C O P E

Member since 2018
JM13708

# In Search of Income Convergence and Ideal Distribution – the Case of European Union Regions

Beata Bal-Domańska  iD  https://orcid.org/0000-0003-0395-4259

Assoc. Prof., Wroclaw University of Economics and Business, Poland, e-mail: beata.bal-domanska@ue.wroc.pl

## Abstract

In the field of economics and regional research, income convergence between countries and regions has been analysed since the 1980s. At the beginning of the 21$^{st}$ century, a number of articles addressing income convergence of European Union (EU) countries were published, which was among many topics related to the accession of 12 countries to the EU between 2004 and 2007. The inspiration for this study was the variety of conclusions about convergence in various groups of EU regions.

The purpose of this article is to discuss the existing knowledge on the economic convergence of the EU regions and to expand it with the research results covering the period 2000–2021. The results confirm the convergence of incomes within EU regions, which translates into a change in the geographical distribution of income in the EU, slowly blurring the boundaries between the regions of the 2004/2007 enlargement countries and the countries located in the west and south of the EU. At the same time, no convergence within most of the biggest EU countries nor regions with well-developed knowledge-intensive sectors, were recorded.

Keywords:      economic growth, sigma convergence, beta convergence, spatial autocorrelation, EU regions

JEL:             O11, O14, O47

# Introduction

One of the most closely monitored trends in economics is the pace of economic growth. Given that the basic measure of an economy's size is GDP (gross domestic product), it follows that the history of growth is the history of GDP Coyle (2014). By observing GDP we can identify periods of strong growth and significant slowdown. As a result, some economies are strengthening their position as global leaders while others are still trying to improve their economic fate. The inspiration for this study was the myriad conclusions about convergence in various groups of regions and levels of aggregation regarding territorial units, i.e., the state, region, and local units (a discussion on convergence research can be found in, among others, Johnson, Durlauf, and Temple (2005)). Such knowledge warrants a systematic organisation and a perspective approached with a degree of detachment.

When analysing income convergence in particular countries, it is crucial to consider situations when the assessment of a country's economy is influenced by the economies of regions with highly diversified economic conditions. The most developed regions of the European Union (EU), for instance, become part of a larger entity, and their competitive advantages are incorporated into a larger economic system, which, as a whole, may present different characteristics. This phenomenon is well known in spatial econometrics as MAUP (modifiable areal units problem) (Gehlke and Biehl 1934; Openshaw 1984; Wong 2004). As territorial units expand, the disparities between territories tend to blur. A good example of this is the assessment of the EU regions in terms of GDP pc (per capita). For years, Luxembourg[1] has been ranked first, among the EU countries with a value of 78,500 (pc PPS; per capita purchasing power standards) (year 2020). By comparison, in the ranking of NUTS–3 regions, Luxembourg comes 13th; first place goes to Wolfsburg, Kreisfreie Stadt (155,400 pc PPS). Overall, Luxembourg is preceded by eigh NUTS–3 regions from Germany, two form Ireland, and two from France.

The purpose of this article is to assess the income convergence of the EU at different levels of territorial units in the 21st century (2000–2021). The study is based on the assumption that common EU laws and values foster the reduction of disparities in regional development. The following research questions were formulated: (1) Do beta and sigma convergence occur simultaneously at all levels of the EU territorial units? (2) Is convergence observed within the regions that make up the largest EU economies (Germany, France, Spain, Italy, and Poland)? (3) Do convergence clubs, defined based on the level of innovation in the economy (reflecting a specific structure of human capital resources),

---

1 Luxembourg in the NUTS classification appears as a country (code: NUTS 0), major socio-economic regions (code: NUTS 1), basic regions for the application of regional policies (NUTS 2), and small regions for specific diagnoses (NUTS 3).

offer a better understanding of economic growth processes in the EU regions? These approaches are consistent with growth models that feature multiple steady states.

The analysis of convergence will be conducted for all the EU countries, NUTS–2 and NUTS–3 regions, as well as groups of regions defined by national borders or convergence clubs, which are identified based on the level of knowledge and technology-based economic structure.

## Income convergence

Income convergence is often discussed in research that addresses the neoclassical growth model with exogenous technical progress (Solow 1956; Swan 1956) or its extended version with human capital (Mankiw, Romer, and Weil 1992). This concept involves regions with initially lower levels of income per capita achieving higher economic growth rates than regions with higher output per capita during the base period. This process is referred to as the catch-up effect.

The neoclassical growth theory explains the accelerated growth of underdeveloped regions through declining marginal factor productivity. A scarcity of capital is associated with a higher rate of return on capital, which encourages capital transfer from richer to poorer regions, thereby stimulating economic growth. In addition, less developed regions can more easily increase the technical reinforcement of labour. Meanwhile, in developed regions, a significant portion of investment goes into maintaining a large stock of tools (Czarny 2000).

A condition for the pursuit of convergence is for economies to have a common steady state where per capita output, capital stock, and consumption grow at a common constant rate, equalling the exogenously given rate of technological progress. It involves similar conditions and parameters that characterise a given group of economies where convergence is expected. This applies to short-term development, wherein capital accumulation can prompt convergence towards a common steady state. Eventually, economies reach the latest or most advanced stage of development, known as the cutting edge, where growth rates are zero. However, if human capital accumulation and related knowledge are present in the economy, a shift of a higher steady state occurs, propelled by the involvement of human capital capable of fostering innovations.

The use of knowledge and innovation resources in production yields endogenous technical progress, a result of deliberate investment in scientific and technical knowledge (Romer 1986; 1990) or human capital (Lucas 1988), increasing production efficiency. The long-term accumulation of human capital can lead to a new steady state (Cowen and Tabarrok 2015). Bernard and Jones (1996) and Bianco (2010) argued

that empirical analyses of convergence exaggerate the role of capital accumulation in generating convergence at the expense of technology diffusion, i.e., the endogenous or Schumpeterian driver of growth.

Both the free flow of capital and the absence of restrictions on the diffusion of technical progress between regions serve as catalysts for convergence (Tokarski 2005). Physical and human capital in the region are prerequisites for absorbing and creating acquired technical progress, e.g., in the form of innovations. As Islam (1995) indicated, "persistent differences in technology level and institutions are a significant factor in understanding cross-country economic growth. It becomes clear that if there had been no such differences, and countries differed only in terms of capital per capita, convergence would have proceeded at a faster rate". Both physical and human capital are subject to diminishing returns (Cowen and Tabarrok 2015). While knowledge absorption appears to be an acceptable developmental incentive for low-level economies, moving to higher levels requires the capacity for creative work and the development of primary innovations characteristic of the leadership position in a given industry.

The concept of endogenous growth is consistent with the idea of convergence clubs. Following Galor (1996) and Johnson, Durlauf, and Temple (2005), if initial conditions play a role in shaping long-run outcomes, and countries with similar initial conditions exhibit similar long-run outcomes, then one can speak of convergence clubs. If two regions with different initial levels of income (development) pursue different steady states, they can achieve similar or even higher growth levels. Convergence clubs suggest that convergence occurs between regions equipped with immobile production factors to a similar extent, leading to long-term steady states. Regions grouped within individual convergence clubs may be approaching their long-term development paths, while simultaneously, divergence may occur between these clubs (Tokarski 2005).

This paper uses the concept of β (beta) and σ (sigma) convergence. β-convergence, also known as the catch-up effect, focuses on achieving higher rates of economic growth by regions with lower initial levels of development than the regions initially characterised by higher productivity (development). Meanwhile, σ convergence is defined as the equalisation of income levels between regions. σ-convergence is typically identified by examining the standard deviation of the logarithms of labour productivity (or GDP pc) between regions over successive periods. When considering these two types of convergence, it should be pointed out that while β-convergence is a necessary condition for σ-convergence, it is not sufficient (Sala-i-Martin 1996).

# An overview of income convergence studies

As the source literature suggests, Baumol (1986) was one of the earliest studies to address absolute convergence in terms of productivity equalisation or the level of economic development measured by GDP pc. He confirmed the productivity convergence for 16 industrialised world economies between 1870 and 1979 (the Baumol-style OLS regression) and referred to these 16 industrialised economies as a convergence "club".

