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## DIFFERENTIATION OF INTERNAL REGIONS IN THE EU COUNTRIES\*

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**Abstract.** The aim of the article is to study safety and sustainability of differentiation of performance of internal regions (NUTS 3) in the EU countries measured by the Sub-national Human Development Index (SHDI). The authors examine differentiation of the SHDI of internal regions in the EU countries by means of correspondence of distribution of this indicator [SHDI] of regional performance to Gauss curve, as well as by analyzing the SHDI of internal regions in the EU countries with the help of the coefficient of variation. As follows from the research, the authors proved that differentiation of regional performance in the EU over the last three decades were not chaotic but they were subjected to certain regularities: the distribution of performance of internal regions is normal, with metropolitan areas almost always being leaders of regional performance; regional differences in the area that is now the EU were increasing during the collapse of the Eastern European Socialist Bloc in the early 1990s, and they were declining later, as the regions adapted to the new conditions. So, identified regularities in performance of internal regions (NUTS 3) in the EU countries – normal distribution and spatial convergence – have been considered by the authors as safe and sustainable for further development of the whole EU and its countries.

**Keywords:** EU countries; internal regions; differentiation; normal distribution; spatial convergence

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**JEL Classifications:** O15, O52, O57

## 1. Introduction

From the standpoint of economic efficiency, spatial inequality may be beneficial or harmful (Kim, 2008; Kiselitsa et al., 2018; Mikhaylov et al., 2018), disruptive (Schwab, Sala-i-Martin, 2017). On the one hand, socio-economic differentiation within a country gives impetus to the development of poorer regions, promotes sustainability of more successful regions, but on the other hand, the stimulating effect of territorial differentiation of socio-economic development takes place only up to a certain level (Glinskiy et al., 2017).

A rather large number of researchers both in Europe and around the world deal with the study of performance of countries' internal regions. For example, M. E. Porter is one of the most active researchers of the economic performance of regions. He studied performance of regional economies in the USA and discovered that it "varies markedly in terms of wage, wage growth, employment growth and patenting rate" (Porter, 2003). The New Zealand Institute of Economic Research (NZIER) in their study into regional economies in New Zealand also dealt with the economic aspect of performance of internal regions having measured its performance using three separate indicators: the level of GDP per capita (economic prosperity), GDP growth (economic progress), and volatility (economic resilience). The NZIER researchers discovered that "the level of GDP per capita (income), GDP growth (progress) and volatility of growth (resilience) rank each region differently – there is no consistent winner. It is also clear that measures like GDP do not capture the whole story. For example, Taranaki, the region of New Zealand, has a very high level of GDP per capita, but this does not fully flow through to household incomes" (New Zealand Institute of Economic Research, 2014). The researchers from Daugavpils University (Latvia), in turn, studying higher education's contribution into economic performance and innovativeness of countries and being aware of all downsides of such an indicator as GDP per capita, still choose it as a tool for measuring economic performance of countries, explaining that "in practice, GDP per capita is a basis for empiric interpretation of the methodological understanding of state economic performance through income" (Stankevics et al., 2014; Boronenko et al., 2014).

The aim of the article is to study the differentiation of performance of internal regions in the EU countries more broadly than economic one. In the authors' opinion, this broader and more integrated perception of performance is included in the Human Development Index (HDI) applied by the United Nations Development Program (UNDP) (UNDP, 2019). Internal regions (NUTS 3) in the EU countries, i.e. regions in 26 countries (excluding Cyprus and Luxembourg which have no internal regions) are the object of the research. Safety and sustainability of differentiation of performance of the research object are the subject of the research.

In order to achieve the aim of the article, the authors study variance and differentiation of the HDI of internal regions in the EU countries by means of examination of correspondence of distribution of this indicator to Gauss curve, as well as by analyzing differences between internal regions in the EU countries with the help of the coefficient of variation of the SHDI. The database of the Sub-national HDI (SHDI) – NUTS 3 level – in the period 1990-2017 created by the Dutch Global Data Lab of Radboud University (Radboud University, 2019) serves as the source of information for the research.

