the remaining capital cities, mainly owing to their own attractiveness for tourism, which was also characteristic for the coastal regions with large harbour cities in Bulgaria (Burgas and Varna), Romania (Constanta) and Slovenia (Koper).

At the other extreme from metropolises, there were agricultural regions, with a high share of employment in agriculture and the associated low productivity of labour. This group consisted of two subtypes: regions characterised by a weak level of industrialisation, and those with relatively poorly developed services, particularly market services. Both of these subtypes formed distinctive spatial clusters. The dominance of agriculture, with a low level of industrialisation, was typical of the southern part of Walachia situated on the River Danube in Romania, and the northern part of Moldavia. Regions of the second subtype were situated in the central and eastern parts of Poland, the southern and central parts of Hungary, Latvia, in the south-eastern part of Estonia and in the eastern part of Lithuania's Samogitia.

Industrial regions also showed some inimitable features, particularly one subtype, characterised by a high level of industrialisation and small diversification of the economy and including primarily old industrial districts, such as Silesia in Poland and Moravia, Legnica (copper basin), Panevežys in Lithuania (traditional industry), the Mures region (metal mining and metallurgy) in Romania, as well as the industrial central Bulgaria (Stara Zagora and Gabrovo). The second subtype encompassed industrial centres situated in farming areas. These were the regions where industrialisation processes started relatively recently, and mostly included modern industry branches. The major clusters included in particular Slovenia's regions bordering on Ljubljana in the east, western regions

of Hungary, the Trnava district neighbouring Bratislava in Slovakia, as well as some regions in the Czech Republic, Lithuania and Estonia.

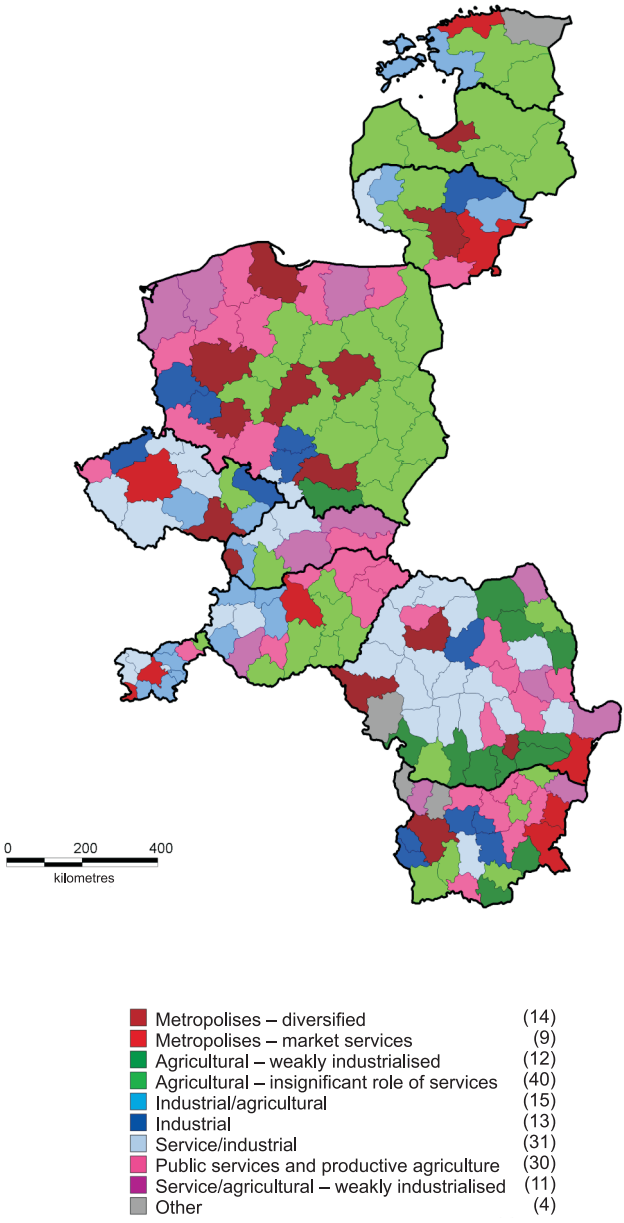


Figure 4. Typology of regions

Source: prepared by the authors.

