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POVERTY IN UKRAINE: EVOLUTION OF INTERPRETING AND ANALYSIS OF IMPACT FACTORS

Purpose. *The purpose of the article is to analyze the evolution of interpretation of the poverty as a category. In addition, among the aims of the article is analysis of the dynamics of the poverty level in Ukraine and Lviv region as well as determination of the most effective economic factors affecting the poverty level.*

Methodology / approach. *An analysis of the importance of the impact of annual growth of Ukraine's GDP, GDP per capita, unemployment rate, and other possible factors on poverty level was carried out using statistical tools, namely the Pearson's, Kendall's, Spearman's and Fechner's correlation coefficients. Research methodology is a systematic approach to the study of the phenomenon of poverty using general scientific methods, as well as statistical methods. The questionnaire method was used to interview residents of cities and villages of Lviv region; methods of correlative-regression analysis were used to assess the importance of individual factors on the poverty level in Ukraine. Authors built VAR-model for the optimal analysis of the poverty level in Ukraine and factors of its influence.*

Results. *After analyzing the value of the coefficient of determination, the authors concluded that the most significant factors of poverty in Ukraine are GDP per capita, PPP ($R^2 = 0.50$), unemployment rate ($R^2 = 0.42$), interest rates on loans ($R^2 = 0.21$), inequality of income distribution (Gini index) ($R^2 = 0.20$), taxes on income and profits ($R^2 = 0.15$). GDP annual growth rate accounts for more than 64% of changes in poverty level in the second period. The value of the inequality of income distribution measured by the Gini index in the dynamics of the poverty level increases from 3.9% in the second period to 5.2% in the 10th period. In addition, value of the interest rate on loans and NBU's account rate increase over time, accounting for approximately 10.0% and 2.4% of the variation in the level of poverty, respectively. Thus, level of interest rates is an important factor influencing the dynamics of poverty level in Ukraine.*

Originality / scientific novelty. *An analysis of the dynamics of the poverty level in Ukraine was conducted, including a survey of residents of towns and villages in the Lviv region. A direct relationship between the interest rate on loans and the level of poverty has been established. In addition, the direct relationship between the inequality of income distribution and poverty level was confirmed.*

Practical value / implications. *It is proposed to use the correlation coefficients of Pearson, Kendall, Spearman and Fechner to calculate the strength of connection between the poverty level and its economic factors. Authors suggest applying VAR-model for optimal analysis of the poverty level in Ukraine.*

Key words: *poverty, poverty level, income, expenditure, savings.*

Introduction and review of literature. *Restructuring of economic relations under conditions of production decline, inflation, change of ownership, military*

conflicts always leads to a sharp decrease in the living standard of the population, a decrease in its solvency, stratification of society by income level. The set of the above factors in combination with imperfect economic policy causes poverty, which is a very old social and economic problem that depends on such macroeconomic indicators as the volume of GDP, the unemployment level, the growth rate of inflation and real wages. Different theories, ideas and interpretations of this concept are presented in scientific views and works of philosophers, economists and sociologists. At the same time, all countries strive to reduce the scale of this social phenomenon and its negative impact on the socio-economic situation, as they realize that poverty limits the degree of satisfaction of individual needs and aggregate demand, production and trade volumes, and, ultimately, restrains economic growth. The so-called vicious circle of poverty may arise when the insufficient level of income causes a low level of savings and, as a result, a low level of investment and economic growth.

At the micro-household level, living in poverty can lead to feelings of powerlessness and inability to make decisions that affect daily life; problems of meeting basic daily needs, including providing decent housing, medical care; lack of opportunity to buy medicine; living without any savings in case of such crisis situations as unemployment or illness; not being able to participate in a normal social life and afford leisure and entertainment, such as going to the movies or the gym, visiting friends or buying birthday presents for family members, etc.

The topicality of the study is determined by the high poverty level of the population of Ukraine and the ineffective policy of overcoming it. Unfortunately, Ukraine remains one of the poorest countries in Europe. Currently, there is a difficult political situation here (in particular, due to the war unleashed by Russia), which is a determining factor affecting the poverty indicator. Although the problems of poverty and social inequality have been relevant to Ukraine for thirty years, modern crisis processes have only aggravated them. The need for taking immediate measures to overcome poverty is obvious. Under such conditions, the study of the evolution of the interpretation of this concept and the factors affecting the formation of the phenomenon of poverty have become particularly relevant.

Specific causes of poverty include: 1) natural and geographical factors (climate, excessive use of land and decrease in their fertility); 2) economic factors (macroeconomic instability, inflation, lack of jobs and high unemployment); 3) medical provision (limited access to quality medicine, spread of social diseases – AIDS, tuberculosis, alcoholism, etc.); 4) administrative and governmental problems (absence or imitation of democratic changes affecting the formation of social policy, weak legal framework for preventing or eliminating poverty, high level of political corruption); 5) social and demographic factors (overpopulation and lack of birth control, spread of crime, war, genocide or ethnocide) [1].

The UN defines four main manifestations of poverty: 1) short life expectancy; 2) low professional and educational training; 3) deprivation of the basic principles of a normal life – clean drinking water, medical services, quality food; 4) non-involvement in social processes [2]. Along with such general features, poverty in Ukraine is

accompanied by a number of specific features: low living standard of the population; psychological rejection of economic inequality; sudden unexpected poverty (as a result of the war unleashed by Russia and hostilities in Ukraine); so-called generational poverty (people who have been in a state of poverty for a long time lose faith in themselves and conditionally program poverty for future generations); increase in the number of people, who consider themselves poor (this is about subjective poverty). The last feature is related to the concept of “relative poverty”, which is determined by comparing it with the generally accepted standard of living, which is considered to be “normal” in this society [2]. Relative poverty is especially evident in times of crisis. Poverty is associated not only with a lack of resources, but also with the so-called social shame, aggravation of awareness of one’s own poverty, which, in turn, gives rise to a subjective perception of the picture of poverty, a discrepancy in its assessments [3].

Ambiguous interpretation of poverty as a socio-economic phenomenon can be traced in the works of philosophers and economists of different historical eras and directions. So, for instance, the ancient Greek philosopher Aristotle believed that there should be three social classes in the state – the very rich, the very poor and the middle class, which should collectively own most of the property. But the state must support the poor, because poverty gives rise to riots and crimes. The philosopher was sure that the state, where the poor numerically predominate, is doomed to disappear [4]. Zh.-Zh. Rousseau considered the lack of morality to be the basis of poverty. Another philosopher I. Kant strongly believed that there will always be poor, disabled, and sick people in society, whose maintenance requires state funds. These ideas by I. Kant are still widely practiced today by socially oriented states [5].

In classical political economy, the phenomena of poverty and wealth were considered by A. Smith, D. Ricardo, J. S. Mill, and T. Malthus. Considering the existence of contradictions between equality-inequality and justice-injustice A. Smith proved that income inequality is an objective process caused by the market organization of life, and the amount of wages or profits of each person depends on the nature of the activity of the latter [6]. At the same time, the probability of success in a certain profession allowed A. Smith to claim that the amount of income/profit of an individual or entrepreneur depends on the risk and correctness of the chosen field of activity. To be specific, he emphasized talent, abilities, a certain luck, fortune. However, socio-economic inequality, which is determined by the individual qualities of a person, working conditions, the sphere of his or her activity, is an objective phenomenon of a market society. Then appears another inequality, which is formed due to the intervention of the state in economic activity and according to A. Smith, it is really an economic problem. Therefore, the state can provoke inequality if: 1) it limits competition in some industries with a smaller number of employees; 2) directly strengthens (supports) competition in other industries; 3) limits the transfer of capital and labour from one industry to another. Overall, this leads to economic inequality and the growth of poverty. Therefore, A. Smith reduces the role of the state only to the performance of socially important functions of protecting the population, the judiciary and the organising of public works [6].

D. Ricardo emphasizes that poverty is connected with the mental trait of the people namely, laziness. In order for the latter to become happier and richer, incentives to work are needed [7]. Countries must accumulate much greater amounts of capital until the reduced rate of production makes the growth of capital less rapid than the growth of population. Accordingly, the function of forming of solvent demand involves coordinating of such demand with the production of consumer goods and the number of the population [7].

J. Mill believes that there are areas of “market weakness” in the market economy. According to the scientist, it is necessary to form such an order in which “no one is poor, no one seeks to become richer and there is no reason to fear being rejected due to the efforts of others to push forward” [8, p. 42]. The function of smoothing out market deficiencies should be performed by the state creating social infrastructure, developing science, not prohibiting the activities of trade unions, etc. [8].

T. Malthus claims that the cause of poverty is the higher rate of population growth compared to the growth of resources. The poor population is growing especially fast, and the state only contributes to this process through the aid system [9].

The English economist J. Keynes argues that poverty can be overcome by reorganizing society. In addition, according to the scientist, non-interference of the state based on the concept of laissez-faire does not ensure full employment, sufficient equality of income and wealth. Therefore, the expansion of state functions and the strengthening of state control over savings and investments (by introducing low rates of profit and implementing a program of public works) is a way to achieve “social justice and stability”. “Keynesian” economic policy is strongly criticized as the one causing inflation and strengthening bureaucracy. However, Keynes proved the need for government intervention and justified ways to increase aggregate demand, which became the basis of the post-war policy of many countries [10].

