Formation of a System of Indicators of Assessment of Economic Security of Regions

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ABSTRACT

The economic security category of the region is complex, multifaceted and has many features. Therefore, the use of a multifactorial approach to assessing economic security is justified. Assessment of the economic security of a region is possible provided that formal approaches are used, using specific indicators. The practical implementation of the analytical and regulatory components of the process of ensuring the economic security of the region requires an economic assessment on the basis of and in comparison with the thresholds. In order to control the level of economic security of the region in order to develop preventive measures for expected threats, it is necessary to carry out a continuous study of the regional economic situation on the chosen system of indicators. The quantitative expression of indicators determines the thresholds for the functioning of the economic system of the region.

Keywords: Scorecard; Economic security; Regions; Integral indicator.

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Formación de un sistema de indicadores de evaluación de la seguridad económica de las regiones

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RESUMEN

La categoría de seguridad económica de la región es compleja, multifacética y tiene muchas características. Por lo tanto, se justifica el uso de un enfoque multifactorial para evaluar la seguridad económica. La evaluación de la seguridad económica de una región es posible siempre que se utilicen enfoques formales, utilizando indicadores específicos. La aplicación práctica de los componentes analíticos y normativos del proceso de garantizar la seguridad económica de la región requiere una evaluación económica sobre la base de los umbrales y en comparación con ellos. Para controlar el nivel de seguridad económica de la región con el fin de desarrollar medidas preventivas para las amenazas previstas, es necesario realizar un estudio continuo de la situación económica regional sobre el sistema de indicadores elegido. La expresión cuantitativa de los indicadores determina los umbrales de funcionamiento del sistema económico de la región.

Palabras claves: Cuadro de mando; Seguridad económica; Regiones; Indicador integral.

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1. Introduction

The lack of a single toolkit for assessing the effectiveness of the regional economic security mechanism complicates the processes of economic stabilization and territorial development. The parameters of the regional economic security estimates are consistent with the country's economic security estimates, although the totality of the factors taken into account is not identical in both cases. The economic security category of the region is complex, multifaceted and has many features. Therefore, the use of a multifactorial approach to assessing economic security is justified. Assessment of the economic security of a region is possible provided that formal approaches are used, using specific indicators. The practical implementation of the analytical and regulatory components of the process of ensuring the economic security of the region requires an economic assessment on the basis of and in comparison with the thresholds. In order to control the level of economic security of the region in order to develop preventive measures for expected threats, it is necessary to carry out a continuous study of the regional economic situation on the chosen system of indicators. The quantitative expression of the indicators determines the thresholds for the functioning of the economic system of the region, which is a signal of approaching the safe reduction of the ability of the regional system to dynamic development; destabilization of socio-economic state of society, etc (Alghamdi et al 2017).

2. Literature review

The choice of valuation indicators is an element of the preparatory stage of the process of ensuring the economic security of the region, namely the next stage of the information and analytical component after the formation of the information base and the development of the system of threats to economic security, which in the future will allow to model socio-economic processes by transferring blurred concepts and definitions formal logic. The system of indicators for assessing the level of economic security is built on the basis of a set of indicators, criteria, characteristics that meets the goals of the development of the region (Gontareva, et al., 2021). Representative indicators of economic security make it possible to assess the protection against threats to the economy of the region, to timely assess the state of the economy of the region and to apply appropriate mechanisms (Iarmosh & Khomiakova, 2020). The quality and reliability of the preparatory phase depend not only on the results of the research and analysis, but also on the correctness of the conclusions that form the basis of management decisions and the foundation of practical measures programs to ensure a sufficient level of economic security of the region (Starychenko, et al., 2021). The indicators do not reveal the reasons for the region's non-compliance with the parameters of sufficient socio-economic development, but the economic security indicators can be used to judge the effectiveness of socio-economic activities in the region (Podgorna, et al., 2020). The crisis level of indicators indicates the need for prompt intervention of management bodies in order to change dangerous situations.