The last, 'service' type of regions, was definitely the most diversified internally, which was partly due to the sector's great versatility. To some extent, this was due to the division of services into market and the so-called non-market (public) services, and to the varying roles of agriculture and industry. In effect, the main three subtypes of regions can be distinguished within this particular type.

The first subtype consists of service and industrial regions typical of Romania's Transylvania and the northern part of Walachia situated at the foothills of the Carpathians. This type of regions was frequently encountered in the Czech Republic, north-western Slovakia, in the western part of Hungary and in Slovenia. In Poland, the type in question included the subregions of Rybnik and Bielsko-Biała, mainly owing to the service functions of their major urban centres. What distinguished the second subtype was the role of the public services sector and relatively high productivity of agriculture. It was prevalent mostly in western and northern Poland, in eastern Hungary and in some regions of Romania and Bulgaria. The last subtype was made up of weakly industrialised service and agricultural regions. Some of them also performed tourist functions, including those related to border cooperation services. These were mainly regions situated in northern Poland (the coastal areas of Szczecin and Koszalin, as well as Olsztyn, with its lake district connections), eastern Slovakia (the mountain areas of Prešov and Banská Bystrica), the Somogy region (on Lake Balaton) in Hungary, as well as non-metropolitan coastal regions of Bulgaria and Romania.

This typology shows the major inter-regional disparities in Central and Eastern Europe, and reveals the polycentric structure of the macroregion, with numerous urban centres which perform metropolitan functions or provide market services to the surrounding regions (or countries in the case of seaport cities)[10]. The other, less distinctive, axis of disparities ran from the east to the west, primarily in the case of Slovakia, Poland and Hungary. In Poland, this division was historical in nature as it reflected the boundaries of the former Congress Kingdom – a region strongly characterised by unproductive agriculture. In contrast, the productivity of agriculture is higher in the western part of the country, which is also much more industrialised. A similar situation can be observed in Hungary, where the region situated within the triangle Budapest-Győr-Vác was much more industrialised than the southern and eastern parts of the country. In contrast, in Romania there was an observable historical distinction between Transylvania versus Walachia and Moldavia. The latter two provinces, particularly the subregions located far from the Carpathian ridge. were predominantly farming in character. In Bulgaria and Lithuania, the existing disparities were associated with the location of the capital city and the key seaport cities. On the other hand, the most homogeneous were the small and most-developed coun-

[10] It should be borne in mind, however, that this was party due to the fact that the index values were relativised by the national averages.

tries of the region. such as Slovenia and the Czech Republic and, to some extent, Estonia. At the other extreme there was Latvia, with the most characteristic division between the capital city metropolis vs. the remaining regions.

Conclusions

In the period 1998–2005, rather weak regional convergence could be observed in Central and Eastern Europe. This was the result of the dissimilar rates at which individual countries grew, particularly higher economic growth in the less developed countries (the Baltic states growing fast due to the liberalisation of their economies; Bulgaria and Romania closing the gaps arising from delayed commencement of restructuring processes). In addition, regional convergence measured in EUR was facilitated by speedy appreciation of national currencies.

Most of these countries (including Poland) saw a slight tendency towards the polarisation of development processes, although in smaller countries this situation was relatively stable. In addition to the capital city regions, other cities (particularly in countries with a polycentric structure of the settlement system) made up the leading group of regions, which proves the significance of metropolisation processes associated with the change of the development paradigm and the transition from industrial to information economy in regional development. In parallel, problem areas characterised by an extremely low rate of growth or even stagnation could be found in most of the CEE countries. As a rule, these were agricultural regions, especially those situated at the external, eastern border of the European Union, and along the internal borders which are difficult to cross owing to the physio-geographic conditions (e.g. the Romanian-Hungarian border along the River Danube).

The remaining regions made up a varied group, with mixed economy structures. They included industrial regions, including those with the prevalence of the traditional and of the modern processing sector; service regions, including those situated in areas attractive for tourism; and regions with productive agriculture and well-developed food-processing industry. The rates of growth of these regions were relatively similar, and their development success relied on a number of different factors, frequently related to the region's specific features.

