QUANTITATIVE ASSESSMENT OF DYNAMICS OF ECONOMIC DEVELOPMENT IN THE COUNTRIES OF THE EUROPEAN UNION

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Abstract. The European Union is made up of countries that differ significantly in their economic development. In order to develop tailored strategies for their development, it should be possible to quantify the condition at a desired point in particular time. Again, on this basis, the process of economic development can be quantified and thus typicalities identified. The process is characterized by several parameters: intensity, which reflects the quantitative side of the development process; homogeneity reflecting upon the qualitative side of the development process, and dynamics, integrating development intensity and homogeneity into one generalizing mean. The values of the economic development process make it possible to divide all the countries of the European Union into three levels. This distinction allows for a differentiated analysis of the effects of economic development of countries in terms of their social, environmental and other development.

Keywords: sustainable development, EU, quantitative assessment, GDP per capita.

JEL Classification: Q01, C00.

Introduction

The construction of the European Union (EU) as a political, economic and administrative community dates back 60 years and is not yet over. As a result, its composition is very uneven. Depending on the level of economic development, three groups of countries could be relatively distinguished. The first group would be made of the most economically advanced members of the EU, which were admitted to the Community before 1995. The second group includes a large number of Central and Eastern European countries, which became members

in 2004. The third group could include the latest adopted countries. They are characterized by a gap in economic development from the countries belonging to the second – and even more so – the first group.

Economic development is the basis for the well-being of both the individual country and the community as a whole, and it is important to notice the patterns of this development. This would help to formulate further targeted development strategies that take into account the level of economic development achieved by the countries. Research object – sustainable development.

Disclosure of regularities is possible if there is a way to quantify the state of the development process at a desired point in time, and to predict the sequence of changes on that basis. First of all, it is necessary to determine which indicator or indicators reflect upon the economic development of the country. Based on this, it will be possible to analyze the changes, identify the components of this complex process, their interdependencies, and so on. The key requirement for an economic development indicator or indicators is that they allow c need to allow making comparisons between particular EU countries in different ways. In this way, countries could be differentiated according to their economic development, in order to formulate differentiated development strategies.

1. The indicator of country's economic development is the gross domestic product per capita

The economic development of the countries is subject to multi-layered complex processes which, in reality, manifest themselves in many different ways. The quantification of such phenomena can only be achieved by indicators, indices or their systems that can combine all these aspects into one aggregated measure.

Bibliography and international practice have raised two approaches to quantifying the status of such complex processes. In the first case, it is suggested to use one indicator that integrates the performance of all economic activities of the country (industry, construction, transport, agriculture, services, etc., i.e. those that create added value) (Čiegis et al., 2010; Babu & Dutta, 2015). In the second case, the overall process of economic activity is broken down into separate parts (Parris & Kates, 2003; Čiegis et al., 2010; Rotmans, 2006; Spangenberg, 2012; Scherp, 1994; Wackernagel & Rees, 1996; McLaren et al., 1998; Hamilton, 2007). Each of these parts represents a system of indicators. These systems quantify the condition of each part. The overall result is obtained by combining the evaluations of the parts in one way into a single summation (Kareivaite, 2012; Janker & Mann, 2018; Strezov et al., 2017; Kondyli, 2010; Compagnolo et al., 2018; Turan, 2013; Radovanovic & Lior, 2017; Zinatizadeh et al., 2017; Touceda et al., 2018; Rametsteiner et al., 2011; Schoenaker et al., 2015; Ginevičius et al., 2018; Gedvilaitė, 2019).

In the first case, the measure of economic development quantifies and uses gross domestic product per capita (GDP) (Van den Beryh, 2009). The second case is based on multi-criteria assessment methods (Song et al., 2017; Pehlivan et al., 2018; N. Prascevic & Z. Prascevic, 2017; Turskis et al., 2017; Boggia & Cortina, 2010; Gedvilaitė, 2019).