For the effective functioning of the process of ensuring regional economic security requires a comprehensive assessment of the state of the economic system of the region because it allows you to correctly select the most effective development strategy and determine the priorities of managerial influence on socio-economic processes (Dovgal & Makhova, 2020). The criterion for creating a set of indicators of economic security of the region is the destructive impact of individual threats on the socio-economic equilibrium of the territory (Vdovenko, et al., 2019). It should be noted that in a market economy, the nature of the system of indicators of assessing the level of economic security of the region is unstable and is formed in accordance with changing threats to economic security (Lomachynska, et al., 2021). Economic security can be assessed both qualitatively and quantitatively, depending on which side of the phenomenon is being measured (Babenko, 2020). The greatest effect is achieved with the simultaneous application of both options. Determining the level of economic security of a region involves measuring the actual level of territorial development, determining security levels by year, and grouping territories by security level (Al-Muhtadi et al 2019).

The requirements to the system of indicators developed by the authors are expedient (Onyshchenko et al., 2018):

- the system is formed from indicators that are a quantitative expression of all identified threats to the economic security of the region;
- the composition of the system of indicators must reflect the specificity of the region and may change over time, which is explained by the dynamics of changes in the qualitative composition of threats to economic security (the disappearance of some, changes in the intensity of others, the emergence of new ones) (Reshetnyak, 2020);
- the system must contain macroeconomic indicators of economic security that affect both the economy of a particular region and the economy of the country as a whole;
- comparability of indicators.

The following list of indicators (criteria) of Ukraine's economic security is enshrined in the law:

- the ability of the economy to function in extended reproduction mode;
- dependence of the economy on the import of the most important types of products and food, the production of which at the required level can be organized in the country;
- the level of external and internal debt and the possibility of its repayment;
- providing the economy with strategic resources and the effectiveness of state control over their use;
- levels of property differentiation of the population and unemployment, which are maximum permissible from the standpoint of socio-economic stability of society;
- accessibility for the population of education, culture, medical and social services, passenger transport and mass communication, as well as housing and utilities;
- support of the country's scientific potential, preservation of national scientific schools and ensuring the effective functioning of especially important objects of science;
- preservation of a single economic space and interregional relations, ensuring the observance of national interests, which exclude the development of separatist tendencies;
- ensuring the necessary level of state regulation of economic processes in order to form the conditions for the normal functioning of a market economy (Ivanova, 2018).

On the whole, all indicators characterize the scale of the region's economy, its performance and resource reproduction (Cherep, et al., 2021). There are general macroeconomic indicators that characterize external threats and private economic security indicators - GRP structure, investment indicators, amount of defaults and others. The main indicators that characterize the regional economy are the dynamics of production, the level of efficiency of the potential of the territory. Indicators that assess the state regulation of economic processes, its ability to contribute to supporting the economy in a state of stability and stability are singled out.

Gross Domestic Product (GRP) in current and comparative per capita prices or percentage of GRP growth as a percentage of the corresponding period of the previous year is a special place in the system of economic security of the region (Babenko et al., 2020). Gross regional product (GRP) as the main indicator of the development of the regional economy is determined by the production method as the difference between the amount of outputs and the amount of intermediate consumption of products (Onyshchenko et al., 2018). GRP is also the value of a regional product created over a period of time by all the factors involved in regional capital. GRP as a general indicator of the regional economy is the measure of its development and well-being of the population that most accurately characterizes the output of goods and services in the region during the year. GRP adequately reflects the region's contribution to national economic growth (Mavlutova, et al., 2021).

3. Data and methodology

Author (Onyshchenko et al., 2018) proposes to calculate the regional product index according to formula (1). The cost of producing a regional product includes the cost of regional costs, that is, the cost of the main factors involved in the regional economy. Release of a regional product (B) is considered as a function of regional costs (B *):

$$B = aF(B^*) \quad (1)$$

or the regional capital function involved.

