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ASSESSMENT OF ECONOMIC CONVERGENCE AMONG COUNTRIES IN THE EUROPEAN UNION

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Abstract. The debate on the presence of economic benefits in the European Union (EU) is not over. The study responds unequivocally to this question, with the intensity of economic development in the countries that joined the European Union in 2004 and beyond twice as high as that of the countries that joined it this year, i.e. the EU's old ones compared to the new ones; smoothness – 1.1 times and dynamics – 1.6 times. Another important trend for further development is that, as the level of economic development increases, its smoothness is diminishing. In respect of the context of the EP of all EU Members, it turned out that the higher intensity of enlargement was characterised by higher economic levels, with similar homogeneity and almost identical values for the dynamic indicator. The introduction to the article presents the context of the studies, i.e. two groups of EU Community countries are formed according to their level of economic development and the year of their accession to the Community, as well as a survey scheme. The literature review reveals the methods used to analyse the convergence of economic development in these countries, as members of the Community. The research methodology introduces the indicator of economic development of countries and provides a methodology for assessing its dynamics. The empirical part assesses the dynamics of economic development of both groups of countries and identifies trends in terms of convergence. The discussion section summarises the consolidation and destabilising factors in the EU and the importance of the study carried out in this context. The conclusions present the main results of the studies and outline their further directions. The results of the study can be used both in the EU and for the purpose-oriented decisions of its members on further economic development.

Keywords: the economic development of the EU Member States, its intensity, evenness and dynamism.

JEL Classification: O10, O20.

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Introduction

Up till now, there is an ongoing discussion on how the economic development of the members of the EU, as an economic community (hereinafter referred to as the Community), has taken place (Rapacki & Proochniak, 2008; Dobrzanski & Olszewski, 2019; Kehagia & Kyriazi, 2021). Before answering this question, a brief overview of the history of the creation of the Community is needed in order to shape the structural conditions of the survey.

The EU started in 1951 with economic cooperation between six countries (Belgium, France, Germany, Italy, Luxembourg and the Netherlands). In 1957 these countries founded the European Economic Community by the Treaty of Rome. Over time, other countries have joined it: Ireland, Denmark and the United Kingdom in 1973 (the latter withdrew in 2020), Greece in 1981, Spain, Portugal in 1986, and Austria, Finland and Sweden in 1995.

The EU, as an economic and political community, was founded in 1992 on the basis of the Maastricht Treaty (entered into force on 1 November 1993). At that time, it comprised of nine countries – Belgium, Italy, Luxembourg, the Netherlands, France, Germany, Ireland, Denmark and the United Kingdom. These counties, as well as those that joined the EU before 2004 (Greece, Spain, Portugal, Austria, Finland and Sweden) are characterised by the fact that all their national currency has been converted. On the basis of these two characteristics, namely the year of accession and the nature of the national currency, as well as the level of economic development achieved, these countries can relatively be distinguished as a separate group of the EU Member States.

The EU membership requires a time-consuming procedure, since the applicant country must fulfil all the conditions for the membership and must also follow the Community rules and regulation in all areas. This is why a large group of countries joined the EU only after almost ten years, i.e. in 2004. It was joined by three more countries later (Bulgaria and Romania in 2007 and Croatia in 2013). Most of them are characterised by the fact that these are the countries that have long been part of the then Soviet Union or the zone of its influence, with the exception of Cyprus, Malta and Slovenia (Croatia in relative terms). Moreover, their national currency was not convertible, and their economic development differed significantly from the first group of countries. All this allows them to be relatively singled out as a separate group of the EU countries.

Establishing relatively homogeneous groups of EU countries makes it possible to formulate the task of analysing their economic development: what being part of the EU has brought to both the first and the second group of countries. For the first group of countries, the answer to this question would be given by a comparison of their economic development before and after their accession to the EU. This article aims to identify the impact of the EU made on the second group of countries. Generally, it is necessary to compare the state of their economic development in relation to the countries in the first group, in the base year and at the end of the period under consideration. The base year is the year of accession, and the end of the reference period is the year before the COVID-19 pandemic. Therefore, the period under consideration is between 2004 and 2019.

The economic development of a country can be seen in two ways: the first can be referenced to the data for the last year, and the second to a certain size for the reference period.

The aim of our analysis is the economic development which took place during your stay in the EU. Enlargement is a process of changes in successive events with causal links. It can be reflected in indicators such as the intensity, consistency and aggregate index of development over the period under consideration – dynamics (Ginevičius et al., 2018). Setting out how the economic development indicators of the two groups of countries developed over the period from 2004 to 2019 will help to answer the question of how the economic development of the second group of countries was affected by their presence in the EU. We will get a full picture if the economic development of the countries is examined both taking into account and regardless of the context of other countries. This is necessary because the higher the level of economic development in the country, the more difficult it is to sustain increasing growth rates (Ginevičius et al., 2018). In this case, the chart for analysing the impact of the EU on the economic development of its members will look like this (Figure 1).

