ECONOMICS OF DEVELOPMENT
Jornal homepage: https://ecdev.com.ua/
Vol. 21, No. 4
2022

UDC 338.061:339.972:364 DOI: 10.57111/econ.21(4).2022.8-18

Tetiana Cherkashyna*

Simon Kuznets Kharkiv National University of Economics
61166, 9A Nauka Ave., Kharkiv, Ukraine

Taxonomic Analysis of Income Inequality in the EU Countries

Abstract. The problem of population economic inequality is an actual issue for all countries of the world, but the peculiarity of economic inequality in EU countries lies in the differentiation of non-labor incomes received from property ownership, and also in the uneven distribution of residential and commercial real estate. Therefore, the analysis of population economic inequality in the EU countries is an urgent scientific and practical task. The purpose of this study was to determine the degree of economic inequality and the optimal rate of population income differentiation in the EU countries, and to develop measures based on this to reduce the degree of property inequality in the countries of this region. To achieve the goal, the taxonomy method was used, as well as general scientific methods (dialectics, analysis, synthesis, induction, deduction). For the quantitative description of the obtained results, the Harrington factor-criterion scale was used, which made it possible to divide 27 EU countries into three groups (clusters): countries with a high degree of economic inequality (Bulgaria, Latvia, Lithuania); countries with an average degree of economic inequality (Austria, Belgium, Greece, Spain, Italy, Cyprus, Luxembourg, Germany, Poland, Portugal, Romania, Hungary, Croatia, Finland, France, Sweden); countries with a low degree of economic inequality (Denmark, Estonia, Ireland, Malta, the Netherlands, Slovakia, Slovenia, the Czech Republic). To reduce the population economic inequality in the countries of the third group, the following measures have been proposed: stimulation of domestic and foreign investments; ensuring a high return on financial assets at the state level; creating more favorable conditions for the development of industry and increasing the wages of workers at the industrial enterprises. The obtained results have scientific and practical value on how to improve the economic policy of the countries of Northern and Eastern Europe and can be used in further theoretical researches on problems of population economic inequality in the countries of this region and for the specification of applied measures to reduce economic inequality in Bulgaria, Latvia and Lithuania

Keywords: property inequality, income differentiation, the Gini coefficient, the Palma index, decile coefficient, taxonomy method

Article's History: Received: 23/09/2022; Revised: 02/11/2022; Accepted: 09/12/2022

INTRODUCTION

The problem of population economic inequality is relevant for all countries of the world, with economically developed countries, in particular the countries of the European Union (EU) being not an exception. However, the peculiarity of economic inequality in the EU countries, is mostly not in the differentiation of labor income (wages, intellectual rent, individual entrepreneurial income), but in the differentiation of non-labor income received from property ownership (monopoly rent, land rent and rent), or financial capital (interest, dividends, profit). Thus, according to the data of the statistical service of the European Union (Eurostat) [1; 2], 10% of the richest citizens of EU countries own aggregate financial assets (cash, securities (shares, bonds, bills of exchange, treasury bills, investment certificates, etc.), deposits in commercial banks or other financial and credit institutions, insurance policies, share contributions in the capital of enterprises, savings certificates, etc.) worth more than 800 billion euros; at the same time, 10% of the poorest citizens of the EU countries own aggregate financial assets worth no more than 500 million euros. Besides, the population economic inequality in European countries is manifested in the uneven distribution of

Suggested Citation:
Cherkashyna, T. (2022). Taxonomic analysis of income inequality in the eu countries. *Economics of Development,* 21(4), 8-18.

*Corresponding author

residential and commercial real estate, as a result of which only 40% of the population uses property objects as intended, more than 40% of citizens are unable to purchase their own housing and are forced to rent it, while almost 20 % invest free money in real estate solely for the purpose of receiving rent or letting. That is why determining the degree of economic inequality and the optimal rate of differentiation of population incomes in different types of economic systems is an extremely urgent scientific and practical task.

The purpose of this study was to analyze the degree of economic inequality in the EU countries by calculating taxonomic coefficients and to develop on this basis scientific and practical recommendations for reducing the degree of population income differentiation in the countries studied.

LITERATURE REVIEW

The analysis of professional literature [3-5] showed that in modern science there are three groups of methodological approaches to the study of problems of the population economic inequality in the EU countries. The first group of scientific approaches brings together scientists who use empirical analysis – quantitative and qualitative analysis of statistical data – to study economic inequality and the degree of property differentiation of population incomes in the countries of the European Union. Thus, O. Rakauskienė and L. Volodzkienė [6] analyzed the state of economic inequality of the population in 27 countries of the European Union and found that the main causes of property differentiation in the countries of this region are ineffective social policy, disproportionate taxation policy, uneven distribution of residential real estate, psychological peculiarities of individuals, etc. The scientists came to the conclusion that it is housing conditions that are a key indicator that determines the degree of inequality in the level and quality of life of the population, and according to this indicator, the highest degree of economic inequality among the EU countries is characteristic of Estonia, Spain and Latvia. Rakauskienė and Volodzkienė [6] also found that members of Greek, German, Romanian, Bulgarian, and Dutch families spend the largest share of disposable income (more than 40%) on utility bills. Moreover, the scientists found out that the highest housing provision is typical for Denmark (54.36 m^2/person), Cyprus (48.8 m^2/person), Italy (42.62 m^2/person), and the lowest – for Romania (21.23 m^2/person), Slovakia (24.51 m^2/person) and Poland (24.7 m^2/person). In turn, D. Furceri and J. Ostry [7] analyzed the degree of inequality in the incomes of population of the EU countries using an empirical model that takes into account the influence of three factors: the demographic structure of society, the level of unemployment, and the degree of globalization. They found that there is a close asymmetric relationship between trade and financial globalization: the expansion of a country's export-import activity contributes to the reduction of socio-economic inequality, at the same time, the strengthening of financial ties between countries, on the contrary, leads to its growth. Therefore, the deregulation of the national financial system and the introduction of technological advances are the main factors that increase the population economic inequality in the developed countries of the world, in particular the EU countries.