Function arguments, i.e. costs, are the cost of employment of the employed population - T, the cost of fixed capital - K, the value of working capital - O, the level of technology at the moment, or the constant value of the productive function - and their interaction is described by the productive function:

$$Oy = aF(T, K) \quad (2)$$

where: y - the working capital ratio; virtually productive function is a transformed equation of the cost function:

$$B = aF(O, y) \quad (3)$$

$$B = aF(T, K) \quad (4)$$

In our opinion, the calculation methodology is logical, but additional statistical information at the regional level is needed to use it. GRP largely determines many economic and social characteristics of the territory, is the level of its economic development. The most accurate indicator is the size of gross regional product produced per capita. It is from its size that largely depends on the level, quality and life expectancy of the population, the state of his health, quality of consumption, the level of education, financial opportunities for additional social assistance to the population, the development of science, art, culture. Therefore, the level of economic development is one of the most important indicators of economic security. The directions of socio-economic policy of the state are determining factors of economic security of the region. Economically unjustified governmental activity of the state, as a rule, leads to a decrease in the rate of economic growth and, consequently, to a decrease in the level of economic security of the regions and the country as a whole (shaikh et al 2009).

4. Results

It is advisable to analyze the economic activity indicators of the region, the main ones being the number of small businesses per 10,000 people of the population and the volume of sales of small businesses as a percentage of the total sales of the region. At the same time, these indicators characterize the effectiveness of regional governance in the direction of market development. The most important area of socio-economic policy at the regional level is its budgetary component. The formation and redistribution of regional financial resources through local budgets are most fully reflected in the share of government spending in GRP.

One of the most important parts of government spending is public consumption - government spending on the purchase of goods and services, as well as on the salaries of civil servants. This is that part of government spending that is consumed directly by government organizations. The pattern found for all government spending also applies to government consumption: the greater the scale of the latter, the slower the rate of economic growth (Karanina, et al., 2017).

Table 1 Comprehensive system of indicators of economic security of the region

Directions	Indicators
Macroeconomic indicators	GDP level, inflation rate; stability of the national currency; budget deficit; ratio of external debt servicing to GDP,%; import-dependence of the economy of the country on more important types of products; extended play ability; efficiency of foreign economic activity; efficiency of territorial organization of production and settlement; progressiveness of sectoral and technological structure; formation of the regional market; balance of regional development; the degree of production innovation; the effectiveness of institutional change; the amount of government spending
Economical activity of the region	Share of the region in the GDP of the country, investment in fixed capital; foreign direct investment; direct investments from the region into the economies of other countries; foreign investments for one person; share of the region in total investments of the country; density of transport networks; availability of budget own resources,%; the number of small businesses per 10 thousand people; sales volume of small business in% of total volume
Assessment of the economy region	characteristic of the production component
	The value of GRP per employee; volumes of industrial and rural production; competitiveness of products; retail trade turnover; balance of exports and imports; freight transportation by motor transport; the level of food security; state of the shadow economy; dynamics of individual industries, including export; growth rate (decrease) of construction works; rates of production of consumer goods; Dynamics Consumption Fund; changing the share of strategically important industries in the structure of the region's economy; relative level of production of specialization products in the region
	characteristic of financial stability of the region
	Balance of Payments of the region; personal income tax; corporate income tax; excise duty on domestic goods; local taxes and fees; subsidies; number of insolvent companies; deductions to the state. budget; expenditures on social protection and social security of the population; expenditures on socio-cultural and scientific fields; expenditures for regional economy development; arrears of financial settlements between economic entities; amounts owed to the population from pensions and other social assistance; total amount of payroll arrears (including budgetary institutions); the difference between the accounts payable and the receivables of economic entities
	natural and resource potential of the region
	Geographical location (including general and border areas); natural conditions; providing the territory with basic natural and energy resources; production potential; volume and condition of fixed assets (in particular in industry); scientific and technical potential; the level and efficiency of use of the resource potential; innovative potential of the territory; investment attractiveness of the region; population size and density; availability of cities with population (more than 1 million)
The state of social equilibrium	characteristic of socio-demographic development of the region
	age structure of the population; population growth; share of urban population; natural population growth; the natural growth rate, the infant mortality rate; interregional migration of the population; number of employees; the number of persons employed in production; the level of social tension; population below the subsistence level; the number of unemployed; working capacity of the population; crime rate; availability of objects of soc. infrastructure; reproduction of the population and labor resources