The literature review provides a general reflection that economic convergence is frequently observed across countries and regions (Schmidt 1997; Próchniak 2006; Batóg 2010; Bal-Domańska 2014; Chocholatá and Furková 2017), with the rate of convergence usually remaining at approx. 2–3% (Quah 1996). The research emphasised the sensitivity of convergence results to the assumptions made and the diversity of the analysed objects (Batóg 2010). In addition to sampling, contemporary authors also point out differences in the rate of convergence estimates that result from the method of data analysis (Caselli, Esquivel, and Lefort 1996; Bond, Hoeffler, and Temple 2001; Ciołek 2003), as well as differences in the data sets (Bernardelli, Próchniak, and Witkowski 2018).

Some studies assessed convergence at different levels of aggregation. For example, Gorzelak (2009) highlighted the difficulties in achieving convergence, noting that concentration often prevails over deconcentration between the two poles that represent opposing development trends. Some have indicated the increase in intra-regional disparities in EU countries, both those that show small income spreads (e.g., Sweden, Denmark, and the Netherlands) and those with traditionally large inter-regional differences (e.g., Italy and Hungary). A summary of research findings for groups of EU countries is available in the source literature (see, e.g., Batóg 2010; Kusideł 2013; Glawe and Wagner 2021). Most studies confirm convergence, although some highlight that convergence following a given model structure can only be confirmed for selected regions. For example, Baumont, Ertur, and Le Gallo (2003) demonstrated convergence in the spatial regimes model only for regions in southern Europe. The rate of income convergence across EU regional/country economies varies from 1% to 3%[2].

A frequent thread in convergence analyses is assessing the rate of convergence among groups of regions often conceptualised as clubs of regions that share common characteristics that approximate their development models. One such common thread is the division of countries into the "old" EU (i.e., the former EU15) and the "new" (after the enlargement in 2004 and 2007 (EU10/EU12)). The 2004 enlargement was noteworthy for the EU, as it included a large number of new countries, of which eight

---

2   The findings differ both in terms of estimates for the rate of convergence and the quality of meeting the model assumptions. A similar growth rate was also indicated for the rate of convergence of the European economies in terms of manufacturing productivity (Petrović and Gligorić Matić, 2023). The exception is the research conducted by Bernardelli, Próchniak, and Witkowski (2018), who presented findings at the level of 17.6% for the period 1996–2016.

had belonged to the communist bloc. It constituted a major challenge politically, organisationally, and economically. As Andor (2019) noted, "[The] 2004 enlargement was different because the income disparity between new and old Member States was much more significant than in any previous round. As a result, great imbalances have developed: capital flowed largely from West to East, while workers went mainly from East to West."

One frequent conclusion in convergence research into these two groups of countries is that convergence is faster in the new EU countries, and it favours the emergence of income beta convergence within the EU (Diaz del Hoyo et al. 2017; Cabral and Castellanos-Sosa 2019; Demertzis, Sapir, and Wolff 2019). Similar conclusions were reached not only regarding GDP pc but also household income (Muszyńska, Oczki, and Wędrowska 2018). However, Ingianni and Žd'árek (2009), who covered the period 1995–2006, confirmed β but not σ convergence. They also stated that the EU8[3] countries made rapid progress both in narrowing the gap and reducing income divergence within the group but not necessarily against the EU15.

The division into EU15 and EU10/EU12 does not exhaust the possibilities of searching for development patterns in EU regions. In particular, nowadays, almost 20 years after Central and Eastern European countries joined the EU, it is worth paying attention to the development models. Bal-Domańska (2011; 2016) has presented comprehensive analyses that considered the determinants of endogenous growth by: 1) including differences in the level of human capital in the model, and 2) dividing regions into clubs that have similar knowledge structures and uses of technology in the economy. Considering both human capital and knowledge accumulation in the models allows the long-term steady state to be shifted to a higher level. The inclusion of variables that represent human capital in the model structure allows differences in regional potential in workers' education and experience to be expressed. On the other hand, the division of economies into clubs with similar structures of knowledge sectors makes it possible to identify clubs with similar development models; thus, they are capable of pursuing the same steady state. The key findings from these studies, which covered the period between 2000 and 2011, can be summarised as follows:

1. Among the classifications grouping regions by criteria, the most robust models were developed for regions characterised by a significant presence of knowledge-intensive sectors, such as high and medium high-technology manufacturing, as well as knowledge-intensive services.

2. Regions with a lower share of knowledge sectors revealed clear unconditional beta convergence and, consequently, also σ-convergence.

3  EU8 – countries involved in the fifth European enlargement (year 2004), with the exception of Cyprus and Malta.

3. The results support the validity of the contradictory concept proposed by Gerschen-kron (Barsby 1969; Kubielas 2009), which highlights the privileged role of regions with a high level of knowledge capital accumulation. These regions are, therefore, capable of creating and absorbing technology better, and as a result, they can achieve higher levels and growth rates of labour productivity.

4. Assessment of regional cohesion

Achieving territorial cohesion, understood as the absence of significant development disproportions in a functionally related area while allowing the existence of various local specialisations, remains one of the goals of regional policy. When formulating the purpose of the analysis presented below, the following assumptions were adopted:

- Implementing international standards and laws, as well as establishing a single market to guarantee the four freedoms (goods, capital, services, and people), constitute strong arguments for joint analyses of all EU regions. As Martin, Velazquez, and Funck (2001) stated, the main effect of European economic integration has been the diffusion of technologies, leading to converging capital/labour relations, which in turn has fostered real convergence.

- The existence of autonomous countries within the EU, which operate in accordance with unique historical, legal, structural, and political conditions, forms the basis for verifying the idea of regional convergence within their internal borders.

- As the size of a country increases, the likelihood of internal developmental dispro-portions increases. The territorial cohesion of higher-level units depends on the de-velopment level of the lower-level units. This aspect can be associated with the Fried-man's Core-Periphery Model (1963). Based on the spatial distance from the core, it distinguishes four stages of regional development: from the initial state of inequali-ties (pre-industrial), disparities are reduced (transitional and further industrial stages with regional sub-centres) to a functionally integrated urban system (post-industrial).

- According to Kapeller, Gräbner-Radkowitsch, and Heimberger (2019), technological capabilities, which play a decisive role in a country's long-term economic develop-ment, continue to be very unevenly distributed among the Eurozone countries (this can be generalised for all EU economies). These inequalities in supplying regions with growth determinants constitute an important premise for defining convergence clubs striving for their proper steady state;

- Kijek, Kijek, and Matras-Bolibok (2022) stated that although technological progress and innovation diffusion create important macroeconomic benefits at the country level, they also make regional convergence even more challenging (Chapman and Meliciani 2017; Pina and Sicari 2021) as the concentration of knowledge-intensive

sectors gradually escalates at the regional level. Therefore, even though cross-country disparities may decrease, within-country divergence remains constant or even increases.

The presence of positive trends favouring the convergence of income levels in the EU economies carries the following implications:

1. There is a decrease in diversification in the value of generated income across different aggregation levels (NUTS–3 regions, NUTS–2 regions, countries), i.e., σ convergence.

2. Reducing differences in income between territorial units is possible in the presence of β convergence.

3. Political, historical and structural determinants imply a strong relationship between regions' level of economic development and their location. Clusters that bring together a large number of regions characterised by a similar, difficult economic situation enhance regional development disproportions. However, supporting regional and local economic centres, as well as their ability to create positive external effects (diffusion, transfer) at every level of territorial aggregation, strengthens β convergence and, consequently, σ convergence.

If we approach these processes as mutually reinforcing complementary phenomena suggests that the causal nature should be attributed to the factors listed in Implication 3 above. Creating appropriate political and legal conditions for the development of entrepreneurship, including the increase in its effectiveness, considering the potential inherent in individual regions, constitutes a developmental stimulus that may lead to the emergence of β convergence and, as a result, σ convergence.

## Data and research procedure

The data come from the Eurostat database. Income was expressed by the value of gross domestic product per capita in the purchasing power standard (GDP pc in PPS). PPS is an artificial common reference currency unit developed by Eurostat. It expresses the same amount of goods and services in each country, allowing significant comparisons to be made in the volume of economic indicators between countries (Eurostat: Statistics Explained). GDP pc in PPS expresses the level of economic development of a region.

The study encompassed various levels of analysis, including countries and NUTS–2 regions, which are the basic unit of the EU regional policy. Twenty-seven EU Member States were included, and 242 NUTS–2 regions, with spatial analysis conducted on 234 NUTS–2 regions. To address data gaps in the employment structure, the examination

within the convergence clubs framework focused on 220 NUTS–2 regions of the EU. Additionally, 1166 NUTS–3 regions were analysed (spatial analysis of 1150 NUTS–3 regions). Overseas regions of France and Portugal, as well as the Canary Islands, were excluded from the spatial analysis of regions. The analysis spanned from 2000 to 2021. However, due to data gaps for NUTS–3 regions, the time frame was narrowed to 2003–2020. To ensure comparability, selected results are presented for both time spans.

