

RESEARCH ARTICLE



<https://doi.org/10.17059/ekon.reg.2023-4-20>

UDC index: 332.1; 330.34

JEL code: O18, R10

Maciej Stawicki , Agnieszka Wojewódzka-Wiewiórska  
Warsaw University of Life Sciences, Warsaw, Poland

Regional Differentiation of GDP at the NUTS-3 Level in Selected European Countries after their Accession to the European Union¹

Abstract. The issue of regional development is gaining importance due to the disproportions in its socio-economic aspects. The study aims to identify changes in economic development of selected countries which joined the European Union (EU) in 2004. The study examines small NUTS-3 (Nomenclature of territorial units for statistics) regions, which are territories determined for statistical purpose, that are less often analysed in the literature. Moreover, it focuses on spatial aspects, also considering rarely examined urban-rural typology of regions. The value and dynamics of gross domestic product (GDP) changes were presented using the Eurostat data for 2004–2019 on GDP per capita ratio (PPS) and GDP per capita (in % in relation to the EU-28 average). The analysis uses basic statistical and convergence measures; regional disparities were presented on graphs and maps. It was found that the examined EU countries are internally different in terms of economic development. The growth of GDP per capita was most dynamic in the Baltic States, Slovakia and Poland. The dynamics of GDP per capita in relation to the EU average was higher in regions – regardless of the type – where the value of GDP per capita was lower at the time of accession to the EU. In rural regions, the dynamics of development changes was smaller in relation to other types of regions. Convergence (both beta and sigma) is occurring at a very low level. Further research may focus on the reasons for enclosed disparities and factors of the ongoing changes.

Keywords: EU regions, EU enlargement, Central-Eastern Europe, urban-rural typology, diversification in development, GDP, dynamics, regional development, NUTS-3, regional policy, convergence

For citation: Stawicki, M., & Wojewódzka-Wiewiórska, A. (2023). Regional Differentiation of GDP at the NUTS-3 Level in Selected European Countries after their Accession to the European Union. *Ekonomika regiona / Economy of regions*, 19(4), 1224-1236. <https://doi.org/10.17059/ekon.reg.2023-4-20>

¹ © Stawicki, M., Wojewódzka-Wiewiórska, A. Text. 2023.

М. Ставицки , А. Воевудска-Вевюрска  

Варшавский университет естественных наук, г. Варшава, Польша

Различия в ВВП на уровне регионов NUTS-3 в ряде европейских стран после их вступления в Европейский союз

Аннотация. Вопрос регионального развития приобретает все большее значение в связи с усилением социально-экономических диспропорций. Цель исследования – выявить, как вступление в Европейский союз в 2004 г. повлияло на экономическое развитие ряда стран. Для этого были рассмотрены небольшие регионы NUTS-3, определенные в Номенклатуре территориальных единиц для целей статистики, которым в научной литературе уделяется не так много внимания. Для изучения пространственных аспектов регионы европейских стран были разделены на три группы: сельские, городские и промежуточные. Величина и динамика изменения валового внутреннего продукта (ВВП) были проанализированы на основе данных Евростата за 2004–2019 гг. по показателям ВВП по паритету покупательной способности (ППС) на душу населения и ВВП на душу населения (в процентах по отношению к среднему показателю ЕС-28). Были изучены базовые статистические показатели и показатели конвергенции; региональные различия были представлены на графиках и картах. Установлено, что исследованные страны ЕС различны по уровню внутреннего экономического развития. Наиболее динамичный рост ВВП на душу населения был зафиксирован в Словакии, Польше и странах Балтии. Динамика ВВП на душу населения по отношению к среднему показателю по ЕС была выше в регионах, где значение ВВП на душу населения было ниже на момент вступления в ЕС (независимо от типа региона). В сельских регионах динамика изменений развития была ниже по сравнению с другими типами регионов. Бета- и сигма-конвергенции слабо выражены. Дальнейшие исследования могут быть направлены на изучение скрытых различий и факторов происходящих изменений.

Ключевые слова: регионы ЕС, расширение ЕС, Центрально-Восточная Европа, типология городских и сельских регионов, диверсификация развития, ВВП, динамика, региональное развитие, NUTS-3, региональная политика, конвергенция

Для цитирования: Ставицкий, М., Воевудска-Вевюрская, А. (2023). Различия в ВВП на уровне регионов NUTS-3 в ряде европейских стран после их вступления в Европейский Союз. *Экономика региона*, 19(4), 1224–1236. <https://doi.org/10.17059/ekon.reg.2023-4-20>

Introduction

A characteristic feature of the socio-economic development process is its differentiation, also in the regional system (Churski, 2008). In the literature, both theoretical and empirical considerations regarding disproportions are based on the assumption of the negative impact of permanent and significant disparities on the development of an area in which they occur. This applies both to interregional analyses within a country and to comparisons between different states.

In the European Union (EU), internal disparities between member countries (Pawlas, 2015; Postiglione et al., 2020) as well as inequalities within individual countries (Borowiec, 2011) are still observed. The increasing differentiation of EU regions is one of the fundamental problems of the modern economy and is important not only from the national perspective, but also from the point of view of the EU as a whole. Regional development is a multifaceted process, in which the national context (Smętkowski & Wójcik, 2008), related to the development level and historical conditions should be taken into account. Individual

member states and their regions were characterised by differences in economic development at the time of accession to the EU. The development level may also be the consequence of the impact of many different instruments of EU policy (e. g. cohesion policy) or result from different handling of the high market competition associated with integration processes (opening of borders, etc.). Thus, it is justified to undertake comparative research on the level and changes in the development of regions in EU member states.

The EU tries to cope with the existence of developmental inequalities using various policy measures and tools (Pukelienė & Butkus, 2012; Greta & Tomczak-Woźniak, 2013; Pietrzykowski, 2019). However, the process of bridging disparities is very long-term; thus, quick results cannot be expected in this regard. Besides, one should be aware that it is simply impossible and pointless to completely level out the differences (Kudęłko, 2014).

The situation in Europe in terms of development disparities has changed with successive enlargements and changes in EU borders. In this paper, we focus on the study of the development of

countries that joined the EU in 2004. The enlargement included 10 countries and was the largest in history, resulting in an increase of 74 million people in the EU population¹, and the EU-15 became the EU-25. The EU enlargement that took place in 2004 included countries mostly with young democracies, immature market economies shaped since the early 1990s by political and economic transformations. Except for Cyprus and Malta, the remaining countries were part of the bloc of socialist countries, and Estonia, Lithuania, and Latvia were socialist republics of the Soviet Union until 1990. Due to these conditions, in 2004 these countries had a significantly lower level of economic development than the EU-15 countries.

This paper analyses the changes in Gross Domestic Product (GDP) in Purchasing Power Standards (PPS), a measure commonly used in empirical studies to determine economic growth and to establish measures describing the formation of economic processes, including measures of development (Surówka & Prędką, 2016; Simionescu et al., 2017; Simionescu, 2017; Jegorow, 2017; Surówka, 2018). This measure is widely used, although many of its shortcomings are pointed out. Among them, we can mention omitting some economic phenomena, such as undeclared production, subsistent agricultural production, voluntary activities, household labour, or taking them into account insufficiently (e. g., non-refundable transfers from the state budget to citizens). It also raises the question of whether it is possible to focus solely on economic issues when describing growth or development, while ignoring other issues such as environmental costs (Ciołek, 2017). Another issue is the inability to use this measure for the local level, as GDP is estimated for the country, NUTS-2 and NUTS-3 levels. Regardless of the many dilemmas concerning both the measurement and interpretation of GDP, it is the indicator based on which the allocation of European funds directed to EU regions under the cohesion policy is determined (Kudełko, 2014).