The analysis of the economic development of the EU Member States is based on their economic development indicators, which are provided in various international statistical publications (Eurostat, OECD, etc.).

The purpose of the article is to quantify, on the basis of the dynamics of economic development of the countries, the impact of their membership in the Community.

In order to achieve the aim of the study, the following objectives shall be set: to group the EU countries according to their distinctive characteristics, analyse the ways of assessing the impact of former EU countries on their economic development; to select the indicator of economic development of the countries on the basis of the proposed methodology in order to determine the dynamics of the economic development of the countries in question, compare the trends of economic development of both groups of countries.

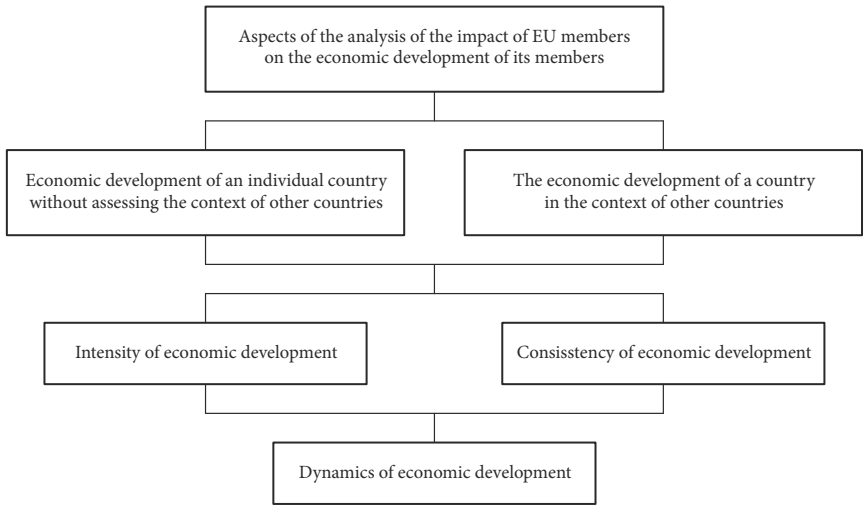

Figure 1. Scheme for analysing the impact of the European Union as an economic community on the economic development of its members (source: compiled by the authors)

1. Literature review

In the first phase of the creation of the Community, between 1958 and 1995, the majority of its members, with the exception of Greece, Spain and Portugal, were the richest countries in Western Europe. In 2004 and beyond, the situation changed radically with the integration of the countries of Central and Eastern Europe. An economic entity with the world's largest internal market of 450 million consumers has emerged (Hubner, 2004). The Community has become very heterogeneous as the newly accessed countries experienced a very large economic lag. These countries also joined the EU in the hope of accelerating their economic development by exploiting the Community's powerful economic potential. Today they are full members for more than 16 years and this is a long enough period to examine to what extent their expectations have been met.

All relevant studies come to the unanimous conclusion that the enlargement of the EU has benefited both its members, especially the newly acceded countries of Central and Eastern Europe, and Europe as a whole, as new opportunities have been created to address the crucial challenges of ageing societies and increasing economic competition with the US (Campos et al., 2019; Dobrzanski & Olszewski, 2019). Today, the EU and its further enlargement are also becoming very relevant due to China's aggressive economic policy.

Literature sources highlight how new opportunities for the EU countries have emerged. They cover a wide range of aspects. It is the creation of a business-friendly environment thanks to the convergence of trade standards, the liberalisation of customs policy, etc.; new opportunities for improving capital markets, investing, upgrading transport infrastructure; creation of new jobs; better protection of them and property rights, etc. (Pesa et al., 2017; Campos et al., 2019; Dobrzanski & Olszewski, 2019; Dhingra et al., 2017; Slusarczyk, 2018; Horridge & Rokicki, 2018).

This has helped to maintain stable economic growth rates for the EU's incumbents and to make new members more competitive on domestic and international markets. The overall outcome of this situation is the convergence of the economic development of the EU Member States. It is most often addressed in the context of the EU Member States, which are predominant in economically developed countries, i.e. what changes have taken place in the economic development of the rest of the Community. In terms of time, the analysis is carried out by distinguishing between the two stages of the enlargement of the EU. The first covers the period from its creation to 2000, the second from 2004 to the present. In both cases, convergence is analysed in three main aspects: individual countries; their groupings, either on the basis of the state of economic development or at the level of accession to the EU; and the use of payments from the EU budget (Table 1).