D. North, winner of the Nobel Prize in Economics, believes that the success of a country depends not on its available resources or even on the rate of economic growth, but on the dominant social order. In countries where the social order with limited access prevails, the rules of the game are such that people do not have full access to the opportunities of participating in various organizations and associations. In such a society, personal relationships especially those between powerful individuals (who, whose and from where), form the basis of social relations and fundamentally affect both the rules of the game and people’s access to opportunities. Accordingly, people in power seek to maintain their monopoly on access to opportunities and limit the access of ordinary (strangers, not their own) persons to political, economic, social and other activities. In order to maintain its status, the top management periodically tries to redeem itself from the people by a certain redistribution of benefits or the widespread introduction of subsidies (redeems peace for a share of the power rent), thus cultivating paternalism and populism in broad layers of the population. A society with limited access is not oriented towards the creation of new value, but towards the appropriation of existing one, search for rent, external loans, extraction of resources, restriction of competition, paternalism. In the end, all this does not increase, but decreases social

well-being. In countries dominated by a restricted social order, personal relationships, wealth, and privilege prevail over rights and rules. This is not some kind of anomaly: such countries are not “sick” of corruption, unfair court, poor state administration, poverty and violation of human rights – rather, this is their “natural state”.

The world has been in a state of closed access until the beginning of the 19th century, when an open access social order was formed. The national state was the essential precondition for this transition. In addition, the social order with an open access is characterized by the absence of restrictions on the pursuit of economic, political, religious and educational activities; support of organizational forms in any type of activity; the rule of law accessible to all citizens. Under such circumstances, personal relationships are also important, but citizens no longer need to focus only on them in public life. In both social systems – with limited access and open one – there are public and private organizations, but in the first case the state limits people’s access to them (it is open only to the “elite”), while in the second case it doesn’t, so there is a greater public trust in institutions, in particular state ones, and in those who represent them [11].

Understanding poverty as an integral part of the market system and evaluating it as the good for the entire society has led to the emergence of population groups for which poverty becomes a way of life, their “inclusion” into the culture of poverty. The scientists distinguish four main blocks of features of the “culture of poverty”: 1) low participation level and critical attitude towards social institutions – state structures, political parties, religion, marriage; 2) minimum level of organization outside the family; 3) relationships of the sexes different from the generally accepted ones – lack of childhood, early sexual contacts, free marriages, high frequency of abortions, etc.; 4) predominance of such attitudes as helplessness, dependence, humiliating position, low motivation for work; orientation to today, inability to plan [12].

Modern foreign researchers do not ignore the problem of poverty. This is confirmed by their scientific investigations concerning the history of poverty in modern rich countries [13], and various interpretations of poverty as an economic category that has political, social, legal, and cultural aspects [14]. They also focus on subjective poverty and generally revise the concept of subjective poverty measurement and assess trends in the level of subjective poverty by income in the European Union [15].

In scientific studies, there is a significant number of classifications of types of poverty. Following the generally accepted world practice, “absolute” and “relative poverty” are distinguished. Absolute poverty is the inability of a person to provide for his/her basic life needs. The relative level of poverty characterizes the population that receives less income than the average standard of well-being of life in a particular country [16].

It is accepted to distinguish Monetary and Multidimensional indicators of the level of poverty. The first (monetary poverty) is based on determining the level of poverty due to the sufficiency / insufficiency of funds for living. Multidimensional poverty is a complex indicator that characterizes the share of households in the country that are deprived of a sufficient amount of money, the opportunity to receive education and

basic infrastructure services [17; 18].

Instead, A. Luczak and S. Kalinowski distinguish the following poverty statuses: “persistent conspicuous poverty (above-average levels of the material deprivation and poverty); poverty without serious material deprivation (above-average level of the poverty); material deprivation without severe poverty (above-average level of the material deprivation); no severe poverty (below-average levels of the material deprivation and poverty)” [19]. According to the results of the scientists’ research, such poverty statuses as poverty without serious material deprivation and material deprivation without severe poverty were not explicitly identified among the analyzed EU countries. The authors identified such poverty statuses in the EU as persistent conspicuous poverty, transient unnoticed poverty, no severe poverty.

In Ukraine, the definition of the poverty concept at the legislative level is reflected in the Decree of the President of Ukraine “On the Strategy for Overcoming Poverty” and is interpreted “... as the impossibility due to a lack of funds to maintain a lifestyle inherent in a specific society in a specific period of time” [20].

To determine the level of poverty in Ukraine, the Methodology of Comprehensive Assessment of Poverty is used, which consists of a number of steps, in particular, the determination and calculation of indicators regarding the scale of poverty in the country; calculation of indicators to determine stratification among the poor population; calculation of poverty indicators in the regions. According to this method, the poverty level is defined as the specific weight of families (households) in which the level of consumption (income) per person is lower than the defined poverty line [21].

In the EU, poverty is treated as “individuals or families whose resources are so small as to exclude them from the minimum acceptable way of life of the member state in which they live” [22; 23]. In general, in the EU, people living in households, whose income is less than 60% of the current average national income of each country are considered poor [24].

It should be noted that in recent years, poverty has become one of the problematic phenomena in Europe, especially this problem has worsened after the COVID-19 pandemic and related quarantine restrictions. Even countries that have traditionally had low levels of poverty (such as the Netherlands and Sweden) have recently seen an increase in this indicator. There is also a trend of increasing poverty among the following categories of the population: young people, single parents and families with single children suffer from a greater disadvantage. The main reasons for the increase in poverty in the EU are the loss of work and a decrease in income [25].

Today, we can observe a significant deepening of the problem of poverty due to the war unleashed by Russia in Ukraine. According to UNICEF research, the causes of poverty among low-income people are the reduction of public expenditures aimed at social benefits, the growth of tax payments and the promotion of austerity measures. As for the Ukrainian population, a significant part of Ukrainian citizens (mostly women and children) were forced to leave their homes and become refugees. A significant part of these immigrants lives on social benefits, which are quite low compared to the cost of living in European countries [26].

Undoubtedly, the war also affected the economic situation of citizens in Ukraine. According to preliminary UN estimates, up to 90% of Ukrainian citizens may face poverty, and data from the International Labor Organization indicate the loss of 4.8 million jobs in Ukraine compared to the pre-war period [27].

Scientists also emphasize the global nature of poverty, which is a socio-cultural phenomenon. Moreover, its level can be a factor that forms the rating and, accordingly, influences the choice of the country to which they arrive as immigrants [28]. Accordingly, the variability of poverty is an important problem. Its variations, which can potentially arise due to the country's vulnerability to various shocks and cause greater macroeconomic instability, including the instability of economic growth, are also the subject of scientific focus [29].

Over the past 25 years, there has been a dramatic reduction in global poverty, although rural poverty remains higher than urban poverty. Therefore, modern scientists consider the impact of this slowdown on the poor population, especially the poor in rural areas [30; 31].

Some authors based on statistical data for a 21-year period from 150 countries of the world establish a relationship between economic freedom and the level of poverty and claim – the higher the economic freedom, the lower the level of poverty [32]; others examine the extent to which country-level poverty (contextual poverty) influences the relationship between an individual's educational level, family income, and the use of political violence [33]; still others look at the links between inequality and rising poverty. The latter, using data from 158 countries for the period from 1960 to 2010, believe that a reduction in the poverty level by population is associated with a further increase in GDP per capita from 0.5 to 1.2% per year [34]. Some economists link growth in average income and changes in relative income distribution to reductions in absolute poverty and examine the role of income inequality in poverty reduction [35]; examine the interaction between exchange rate pressures (ERPs) and fiscal redistribution in the impact on poverty in developing countries [36].

The link between education, income and poverty alleviation is also undeniable. At least this was confirmed by econometric data for 1990–2016 [37].

Modern economists use various methods of forecasting the poverty applying World Development Indicators and Google Earth Engine. “A simple approach that scales the last observed welfare distribution by a fraction of real GDP per capita growth performs nearly as well as models using statistical learning on 1,000+ variables” [38]. In particular, a statistical modeling method based on consumer surveys is used to measure poverty levels over time in low-income countries [39]. They also propose to analyze poverty at the EU level using a set of relevant socio-economic indicators (relative poverty level, income inequality index, relative average deficit, GINI coefficient, AROPE indicator, working poverty rate) and data from national statistical institutes. Recent studies are important in light of the 2030 Agenda for Sustainable Development, which proposes the fight against poverty as its main goal [40]. There are scientists who analyze the level of poverty through taxation systems, in particular, the relationship between taxation rates and the level of poverty is presented in the work of

N. Li [41].

Scientists from Electronic commerce research propose to take into account not only such traditional sources of information as statistical data and sociological surveys, but also use data from social networks, information about calls and electronic commerce to determine the level of poverty [42].

Researchers T. Hellwig and D. M. Marinova suggest moving away from the usual assessment of the poverty level. Having analyzed the public opinion of more than 27 countries, they consider it expedient to analyze not only the macroeconomic indicators of national economies, but also to take into account geographical, political and social factors when determining the level of poverty in countries [43].