In the literature, consideration of economic development based on GDP is most often conducted at the country level (Halmai & Vásáry, 2010; Matkowski et al., 2013; Piotrowski, 2015; Strielkowski & Höschle, 2016; Jegorow, 2017) or NUTS-2 units (Górna & Górna, 2014; Józwiak, 2014). This research fills a gap in this regard, as it deals with the lower level, i. e. NUTS-3 regions, which

are less often analysed in the literature (Pukeliene & Butkus, 2012; Kotosz & Lengyel, 2017; Butkus et al., 2018; Postiglione et al., 2020). Thus, our analysis includes the smallest comparable units for which GDP indicator is available in order to show a better differentiation of development in small countries. Moreover, we focus on spatial aspects, also considering different types of regions: predominantly urban, rural and intermediate according to urban-rural typology (Wołkonowski, 2019). The examined period of 2004–2018 seems to be long enough and thus can show how the regions of selected countries (the so-called new Union) developed under the influence of EU policy instruments. This is important, especially in the context of reports on persistent developmental differences between EU member states at various levels of territorial division and indications that the desired effect of convergence, which is the subject of many studies (Próchniak & Rapacki, 2007; Kotosz & Lengyel, 2017; Simionescu, 2017; Butkus et al., 2018; Pietrzykowski, 2019; Postiglione, Cartone & Panzera, 2020) seems increasingly distant (Jegorow, 2017).

Therefore, the aim of the study was to identify and present spatial differentiation of the level and changes in economic development of regions (NUTS-3) in selected EU countries that joined the EU in 2004. The following research tasks were set: (1) to present spatial differences of GDP per capita in relation to the EU average in 2004 and 2018 in three types of NUTS-3 regions (urban, rural and intermediate); (2) to calculate and present changes of GDP per capita in relation to the EU average in the period 2004–2018 and sub-periods; (3) to identify regional convergence by types of NUTS-3 regions.

Taking into account the results of the research conducted so far, indicating in particular the faster development of EU countries with a lower level of development (Pawlas, 2015; Piotrowski, 2015; Simionescu, 2017) and a lower level of rural development compared to other areas (Shucksmith et al., 2009; Butkus et al., 2018), the research hypotheses have been formulated for NUTS-3 regions. Two following hypotheses were set: (1) the dynamics of GDP was higher in regions – regardless of the type – where the value of GDP per capita was lower in 2004 (in the year of joining the EU); (2) rural regions in all countries developed more dynamically than the urban ones taking into account GDP per capita in relation to EU average.

Methods

To determine the level of development, the value and dynamics of Gross Domestic Product

¹ Population Statistics. Detailed tables. (2006). Luxembourg: Office for Official Publications of the European Communities. Retrieved from: <https://ec.europa.eu/eurostat/documents/3217494/5685052/KS-EH-06-001-EN.PDF> (Date of access: 29.07.2021).

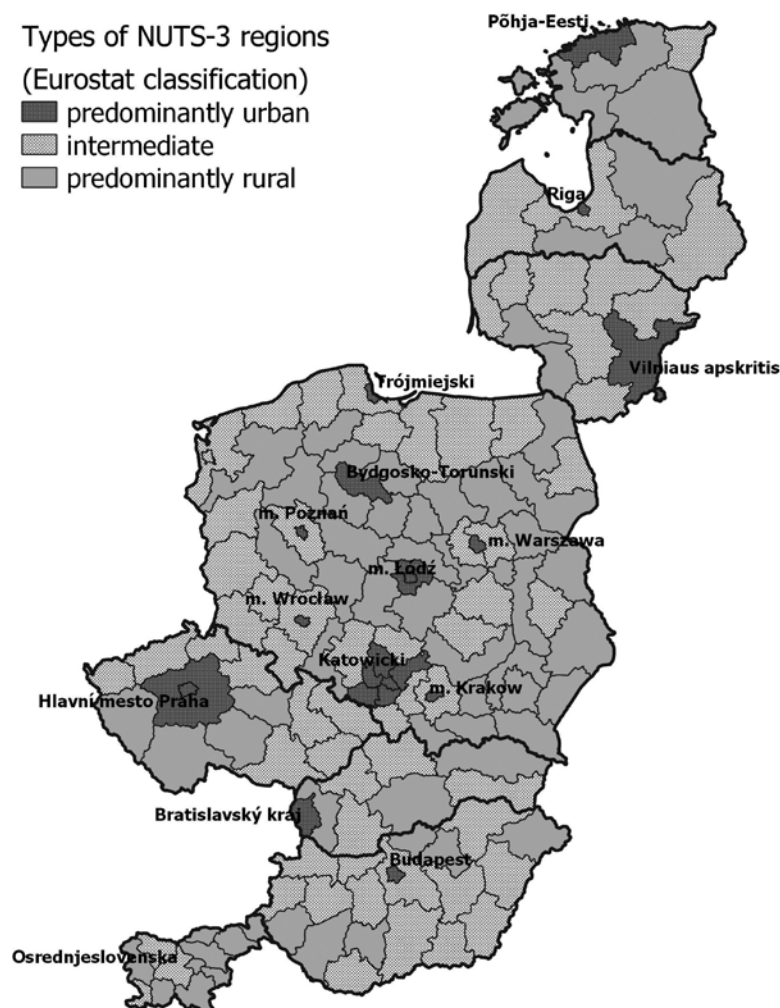


Fig. 1. Classification of NUTS-3 regions for selected EU countries (source: own elaboration based on urban-rural typology (Eurostat 2020))

(GDP) changes at the NUTS-3 level in selected EU countries were presented using GDP at current market prices (units: Purchasing Power Standard (PPS) per inhabitant in percentage of the EU average¹). GDP at current market prices in PPS per inhabitant (per capita) were used for β -convergence and σ -convergence analysis. The source of statistical data is Eurostat². According to Eurostat, the analysis takes into account the division of regions into rural, urban and intermediate (Fig. 1) and indicates changes in rural areas in comparison to other types of regions. On the basis of the population density and share of the population of NUTS-3 regions living in rural areas, they are classified as follows:

¹ Methodological notes on GDP per capita in PPS. Retrieved from: https://www.umar.gov.si/fileadmin/user_upload/publikacije/dr/07/ml/aMLBDPPPS.pdf (Date of access: 10.12.2021).

² Eurostat data on Gross domestic product (GDP) at current market prices by NUTS 3 regions. Retrieved from https://ec.europa.eu/eurostat/databrowser/view/NAMA_10R_3GDP/default/table. (Date of access: 10.12.2021). The most recent and complete data available was used.

- Predominantly urban — share of the population living in rural areas is below 20 %,
- Intermediate — share of the rural population is between 20 and 50 %,
- Predominantly rural — share of the population living in rural areas is higher than 50 %³.

In the paper, we will use the following names of region types: urban, intermediate and rural.

The research covers the period 2004–2018, from the accession to the EU to the last available and complete data on GDP for all analysed regions at NUTS-3 level at the time of study (only for half of selected countries data as of 2019 were available — see Fig. 3). For detailed studies, a group of 8 neighbouring countries was selected: Czechia (CZ), Estonia (EE), Latvia (LV), Lithuania

³ Eurostat urban-rural typology. Retrieved from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Territorial_typologies_manual_-_urban-rural_typology (Date of access: 22.12.2020). Based on the Eurostat approach, official names in local languages were used, exactly as they appear in international statistics; when possible, English names of regions were also given.