The convergence of the economic development of the EU Member States is widely examined in all three respects by Mr. Orłowski (Table 1). He and other authors use a variety of methods – econometrics, statistics of mathematics, etc. The econometric model of convergence analysis provides three stages. The first one prepares a baseline scenario, assuming that the current trends in economic development in the countries will be maintained. In the second phase, the modelling process prepares a scenario for possible changes in key macroeconomic indicators. The third step compares the results of the first and the second phases (Orłowski, 2000, 1998; Lejour et al., 2001; Breuss, 2002).

Table 1. Structural analysis of the convergence of economic development in EU countries (source: compiled by the authors)

Enlargements of the EU	Aspects of the analysis of convergence of economic development			
	Year	by country	groups of countries	use of EU benefits
	1958–2000	Orłowski, 2000; Lejour et al., 2001; Breuss, 2002	Joergensen et al., 2001; Orłowski, 1998, 2000; Czy żewski et al., 2003	Orłowski, 2000
	2004–2020	Gryshova et al., 2020; Rosés & Wolf, 2018; Vasylieva et al., 2019; Kocinska & Puziak, 2018; Pesa et al., 2017; Campos et al., 2019	Huang et al., 2021; Pesa et al., 2017; Spychala, 2019	Spychala, 2020; Kehagia & Kyziazi, 2021; Campos et al., 2019

Convergence between the EU countries and the EP was also assessed on the basis of the so-called β analysis and standard deviation σ indicator. Beta convergence takes place if the rates of economic development in poorer countries were higher in the period under consideration compared to rich countries. The calculations are based on a correlation-regressive analysis model (Hubner, 2004).

The value of the function will be determined as follows:

$$K = \frac{BVP^B}{BVP^F}, \tag{1}$$

where K – the function of the correlation regression model; BVP^B – the value of gross domestic product per capita at the end of the reference period; BVP^F – meaning of gross domestic product per capita at the end of the reference period.

The coefficient β shall be calculated as follows:

$$K = \propto + \beta BVP^F, \tag{2}$$

where $\propto$ is the constant value.

The studies covering the period from 1960 to 2002 have shown that β convergence has been markedly positive. On the other hand, the correctness of the model can be questioned, since the same BVP^F size is on both sides of equality.

The convergence of EU countries' per capita income between 1960 and 2002 was also confirmed by the decline in the σ standard deviation. Its convergence is even better reflected by the coefficient of variation.

Part of the studies examining the economic development in the first enlargement of the EU (Table 1) sought to determine how convergence has taken place between groups of countries based on their level of economic development. All 15 countries of the Community at that time were divided into two groups. The first is rich, and the second is the less developed countries – Greece, Spain and Portugal. The factors that may have influenced the differences in the pace of economic development in these groups of countries were analysed. The results obtained turn out to be interesting. They showed that EU membership did not automatically ensure the desired convergence process. On the one hand, the presence in the Community has facilitated economic development for the less developed countries. On the other hand,

if they have been used incompletely or improperly, i.e. they have not been subordinated to the further economic development of the countries, as happened in Greece, convergence processes have become quite different, even contrary (Joergensen et al., 2001; Orłowski, 1998, 2000; Czyżewski et al., 2003).

The EU has become a real test of its second enlargement, with the adoption of a large group of the countries with extremely low levels of economic development in 2004. Therefore, the analysis of the processes of convergence of economic development in this group is interesting both in scientific and practical terms. For these countries, in addition to all the new opportunities for accelerated economic development, payments from the EU budget have become a key factor (Spychala, 2020; Kehagia & Kyziazi, 2021). The studies were carried out both at the level of individual EU countries and in the newly acceded countries as a group compared to the rest of the Community. In all cases, the country's economic development was measured by GDP per capita (Gryshova et al., 2020; Rosés & Wolf, 2018; Vasylieva et al., 2019; Kokocinska & Puziak, 2018; Lisiński et al., 2020). The EU membership for a whole new group of the EU countries has been shown to have led to a significant increase in GDP growth rates. In addition to GDP, other macroeconomic indicators have improved: export volumes (Pesa et al., 2017), productivity (Dobrzanski & Olczewski, 2019); improving the structure of the capital market, increasing investment flows, etc. (Rapacki & Priochniak, 2008); indicators reflecting financial inclusion improved (Huang et al., 2021), etc.