	assessment of the environmental safety of the region
	total revenues from environmental payments (% of GRP); emission of harmful substances into the atmosphere, t / km ² ; volume of discharge of contaminated water without treatment,%; storage of toxic waste in violation of requirements, t / km ²
	the quality of life of the region's population
	real monetary income per capita; average monthly nominal and real wages; level and rates of income differentiation (ratio of income of 10% of the most affluent population to income of 10% of the least affluent population); unemployment rate; personal savings; the ratio of average wages (including social benefits) to the value of the standard food basket and the value of the subsistence level; the level of food consumption; per capita consumer spending and growth rate; providing the population with material goods and services; commissioning of housing; providing housing to the population; poverty rate (the proportion of the population with incomes below the subsistence level); Consumer price indices; working conditions; life expectancy at birth, years; %; level of physical health (level of illness); infant mortality (deaths up to 1 year per 1000 born)

One of the most important roles at all stages of regional production is played by living labor, and human capital and the efficiency of its reproduction are central to economic security (Lysenko et al., 2017). The economic security of the region should not be seen as an end in itself, but only as a means of ensuring the safety of citizens and the proper standard and quality of life. According to the results of the study (Lysenko et al., 2017), the main indicator that primarily identifies problem regions in world practice is the unemployment rate.

Quality of life is the satisfaction of the material and spiritual needs of a person, which may or may not be provided by the "environment of life", i.e. "quality of life is a measure of interaction between the environment and its use" (Onyshchenko et al., 2018). The level and quality of life of the region's population also testify to the various potentials for their economic development. The criterion for assessing the effectiveness of economic security in (Onyshchenko et al., 2018) is to maintain a level that is characterized by a high quality of life or meets the minimum total costs, which, in turn, consist of costs needed to neutralize and prevent threats, as well as losses from the implementation of threats. Within the framework of the United Nations Development Program (Karanina et al., 2017), the human development index is used to assess the degree of development of both countries and regions.

According to the Law of Ukraine "On National Security of Ukraine", the objects of national security of Ukraine are defined first of all by the person, society, and then by the state. Thus, the main indicator that most accurately characterizes the level of economic security of the region is the quality of life of the population. The indicators of the group "level and quality of life" in table 1 can be supplemented by other indicators:

- the ratio of the difference between the number of jobseekers and the stated need for workers by enterprises and organizations to the total number of employed in the economy, %;
- share of remuneration in the structure of personal income, %;
- personal savings rates (increase in deposits and deposits, securities, real estate, durable goods) in personal income, %;
- the ratio of expenditures for social programs to the gross regional product, %;
- the proportion of the population living in the areas of environmental pollution, natural disasters, to its total number,%;
- share of serious crimes in the total number of crimes,%;
- share of solved crimes in the total number of registered,%.

Indicators such as physiological rates of food consumption by structure may also be used; self-sufficiency of the region with food and production resources for its sustainable production; sizes of strategic and operational food stocks in accordance with regulatory needs; the level of average per capita production and consumption of food, especially their basic types; the level of physiological and economic security of its consumption for different categories of population; quality and environmental friendliness of food. These indicators provide a more accurate assessment of food security in the region by relating the actual consumption of certain foods to scientifically sound standards. It complements the availability of food, namely: food prices and household incomes (Lysenko et al., 2017).

The main indicators of economic security for (Onyshchenko et al., 2018) are: changing demographic situation; change in the standard of living of the population; changing the economy's openness; change of economic activity of the population; income and expenditure of the population; scientific and technical potential. The author proposes to conduct the analysis of security of economic systems of districts using the method of point evaluation. Indicators of economic security are selected industrial production index, agricultural production index, retail turnover in% of GRP, fixed capital investment in% of GRP, the level of official unemployment. A score of 0 to 1 was used to evaluate the relative deviations from the threshold values. The overall characteristic was calculated as the arithmetic mean of all indicators. In our opinion, the results of this study do not sufficiently comprehensively evaluate the economic system of the region, and the indicators are used only overall without the use of partial, calculated per unit of resource. It should also be noted that the alignment of the indicator values does not allow you to highlight the main indicator.

