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DISPROPORTIONS OF THE GREEN ECONOMY IN THE SELECTED COUNTRIES*

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Abstract. One of the main objectives of the economic policy of the European Union is to reduce the differences in the development levels of its member states or a process of real convergence to ensure balanced and sustainable economic development and growth in the EU countries. Each country strives to contribute to its prosperity. The authors analyse and compare the dynamics of green economy development in the EU countries in the period 2015 - 2019 to clarify whether there is convergence or divergence, and this way, answering the question of whether disparities in the green economy development between the EU member states increase or decrease during this period. The study used logical analysis and synthesis, monographic and analytical research of economic, theoretical, and empirical sources (at the international level), statistical analysis methods, Barro regressions, and a cartographic method.

Keywords: green economy; economic convergence; economic divergence

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JEL Classifications: C43, O44, O52, O57, R11, Q30

1. Introduction

Since the late 1960s - early 1970s, society has begun to pay special attention to the problems of environmental protection and rational use of natural resources. Transition to sustainable economic development includes addressing global challenges related to global population economic growth, replacing non-renewable resources with alternative resources, preserving conditions for the reproduction of renewable resources, and reducing environmental pollution. Green economy generally supports addressing these challenges ((Istudor et al., 2021; Wei et al., 2021; Jiang et al., 2022; Rezk et al., 2023). it is necessary to identify the factors influencing the green economy and indicators that characterise these factors to assess the green economy development in the EU countries in the period 2015 - 2019,

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As the volume of international trade increases, the parties' interdependence also increases. Therefore, the economic situation of countries and their stability are critical. This, in turn, generates the necessity for poorer countries to reach the level of developed countries. Economic convergence refers to the convergence of economic parameters and levels of countries' or regions' development over some time. The opposite process is called economic divergence.

Almost all economists engaged in long-term economic development consider the problem of real convergence in their research. However, many address this issue indirectly, analysing factors of production - capital, labour, natural resources, technological progress, and human capital in long-term economic development. This study attempts to develop an indicator characterising the green economy in the EU countries that meets the following criteria which characterise their scientific and practical relevance (Eglītis, 2008): objectivity of data, objectivity of results, theoretical validity of data and proportions, objectivity of weighting factors, possibility to decompose the indicator, and possibility for practical application.

2. Review of literature

A green economy means the economic growth and stability of the natural environment at the same time, jobs for restoring the natural environment, improving the quality of the natural environment, rational and efficient use of natural resources and their reasonable consumption, reducing energy consumption, using resource-saving, environmentally friendly and innovative technologies, preserving natural capital and its development, improving the quality of human capital, using renewable resources, waste reduction and recycling of raw materials for the well-being of present and future generations. Current and future generations must have natural resources and a clean environment. A "Green" economy is usually understood as an economic system compatible with the natural environment, environmentally friendly, ecological, and socially just for many groups (Fulai, 2010). A “Green” economy is a low-carbon, resource-efficient and socially inclusive economy. "Green" economy also includes developing and implementing specific policy instruments to protect the environment (Swart & Groot, 2020). Thus, the analysis carried out by the authors of this study shows that according to the closest definition given by Swart and Groot (Swart, Groot, 2020) and consistent with the objectives of this study, the green economy is an economic system that is compatible with the natural environment, harmless to the environment, environmentally friendly, and socially just.

Based on the sources analysed Pearce, Markandya, and Barbier (1989), Hoken, Lovins and Lovins (2002), Kennet and Heinemann (2006), Brand (2012), Ryszawska (2013; 2015; 2017), as well as the research carried out by Jevons (1924), Walras (1874), and Veblen (1899), analysing the availability of data in EUROSTAT and OECD databases, the authors determined the following factors and sub-factors that characterise the green economy development (Table 1).

Table 1. Green Economy Factors, Sajvazianub-factors, and Indicators

Factors	Sub-factors	Indicators
Ecological factors	Protection of biological diversity	Area of organic farming, % of used agricultural land
		Protected territories, dry land, % of the total land area
		Surface area, % of national territory
	Conservation of limited resources	Share of fuel in final energy consumption, %
		Supply, transformation, and consumption of oil and oil products, thousand tonnes
		Supply, transformation, and consumption of solid fossil fuels, thousand tonnes
	Development of renewable energy sources	Share of renewable energy in total final energy consumption, %
		Renewable energy sources in electricity, %
		Non-energy material productivity, GDP per unit of consumption of household materials
Economic	Decoupling economic	Degree of use of recyclable materials, %

factors	growth from natural resources	Level of household waste recycling, %
		Resource productivity, %
	Sustainable consumption	Consumption of household materials per capita, tonnes per capita
		Primary energy consumption, %
		Final energy consumption, %
		Household final energy consumption by fuel, %
	Energy efficiency	Energy productivity, GDP or revenue by amount of energy consumed
		Energy dependence, %
		Energy taxes by paying sector, %
		Electricity supply, transformation, and consumption, gigawatts per hour
Social responsibility factors	Social responsibility of companies and investors in the ecological sector	Average CO2 emissions per km of new passenger cars, g CO2 per km
		Revenue from taxes on the natural environment, %
		Greenhouse gas emissions per capita, tonnes of CO2 equivalent per capita
		Eco-innovation index, index (ES=100)
		CO2 emissions from production, tonnes