Spatial statistics, taxonometric, and econometric methods were applied to characterise development in the EU regions. These methods were based on the mutually reinforcing complementary phenomena outlined in the previous section.

Implication 1 was verified using the idea of σ-convergence based on the standard deviation of GDP pc (PPS) logarithms. Cross-sectional data (the Baumol-style OLS regression) were used to assess β-convergence (Implication 2). This approach allowed verifying the presence of convergence, and their graphic presentation. A broad description of the method for measuring convergence and the accompanying assumptions was presented by Sala-i-Martin (1996) and Batóg (2010). The Global and local Moran's I statistics (Moran 1950) were used to assess spatial correlations (Implication 3). The statistically significant values of Moran's I statistic indicate regional clusters with similar GDP pc (PPS) values in the cross-section of regions. The calculations used a row-normalised first-order adjacency matrix, in which units that share a common border were considered neighbours. The R CRAN program was used to perform the calculations.

The analysis of income convergence for convergence clubs was carried out for the NUTS–2 regions characterised by a similar economic structure, and the traditional Baumol-style OLS regression parameters were estimated for them. Grouping regions into classes that feature a similar structure was based on the data describing the percentage of people working in knowledge sectors, i.e., knowledge-intensive services (KIS) and also in high and medium high-technology manufacturing (MHTC). Due to data gaps for the NUTS–3 regions, the analysis was restricted to NUTS–2 regions. The classification was performed using the *k*-means method. The *k*-means algorithm (MacQueen 1967) aims to separate *n* regions in *k* non-overlapping groups to minimise the distances between the points and the centre of their group. The number of classes was determined based on a dendrogram created using Ward's hierarchical clustering method.

## Characteristics of income convergence in the EU

The accession of 10 new Member States to the EU in 2004, followed by another 2 in 2007, resulted in a highly polarised economic landscape across EU regions. The newly admitted countries were achieving significantly lower incomes (GDP pc in PPS) that did not

exceed 50% of the EU average. The following years of economic development, investment, and cooperation also carried out within the framework of the EU policy brought about a change in the economic picture of the EU regions. A comparison of the GDP pc in PPS expressed as the EU average in the EU NUTS–3 regions in 2000 and 2020 (Chart 1) reveals a blurring of divisions overlapping with state borders. In 2020, the picture of the EU NUTS–3 regions resembled centrically spreading waves from the most developed regions, whose income is close to or above the EU average, to the least developed regions. The richest regions include the regions of Germany (particularly the western part, northern Italy, Austria, Denmark, Belgium and the Netherlands, as well as Sweden). The regions with the lowest income are the western, southern and easternmost areas of the EU.
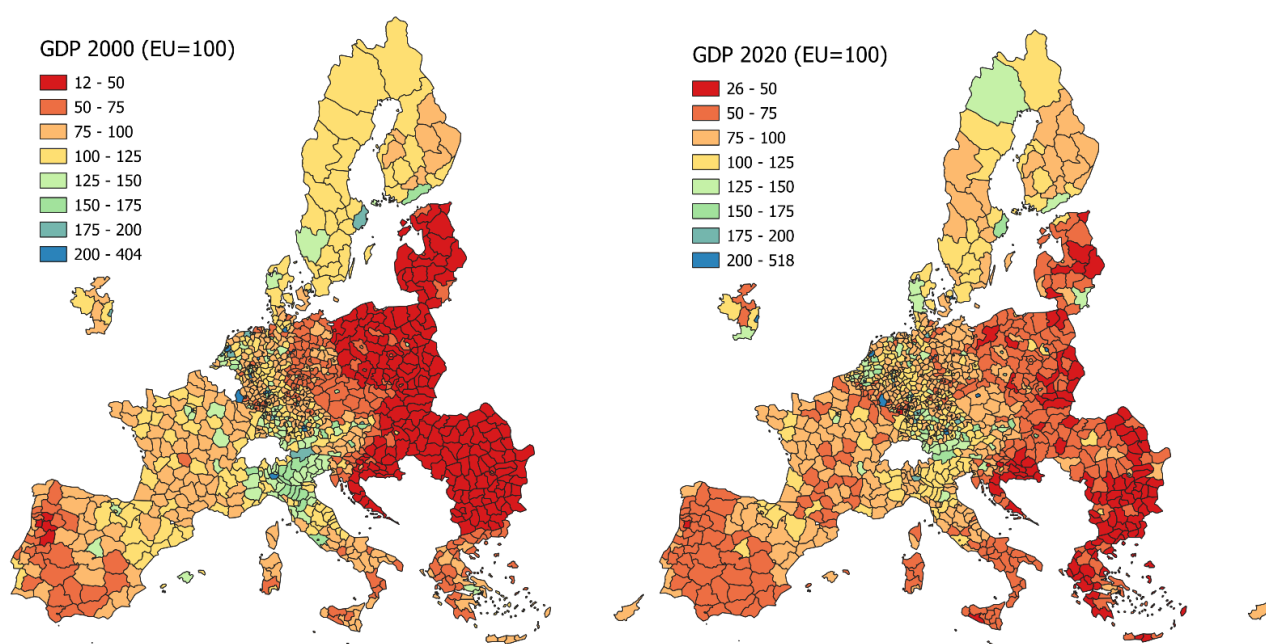


**Chart 1.** GDP pc in PPS as a percentage of the EU average in the EU NUTS–3 regions, 2000 and 2020

Source: author's compilation.

Twenty years of development saw significant economic progress in many of the new EU countries, including Poland, the Czech Republic, Hungary, Lithuania, Romania, and Estonia. Income levels in these regions approached 75% of the EU average. At the same time, many regions of Spain, France, southern Italy, and Greece recorded a relative decline in wealth, generating incomes below 75% of the EU average, with Greece falling below 50%. The change in the spatial wealth pattern of the EU regions and the disappearance of a clear geographical division into the Eastern Bloc and other Member States should also be assessed positively. These observations are confirmed by Moran's I spatial statistics (Chart 2), which assess the strength of income spatial autocorrelation. The decreasing values indicate a weakening tendency to concentrate regions with similar levels in

one location in favour of an irregular income distribution. This trend is evident at both the NUTS–2 and NUTS–3 levels. In the NUTS–2 regions, the global Moran's I statistic decreased from 0.62 to 0.36. The disappearance of clear spatial regimes was accompanied by a decline in income differentiation between regions, thus confirming the emergence of σ-convergence at all levels of territorial aggregation. In the NUTS–2 regions, the σ-convergence measure dropped from 0.52 to 0.37 (Chart 2).
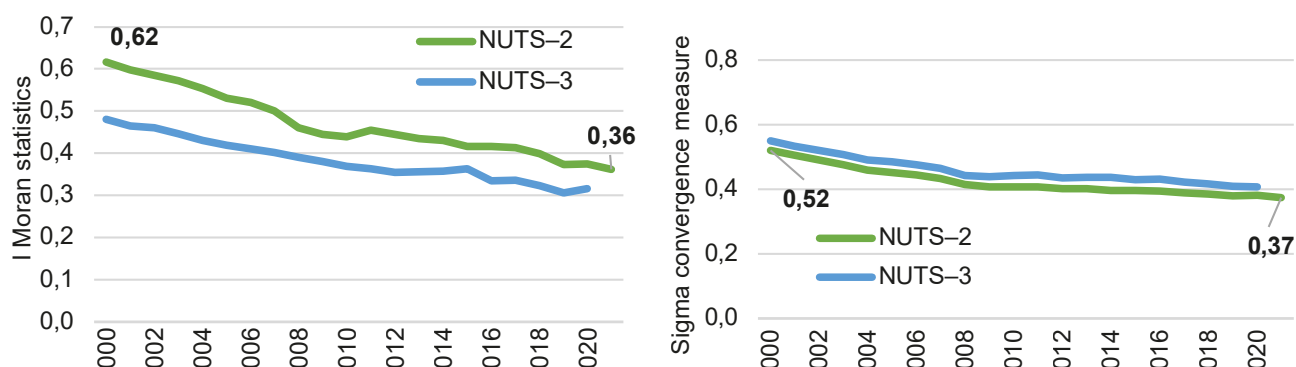


Chart 2. Global Moran's I statistics (left) and σ-convergence measures (right) for the EU NUTS–2 and NUTS–3 regions, 2001–2021.