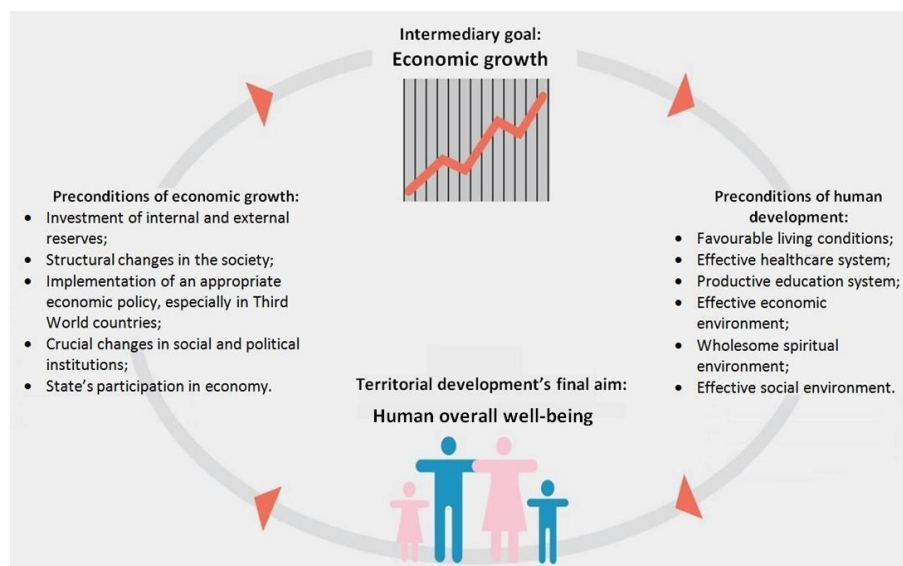
Further, the body of the article is organized as follows: Part 1 discusses the theoretical framework and methodology of the measurement of performance of territories; Part 2 presents the outcomes of the study into performance's distribution of internal regions of the EU countries; Part 3 presents the outcomes of the study into performance's differences between internal regions of the EU countries.

## 2. Theoretical framework and methodology of the measurement of performance of territories

In August 2009, the European Commission published an important report “GDP and Beyond. Measuring Progress in a Changing World” which recognized the need to complement GDP with the indicators of environment and social indicators when measuring performance of territories (European Commission, 2009). In September 2009 “Report by the Commission on the Measurement of Economic Performance and Social Progress” (more known as “Stiglitz-Sen-Fitoussi commission report”), which identified the boundaries for using GDP as an indicator of economic development and social progress, was published (Stiglitz et al., 2009). The Commission recognized that GDP was the main indicator of economic activity, but it was insufficient to measure the well-being of society, and it was time to shift the focus from the measurement of economic production to the assessment of human well-being. This does not mean a refusal from GDP as an indicator of production, but it shows that indicators which complement indicators of market performance with indicators of human well-being and sustainable development should be used.

Despite the fact that sustainable economic growth is still an important goal for the development of a territory, modern society wants to make sure that this economic growth will result in a higher standard of living and higher well-being for as many people as possible; that people will not only gain benefits from the development process, but they will also participate in it.

The impact of economic growth and its preconditions on the human overall well-being within the framework of the modern Human Development Conception is presented in Figure 1.

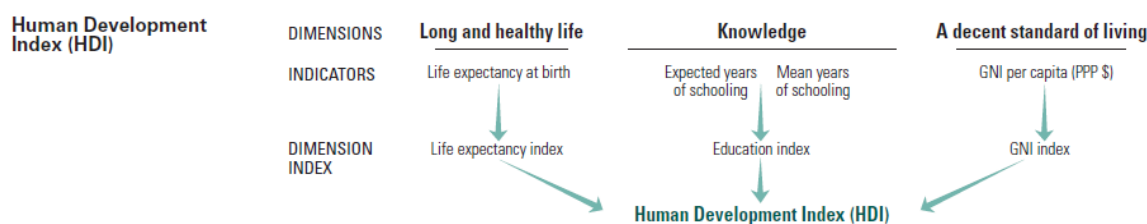


**Fig. 1.** The impact of economic growth and its preconditions on the human overall well-being within the framework of the Human Development Conception