It is possible that the second way of quantifying the state of economic development is more accurate than the first. This is because the overall development process is broken down

into the desired number of dimensions. This gives a fairly adequate picture of the pheno-menon under consideration. By giving these aspects specific quantitative expressions, i. e. formalizing them, indicator systems that fully reflect the phenomenon under consideration are being created. They provide a reasonably accurate quantification of the condition at the point in time.

On the other hand, deeper analysis reveals the reasons for limited applicability of this approach to assess the economic development of countries. There are several of the reasons. Firstly, in each country, due to its specificity, access to relevant information, and so on. eco-nomic development is reflected by indicator systems that differ from their counterparts in other countries, both in their composition and in their number (Wallis et al., 2011; Gzzebyk & Stec, 2015; Graymore et al., 2010; Ivanovic et al., 2009; Delai & Takahashi, 2011; Xavier et al., 2018; Wang et al., 2018; Sala et al., 2015). Secondly, the high cost of computation due to the fact that the importance of indicators that are difficult to formalize and the importance of system indicators can only be determined on the basis of expert judgment (Golusin et al., 2011; Boggia et al., 2014; Becker et al., 2017; Rogge, 2018; Zhou et al., 2010; Chowolhury & Squire, 2006; Booysen, 2002). For these reasons, the results of the multi-criteria assessment cannot be used to compare economic development between countries.

Moreover, in all the proposed systems of economic development indicators, GDP is the most other important components (Mally, 2018; Jia et al., 2017; Bilan et al., 2019). Consequ-ently, it is recognized as one of the most important indicators of the economic development. The fact that information on GDP is easily accessible and is made public in national or in-ternational statistical publications or databases (Eurostat, 2019) also speaks in favor of GDP. Gross Domestic Product per capita is calculated according to a unified methodology and thus becomes a universal indicator allowing comparisons between countries according to their level of economic development.

The main reason that GDP per capita to be used to measure countries' economic develop-ment is its complexity. It combines all economic performance, both sectoral and territorial. Therefore, it is not surprising that the amount of GDP adequately reflects upon the state of economic development of the country (Čiegis et al., 2010). Therefore, GDP per capita is taken as the indicator of economic development of EU countries in this study.

2. Methodology for quantification of economics development in the countries of the European Union

The economic development of countries is measured over a period of time, which consists of time spans. Time span is considered to be usually a year. The basis for assessment is the state of economic development over particular time periods. The totality of these conditions makes it possible to assess and analyze changes in economic development that have taken place over the period under review. They can be quite different: for some countries they can be quite noticeable, whereas for others economic development can undergo without signifi-cant fluctuations (see Figure 1).

Figure 1 shows that the situation of country's economic development can be characterized by four parameters: development intensity, uniformity, dynamics and duration of the period under consideration. The first three parameters are changeable and differ for each country,

whereas the fourth parameter remains the same. Changeable parameters, in their sense, represent two different sides of the development process: intensity as quantitative changes, and uniformity as qualitative, whereas dynamics as the integral size of quantitative and qualitative changes. Based on this, a quantitative matrix of economic development of the country can be formed (see Table 1).

From Table 1 it is clear that three indicators of economic development – intensity, continuity and dynamics – can be calculated for each country. For each country, they are determined in two viewpoints – with or without assessing and evaluating the context of the other countries.

From Table 1 an important development trend can be identified. This will be the effect of the intensity of economic development on the sustainability of development.