At the same time, within the first group of methodological approaches, the number of publications dedicated to the analysis of the COVID-19 pandemic impact on the dynamics of economic inequality and poverty in various types of economic systems is significantly increasing. Most scientists draw attention to the fact that the introduction of quarantine restrictions has had an extremely negative effect not only on the economic development of the so-called "third" countries, but also on the economic growth of the most developed countries in the world. In particular, C. D'Ambrosio, A. Clark and A. Lepinteur [8] conducted an empirical analysis of the coronavirus disease impact on the population well-being of four EU countries (Spain, Italy, Germany and France) and found out that the available personal income of the population in these countries significantly decreased during the first wave of the COVID-19 pandemic (2020), primarily among middle-income households, due to the fact that the key state social support programs were aimed at protecting the most vulnerable segments of population (pensioners, disabled, unemployed, large families, etc.), not the representatives of the "middle" class. At the same time, during the pandemic, the degree of relative inequality of population decreased the least in France, and the degree of absolute inequality decreased equally in all four analyzed countries.

Representatives of the second group of scientific approaches to the study of the problem of population economic inequality use mainly mathematical and statistical methods. For example, C. Jones and J. Kim [9] examine the trends of economic inequality in three centers of the world: the United States, the European Union, and Japan. The peculiarity of the Jones-Kim study is the analysis of income inequality among only one category of population – entrepreneurs. Based on the calculation of the power law exponent, these scientists [9] found that in the USA, Great Britain and Norway, economic inequality in terms of entrepreneurial income is significantly higher than in France and Japan, which is explained by the positive consequences of globalization processes, which facilitate access to the latest information technologies and innovative developments and, therefore, increase the profit of entrepreneurs from the export of innovative products. Instead, L. Kiss in [10] studies the quantitative relationship between the degree of economic inequality and inequality in land ownership in European countries. Mathematical calculations carried out by L. Kiss and their verification based on the Dickey-Fuller, Phillips-Perron tests, and the cointegration test showed that this problem is most burning in Bulgaria and Romania, as it leads to the growth of "informal" employment and illegal income in these countries.

Representatives of the third group of approaches to the study of economic inequality mainly use methods of economic and mathematical modeling, in particular regression and cluster analysis. So, Z. Darvas [11; 12] used the poverty risk indicator as an independent variable, which determines the specific weight of households that receive less than 60% of the average disposable income, and the Gini coefficient by income as a factor indicator. In his research, the scientist built regression models of two types (linear and non-linear), which clearly indicate the existence of a positive correlation between input factors and the resulting indicator in most EU countries, in particular Bulgaria, Greece, Latvia, Romania. A. Mehedintu, G. Soava and M. Sterpu [13] came to the similar conclusions, they found that the faster the speed

of economic inequality growth, the greater the threat of poverty and economic decline in the country. Meanwhile, T. Cherkashina [14] investigated the problems of population economic inequality in the post-socialist countries of Central and Eastern Europe, which are members of the EU, with the help of cluster analysis and found out that the highest degree of population economic inequality is characteristic of the Baltic "tigers" (Estonia, Latvia and Lithuania), and the lowest – of Eastern European countries (Albania, Moldova, Poland, Slovakia, Slovenia and Ukraine).

Despite the significant scientific contribution of these authors, there are still almost no studies dedicated to the quantitative assessment of the degree of population economic inequality in the EU countries on the basis of a generalizing indicator. This determines the relevance of further scientific investigations and a more in-depth study of issues related to the formation of a comprehensive indicator of population economic inequality in the EU countries.

MATERIALS AND METHODS

In order to determine the degree of population economic inequality in the EU countries, the author used the method of taxonomic analysis. The basis of taxonomic analysis is the definition of the so-called "taxonomic distance" – the distance between points of a multidimensional space, whose dimension is determined by the number of features (indicators) that characterize the object under study. The definition of "taxonomic distance" characterizes the degree of remoteness of the studied object from the nearest competitor or the standard, and makes it possible to determine the location of each individual point (object) relative to others and, in this way, to structure the entire set of input features-indicators. In this study, the use of taxonomic analysis was expedient, as it made it possible to obtain a quantitative assessment of the degree of population economic inequality in each country, to determine the rank (rating) of each EU country, to distribute EU countries depending on the values of taxonomic coefficients, and on this basis, to propose directions that reduce the degree of income differentiation, and also to more fully determine the social policy reserves for countries of this region.

The taxonomic analysis of the population economic inequality of EU countries involves standardization of input data, i.e., bringing them to the same dimensionless values, which characterize the ratio of the deviation of each indicator from its average value for the group of EU countries to the root mean square (or standard) deviation for this feature. Standardization of input data was carried out according to the formula:

$$z_{ij} = \frac{x_{ij} - \bar{x}_j}{s_j}, \quad (1)$$

where z_{ij} – the standardized value of the j_{th} feature for the ith country; x_{ij} – the value of the j_{th} feature (indicator) for the ith country; $\overline{X}j$ – the average arithmetic value of the j_{th} feature; s_j – the standard deviation of the jth feature (index).

After that, the input features of the observation matrix were divided into stimulators (indicators whose increasing values positively affect the degree of economic inequality in the country's economy, therefore, the highest value of the stimulator indicators corresponds to the highest degree of uneven distribution of income between different stratified population groups) and extremators-stimulators (indicators, the positive effect of which on the degree of population economic inequality is not monotonic and has the properties of a stimulator if the values of the indicators are less than optimal and the properties of a destimulator if the values of the indicators are less than optimal). The normalization of indicators was carried out according to the following formulas:

$$X_s = \frac{Xfact - Xmin}{Xmax - Xmin}, \quad (2)$$

$$X_e = \frac{Xmax - Xfact}{\delta_j}, \quad (3)$$

where X_s – the normalized value of the stimulator indicator; X_e – the normalized value of the extremum indicator; X_{fact} – the actual value of the indicator; X_{max} – the maximum value of the indicator; X_{min} – the minimum value of the indicator; δ_j – the root mean square deviation of the indicator from the average for the group of EU countries.