S. Kim and M. Shahandashti consider it appropriate to examine the phenomenon of poverty through the lens of other fields. In particular, in their work [44], they justify the dependence of the poverty level on the development of the construction sector.

Conclusions about the influence of the complexity of the economy on raising the level of poverty in developing countries are important. These findings have important policy implications for countries seeking ways and means to recover from the current COVID-19 crisis and prepare for future crises [45]. Some authors question the “official” estimates of global cash poverty before and during the COVID-19 pandemic and argue that there is over-optimism in the measurement of global poverty [46].

Using data from 166 countries, home to 97.5% of the world’s population, the authors model global poverty scenarios from 2019 to 2030 under various growth and inequality assumptions. If within-country inequality remains unchanged and GDP per capita grows in line with World Bank projections and historically observed growth rates, the number of extreme poor (those living on less than USD 1.90 per day) will remain above 600 million in 2030, as a result, the global level of extreme poverty will be 7.4%. If the Gini index in each country declines by 1% per year, the global poverty rate could drop to about 6.3% in 2030 [47].

M. Khomiak [48], H. Verbytska [49], E. Libanova et al. [50], R. Pidlypna [51], and others are among Ukrainian modern scientists who research methodical approaches to defining poverty as well as the peculiarities of the manifestation of this phenomenon in Ukraine and its consequences. However, despite a significant number of scientific developments, certain aspects of this problem require further study and development. For example, it is noteworthy that there is a lack of surveys regarding the analysis of poverty level in certain regions of Ukraine.

In addition, it is necessary to analyze the connection between the poverty level and its economic factors, including inequality of income distribution, NBU’s account rate, interest rate on loans, official exchange rate of Ukrainian hryvnia etc. It would be also relevant to analyze the strength of connection between the mentioned variables using various correlation coefficients and build VAR-model, which would be very useful to forecast the poverty level in Ukraine.

The hypothesis of our research is a reverse relationship between the poverty level in Ukraine and GDP growth rate, GDP per capita and ease of doing business. On the other hand, we expect to find out the direct connection between the poverty level and

Gini index, NBU's account rate, interest rate on loans, official exchange rate USD/UAH.

The purpose of the article. The purpose of the study is to analyze the evolution of interpretation of the poverty as a category. In addition, among the aims of the article are analysis the dynamics of the poverty level in Ukraine and Lviv region as well as identification of the most effective economic factors affecting the poverty level.

Methodology. One of the most important goals of the article is to analyze the poverty level in Lviv region and in Ukraine in general. In order to analyze the level of poverty in Lviv region, the authors conducted a survey among the residents of the cities and villages of the region. To ensure representativeness, the data of the Main Department of Statistics in Lviv region regarding the structure of the population up to 2020 by age, gender and place of residence were used [52]. In total, 500 people were interviewed, and the structure of the sample corresponds to the structure of the population of Lviv region according to the three criteria indicated below (see Table 1).

Table 1

Population structure of Lviv region as of 2020, %

Groups by age	Urban and rural areas			Urban area			Rural area		
	Both sexes	Men	Women	Both sexes	Men	Women	Both sexes	Men	Women
Up to 20 years	21	11	10	12	6	6	9	4	4
20–29	13	7	6	8	4	4	5	3	3
30–39	17	9	8	11	5	5	6	3	3
40–49	14	7	7	9	4	4	5	3	3
50–59	14	6	7	8	4	5	5	3	3
60–69	12	5	7	7	3	4	4	2	2
More than 70	10	3	7	6	2	4	4	1	3
Total	100	47	53	61	28	32	39	19	20

Source: calculated by the authors based on [52].

The level of poverty directly depends on the level of income of citizens, their consumer expenditures and savings. The poverty level can also reflect the level of savings, since richer families save more of their income. To determine the level of population savings, the question in the questionnaire was formulated in the following way: “What percentage of your personal income do you save per month?” with the following answer options: “less than 1%/I do not save at all”, “1–5%”, “5–10%”, “10–15%”, “15–20%” and “greater than 20%”.

In addition to questionnaires, such indicators as the poverty level with expenses below the actual subsistence minimum, as well as the level of poverty with expenses below USD 5.5 per day were used to assess the dynamics of the poverty level.

Pearson's, Kendall's, Spearman's and Fechner's correlation coefficients were used to determine the most important factors affecting the poverty level in Ukraine.

Pearson's and Fechner's correlation coefficients are most often used to characterize the relationship between quantitative traits. The Pearson's correlation coefficient is calculated to measure the degree of linear correlation between

quantitative scalar features¹. This coefficient is calculated according to the formula [53]:

$$r = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2} \sqrt{\sum_{i=1}^n (y_i - \bar{y})^2}} \quad (1)$$

Table 2

Advantages and disadvantages of different correlation coefficients

Correlation coefficients	Advantages	Disadvantages
Pearson's	<ul style="list-style-type: none"> - is one of the most often used to characterize the relationship between quantitative traits; - it is easy to be calculated; - the Pearson's correlation coefficient is often regarded as a universal measure of correlation 	<ul style="list-style-type: none"> - it shows the strength of only the linear relationship between the variables; - the use of the Pearson's coefficient as a measure of association is justified only, if the joint distribution of a pair of features is normal
Kendall's	<ul style="list-style-type: none"> - it can be used in the case of small number of observations; - a better level of knowledge of its statistical properties, in particular its sample distribution; - the possibility of its application to determine partial correlation; - greater convenience of calculation, when adding new data; - Kendall's coefficient gives a more careful and, apparently, more objective assessment of the degree of connection between two features, than Spearman's coefficient 	<ul style="list-style-type: none"> - calculating the Kendall coefficient is more laborious; - it is quite rarely and limitedly used in the study of socio-economic processes and phenomena
Spearman's	<ul style="list-style-type: none"> - it can be used in the case of a small number of observations; - it can be used in a case of a non-linear relationship or the sample data are not normally distributed 	<ul style="list-style-type: none"> - it is quite rarely and limitedly used in the study of socio-economic processes and phenomena; - its values are almost always higher, than Kendall's coefficient, but is perhaps less realistic
Fechner's	<ul style="list-style-type: none"> - it can be easily calculated, since only the number of matches or mismatches of signs of deviations from the average values are needed to compute the coefficient; - in certain cases, when information about the coincidence and non-coincidence of the signs of deviations is also needed for other purposes, it may be more convenient than the Pearson's' criterion 	<ul style="list-style-type: none"> - it shows the presence of a linear relationship; - indicator losses some useful information due to reducing the primary quantitative scale to a nominal one

Source: formed by the authors based on [53].

¹ It was proposed by K. Pearson in 1896. Often, referring to K. Pearson's mentioning of the ideas of the mathematical representation of the bond expressed in 1846 by the famous French physicist and crystallographer Auguste Bravet, this indicator is called the Bravais-Pearson's coefficient.

The use of the Pearson's coefficient as a measure of association is justified only if the joint distribution of a pair of features is normal. Therefore, it is necessary to check the fulfillment of this hypothesis before calculating it. If it is true, then the square of the Pearson's correlation coefficient is equal to the coefficient of determination.

The Fechner's correlation coefficient² is calculated using the formula:

$$r_F = \frac{C-H}{C+H} = \frac{2C-n}{n} = \frac{2C}{n} - 1, \quad (2)$$

where C is the number of coincidences of signs of deviations from the corresponding averages; H is the number of characters that do not match [53].

Spearman's rank correlation³ coefficient is used as a measure of statistical dependence between variables, the value of which is calculated according to the formula:

$$r_s = 1 - \frac{6(S_p + B_x + B_y)}{n^3 - n}, \quad (3)$$

where B_x, B_y are corrections for combining ranks in the corresponding rows, which are calculated according to the formula:

$$B_i = \frac{1}{12} \sum_{i=1}^m n_i (n_i^2 - 1), \quad (4)$$

where m – the number of combined rank groups in the sample;

n_i – the number of ranks in the i -th group [53].

As in the previous case, the number of inversions depends on the size of the sample and is inconvenient to be used as a correlation indicator. For this purpose, the Kendall rank correlation coefficient (rank correlation coefficient, rank correlation coefficient) is used. It was proposed by the British statistician Maurice Kendall in 1938. It is calculated according to the formula:

$$\tau_b = \frac{\sum_{i < j} (\text{sgn}(x_i - x_j) (\text{sgn}(y_i - y_j)))}{\sqrt{(T_0 - T_1)(T_0 - T_2)}}, \quad (5)$$

² This indicator was proposed by the German psychologist Gustav Fechner in 1860. The values of the Fechner's coefficient can vary from -1 to $+1$. Like the Pearson's coefficient, it shows the presence of a linear relationship: the closer the value of the coefficient is to unity in magnitude, the stronger is the relationship. Small values of the absolute value of the coefficient indicate the absence of a linear relationship, but this is not enough to assert the absence of any relationship at all. Using only the number of matches or mismatches of signs of deviations from the average values to calculate the coefficient can be considered as reducing the primary quantitative scale to a nominal one, which should lead to the loss of some useful information. Therefore, this criterion is used quite rarely, but in certain cases, when information about the coincidence and non-coincidence of the signs of deviations is also needed for other purposes, it may be more convenient than the Pearson's criterion.