In order to carry out such an analysis, in both cases it is necessary to have expressions of the indicators of intensity and uniformity of economic development and to calculate their values.
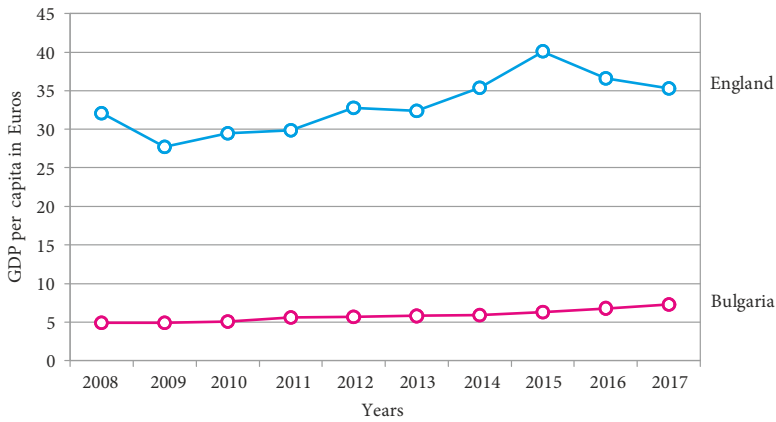
Figure 1. GDP per capita in England and Bulgaria (source: Eurostat, 2019)

Table 1. Matrix of quantitative assessment of national economic development
(source: compiled by authors)

Aspect of development / Parameters of assessment		quantitative	qualitative	complex
Intensity	One country	+	–	–
	All countries' context	+	–	–
Uniformity	One country	–	+	–
	All countries' context	–	+	–
Dynamics	One country	–	–	+
	All countries' context	–	–	+

The intensity of economic development for a particular country over a particular time span can be determined as follows (Ginevičius et al., 2018):

$$D_{Ij}^T = \frac{Q_{fj}^T}{Q_{bj}^T}, \tag{1}$$

where D_{Ij}^T is intensity of economic development of country j over the period T considered; Q_{fj}^T is economic development status of country j at the end of period T; and Q_{bj}^T is the same value at the beginning of period T.

The intensity of economic development of a country during the analyzed period T, while assessing the context of economic development in other EU countries as follows (Ginevičius et al., 2018) can be determined by the following formula:

$$\tilde{D}_{Ij}^T = \frac{Q_{fj}^T}{Q_{\min}^T}, \tag{2}$$

where $\tilde{D}_{Ij}^T$ is the intensity of economic development of EU country j during the period under consideration T, which assesses the economic development context of other EU countries; and $Q_{\min}^T$ is the value of the economic development indicator at the beginning of period T for the EU country with the lowest level.

The uniformity of economic development of the EU countries during the analyzed period T can be determined based on MDD methodology (Ginevičius et al., 2018). Its essence is the ratio of the value expressed as the total duration of the period under consideration, to the actual total length of the economic development trajectory:

$$D_{Tj}^T = \frac{T}{\displaystyle\sum_{i=1}^{n} \sqrt{1 + \Delta q_{ji}^2}}; \tag{3}$$

$$\Delta q_{ji} = q_{ji+1} - q_{ji}, \tag{4}$$

where D_{Tj}^T is the measure of the uniformity of economic development of the EU country j during the period under review T; Δq_{ji} – change in economic development of E country j during the examined period Ti of the whole period considered; q_{ji} – value of economic development of EU country j at the beginning of period Ti of the period under consideration; q_{ji+1} is thevsame value at the end of period Ti of the whole period under consideration; and n is the number of time periods $(i = \overline{1, n})$ of the period T under consideration.

By knowing how to calculate the intensity and sustainability indices of countries' economic development, it is possible to determine the level of development dynamics (Figure 2). The way in which this is determined depends on the importance of the intensity and continuity indicators for the dynamics of economic development. If it is not possible to be evaluated, the dynamics index can be calculated as follows (Ginevičius et al., 2018):

$$D_{Dj}^T = D_{Ij}^T \times D_{Tj}^T; \tag{5}$$

$$\tilde{D}_{Dj}^T = \tilde{D}_{Ij}^T \times D_{Tj}^T, \tag{6}$$

where D_{Dj}^T is an indicator of the economic development dynamics of the particular EU co-

untry j, especially when the economic development context of other EU countries is not possible to be considred; and $\tilde{D}_{Dj}^{T}$ is the same value when this context is evaluated.