Next, the distance between individual objects and the so-called "reference point" was determined, and the closer the aggregate unit (X_i) is located to the "reference point", the smaller the value of the reference distance will be. The calculation of distances between multidimensional "variant units", that is, the coordinates of the standard vector, was carried out using the formula:

$$\sigma_j = \sqrt{\frac{1}{m}\sum_{i=1}^{m}(c_{ij} - \overline{c_j})^2} \quad (4)$$

where σ_j – the mean square deviation of the random variable from the reference point; c_{ij} – the value of the indicator of a specific object (country); c_j – the value of the "reference point"; m – the number of input indicators.

The calculations made became the basis for determining the taxonomic coefficients of the degree of population economic inequality in the EU countries:

$$d_i = 1 - \frac{c_{i0}}{c_0}, \quad (5)$$

$$K_i = 1 - d_i, \quad (6)$$

where K_i – the taxonomic coefficient of population economic inequality; d_i – deviation of the indicator from the standard; c_{i0} – the maximum distance between the object (country) and the "reference point"; c_0 – the distance between a specific object (country) and the "reference point".

The taxonomic analysis of the population economic inequality in the EU countries was carried out in three stages (Fig. 1).

At the beginning of the study, a matrix of observations has been formed, the elements of which are the numerical values of the input features-indicators that characterize the degree of population economic inequality in the EU. A detailed study of the existing scientific literature on this issue [15-17] allowed the author to attribute the Gini coefficient by income to these indicators that shows the degree of uneven distribution of income between different stratification groups; Gini coefficient by property that shows the degree of uneven distribution of property (residential and commercial real estate objects, movable and immovable property, land, financial and digital assets) between different stratification groups; decile coefficient that shows the ratio of the total incomes of 10% of the richest to the total incomes of 10% of the poorest of the population; the quantile coefficient that shows the ratio of the total incomes of 20% of the richest to the total incomes of

20% of the poorest of the population; the Palma index that shows the ratio of the share of total income of 10% of the richest of the population to the share of the gross national income (GNI) of 40% of the poorest.

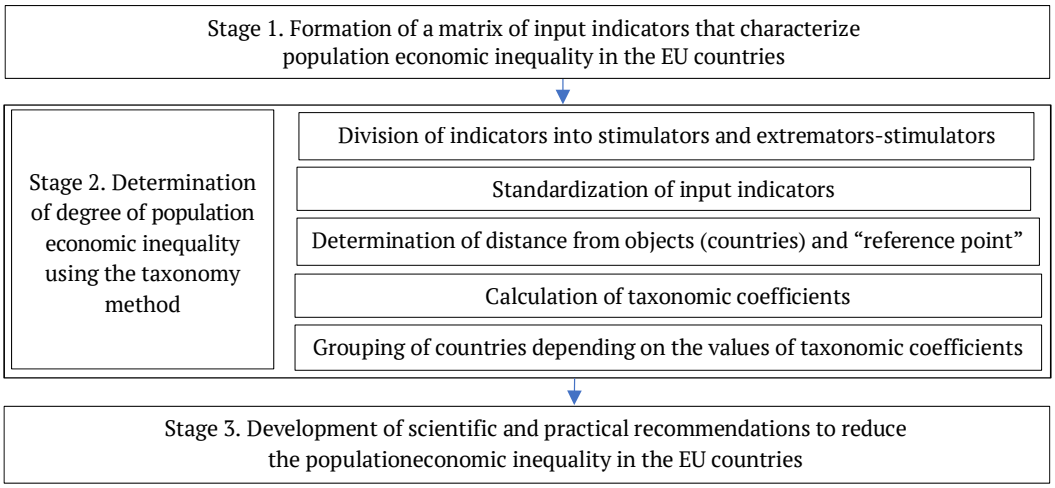

Figure 1. Sequence of stages of taxonomic analysis of population economic inequality in the EU countries
Source: developed by the authors

27 countries of the European Union have been selected as objects of the taxonomic analysis of economic inequality: Austria, Belgium, Bulgaria, Greece, Denmark, Estonia, Ireland, Spain, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Hungary, Finland, France, Croatia, the Czech Republic, and Sweden. The collected information on the studied objects (countries) is given in the Table 1.

Table 1. Input indicators that characterize the degree of population economic inequality in the EU countries (2020)

Country	Gini coefficient by income	Gini coefficient by property	Decimal coefficient	Quantile coefficient	Palma index
Austria	30.44	35.1	7.8	4.84	1.09
Belgium	27.57	32.2	6.19	4.06	0.96
Bulgaria	37.15	72.08	17.15	8.2	1.5
Greece	36.47	66.09	9.96	5.73	1.27
Denmark	28.5	34	6.18	3.93	1.1
Estonia	32.18	38.05	7.77	4.8	1.12
Ireland	30.77	31.5	6.97	4.56	1.15
Spain	36.89	44.78	12.45	6.55	1.58
Italy	35.92	46.12	13.63	6.8	1.42
Cyprus	33.5	49.21	7.29	4.72	1.197
Latvia	33.71	48.46	10.23	5.92	1.38
Lithuania	36.98	50.04	10.58	6.11	1.45
Luxembourg	35.11	46.09	9.21	5.75	1.35
MaltaМальта	29.74	34.85	8.03	4.86	1.17
The Netherlands	28.31	34.89	7.03	4.42	1.07
Germany	32.33	39.06	8.097	5.05	1.21
Poland	30.19	42.74	7.5	4.5	1.2
Portugal	34.9	46.15	9.29	5.38	1.27
Romania	35.14	44.02	5.0	4.1	1.2
Slovakia	25.77	29.13	4.00	3.8	.09
Slovenia	24.84	27.54	3.8	3.7	0.8
Hungary	29.76	45.16	7.51	4.9	1.1
Finland	26.89	32.78	6.05	4.03	0.996
France	32.55	39.45	8.34	5.1	1.28
Croatia	29.8	32.47	7.4	4.62	1.02
The Czech Republic	25.43	36.09	5.12	3.8	0.9
Sweden	30.00	33.46	7.83	4.63	1.04

Source: [1; 2]