*Source:* J. Lonska (2015) on the basis of Soubbotina, Sheram, 2000; Domar, 1957; Lewis, 1955; Todaro, Smith, 2011; Myrdal, 1968; Prebisch, 1978; Cortright, 2006; Haq, Jolly, 1996

As it has been already mentioned in the introduction to the article, the authors believe that the Human Development Index can be the best tool for measuring performance of countries and their regions. The Human Development Index was elaborated in 1990 by a Pakistani economist Mahbub ul Haq (Haq, 1990) to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not

economic growth alone (Seers, 1969; Sen, 1983; World Bank, 1991; Stiglitz, 1994; UN General Assembly, 2000; Boronenko, Lonska, 2013; Lonska, 2015). The HDI is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living (Figure 2).



**Fig. 2.** The structure of the Human Development Index

Source: UNDP, 2019a

The health dimension is assessed by life expectancy at birth, the education dimension is measured by mean of years of schooling for adults aged 25 years and more and expected years of schooling for children of school entering age. The standard of living dimension is measured by gross national income per capita. The HDI uses the logarithm of income, to reflect the diminishing importance of income with increasing Gross National Income (GNI). The scores for the three HDI dimension indices are then aggregated into a composite index using geometric mean (UNDP, 2019a).

It should be emphasized that the development of tools for measuring performance of territories is continuing, and at the moment there is also the Inequality-adjusted Human Development Index (IHDI) used. It combines a country's average achievements in health, education and income with how those achievements are distributed among a country's population by "discounting" each dimension's average value according to its level of inequality. Thus, the IHDI is the distribution-sensitive average level of human development. Two countries with different distributions of achievements can have the same average HDI value. Under perfect equality the IHDI is equal to the HDI, but falls below the HDI when inequality rises. The difference between the IHDI and HDI is the human development cost of inequality, also termed – the loss to human development due to inequality (UNDP, 2019b).

In the authors' opinion, the IHDI measures the performance of regions better than the HDI. However, the researchers do not have a database on the IHDI at regional levels at their disposal. Therefore, the research will have to be limited to the analysis of the Sub-national HDI (SHDI), excluding intra-regional inequality in human development which affects the performance of each region of any country.

### 3. Distribution of performance of internal regions of the EU countries

The philosophy of statistics argues that normal distribution commonly found in nature and in society is the most safety and sustainable for further development, and gives the following explanation for this: the overall selection pressure determines an ideal norm for something (for instance, people's height or intellect), but the selection pressure is not perfect itself, and some variability around the ideal norm will not matter very much. There may even be a selection pressure to maintain some variability to hedge against fluctuating circumstances in the environment. Therefore, in the process of natural selection only the average value (an ideal norm) and the extreme

limit of the indicator’s variability (in one direction and the other) are strictly fixed. Apart from that, there is no other relevant selection pressure, and the elements of the system (countries, people, animals, cells, etc.) will naturally tend to the state of maximal disorder – i.e., the state of maximum entropy – subject to its selection constraints. (This is another appeal to something like the second law of thermodynamics). The variance of some measured indicators that maximizes entropy subject to those constraints is a normal distribution, and, so, that is why most indicators in nature and society are normally distributed (Cover, Thomas, 2006; Lyon, 2014) or, in other words, that is why nature and society “have chosen” this kind of distribution of random variables as normal.

In order to study the regularities in performance’s distribution of internal regions of the EU countries the authors will analyze the parameters of variance of the SHDI in the internal regions (NUTS 3) of the EU countries in the period 1990-2017 with respect to compliance of the SHDI distribution to normal one. This analysis will allow the authors to find out whether the distribution of the SHDI of the European regions corresponds to Fauss curve or the Gauss curve and how close this correspondence is.