³ This coefficient was developed and proposed for correlational analysis in 1904 by Charles Edward Spearman, an English psychologist and professor at the University of London and Chesterfield. The values of the coefficient can vary from -1 to $+1$, with -1 corresponding to the complete opposite of the sequences of ranks, and $+1$ to their complete coincidence. Spearman's rank correlation coefficient can be used as an indicator of uncorrelatedness of samples. This measure also evaluates how well the relationship between two variables can be described by a monotonic function.

where $T_0 = n(n - 1)/2$; $T_1 = \sum_k t_k(t_k - 1)/2$; $T_2 = \sum_l u_l(u_l - 1)/2$;

t_k – the number of relations of magnitudes in the k -th group of relations of the first magnitude;

u_l – relations of magnitudes in the j -th group of relations of the second magnitude;

n - number of observations; and

$$sgn(z) = \begin{cases} 1 & \text{if } z > 0 \\ 0 & \text{if } z = 0 \\ -1 & \text{if } z < 0 \end{cases}$$

Kendall's rank correlation⁴ coefficient is designed to determine the strength of correlation between two data series under the same conditions as Spearman's rank correlation coefficient [53].

Results and discussion. In order to conduct an optimal objective analysis of poverty level in Ukraine and the factors influencing it, a VAR model should be created. To do this, we took annual data from 2002 to 2021 for the following variables:

PR – the level of poverty based on expenses below the actual subsistence minimum, %;

GDP GR – GDP annual growth, %;

GDP PC – GDP per capita, current USD;

GDP PC 17 – GDP per capita, PPP (constant 2017 international USD);

GINI – the value of the Gini coefficient, which characterizes the inequality of income distribution;

LIR – interest rates on new loans, %;

ER – official exchange rate, USD/UAH;

AR – official account rate, at the end of period;

UR – unemployment rate, %;

Most of data applied in the article are presented in Table 3, which was formed using the database of the World Bank and the State Statistics Service of Ukraine.

Table 3

Data used in analysis

Year	PR	Gini index (World Bank estimate)	GDP growth	GDP per capita, PPP (constant 2017 international USD)	GDP per capita (current, USD)	Unemployment, total (% of total labor force) (modeled ILO estimate)	Account rate	Lending interest rate, %	Official exchange rate (LCU per USD, period average)
2002	65.9	29	5.2	8468	879	10.1	7.0	25.3	5.3
2003	59.9	29	9.5	9349	1048	9.1	7.0	17.9	5.3
2004	48.8	29	12.1	10561	1366	8.6	9.0	17.4	5.3

⁴ The calculation of the Kendall's coefficient is more time-consuming, but on the other hand, it has a number of advantages compared to the Spearman's coefficient. The main ones are the following: – a better level of study of its statistical properties, in particular, its sample distribution; – the possibility of its application to determine partial correlation; – greater convenience of calculation when adding new data.

Continuation of Table 3

2005	38.7	29	3.0	10958	1827	7.2	9.5	16.2	5.1
2006	36.1	30	7.4	11853	2301	6.8	8.5	15.2	5.1
2007	30.5	27	7.6	12829	3066	6.4	8.0	13.9	5.1
2008	19.9	27	2.3	13196	3887	6.4	12.0	17.5	5.3
2009	24.8	25	-14.8	11298	2543	8.8	10.3	20.9	7.8
2010	23.5	25	3.8	11778	2965	8.1	7.8	15.9	7.9
2011	25.8	25	5.5	12467	3570	7.9	7.8	15.9	8.0
2012	24.0	25	0.2	12527	3855	7.5	7.5	18.4	8.0
2013	22.4	25	0.0	12553	4030	7.2	6.5	16.6	8.0
2014	28.6	24	-6.6	12409	3105	9.3	14.0	17.7	11.9
2015	58.3	26	-9.8	11216	2125	9.1	22.0	21.8	21.8
2016	58.6	25	2.4	11536	2188	9.4	14.0	19.2	25.6
2017	47.3	26	2.4	11861	2638	9.5	14.5	16.4	26.6
2018	43.2	26	3.5	12337	3097	8.8	18.0	19.0	27.2
2019	38.5	27	3.2	12805	3661	8.2	13.5	19.8	25.8
2020	43.6	26	-3.8	12408	3752	9.5	6.0	14.3	27.0
2021	39.1	25	3.4	12944	4836	9.8	9.0	13.3	27.3

Source: formed by authors based on [54; 55].

First of all, it is necessary to check the data for stationarity, since the VAR model can be built only for stationary data (Table 4).

Table 4

Results of testing the data group for stationarity by the Dickey-Fuller test

Null Hypothesis: Unit root: individual unit root process				
Series: PR, GDP GR, GDP PC 2017, GDP PC, GINI, LIR, ER, AR, UR				
Sample: 2002–2021				
Exogenous variables: Individual effects				
Automatic selection of maximum lags				
Cross-sections included: 9				
Method		Statistic		Prob.
Im, Pesaran and Shin W-stat		-1.84242		0.00327
Intermediate ADF test results				
Series	Prob.	Lag	Max lag	Obs
PR	0.1987	0	4	19
GDP GR	0.0411	0	4	19
GDP PC	0.5727	0	4	19
GDP PC 2017	0.0324	1	4	19
GINI	0.5109	0	4	19
LIR	0.2691	3	4	19
ER	0.8148	1	4	19
AR	0.1623	0	4	19
UR	0.2277	0	4	19

Source: calculated by the authors.

As we can see from Table 4, the data for all-time series are non-stationary, since the p-value is greater than 10%, and therefore we accept the null hypothesis of the existence of a unit root. Taking into consideration the non-stationarity of the time series variables in their levels, it is necessary to transform them into first differences and

perform a stationarity check again using the Dickey-Fuller test (Table 5).

The results of the test are shown in Table 5. Note that the first differences in percent of the time series described above were checked for stationarity. As we can see from the test results, the series of first percent differences are stationary as the probabilities for all variables in the model approach zero. After bringing the data to a stationary form, we can proceed to build the model, but first we need to determine the maximum length of the lags.

Table 5

Results of testing the data group for stationarity by the Dickey-Fuller test

Null Hypothesis: Unit root: individual unit root process				
Series: PR, GDP GR, GDP PC 2017, GDP PC, GINI, LIR, ER, AR, UR				
Sample: 2002–2021				
Exogenous variables: Individual effects				
Automatic selection of maximum lags				
Cross-sections included: 9				
Method			Statistic	Prob.
Im, Pesaran and Shin W-stat			-7.49025	0.0000
Intermediate ADF test results				
Series	Prob.	Lag	Max lag	Obs
PR	0.0311	0	3	18
GDP GROWTH	0.0048	0	3	18
GDP PC	0.0843	0	3	18
GDP PC 2017	0.0217	1	3	18
GINI	0.0022	0	3	18
LIR	0.0008	3	3	18
ER	0.0860	1	3	18
AR	0.0039	0	3	18
UR	0.0038	0	3	18

Source: calculated by the authors.

At the first stage, we will apply the test for the maximum length of lags (Lag Length Criteria). We set the maximum lag to 2, which corresponds to two years in the conditions of the data under consideration. The optimal lag length in this test is determined simultaneously by five common information criteria. The results of the test are shown in Table 6.

Table 6

The results of the test for the maximum lag length of the VAR model

VAR Lag Order Selection Criteria						
Endogenous variables: GDP GR, GDP PC 2017, GDP PC, GINI, LIR, ER, AR, UR						
Exogenous variables: C						
Sample: 2002–2021						
Lag	LogL	LR	FPE	AIC	SC	HQC
0	-335.2690	NA	7.26E+08	40.26694	40.6100	40.3010
1	-238.5333	102.4260*	4635069*	34.6509*	37.3956*	34.9258*
2	-227.1501	46.2653	1.25E+10	35.2060	38.1887	35.3418

Note. *The choice of lag length according to the criterion is indicated.

Source: calculated by the authors.

As it is evident from the results of the calculations (Table 6), according to all information criteria, in particular, the ratio of the logarithms of the Likelihood Functions (LR), the Final Prediction Error (FPE), the Schwartz's criterion (SC), the Akaike's Information Criterion (AIC), and the Hann–Quinn's Criterion (HQC), 1 lag is recommended.

As it has already been mentioned, in order to determine the level of savings of the population in Lviv region, a question was formulated in the questionnaire about the percentage of income that respondents save during the month with possible options: “less than 1%/I do not save at all”, “1–5%”, “5–10%”, “10–15%”, “15–20%” and “greater than 20%”.

It is convenient to analyze the distribution of respondents' answers using the histogram shown in Figure 1.