Next, the input indicators were standardized, as a result of which the average values for each investigated feature are equal to 0, and their variances are equal to 1. This made it possible to obtain an m×n matrix of normalized values (observations), in which each EU country can be interpreted as some point P_i in an n-dimensional vector space whose coordinates are the values $z_{ij}(i=\overline{1,m},j=\overline{1,n})$. The distance between individual objects and the so-called "reference point" has also been determined. However, the obtained value of the reference distance does not give a complete description of the degree of distance of a population unit from the ideal (or "reference") point, therefore, in this study, the ratio of the reference distance to the maximum possible in the studied population has been determined. Usually, this ratio varies from 0 to 1 (d ε [0, 1]) and reflects the degree of proximity of any unit of the population to the "reference point". Note that according to the rules of taxonomic analysis, under the condition of a normal distribution of the random value of the maximum distance between the object (country) and the "reference point" (or efficiency point) of each multidimensional unit to the reference point, it is considered that 97.58% of all distance values are no more than this distance. Let us add that the maximum value of the calculated taxonomic indicator of the degree of economic inequality in the country equals 1, so the closer the value is to 1, the higher the inequality of the population in the country; and, conversely, the further the obtained value is from 1, the lower the inequality of the population in the country.

RESULTS AND DISCUSSION

Analysis of taxonomic indicators of population economic inequality in the EU countries. Let us consider the results of the author's research in more detail. Tables 2-3 show that the highest values of taxonomic coefficients and, accordingly, the highest degree of population economic inequality are characteristic of three post-socialist countries: Bulgaria (d_i=0,8622, rank 1), Lithuania (d_i=0,8342, rank 2) and Latvia (d_i=0,8026, rank 3). This is largely due to the rapid capitalization of intangible assets and excessive concentration of financial capital in these countries as a result of their accession to the EU in 2004-2007.

Table 2. Normalized values of indicators that characterize the degree of population economic inequality in the EU countries (2020)

Country	Gini coefficient by income	Gini coefficient by property	Decimal coefficient	Quantile coefficient	Palma index
Austria	0.45	0.178	0.299	0.253	0.78
Belgium	0.22	0.11	0.179	0.08	0.205
Bulgaria	1	1	1	1	0.897
Greece	0.94	0.867	0.461	0.451	0.603
Denmark	0.297	0.156	0.178	0.051	0.385
Estonia	0.593	0.244	0.297	0.244	0.41
Ireland	0.596	0.244	0.237	0.191	0.449
Spain	0.98	0.378	0.648	0.633	1
Italy	0.9	0.422	0.736	0.689	0.795
Cyprus	0.703	0.489	0.261	0.227	0.509
Latvia	0.72	0.467	0.482	0.493	0.744
Lithuania	0.986	0.511	0.508	0.536	0.833
Luxembourg	0.834	0.422	0.405	0.456	0.705
Malta	0.398	0.156	0.317	0.258	0.474
The Netherlands	0.282	0.156	0.242	0.16	0.346
Germany	0.608	0.267	0.322	0.3	0.526
Poland	0.435	0.4	0.277	0.178	0.513
Portugal	0.817	0.422	0.411	0.373	0.603
Romania	0.837	0.377	0.089	0.089	0.513
Slovakia	0.076	0.044	0.015	0.022	0.128
Slovenia	0	0	0.07	0	0
Hungary	0.399	0.333	0.278	0.267	0.385
Finland	0.166	0.11	0.169	0.073	0.251
France	0.626	0.267	0.34	0.311	0.615
Croatia	0.387	0.21	0.269	0.206	0.282
The Czech Republic	0.048	0.2	0.099	0.022	0.128
Sweden	0.419	0.133	0.302	0.207	0.308

Source: developed by the author

Table 3. Dynamics of taxonomic indicators of the degree of population economic inequality in the EU countries (2020)

Country	Value (K_i)	Deviation (d_i)	Rank
Austria	0.6962	0.3068	14
Belgium	0.6712	0.3288	19
Bulgaria	0.8622	0.1378	1
Greece	0.7945	0.2055	4
Denmark	0.5026	0.4974	27
Estonia	0.5241	0.4759	23
Ireland	0.5162	0.4838	25
Spain	0.789	0.211	6
Italy	0.7111	0.289	13
Cyprus	0.6942	0.3058	15
Latvia	0.8026	0.1974	3
Lithuania	0.8342	0.1658	2
Luxembourg	0.7294	0.2706	10
Malta	0.5097	0.4903	26
The Netherlands	0.577	0.423	22
Germany	0.6911	0.3089	18
Poland	0.7155	0.2845	4
Portugal	0.7492	0.2508	9
Romania	0.6966	0.3034	16
Slovakia	0.6329	0.3671	20
Slovenia	0.5229	0.4771	24
Hungary	0.7622	0.2378	8
Finland	0.6939	0.3061	17
France	0.7911	0.2089	5
Croatia	0.7113	0.2887	12
The Czech Republic	0.5811	0.4189	21
Sweden	0.7829	0.2171	7

Source: developed by the author

At the same time, the lowest values of taxonomic coefficients among the EU countries are characteristic of other post-socialist countries: Estonia, Slovakia, Slovenia and the Czech Republic. This phenomenon is explained by an effective budget and tax policy aimed at equalizing the gap between the incomes of different stratification groups and forming additional reserves to support the most vulnerable social strata of the population from the negative impact of external economic shocks [18; 19]. Thus, the instruments of the budget and tax policy in Slovakia and Slovenia combine a system of "zero" taxation, when individuals with the lowest incomes (not higher than the subsistence minimum) are generally exempt from paying taxes, with the mechanism of "dispersion" of capital through the repurchase of shares by employees of corporations on preferential terms (the so-called "ESOP programs" or the plan for the distribution of company shares among employees (Employee Stock Ownership Plan)) [19; 20]. Also, low values of the taxonomic coefficients of economic inequality are characteristic of the leading countries of Western Europe, in particular Germany and the Netherlands, so they occupy 20th and 21st place respectively in the ranking of countries in terms of economic inequality, which indicates the presence of the most effective institutions of ownership and income distribution within pan-European space.