Source: developed by the authors based on sources by Pearce, Markandya and Barbier (1989), Hoken, Lovins, and Lovins (2002), Kennet and Heinemann (2006), Brand (2012), Ryszawska (2013), Jevons (1924) and Walras (1874), Veblen (1899)

2. Methodology

To assess the green economy factors and sub-factors, it is necessary to unify the indicators presented in Table 1. Unification of indicators is the reduction of statistical data to a certain type for further assessment of sub-factors, factors, and the overall green economy indicator in the segment [0:10] (Lavrinenko, 2015; Čižo et al., 2018):

$$x_{ij}^{'} = \frac{x_{ij} - x_{\min j}}{x_{\max j} - x_{\min j}} *10$$ – stimulant for indicators;

$$x_{ij}^{'} = \frac{x_{\max j} - x_{ij}}{x_{\max j} - x_{\min j}} *10$$ – destimulant for indicators; where x_{ij} – value of the unified indicator in the country, x_{minj} and x_{maxj} – respectively, the minimum and maximum values of a certain indicator in the EU countries during the period under study.

Values of the green economy indicator in each country are defined as the arithmetic mean of each factor characterising the green economy. The value of each factor is determined as the arithmetic mean of sub-factors characterising certain factors. The value of each sub-factor is determined as the sum of unified indicators characterising the sub-factors of green economy development. Convergence is the process of steady convergence of parameters to a certain level and the convergence of development levels in different countries or regions in the area under study. Divergence is an increase in disparities and differences in the development levels in the area under study and its indicators in different countries or regions. Historically, some of the first studies on convergence were the concept of a mixed economy and various welfare state models (e.g., Mill, Galbraith). With the transition of planned economies to a market economy in the late 20th century, ideas of convergence were applied to establish the convergence of legal systems, regions, and institutions. In this case, convergence is understood as the convergence of social and economic development levels of countries, regions, industries, etc. The two concepts of convergence that are best known in this context are interrelated but cause different effects on socioeconomic policy: β-convergence (Barro, Sala-i-Martin, 1992) and σ-convergence (Sala-i-Martin, 1996a, Sala-i-Martin, 1996b, Islam, 2003). According to β-convergence, countries with the lowest values of the indicator under study in the initial period are, on average, characterised by higher growth rates during the integration process. The so-called growth-initial level regressions, in which the dependent variable is the growth rate and the independent variable is the initial level of the indicator, are used to estimate β-convergence. The simplest regression of this type is like the following:

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yi = a+ β ln(xit-T)+e, where xit-T – indicator at the point in time prior to the current point in time t for T periods (as a rule, the initial period of integration or another point in time significant for the development of the integration grouping), β - coefficient to be estimated, yi - the average growth rate in the i country for T periods, calculated as ln(yit)/ln(yit-T), e - random deviation. The sign of the coefficient β is an indicator of convergence. If β < 0, a high level of the indicator at the initial moment of time correlates with a relatively lower growth rate.

In contrast to β-convergence, σ-convergence implies a decrease in the standard deviation of the indicator value over time, smoothing the divergence between countries. The ratio of the standard deviation to the mean (variation coefficient) is another indicator that is often used if there is a trend in the time series. However, β-convergence does not always imply σ-convergence: in the situation where a group of richer and poorer regions is constantly changing (due to deterioration of the economic situation in the rich regions and economic improvement in the poor regions), but the overall level of the gap between the rich and poor regions is constant, there is no σ-convergence (Sala-i-Martin 1996a, Sala-i-Martin 1996b, Barro and Sala-I-Martin 1995; Lavrinenko, 2015; Čižo et al, 2018). σ-convergence is based on a statistical approach: the analysed indicators are variance, standard deviation, variation coefficient, etc. (Quah 1993; Quah 1996; Quah 1997). However, β-convergence is a prerequisite for σ-convergence to exist (Sala-I-Martin, 1993). Some studies also determine σ-convergence based on the analysis of indices, for example, the Theil index, the Gini index, the Atkinson coefficient, etc. (Gini 1912; Gini 1909; Theil, 1967; Atkinson, 1970).