Source: author's compilation.

The σ-convergence was the consequence of different income dynamics in individual regions. As the data in Chart 3 show, Romania saw the highest relative income increase in 2020 compared to 2003, where most regions recorded an increase of over 200%. Large increases were also observed for the NUTS–3 regions in Poland, Estonia, Lithuania, Latvia and Bulgaria. The relative growth in other EU countries did not exceed 50% (with a dynamics index of 1.5). At the same time, almost all Greek regions and selected Irish regions recorded a drop in income. Due to the COVID–19 pandemic in 2020, which affected regional economic results, Chart 3 presents both the dynamics of GDP pc in PPS in 2020 and in 2019, before the COVID–19 pandemic. The picture of changes against the base year 2003 is similar in both years. The differences arose in the dynamics observed in selected Italian and Spanish regions, where 2020 saw GDP pc in PPS income levels lower than those recorded 16 years earlier. These observations lead to the conclusion that σ-convergence is indeed ocurring at the EU level.
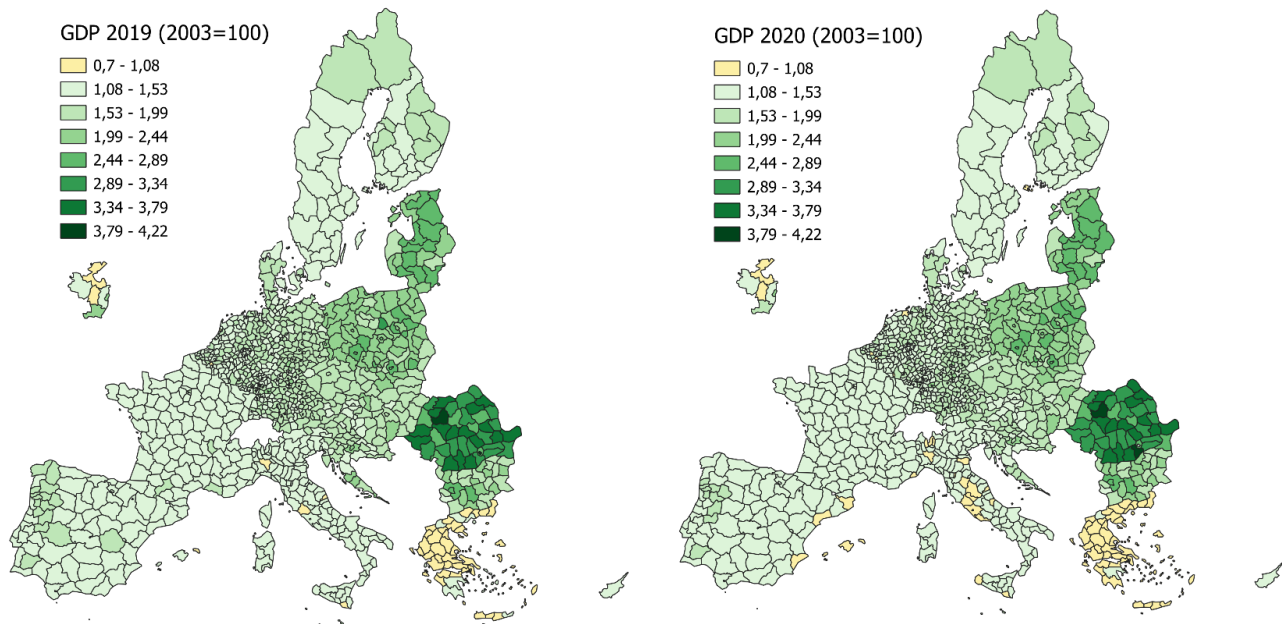
**Chart 3.** GDP pc in PPS dynamics indices for EU NUTS–3 regions

Source: author's compilation.

Chart 4 presents the income level of the EU NUTS–3 regions in 2003 and the dynamics indexes in 2020. This comparison allows the analysis of income β-convergence for NUTS–3 regions using the Baumol-style OLS regression. As evidenced by the data arrangement, the correlation is as expected, confirming β-convergence. Estimates of the corresponding power-form models at the NUTS–2 and NUTS–3 levels are presented in Table 1. The results confirm convergence both at the NUTS–3 and NUTS–2 levels, as well as in the group of 12 new countries. The estimated convergence rate at the NUTS–2 level is 2.5% per year, which gives a period of 27 years needed to cover half the distance to a common long-term steady state. In the NUTS–3 regions, the catching-up rate is slightly lower, at 2.2% per year (which gives a half-time of 32 years). In the group of regions from the new EU countries, catching up is characterised by lower dynamics, at approx. 2%. This means that within 34 years, the income generated by regions in this group should reduce the distance to the periodic steady state by half. However, in the old EU15 countries, no catching-up was observed. To understand this situation better, Chart 4 distinguishes observations for the EU15 and individual countries of the new EU12 enlargement.

The new EU countries, in particular Romania, Lithuania, Poland, and Bulgaria, are characterised by the highest growth rates, driving convergence. However, a small group of regions in the central part of the chart deviates from the convergence model, achieving an unexpectedly high growth rate (by 150%) along with a simultaneously high-income level in the initial period. These regions cover the rapidly developing capital regions of the EU12 countries, including Warsaw, Zagreb, Budapest, Bratyslavsky Kraj,

as well as Dublin. Some of the regions with the highest income in 2003 (visible in the chart as the rightmost regions) also achieved a high growth rate (up to 100%), doubling their income in 17 years (GDP pc in PPS). These regions include the two previously mentioned German regions with the seat in Wolfsburg and Ingolstadt.
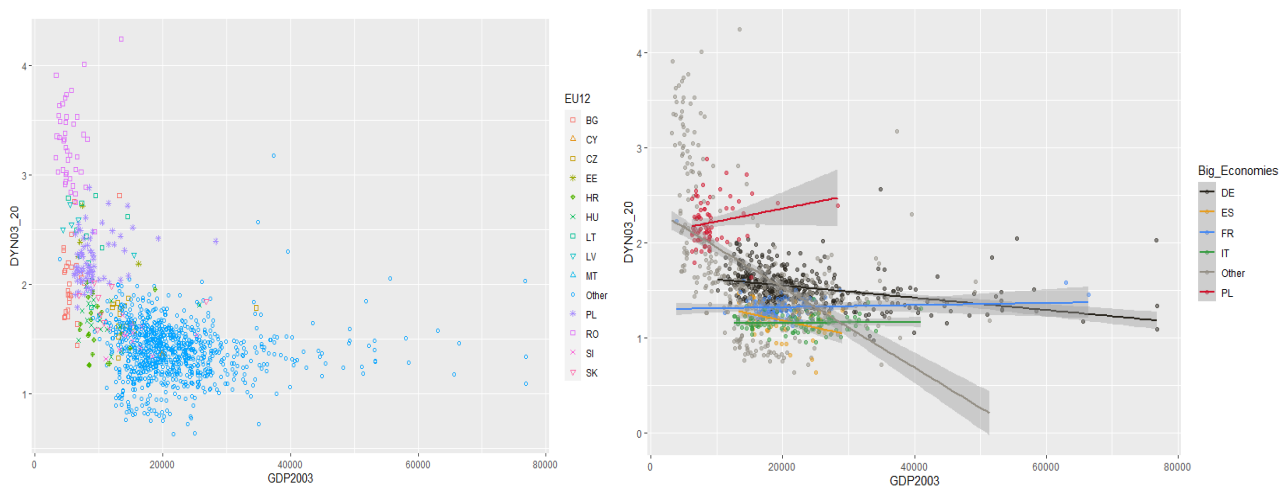


Chart 4. GDP pc in PPS and their dynamics in the EU NUTS–3 regions by country (left), and β-convergence models for selected countries (right)

Source: author's compilation in R CRAN.

Analysis of the regions of the EU15 countries shows that the regions are highly diversified. Some of the most affluent regions achieved a comparable high growth rate as the regions with an initially low level of wealth. At the same time, the regions with the lowest income in 2003 constitute a highly diversified group in terms of economic growth rate. In the initial income range, from 17,000 pc PPS (Purchasing Power Standard) to 30,000 pc PPS, the regions recorded income growth rates ranging from almost 0 to 100%. The results suggest different income growth models among the EU15 regions. To illustrate this, a β-convergence analysis was conducted for the five most populated EU economies (Chart 4; Table 1). This allowed us to closely examine the situation in four EU15 countries whose regions largely form the described cluster.