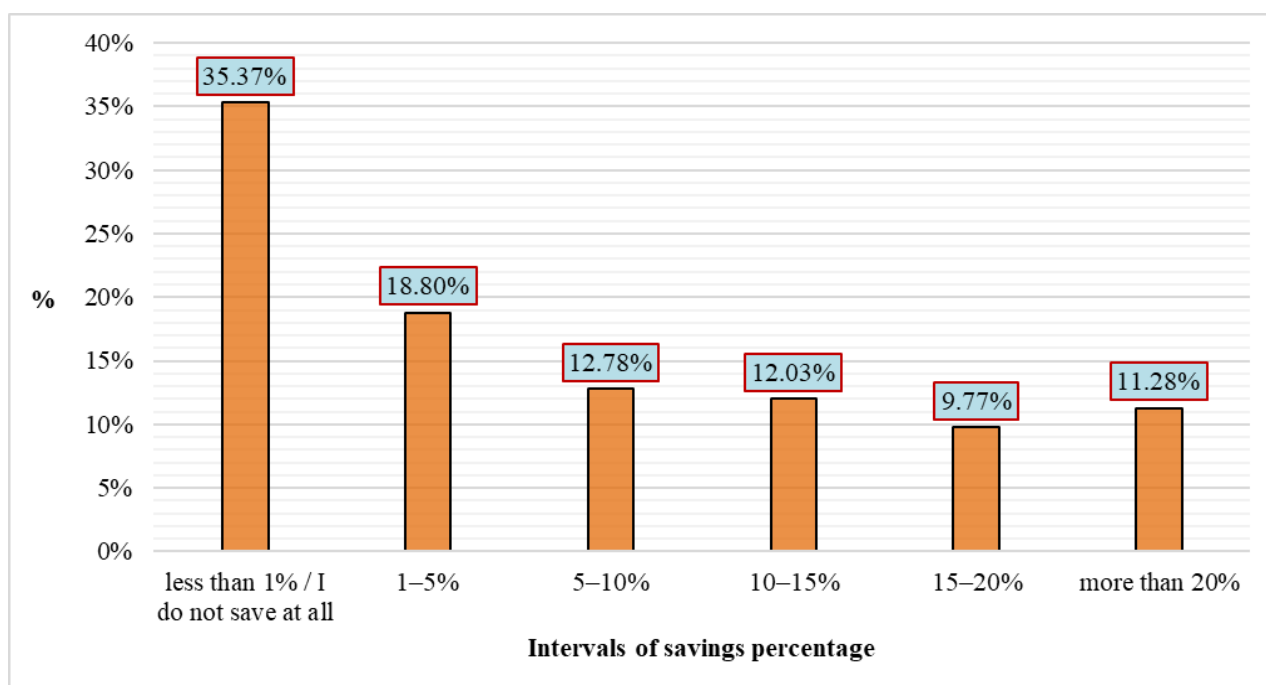


Figure 1. Distribution of responses of respondents in Lviv region regarding the level of personal savings per month

Source: calculated by the authors.

According to the results of the answers to the mentioned question, more than a third of the population of Lviv region saves less than 1% of their income or they do not manage to save at all. In addition, 66.95% or more than two-thirds of respondents save less than 10% of their personal income. According to the results of the distribution of responses among urban and rural residents of Lviv region, 69.2% of rural residents and 65.9% of urban residents save less than 10% of their personal income, which may indicate a higher standard of living in cities (Figure 2).

At the same time, the level of savings depends significantly on the disposable income, and, therefore, such a high share of the population saving less than 10% of personal income indicates the low standard of living of the population in Lviv region.

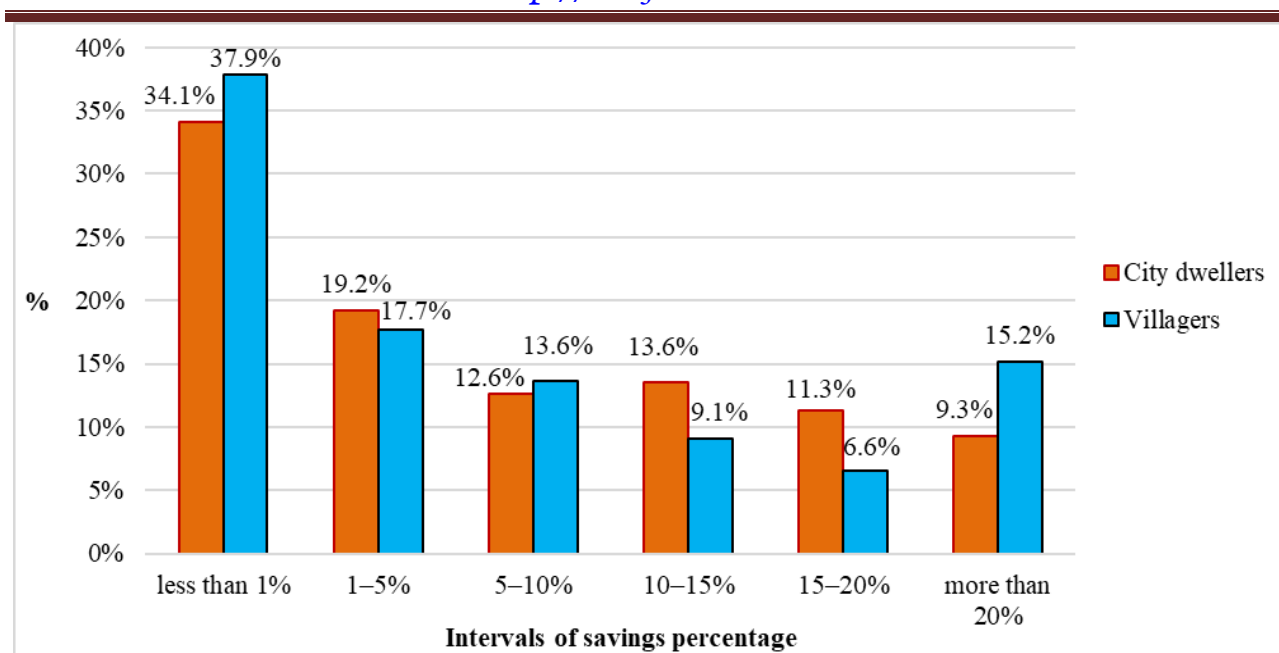


Figure 2. Distribution of responses among urban and rural respondents in Lviv region regarding the level of personal savings per month

Source: calculated by the authors.

According to the poverty level by expenses below the actual Subsistence Minimum (SM)⁵, the poverty rate declined sharply from 65.9% in 2002 to a low of 19.9% in 2008 (Figure 3). With the beginning of the 2008–2009 Global Financial Crisis, the poverty rate rose to 24.8% in 2009, remaining relatively stable until 2013. In 2014–2015, there was a significant devaluation of the national monetary unit, an increase in the rate of inflation, as well as a drop in the GDP level of Ukraine caused by the Revolution of Dignity and the subsequent war in Donbas. Therefore, the poverty rate increased to 58.3% and 58.6% in 2015 and 2016, respectively. Since 2016, the level of Ukraine’s GDP has been growing, which caused the poverty rate to decrease to 38.5% in 2019. The pandemic of COVID-19 and further lockdown caused increase in poverty level to 43.6% in 2020.

A similar dynamic is demonstrated by the indicator of the poverty headcount ratio at 6.85 USD a day, falling from 61.9% in 2002 to 16.7% in 2008. During the period of the financial and economic crisis, the indicator increased to 19.9% in 2009, and its repeated growth occurred during the period of the crisis of 2014–2015, when the poverty level increased from 9.0% in 2015 to 15.0% in 2016. In the future, a gradual decrease in the level of poverty is observed against the background of economic growth in 2016–2019. Unfortunately, the level of poverty in Ukraine remains high, and the rate of economic growth of the country does not allow rapid growth of per capita income. According to the report of the State Statistics Committee “Self-assessment by households of Ukraine of their income level (based on sample survey materials)”, the share of households that classify themselves as poor has increased from 65.3% in 2019 to 67.1% in 2020.

⁵ Annually computed by the Ministry of social policy of Ukraine. It grew from 2493 UAH per person in December, 2015 to 4478 UAH per person in December, 2021 (This number excludes taxes and other mandatory payments).