The only difference between the panel approach **(**Coulombe, Lee, 1995; Evans, Kim, 2005**)** and the Barro regression is that the panel analysis is conducted for a panel. Since the number of observations increases, the estimates will have more accurate characteristics. In addition, peculiarities of specific regions are also considered. Some scientists have developed other methods for determining convergence (divergence). D.Quah was one of the first scientists who criticised the Barro regression. The regression is dependent on the choice of the initial point of time and does not consider changes in the income distribution by region (country). Quah uses Markov chains to simulate changes in the sampling distribution. As a result, the author receives transition matrices from one state to another. Time series research (Loewy, Papel, 1996; Carlino, Mills, 1996; Lau, 2009) is also used to test stochastic convergence - a gradual decrease to a certain level (α) of the mathematical expectation of the difference between two series. According to the concept of stochastic convergence, inequalities between regions (or countries) do not disappear entirely but stabilise at a certain level.

$$\lim_{t \to \infty} \| X_t - Y_t \| = \alpha$$

In the scientific literature, an approach also considers the spatial dependence of observations - the correlation between observations corresponding to nearby regions (Battisti, Vaio, 2008). In these models, a matrix of spatial weights is introduced to account for the spatial factor – a matrix of distances between objects, which is included in the final regression as one of the factors. Therefore, sigma- and beta- convergences, and stochastic convergence are the main concepts of convergence. Statistical methods, the Barro regression, Markov chains, the study of time series for stationarity, and the panel approach are the main approaches to studying region convergence or divergence. The authors chose statistical methods and the Barro regression as the most appropriate methods to achieve the purpose of the study. The downsides of this method are not significant for this study because it is necessary to determine the convergence in a specific period since 2015, but changes in the distribution of the value of the indicator under study for specific regions in this period can be specified by applying the following methodology. To determine the problematic values of the green economy index by country, it is necessary to analyse both the dynamics of the indicator values and the analysis of the country's position by the indicator under study in relation to other countries. Thus, it can be assumed that the negative dynamics of the index values relative to its previous value and the simultaneous deterioration of the country's position in terms of the indicator's value relative to other countries is a signal of the so-called problem.

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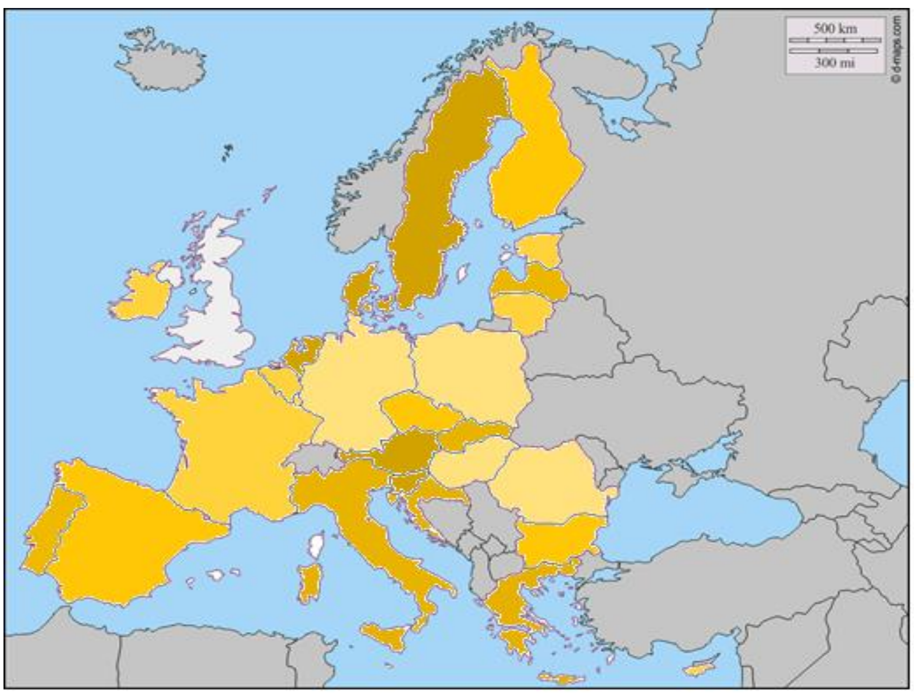
According to the logic described above, the indicators are divided into four problem groups (see Table 2) based on the following algorithm (Ajvazyan, 2005):
- the first group includes indices whose values deteriorate relative to the values of previous periods and values in the ranking of other countries (the first problem class);
- the second group includes indices whose values deteriorate relative to other countries and improve or remain at the same level relative to the values of previous periods (the second problem class);
- the third group includes indices whose values deteriorate relative to previous values but improve or remain at the same level relative to the ranking of other countries (the third problem class);
- the fourth group includes indices whose values improve relative to previous values and the ranking of countries (the fourth problem class).