According to the results of the study (Onyshchenko et al., 2018), the main indicator that primarily identifies problem regions in world practice is the unemployment rate. The second most frequent use is GDP per capita. In some countries, GDP is replaced or supplemented by a household income indicator; rates of industrial development (USA), accumulated assets per capita (Slovenia), (unemployment rate + per capita GDP) - EU standards. On average, 5-10 indicators are used. As you can see, the level of economic security of the region is not determined by one indicator. It is considered in the world practice that sustainable development of the territory provides its economic security and high quality of life of the population. Under territorial development, the authors (Lysenko et al., 2017) fairly understand such a mode of functioning of the economic system, which is focused on the positive dynamics of the parameters of the quality of life of the population, which are ensured by a stable, balanced reproduction of the economic, resource, social and environmental potentials of the territory.

Thus, one of the main conditions for economic security of the territory is the sustainable development of the regional economy. The modern region is a complex, stochastic, dynamically developing hierarchical system. Ensuring economic security requires many challenges to be addressed in different directions. The most comprehensive assessment of the socio-economic situation of the region uses many different indicators. Each task or result will be determined by separate indicators, which are combined by a general indicator of the economic security of the region. The presented system of indicators allows to demonstrate the chosen method of calculating the level of economic security of the region.

Using one integral (consolidated) indicator is a much simpler decision-making process. The number of structural indicators chosen should be optimal, and the indicators themselves should fully and accurately reveal the essence of the component of the overall assessment and not duplicate each other. Next, a management model with many inputs and many options for the development of the current regional economic situation is developed. It should be noted that there are simpler and more complex techniques. Increasing regional economic security requires more accessible methodological and calculation tools. One method of generalizing the many characteristics of the regional system is the method of constructing integrated (consolidated) socio-economic indicators (Lysenko et al., 2017). The indicator is a quantitative indicator, on the basis of which (which) the situation in the region is evaluated, and further program-targeted measures for ensuring the economic security of the region are developed and substantiated (Karanina et al., 2017).

There are three options for transforming single indicators into a consolidated indicator:

I. (normalization of indicators) - the calculation of the specific gravity of the indicator by region from the national average; in this way the variation of the values of individual indicators remains;

II. (minimum-maximum-maximum method) - equalization of minimum and maximum values for all indicators; there is no variation of values;

III. (standardization) - a method that represents the average between the first and the second - different weights are varied for different indicators, but in most cases different from the primary.

According to (Karanina et al., 2017) the initial system of indicators, which is arbitrarily large dimension, is translated into one integral index of economic security, which is normalized and changes from 0 to 1, which allows to rank regions by the level of economic security. The indicator is easy to interpret: its values are close to 1, correspond to large values of indicators that have a positive impact on the level of economic security, and low values of indicators that negatively affect the level of economic security of the region.

To evaluate the level of economic security the author (Lysenko et al., 2017) suggested the use of a modification of the Delphi Expert Assessment Method, in particular its iterative procedure, and the built-in features of the MS Excel office suite - Statistical Quarter. A score of 4 points corresponds to a better level of manifestation of the threat count, and a score of 1 indicates a low state of ability to resist a particular threat. To derive an integrated assessment of the level of counteraction to a particular threat, similar procedures were performed with the initial estimates obtained on the basis of an analysis of indicator values: a four-point ranking was performed on the total number of points exposed at the previous stage. At the same time, the principle of conformity of the higher assessment to the best level of manifestation of a certain aspect of security of the regional economic system was maintained.

To predict the impact of any factor on the development of the region, it is possible to determine the weight of the j -th characteristic by the expert way among the n -th number of experts as the arithmetic mean of the partial estimates of the j -th feature by the n -th expert by the formula:

$$k_j = \frac{\sum_{n=1}^N S_{jn}}{N} \quad (5)$$

where: k_j - the weight factor of the j th sign;

S_{jn} - the estimate of the j th sign given by the n th expert;

N - the number of experts.

To calculate the integral index of regional development, you can use the formula:

$$I^i = \frac{1}{1} \sum_{j=1}^1 i^{ij} \quad (6)$$

where: i^{ij} - the integral index of regional development; j - number of indicators (signs).

The obtained index, provided that the sum of j -x signs gives an opportunity to generalize the typical characteristics of the phenomenon during the study period.