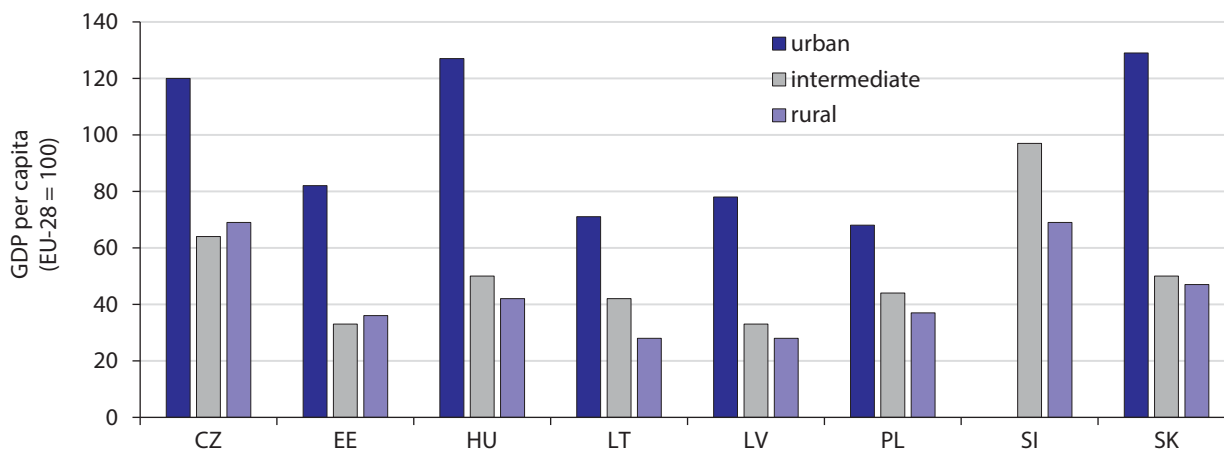


Fig. 2. Average GDP per capita by NUTS-3 regions by types (percentage of the EU average in 2004) (source: own elaboration based on data by Eurostat)

(LT), Hungary (HU), Poland (PL), Slovenia (SI) and Slovakia (SK). All these countries joined the European Union in 2004 together with Cyprus and Malta, which were excluded from the study, as too few NUTS-3 regions would make it impossible to draw conclusions about internal differences in these countries. Ultimately, the total number of analysed regions amounted to 148, of which 21 were urban regions, 66 intermediate regions and 61 rural regions (according to the presented urban-rural typology).

The following research methods were used to analyse the data: comparative analysis, statistical analysis, including the use of basic methods of descriptive statistics (Statistica software) to assess the changes in regional GDP. In order to determine the regional convergence, the method of analysis of regional beta and sigma convergence built into the R statistical package was used. The research results are presented graphically in the form of charts, choropleth maps (QGIS) and tables.

Results

Regional diversification and dynamics of GDP at NUTS-3 regions in the period 2004-2018

At the beginning of the study period, urban areas in all countries were characterised by a much higher GDP per capita than in other types of regions, but only in Czechia, Hungary and Slovakia this level has exceeded the EU average (Fig. 2). In Slovenia, where the capital region is classified as intermediate, this type of regions had the highest value of GDP.

At the time of accession, capital regions in the Baltic Countries had a significantly lower GDP than capitals in other countries (see Fig. 3), but after 13 years they almost reached the Slovenian or Hungarian level. The first place of Prague in 2004 was taken over in 2018 by Warsaw, and the dif-

ference between Bratislava and Budapest has increased significantly. Despite the general increase in GDP in relation to the EU average indicator, national differences between NUTS-3 regions have increased in all analysed countries, to the least extent in Slovenia and to the greatest extent in Poland.

In the year of accession to the EU, GDP per capita in most of analysed regions was below half of the EU average, only in Czechia and Slovenia the level of economic development was higher, and all NUTS-3 regions were above the EU average (Fig. 4).

Among all countries, the highest GDP was observed in the capital cities or other metropolitan regions, while in the Baltic States, these values were noticeably lower than in other states. In Lithuania and Estonia, it could be caused by the NUTS-3 division, as the regions contain not only the capitals but also suburbs and rural areas around. In 2018, most of the regions have improved their position relative to the EU average. More urban regions have exceeded the EU average in terms of GDP; these were the capital regions of Estonia, Latvia and Lithuania, and many urban regions in Poland (cities of Kraków, Wrocław, Poznań and Trójmiejski region) due to polycentric space system and dynamic development of these cities. Interestingly, one rural Polish region (Płock Subregion) was also found in this group – the reason is that Płock is the seat of the Polish company with the highest revenues – PKN Orlen (fuel industry).

Types of regions indicated in Figure 5 were divided on the basis of GDP value in 2004 and dynamics in 2004–2018, with median values as the border between low and high level. The largest group, represented by 35 % of regions (mainly in Poland and the Baltic States) is characterised by low initial level of GDP and high GDP dynamics.