3. Assessment of the Green Economy Index Values

To analyse which EU countries have the highest and lowest overall index of the green economy development trends and to compare years 2015 and 2019, the authors divided the results obtained on the green economy development trends and their factors into 5 quintiles (from the lowest overall index to the highest overall index). Quintile 1 includes EU countries with the lowest total scores, quintile 2 includes EU countries with low total scores, quintile 3 includes EU countries with average total scores, quintile 4 includes EU countries with high total scores, and quintile 5 includes EU countries with the highest total scores. The results are shown on the maps.



	4,49-5,0240	Quintile 1
	5,0241-5,3080	Quintile 2
	5,3081-5,7260	Quintile 3
	5,7261-6,0900	Quintile 4
	6,0901-6,67	Quintile 5

Figure 1. Green Economy Index Values by Quintiles in EU Countries in 2015
Source: developed by the authors based on the results obtained

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In 2015, the values of the Green Economy Index were distributed as follows: quintile 1 includes Germany, Hungary, Luxembourg, Poland, and Romania; quintile 2 includes Belgium, Lithuania, Estonia, Ireland, France, and Cyprus; quintile 3 includes Bulgaria, the Czech Republic, Finland, Spain, and Malta; quintile 4 includes Greece, Croatia, Slovakia, Italy, Latvia, and Portugal; quintile 5 includes Austria, Sweden, Denmark, Slovenia, and the Netherlands. Thus, Austria, Sweden, Denmark, Slovenia, and the Netherlands have the highest values of the Green Economy Index; Germany, Luxembourg, Hungary, Poland, and Romania have the lowest values of the Green Economy Index.

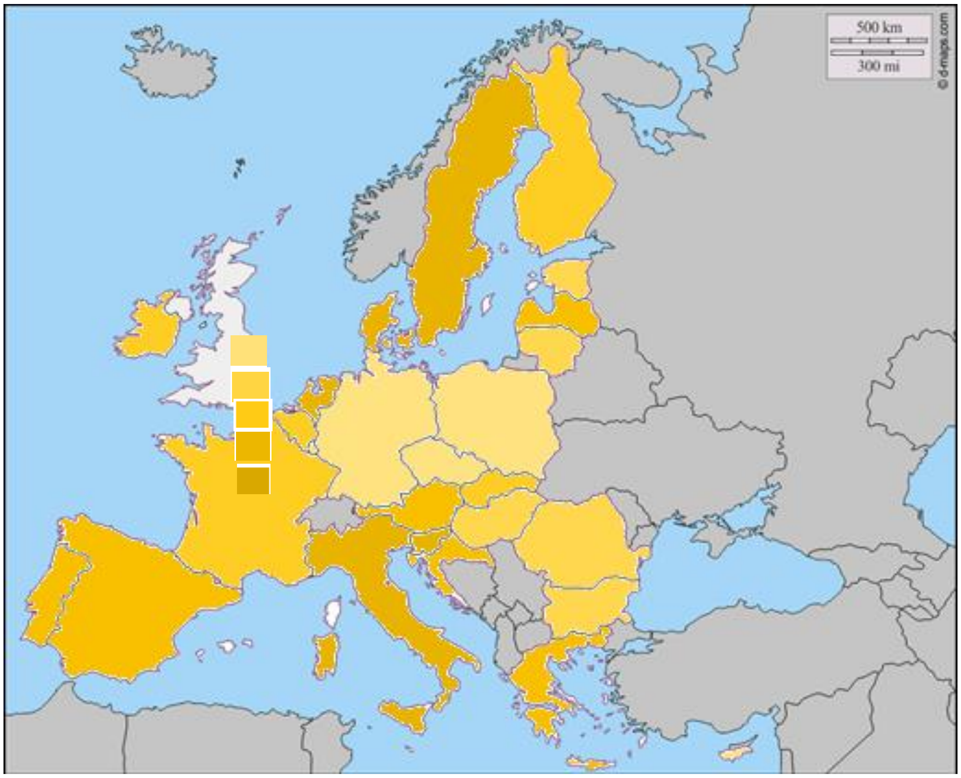

Figure 2. Green Economy Index Values by Quintiles in EU Countries in 2019\
Source: developed by the authors based on the results obtained

In 2019, the values of the Green Economy Index were distributed as follows: quintile 1 includes the Czech Republic, Germany, Cyprus, Hungary, and Poland; quintile 2 includes Bulgaria, Estonia, Ireland, Lithuania, Luxembourg, and Romania; quintile 3 includes Belgium, Spain, France, Malta, and Slovakia, 4th quintile includes Greece, Croatia, Latvia, Austria, Portugal and Finland, and quintile 5 includes Denmark, Italy, the Netherlands, Slovenia and Sweden. In 2019, Denmark, Italy, the Netherlands, Slovenia, and Sweden have the highest green economy development trends, while the Czech Republic, Germany, Cyprus, Hungary, and Poland have the lowest ones. Therefore, the increase in the values of the green economy index during the period under study is observed in Malta, Finland, and Luxembourg; the decrease in the values of the green economy index during the period under study is observed in Hungary, Spain, and Ireland.