If the importance of the intensity and continuity of economic development as an indicator of development dynamics is assessed, it can be determined as follows:

$$D_{DKj}^{T} = \omega_1 D_{Ij}^{T} + \omega_2 D_{Tj}^{T} ; \tag{7}$$

$$\tilde{D}_{DKj}^{T} = \omega_1 \tilde{D}_{Ij}^{T} + \omega_2 D_{Tj}^{T} , \tag{8}$$

D_{DKj}^{T} here is the indicator of the economic development dynamics of the EU country j, where the importance of development intensity and continuity to the dynamics of development is assessed; $\tilde{D}_{DKj}^{T}$ is the same value when assessing the context of other EU countries.

Based on the above methodology, a complex analysis of economic development of the EU countries was performed.

3. Analysis of economic development in EU countries

The analysis of the economic development of the EU countries is based on the basic table, which provides the GDP per capita values for 2008–2017. This means that the period under consideration T consists of ten time periods (years) (see Table 2).

Based on Table 1 and the formulas (1) to (3), the values D_{Ij}^{T}, $\tilde{D}_{Ij}^{T}$ and D_{Tj}^{T} were calculated (see Table 3).

From this table, it can be seen that the uniformity of the countries' economic development varies from 0 to 1, while the range of intensity variation is open, i. e. it does not have a possible frame, and, therefore, has values greater than 1.0. In order to correctly calculate the rate of dynamics of economic development (formulas (5) to (8)), both quantities, namely, intensity and uniformity, must be comparable. This means that the indicator of economic development intensity must be transformed in an appropriate way so that it also varies between 0 and 1. This procedure can be performed according to formulas (1) and (2) as follows:

$$D_{Ij}^{TT} = \frac{D_{j}^{T}}{D_{max}^{T}} ; \tag{9}$$

$$\tilde{D}_{Ij}^{TT} = \frac{\tilde{D}_{j}^{T}}{\tilde{D}_{max}^{T}} , \tag{10}$$

D_{j}^{TT} here is the transformed value of the economic development intensity indicator of the EU country j during the period T under review for the EU country as a whole; e.g. not considering the economic development context of other EU countries; $\tilde{D}_{j}^{TT}$ is the same value in the context of the economic development of other EU countries; D_{max}^{T} is the value of the economic development indicator for the EU country with the largest size; $\tilde{D}_{max}^{T}$ is the same for the EU country for which size $\tilde{D}_{Ij}^{T}$ matters most.

Analogous to formulas (5)–(6), the indicator of economic development dynamics of the EU countries can be determined by using formulas (9)–(10). The calculation formulas will look like this:

$$D_{DTj}^{T} = D_{Tj}^{T} \times D_{Ij}^{TT} ; \tag{11}$$

Table 2. EU Gross Domestic Product per capita 2008–2017 (source: Eurostat, n.d.)