**Table 1.** Results of checking for compliance of distribution of the Sub-national Human Development Index (SHDI) with the Gauss curve in the EU internal regions (NUTS 3)\*, n = 278 regions, 1990-2017

Year	Mean of SHDI in the EU internal regions (NUTS 3)	Standard deviation	Significance from the Kolmogorov-Smirnov test, p-coefficient	Decision according the hypothesis about normal distribution of SHDI (null hypothesis)
1990	0.746	0.049	0.115	Retain the null hypothesis
1991	0.748	0.053	0.027	Reject the null hypothesis
1992	0.753	0.056	0.006	
1993	0.758	0.059	0.007	
1994	0.766	0.060	0.003	
1995	0.773	0.059	0.001	
1996	0.780	0.058	0.003	
1997	0.786	0.057	0.006	
1998	0.793	0.056	0.003	
1999	0.799	0.056	0.011	
2000	0.806	0.055	0.015	
2001	0.813	0.054	0.011	
2002	0.818	0.052	0.059	Retain the null hypothesis
2003	0.824	0.051	0.099	
2004	0.829	0.051	0.133	
2005	0.835	0.050	0.055	
2006	0.841	0.050	0.066	
2007	0.847	0.049	0.025	Reject the null hypothesis
2008	0.849	0.048	0.120	Retain the null hypothesis
2009	0.849	0.048	0.093	
2010	0.853	0.048	0.102	
2011	0.856	0.048	0.107	
2012	0.857	0.048	0.205	
2013	0.862	0.047	0.143	
2014	0.864	0.047	0.276	
2015	0.868	0.047	0.196	
2016	0.871	0.047	0.122	
2017	0.873	0.046	0.237	

\*The analysis in the period 1990-2017 involves the internal regions (NUTS 3) of all countries (except Cyprus and Luxembourg which do not have internal regions) that are members of the EU in 2018.

Note: according to the official website of the European Union (European Union, 2019), the UK was officially a member of the EU at the time of submission of the article.



*Source:* the authors' calculation on the basis of The Global Data Lab, Sub-national HDI database (Radboud University, 2019)

According to the results presented in Table 1, the distribution of the SHDI for the internal regions in the current EU came to steadily correspond to the normal one only after 2008, when the p-coefficient of statistical significance of the Kolmogorov-Smirnov test became consistently higher than the threshold value of 0.05 (Table 1).

The authors explain a long-term (from 1991 to 2001) and short-term (in 2007) inconsistency of distribution of the Sub-national HDI for the EU internal regions to Gauss curve by the fact that until 2008 many internal regions of the current EU were part of other political and socio-economic systems (for example, the USSR, or Yugoslavia) and they probably fell under the law of normal distribution only within their systems. During the periods of transition of the current EU countries from one political and socio-economic system to independence or to another system (for example, 1990-1991 for the countries of Eastern Europe, 2004 for 10 “new” EU countries, 2007 for Bulgaria and Romania) distribution of performance of the internal regions in the EU was inconsistent with the law of normal distribution and began to correspond to it again only after a certain period of adaptation to a new state or to a new system.

This can be checked by “cleaning” the database of the EU internal regions exactly in accordance with the year of a country’s accession to the EU and comparing the new results (compliance of the distribution of the “cleaned” Sub-national HDI with the Gauss curve) with the data presented in Table 2.

**Table 2.** Results of checking for compliance of distribution of the Sub-national Human Development Index (SHDI) with the Gauss curve in the EU internal regions (NUTS 3)\*, 1990-2017

Year	Mean of SHDI in the EU internal regions (NUTS 3)	Standard deviation	Number of regions, n	Significance from the Kolmogorov-Smirnov test, p-coefficient	Decision according the hypothesis about normal distribution of SHDI (null hypothesis)
1990	0.767	0.035	151	0.537	Retain the null hypothesis
1991	0.775	0.034	151	0.405	
1992	0.782	0.034	151	0.372	
1993	0.790	0.034	151	0.483	
1994	0.800	0.036	151	0.284	
1995	0.806	0.036	151	0.117	
1996	0.814	0.035	173	0.115	
1997	0.819	0.035	173	0.157	
1998	0.826	0.035	173	0.085	
1999	0.830	0.036	173	0.170	
2000	0.837	0.036	173	0.367	
2001	0.842	0.035	173	0.322	
2002	0.845	0.036	173	0.596	
2003	0.850	0.036	173	0.756	
2004	0.855	0.036	173	0.508	
2005	0.846	0.042	243	0.229	
2006	0.852	0.042	243	0.189	
2007	0.857	0.042	243	0.137	
2008	0.855	0.045	257	0.164	
2009	0.855	0.045	257	0.128	
2010	0.859	0.046	257	0.137	
2011	0.861	0.046	257	0.135	
2012	0.862	0.045	257	0.251	
2013	0.867	0.045	257	0.182	
2014	0.864	0.047	278	0.276	