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Table 2. Problem Matrix

		Position relative to other countries	
		Deteriorate	**Improve or remain the same**
Position of the country relative to its own indices in the past (dynamics)	**Deteriorate**	*Bulgaria, Czechia, Denmark, Greece, Cyprus, Latvia, Malta, Austria, Poland, Slovenia*	*Germany, Estonia, Ireland, Lithuania, Hungary, Portugal, Romania, Slovakia, Finland*
	Improve	-	*Belgium, France, Croatia, Italy, Spain, Luxembourg, Netherlands, Sweden*

Source: authors' calculations based on (Ajvazyan, 2005).

The problem levels of countries according to the values of the Green Economy Index and places in the country ranking in 2015 and in 2019 are established. The first problem group includes countries according to indices whose values **deteriorate** relative to the values of previous periods and values in the ranking of other countries (the first problem level): Bulgaria, Czechia, Denmark, Greece, Cyprus, Latvia, Malta, Austria, Poland, and Slovenia. The second group includes countries according to indices whose values **deteriorate** relative to other countries and at the same time **improve** or remain at the same level relative to the values of previous periods (the second problem class): Germany, Estonia, Ireland, Lithuania, Hungary, Portugal, Romania, Slovakia, and Finland. The third group includes countries according to indices whose values deteriorate relative to previous values but improve or remain at the same level relative to the ranking of other countries (the third problem class) and does not include any EU country. The fourth group comprises countries according to indices whose values improve relative to previous values and in the ranking of countries (the fourth problem class): Bulgaria, Czechia, Denmark, Greece, Cyprus, Latvia, Malta, Austria, Poland, and Slovenia.

Thus, in most countries, the values of the green economy index deteriorated relative to 2015 in the period under study; Germany, Estonia, Ireland, Lithuania, Hungary, Portugal, Romania, Slovakia, and Finland also deteriorated their position in the country ranking. A more detailed study into the reasons for the situation described above requires more thorough research, but it is out of the scope of this article.

4. Green Economy Convergence and Divergence

We will test the β-convergence hypothesis on the green economy index values in the EU countries in the period 2015 - 2019. β-convergence is considered a prerequisite for σ-convergence (Sala-i-Martin X., 1996a, p.1325-1352., Sala-i-Martin X., 1996b, p.1019– 1036).

The authors built a regression of the growth of green economy index values from 2015 to 2019 on the baseline in 2015, where the dependent variable is the growth rate and the independent variable is the index's baseline.

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Table 3. Regression model

	constant	β	value
y=a+ βx ,where *y= ln(z_ekon2019/z_ekon2015),* *x= ln(z_ekon2015)*	-0,396	0,329	0,094

Source: authors' calculations based on European statistical data

Based on the data presented in the Table 2, we get the equation ln(g_econ 2019/g_econ 2015)=0.396+0.329ln(g_econ 2015) and since β=0.329>0, the assumption of convergence of the green economy index values in the EU countries in the period 2015 - 2019 is not confirmed. However, it should be noted that the p-value is 0.094, which falls within the interval from 0.05 to 0.1. Therefore, there is only a trend for the divergence of the Green Economy Index values in the EU countries in the period under study.

The data obtained also suggest that there is σ-divergence of the Green Economy Index values in the EU countries in 2015 - 2019. To find out whether the green economy in the countries under study is characterised by σ-divergence, general indicators of variation are used - the amplitude of variation and the standard deviation. They are calculated based on the formula (Чижо, Игнатьева, Лавриненко 2018):

$$R = X_{\max} - X_{\min};$$

$$\sigma = \frac{\sum (x_i - \bar{x}) f_i}{\sum f_i},$$

where $X_{\max}$ and $X_{\min}$ is the highest and lowest values of the indicator; … $\bar{x}$ indicator mean values; x_i indicator variants; f_i frequency; $i = 1,2,\ldots n$ number of variants.

Based on the abovementioned information, the constructed indicators of relative variation will be used: amplitude coefficient and variation coefficient. They are calculated based on the formulae:

$$K_R = \frac{X_{\max} - X_{\min}}{\bar{x}};$$

$$(V_\sigma) = \frac{\sigma}{\bar{x}},$$

δ - standard deviation, $\bar{x}$ - average value, $X_{\max}$ и $X_{\min}$ –the largest and smallest value of a characteristic in the sample population

.

Table 3. Variation and amplitude coefficients of the Green Economy Index in the EU countries in 2015 and 2019.