When translating any index x into an index whose value is placed between 0 and 1 (this will allow you to add different indicators), the following formula is used:

$$\frac{x - \min(x)}{\max(x) - \min(x)} \quad (7)$$

where: $\min(x)$ and $\max(x)$ - the minimum and maximum values of the index x among all the studied regions.

In the process of analysis, a considerable number of partial indicators are processed, which are then compared with respect to their effect ("weights" or "intensity of influence") on the summarizing (integral) indicator, which then receives a numerical expression. The formalized expression of this relationship between the indicators that characterize the economic security of a region can be

represented as a mathematical model, that is, a model in which the factors affecting the result are in the form of an algebraic sum:

$$Y_{int} = B_1X_1 + \dots + B_nX_n \quad (8)$$

where: Y_{int} - an integral indicator of economic security; X_i - indicators that affect economic security; B_i is the weight value of the coefficient.

The scorecard will determine the integral index of economic security of the region. If necessary, the structure of the integral index allows to decompose into its constituent parts. After generalizing the indicators, it is necessary to establish an integral indicator of economic security assessment at the regional level. The organic interconnection of indicators makes it possible to comprehensively evaluate the effectiveness of the process of ensuring the economic security of the region. An expert method can be used to determine the impact (weight) of each individual indicator on the aggregate indicator.

Based on the analysis of assessments of the impact on economic security, the criteria can be divided as follows: current economic situation in the territory (0,12-0,14) (UPE), ability of the region's economy to sustainable development (0,13-0,14) (USD), natural resource potential of the region (0,11-0,13) (URP), functioning of the organizational and economic mechanism of the region (0,12-0,14) (Uem), characteristic of economic activity (0,10-0,12) (UEA), characteristic of the stability of the financial system of the region (0,11-0,13) (Ufs), social and demographic factors of the development of the region (0,09-0,11) (USD), quality of life of the population (0,14-0,16) (Uyazh).

Based on these estimates, the formula for the integrated regional economic security assessment indicator is as follows:

$$W_{inteb} = 0.13U_p + 0.14U_p + 0.12U_p + 0.13U_m + 0.11U_{ea} + 0.12U_{fs} + 0.10U_p + 0.15U_y \quad (9)$$

where: W_{inteb} - an integral indicator of the level of economic security of the region.

5. Discussion and Conclusion

As we can see, the most important influence on the level of economic security has the following security criteria: the quality of life of the region's population, the current economic situation in the territory, the ability of the region's economy to sustainable development and the functioning of the organizational and economic mechanism of the region. After quantitative analysis and determination of the state of the region, the possibility of stabilizing the situation at the expense of the internal resources of the region is determined, the possible consequences of unregulated development of the situation are predicted, and as a result the need for rapid development of special measures is determined.

Assessment of the socio-economic situation in the region should reflect the problems of the territory, which, in turn, will allow the regional government to respond to the manifestation of negative tendencies in the socio-economic sphere. The core of anti-crisis economic policy should be the adoption of a more effective system of indicators of economic security, taking into account the specifics of the current economic transformations of the region. Development of measures of influence of governing bodies on the course of processes of economic and social development of territorial systems should be based on a deep study of the nature of economic processes, taking into account possible directions of development on the basis of observed tendencies. In some cases, processes may be unmanageable. Hence, the task of the economic security management system is, first, to form a complete comprehensive system of indicators - indicators of socio-economic development; second, in determining the integral indicator of assessing the level of economic security of the territory, taking into account the uneven influence of individual indicators; thirdly, on the basis of the functional dependence of the level of economic security on individual factors, to develop an economic and mathematical model of managing the economic security of the region and the stable development of the socio-economic system of the region.

Our system of indicators allows us to manage the process of ensuring the economic security of the region, to measure and model strategic goals. The results of the developed methodology for assessing the level of economic security can be used:

- when creating an interconnected system of regional development targets in strategies, programs and budgets focused on the formation of economically safe economic conditions;
- when evaluating the performance of the governments (administrations) of the regions;
- when developing regional policy;
- to improve the management of the regional economy, which ensures the growth of its economic security.

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