Regarding the dynamics of taxonomic indicators of population economic inequality in the EU countries, it should be noted that it changed somewhat during 2019-2021 (Fig. 2).

The calculated values of the taxonomic coefficients of economic inequality in the EU countries in 2019-2021 indicate that there is a tendency to increase the degree of differentiation of the population in income and ownership of property and estate in almost all EU countries, primarily in the countries of Southern Europe (in Greece – from 0.7911 in 2019 to 0.8074 in 2021, in Spain – from 0.7542 in 2019 to 0.8267 in 2021, in Italy – from 0.7785 in 2019. to 0.8246 in 2021) and Northern Europe (in Latvia – from 0.7844 in 2019 to 0.8509 in 2021, in Lithuania – from 0.8476 in 2019 to 0.8692 in 2021). In our opinion, this is due to the negative consequences of the coronavirus pandemic, as a result of which the level of unemployment among stratified groups with medium and low incomes increased.

EU countries clustering results that depend on the values of the taxonomic coefficients. The obtained results have been given an economic interpretation using Harrington factor-criterion scale, according to which the gradation of the numerical values of the taxonomic coefficients is as follows: if the value of the taxonomic coefficient varies from 0.0 to 0.2, then the degree of

population economic inequality is very low; if the value of the taxonomic coefficient varies from 0.2 to 0.37, then the degree of population economic inequality is low; if the value of the taxonomic coefficient varies from 0.37 to 0.64, then the degree of population economic inequality is average; if the value of the taxonomic indicator varies from 0.64 to 0.8, then the degree of economic inequality is high; if the value of the taxonomic coefficient varies from 0.8 to 1.0, then the degree of population economic inequality is very high. According to this scale, 27 countries of the European Union were divided into three groups (Table 4).

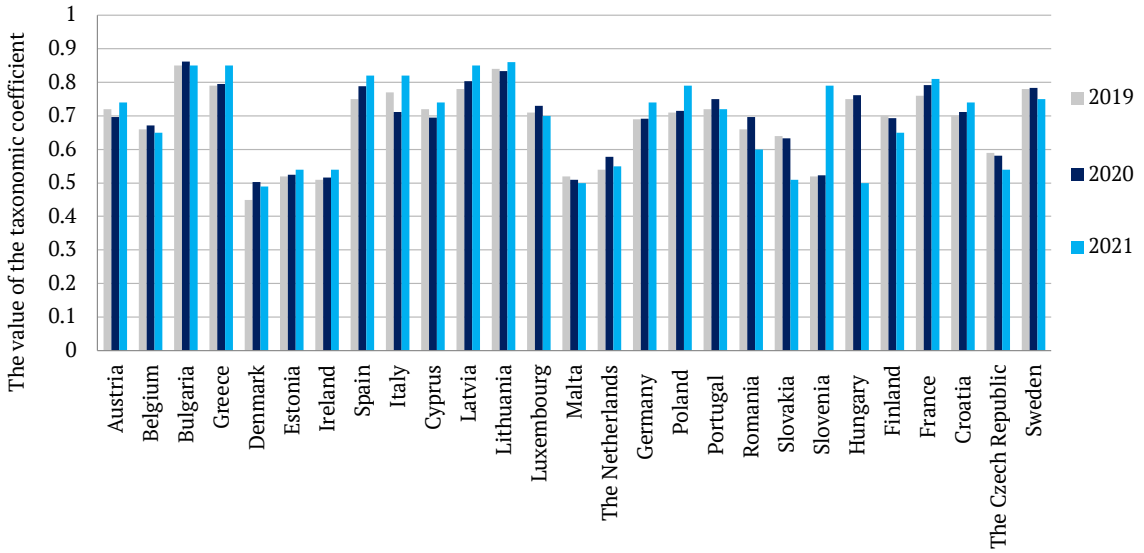

Figure 1. Dynamics of taxonomic coefficients of population economic inequality in the EU countries
Source: developed by the authors

Table 4. Dynamics of taxonomic indicators of the degree of population economic inequality in the EU countries (2020)

A group of countries	Number of countries in the group	Composition of the group	The value of the taxonomic coefficient	Group characteristics
I	3	Bulgaria, Latvia, Lithuania	0.8-1.0	A very high degree of property inequality and income differentiation of the population
II	16	Austria, Belgium, Greece, Spain, Italy, Cyprus, Luxembourg, Germany, Poland, Portugal, Romania, Hungary, Finland, France, Croatia, Sweden	0.64-0.8	High degree of income differentiation and possession of physical, human, intellectual and social capital of the population
III	8	Denmark, Estonia, Ireland, Malta, The Netherlands, Slovakia, Slovenia, The Czech Republic	0.37-0.64	Average degree of population economic inequality, high share of the "middle" class

Source: developed by the author

Table 4 shows that the first group includes three countries: Bulgaria, Latvia, and Lithuania. As for the "Baltic tigers" (Latvia and Lithuania), the high population economic inequality is associated with a very high degree of openness of national economies as a result of the accelerated pace of structural reforms (1991-2006), which consisted in a significant reduction of the government role and the development of market economy based on free pricing, entrepreneurial initiative and a flexible labor market. At the same time, the key actions of Latvia and Lithuania governments were aimed at increasing the investment attractiveness of national economies and the inflow of FDI and portfolio investments, primarily from the leading countries of the EU (France, Germany, Italy, the Netherlands). As a result, this formed a certain dependence of these countries on foreign financial capital, associated with the growth of credit risks, exchange rate fluctuations, changes in the effective interest rate, therefore, in our opinion, the main directions to reduce economic inequality in the Baltic countries (Latvia and Lithuania) can be the stimulation of domestic investments and ensuring the high yield of domestic government bonds (DGB) [20-22].