Germany and Spain had statistically significant negative estimates of convergence parameters, suggesting catch-up processes. However, the quality of the model expressed by the fit (determination) coefficient was very low, at 14%/20%, respectively. Low fit is a consequence of, among other things, the presence of regions that deviate from the convergence model determined by the traditional Baumol-style OLS regression. Spain's results were influenced by a group of regions that recorded an income decrease in 2020 compared to 2003.

Table 1. The traditional Baumol-style OLS regression results

| | Coefficient | R² | Speed of convergence | Half Time |
|---|---|---|---|---|
| EU27 NUTS–2 (2000–2021) | – 0.429*** | 0.492 | 2.5 | 27 |
| EU27 NUTS–3 (2003–2020) | – 0.323*** | 0.358 | 2.2 | 32 |
| EU12 NUTS–2 (2000–2021) | – 0.364*** | 0.340 | 2.1 | 34 |
| EU12 NUTS–3 (2003–2020) | – 0.3*** | 0.280 | 2.0 | 35 |
| EU15 NUTS–2 (2000–2021) | – 0.009 | 0.000 | – | – |
| EU15 NUTS–3 (2003–2020) | – 0.043* | 0.006 | – | – |
| Five biggest EU countries (in terms of population) (NUTS–3, 2003–2020) | | | | |
| Germany | – 0.147*** | 0.203 | 0.9 | 78 |
| France | – 0.057 | 0.035 | – | – |
| Spain | – 0.284*** | 0.139 | 1.9 | 37 |
| Italy | – 0.001 | 0.002 | – | – |
| Poland | 0.072 | 0.041 | – | – |

$R^2$ – the coefficient of determination; *** – 0.001 level of statistical significance; ** – 0.01 level of statistical significance; * – 0.05 level of statistical significance.
Source: author's compilation.

Convergence is not a common phenomenon in the largest EU countries, including Germany. German regions stand out for their high income levels within the EU and the presence of convergence. The strong position of the German economy can be attributed to its diversified and frequently highly specialised economic structure of the economy based on high and medium high-technology manufacturing and innovation. As noted by Baccaro and Benassi (2017), the German growth model has transitioned from being driven by net exports and consumption to predominantly export-led growth.

For the three remaining countries (Poland, France and Italy), β-convergence could not be confirmed, which suggests the possibility of increasing income disparities between the regions. The absence of β-convergence in Italy was influenced by the low growth rate and even a decline in incomes in most regions (with income changes ranging from –5% to 40%). When all regions experience a low or negative rate of income change, it is not possible to observe catching-up processes according to the idea of β-convergence.

In France, most regions recorded a relatively moderate income growth (from 13% to 50%). Consequently, the poorer regions failed to narrow the gap with the richest ones, maintaining similar levels of regional wealth.

In Poland, the results were influenced by the relatively large group of regions which achieved the highest income in the initial period of the analysis (2003) and, at the same time, recorded the highest growth rate. These NUTS–3 regions, including Warsaw, Poznań, Kraków, Wrocław, and Łódź, now serve as significant development drivers, achieving positive economic results within their boundaries while also spreading these economic benefits to neighbouring areas (Chart 1). These regions attract foreign investments and, therefore, promote exports and foster innovation and productivity growth (OECD 2018). Overall, the economic growth rate of Polish NUTS–3 regions ranged from 65% to 190%.
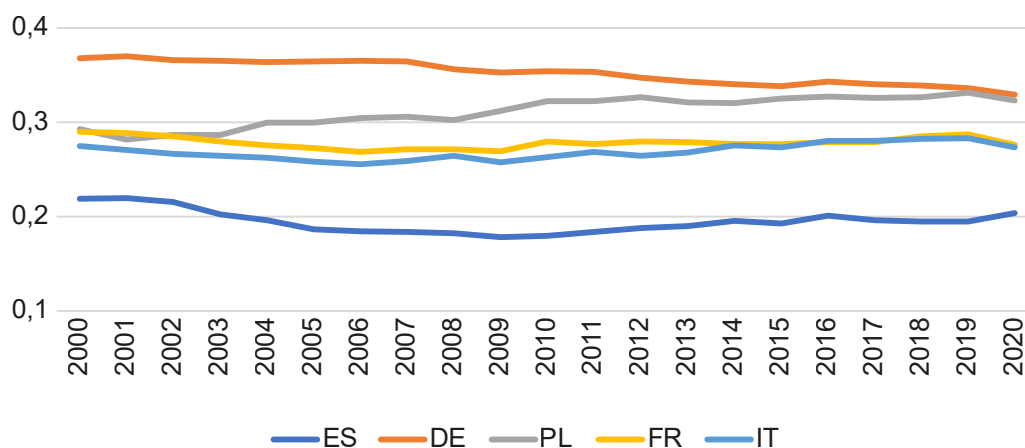


**Chart 5.** Sigma convergence in the selected EU countries (based on NUTS–3 regions)

Source: author's compilation.

To summarise, σ-convergence was recorded only in Germany (Chart 5), polarisation was visible in Poland, and income differences between NUTS–3 regions in France and Italy remained at a similar level. Meanwhile, in Spain, after initially seeing a decline in differences in regional wealth, recent years have seen the threat of increasing income polarisation.

## Club convergence results

According to the neoclassical growth theory, one determinant of the pace of growth is the distance of an economy from its long-term steady state. The long-term steady-state point varies between economies characterised by different levels of efficiency and ability to adopt knowledge and technology. Chart 6 presents the key values of the Baumol-style model divided into three clubs of NUTS–2 regions, which were identified based on the economic structure in the knowledge-intensive sectors.

The Industry club comprises 107 regions with the highest percentage of people employed in high and medium high-technology manufacturing MHTC (with an average of 8.6%) and a relatively high percentage of people employed in knowledge-intensive

services KIS (28%). The Services club is the smallest, covering 46 regions where, on average, 41% of employment is attributed to KIS, while approx. 5.8% is MHTC. The Other club comprises 67 regions with the lowest percentage of employment in knowledge-intensive sectors (MHTC 3.9%; KIS 19.2%).

The first observation drawn from the analysis of club data relates to the highest income level in the Services club regions (see also Cutrini and Mendez 2023). The average level ranged from 25,109 pc PPS in 2000 to 41,093 pc PPS in 2021. At the same time, the average income level in the Industry club ranged from 19,060 pc PPS to 31,060 pc PPS, respectively, while in the Other club, the range was narrower, spannding from 11,800 pc PPS to 21,607 pc PPS.
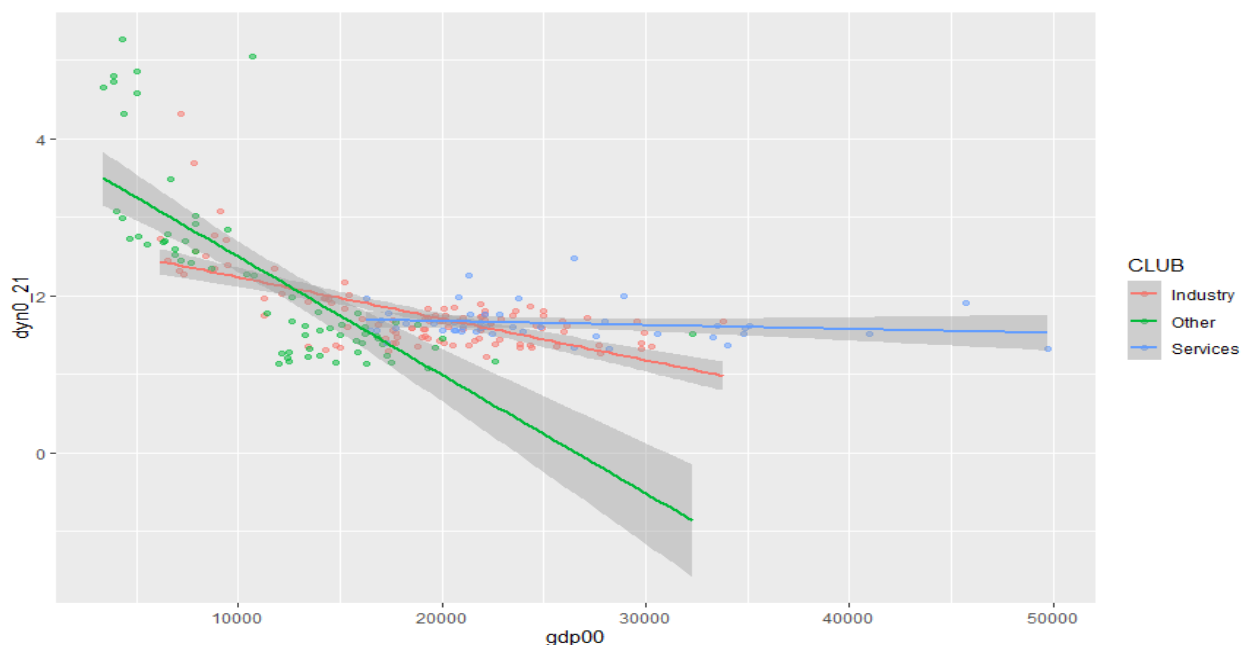


**Chart 6.** Income (GDP pc in PPS) and its dynamics in the EU NUTS–2 EU regions according to convergence clubs

Source: author's compilation in R CRAN.