2015	0.868	0.047	278	0.196	
2016	0.871	0.047	278	0.122	
2017	0.873	0.046	278	0.237	

\*The analysis in the period 1990-2017 involves the internal regions (NUTS 3) of all EU countries (except Cyprus and Luxembourg which do not have internal regions) since the year which follows the year of their joining to the EU: Austria's, Finland's, and Sweden's regions since 1996, the Czech Republic's, Estonia's, Latvia's, Lithuania's, Malta's, Poland's, Slovakia's, and Slovenia's regions since 2005, Romania's and Bulgaria's regions since 2008, Croatia's regions since 2014 (i.e. only the regions included in the EU during all of the period 1990-2017 have been analyzed).

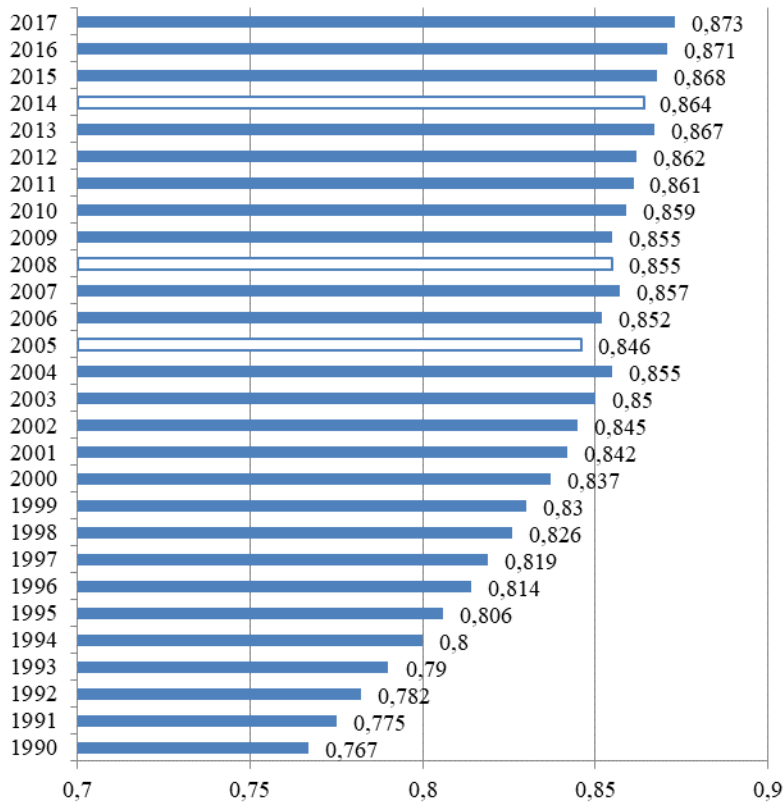
Note: according to the official website of the European Union (European Union, 2019), the UK was officially a member of the EU at the time of submission of the article.

*Source:* the authors' calculation on the basis of The Global Data Lab, Sub-national HDI database (Radboud University, 2019)

According to the results presented in Table 2, the authors' assumption has been fully confirmed, and the distribution of the SHDI for the internal regions that are part of the EU over the period 1990-2017 consistently corresponded to the normal distribution over the study period of 28 years (p-coefficient of statistical significance of the Kolmogorov-Smirnov test every year during 1990-2017 exceeded the threshold value of 0.05) (Table 2).

During the period 1990-2017, the EU experienced 4 "accessions" of new regions: in 1995, the internal regions of Austria, Finland and Sweden joined the EU (and this led to an increase in the average European SHDI from 0.806 in 1995 to 0.814 in 1996); in 2004, the internal regions of the Czech Republic, Estonia, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia joined the EU (and this led to a decrease in the average European SHDI from 0.855 in 2004 to 0.846 in 2005); in 2007, the internal regions of Romania and Bulgaria joined the European Union (and this led to a decline in the average European SHDI from 0.857 in 2007 to 0.855 in 2008); and, finally, in 2013, the internal regions of Croatia joined the European Union (and this resulted in a decline in the average European SHDI from 0.867 in 2013 to 0.864 in 2014) (Table 2). Therefore, each of the European Union's new "accession" countries of the former Socialist Bloc were a "blow" which the EU quickly "recovered" from and continued to develop (Figure 3).