Differences in the economic structure proved to be a critical dimension of the disparities between the CEE regions. In most cases, the modern market services sector played a crucial role. After excluding the capital city regions from the analysis, the level of industrialisation proved to be far more important. Nevertheless, the role of structural aspects was clearly less significant in the analysis of the rate of growth. Other than the aforementioned metropolitan and problem areas, the analysis did not reveal any distinct differences in the rate of economic growth which would result from the dissimilarities of their economic structures.

Increased labour productivity, especially in industry and market services, proved to be a crucial factor underpinning economic growth. This increase can be the effect of an interplay of both endogenous and exogenous factors. The endogenous factors include in particular the development of quality human capital stock, which positively influences both enterprise and innovation, and increasing capital expenditure in enterprises to finance modern production facilities. Exogenous factors encompass the influx of inward capital, also from abroad, and to some extent to the region's attractiveness for tourism (provided that the existing conditions enable the development of the tourist industry). In both of these cases, qualitative rather than quantitative aspects of these factors' operation come to the fore. It should be pointed out, however, that the above interrelationships were not confirmed in the dynamic approach, mainly due to the lack of data for a longer period.

The labour market situation in the analysed period was not directly reflected in the rate of economic growth. This was due to the characteristic features of the region's countries, with persisting hidden unemployment in rural areas, and to privatisation and downsizing processes in industry, particularly in those countries which were the last of the group to start root-and-branch reforms. Nevertheless, the high rate of economic development had a positive impact on the labour market, which led to a reduction in unemployment (also in the long term), particularly in the metropolitan regions.

It should also be noted that the above factors can only explain some of the dissimilarities between the development paths of the CEE regions, especially those without the capital cities. This means that also other aspects play an important role in regional development processes, including some which were not embraced by the adopted set of variables. Some of them are probably associated with qualitative phenomena, which are difficult to measure, such as an effective and efficient institutional setup, pro-growth attitudes of citizens, or human capital resources. More specific case studies should be carried out to investigate these aspects in more depth.

The observable tendencies suggest that wider disparities can be expected, both nationally and regionally. This may occur despite the implementation of policies supporting the poorest regions by means of EU funds. This is clear from the experiences of other EU Member States such as Spain, Greece or southern Italy. On the one hand, the fastest growth in Central and Eastern Europe may be expected in the wealthiest metropolitan regions, that is areas with a significant concentration of well-educated and pro-active workforce, and a modern economic structure with a relatively high proportion of the market services sector. At the other extreme, there are regions with a prevalence of traditional sectors, dependent on public transfers, stagnating and participating in the development and modernisation processes only to a limited extent, thus remaining poor. These two constantly diverging extremes will drive further stratification, particularly within individual countries.

This picture offers an interesting starting point for further analyses of the dynamic of convergence processes in the CEE countries. It shows what regional development processes take place in the conditions of relatively fast economic growth. However, how the situation will develop in the coming years will on the one hand certainly strongly depend on the anticipated downturn or even recession, which has already hit the region's recent leaders, such as Estonia or Latvia, and countries which are struggling with excessive budget deficits (Hungary). On the other hand, in the coming years we will see the first outcomes brought about by the utilisation of EU structural funds.

References

Bachtler J., Downes R., Gorzelak G. (eds.), 2000, *Transition, Cohesion and Regional Policy in Central and Eastern Europe*, Aldershot–London: Ashgate.

Barro R., Sala-i-Martin X., 1992, 'Convergence', *Journal of Political Economy*, No. 100, pp. 223–251.

Cappelen A., Fagerberg J., Verspagen B., 1999, 'Lack of regional convergence', in: J. Fagerberg, P. Guerrieri, B. Verspagen (eds.), *The Economic Challenge for Europe. Adapting to Innovation Based Growth*, Cheltenham: Edward Elgar, pp. 130–148.

Chojnicki Z., 1999, *Podstawy metodologiczne i teoretyczne geografii*, Poznań: Bogucki Wydawnictwo Naukowe.