**Table 2.** The Baumol-style OLS regression results for convergence clubs

| | Coefficient | R² | Speed of convergence | Half Time |
|---|---|---|---|---|
| **2000–2021 (NUTS–2)** | | | | |
| All | − 0.446*** | 0.550 | 2.7 | 26 |
| Services | − 0.09 | 0.038 | – | – |
| Industry | − 0.443*** | 0.557 | 2.7 | 26 |
| Other | − 0.74*** | 0.739 | 6.1 | 11 |

$R^2$ – the coefficient of determination; *** – 0.001 level of statistical significance; ** – 0.01 level of statistical significance; * – 0.05 level of statistical significance.
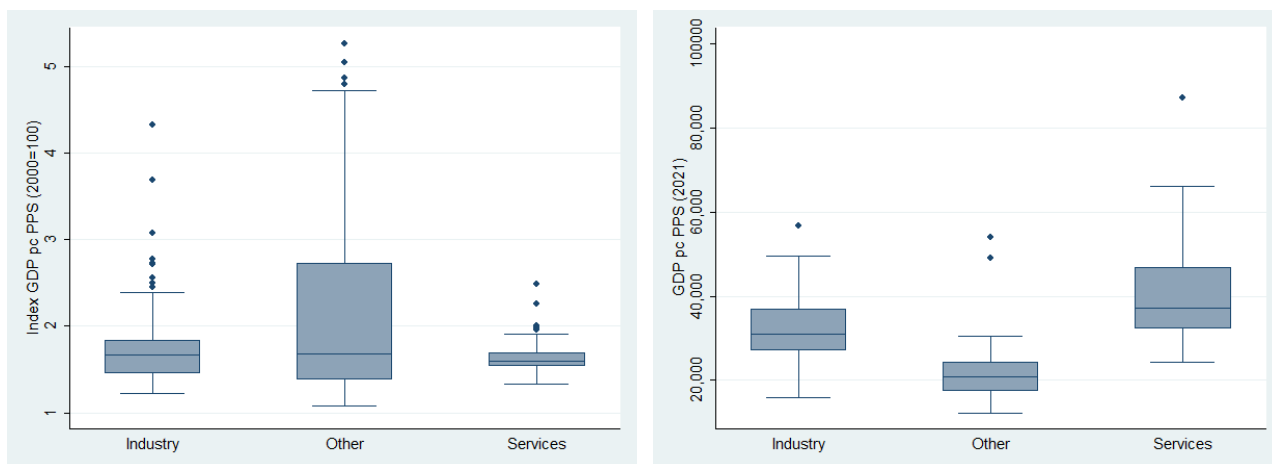Source: author's compilation.

**Chart 7.** Dynamics indices GDP pc in PPS (2000 = 100) (left) and the level of regional GDP pc in PPS (right) among the EU NUTS–2 regions by convergence club in 2021

Source: author's compilation in STATA.

Absolute β-convergence was confirmed in two clubs, Industry and Other (Table 2). These convergence models are characterised by greater variance of the dependent variable, measured by the coefficient of determination ($R^2$), than the results presented earlier in Table 1. It can, therefore, be concluded that the division into clubs provides a better understanding of convergence within the EU NUTS–2 regions.

The Other club yielded the highest level of explanation and the highest convergence parameter. This indicates that the regions in this group are progressing towards a common long-term steady state at the fastest rate (5.7% per year). According to the estimates, it would take 12 years to halve the distance to the long-term steady-state shared by all regions within the club. In contrast, the Industry club demonstrates a convergence speed of only 2.7%, requiring 26 years to reduce the distance.

β-convergence was not observed in the Services club. The absence of convergence can be attributed to similar growth rates in these regions. As shown by the data presented in the box chart (Chart 7, left), the median of income dynamics indexes reached a similar level of 1.6 in all convergence clubs, with the Services club exhibiting the lowest deviations from this value (the coefficient of variation was only 14%). The lack of regions achieving high growth rates translated into the absence of convergence. Furthermore, the regions within the Services club are among those with the highest income levels, significantly exceeding the income achieved by the regions of the remaining two clubs (Chart 7, right). The results suggest that the Services club regions are approaching the growth limit at a given long-term steady state and within the existing economic model.

## Conclusion

When answering the questions posed at the beginning of this article, it becomes apparent that income convergence was observed regardless of the level of analysis (i.e., NUTS–2 or NUTS–3 regions). The rate of convergence achieved by the EU regions is similar to the estimates in other studies, including those that focused on the EU, averaging around 2.5% per year. However, the situation becomes more complicated when examining smaller territorial systems rather than the entire EU. Catch-up processes were confirmed only within the regions of the new EU12, with no convergence observed in the EU15 regions. Convergence was also not common in the largest EU countries. Only in Germany were β and σ-convergence confirmed. Conversely, clear divergence was recorded in Poland.

These observations align with Pina and Sicari's (2021) assertion that the reduction of differences between countries in the first decade of the 21st century was more crucial for income convergence in the EU than the reduction of disproportions within countries. They also mentioned the lack of improvement in the EU15 countries and that there was even a tendency towards divergence and polarisation.

This situation is influenced by globalisation and changes in the political and economic systems in Europe. These dynamics determine the flows of financial resources, investments and employees between countries. The last EU enlargements (in 2004 and 2007) have driven strong economic growth, labour market improvements, and buoyant investment, including increases in FDI inflows in the EU12 countries (Borys, Polgár, and Zlate 2008). Additionally, the EU cohesion policy has also provided a positive stimulus for the economic growth of the new Member States (Savić, Drvenkar, and Drezgić 2023), resulting in the countries of Central and Eastern Europe improving their economic position in Europe. For example, when Poland joined the EU, it was ranked the 23rd economy in terms of GDP pc in PPS. By 2021, it had risen to 19th.

Maintaining this positive trend in the EU12 countries requires them to address further economic challenges to increase productivity and structural transformation (Borys, Polgár, and Zlate 2008; Pina and Sicari 2021). They must focus on accumulating capital, including the activation of human capital towards innovation and the development of modern economic sectors of international or supra-local importance. The transition to the next stage of development requires that these countries and regions develop industries and services based on the latest technical expertise and standards, extending far beyond the local markets.

While the inflow of investments, particularly foreign ones, into low-income regions may serve as an important incentive in the first period of development, it cannot constitute a target model. As noted by Gorzelak (2009), the "high" segment, which is based on research and development, as well as innovation, is not subject to relocation. In contrast,

foreign investments that target foreign markets typically address industries with lower technological advancement. Consequently, at a certain stage of regional development, entrepreneurship must be established based on the latest knowledge achievements, broad coverage, and native roots in technical innovation and market ideas.

The observation of disruptions in convergence within countries can be linked to the findings drawn from the existing literature. As Pina and Sicari (2021) stated, "high-value added services have become more concentrated at the regional level. This has mainly benefited large cities since productivity in knowledge-intensive sectors has proved particularly sensitive to agglomeration economies." This is a problem not only for Europe but for economic geography in general.

Furthermore, businesses are more willing to invest in centres that already possess capital, have access to educational and scientific centres and housing resources, and are well-connected (Moretti 2021). Even though the concentration of enterprises, especially high technologies, results in an increase in wages and housing prices, it remains a common strategy among employers. The tendency to concentrate in selected locations is demonstrated, in particular, by the deployment of industry and services characterised by high technology and knowledge, deepening the division of the EU economy into "high" and "low" technology segments (Porter 1990; Gorzelak 2009).