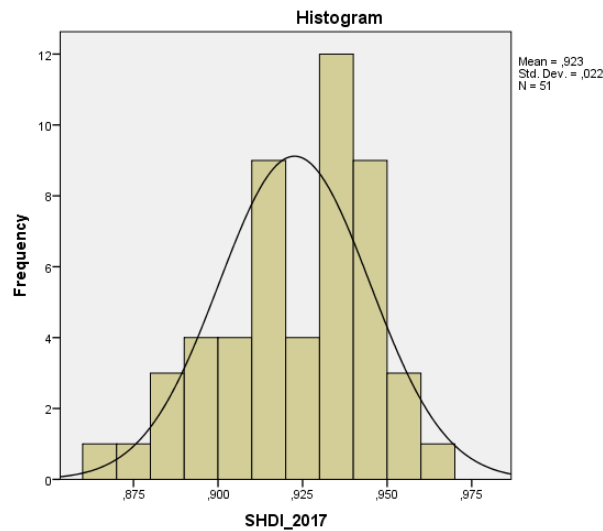
**Fig. 3.** Mean of the European Sub-national HDI, standardized values from 0 to 1, 1990-2017

*Source:* the authors' elaboration on the basis of the data from Table 2

Therefore, despite the almost constant growth of mean of the European Sub-national HDI, its variance consistently corresponded to the normal distribution every individual year in the period (1990-2017) of the EU history under study, and in a short time the European Union absorbed the negative impact on the regional performance of each new “accession” of the internal regions of the countries of the former Socialist Bloc in its structure, which at the time of their accession to the EU had quite low indicators of performance.

It is interesting that in almost all EU countries which have internal regions, the metropolitan regions are the leaders of performance measured by the Human Development Index, with the exception of only 3 countries. Germany where Hamburg is the leader of human development (HDI = 0.977), but Berlin, which is a metropolitan region (HDI = 0.944), in terms of human development occupies only the 5th place among the regions of Germany; the Netherlands where Utrecht is the leader of human development (HDI = 0.950) followed by the metropolitan region of Amsterdam (HDI = 0.946); Italy where Trento is the leader of human development (HDI = 0.912), whereas the metropolitan region of Rome (HDI = 0.901) in terms of human development only takes the 3rd place among the regions of Italy.

In support of the fact that in the modern world the variance of regional performance corresponds to the Gauss curve not only in the European Union, the authors analyzed the variance of the SHDI in the US internal regions (figure 4), as their number (51 regions) allows, although with great reserve, to apply the Kolmogorov-Smirnov test (ideally, at least 80 objects are needed for the correct application of this statistical test) to assess the compliance of the variance of the SHDI with the Gauss curve.



Note: variance of the SHDI in the US internal regions corresponds to the Gauss curve, i.e. normal distribution (p-coefficient of statistical significance of Kolmogorov-Smirnov test equals 0.296).

**Fig. 4.** Variance of Sub-national Human Development Index in the US internal regions,  $n = 51$  region, 2017

*Source:* the authors' elaboration on the basis of The Global Data Lab, Sub-national HDI database (Radboud University, 2019)

Therefore, as a result of the analysis of the Sub-national HDI in the EU and the USA for its compliance with the Gauss curve, the authors obtained the basis to claim that the variance of performance in the EU (as well as the USA) internal regions consistently corresponds to the normal distribution, since it is the normal distribution of performance of territories which most effectively provides simultaneous sustainability of development and the possibility for survival and progress of any territorial systems (Cover, Thomas, 2006; Lyon, 2014). The outcomes of this study give the authors reason to assume that not only indicators of human development of the internal regions in the EU, but also their economic achievements, measured by GDP, national income, and other socio-economic indicators are distributed in accordance with the Gauss curve, which can be studied in further research, checking the variance of the abovementioned indicators for their compliance with normal distribution.