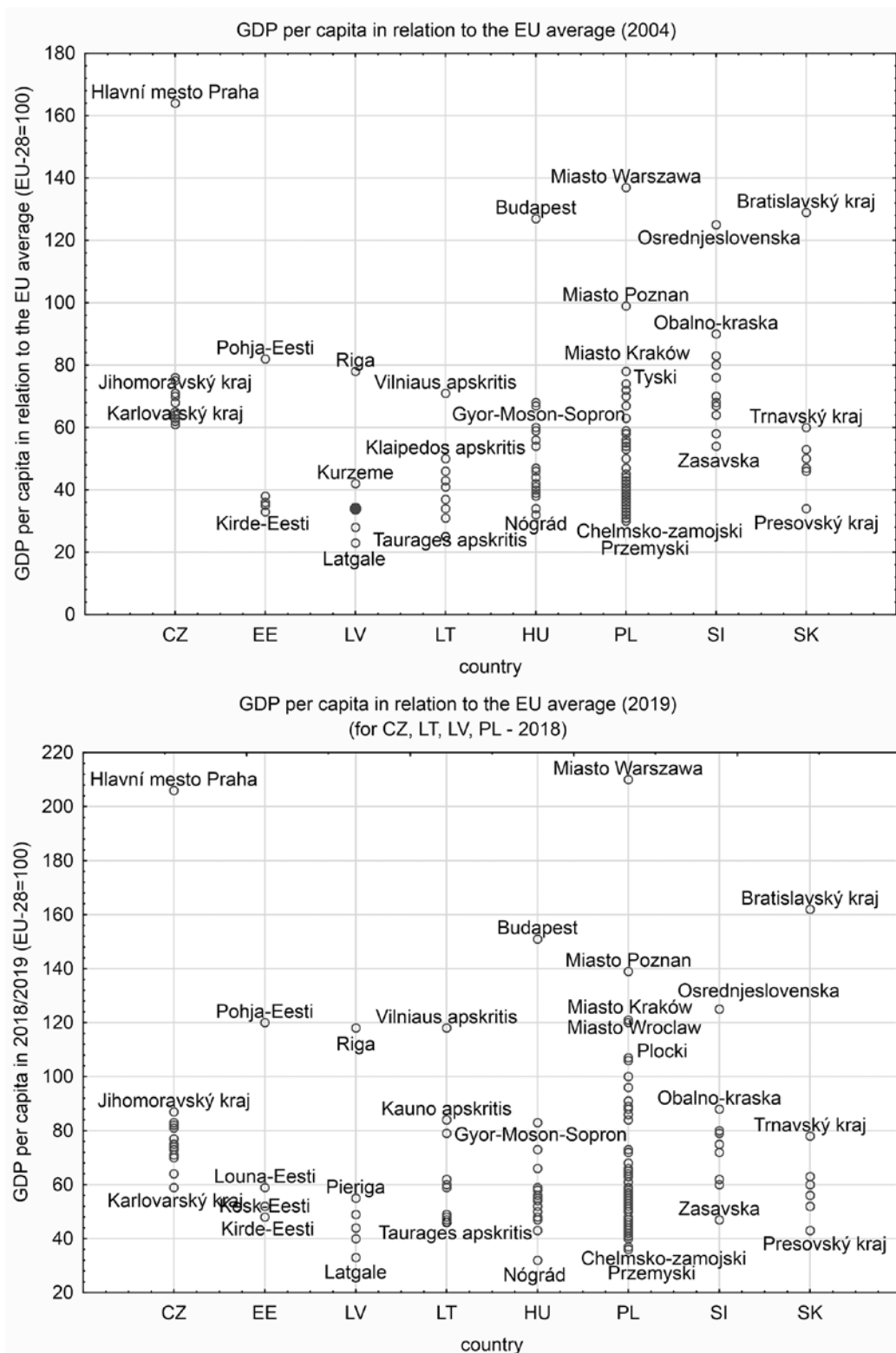


Fig. 3. GDP per capita in relation to the EU average in 2004 and 2018(19) (labels for selected NUTS-3 regions) (source: own elaboration based on data by Eurostat)

English names of some regions: Hlavní město Praha — Prague, Jihomoravský kraj — South Moravian Region, Karlovarský kraj — Karlovy Vary Region; Põhja-Eesti — North Estonia, Kesk-Eesti — Central Estonia, Kirde-Eesti — North-East Estonia, Lõuna-Eesti — South Estonia; Vilnius apskritis — Vilnius County, Kauno apskritis — Kaunas County, Taurages apskritis — Taurage County, Klaipėdos apskritis — Klaipėda County; Miasto Warszawa — city of Warsaw, Miasto Kraków — city of Kraków, Miasto Wrocław — city of Wrocław, Miasto Poznań — city of Poznań, Chelmsko-Zamojski — Chełm and Zamość Subregion, Przemyski — Przemysł Subregion; Osrednjeslovenska — Central Slovenia Statistical Region, Zasavska — Central Sava Statistical Region, Obalno-Kraška — Coastal-Karst Statistical Region; Bratislavský kraj — Bratislava Region, Trnavský kraj — Trnava Region, Prešovský kraj — Prešov Region

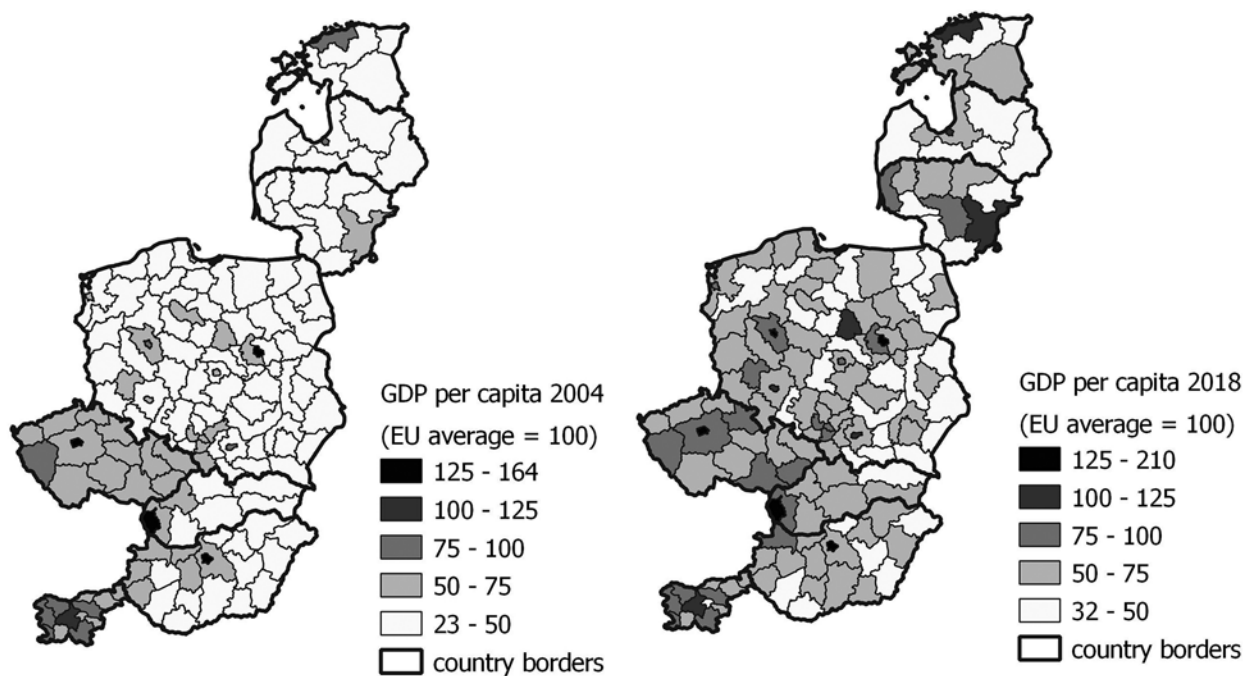


Fig. 4. GDP per capita in relation to the EU average in 2004 and 2018 (source: own elaboration based on data by Eurostat)

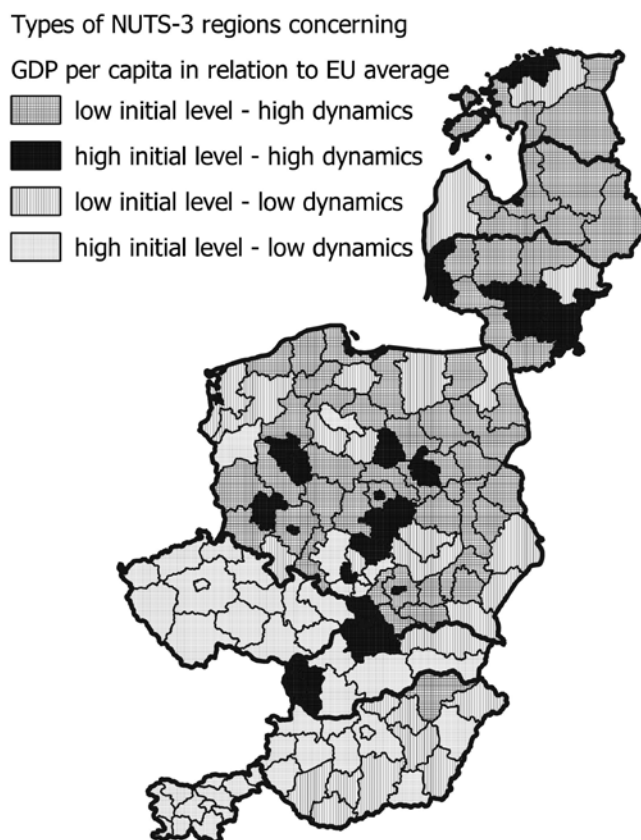


Fig. 5. Types of NUTS-3 regions based on GDP per capita level and dynamics in 2004–2018 (source: own elaboration based on data by Eurostat)