Domański R., 1997, *Przestrzenna transformacja gospodarki*, Warsaw: Wydawnictwo Naukowe PWN.

Domański B., Guzik R., Micek G., 2003, 'Zróżnicowanie regionalne krajów Europy Środkowej i Wschodniej i jego zmiany w latach 1995–2000', *Biuletyn Komitetu Przestrzennego Zagospodarowania Kraju PAN*, issue 204, pp. 125–142.

EC, 2007, *Growing Regions, Growing Europe, Fourth Report on Economic and Social Cohesion*, Luxembourg: Office for Official Publications of the European Communities.

ESPON, 2005, Project 1.1.3: *Enlargement of the European Union and the Wider European Perspective as Regards its Polycentric Spatial Structure*, Stockholm: KTH, The Royal Institute of Technology.

ESPON, 2006, Project 2.2.2.: *Pre-Accession Aid Impact Analysis*, Berlin: Institut für Regionalentwicklung und Strukturplanung (IRS).

Ezcurra R., Rapún M., 2006, 'Regional disparities and national development revisited', *European Urban and Regional Studies*, No. 13, pp. 355–369.

Frankfort-Nachmias Ch., Nachmias D., 2001, *Metody badawcze w naukach społecznych*, transl. by E. Hornowska, Poznań: Wydawnictwo Zysk i S-ka.

Giannetti M. 2002, 'The effects of integration on regional disparities: Convergence, divergence or both?', *European Economic Review*, No. 46, pp. 539–567.

Gorzelak G., 1979, 'Dobór zmiennych w statystycznej analizie porównawczej', part 1, *Wiadomości Statystyczne*, Vol. 3, part 2, *Wiadomości Statystyczne*, Vol. 4.

Gorzelak G., 1995, *Transformacja systemowa a restrukturyzacja regionalna*, Warsaw: UNESCO Chair in Sustainable Development, University of Warsaw.

Gorzelak G., 1996, *The Regional Dimension of Transformation in Central and Eastern Europe*, London: Jessica Kingsley Publishers.

Gorzelak G., 2004, 'Polska polityka regionalna wobec zróżnicowań polskiej przestrzeni', *Studia Regionalne i Lokalne*, No. 4 (18).

Gorzelak G., 2007, 'Rozwój polskich regionów a polityka spójności Unii Europejskiej', in: *idem* (ed.), *Polska regionalna i lokalna w świetle badań EUROREG-u*, Warsaw: Wydawnictwo Naukowe Scholar.

Gorzelak G., Ehrlich E., Faltan L., Illner M. (eds.), 2001*, Central Europe in Transition: Towards EU Membership*, Warsaw: Regional Studies Association Sekcja Polska, Wydawnictwo Naukowe Scholar.

Gorzelak G., Smętkowski M., 2005, *Metropolia i jej region w gospodarce informacyjnej*, Warsaw: Wydawnictwo Naukowe Scholar.

Gorzelak G., Smętkowski M., 2009, 'Dynamika rozwoju regionów w krajach Europy Środkowej i Wschodniej', in: G. Gorzelak, M.S. Szczepański, W. Ślęzak-Tazbir (eds.), *Człowiek – miasto – region. Związki i interakcje*, Warsaw: Wydawnictwo Naukowe Scholar.

Grazia Pittau M., 2005, 'Fitting regional income distributions in the European Union', *Oxford Bulletin of Economics and Statistics*, No. 67, pp. 135–161.

Grazia Pittau M., Zelli R., 2006, 'Empirical evidence of income dynamics across EU regions', *Journal of Applied Econometrics*, No. 21, pp. 605–628.

Janc K., 2006, 'Zjawisko autokorelacji przestrzennej na przykładzie statystyki I Morana oraz lokalnych wskaźników zależności przestrzennej (LISA) – wybrane zagadnienia metodyczne', in: T. Komorowski, Z. Podgórski (eds.), *Idee i praktyczny uniwersalizm geografii: geografia społeczno-ekonomiczna, dydaktyka*, *Dokumentacja Geograficzna*, No. 33, Warsaw: Instytut Geografii i Przestrzennego Zagospodarowania PAN, pp. 76–83.