Variation markers	2015	2019
Range coefficient, (K_R)	0,4	0,5
2000 = 100%	100%	125%
Variation coefficient, (V_σ)	0,06	0,1
2000 = 100%	100%	167%

Source: author's calculations

The Table shows that after 4 years the "polarisation" of the Green Economy Index values in the EU countries increases, and the rise in the variation coefficient by 67% proves it. It means that there was an increase in the differences in the Green Economy Index values, which is confirmed by σ-divergence of the Green Economy Index values in the EU countries in the period 2015 – 2019.

5. Conclusions

In 2015, Austria, Sweden, Denmark, Slovenia, and the Netherlands have the highest overall index for the green economy trends, while Germany, Luxembourg, Hungary, Poland, and Romania had the lowest overall index for the green economy trends. In 2019, Denmark, Italy, the Netherlands, Slovenia, and Sweden had the highest overall green economy trend index, while the Czech Republic, Germany, Cyprus, Hungary, and Poland have the lowest index.

After 4 years, the "polarisation" of the Green Economy Index values increased, as evidenced by the 67% increase in the variation coefficient - there was an increase in the green economy differences, confirmed by the σ-divergence of Green Economy Index values in the EU countries. There is a trend of β -divergence in the EU Green Economy Index values in 2015 - 2019. The statement that countries with initially higher values of the Green Economy Index increase their level faster and countries with initially lower green economy levels increase their level more slowly has not been confirmed. More detailed research into this statement is required to find the reasons for the increasing disparities. Moreover, it defines the direction for further research in this area.

The problem matrix revealed negative trends in the dynamics of the Green Economy Index in 2015 - 2019. The most problematic group of countries (Bulgaria, Czechia, Denmark, Greece, Cyprus, Latvia, Malta, Austria, Poland, and Slovenia) are those that have seen both a decline in the Green Economy Index and a deterioration in the country ranking over the period under study. A group of countries (Germany, Estonia, Ireland, Lithuania, Hungary, Portugal, Romania, Slovakia, and Finland) in which their indices' values deteriorate slowly so that their ranking position does not deteriorate is considered problematic. A group of countries lead both in the dynamics of their index values. In the overall ranking, countries that improve their Green Economy Index values rapidly outperform others: Belgium, France, Croatia, Italy, Spain, Luxembourg, Netherlands, and Sweden.

Therefore, we can conclude that disparities in the Green Economy Index in EU countries do not decrease but increase, indicating that the EU cohesion policies in this area are ineffective.

References

Ajvazyan S.A. (2005). Razrabotka i analiz integral'nyh indikatorov kachestva zhizni naseleniya Samarskoj oblasti. - M.: CEMI RAN. 124 p.

Atkinson, A.B. (1970) On the measurement of economic inequality. *Journal of Economic Theory*, 2(3), 244-263. https://doi.org/10.1016/0022-0531(70)90039-6

Barro R.J., & Sala-i-Martin X. (1992) Convergence. *Journal of Political Economy*, 100(2), 223-251. https://doi.org/10.1086/261816

Barro R.J., & Sala-I-Martin X. (1995). Economic Growth. Chicago: The MIT Press.

Battisti, M., & Di Vaio. G. (2008). A spatially filtered mixture of β-convergence regressions for EU regions, 1980-2002. *Empirical Economics*, 34(203). https://doi.org/10.1007/s00181-007-0169-7

Brand U. (2012). Green Economy - the Next Oxymoron? No Lessons Learned from Failures of Implementing Sustainable Development. *Gaia*, 21(1), 28-32. https://doi.org/10.14512/gaia.21.1.9

Carlino G., & Mills L. (1996). Testing neoclassical convergence in regional incomes and earnings. *Regional Science and Urban Economics*, 26, 565-590. https://doi.org/10.1016/S0166-0462(96)02137-0

Čižo, E., Ignatjeva, S., & Lavrinenko, O. (2018). Assessment of Convergence Processes of Financial Depth Indicators in States with Different Levels of Economic Development. *Journal of security and sustainability Issues* 7(3) https://doi.org/10.9770/jssi.2018.7.3(8)

Coulombe S., & Lee F. (1995). Convergence across Canadian Provinces, 1961 to 1991. *The Canadian Journal of Economics* 28(4a), 886-898. https://doi.org/10.1007/s00181-007-0169-7

Domestic material consumption per capita. EUROSTAT data base. https://ec.europa.eu/eurostat/web/products-datasets/-/t2020_rl110

Eco-innovation index. EUROSTAT data base. https://ec.europa.eu/eurostat/web/products-datasets/-/t2020_rt200

Eglītis, J. (2008). Globālie reitingi un Daugavpils Universitātes faktors reģiona attīstībā. *Sociālo Zinātņu Vēstnesis*, 1(59)

Energy dependence. EUROSTAT data base. https://ec.europa.eu/eurostat/web/products-datasets/-/t2020_rd320