Instead, the main reason for the economic inequality of population in Bulgaria is the disproportionality of deindustrialization processes, which have led to changes in the sectoral structure of employment, an increase in the role of service sector and job cuts in the main industries (mining, metallurgy, machine-building, chemical industry, food industry, light industry, textile industry) [9]. Besides, a number of non-economic factors (complicated bureaucratic procedures, high level of corruption, low level of public trust in the judicial system, instability of the regulatory

and legal framework) restrain the development of private entrepreneurship and, at the same time, contribute to the further differentiation of both labor and non-labor incomes of the population. Given this situation, the most effective measures for the Bulgarian economy can be the creation of favorable conditions for the development of industry, in particular, mining, and the growth of wages for employees in the industry [23; 24].

The second group includes 16 countries, including the most developed EU countries (Austria, Belgium, Luxembourg, Germany, Poland, Finland, Sweden) and some post-socialist countries (Romania, Hungary, Croatia). We believe that for these countries, economic inequality is a certain driver of economic development, as it stimulates high innovative activity and technological competitiveness of the national economy. The third group included both the developed countries of Northern Europe (Denmark, Estonia, Ireland, Malta, the Netherlands) and the countries of the former "socialist camp" (Slovakia, Slovenia, the Czech Republic). This group is characterized by a low degree of population economic inequality, which, in particular in post-socialist countries, was achieved through the implementation of effective market reforms, that ensured their successful convergence to the single European space and to some extent neutralized the negative impact of external imbalances of the global market on technological modernization and social progress, which is confirmed by the list of key global indices: the human development index ($HDI_{of\ Slovakia}$=0.860, $HDI_{of\ Slovenia}$=0.917, $HDI_{of\ the\ Czech\ Republic}$=0.9), the social progress index ($SPI_{of\ Slovakia}$=80.43, $SPI_{of\ Slovenia}$=85.8, $SPI_{of\ the\ Czech\ Republic}$=84.36) and the prosperity index ($LPI_{of\ Slovakia}$=70.6, $LPI_{of\ Slovenia}$=74.8, $LPI_{of\ the\ Czech\ Republic}$=74.6) [25].

Proposed measures to reduce the population economic inequality. To reduce the population economic inequality in countries with a high degree of population economic inequality, the author proposed the following measures: stimulating domestic and foreign investments; ensuring high profitability of financial assets at the state level; creating more favorable conditions for the development of industry and increasing wages for employees in industry. Thus, in order to reduce the population economic inequality in Bulgaria, it is proposed to create more favorable conditions for the development of industry, in particular the mining industry, and to increase the wages of employees in this industry. It is known that, despite the fact that in terms of geological distribution of mineral deposits, Bulgaria is not a leader among the EU countries, however, according to the sectoral structure of the national economy of this country, the share of coal and brown coal mining, as well as lignite, which is a rather rare type of natural resources, is quite high. Also, according to Eurostat data [1], the added value of mining enterprises in Bulgaria's GDP is relatively high (more than 10%), which actualizes the improvement of the organizational and economic mechanism of managing the country's mining complex as a component of the national economic policy to reduce the population economic inequality. In our opinion, the key element of this mechanism should be the reform of the taxation system of enterprises in the mining industry of Bulgaria. However, the study of the current state and trends of taxation of mining enterprises in Bulgaria clearly indicates the following shortcomings: irrational distribution of the tax burden along the technological chain; lack of consistency in regulating the mining complex; lack of differentiation of deposits depending on mining conditions and equalization of all mining enterprises to pay a single income tax of 20%; receipt of excess profits by the largest mining companies; special conditions for taxation of enterprises that work under the terms of a production sharing agreement (PSA).

In this regard, the author proposes a significant reduction of taxes on mineral extraction in Bulgaria and their replacement with additional income tax (AIT). The purpose of introducing a tax on additional income is not to tax natural resources (hard coal, brown coal, lignite) at the time of their extraction, but the accumulated profit during the period of development of deposits, which is the difference between income and expenses for the entire period of development of the site. However, additional income tax (AIT) is a form of special tax on natural (resource) rent, which is widespread in the USA, Norway, Denmark, Saudi Arabia, the United Arab Emirates (UAE), Kuwait, Qatar, etc. Since all the mining, geological and geographical characteristics of the deposit are ultimately reflected in the income received during its development, this approach will ensure automatic differentiation of the tax burden depending on the specific conditions of extraction of natural resources, as well as changes in tax regimes for the use of subsoil depending on the type of deposit and stage of its development. Note that the changes in the tax regime for the mining sector are also aimed at minimizing the withdrawal of funds from mining enterprises during the exploration period and at the initial stage of production, however, at the peak of production, maximum payments to the State Budget of Bulgaria are envisaged. In the perspective of reforming the taxation system of mining enterprises in Bulgaria, it will allow the release of part of the income tax, will promote the activation of internal reproductive innovation and investment processes, the creation of additional reserves of labor employment in industry, the achievement of a balance of interests between the state and citizens, and in the end will ensure the growth of wages of employees and, therefore, a significant reduction in the differentiation of incomes of the country's population.

At the same time, to reduce the population economic inequality in the Baltic countries (Latvia and Lithuania), the author proposes the following. In order to stimulate domestic investments in these countries, the author considers it necessary to introduce more flexible monetary policy instruments, in particular, to ensure the discount rate at a level of at least 2%, which is typical for most EU countries, and simultaneously increase the yield of long-term bonds with fixed income . In the author's opinion, such actions will stimulate the development of the national debt capital market and the desire of domestic investors to invest free money in Baltic commercial banks even in the face of global uncertainty and geopolitical threats. The stability of the interest rate will also contribute to an increase in the discount rate of future cash flows from investing in other financial assets (real estate and land), an increase in the market value of shares of Latvian and Lithuanian companies, and a simultaneous increase in the yield of other securities (domestic government bonds, Eurobonds, municipal bonds, targeted bonds, general coverage loans), bills of exchange, bank certificates, warrants, bills of lading, credit

notes, options, futures, forwards, etc). In the future, this will contribute to reducing the dependence of the Latvian and Lithuanian economy on foreign capital, ensuring stability in the national financial market, and the interest of the population in receiving non-labor income (dividends, loan interest, annuity), which is the basis for reducing economic inequality in the countries of this region.