No.	Country	Year									
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
1	Belgium	33.1	32.3	33.5	34.5	35.0	35.3	35.8	36.6	37.6	38.7
2	Bulgaria	4.9	4.9	5.1	5.6	5.7	5.8	5.9	6.3	6.8	7.3
3	Czekh	15.5	14.2	14.9	15.6	15.4	15.0	14.9	16.0	16.7	18.1
4	Denmark	44.0	41.9	43.8	44.5	45.5	46.1	47.1	48.0	49.2	50.8
5	Germany	31.7	30.6	32.1	33.7	34.3	35.0	36.3	37.3	38.4	39.6
6	Estonia	12.3	10.6	11.0	12.5	13.5	14.3	15.2	15.7	16.5	18.0
7	Ireland	41.8	37.5	36.8	37.4	38.1	38.9	42.0	55.9	57.5	61.2
8	Greece	21.8	21.4	20.3	18.6(p)	17.3(p)	16.5(p)	16.4(p)	16.4(p)	16.4(p)	16.7(p)
9	Spain	24.3	23.3	23.2	22.9	22.2	22.0	22.3	23.3	24.1(p)	25.1(p)
10	France	31.0	29.9	30.7	31.5	31.8	32.1	32.4	33.0	33.3(p)	34.2(p)
11	Croatia	11.2	10.5	10.5	10.5	10.3	10.3	10.2	10.6	11.2	11.8
12	Italy	27.6	26.4	26.8	27.3	26.7	26.5	26.7	27.2	27.9	28.5
13	Cyprus	24.2	23.1	23.3	23.2	22.6	21.0	20.7	20.9	21.7(p)	22.8(p)
14	Latvia	11.2	8.8	8.5	9.8	10.8	11.3	11.8	12.3	12.8	13.9
15	Lithuania	10.2	8.5	9.0	10.3	11.2	11.8	12.5	12.9	13.5	14.9
16	Luxembourg	77.9	74.2	79.2	83.1	83.0	85.3	89.2	90.6	91.3	92,6
17	Hungary	10.8	9.4	9.9	10.2	10.0	10.3	10.7	11.3	11.6	12.7
18	Malta	15.0	14.9	15.9	16.4	17.1	17.9	19.5	21.4	22.3	23.8
19	Netherlands	39.4	37.8	38.5	39.0	39.0	39.3	39.8	40.8	41.6(p)	43.0(p)
20	Austria	35.3	34.5	35.4	37.0	37.8	38.2	39.0	39.9	40.8	42.1
21	Poland	9.6	8.2	9.4	9.9	10.1	10.3	10.7	11.2	11.1	12.2
22	Portugal	16.9	16.6	17.0	18.0	17.5	16.3	16.6	17.4	18.1	18.9(p)
23	Romania	7.1	6.1	6.2	6.5	6.6(p)	7.2	7.6	8.1	8.6	9.6(p)
24	Slovenia	18.8(p)	17.7	17.7	18.0	17.5	17.6	18.2	18.8	19.5	20.8
25	Slovakia	12.2	11.8	12.4	13.1	13.4	13.7	14.0	14.6	15.0	15.6
26	Finland	36.5	33.9	34.9	36.5	36.9	37.4	37.6	38.2	39.3	40.6
27	Sweden	38.3	33.3	39.4	42.9	44.5	45.4	44.7	45.8	46.7	47.3
28	England	32,1	27,7	29,5	29,9	32.8	32.4	35.4	40.1	36.6	35.3
29	Island	34,3	29,5	32,5	34,1	35,7	37.3	40.9	47.3	55.9	63.2
30	Lichtenstein*	:	:	:	:	:	128.4	133.2	149.0(p)	147.1(p)	:
31	Norway	66.5	57.7	66.3	72.4	79.1	77.6	73.3	67.1	64.1	67.1
32	Switzerland	49.3	50.2	56.1	63.7	65.0	64.1	65.3	74.0	72.4(p)	:
33	Former Republic of Yougoslavia	3.3(p)	3.3(p)	3.5(p)	3.7(p)	3.7(p)	3.9(p)	4.1(p)	4.4(p)	4.7(p)	:
34	Albania	3.0	3.0	3.1	3.2	3.3	3.3	3.5	3.6	3.7(p)	4.0(p)
35	Serbia	4.6	4.2	4.1	4.6	4.4	4.8	4.7	4.7	4.9	5.2(p)

Note: ∗ – data unavailable.

$$\tilde{D}_{DTj}^T = D_{Tj}^T \times \tilde{D}_{Ij}^{TT}, \tag{12}$$

where D_{DTj} is the indicator of the economic development dynamics of the EU member state j for a single country (without considering the economic development context of other EU countries) based on the transformed values; and $\tilde{D}_{DTj}$ is the same value in the context of the economic development of other EU countries.

The calculated dimensions and values D_{Ij}^{TT}, $\tilde{D}_{Ij}^{TT}$, D_{DTj} and $\tilde{D}_{DTj}$ are shown in Table 3.