This observation leads to the question of whether the existence of mechanisms that favour specific locations and that support capital accumulation in already developed regional centres results in convergence within clubs of regions that share a similar development model. The Services club regions, with a modern economic structure characterised by a large share of people working in knowledge-intensive services, as well as high and medium high-technology manufacturing sectors, do generate the highest incomes. However, the development they experience is characterised by a relatively moderate and similar growth rate.

Income convergence within EU regions is not accompanied by convergence within EU countries. In this scenario, development is dominated by the factors described in location theories. Going beyond the issues of convergence characteristics and formulating recommendations, it can be stated that the pursuit of income convergence, despite its somewhat utopian nature, has positive effects. Convergence, as a way of equalising disproportions in the level of regional economic prosperity, remains one of the dimensions of achieving economic cohesion. Economic cohesion, according to Gorzelak (2009), involves harmonising the entire complex economic system and maximising the potential inherent in its components. Even if convergence only leads to the disappearance of differences between countries and regions of the entire EU, it still brings us closer to the goal of an economically cohesive Europe. Furthermore, it paves the way for regional and local policy initiatives aimed at achieving economic cohesion within countries. This approach also capitalises on the positive externalities

obtainable from economically stronger agglomerations. It fosters social and territorial cohesion and promotes employee mobility and remote work while strengthening local relationships, supporting local specialisations and seeking local comparative advantages.

By supporting networks of cooperation and mutual correlations between central areas and their peripheries, local and regional policies should consider the development of regional polycentric and balanced territorial structures. They should also develop less significant centres to create a more integrated hierarchy of cities and, consequently, interconnected and interdependent economic systems[4].

# References

Andor, L. (2019), *Fifteen Years of Convergence: East-West Imbalance and What the EU Should Do About It*, "Intereconomics", 54 (1), pp. 18–23, https://doi.org/10.1007/s10272-019-0785-4

Baccaro, L., Benassi, Ch. (2017), *Throwing out the ballast: growth models and the liberalization of German industrial relations*, "Socio-Economic Review", 15 (1), pp. 85–115, https://doi.org/10.1093/ser/mww036doi.org/10.1093/ser/mww036

Bal-Domańska, B. (2011), *Konwergencja w regionach Unii Europejskiej o różnym poziomie innowacyjności*, "Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu", 176 (Taksonomia 18. Klasyfikacja i analiza danych – teoria i zastosowania), pp. 120–128.

Bal-Domańska, B. (2014), *Próba identyfikacji większych skupisk regionalnych oraz ich konwergencja*, "Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu", 327 (207), pp. 285–293.

Bal-Domańska, B. (2016), *The Impact of Economic Crisis on Convergence Processes in European Union Regions*, "Prague Economic Papers", 25 (5), pp. 509–526, https://doi.org/10.18267/j.pep.574

Barsby, S. (1969), *Economic Backwardness and the Characteristics of Development*, "Journal of Economic History", 29 (3), pp. 449–472, https://doi.org/10.1017/S0022050700072429

Batóg, J. (2010), *Konwergencja dochodowa w krajach Unii Europejskiej. Analiza ekonometryczna*, Wydawnictwo Naukowe Uniwersytetu Szczecińskiego, Szczecin.

Baumol, W.J. (1986), *Productivity Growth, Convergence, and Welfare*, "American Economic Review", 76, pp. 1072–1085.

Baumont, C., Ertur, C., Le Gallo, J. (2003), *Spatial Convergence Clubs and the European Regional Growth Process, 1980–1995*, [in:] B. Fingleton (ed.), *European Regional Growth. Advances in Spatial Science*, Springer, Berlin–Heidelberg, pp. 131–158, https://doi.org/10.1007/978-3-662-07136-6_5

---

4 The suggestions are consistent with the provisions in strategic documents, e.g. National Strategy for Regional Development 2030, Warsaw, September 2019, https://www.gov.pl/web/fundusze-regiony/krajowa-strategia-rozwoju-regionalnego, and also (Sobala-Gwosdz 2023).

Bernard, B.A., Jones, I.C. (1996), *Technology and Convergence*, "The Economic Journal", 106 (437), pp. 1037–1044, https://doi.org/10.2307/2235376

Bernardelli, M., Próchniak, M., Witkowski, B. (2018), *Konwergencja dochodowa w krajach UE: ujęcie miesięczne*, "Prace i Materiały Instytutu Rozwoju Gospodarczego", 100, pp. 85–111.

Bianco, D. (2010), *Technology Diffusion or Capital Accumulation? An Empirical Assessment of Convergence in Manufacturing*, "Quaderni di Dipartimento", 114, https://www.econstor.eu/handle/10419/95295

Bond, S., Hoeffler, A., Temple, J. (2001), *GMM Estimation of Empirical Growth Models*, "CEPR Press Discussion Paper", 3048.

Borys, M.M., Polgár, K., Zlate, A. (2008), *Real convergence and the determinants of growth in EU candidate and potential candidate countries: a panel data approach*, "Occasional Paper Series", 86, European Central Bank.

Cabral, R., Castellanos-Sosa, F.A. (2019), *Europe's income convergence and the latest global financial crisis*, "Research in Economics", 73 (1), pp. 23–34, https://doi.org/10.1016/j.rie.2019.01.003

Caselli, F., Esquivel, G., Lefort, F. (1996), *Reopening the convergence debate: A new look at cross-country growth empirics*, "Journal of Economic Growth", 1, pp. 363–389, https://doi.org/10.1007/BF00141044

Chapman, S., Meliciani, V. (2017), *Behind the Pan-European Convergence Path: The Role of Innovation, Specialisation and Socio-Economic Factors*, "Growth and Change", 48 (1), pp. 61–90, https://doi.org/10.1111/grow.12148

Chocholatá, M., Furková, A. (2017), *Does the location and the institutional background matter in convergence modelling of the EU regions?*, "Central European Journal of Operations Research", 25 (3), pp. 679–697, https://doi.org/10.1007/s10100-016-0447-6

Ciołek, D. (2003), *Badanie konwergencji krajów Europy Środkowo-Wschodniej z wykorzystaniem danych panelowych*, Dynamiczne Modele Panelowe VIII Ogólnopolskie Seminarium Naukowe, Toruń.

Cowen, T., Tabarrok, A. (2015), *Modern Principles of Economics*, Worth Publishers, New York.

Coyle, D. (2014), *GDP: A Brief but Affectionate History*, Princeton University Press, Princeton, https://doi.org/10.1515/9781400873630

Coyle, D. (2018), *GDP: A Brief but Affectionate History*, Wydawnictwo Naukowe PWN, Warszawa.

Cutrini, E., Mendez, C. (2023), *Convergence clubs and spatial structural change in the European Union*, "Structural Change and Economic Dynamics", 67, pp. 167–181, https://doi.org/10.1016/j.strueco.2023.07.009

Czarny, B. (2000), *Wzrost gospodarczy*, "Bank i Kredyt", November, pp. 34–48.

Demertzis, M., Sapir, A., Wolff, G. (2019), *Promoting sustainable and inclusive growth and convergence in the European Union*, "Bruegel Policy Contribution Issue", 7 [Policy Paper].

Diaz del Hoyo, J.L., Dorrucci, E., Heinz, F., Muzikarova, S. (2017), *Real Convergence in the Euro Area: A Long-Term Perspective*, "Occasional Paper Series", European Central Bank, https://doi.org/10.2139/ssrn.3082205

Galor, O. (1996), *Convergence?: Inferences from Theoretical Models*, "The Economic Journal", 106 (437), pp. 1056–1069, https://doi.org/10.2307/2235378

Gehlke, C.E., Biehl, K. (1934), *Certain Effects of Grouping Upon the Size of the Correlation Coefficient in Census Tract Material*, "Journal of the American Statistical Association", 29 (185A), pp. 169–170, https://doi.org/10.1080/01621459.1934.10506247

Glawe, L., Wagner, H. (2021), *Divergence Tendencies in the European Integration Process: A Danger for the Sustainability of the E(M)U?*, "Journal of Risk and Financial Management", 14 (3), 104, https://doi.org/10.3390/jrfm14030104

Gorzelak, G. (2009), *Fakty i mity rozwoju regionalnego*, "Studia Regionalne i Lokalne", 2 (36), pp. 5–27.