Another important aspect of the research is the impact of disbursements from the EU budget on convergence of economic development in countries (Table 1). The results obtained are mixed. The use of the funds received by the different countries has been unevenly effective, since some countries used them in a targeted way, i.e. to increase the economic potential of enlargement (e.g. Ireland), while others sought to meet current domestic needs: increasing domestic consumption, reducing budget deficits, etc. (e.g. Greece). Such irresponsible behaviour only produced a short-term effect, increasing the standard of living, but limiting the opportunities for long-term economic growth (Orłowski, 2000; Spychala, 2020; Kehagia & Kyziazi, 2021; Campos et al., 2019).

Rapacki and Proochniak (2008) analysed how accession to the EU contributed to the economic growth of ten Central and Eastern European countries. Correlation and regression analysis were performed and the relationship among the selected macroeconomic variables (the progress of market or structural reforms, economic freedom, foreign aid and the FDI INFLOW) and GDP was established. The results showed that accession to the EU contributed significantly to the economic growth of those countries and to the level of convergence with the rest of the EU.

An analysis of the convergence of economic development in the EU countries has shown that literature sources tend to address either individual aspects or individual countries. Less emphasis is placed on analysing common trends in convergence processes. In addition, the advancements in economic development during the period considered are not taken into account. Ideally, only the end-to-end ratio is used, i.e. the dynamics of economic development over the whole period are not taken under consideratio.

2. Test methodology

On the basis of Figure 1, first of all, it is necessary to determine the set and quantification of criteria reflecting the development of enlargement over the period considered.

Quantification of economic development in the countries. Literature analysis shows that the country's level of economic development is mostly measured by gross domestic product per capita (Cook & Davíšsdóttir, 2021; Aitken, 2019; Kalimer et al., 2020; Sokolov Mladenović et al., 2019). This indicator is defined as the final market value of goods and services developed in a country over a period of time. It shows the country's overall economic strength. The higher it is, the more it manifests in the monetary economy, the more taxes are collected into the budget, the greater the overall capacity of the state. Thus, its power is closely related to the economic power, which is usually measured by the GDP generated per year. On the other hand, critics argue that this indicator is limited because it does not fully reflect the well-being of people's lives. This is partly true because GDP is primarily an economic indicator that does not involve many social aspects (life inequality, poverty, etc.) as well as intangible aspects. This indicator should therefore, in particular, not be seen as an indicator of the well-being of life, but as an indicator of the economic strength of a country or economic development. For international comparisons, GDP per capita is convenient. Its practical use is facilitated by the fact that the parties calculate it on the basis of a uniform methodology and it is easily accessible. Data on economic development in the EU are provided by international statistical publications, various databases (Eurostat, OECD).

An assessment of the intensity of the economic development over the period considered, regardless of the context of the rest of the world. The intensity of the country's economic development reflects its development during the period considered. To that end, it is necessary, in an appropriate manner, to compare its significance at the beginning and at the end of the period of the question. This can be done in two ways: first, to establish the relationship between those two values; secondly, to calculate the coefficient of economic development intensity.

The ratio of the intensity of economic development of a country is calculated as follows (Ginevičius et al., 2018):

$$S_{jI}^{T} = \frac{Q_{jf}^{T}}{Q_{jb}^{T}}, \tag{3}$$

where S_{jI}^{T} is the intensity of economic development of the country j-s over the reference period T; Q_{jf}^{T} – the significance of the economic development of the country J-s at the end of the reference period T; Q_{jb}^{T} – the importance of the country's economic development at the beginning of the reference period T.

The coefficient of intensity of economic development of a country is determined as follows (Ginevičius et al., 2021):

$$K_{jI}^{T} = \frac{Q_{jf}^{T} - Q_{jb}^{T}}{Q_{jf}^{T}}, \tag{4}$$

where K_{jI}^{T} – the intensity factor T of the economic development of the country j-s over the reference period.

The indicator of the intensity of economic development of a country reflects its quantitative side and can therefore be considered as a partial indicator of development dynamics (Ginevičius et al., 2018).

An assessment of the equilibrium of the economic development of a country over the period considered, regardless of the context of the rest of the world. The measure of the uniformity of economic development reflects the magnitude of its changes in time periods T for the period under consideration. Continuity of the development is important in the sense that it influences the social and environmental situation of the country. This value is determined as the ratio of the length of the ideal trajectory of economic development over the reference period T to the length of the actual trajectory (Ginevičius et al., 2018).

The length of the ideal uniform trajectory is determined as follows:

$$L_{jI}^{T} = \sum_{i=1}^{m} t_i^T = N - 1, \tag{5}$$

where L_{jI}^{T} – the length of the trajectory of the economic development of the country during the reference period T is perfectly uniform; t_i^T – the length of time period T i-o for the reference period (t_i = 1.0); N is the length of the reference period T (start and end years), m is the number of periods of time T of the reference period ($m = \overline{1, N-1}$).