#### 4. Differences of performance between internal regions of the EU countries

Performance's differences between internal regions of the EU countries within the framework of this research have been studied by means of the analysis of coefficients of variation of the Sub-national HDI, which characterizes  $\sigma$ -convergence, i.e. "spatial convergence" (Sala-i-Martin, 1996) in performance of internal regions of the EU countries. The calculation of coefficient of variation was carried out in a traditional way – the ratio of the standard deviation to the mean of the sample (Marques, Soukiazis, 1998). Similar to the analysis of performance's distribution between internal regions of the EU countries which was carried out in the previous part of the article, regional performance's differences will also be examined on both the sample of current EU internal regions (a permanent sample of 278 regions over the period 1990-2017), and the sample of internal regions in accordance to the accession of a country to the European Union. Coefficients of variation of regional performance in the period 1990-2017 are presented in Table 3.

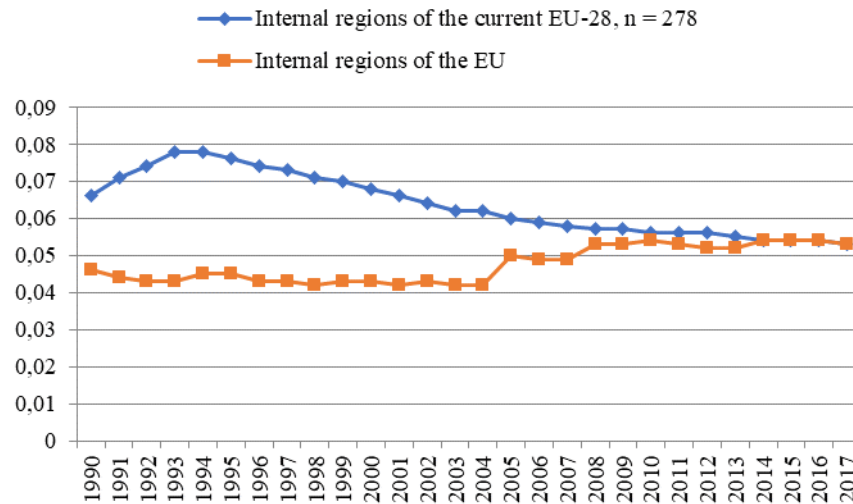
**Table 3.** Coefficients of variation\* of performance of the EU internal regions, 1990-2017

Year	Coefficients of variation of SHDI in the current EU internal regions (n = 278 regions)	Coefficients of variation of SHDI in the EU internal regions with account of the year of a country's accession to the EU
1	2	3
1990	0.066	0.046 (n = 151 regions)
1991	0.071	0.044 (n = 151 regions)
1992	0.074	0.043 (n = 151 regions)
1993	0.078	0.043 (n = 151 regions)
1994	0.078	0.045 (n = 151 regions)
1995	0.076	0.045 (n = 151 regions)
1996	0.074	0.043 (n = 173 regions)
1997	0.073	0.043 (n = 173 regions)
1998	0.071	0.042 (n = 173 regions)
1999	0.070	0.043 (n = 173 regions)
2000	0.068	0.043 (n = 173 regions)
2001	0.066	0.042 (n = 173 regions)
2002	0.064	0.043 (n = 173 regions)
2003	0.062	0.042 (n = 173 regions)
2004	0.062	0.042 (n = 173 regions)
2005	0.060	0.050 (n = 243 regions)
2006	0.059	0.049 (n = 243 regions)
2007	0.058	0.049 (n = 243 regions)
2008	0.057	0.053 (n = 257 regions)
2009	0.057	0.053 (n = 257 regions)
2010	0.056	0.054 (n = 257 regions)
2011	0.056	0.053 (n = 257 regions)
2012	0.056	0.052 (n = 257 regions)
2013	0.055	0.052 (n = 257 regions)
2014	0.054	0.054 (n = 278 regions)
2015	0.054	0.054 (n = 278 regions)
2016	0.054	0.054 (n = 278 regions)
2017	0.053	0.053 (n = 278 regions)

\* The ratio of the standard deviation to the mean of the sample.