The conducted research is significantly different from the existing ones, because in modern science there are almost no publications dedicated to the quantitative assessment of the population economic inequality in the EU countries. Therefore, the key difference of the author's research is the formation and calculation of quantitative taxonomic coefficients of economic inequality, which can be given an economic interpretation. However, despite the difference in the analysis tools used, the research results obtained by the author are quite similar to the results of the scientific works of other authors. First of all, the obtained results largely coincide with the results of the analysis conducted by other Ukrainian scientists A. Stavytskyi and M. Kozub [21], who carried out a quantitative assessment of the degree of property inequality in the EU countries based on the construction of a dynamic stochastic model of general equilibrium (DSGE) In [21], these scientists found that the highest level of property inequality is characteristic of four countries of Central-Eastern Europe (Romania, Bulgaria, Lithuania and Latvia), which is explained by fluctuations in domestic and foreign investments and a violation of the overall macroeconomic balance. Instead, the lowest indicators of property inequality are characteristic of Slovenia, the Czech Republic, Finland and Slovakia, which, according to A. Stavytskyi and M. Kozub, is ensured by the implementation of effective budget, tax and social policies in these countries.

Also, the results of the author's research are similar to the results of the research conducted by Lithuanian scientists O. Rakauskienė and L. Volodzkienė [6]. These scientists proved that the highest degree of economic inequality among the EU countries is characteristic of Estonia, Spain and Latvia and explained this disproportion in the distribution of non-labor income (monopoly rent, land rent, rent) and financial assets (cash, securities (shares, bonds , bills of exchange, treasury bills, investment certificates, etc.) ineffective social and fiscal policy in the countries of this region. We should add that scientists O. Rakauskienė and L. Volodzkienė in their study [6] also took into account the influence of housing conditions on the dynamics of inequality in the level and the quality of life of the EU population; at the same time, in the study conducted by the author of this article, the influence of housing conditions on the degree of economic inequality of population has not been not taken into account.

At the same time, the author of this study assigned the Polish economy to a group (cluster) with an average level of economic inequality, which fully corresponds to the results of the analysis conducted by the famous Polish scientist M. Brzeziński [25], who used economic and mathematical methods to prove that Poland is a country with an average level of differentiation of labor and non-labor incomes, it managed to achieve rapid rates of economic growth with the help of effective market reforms, which ensured the country's successful convergence to the single European space and neutralized the negative impact of external economic shocks on the global resource and labor market.

On the other hand, the author of this article has determined the negative consequences of the COVID-19 pandemic for the population economic inequality in the EU countries. French economists A. Clark, C. D'Ambrosio and A. Lepinteur, who in [8] conducted an empirical analysis of the impact of the COVID-19 pandemic on the level and quality of life of the population of Spain, Italy, Germany, and France, also came to similar conclusions. The results of the analysis [8] clearly indicate that the national income in the specified countries decreased significantly in 2020, primarily among representatives of the "middle" class, since the national social security programs for the population were aimed, first of all, at protecting households with low incomes (pensioners, disabled, unemployed, large families, etc.), and not households with average incomes. It should be noted that scientists. Clark, C. D'Ambrosio and A. Lepinteur [8] also took into account the degree of absolute and relative inequality of the EU population; at the same time, in the study conducted by the author of this article, the influence of the specified indicators on the dynamics of population economic inequality has not been taken into account.

CONCLUSIONS

A taxonomic analysis of the degree of population economic inequality in the EU countries has been carried out using the taxonomy method in several stages: the formation of a list of indicators-features that characterize economic inequality, namely the Gini coefficient by income, the Gini coefficient by property, decile coefficient, quantile coefficient, Palma index; the formation of an input indicators matrix; division of indicators into stimulators and extremators-stimulators; determination of distance from objects (countries) and a "reference point"; calculation of taxonomic coefficients of population economic inequality. The calculated values of taxonomic coefficients indicate that during 2019-2021 the highest values of taxonomic coefficients and, accordingly, the highest degree of population economic inequality are characteristic of three post-socialist countries (Bulgaria, Latvia and Lithuania), which is largely due to the rapid capitalization of intangible assets and excessive concentration of financial capital in these countries as a result of their accession to the EU in 2004-2007. At the same time, the lowest values of taxonomic indicators among EU countries are characteristic of other post-socialist countries of Eastern Europe (Estonia, Slovakia, Slovenia, the Czech Republic), which is the result of the implementation of the "zero" taxation system and "dispersion" of financial capital through the purchase of shares by employees of corporations on preferential terms (the so-called "ESOP programs"). For the quantitative description of the obtained results, the Harrington factor-criterion scale has been used, which made it possible to divide the 27 countries of the European Union into three groups (clusters): the first group, which is characterized by a high degree of population economic inequality due to the rapid pace of carrying out structural reforms and reducing the role of the state in the economy, includes three countries (Bulgaria, Latvia, Lithuania); the second group, which is characterized by an average degree of economic inequality, includes 16 EU countries (Austria, Belgium, Greece, Spain,

Italy, Cyprus, Luxembourg, Germany, Poland, Portugal, Romania, Hungary, Croatia, Finland, France, Sweden); the third group, which is characterized by a low degree of economic inequality, includes 8 EU countries (Denmark, Estonia, Ireland, Malta, the Netherlands, Slovakia, Slovenia, the Czech Republic). The obtained results are of scientific and practical value for improving the economic policy of the countries of Northern and Eastern Europe and can be used in further theoretical studies of the problems of population economic inequality in Bulgaria, Latvia and Lithuania.