The length of the actual trajectory of the country's economic development during the period under consideration is determined as follows (Ginevičius et al., 2018):

$$L_{jF}^{T} = \sum_{i=1}^{n} \sqrt{1 + \Delta q_i^2}, \tag{6}$$

where L_{jF}^{T} – the length of the actual trajectory for the economic development of the country during the period under consideration; Δq_i – the extent of economic development during the T period under consideration.

Size Δq_i: determined as follows:

$$\Delta q_i = \left| q_{i+1} - q_i \right|, \tag{7}$$

where q_i – the importance of economic development at the beginning of the time period considered.

Based on the Eqs (5)–(6), the indicator of consistency in the economic development of the country during the period considered will look like this (Ginevičius et al., 2018; Lisiński et al., 2020):

$$D_{jT}^{T} = \frac{L_{jI}^{T}}{L_{jF}^{T}} = \frac{N \quad 1}{\sum_{i \quad 1}^{n} \sqrt{1 + \Delta q_i^2}}, \tag{8}$$

where D_{jT}^{T} is the uniformity of economic development of country *J* during the reference period *T*.

The indicator of the uniformity of economic development of the country reflects its qualitative side and can therefore be considered as a partial indicator of development dynamics (Ginevičius et al., 2018).

An assessment of the dynamics of the country's economic development over the period considered, regardless of the context of the rest of the world. The indicator of the dynamics of eco-

nomic development is determined by combining indicators of its intensity and uniformity in an appropriate way. Various types of combination are available: product of values, geometric means, summing to measure the importance of partial indicators for the dynamic indicator (Ginevičius et al., 2021):

$$D_{jD}^{T} = K_{jJ}^{T} \times D_{jT}^{T}; \tag{9}$$

$$D_{jD}^{T} = \sqrt{K_{jJ}^{T} \times D_{jT}^{T}}; \tag{10}$$

$$D_{jD}^{T} = \omega_1 K_{jJ}^{T} + \omega_2 D_{jT}^{T}, \tag{11}$$

where, ω_1, ω_2 respectively, the importance of the intensity and evenness of economic development in the dynamics of $\omega_1 + \omega_2 = 1.0$ development.

Another important aspect of the research is the assessment of the economic development situation in the country at the beginning of the period under consideration. This can be done on the basis of correlation-regressive analysis models:

$$Y_j^T = f(X_j^T), \tag{12}$$

where Y_j^T – the magnitude of the changes in the economic development of the country during the reference period T; X_j^T – the significance of the economic development of country J-s at the beginning of the period considered.

Assessing the intensity of a country's economic development in the context of other countries. The intensity of the country's economic development during the period considered K_{ij}^T does not present a full picture of it, since it does not take into account the context of other countries. It can be assumed that an economically developed country is more difficult to sustain the same pace of the development compared to a much less economically developed member of the same community. On the other hand, despite the pace of enlargement, the economic power of a developed country is significantly higher than that of one with more intensive economic development, but a country lagging behind. In order to determine the intensity of economic development during period T, taking into account the context of other countries, the magnitude of its changes needs to be compared to the level of economic development achieved in the country where it is the highest:

$$\widetilde{K_{jy}^T} = \frac{Q_{if}^T - Q_{jB}^T}{Q_f^{\max T}}, \tag{13}$$

where K_{jy}^T – the intensity of economic development during period T is measured in the context of the rest of the world; $Q_f^{\max T}$ – the significance of economic development at the end of the reference period T of the country for which it was the largest.

An assessment of the equilibrium of the economic development of a country over the period considered in the context of the rest of the world. The uniformity of the economic development of a country during the period considered, taking into account the context of the rest of the world, with a similar intensity, can be established as follows:

$$\widetilde{K_{jT}^T} = \frac{K_{jT}^{\max T} - K_{jT}^T}{K_{jT}^{\max T}}, \tag{14}$$

where $\widetilde{K_{jT}^T}$ – the consistency indicator of the economic development of the country during

period T assesses the context of the rest of the world; $K_{jT}^{\max T}$ – the continuity of economic development in the country for which it was the highest.

Assessing the dynamics of the country's economic development in the context of other countries. It is carried out on the basis of one of the Eqs (7)–(9):

$$\tilde{K}_{jd}^{T} = \widetilde{K_{jL}^{T}}\omega_1 + \widetilde{K_{jT}^{T}}\omega_2, \tag{15}$$

where $\tilde{K}_{jd}^{T}$ – an indicator of the dynamics of economic development of a country during period T, which assesses the context of other countries.