Energy taxes by paying sector. EUROSTAT data base. https://ec.europa.eu/eurostat/web/products-datasets/-/t2020_rt310

Environmental tax revenues. EUROSTAT data base. https://ec.europa.eu/eurostat/web/products-datasets/-/t2020_rt320

Evans, P., & Kim, J. (2005). Estimating convergence for Asian economies using dynamic random variable models. *Economics Letters* 86, 159-166. https://doi.org/10.1016/j.econlet.2004.06.014

Final energy consumption in households by fuel. EUROSTAT data base. https://ec.europa.eu/eurostat/web/products-datasets/-/t2020_rk210

Final energy consumption. EUROSTAT data base. https://ec.europa.eu/eurostat/web/products-datasets/-/t2020_34

Fulai, S. (2010). Green Economy: conceptual issues. Background Paper for the UNEP. Major Groups and Stakeholders. Consultation on Green Economy. Geneva, p. 1-7. Retrieved September 2, 2023 from: http://new.unep.org/civilsociety/Portals/59/Documents/GMGSF12-GE-Conceptual-Issues.pdf

Gini, C. (1909). Concentration and dependency ratios (in Italian). English translation in Rivista di Politica Economica, 87 (1997), p. 769-789.

Gini, C. (1912). Variabilità e mutabilità (Variability and Mutability, C. Cuppini, Bologna, 156 pages. Reprinted in Memorie di metodologica statistica (Ed. Pizetti E, Salvemini, T). Rome: Libreria Eredi Virgilio Veschi (1955).

Green Growth Indicators. OECD database. https://stats.oecd.org/viewhtml.aspx?datasetcode=GREEN_GROWTH&lang=en#

Greenhouse gas emissions per capita. EUROSTAT data base. https://ec.europa.eu/eurostat/web/products-datasets/-/t2020_rd300

Hoken P., Lovins E., & Lovins H. (2002). Estestvennyj kapitalizm: gryadushchaya promyshlennaya revolyuciya [Natural Capitalism: The Coming Industrial Revolution]. Moskva: Nauka, 459 p.

Indicators explained. EUROSTAT data base. https://ec.europa.eu/eurostat/web/europe-2020-indicators/resource-efficient-europe/indicators-explained

Islam, N. (2003). What Have We Learnt from the Convergence Debate? *Journal of Economic Surveys*, 17(3), 313-315. https://doi.org/10.1111/1467-6419.00197

Istudor, N., Dinu, V., & Nitescu, D.C. (2021). Influence Factors of Green Energy on EU Trade. *Transformations in Business & Economics*, Vol. 20, No 2 (53), pp.116-130.

Jiang, M. (2022). The Impact of Digital Inclusive Finance on Green Total Factor Productivity of the Service Industry: New Evidence from China. *Transformations in Business & Economics*, Vol. 21, No 2B (56B), pp.753-771

Jevons, W.S. (1924). The theory of political economy. Fifth edition. London: Macmillan.

Kennet, M., & Heinemann, V. (2006). Green Economics: setting the scene. Aims, context, and philosophical underpinning of the distinctive new solutions offered by Green Economics. *International Journal of Green Economics*, 1, 68-102. https://doi.org/10.1504/IJGE.2006.009338 ,

Lau, C. (2009). New evidence about regional income divergence in China. *China Economic Review*, 1-17.

Lavrinenko, O. (2015). Living standard of Central and Eastern Europe. GlobeEdit, Germany, 146 p. ISBN 978-3-639-74780-5

Loewy, M., & Papel, D. (1996). Are US regional incomes converging? Some further evidence. *Journal of Monetary Economics*, 38, 587-598. https://doi.org/10.1016/S0304-3932(96)01292-5

Pearce, D.W., Markandya, A., & Barbier, E. R. (1989). Blueprint for a Green Economy. London. Earthscan Publications Ltd.

Primary energy consumption. EUROSTAT data base. https://ec.europa.eu/eurostat/web/products-datasets/-/t2020_33

Protected areas. OECD database. https://data.oecd.org/biodiver/protected-areas.htm

Quah, D. (1993). Galton's Fallacy and Tests of the Convergence Hypothesis. *The Scandinavian Journal of Economics*, 95(4) Endogenous Growth, 427-443. https://doi.org/10.2307/3440905

Quah, D. (1997). Convergence Empirics Across Economies with (Some) Capital Mobility. *Journal of Economic Growth*, 1, 95-124. https://doi.org/10.1007/BF00163344

Quah D. (1996). Regional convergence clusters across Europe. *European Economic Review*, 40 https://doi.org/10.1016/0014-2921(95)00105-0

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

Recycling rate of municipal waste. EUROSTAT data base. https://ec.europa.eu/eurostat/web/products-datasets/-/t2020_rt120