The mean value of GDP in relation to the EU average has increased in all types of regions but the dispersion measured by standard deviation increased only in the group of predominantly urban areas (Table 1). Pearson correlation coefficient between GDP in 2004 and GDP dynamics in 2004–

2018 was significant below 0.05 only in rural and intermediate regions; also, the value of r in these groups allowed us to conclude that the negative correlation was quite strong and therefore the less developed regions of these types were developing faster. In this way, based on spatial and correla-

Table 1

Main statistics on GDP level and dynamics by types of analysed NUTS-3 regions

Types of regions	GDP per capita in 2004 (EU average = 100)		GDP per capita in 2018 (EU average = 100)		Change in GDP 2004-2018 (%)		Pearson correlation coefficient between GDP in 2004 and GDP dynamics 2004-2018 (<i>r</i>)
	Mean	SD	Mean	SD	Mean	SD	
predominantly urban	80.2	33.1	110.7	44.2	35.0	16.9	-0.20*
intermediate	49.6	15.6	61.7	15.4	25.8	18.9	-0.51
predominantly rural	44.2	15.4	54.9	14.5	25.0	19.1	-0.61
total	51.7	22.2	66.4	28.3	26.8	18.9	-0.27

* correlation coefficient with significance above 0.05.

Source: own elaboration based on Eurostat data.

tion analyses, the first hypothesis was partly confirmed, as the dynamics of GDP was significantly higher only in intermediate and predominantly rural regions characterised by lower values of GDP per capita in 2004.

During the first 3 years after accession to the EU, the highest dynamics of GDP per capita was observed in Estonia and Latvia and capital Lithuanian region (Fig. 6), which was combined with a decline in the population of several percent (between 2–4.5) in these countries¹. Also western and north-western part of Slovakia (Bratislavský kraj and Žilinský kraj (Bratislava and Zlín Regions)) and Legnicko-Śląski (Legnica and Śląsk County) in Poland have increased the GDP level significantly, possibly due to foreign capital inflow and investments in automotive industry. During the 2007–2009 crisis (economic downturn), fast development in the Baltic regions turned out to be unstable; these countries were hit by the strongest slowdown in economic development. On the other hand, only few NUTS-3 regions in Poland, Slovakia and Czechia faced a decrease in GDP during the crisis. In the period 2009–2018, Lithuania, Latvia and Estonia returned to the path of growth, dynamic change took place also in two Hungarian regions: Fejér and Bács-Kiskun Counties, and 7 Polish regions, among others city of Wrocław, suburban regions: Wrocławski (Wrocław Subregion), Krakowski (Kraków Subregion), Warszawski Zachodni (Warsaw West Subregion) and Płocki (Płock Subregion) with strong fuel industry. During the whole period, some of the analysed regions were facing population changes: most often it was an increase in the population in urban and central regions located close to the capital cities (by 10–20 %) and decrease in the population in rural and peripheral areas (from 1–5 % in Poland or Hungary to 20–35 % in the Baltic States). This

process has affected the GDP per capita growth to a small extent, as GDP change was weakly correlated to the ongoing population changes: Pearson correlation coefficient was equal to -0.16 and statistically significant.

The dynamics of GDP in relation to the EU average significantly differed in NUTS-3 units analysed (Fig. 7).

The highest increase was observed in the Baltic States (in Lithuania in centrally located intermediate regions: Taurages apskritis (Taurage County), Kauno apskritis (Kaunas County), Siauliai apskritis (Siauliai County) and in urban Vilniaus apskritis (Vilnius County); in Latvia in the surrounding the capital Pierīga region; in Estonia in Lõuna-Eesti (South Estonia) rural region). Additionally, the highest increase was recorded in Poland, especially in the cities Kraków, Wrocław and around their metropolitan areas (Wrocław and Krakows Subregions), but also in urban Gliwicki (Gliwice Subregion), and predominantly rural Kaliski (Kalisz Region), Ostrołęcki (Ostrołęka Subregion), Siedlecki (Siedlce Subregion) and Rzeszowski (Rzeszów Subregion) NUTS-3 regions.

The dynamics of GDP in relation to the EU average in the period 2004–2018 differed between both countries and types of regions. In all countries, urban regions have improved their position in relation to the EU average (Fig. 8) to the greatest extent, in Slovakia by 40 pp. and in Poland and the Baltic States by 29–47 pp. In intermediate and predominantly rural regions, this progress was comparable and much lower than in urban areas (between 5 and 21 pp.). Therefore, the second hypothesis was not confirmed: rural regions in all countries developed less dynamically than urban ones taking into account GDP per capita in relation to EU average.

Convergence by types of NUTS-3 regions

In order to determine the occurrence of regional convergence in relation to the level of development (measured by GDP per capita in PPS),

¹ Population Statistics. Detailed tables. (2006). Luxembourg: Office for Official Publications of the European Communities. Retrieved from: <https://ec.europa.eu/eurostat/documents/3217494/5685052/KS-EH-06-001-EN.PDF> (Date of access: 29.07.2021).

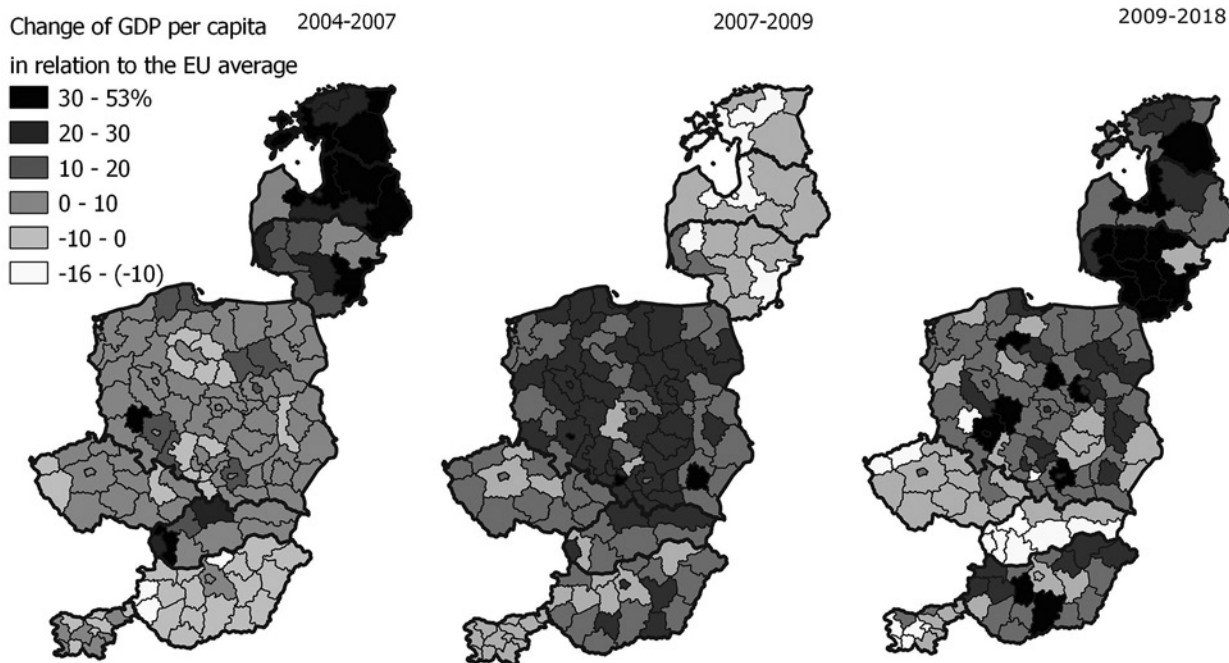


Fig. 6. Change in GDP per capita in relation to the EU average in sub-periods (source: own elaboration based on data by Eurostat)