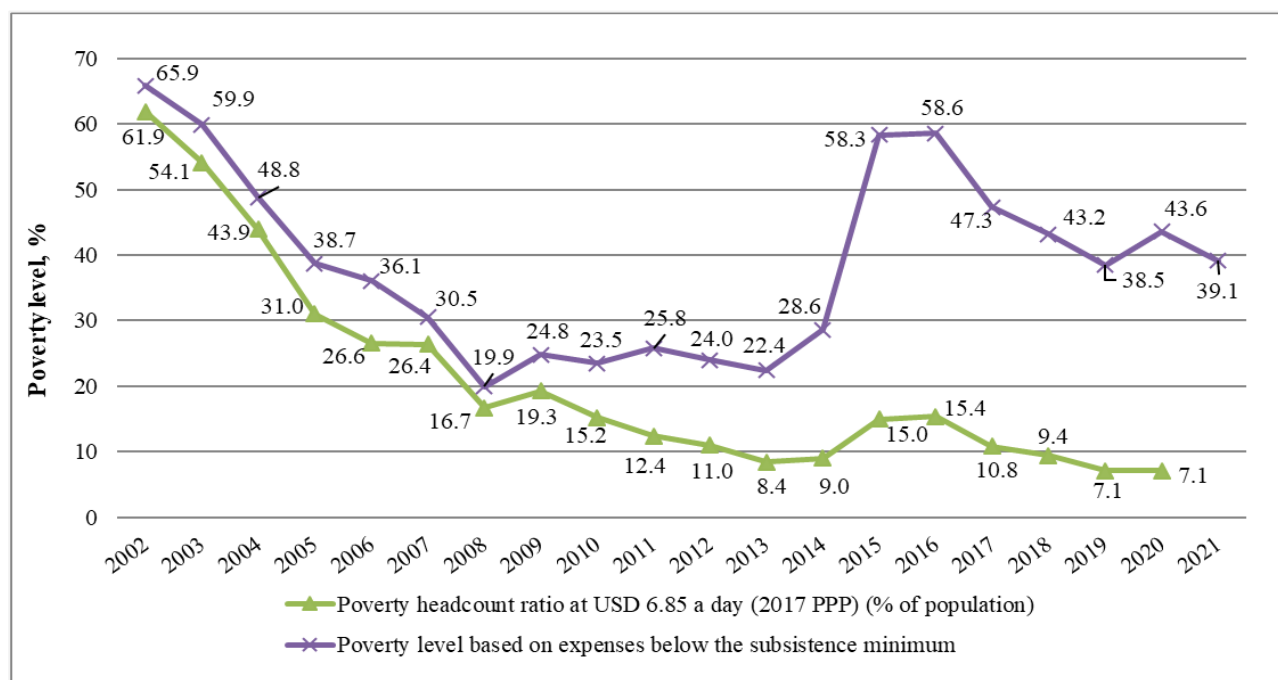


Figure 3. Dynamics of the poverty level in Ukraine

Source: calculated by the authors.

We will try to find out the impact of the annual growth of Ukraine's GDP, GDP per capita, unemployment rate and other possible factors on the poverty level using mathematical tools. One of the main problems that arises in this case is related to the different frequency of publication of various indicators as well as the limitation of data.

The values of the Pearson's correlation coefficients indicate the presence of a directly proportional relationship between the Gini index and the level of poverty ($r = 0.44$, $\alpha = 0.001$). This relationship is also indicated by the Spearman's and Kendall's rank correlation coefficients ($\rho = 0.46$ and $\tau = 0.28$) shown in Table 6. Therefore, the higher the value of the Gini index is, the higher is the level of poverty by expenses below the actual subsistence minimum. In other words, the level of poverty increases with increasing inequality of income distribution between households, as measured by the Gini index. Such a relationship seems quite natural in countries, where a small proportion of families receive a high share of income, while the majority of the population may be on the verge of poverty.

At the same time, a sufficiently strong inverse relationship between the value of the ease of doing business index and the poverty level was found ($r = -0.75$), as evidenced by the data in Table 7. In other words, the more difficult it is to do business in the country, the higher the level of poverty by expenses below the actual subsistence minimum is. Such a connection also seems well-founded, since a high level of bureaucracy restrains the rate of investment, the development of small and medium-sized businesses, and ultimately the rate of economic growth. This relationship is also confirmed by the Spearman's, Kendall's, and Fechner's rank correlation coefficients ($\rho = -0.73$, $\tau = -0.47$, $K_F = -0.71$). At the same time, a sufficiently high value of the coefficient of determination confirms the presence of a strong relationship between the

variables.

Table 7

Values of Pearson's (r), Spearman's (ρ), Kendall's (τ) and Fechner's (K_F) correlation coefficients between the poverty level by expenses below the actual subsistence minimum and its possible factors from 2002 to 2021

Indicators	The level of poverty by expenses below the actual subsistence minimum				
	Pearson, r	Kendall, τ	Spearman, ρ	Fechner, K_F	Coefficient of determination, R^2
Gini index	0.44	0.28	0.46	-0.10	0.20
Ease of doing business	-0.75	-0.47	-0.73	-0.71	0.57
GDP per capita, PPP (constant 2017 international USD)	-0.71	-0.48	-0.63	-0.40	0.50
GDP per capita (current USD)	-0.68	-0.51	-0.66	-0.40	0.46
Unemployment rate, %	0.65	0.49	0.68	0.80	0.42
Accounting rate at the end of the period, %	0.27	0.16	0.15	0.20	0.07
Interest rate on loans, %	0.45	0.20	0.29	0.20	0.21
The exchange rate (USD/UAH), average for the period	0.33	0.12	0.21	0.60	0.11
Taxes on goods and services, % of sales	0.00	0.03	-0.01	0.26	0.00
Taxes on income and profits, % of revenue	0.39	0.29	0.43	0.30	0.15

Source: calculated by the authors.

All three correlation coefficients show an inverse relationship between the poverty level by expenses below the actual subsistence minimum and GDP per capita at PPP (USD in 2017). Such a connection is quite logical, since the growth of GDP per capita at PPP directly reduces the level of poverty in the state. A similar relationship is observed between the poverty level and nominal GDP per capita in USD ($r = -0.68$, $\tau = -0.51$, $\rho = -0.66$, $K_F = -0.40$).

All considered correlation coefficients indicate a direct relationship between the unemployment rate and the poverty level ($r = 0.65$, $\tau = 0.49$, $\rho = 0.68$, $K_F = 0.80$) (Table 7). As the unemployment rate increases, the poverty level raises and the consumption level falls. Such a connection is quite obvious, because unemployed people lose the opportunity to earn money and increase their level of consumption.

According to the results of the analysis presented in Table 7, there is a direct relationship between the interest rate on loans and the poverty level in terms of expenses below the actual subsistence minimum ($r = 0.45$, $\tau = 0.20$, $\rho = 0.29$, $K_F = 0.20$). This relationship is well-founded, since a higher interest rate limits the ability of households and firms to obtain loans. In addition, an increase in the interest rate restricts the supply of money in the national economy and ultimately reduces the aggregate demand for goods and services. The coefficient of determination of 0.21 indicates the dependence of the below-average density.

State fiscal policy also has a significant impact on the level of poverty, that is confirmed by the existence of a direct relationship between the aggregate tax rate on income and profits and the level of poverty based on expenses below the subsistence minimum ($r = 0.39$, $\tau = 0.29$, $\rho = 0.43$, $K_F = 0.30$). Therefore, by increasing the level of direct taxes, government bodies directly affect the disposable income of consumers and the poverty level in the national economy.

According to the results of the analysis, there is a direct relationship between the poverty level and the official exchange rate of the hryvnia against the USD (UAH/USD) ($r = 0.33$, $\tau = 0.12$, $\rho = 0.21$, $K_F = 0.60$). Such a connection is caused by the high level of dollarization of the Ukrainian economy, mistrust of the national currency, high level of imports of finished products, etc. We consider such a connection quite logical under the conditions that have developed in Ukraine. The increase in the price of the USD expressed in hryvnias means that the incomes of Ukrainians in USD are decreasing, as well as their ability to buy foreign goods.

Having analyzed the value of the coefficient of determination, we came to the conclusion that the most significant factors of the level of poverty in Ukraine are GDP per capita at PPP ($R^2 = 0.50$), GDP per capita in current USD ($R^2 = 0.46$), unemployment rate ($R^2 = 0.42$), interest rate on loans ($R^2 = 0.21$), inequality of income distribution (Gini index) ($R^2 = 0.20$), taxes on income and profits ($R^2 = 0.15$), and official exchange rate (UAH/USD) ($R^2 = 0.11$).

As we can see from the results of the VAR model, the change in the inequality of income distribution of the population significantly affects the poverty level based on expenses below the actual subsistence minimum. The corresponding coefficients at the difference value of the Gini coefficient are 0.8465. Among other important factors affecting the current level of poverty, it is worth emphasizing the level of unemployment and its direct effect on the growth of poverty level, as well as the GDP per capita, PPP and the interest rate on new loans.

VAR Model – Substituted Coefficients:

$$PR = -0.501613942144 \cdot PR_{t-1} + 0.0049975532224 \cdot GDP_GR_{t-1} - 0.00686176538279 \cdot LIR_{t-1} + 1.12984335834 \cdot GINI_{t-1} + 0.0437408127324 \cdot AR01_{t-1} - 0.400350211124 \cdot GDP_PC_{t-1} - 0.828764223015 \cdot UR_{t-1} - 2.41738448101 \cdot GDP_PC_{17_{t-1}} + 5.64975365932$$

$$GDP_GR = -186.397414921 \cdot PR_{t-1} - 0.0423681028065 \cdot GDP_GR_{t-1} - 105.45240127 \cdot LIR_{t-1} - 132.080927516 \cdot GINI_{t-1} + 24.3206255071 \cdot AR01_{t-1} - 402.846797024 \cdot GDP_PC_{t-1} - 401.924706524 \cdot UR_{t-1} - 224.202917193 \cdot GDP_PC_{17_{t-1}} + 6099.65330382$$

$$LIR = 0.0595504437501 \cdot PR_{t-1} - 0.000131359741909 \cdot GDP_GR_{t-1} - 0.414568326453 \cdot LIR_{t-1} - 1.79322081389 \cdot GINI_{t-1} + 0.395240305559 \cdot AR01_{t-1} + 0.723157316155 \cdot GDP_PC_{t-1} + 0.0521495766656 \cdot UR_{t-1} - 1.35434239047 \cdot GDP_PC_{17_{t-1}} - 8.82692268216$$