Kopczewska K., 2006, *Ekonometria i statystyka przestrzenna*, Warsaw: CeDeWu.

Magrini S., 2004, 'Regional (di)convergence', in: V. Henderson, J. Thisse (eds.), *Handbook of Urban and Regional Economics*, Amsterdam: Elsevier.

Mankiw G.N., Romer D., Weil D.N., 1992, 'A contribution to the empirics of economic growth', *Quarterly Journal of Economics*, No. 107, pp. 407–437.

Młodak A., 2006, *Analiza taksonomiczna w statystyce regionalnej*, Warsaw: Difin.

Nowińska-Łaźniewska E., 2004, 'Relacje przestrzenne w Polsce w okresie transformacji w świetle teorii rozwoju regionalnego', *Prace Habilitacyjne*, Vol. 13, Poznań: Akademia Ekonomiczna w Poznaniu.

Olejniczak K., 2008, *Mechanizmy wykorzystania ewaluacji. Studium ewaluacji średniookresowych INTERREG III*, Warsaw: Wydawnictwo Naukowe Scholar.

Ponzio S., Di Gennaro L., 2004, 'Growth and Markov chains: an application to Italian provinces', *Second PhD Conference in Economics, Research in Economics: Aims and Methodologies*, 23–25 September, Universitá di Pavia, Italy.

Portnov Boris A., Schwartz M., 2008, 'On the relativity of urban location', *Regional Studies*, No. 42 (4), pp. 605–605.

Radosevic S., Pavitt K., 1999, 'Trade, technology and structural change in post-socialist countries: An introduction', in: D. Dyker, S. Radosevic (eds.), *Innovation and Structural Change in Post-Socialism: A Quantitative Approach*, Dordrecht: NATO Science Series, Kluwer Academic Publishers.

Quah D., 1996, 'Twin peaks: Growth and convergence in models distribution dynamics', *Economic Journal*, No. 106, pp. 1045–1055.

Sala-i-Martin X., 1990, *On Growth and States*, PhD dissertation, Harvard University.

Smętkowski M., 2007, 'Nowe relacje metropolia–region w gospodarce informacyjnej na przykładzie Warszawy i Mazowsza', in: G. Gorzelak (ed.), *Polska regionalna i lokalna w świetle badań EUROREG-u*, Warsaw: Wydawnictwo Naukowe Scholar.

Smętkowski M., 2008a, 'Intraregional cohesion in metropolitan regions – a challenge for regional policy', in: H. Jonuschat, M. Knollss (eds.), *Regional Transformation Processes in Central and Eastern Europe*, Berlin: Sekretariat für Zukunftsforschung.

Smętkowski M., 2008b, *Wymiary zróżnicowań przestrzeni gospodarczej Polski w ujęciu regionalnym i subregionalnym*, unpublished paper prepared as part of the project 'Socjologiczne i psychologiczne determinanty radzenia sobie z szybkimi zmianami'.

Yamamoto D., 2008, 'Scale of regional income disparities in the USA, 1955–2003', *Journal of Economic Geography*, No. 8, pp. 79–103.

Wójcik P., 2004, 'Konwergencja regionów Polski w latach 1990–2001', *Gospodarka Narodowa*, No. 11–12, pp. 69–86.

Annex 1. Factor analysis (N = 179) [country = 100] in 2005. Principal components (after Varimax rotation)*