3. Empirical study and discussion of results

In order to answer the question of the impact of the accession of the countries to the EU as an economic community, they must first of all be grouped according to their distinctive characteristics. As stated above, such may be the year of accession, the status of the national currency, i.e. whether it has been converted or not, and the level of economic development. According to this, all 27 EU countries are divided into two groups. The first one includes those counties that joined the EU before 1995 and the second group consists of those that have joined since 2004 (Table 2). During the period from1996 to 2003, no new members joined the Community.

Table 2. Countries of the European Union: year of accession (source: compiled by the authors)

Groups of countries			
first		second	
Country	Year of EU accession	Country	Year of EU accession
Belgium	1958	Czech Republic	2004
Italy	1958	Estonia	2004
Luxembourg	1958	Cyprus	2004
Netherlands	1958	Latvia	2004
France	1958	Poland	2004
Germany	1958	Lithuania	2004
Ireland	1973	Malta	2004
Denmark	1973	Slovakia	2004
Greece	1981	Slovenija	2004
Spain	1986	Hungary	2004
Portugal	1986	Bulgaria	2007
Austria	1995	Romania	2007
Finland	1995	Croatia	2013
Sweden	1995		

The analysis was carried out on the basis of Figure 1 and Table 2. In order to make the countries in the first and second groups comparable, the base year of economic development for both groups took place in 2004. The following calculations were carried out in two respects. In particular, for both groups of countries, average values for the intensity, homogeneity and dynamics of their economic development between 2004 and 2019 were determined, followed by a correlation-reviewed analysis of their dependency on GDP baselines. The models of the study look as follows:

$$K_{jT}^{T} = f\left(K_{jI}^{T}\right); \tag{16}$$

$$K_{jI}^{T} = f\left(Q_{B}\right); \tag{17}$$

$$K_{jT}^{T} = f\left(Q_{B}\right); \tag{18}$$

$$K_{jD}^{T} = f\left(Q_{jB}\right), \tag{19}$$

where the baseline value of the economic development of the country is Q_j j-s.

Assessment of the intensity of economic development in the countries between 2004 and 2019, regardless of the context of the rest of the world. The calculations are based on Eqs (4), (8) and (11) and the results are given in Table 3.

Table 3. Indicators of economic development in the European Union for the period 2004–2019 (source: compiled by the authors)

Groups of countries													
first							second						
indicator values							indicator values						
Country	not assessing the context of other countries			estimating the context of other countries			Country	not assessing the context of other countries			estimating the context of other countries		
	K_{jI}^{T}	K_{jT}^{T}	K_{jD}^{T}	$\tilde{K}_{jI}^{T}$	$\tilde{K}_{jT}^{T}$	$\tilde{K}_{jD}^{T}$		K_{jI}^{T}	K_{jT}^{T}	K_{jD}^{T}	$\tilde{K}_{jI}^{T}$	$\tilde{K}_{jT}^{T}$	$\tilde{K}_{jD}^{T}$
Belgium	0.31	0.71	0.43	0.11	0.82	0.33	Czech Republic	0.55	0.67	0.59	0.11	0.77	0.31
Italy	0.16	0.85	0.37	0.03	0.98	0.31	Estonia	0.66	0.63	0.65	0.13	0.72	0.31
Luxembourg	0.41	0.29	0.36	0.40	0.33	0.38	Cyprus	0.24	0.71	0.38	0.04	0.82	0.28
Netherlands	0.31	0.62	0.40	0.13	0.71	0.30	Latvia	0.67	0.65	0.66	0.10	0.75	0.30
France	0.25	0.79	0.38	0.07	0.91	0.32	Poland	0.69	0.68	0.69	0.12	0.78	0.31
Germany	0.33	0.67	0.43	0.12	0.77	0.31	Lithuania	0.61	0.77	0.66	0.08	0.88	0.32
Ireland	0.47	0.28	0.41	0.35	0.32	0.32	Malta	0.55	0.69	0.59	0.12	0.79	0.32
Denmark	0.30	0.59	0.39	0.08	0.68	0.26	Slovakia	0.62	0.76	0.66	0.10	0.87	0.33
Greece	–0.04	0.76	0.20	–0.02	0.82	0.24	Slovenia	0.40	0.74	0.50	0.08	0.85	0.32
Spain	0.24	0.78	0.40	0.04	0.90	0.30	Hungary	0.45	0.81	0.56	0.06	0.93	0.32
Portugal	0.30	0.85	0.47	0.05	0.98	0.33	Bulgaria	0.69	0.74	0.71	0.06	0.85	0.30
Austria	0.34	0.66	0.41	0.12	0.76	0.31	Romania	0.76	0.63	0.72	0.08	0.72	0.28
Finland	0.30	0.62	0.39	0.12	0.71	0.28	Croatia	0.42	0.87	0.56	0.04	1.00	0.33
Sweden	0.26	0.45	0.31	0.11	0.52	0.24	Average	0.56	0.72	0.61	0.09	0.83	0.31
Average	0.28	0.64	0.38	0.12	0.73	0.30							