$$GINI = -0.0537494630674 \cdot PR_{t-1} + 0.000161390828064 \cdot GDP_GR_{t-1} - 0.0665973070811 \cdot LIR_{t-1} - 0.246010373399 \cdot GINI_{t-1} + 0.0342109008842 \cdot AR01_{t-1} - 0.157694349734 \cdot GDP_PC_{t-1} - 0.148506029979 \cdot UR_{t-1} + 0.0105278397341 \cdot GDP_PC_{17_{t-1}} + 0.379671072706$$

$$AR01 = -0.617038709528 \cdot PR_{t-1} - 0.00025357693563 \cdot GDP_GR_{t-1} - 2.02221769169 \cdot LIR_{t-1} - 3.89467391238 \cdot GINI_{t-1} + 0.590494582328 \cdot AR01_{t-1} - 1.05114524741 \cdot GDP_PC_{t-1} - 0.84850542401 \cdot UR_{t-1} - 1.58398921597 \cdot GDP_PC_17_{t-1} + 15.1895751754$$

$$GDP_PC = 0.509279405825 \cdot PR_{t-1} - 0.00183065113612 \cdot GDP_GR_{t-1} - 0.316019929686 \cdot LIR_{t-1} + 0.201041831848 \cdot GINI_{t-1} - 0.129814058413 \cdot AR01_{t-1} + 0.540094404742 \cdot GDP_PC_{t-1} + 0.966520543347 \cdot UR_{t-1} + 1.91926196854 \cdot GDP_PC_17_{t-1} + 2.64815835788$$

$$UR = -0.292231631381 \cdot PR_{t-1} + 0.000381752275661 \cdot GDP_GR_{t-1} + 0.0871768024014 \cdot LIR_{t-1} - 0.611458408096 \cdot GINI_{t-1} + 0.0397904575218 \cdot AR01_{t-1} - 0.148001113016 \cdot GDP_PC_{t-1} - 0.705701038977 \cdot UR_{t-1} - 1.64745275788 \cdot GDP_PC_17_{t-1} + 6.33108504371$$

$$GDP_PC_17 = 0.0569433186708 \cdot PR_{t-1} - 0.000657932378953 \cdot GDP_GR_{t-1} - 0.227037799252 \cdot LIR_{t-1} + 0.0888110400945 \cdot GINI_{t-1} + 0.0140002773992 \cdot AR01_{t-1} - 0.0940574935549 \cdot GDP_PC_{t-1} + 0.0162432208156 \cdot UR_{t-1} + 0.326894511853 \cdot GDP_PC_17_{t-1} + 2.62979610723$$

Table 8

Results of the VAR model

Vector Autoregression Estimates								
Sample (adjusted): 2004–2021								
Included observation: 18 after adjustments								
Indicators	PR	GDP GR	LIR	GINI	AR	GDP PC	UR	GDP PC17
R-squared	0.8558	0.2993	0.6462	0.3811	0.5347	0.6231	0.2649	0.5941
Adj. R-squared	0.7277	-0.3234	0.3318	-0.1689	0.1211	0.2882	-0.3884	0.2333
Sum s q. resids	2230.46	3.33E+0.8	1464.37	128.87	13037.02	2907.701	2361.18	275.747
S.E. equation	15.742	6454.62	12.755	3.7840	38.0599	17.9743	16.197	5.5352
F-statistic	6.6790	0.4806	2.055	0.6928	1.2929	1.8604	0.4055	1.6468
Log likelihood	-68.91724	-177.75	-65.130	-43.256	-84.807	-71.303	-69.429	-50.102
Akaike AIC	8.6574	20.7508	8.236	5.8063	10.4230	8.922	8.7144	6.5669
Schwarz SC	9.1026	21.1960	8.681	6.2514	10.8682	9.3678	9.1596	7.0121
Mean dependent	0.8581	1277.66	-0.4752	-0.7270	8.0835	11.1706	1.2365	2.0177
S.D. dependent	30.1686	5784.52	15.605	3.4998	40.5986	21.304	13.746	6.3218
Determinant resid covariance (dof adj.): 2.30E+18								
Determinant resid covariance: 8.89E+15								
Log likelihood: -534.927								
Akaike information criterion: 67.436								
Schwarz criterion: 70.997								
Number of coefficients: 72								

Source: calculated by the authors.

Analysis of the graphs shown in Figure 4, shows a fairly significant dependence of the dynamics of the poverty level on shocks in GDP growth rate, the interest rate on loans and the Gini index.

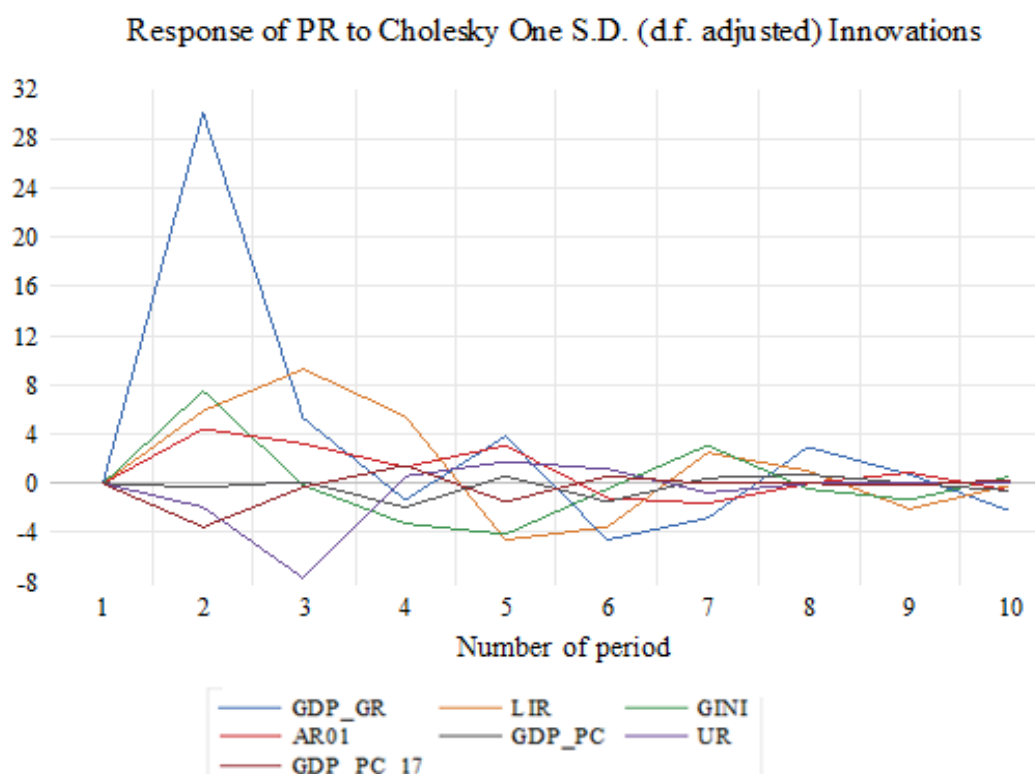


Figure 4. Impulse response function for the case of analytically calculated confidence intervals

Source: constructed by the authors.

GDP annual growth rate accounts for more than 64% of the change in poverty in the second period. In addition, the effect of the interest rate on loans unexpectedly increases from 2.4% in the variation of the poverty level in the second period to 10.0% in the 5th period (Table 9).

Table 9

The value of the variation decomposition for the PR

Period	S.E.	PR	GDP GR	LIR	GINI	AR01	GDP PC	UR	GDP PC 17
1	15.742	100.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	37.344	26.655	64.422	2.448	3.982	1.369	0.003	0.244	0.873
3	39.855	24.048	58.369	7.609	3.497	1.888	0.0039	3.812	0.769
4	40.485	23.338	56.681	9.189	4.023	1.943	0.209	3.721	0.891
5	41.366	22.593	55.137	10.045	4.845	2.443	0.220	3.739	0.975
10	42.486	21.753	54.571	10.819	5.266	2.584	0.387	3.666	0.951

Source: calculated by the authors.

As we can see from the graphs in Figure 5, the value of the interest rate on loans and NBU’s account rate increase over time, reaching at about 10.0% and 2.4% of the variation in the level of poverty, respectively. This can be explained by the long-term influence of the interest rates’ level on the dynamics of the state economic development.

Analyzing the graph of the decomposition of the variation for the poverty level, it

can be stated that the value of GDP growth rate in the variation of the poverty level decreases from 64.4% in the second period to 54.5% in the 10th period.

The value of the inequality of income distribution measured by the Gini index in the dynamics of the poverty level increases from 3.9% in the second period to 5.2% in the 10th period. Therefore, GDP growth rate is the main factor affecting the dynamics of the poverty level.