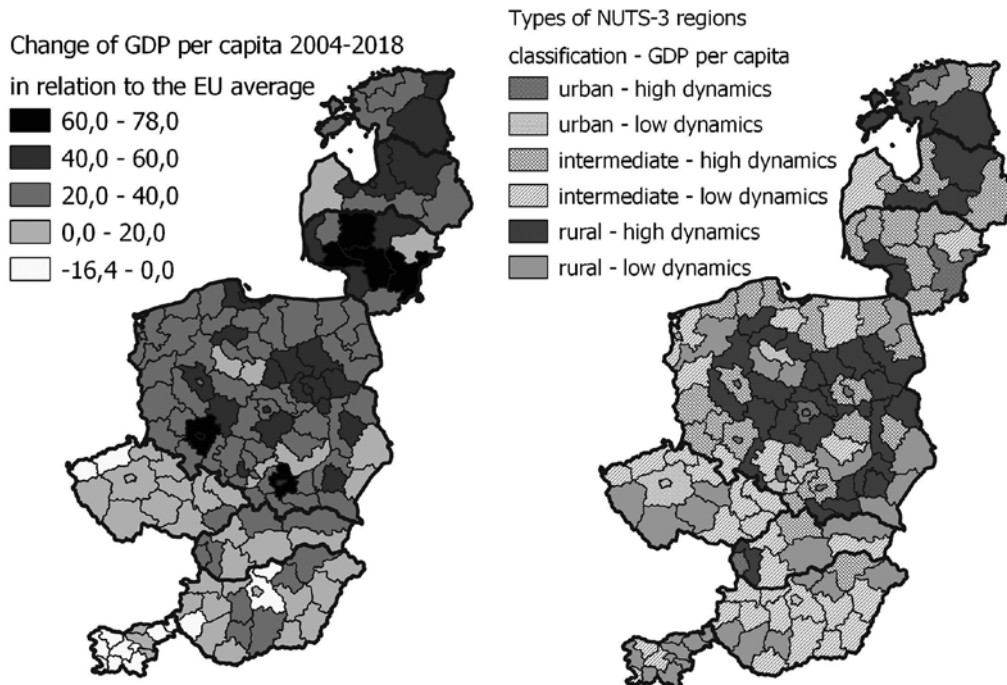


Fig. 7. Change in GDP per capita in relation to the EU average and NUTS-3 typology (source: own elaboration based on data by Eurostat)

absolute β -convergence and σ -convergence were used (Próchniak & Rapacki, 2007). The beta convergence occurs when less developed regions show a faster growth rate of GDP per capita than more developed regions. On the other hand, sigma convergence occurs when the differentiation of GDP per capita between the analysed regions decreases over time.

By using the method of analysis of regional beta and sigma convergence built into the R statistical package, the results of absolute and conditional

beta convergence were compared. In the conditional model, the explained variance increases from $R^2 \approx 0.13$ to $R^2 \approx 0.3$, indicating increased explanatory power of the model due to the added conditional variable. Both models are statistically significant, also β values are negative and significant ($p < 0.001$ in both cases). The «Intermediate» condition is significant ($t \approx -4.95, p < 0.001$) and negative, indicating that, on average, GDP per capita in urban regions grew more slowly than in intermediate regions. The same was true for the

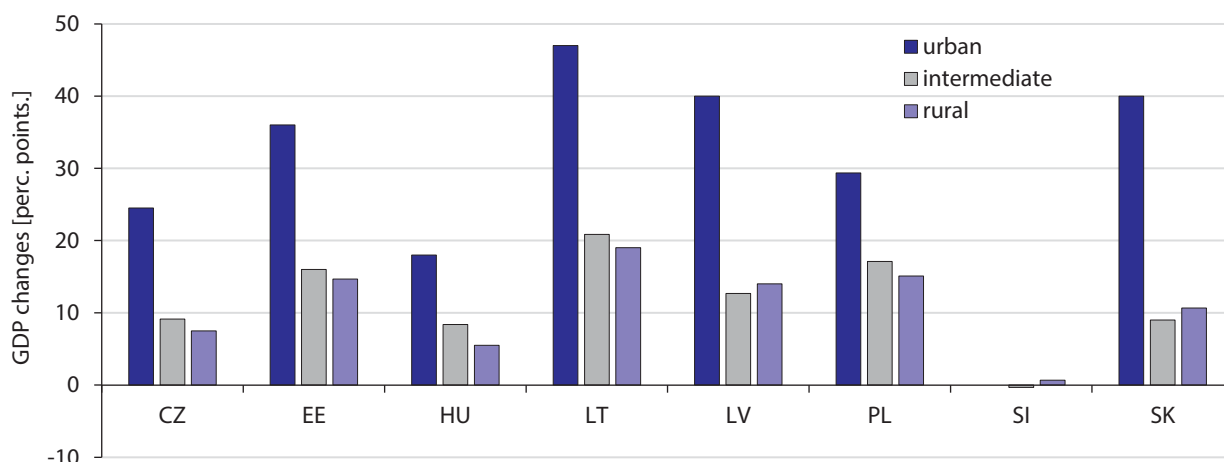


Fig. 8. Changes in GDP in relation to the EU average 2004–2018 [pp.] (source: own elaboration)

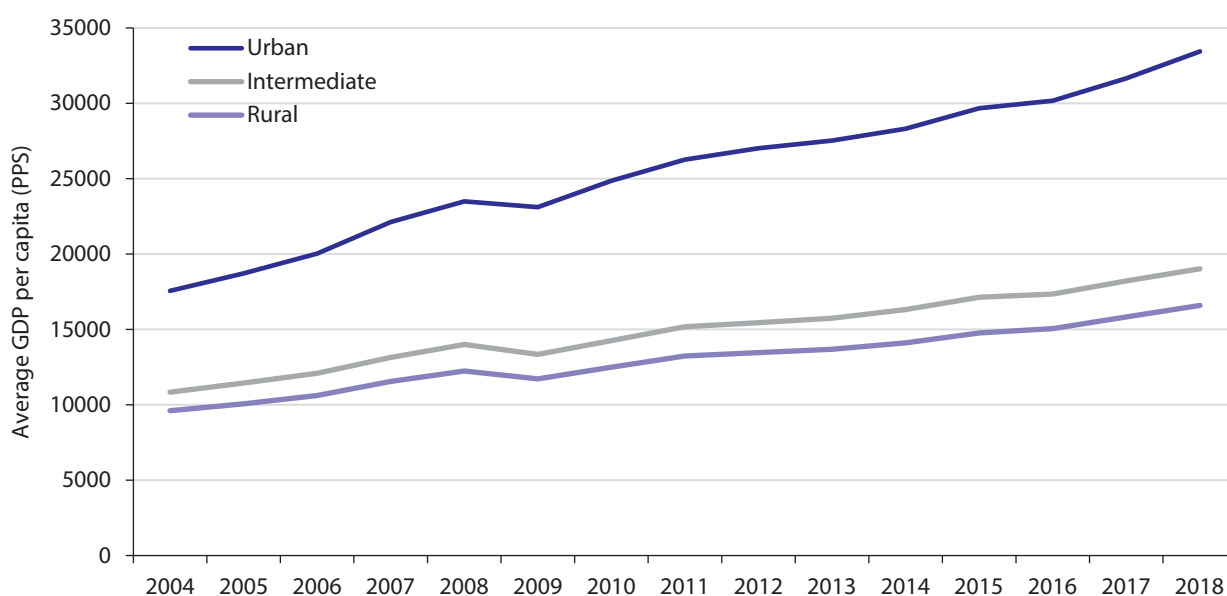


Fig. 9. Change in average GDP per capita (PPS) in different types of NUTS-3 regions of the countries that joined the EU in 2004 (excluding Malta and Cyprus) between 2004 and 2018 (source: own elaboration)