Table 3 shows that the intensity of economic development in the second group of countries between 2004 and 2019 is twice as high as for the first group. Taking into account that the GDP of the first group of countries was 3.7 times higher on average in 2004 than in the second group, and 2.5 times in 2019, it can be argued that the accession of the second group of countries to the EU represented significantly greater opportunities for economic development than before 2004. This conclusion is important in the sense that it excludes speculation about the benefits of the membership in the EU for less developed countries. This is also confirmed by the results of the correlation-regression analysis (Table 4).

Table 4 shows that the intensity of change is decreasing as GDP grows in the first group. At the same time, GDP growth in the second group of the countries has a positive impact on the intensity of its change.

An assessment of the equilibrium of the economic development of the countries between 2004 and 2019, regardless of the context of the rest of the world. The calculations based on Eqs (5)–(8) are given in Table 4. It shows that GDP developments in the second group are only slightly higher than in the second group of the countries. So it can be concluded that the country's higher levels of economic development slightly diminish the uniformity of change. The results of the correlation-regression analysis also showed that there is little correlation between the level of economic development and the level of homogeneity for the first group of the countries. On the other hand, the overall trend is confirmed by the results of this analysis for the second group of countries: the increase in basic GDP reduces the uniformity of change.

In the context of the analysis of uniformity changes, it is expedient to look at how the intensity of the changes affects the smoothness. The correlation-reflection analysis (16) showed that it is very significant for the first group and rather high for the second group (correlation coefficient r = 0.88 and 0.69 respectively). This also confirms the general trend, which is increasing with higher levels of economic development.

Table 4. Results of a correlation-regressive analysis of the impact of the economic development situation in the euro area in the European Union on its indicators in the base year (source: compiled by the authors)

Indicator of economic development	Groups of countries			
	first		second	
	regression equation	correlation coefficient *r*	regression equation	correlation coefficient *r*
Intensity	$K_{jI}^{T} = -68.63Q_{jB}^{2} + 51.86$	–0.85	$K_{jI}^{T} = 137.59Q_{j}^{2} - 140.74Q_{j} + 41.02$	0.68
Uniformity	$K_{jT}^{T} = 37.02Q_{jB}^{2} - 32.56Q_{jB} + 34.88$	–0.15	$K_{jT}^{T} = 121.56Q_{jB}^{2} - 202.14Q_{j} + 90.26$	–0.44
Dynamics	$K_{jD}^{T} = 660.61Q_{jB}^{2} - 566.08Q_{jB} + 147.65$	–0.74	$K_{jD}^{T} = 159.51Q_{jB}^{2} - 156.67Q_{j} + 42.303$	0.60

An assessment of the dynamics of economic development in the countries between 2004 and 2019, regardless of the context of the rest of the world. As the intensity of the country's economic development strongly influences its smoothness, it can be argued that these sub-indicators play an unevenly important role in the development dynamics. Therefore, the dynamic level calculations were made on the basis of the Eq. (9). On the basis of the above studies, the importance of the intensity of economic development has been estimated at 0.7, while consistency is estimated at 0.3. The results of the calculation are given in Table 4. It shows that, this figure is 1.6 times higher for the first group than for the second group. The correlation-reflection analysis showed that the significantly higher level of economic development in the first group of the countries has a greater impact on the dynamic indicator compared with the faster economic development of the second group of the countries.

The next step in the research is the assessment of the impact of the country's economic development in the context of other countries (Figure 1). For this purpose, the values of indicators, intensity, homogeneity and dynamics analysed were transformed on the basis of Eqs (13)–(15). The results of the calculations are given in Table 3. It shows that the assessment of the level of economic development achieved by the countries is fundamentally changing the picture in some aspects. For example, the intensity of economic development is 1.33 times higher for the first group (without taking into account the context of the countries, it was twice as high for the second group). The picture of the smoothness of enlargement has remained broadly unchanged, leaving it slightly better for the second group of the countries. There was a convergence in the development dynamics indicator (without considering the context of the countries, it was 1.6 times higher for the second group). Thus, this investigation makes it possible to see how the country taken out specifically appears to be vis-à-vis other countries.