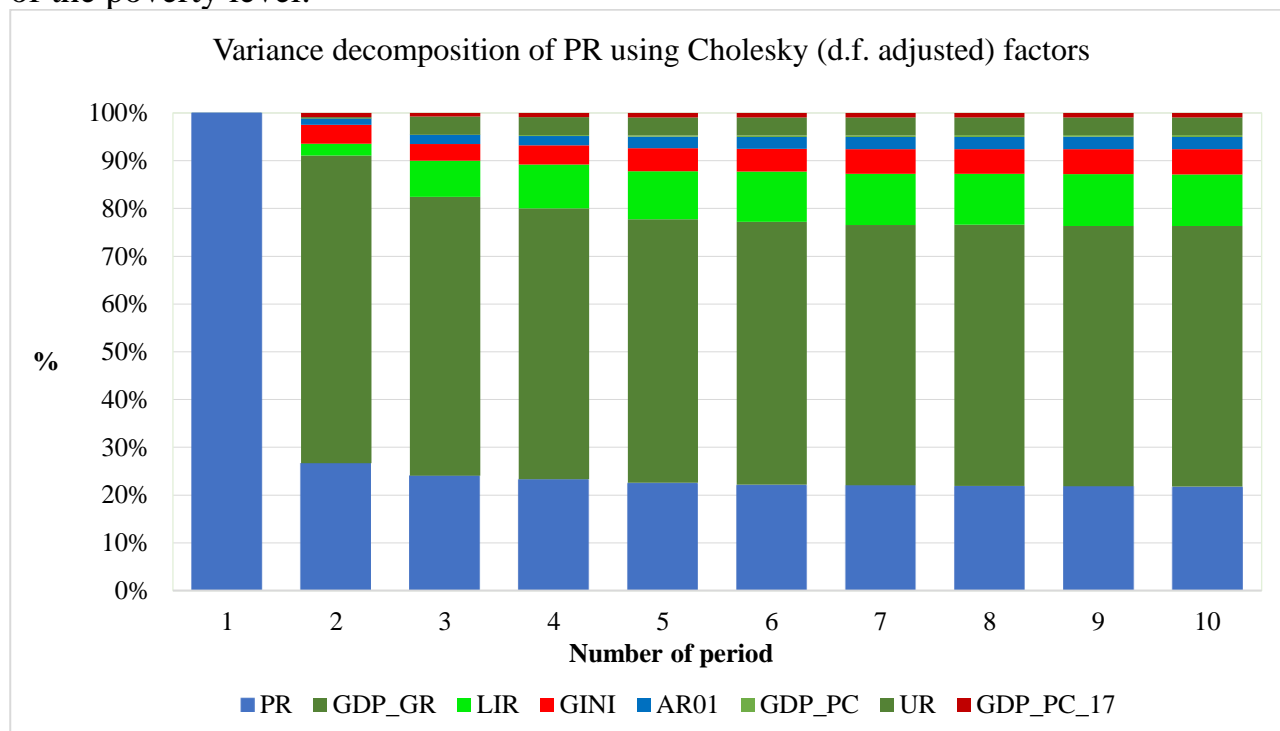


Figure 5. Graphic display of the variance decomposition of the estimated VAR model

Source: constructed by the authors.

According to the results of the analysis, the most significant factors of changes in the poverty level are GDP growth rate (64.4% in the variation of the poverty level in the second period) and the interest rate on new loans (more than 10% of changes in the dynamics of the poverty level, since the 5th period).

Summarizing the practical significance of the current research, it is noteworthy that there is a direct relationship between the Gini index and poverty level in Ukraine, i.e. higher inequality of income distribution provokes an increase in poverty. Thus, the national macroeconomic policy should be conducted taking into account the necessity of decreasing the inequality of income distribution. In addition, there is a direct relationship between the poverty level in Ukraine and interest rate on loans. It can be helpful in the process of realization the NBU's monetary policy, i.e. reduction of interest rate may lead to revitalization of aggregate demand and reduction of poverty level. Moreover, the NBU's monetary policy is more relevant due to significant connection between the Ukrainian hryvnia exchange rate and poverty level. Considering the impact of fiscal policy and state debt on the hryvnia's exchange rate, monetary and fiscal policy should be coordinated to struggle the poverty.

In conditions of necessity of Ukrainian economy's recovery after the end of war,

much attention should be focused primarily on stabilizing consumer expectations by controlling inflation and exchange rates due to their significant influence on poverty level. After the stabilization of the financial system, it is worth moving to a comprehensive program of stimulating economic growth and investment, taking into account the need to reduce the inequality of income distribution.

Discussion. Comparing the attained results of our research with the existing ones, it is noteworthy that some results are similar, while the others are new to some extent. Firstly, in accordance with UNICEF research, among the main causes of poverty are the reduction of public expenditures aimed at social benefits and the growth of tax payments. Similarly, according to the authors' findings, there is a direct relationship between the aggregate tax rate on income and profits and the level of poverty based on expenses below the subsistence minimum. On the other hand, the authors haven't analyzed the influence of public expenditures aimed at social benefits and the number of tax payments, which could deepen the results of research.

According to the findings of S. Gnanon, the variations of poverty level can potentially arise due to the country's vulnerability to various shocks and cause greater macroeconomic instability, including the instability of economic growth [29]. The authors of the current research also analyzed the impact of macroeconomic instability and rates of economic growth on poverty level. However, S. Gnanon proposed different way of considering the connection between the macroeconomic instability and poverty level, which might enrich the aspects of the current research.

According to the findings of our research, 69.19% of rural residents and 65.89% of urban residents of Lviv region save less than 10% of their personal income, which may indicate a higher standard of living in cities in Lviv region. Similarly, according to the results of research conducted by D. Debucquet and M. Fransham, there has been a dramatic reduction in global poverty over the past 25 years, although rural poverty remains higher than urban poverty [30; 31].

Modern scientists analyzed the impact of many indicators on poverty level. For instance, some authors made a conclusion that the higher the economic freedom, the lower the level of poverty, based on statistical data for a 21-year period from 150 countries [32]. In addition, G. Marrero and L. Serven, using data from 158 countries for the period from 1960 to 2010, believe that a reduction in the poverty level by population is associated with a further increase in GDP per capita from 0.5 to 1.2% per year [34]. The connection between the GDP per capita and poverty level was also analyzed in the current research. According to our findings, GDP per capita at PPP and GDP per capita in current USD are among the most significant factors of the level of poverty in Ukraine.

Additionally, K. Bergstrom analyzed the link of growth in average income and changes in relative income distribution to reductions in absolute poverty and examine the role of income inequality in poverty reduction [35], while S. Gnanon examined the interaction between exchange rate pressures (ERPs) and fiscal redistribution in the impact on poverty in developing countries [36]. We also analyzed the impact of inequality of income distribution (Gini index) and official exchange rate on poverty

level in Ukraine. According to our findings, there is a direct relationship between the Gini index and poverty level in Ukraine, while the NBU's monetary policy is more relevant due to significant connection between the Ukrainian hryvnia exchange rate and poverty level. On the other hand, the investigated impact of lending interest rate and NBU's account rate on poverty level in Ukraine may be considered as originality of the current article.

Conclusion. Traditionally, the causes of poverty include natural and geographical factors, economic factors, medical care, administrative and governmental problems, social and demographic factors, and public policy. Unfortunately, the level of poverty in Ukraine remains high, and the rate of economic growth of the country does not allow rapid growth of income per capita. According to the report of the State Statistics Committee "Self-assessment by households of Ukraine of their income level (based on sample survey materials)", the share of households that classify themselves as poor has increased from 65.3% in 2019 to 67.1% in 2020. Having analyzed the value of the coefficient of determination, the authors came to the conclusion that the most significant factors of the level of poverty in Ukraine are GDP per capita at PPP ($R^2 = 0.50$), GDP per capita in current USD ($R^2 = 0.46$), unemployment rate ($R^2 = 0.42$), interest rate on loans ($R^2 = 0.21$), inequality of income distribution (Gini index) ($R^2 = 0.20$), taxes on income and profits ($R^2 = 0.15$), and official exchange rate (UAH/USD) ($R^2 = 0.11$). GDP annual growth rate accounts for more than 64% of the change in poverty in the second period. The value of the interest rate on loans and NBU's account rate increase over time, reaching at about 10.0% and 2.4% of the variation in the level of poverty, respectively. This can be explained by the long-term influence of the interest rates' level on the dynamics of the state economic development. The value of the inequality of income distribution measured by the Gini index in the dynamics of the poverty level increases from 3.9% in the second period to 5.2% in the 10th period. Therefore, GDP growth rate is the main factor affecting the dynamics of the poverty level. In addition, in accordance with the results of the research, interest rate on loans and NBU's account rate significantly affects the poverty level in Ukraine, which approves the importance of monetary policy and efficiency of its transmission mechanism in regulation of poverty level.

Limitations of research. Any research has its limitations and this article is no exception. The main limitation of this article is the different periodicity of the data used and the small database available for the analysis of the level of poverty in Ukraine. For this reason, the study is limited to data during 2002–2021, which limits the application of the model to some extent.

Prospects for further research. In our opinion, overcoming the limitations of data and using them for comprehensive analysis of all factors that determine the level of poverty in Ukraine should become an important direction of further research. Considering the consequences of the war unleashed by Russia in Ukraine, a large part of the population of Ukraine was faced with the lack of work, forced displacement and destruction of housing and workplaces. In the context of the new realities, the economic policy should become the driving force for the recovery of Ukraine and improvement

of people's living standards, taking into account the researched factors of the poverty level. A separate aspect of further research should be the analysis of interaction of the monetary and physical economy in the context of poverty alleviation, taking into account the importance of the discount rate and the interest rate on loans as factors of the poverty level.

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