Based on the values of Table 3, it is possible to determine the impact of the intensity of economic development on its uniformity, as well as the degree of dynamics of economic development in the EU countries with and without assessing the importance of the intensity and uniformity of economic development. In the second case we need to know the weights of these indicators. According to the expert survey, the importance of the intensity of economic development of a country to dynamics is 70 per cent, and that of continuity – 30 per cent. The result can be considered to be logical, since the economic development fluctuations during the particular time spans of the period under consideration, i.e. short-term fluctuations do not affect the social or economic development of a country as much as the development intensity, which is of a long-term nature. In this case, formulas (7)–(8) of the integrated assessment of the dynamics of economic development in the EU countries will look like this:

$$D_{DKj}^T = 0{,}7D_j^T + 0{,}3D_{Tj}^T; \tag{13}$$

$$\tilde{D}_{DKj}^T = 0{,}7\tilde{D}_j^T + 0{,}3\tilde{D}_{Tj}^T. \tag{14}$$

The results of the calculations based on formulas (5), (6) and (11) to (14) are shown in Table 3.

When the values of the intensity and stability indicators of the economic development of the EU countries are known (Table 3), it is possible to determine the relationship between them. The correlation-regression analysis has shown that both with the non-estimation and the estimation of the context of the economic development of other countries while the intensity increases, integrity decreases (Figures 2 and 3).
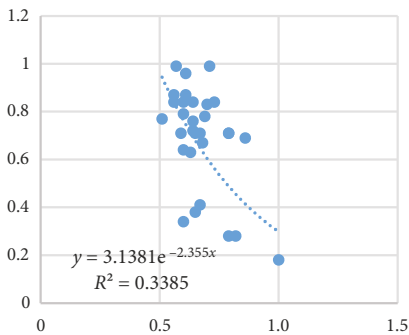

Figure 2. Results of the correlation-regression analysis on the impact of economic development intensity on ots integrity in EU when non-contextualising other countries applies (source: compiled by the authors)
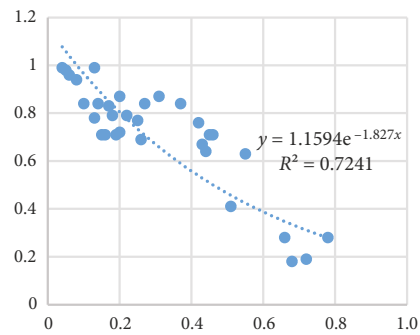
Figure 3. Results of correlation-regression analysis of the impact of economic development intensity on EU in the case when context of other countries is considered (source: compiled by authors)

Table 3. Estimated values of indices of economic development of EU countries (source: compiled by authors)