«Rural» condition ($t \approx -5.81$ and $p < 0.001$), which allows us to conclude that, on average, the value of GDP per capita in urban regions grew slower than in rural regions, but was characterised by higher dynamics than in intermediate regions. The rate of conditional convergence, represented by Alpha, shows a harmonisation of 0.23 % per year. The half-life value shows that, as a result of the beta convergence model, regional disparities in GDP per capita will halve in about 465 years. Based on the calculations, the trend regression model for sigma convergence was found to be significant ($F \approx 281.4$, $p < 0.001$). The slope is significant and negative ($b -0.0025$, $t \approx 8.37$, $p < 0.001$), indicating the presence of sigma convergence. So, based on the trend regression, we can conclude that the coefficient of variation decreases by only 0.0025 per year, which represents a small rate of income equalisation across regions.

Analysis of changes in average GDP per capita in urban, intermediate and rural regions, revealed weak convergence within these groups. The growth rate of GDP per capita in rural regions is at a similar level as that of urban regions (Fig. 9).

Discussion

This study revealed that rural NUTS-3 regions generally developed GDP per capita in relation to the average slower than urban ones in the period 2004–2018. Similar conclusions referring to rural regions were presented by Butkus et al. (2018), who stated that urban and capital regions are growing faster, while coastal and rural regions are lagging. However, when analysing detailed differences within the countries, we can see higher GDP dynamics in Poland and the Baltic States than in other 3 countries. It should be kept in mind that the average GDP as point of refer-

ence was changing since 2004, when the European Union has experienced two further enlargements. Bulgaria and Romania joined the EU in 2007, and the inclusion of Croatia took place in mid-2013, which has shaped regional variations in the study group (Butkus et al., 2018) and affected the average level of GDP in the analysed period. After accession to the EU, many countries (especially the Baltic) were facing decreasing number of inhabitants (for example, a decrease of 25 % was observed in Utena County in LT or Latgale in LV)¹, which was also one of factors affecting the GDP per capita indicator. Also, it is worth mentioning that the analysis of economic development solely based on changes in the value of GDP may be incomplete, as it does not take into account those factors that determine its level and the scale and direction of the transformations taking place, as Maciejewski (2017) pointed out. All countries that entered the EU in 2004 demonstrate a high pace of real GDP per capita growth, which confirms the standard analysis without spatial effects (Pietrzykowski, 2019). Our study also confirmed findings of Kilroy and Ganau (2020), who found out that low-income regions in the east of the EU have had a relatively high growth of GDP.

The results obtained here are in line with Abramovitz & David's (1994) findings that convergence generally occurs faster in less developed regions. Aspects related to the specificity of a given region should not be forgotten, as individual countries do not have the same speed of convergence (there are regions with a decrease in GDP), which can slow down the GDP per capita convergence process (Simionescu, 2017; Wołkonowski, 2019). Changes in the size and dynamics of GDP growth in the EU countries, identified in the study, should be linked to the occurrence of the economic crisis (Strielkowski & Höschle, 2016), which significantly reduced the potential development of these new countries (Halmai & Vásáry, 2010) and affected convergence processes in the short term ('convergence crisis'). Moreover, as Strielkowski and Höschle (2016) pointed out, in analyses of the convergence process within a single enlargement one has to take into account the level of homogeneity in terms of important economic variables affecting the development.

According to our research, it would take long time to even out regional differences in GDP per capita. The process of bridging development gaps is therefore a long one and thus neither quick re-

sults nor full equality should be expected. Besides, these goals are unrealistic and pointless as good living conditions are the most important objective (Kudełko, 2014). However, the presence of within-country disparities (Butkus et al., 2018) may hinder spatially balanced and sustainable development.

Conclusions

The calculations and analyses led to the following conclusions.

1. Analysed EU countries are internally differentiated taking into account GDP per capita (PPS) at NUTS-3 level in 2018, the smallest disparities exist in Lithuania and Estonia, the highest are in Poland and Slovakia. Countries joining the EU in 2004 also differ in terms of GDP per capita growth in 2004–2018, which was the most dynamic in the Baltic States, Slovakia and Poland. GDP per capita growth rate was slower in the countries that had higher GDP levels in 2004. The dynamics of development of individual countries and their regions varied over time. In the first years after accession to the EU, decreasing GDP in relation to the EU average was found in some Hungarian regions. On the other hand, during the 2007–2009 crisis, the Baltic and Slovenian regions have faced the highest decrease in GDP per capita.

2. Significant differences in the development of regions depending on the types were found. The growth of GDP in relation to the EU average (%) was most dynamic in urban regions (average change of 30 pp. in 2004–2018); in intermediate and rural regions, the growth was slower and similar (on average about 12 pp.). Regions with lower GDP in 2004 had generally higher GDP dynamics, significant correlation coefficient was highest in rural (–0.61) and intermediate regions (–0.51).

3. In the regions analysed, convergence within the type of regions occurs but at a very low level. This is confirmed by the results of the analyses carried out (beta and sigma).

The obtained results revealed the still existing internal differences in the economic development within the 8 selected EU countries. With a few exceptions, urban regions (especially with big cities) have a higher level and dynamics of GDP per capita, which is affected by many different factors related to intra- and interregional policies and the global situation. It is worth mentioning that the resilience to the global crisis of the analysed regions was very diverse as a result of domestic demand, risks related to the internationalisation of finance, links to foreign markets, etc., which may be considered as a topic for further research on the NUTS-3 level.

¹ Population Statistics. Detailed tables. (2006). Luxembourg: Office for Official Publications of the European Communities. Retrieved from: <https://ec.europa.eu/eurostat/documents/3217494/5685052/KS-EH-06-001-EN.PDF> (date of access: 29.07.2021).