The results of the study need to be assessed cumulatively in two aspects – EU countries as a whole and from country-specific positions. The main conclusion on the first aspect is that the accession of the second group of the countries to the EU as an economic community has significantly improved the conditions of their economic development and revealed its wider potential. This has particularly affected the intensity of their economic development, with the gap narrowing by almost 1.5 times over the period from 2004 to 2019. The results obtained are also relevant for individual countries, as each of them can see and assess its situation and compare it with other countries. All this can be successfully used for targeted decisions on the economic development of both the EU and its members.

Discussion

The EU, as an economic community of countries, is affected by many factors, both strengthening and destabilising its functioning. Members who, at their level of economic development, are far behind developed countries have great potential for further economic and social development, as they can exploit the potential of the community as a whole. They create a large common market, have reduced entry barriers due to the common customs policy, etc. destabilising factors can be attributed to the primacy of Community law in the individual laws of its members. This may be at odds with the willingness of the countries, especially

those that have newly acceded, to address some issues independently, regardless of the requirements of the EU. This leads to a conflict with the Community, which often results in financial and other sanctions. The obvious confirmation of this is demonstrated by Poland and Hungary. Their desire to ignore Community law led to litigation and financial sanctions. Other detailed factors arise from different levels of economic development in the EU, which promotes the emigration of both unskilled and skilled labour force from the less developed countries to the rich ones. Tensions are also raised by the general imposition of a culture that intersects with the traditions of the newly acceded countries.

The EU's developed countries also suffer both positive and negative consequences. The latter include access to cheap labour force, investment in less developed countries, opportunities for joint ventures, branching opportunities, etc. On the other hand, the influx of cheap labour force increases social tensions due to competition with the local population, accompanied by serious consequences. This is confirmed by the example of the United Kingdom where such a conflict resulted in its withdrawal from the Community.

There is another problem for those EU members who bear the greatest financial burden. These are primarily Germany and France. Huge contributions are a cause of dissatisfaction among the people of these countries. It is no coincidence that they give rise to movements which result in the question of the desirability of staying in the Community.

Further research should be developed both horizontally and vertically. The first should include, in particular, the benefits of the presence of economically developed countries in the EU, the subject of vertical research should not only be the economic development of the countries, but also social, environmental, cultural, etc. development. Limitations to such studies may include the availability of information. This may even require information structures from international statistical institutes.

Conclusions

The ongoing debate on the meaning of EU membership as an economic community is relevant to the analysis of the economic development of its members. Changes in the economic development of countries may be revealed if they are divided into two groups based on their distinctive characteristics, such as the year of accession to the EU, the nature of the national currency and the level of economic development achieved. The EU membership has been examined in two aspects – without assessing and assessing the context of other countries. This has made it possible to see the real differences in their economic development.

The economic development of the countries is reflected in three indicators – their intensity, consistency and dynamics. The evolution of their values over the period from 2004 to 2019 reflected the evolution of the economic development of the second group of the countries that joined the EU in 2004 and beyond compared to the countries that joined earlier than them.

The studies have revealed important trends in economic development in the EU. Particular attention is paid to the fact that the economic development of the less economically developed countries comprising the second group of countries after accession to the EU was twice as rapid as that of the more developed countries classified in the first group. It follows

that their presence in that economic community has facilitated rapid economic development for the new Member States, using the Community's powerful potential to do so. Apart from this, another important trend, both scientifically and practically, emerged – the higher the country's level of economic development, the less uniform it is. This phenomenon requires a separate in-depth study.

Various ways of sub-indicators of economic development, intensity and uniformity, aggregation into aggregate, dynamics are possible. On the basis of a correlation-regressive analysis, a strong effect of intensity on uniformity has been identified. The Dynamics Indicator should therefore be attributable to one that assesses the relevance of these sub-indicators. A markedly higher intensity of economic development has been observed in the first group of the countries, while the second is characterised by improving economic development dynamics.

In the context of the rest of the world, it appears that the intensity of economic development in the first group has become higher than that of the second group of the countries. The balance of enlargement between the two groups of the countries has remained practically the same, but their dynamics has been equated in terms of their values. These results are quite important for each country, as they can observe and assess the real state of their economic development.

Further research should be developed both horizontally and vertically. The first should include, in particular, the benefits of the presence of economically developed countries in the EU, the subject of vertical research should not only be the economic development of the countries, but also social, environmental, cultural, etc. development. Limitations to such studies may include the availability of information. This may even require information structures from international statistical institutes.

The results of this study can be used to guide the economic development decisions of both the EU and its members.

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Author contributions

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