No	Country	Indices										
		D_{Ij}^{T}	$\tilde{D}_{Ij}^{T}$	D_{Tj}^{T}	D_{Ij}^{TT}	$\tilde{D}_{Ij}^{TT}$	D_{Dj}^{T}	$\tilde{D}_{Dj}^{T}$	D_{Dj}^{T}	$\tilde{D}_{Dj}^{T}$	D_{DKj}^{T}	$\tilde{D}_{DKj}^{T}$
1	Belgium	1.17	12.9	0.76	0.64	0.42	0.89	0.80	0.49	0.32	0.68	0.52
2	Bulgaria	1.49	2.43	0.94	0.81	0.08	1.40	2.28	0.76	0.07	0.85	0.34
3	Czech	1.17	6.03	0.72	0.64	0.20	0.84	4.34	0.46	0.14	0.67	0.36
4	Denmark	1.15	16.93	0.63	0.63	0.55	0.72	10.67	0.40	0.35	0.63	0.58
5	Germany	1.25	13.20	0.67	0.68	0.43	0.84	8.84	0.46	0.29	0.68	0.50
6	Estonia	1.46	6.00	0.71	0.79	0.19	1.04	4.26	0.56	0.13	0.76	0.34
7	Ireland	1.46	20.40	0.28	0.79	0.66	0.41	5.71	0,22	0.18	0.63	0.54
8	Greece	0.77	5.57	0.79	0.42	0.18	0.61	4.40	0.33	0.14	0.69	0.37
9	Spain	1.03	8.37	0.84	0.56	0.27	0.87	7.03	0.47	0.23	0.64	0.44
10	France	1.10	11.40	0.84	0.60	0.37	0.92	9.58	0.50	0.31	0.67	0.51
11	Croatia	1.05	3.93	0.99	0.57	0.13	1.04	3.89	0.56	0.13	0.70	0.39
12	Italy	1.03	9.50	0.87	0.56	0.31	0.90	8.27	0.49	0.49	0.65	0.48
13	Cyprus	0.94	7.60	0.77	0.51	0.25	0.72	5.85	0.39	0.19	0.59	0.41
14	Latvia	1.24	4.63	0.71	0.67	0.15	0.88	3.29	0.48	0.11	0.68	0,32
15	Lithuania	1.46	4.97	0.71	0.79	0.16	1.04	3.53	0.56	0.11	0.76	0.32
16	Luxemburgh	1.19	30.87	0.38	0.65	1.00	0.45	11.73	0.25	0.38	0.57	0.81
17	Hungary	1.18	4.23	0.84	0,64	0.14	0.99	3.55	0.54	0.12	0.70	0.35
18	Malta	1.59	7.93	0.69	0.86	0.26	1.10	5.47	0.59	0.18	0.81	0.39
19	Netherlands	1.09	14.33	0.71	0.59	0.46	0.77	10.17	0.42	0.33	0.62	0.53
20	Austria	1.19	14.03	0.71	0.65	0.45	0.84	9.96	0.46	0.32	0.67	0.53
21	Poland	1.27	4.07	0.78	0.69	0.13	0.99	3.17	0.54	0.10	0.71	0.32
22	Portugal	1.12	6.30	0.87	0.61	0.20	0.97	5.48	0.53	0.17	0.69	0.40
23	Romania	1.35	3.20	0.84	0.73	1.10	1.13	2.69	0.61	0.08	0.76	0.32
24	Slovenia	1.11	6.93	0.79	0.60	0.22	0.88	5.47	0.47	0.17	0.66	0.39
25	Slovakia	1.28	5.20	0.83	0.70	0.17	1.06	4.32	0.58	0.14	0.74	0.37
26	Finland	1.11	13.53	0.64	0.60	0.44	0.71	8.66	0.38	0.28	0.61	0.50
27	Sweden	1.23	15.77	0.41	0.67	0.51	0.50	6.47	0.27	0.21	0.59	0.48
28	England	1.10	11.77	0.34	0.60	0.38	0.20	4.00	0.20	0.13	0.52	0.37
29	Island	1.84	21.07	0.18	1.00	0.68	0.61	3.79	0.18	0.12	0.75	0.53
30	Lichtenstein*	–	–	–	–	–	–	–	–	–	–	–
31	Norway	1.01	22.37	0.19	0.55	0.72	0.19	4.25	0.10	0.14	0.41	0.56
32	Switzerland	1.50	24.67	0.28	0.82	0.78	0.42	6.91	0.23	0.22	0.65	0.63
33	Former Republic of Yugoslavia	1.48	1.63	0.98	0.80	0.05	1.45	1.60	0.78	0.05	0.85	0.33
34	Albania	1.33	1.33	0.99	0.71	0.04	1.32	1.32	0.70	0.04	0.80	0.33
35	Serbia	1.13	1.73	0.96	0.61	0.06	1.08	1.66	0.59	0.06	0.74	0.35

Note: ∗ – data unavailable.

The results of correlation-regression analysis can be used in the strategic planning of economic development of countries. Based on the established values of intensity, continuity and dynamics of economic development of EU countries, all countries can be divided into groups (Figures 4 and 5).