Source: the authors' calculation on the basis of the data from Tables 1 and 2

Both trends of changes in the coefficients of variation of performance in the EU internal regions in the period 1990-2017 are visually presented in Figure 5.



**Fig. 5.** Trends of changes in coefficients of variation of performance in the EU internal regions, 1990-2017

*Source:* the authors' elaboration on the basis of the data in Table 3.

According to the data presented in Table 3 and Figure 5, regional performance's differences between the EU internal regions, similar to regional performance's variance, underwent "shocks" every time when one of the countries of the former Socialist Bloc with its internal regions joined the European Union. Thus, after each of the three EU expansions in the period 1990-2017, the coefficient of variation of the Sub-national HDI in the European Union increased (Table 3 and Figure 5). In turn, after the accession of Austria, Finland and Sweden with their internal regions to the EU in 1995, the coefficient of variation of the Sub-national HDI in the European Union, on the contrary, decreased (Table 3 and Figure 5).

As far as the trend of change in regional performance's differentiation between internal regions of the current EU (i.e., on a 28-year long constant sample equal to 278 internal regions of those countries that were the EU members in 2018) is concerned, there is a regularity illustrated by the inverted U-shape curve, which was noticed already in one of the previous study on the example of GDP of the internal regions of the "new" EU countries (Boronenko et al., 2014; Williamson, 1965).

In the study into the economic differentiation of the internal regions of the "new" EU countries that joined the European Union in 2004 and later, it was found that the coefficient of GDP variation in the regions under investigation increased significantly during the transition period of these countries to a market economy, and then – as adaptation to it – again decreased to the level characteristic of the political and socio-economic system (in this case, the market system of the EU) which these countries entered (Boronenko et al., 2014). As it can be seen from the data in Table 3 and Figure 7 relating to the 278 internal regions of the current EU, the same happened to the differentiation of regional performance measured by the Sub-national Human Development Index. In the 1990s a significant number of the current EU countries just gained their independence after the collapse of the USSR and the entire Eastern European Socialist system. According to J. Williamson, the performance of the internal regions of these countries underwent a sharp increase in differentiation, and it was reflected in the coefficients of variation in the performance of the internal regions of the entire territory that is now the European Union (Williamson, 1965). It puts the segment of the graph related to the 1990s into the shape of an inverted U-shaped curve (Figure 5).

## Conclusions

As a result of the research carried out, the authors have made the following conclusions:

- the Human Development Index developed by the Pakistani economist Mahbub ul-Haq in 1990 is the best tool to measure the performance of the internal regions in the EU countries in order to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth alone;
- the indicators of the Human Development Index in the internal regions (NUTS 3) of 189 countries in the world over the period 1990-2017 are located in the Sub-national HDI (SHDI) database elaborated by the Dutch Global Data Lab of Radboud University;
- the analysis of parameters of distribution of the Sub-national HDI in the internal regions of the European Union and the United States (for comparison) over the period 1990-2017, as well as its [distribution] compliance with the Gauss curve, showed that in the EU the performance of internal regions is distributed normally, while metropolitan regions are almost always the leaders of regional performance;
- regularities in performance's differences between the internal regions of the EU countries are examined by means of the analysis of coefficients of variation of the Sub-national HDI which characterizes  $\sigma$ -convergence, i.e. "spatial convergence" of performance of internal regions over the period 1990-2017 for both the current EU regional structure and considering the time when several countries joined the EU;
- the trend of changes in regional performance's differences between the internal regions in the current EU (i.e., on a constant sample that remained unchanged over the period 1990-2017 and is equal to 278 internal regions of those countries that were the EU members in 2018) has a shape of the inverted U-shape curve, i.e. regional differences on the territory which is now the EU increased over the last 28 years during the collapse of the Eastern European Socialist Bloc at the beginning of the 1990s, but later, in the process of adaptation of regions to new conditions of independence and market economy, they decreased;
- the trajectories of differentiation of regional performance in the EU over the last three decades were not chaotic, but they were subjected to certain regularities – normal distribution and spatial convergence, which have been considered by the authors as safe and sustainable for further development of the whole EU and its countries.

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