Resource productivity. EUROSTAT data base. https://ec.europa.eu/eurostat/web/products-datasets/-/t2020_rl100

Rezk, M. R., Kapiel, T. Y., Piccinetti, L., Salem, N., Khasawneh, A., Santoro, D., Montagnino, F. M., El-Bary, A. A., & Sakr, M. M. (2023). Circular economy in Egypt: an overview of the current landscape and potential for growth. *Insights into Regional Development*, 5(3), 45-57. https://doi.org/10.9770/IRD.2023.5.3(3)

Ryszawska, B. (2013). Green economy indicators. In: Towards a Green Economy. From ideas to practice Łódź: IndicatorsPublisher Wydawnictwo Uniwersytetu Łódzkiego, p. 31-52.

Ryszawska B. (2015). Green Economy Indicators. In: Towards a Green Economy. From ideas to practice. Burchard-

Ryszawska B. (2017). Green economy transition and regional policy of European Union. Prikladna ekonomika - vid teoriï d o praktiki. Retrieved October 2, 2021 from: http://dspace.wunu.edu.ua/bitstream/316497/24349/1/RYSZAWSKA%20B..pdf

Ryszawska, B. (2013). Koncepcja zielonej gospodarki jako odpowiedź na kryzys gospodarczy i środowiskowy. *Prace naukowe uniwersytetu ekonomicznego we wrocławiu research papers of Wrocław University of Economics*, 318, 50-52. https://doi.org/10.15611/pn.2013.318.04

Sala-i-Martin X. (1996a) Regional Cohesion: Evidence and Theories of Regional Growth and Convergence. *European Economic Review*, 40(6), 1325-1352. https://doi.org/10.1016/0014-2921(95)00029-1

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

Share of energy from renewable sources. Renewable energy sources in electricity. EUROSTAT data base. https://appsso.eurostat.ec.europa.eu/nui/show.do?query=BOOKMARK_DS-1032380_QID_16EE5EB6_UID_-3F171EB0&layout=TIME,C,X,0;GEO,L,Y,0;NRG_BAL,L,Z,0;UNIT,L,Z,1;INDICATORS,C,Z,2;&zSelection=DS-

1032380UNIT,PC;DS-1032380NRG_BAL,REN_ELC;DS-1032380INDICATORS,OBS_FLAG;&rankName1=UNIT_1_2_-1_2&rankName2=NRG-BAL_1_2_-1_2&rankName3=INDICATORS_1_2_-1_2&rankName4=TIME_1_1_0_0&rankName5=GEO_1_2_0_1&sortC=DESC_-1_FIRST&rStp=&cStp=&rDCh=&cDCh=&rDM=true&cDM=true&footnes=false&empty=false&wai=false&time_mode=FIXED&time_most_recent=true&lang=EN&cfo=%23%23%23%2C%23%23%23.%23%23%23

Share of fuels in final energy consumption. EUROSTAT data base. https://ec.europa.eu/eurostat/web/products-datasets/-/nrg_ind_fecf

Share of renewable energy in gross final energy consumption. EUROSTAT data base. https://ec.europa.eu/eurostat/web/products-datasets/-/t2020_31

Supply, transformation and consumption of electricity. EUROSTAT data base. https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_cb_e&lang=en

Supply, transformation and consumption of oil and petroleum products. EUROSTAT data base. https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_cb_oil&lang=en

Supply, transformation and consumption of solid fossil fuels. EUROSTAT data base. https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_cb_sff&lang=en

Surface of terrestrial sites designated under Natura 2000. EUROSTAT data base. https://ec.europa.eu/eurostat/web/products-datasets/-/sdg_15_20

Sustainable development indicators. Responsible consumption and production. EUROSTAT data base. https://ec.europa.eu/eurostat/web/sdi/responsible-consumption-and-production

Swart, J., & Groot, L. (2020). Sustainable development: The transition to the green economy. *Quality - Access to Success*, 15(1), 129-133.

Theil, H. (1967). Economics and information theory. Amsterdam: North-Holland, 488 p.

Veblen, T. (1899). The Theory of the Leisure Class: An Economic Study of Institutions. New York: The Macmillan Company.

Walras, L. (1874). Éléments d'économie politique pure, ou, Théorie de la richesse sociale. Lausanne: L. Corbaz & Cie. Retrieved October 2, 2021 from: https://gallica.bnf.fr/ark:/12148/bpt6k1181431v/f7.item

Wei, H., Fuqiang, Zh., Yu, Zh., Tracy, L. (2021). Green Human Resource Practice and Team Innovation Performance: Roles of Team Boundary-Spanning Behaviour and Responsible Leadership. *Transformations in Business & Economics*, Vol. 20, No 3C (54C), pp.585-604.

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