Ingianni, A., Žd'árek, V. (2009), *Real Convergence in the New Member States: Myth or Reality?*, "Journal of Economic Integration", 24 (2), pp. 294–320, https://doi.org/10.11130/jei.2009.24.2.294

Islam, N. (1995), *Growth Empirics: A Panel Data Approach*, "The Quarterly Journal of Economics", 110 (4), pp. 1127–1170.

Johnson, P.A., Durlauf, S.N., Temple J.R.W. (2005), *Growth economics*, [in:] P. Aghion, S. Durlauf (eds.), *Handbook of Economic Growth*, Vol. 1, part A, Elsevier, New York, pp. 555–677, https://doi.org/10.1016/S1574-0684(05)01008-7

Kapeller, J., Gräbner-Radkowitsch, C., Heimberger, P. (2019), *Economic Polarisation in Europe: Causes and Policy Options/Wirtschaftliche Polarisierung in Europa Ursachen und Handlungsoptionen*, Research Report, 440, https://www.jku.at/fileadmin/gruppen/108/ICAE_Working_Papers/wp99.pdf (accessed: 27.11.2023).

Kijek, T., Kijek, A., Matras-Bolibok, A. (2022), *Club Convergence in R&D Expenditure across European Regions*, "Sustainability", 14 (2), 832, https://doi.org/10.3390/su14020832

Kubielas, S. (2009), *Innowacje i luka technologiczna w gospodarce globalnej opartej na wiedzy. Strukturalne i makroekonomiczne uwarunkowania*, Wydawnictwo Uniwersytetu Warszawskiego, Warszawa.

Kusideł, E. (2013), *Konwergencja gospodarcza w Polsce i jej znaczenie w osiąganiu celów polityki spójności*, Wydawnictwo Uniwersytetu Łódzkiego, Łódź, https://doi.org/10.18778/7525-877-6

Lucas, R.E. (1988), *On the mechanics of economic development*, "Journal of Monetary Economics", 22 (1), pp. 3–42, https://doi.org/10.1016/0304-3932(88)90168-7

MacQueen, J.B. (1967), *Some Methods for classification and Analysis of Multivariate Observations*, [in:] *Proceedings of 5th Berkeley Symposium on Mathematical Statistics and Probability*, University of California Press, Berkeley, pp. 281–297.

Mankiw, N., Romer, D., Weil, D. (1992), *A Contribution to the Empirics of Economic Growth*, "Quarterly Journal of Economics", 107 (2), pp. 407–437, https://doi.org/10.2307/2118477

Martin, C., Velazquez, F.J., Funck, B. (2001), *European Integration and Income Convergence. Lessons for Central and Eastern European Countries*, "World Bank Technical Papers", 12 Aug 2001, https://doi.org/10.1596/978-0-8213-4994-6

Moran, P.A.P. (1950), *Notes on Continuous Stochastic Phenomena*, "Biometrika", 37 (1–2), pp. 17–23, https://doi.org/10.1093/biomet/37.1-2.17

Moretti, E. (2021), *The Effect of High-Tech Clusters on the Productivity of Top Inventors*, "American Economic Review", 111 (10), pp. 3328–3375, https://doi.org/10.1257/aer.20191277

Muszyńska, J., Oczki, J., Wędrowska, E. (2018), *Konwergencja dochodów gospodarstw domowych*, "Wiadomości Statystyczne", 11 (690), pp. 21–40.

OECD (2018), *Productivity and Jobs in a Globalised World: (How) Can All Regions Benefit?*, OECD Regional Development Studies, OECD Publishing, Paris, https://doi.org/10.1787/9789264293137-en

Openshaw, S. (1984), *The Modifiable Areal Unit Problem*, Concepts and Techniques in Modern Geography, Geo Books, Norwich.

Petrović, P., Gligorić Matić, M. (2023), *Manufacturing productivity in the EU: Why have Central and Eastern European countries converged and Southern EU countries have not?*, "Structural Change and Economic Dynamics", 65, pp. 166–183, https://doi.org/10.1016/j.strueco.2023.02.012

Pina, Á., Sicari, P. (2021), *Enhancing regional convergence in the European Union*, "Economics Department Working Papers", 1696, OECD Publishing, Paris, https://doi.org/10.1787/253dd6ee-en

Porter, M. (1990), *The Competitive Advantage of Nations*, The Free Press, New York.

Próchniak, M. (2006), *Realna konwergencja typu beta (β) i sigma (σ) w świetle badań empirycznych*, "International Journal of Management and Economics", 20, pp. 74–91.

Quah, D.T. (1996), *Twin Peaks: Growth and Convergence in Models of Distribution Dynamics*, "The Economic Journal", 106 (437), pp. 1045–1055, https://doi.org/10.2307/2235377

Romer, P.M. (1986), *Increasing Returns and Long-Run Growth*, "Journal of Political Economy", 94 (5), pp. 1002–1037, https://doi.org/10.1086/261420

Romer, P.M. (1990), *Endogenous Technological Change*, "Journal of Political Economy", 98 (5), pp. 71–102, https://doi.org/10.1086/261725

Sala-i-Martin, X.X. (1996), *The Classical Approach to Convergence Analysis*, "The Economic Journal", 106 (437), pp. 1019–1036, https://doi.org/10.2307/2235375

Savić, Z., Drvenkar, N., Drezgić, S. (2023), *Convergence and economic integration of CEECs through EU regional policy system*, "Economic Research – Ekonomska Istrazivanja", 36 (3), 2188407, https://doi.org/10.1080/1331677X.2023.2188407

Schmidt, C. (1997), *Technology, convergence and growth in the European Union Book*, "International Advances in Economic Research", 2, pp. 255–269, https://doi.org/10.1007/BF02295253

Sobala-Gwosdz, A. (2023), *Pozycja miast jako ośrodków centralnych*, Badania Obserwatorium Polityki Miejskiej, Instytut Rozwoju Miast i Regionów, Warszawa–Kraków, https://cwd .info.pl/wp-content/uploads/2023/06/Pozycja-miast-jako-osrodkow-centralnych.pdf (accessed: 27.11.2023).

Solow, R. (1956), *A Contribution to the Theory of the Economic Growth*, "Quarterly Journal of the Economics", 70 (1), pp. 65–94, https://doi.org/10.2307/1884513

Swan, T. (1956), *Economic Growth and Capital Accumulation*, "Economic Record", 32 (2), pp. 334–361, https://doi.org/10.1111/j.1475-4932.1956.tb00434.x

Tokarski, T. (2005), *Statystyczna analiza regionalnego zróżnicowania wydajności pracy, zatrudnienia i bezrobocia w Polsce*, PTE, Warszawa.

Wong, D.W.S. (2004), *The Modifiable Areal Unit Problem (MAUP)*, [in:] D.G. Janelle, B. Warf, K. Hansen (eds.), *WorldMinds: Geographical Perspectives on 100 Problems*, Springer Science Business Media, Dordrecht, pp. 571–575, https://doi.org/10.1007/978-1-4020-2352-1_93

## W poszukiwaniu konwergencji dochodowej i idealnego podziału – przypadek regionów Unii Europejskiej

W obszarze ekonomii i badań regionalnych badania konwergencji dochodów między krajami i regionami prowadzone są od lat 80. XX wieku. Na początku XXI w. ukazało się wiele artykułów poruszających kwestię konwergencji dochodowej krajów UE, co wiązało się m.in. z przystąpieniem w latach 2004–2007 dwunastu krajów do struktur Unii Europejskiej (UE). Inspiracją do przygotowania niniejszego opracowania była rozbieżność wniosków na temat występowania procesów konwergencji w różnych grupach regionów UE. Celem artykułu jest omówienie istniejącej wiedzy na temat procesów konwergencji gospodarczej regionów UE i poszerzenie jej o wyniki badań obejmujących okres 2000–2021. Uzyskane wyniki potwierdzają konwergencję dochodów w obrębie regionów UE, co przekłada się na zmianę geograficznego rozkładu dochodów w UE i powoli zacierające się granice między regionami krajów objętych procesem rozszerzenia 2004–2007 a krajami położonymi na południu i zachodzie UE. Jednocześnie nie odnotowano konwergencji w obrębie większości największych krajów UE oraz w ramach klubu regionów o rozwiniętym sektorze usług opartych na wiedzy.

Słowa kluczowe: wzrost gospodarczy, beta i sigma konwergencja, autokorelacja przestrzenna, regiony UE