Based on Figures 4 and 5 country-specific analysis can be conducted to determine the impact of the intensity, continuity and dynamics of the economic development of groups of countries on their social, ecological and other development. The results of such analysis can

S			Intensity of economic development		
			large	medium	small
			1÷0.4	0.4÷0.2	0.2÷0
+Uniformity of economic development	large	0.8–1.0	–	Spain France Italy Portugal	Bulgaria Croatia Hungary Romania Slovakia Former Republic of Yugoslavia Albania Serbia
	medium	0.6–0.8	Denmark Netherlands Austria Finland	Belgium Germany Iceland Cyprus Malta Slovenia	Czech Estonia Greece Latvia Lithuania Poland
	small	0–0.6	Luxembourgh Sweden England Ireland Norway Switzerland	–	–

Figure 4. Matrix of EU economic development during 2008–2017
(source: compiled by the authors)

Dynamics of economic development		
1level	2 level	3 level
1.0–0.6	0.6–0.4	0.4–0
Luxembourgh Switzerland	Belgium Denmark Germany Ireland Greece Spain France Italy Cyprus Netherlands Austria Portugal Finland Iceland Norway Switzerland	Bulgaria Czekh Estonia Croatia Latvia Lithuania Hungary Malta Poland Romania Slovenia Slovakia England Former Republic of Yugoslavia Albania Serbia

Figure 5. Breakdown of EU countries by the dynamics of economic development
over 2008–2017 (source: compiled by authors)

be used in strategic planning of the development of countries, in the formulation of their consecutive regional policy of countries, and so on. The methodology used is universal and can be applied to the analysis of the development of any socio-economic process.

Conclusions

1. Economic development is at the heart of the country's well-being. In order to manage this process in a consecutive way, it should be possible to quantify its condition at a desired point in time. Literature analysis has highlighted two fundamental approaches to measuring the economic status of a country. One of these proposes Gross Domestic Product per capita (GDP), and the other suggests to base it on multi-criteria approaches. By recognizing that the second approach to assessing the state of economic development may be more accurate as it can take into account all its essential aspects, the first approach is nevertheless preferred. The system of indicators is the basis for multi-criteria evaluation. Due to the specificity of countries, and the availability of relevant information it differs both in the number of indicators and in the composition. For these and other reasons, the results of the evaluation cannot be used for comparisons between countries. Meanwhile, GDP is widely recognized as one of the most important indicators of economic development. The information about it is easily accessible, and its content is applicable for international comparison.

2. Analysis of the changes in GDP per capita over individual time periods showed that the process of country's economic development can be characterized by four parameters – intensity, homogeneity, dynamics and duration of the period considered. Intensity reflects upon quantitative changes in development, while continuity refers to the qualitative changes, and dynamics integrates the previous ones. The nature of their interaction has become apparent, as the intensity of economic development diminishes at the account of its continuity.

3. Developmental dynamics refers to the product or sum of the values of intensity and smoothness variables respectively if their relevance to developmental dynamics is evaluated or not evaluated. The analysis of the dynamics of economic development of the European Union countries for the years 2008–2017 was carried out according to the MDD methodology published in the scientific press. It assumes that development intensity is the ratio of the state of economic development at the end of the period under consideration to the situation at the beginning of that period. The integrity of development is the ratio of the length of the period under consideration to the actual length of the economic development trajectory. Development dynamics is the multiplication of the values of the intensity and continuity indices if their importance to the dynamics of development is non-estimated or the sum if the importance is estimated.

4. All EU countries have been divided into three levels of development based on the values of the indicators of intensity, continuity and dynamics of economic development. Only two countries – Luxembourg and Switzerland – came first, followed by 16 countries after the second and third. Such a breakdown allows for a differentiated analysis of the social, environmental, and other effects of the economic development dynamics of countries development, depending on the level of economic development achieved.

Author contributions

All authors have the same contribution to the article.

Disclosure statement

Authors declare that they do not have any competing financial, professional, or personal interests from other parties.

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