Variables	Component 1 metropolitanism	Component 2 market services	Component 3 industrialisation	Component 4 public sector and productive agriculture
Explained variable	8.14	3.53	3.14	2.57
Share in explained variable	0.31	0.14	0.12	0.10
GDP per capita	**0.78**	**0.50**	0.16	0.05
Employment in agriculture [%]	–0.31	**–0.52**	–0.33	***–0.60***
Employment in industry and construction [%]	0.02	0.04	**0.80**	0.36
Employment in market services [%]	**0.71**	**0.50**	0.07	0.24
Employment in non-market services [%]	0.06	0.05	–0.20	**0.88**
Gross value added in agriculture [%]	**–0.43**	**–0.58**	–0.34	–0.11
Gross value added in industry and construction [%]	–0.03	–0.10	**0.96**	–0.08
Gross value added in market services [%]	**0.51**	**0.63**	**–0.47**	0.10
Gross value added in non-market services [%]	–0.08	**–0.45**	**–0.69**	0.13
Productivity in agriculture	0.05	–0.01	0.16	**0.82**
Productivity in industry and construction	**0.47**	0.30	0.51	–0.07
Productivity in market services	0.30	**0.54**	–0.21	0.25
Productivity in non-market services	**0.66**	0.15	–0.14	–0.21
Employment rate [%]	**0.64**	0.05	0.10	–0.30
Registered unemployment rate [%]	**–0.48**	–0.30	–0.23	0.32
Share of long-term unemployed	–0.02	**–0.57**	–0.29	0.02
Self-employment ratio**	**0.70**	0.22	0.16	0.08
Capital expenditure per capita	**0.81**	0.28	0.14	0.07
Foreign capital***	**0.63**	0.36	0.00	0.11
R&D expenditure per capita	**0.88**	0.11	–0.06	0.05
Share of employed in R&D	**0.86**	0.02	–0.06	0.13
Share of people with tertiary education	**0.83**	**0.40**	–0.05	0.10

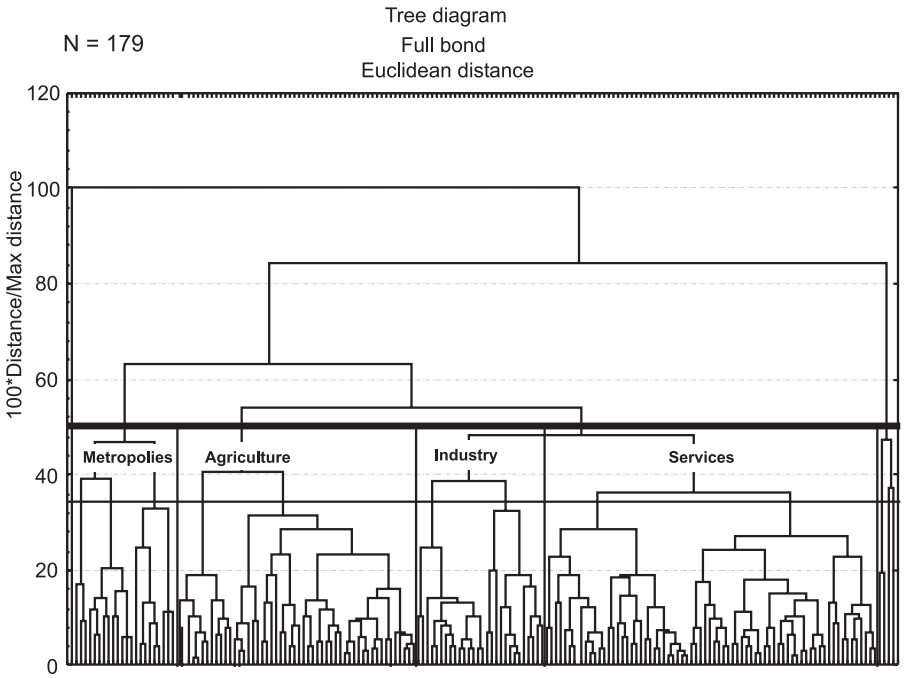
Number of university students per 1000 population	**0.76**	0.19	–0.02	0.06
Share of population using water network	**0.57**	–0.26	0.08	0.30
Share of population using sewage network	**0.62**	0.27	0.18	0.28
Tourists using accommodation per 1000 population	0.24	**0.63**	0.02	–0.10

* values with correlation higher than 0.4 are in bold; values with correlation higher than 0.6 are underlined

** number of natural persons running business activity

*** companies with foreign shareholdings per 1000 population

Source: prepared by the authors.



Annex 2. A dendrogram presenting the classification of regions by four factors (N = 179)

Source: prepared by the authors.