REFERENCES

[1] Official site of Global Wealth Report. (n.d.). Retrieved from https://worldwealthreport.com/.
[2] Official site of European Statistical Recovery Dashboard. (n.d.). Retrieved from https://ec.europa.eu/eurostat/data/database.
[3] Antonucci, L., & Corti, F. (2020). *Inequalities in the European semester*. Brussels: FEPS.
[4] Blanchet, T., Chancel, L., & Gethin, A. (2019). How unequal is Europe? Evidence from distributional national accounts (1980-2017). *Working Papers*, 6, 1-79.
[5] Kollurul, M., & Semenenko, T. (2021). Income inequalities in EU countries: Gini indicator analysis. *Economics*, 9(1), 125-142.
[6] Rakauskienė, O.G., & Volodzkienė, L. (2017). The inequality of material living conditions in EU countries. *Economics and Sociology*, 10(1), 265-278.
[7] Furceri, D., & Ostry, J. (2019). Robust determinants of income inequality. *Oxford Review of Economic Policy*, 35(3), 490-517.
[8] Clark, A., D'Ambrosio, C., & Lepinteur, A. (2021). The fall in income inequality during COVID-19 in four European countries. *The Journal of Economic Inequality*, 19, 489-507.
[9] Jones, C., & Kim, J. (2018). A Schumpeterian model of top income inequality. *Journal of Political Economy*, 126(5), 1785-1826.
[10] Kiss, L. (2020). Examination of agricultural income inequality in the European Union. *Business Ethics and Leadership*, 4(3), 36-45.
[11] Darvas, Z. (2021). *The unequal inequality impact of the COVID-19 pandemic*. Retrieved from https://www.bruegel.org/sites/default/files/wp-content/uploads/2021/03/WP-2021-06_30032021.pdf.
[12] Darvas, Z. (2019). Why is it hard to reach the EU's poverty target? *Social Indicators Research*, 141(3), 1081-1105.
[13] Soava, G., Mehedintu, A., & Sterpu, M. (2020). Relations between income inequalities, economic growth and poverty threshold: New evidences from EU countries panels. *Technological and Economic Development of Economy*, 26(2), 290-310.
[14] Cherkashyna, T. (2021). Clusterization of post-communist countries of the Central and Eastern Europe by income inequality level. *Galician Economic Journal*, 5(72), 41-52.
[15] Lockwood, E. (2021). The international political economy of global inequality. *Review of International Political Economy*, 28(2), 421-445.
[16] Palomino, J., Rodríguez, J., & Sebastián, R. (2020). Wage inequality and poverty effects of lock down and social distancing in Europe. *INET Oxford Working Paper*, 13, 1-51. doi: 10.1016/j.euroecorev.2020.103564.
[17] Picketty, T. (2020). *Capital and ideology*. Harvard: Belknap Press of Harvard University Press.
[18] Stilwell, F. (2019). *The political economy of inequality*. Oxford: Oxford Press.
[19] Savoia, F. (2020). Income inequality convergence across EU regions. Retrieved from https://www.econstor.eu/bitstream/10419/228479/1/LIS-WP-760-Nov-2020.pdf.
[20] Syahnur, S., Frohberg, K.K., Ryu, D., & Diantimala, Y. (2021). Enriching the socio-economic inequality model by using alternative indices. *Economics and Sociology*, 14(4), 47-72.
[21] Stavytskyi, A., & Kozub, M. (2019). Modeling of income inequality in the European Union countries. *Bulletin of Taras Shevchenko National University of Kyiv*, 4(205), 34-40.
[22] Markina, I., Kalinichenko, O., & Lesiuk, V. (2019). Economic inequality: World experience and feature in Ukraine. *Bulletin of Berdyansk University of Management and Business*, 2, 13-18.
[23] Medgyesi, M., & Tóth I.G. (2021). Income, wealth, employment, and beyond. In: *Europe's income, wealth, consumption, and inequality* (pp. 177-195). Oxford: Oxford University Press. doi: 10.1093/oso/9780197545706.003.0005.
[24] Kuhn, M., Schularick, M., & Steins, U. (2020). Income and wealth inequality in America, (1949-2016). *Journal of Political Economy*, 128(9), 3469-3519.
[25] Brzeziński, M. (2017) *Is high inequality an issue in Poland?* (2017). Retrieved from https://ibs.org.pl/app/uploads/2017/06/IBS_Policy_Paper_01_2017_en.pdf.

Тетяна Сергіївна Черкашина

Харківський національний економічний університет імені Семена Кузнеця
61166, просп. Науки, 9А, м. Харків, Україна

Таксономічний аналіз економічної нерівності населення в країнах Європейського Союзу

Анотація. Проблема економічної нерівності населення є актуальною для усіх країн світу, однак особливість економічної нерівності в країнах ЄС полягає у диференціації нетрудових доходів, отриманих від володіння власністю, а також нерівномірному розподілі житлової та комерційної нерухомості. Тому аналіз економічної нерівності населення в країнах ЄС є актуальним науково-практичним завданням. Метою даного дослідження було визначення ступеня економічної нерівності та оптимальної норми диференціації доходів населення в країнах ЄС, а також розробка на цій основі заходів щодо зниження ступеня майнової нерівності в країнах цього регіону. Для досягнення поставленої мети було використано метод таксономії, а також загальнонаукові методи (діалектику, аналіз, синтез, індукцію, дедукцію). Для кількісного опису отриманих результатів використано факторно-критеріальну шкалу Харрінгтона, яка дала змогу розподілити 27 країн ЄС на три групи (кластери): країни з високим ступенем економічної нерівності (Болгарія Латвія, Литва); країни з середнім ступенем економічної нерівності (Австрія, Бельгія, Греція, Іспанія, Італія, Кіпр, Люксембург, Німеччина, Польща, Португалія, Румунія, Угорщина, Хорватія, Фінляндія, Франція, Швеція); країни з низьким ступенем економічної нерівності (Данія, Естонія, Ірландія, Мальта, Нідерланди, Словаччина, Словенія, Чехія). Для зменшення економічної нерівності населення в країнах третьої групи запропоновано такі заходи: стимулювання внутрішніх і зовнішніх інвестицій; забезпечення високої дохідності фінансових активів на державному рівні; створення більш сприятливих умов для розвитку промисловості та підвищення оплати праці найманих працівників у цій галузі. Одержані результати становлять науково-практичну цінність для удосконалення економічної політики країн Північної та Східної Європи та можуть бути використані у подальших теоретичних дослідженнях проблем економічної нерівності населення в країнах даного регіону та для конкретизації прикладних заходів зменшення економічної нерівності в Болгарії, Латвії та Литві

Ключові слова: майнова нерівність, диференціація доходів, коефіцієнт Джині, коефіцієнт Палма, децільний коефіцієнт, метод таксономії