References

- Abramovitz, M., & David, P. A. (1994). *Convergence and Deferred Catch-up. Productivity Leadership and the Waning of American Exceptionalism*. Final Draft: December 4, 1994. Retrieved from: <https://www.merit.unu.edu/publications/rm-pdf/1994/rm1994-027.pdf> (Date of access: 02.05.2021).
- Borowiec, J. (2011). *Ekonomia integracji europejskiej [Economics of European integration]*. Wrocław: Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu, 566. (In Polish)
- Butkus, M., Cibulskiene, D., Maciulyte-Sniukiene., A., & Matuzeviciute, K. (2018). What Is the Evolution of Convergence in the EU? Decomposing EU Disparities up to NUTS 3 Level. *Sustainability*, 10(5), 1552. <https://doi.org/10.3390/su10051552>
- Churski, P. (2008). *Czynniki rozwoju regionalnego i polityka regionalna w Polsce w okresie integracji z UE [Factors of regional development and regional policy in Poland in the period of integration with the EU]*. Poznań: Wydawnictwo Naukowe UAM, 527. (In Polish)
- Ciołek, D. (2017). Estimation of Gross Domestic Product in Polish Counties. *Gospodarka Narodowa [The Polish Journal of Economics]*, 3(289), 55–87. (In Polish)
- Górna, J., & Górna, K. (2014). Convergence or divergence of regions of Middle-East Europe after their accession to the European Union. *Acta Universitatis Lodzianis Folia Oeconomica*, 6(308), 31–49. (In Polish)
- Greta, M., & Tomczak-Woźniak, E. (2013). Problem of cohesion in new EU regional policy 2014–2020. *Optimum. Studia Ekonomiczne [Optimum. Economic studies]*, 4(64), 3–12. (In Polish)
- Halmaj, P., & Vásáry, V. (2010). Real convergence in the New Member States of the European Union (Shorter and longer term prospects). *The European Journal of Comparative Economics*, 7(1), 229–253.
- Jęgorow, D. (2017). Differences in the development of member states of the European Union (in the context of individual and domestic revenue). *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu [Research papers of Wrocław University of Economics]*, 498, 122–132. (In Polish)
- Jóźwik, B. (2014). Economic Convergence in the Regions of the European Union Member States in East-Central Europe. *Roczniki Ekonomii i Zarządzania [Annals of Economy and Management]*, 6(42), 93–113. (In Polish)
- Kilroy, A., & Ganau, R. (2020). *Economic Growth in European Union NUTS-3 Regions*. Policy Research Working Paper 9494. Finance, Competitiveness and Innovation Global Practice, World Bank Group.
- Kotosz, B., & Lengyel, I. (2017). *Regional growth and convergence of the Nuts 3 regions of Eastern European countries*. Paper presented at the 57th ERSA Congress: Social Progress for Resilient Regions. Groningen, 29 August — 1, September 2017.
- Kudęłko, J. (2014). Developmental Conditions of Region Sine the Context of the Assumption of European Cohesion Policy for the Period 2014–2020. *Studia Ekonomiczne*, 166, 118–127. (In Polish)
- Maciejewski, M. (2017). The problems of the economic development of the European Union member states. *Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach*, 319, 117–126. (In Polish)
- Matkowski, Z., Próchniak, M., & Rapacki, R. (2013). New and Old EU Countries: Convergence or Divergence? In: *Prace i Materiały Instytutu Rozwoju Gospodarczego SGH, 91 Badania koniunktury — zwierciadło gospodarki. [Papers and Studies of RIED SGH]* (pp. 63–98). Część II. (In Polish)
- Pawlas, I. (2015). Socio-economic development of European Union countries — comparative analysis. *Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach*, 228, 61–75. (In Polish)
- Pietrzykowski, M. (2019). Convergence in GDP per capita across the EU regions — spatial effects. *Economics and Business Review*, 5(19), 64–85. <https://doi.org/10.18559/eb.2019.2.4>.
- Piotrowski, J. (2015). Convergence of Poland's Economy towards EU Developed Member States. *Unia Europejska*, 1(230), 11–20. (In Polish)
- Postiglione, P., Cartone, A., & Panzera, D. (2020). Economic Convergence in EU NUTS 3 Regions: A Spatial Econometric Perspective. *Sustainability*, 12(17), 6717. <https://doi.org/10.3390/su12176717>
- Próchniak, M., & Rapacki, R. (2007). Beta and Sigma Convergence in the Post-Socialist Countries in 1990–2005. *Bank i Kredyt*, 2007, 42–60. (In Polish)
- Pukelienė, V., & Butkus, M. (2012). Evaluation of regional — convergence in EU countries NUTS3 level. *Ekonomika*, 91(2), 22–37.
- Shucksmith M., Cameron S., Merridew T., & Pichler F. (2009). Urban-Rural Differences in Quality of Life across the European Union. *Regional Studies*, 43(10), 1275–1289. <https://doi.org/10.1080/00343400802378750>.
- Simionescu, M. (2017). The GDP per Capita Convergence in the European Union. *Academic Journal of Economic Studies*, 3(1), 81–87.
- Simionescu, M., Lazányi, K., Sopková, G., Dobeš, K., & Balcerzak, A. (2017). Determinants of Economic Growth in V4 Countries and Romania. *Journal of Competitiveness*, 9(1), 103–116. <https://doi.org/10.7441/joc.2017.01.07>
- Smętkowski, M., & Wójcik, P. (2008). *Regiony w Europie Środkowo-Wschodniej: tendencje i czynniki rozwojowe [Regions in Central and Eastern Europe: development trends and factors]*. Warsaw: Centre for European Regional and Local Studies, Warsaw University, 123. (In Polish)

Strielkowski, W., & Höschle, F., (2016). Evidence for economic convergence in the EU: The analysis of past EU enlargements. *Technological and Economic Development of Economy*, 22(4), 617–630. <https://doi.org/10.3846/20294913.2014.890138>.

Surówka, A. (2018). Gross Domestic Product per capita as a determinant of an economic development of Polish and Lithuanian regions — comparative analysis in a dynamic approach. *Nierówności Społeczne a Wzrost Gospodarczy [Social inequalities and economic growth]*, 55(3), 187–198. <https://doi.org/10.15584/nsawg.2018.3.12>. (In Polish)

Surówka, A., & Prędką, P. (2016). Convergence Analysis of the Phenomenon Eastern Polish Provinces and the Country. In: L. Kowalczyk, F. Mroczko (Eds.), *Innowacyjność to rozwój. Zarządzanie operacyjne w teorii i praktyce organizacji biznesowych, publicznych i pozarządowych. T. 39(3) [Innovation is development. Operations management in the theory and practice of business, public and non-governmental organizations. Vol. 39(3)]* (pp. 209–220). Prace Naukowe Wyższej Szkoły Zarządzania i Przedsiębiorczości z siedzibą w Wałbrzychu. (In Polish)

Wołkonowski, J. (2019). The Beta-Convergence of the EU-10 Countries and Regions in the Years 2004–2015. *Comparative Economic Research. Central and Eastern Europe*, 22(2), 87–104. <http://doi.org/10.2478/cer-2019-0014>.

About the authors

Maciej Stawicki — Dr. Sci. (Econ.), Institute of Economics and Finance, Warsaw University of Life Sciences (SGGW); Scopus Author ID: 57191274638; <http://orcid.org/0000-0002-4488-6136> (166, Nowoursynowska St., Warsaw, 02-787, Poland; e-mail: maciej_stawicki@sggw.edu.pl).

Agnieszka Wojewódzka-Wiewiórska — Dr. Sci. (Econ.), Institute of Economics and Finance, Warsaw University of Life Sciences (SGGW); Scopus Author ID: 57196237117; <http://orcid.org/0000-0003-2393-0430> (166, Nowoursynowska St., Warsaw, 02-787, Poland; e-mail: agnieszka_wojewodzka@sggw.edu.pl).

Информация об авторах

Ставицки Мацей — доктор экономических наук, Институт экономики и финансов, Варшавский университет естественных наук; Scopus Author ID: 57191274638; <http://orcid.org/0000-0002-4488-6136> (Польша, 02-787, г. Варшава, ул. Новоурсыновска, 166; e-mail: maciej_stawicki@sggw.edu.pl).

Воевудска-Вевюрска Агнешка — доктор экономических наук, Институт экономики и финансов, Варшавский университет естественных наук; Scopus Author ID: 57196237117; <http://orcid.org/0000-0003-2393-0430> (Польша, 02-787, г. Варшава, ул. Новоурсыновска, 166; e-mail: agnieszka_wojewodzka@sggw.edu.pl).

Дата поступления рукописи: 07.11.2021.

Прошла рецензирование: 09.06.2022.

Принято решение о публикации: 19.09.2023.

Received: 07 Nov 2021.

Reviewed: 09 Jun 2022.

Accepted: 19 Sep 2023.