

# PRINCIPLES OF ASSESSING THE ECONOMIC SECURITY OF THE REGION

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**Abstract.** *The subject of the study* is the theoretical and methodological aspects of assessing the economic security of the region. *The purpose of the article* is to develop a methodology for assessing the economic security of the region on the basis of the analysed basic methods and techniques. *Research methodology.* The theoretical and methodological basis of the study is the fundamental provisions of economic theory, modern concepts of economic security on the meso-level, scientific works of Ukrainian and foreign scholars, and state laws and regulations on the assessment of economic security. In the course of the research, general scientific and special methods of research were applied, namely: theoretical generalization, scientific abstraction, and system analysis – during the generalization of theoretical foundations of the subject-object sphere of research, comparison study – during the establishment of causal relationships, data classification and systematization, comparative analysis – when identifying the positive and negative sides of the investigated methods of assessing economic security, abstract-logical analysis – in the process of drawing conclusions. *The research results show* that the use of methods of monitoring and analysis of the key economic indicators, on the basis of which the integral indicators of components of regional economic security and the overall integral indicator are calculated, allows carrying out a comprehensive analysis of the current state of economic security, determining its positive and negative tendencies in general and by separate functional constituents. The methodology for assessing the economic security of the region is proposed, which allows fully taking into account the impact of threats on the economic security of the region and evaluating it in a complex way with the use of a system of indicators. The threshold, critical, and satisfactory value for an integrated assessment of the regional economic security and individual components are calculated. Intervals of satisfactory, unsatisfactory, critical, and absolutely unsatisfactory state of economic security of the region are determined. *Practical implementation.* The obtained assessments of the regional economic security are useful for making decisions in order to avoid destructive processes of socio-economic development of regions. *Further research directions* are related to the calculation and analysis of the state of economic security of regions of Ukraine, determination of the degree of influence of threats on the regional economic security, development of a model for ensuring regional development security.

**Key words:** regional economic security, indicator, indicator analysis, functional analysis, modified method, threshold value, weight coefficient, integral index.

**JEL Classification:** C18, C02, O18, R10, R13

## 1. Introduction

At the current stage of development of Ukraine, the issues of regional security, development and improvement of interregional relations are of key importance. The study of the socio-economic situation in the country shows that the causes of threats to economic security are of a regional nature. The growth of disproportions in the socio-economic development of regions contributes to the emergence and further

strengthening of negative processes in the economic complex that affect the stable functioning of the economy and the sovereignty of the state.

The deepening of differences in the levels of competitiveness of Ukrainian regions as a result of the influence of destabilizing factors creates a danger both for the economy of the state as a whole and its individual regions. Therefore, there is a need to develop scientific and methodological provisions and tools for assessing the economic security of territorial systems.

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The main purpose of the article is to develop a methodology for assessing the economic security of the region on the basis of the analysed basic methods and techniques.

The theoretical and methodological basis of the study is the fundamental provisions of economic theory, modern concepts of economic security on the meso-level, scientific works of Ukrainian and foreign scholars, and state laws and regulations on the assessment of economic security.

In the course of the research, general scientific and special methods of research were applied, namely: theoretical generalization, scientific abstraction, and system analysis – during the generalization of theoretical foundations of the subject-object sphere of research, comparison study – during the establishment of causal relationships, data classification and systematization, comparative analysis – when identifying the positive and negative sides of the investigated methods of assessing economic security, abstract-logical analysis – in the process of drawing conclusions.

## 2. Analysis of recent research and publications

Despite the urgency of issues of assessing the economic security of the region, research in this area cannot be considered full, systematic, and complete. And, first of all, this concerns the choice of the method of evaluation, since it is precisely it that forms the basis of the methodology for assessing the economic security of the region with a combination of interrelated methods and techniques of conducting valuation operations. This assessment methodology largely determines the quality of assessments of the regional economic security.

In developing methodological support for assessing the economic security of the region, such methods as indicator (Sukhorukov, 2009; Humeniuk, 2014; Babets, 2013), functional (Sukhorukov & Kharazishvili, 2012), methods of relative tempo indicators (Sukhorukov & Kharazishvili, 2012), economic tools (Sytnyk & Oluiko & Vavrynychuk & Lytvyn, 2007), expert evaluations (Shlemko & Binjko, 1997), optimization (Rozen & Inshekov & Mylnichenko, 2011), scalarization (Mikhalevich, 1989) were used. Each of these methods has advantages and disadvantages, which is why they are often used together.

Currently, in Ukraine there is no uniform methodology for assessing and diagnosing the state of economic security of the region and, accordingly, a generally accepted list of key indicators, their thresholds, algorithm for calculating the level of economic security in the region, which causes a high interest of scientists to study the economic security at the meso-level.

## 3. Results

### 3.1. Systematization of the basic methods for assessing the economic security of the region

In the economic security science of the meso-level, a number of methods for assessing the economic security in the region are developed, analysis and comparison of which indicate their significant differences. The indicator method and the method of functional analysis are the most common in assessing the economic security of the region.

Indicator method is to identify positive trends in the indicators of economic security of regions. The complexity of the assessment is ensured by the use of a system of indicators (quantitative parameters), in which each of the indicators characterizes a certain aspect of the economic security in the region. Indicator method allows comprehensively assessing the economic security of the region, because if not all (depending on the system of indicators), then its main aspects are evaluated. The main methodological difficulties in applying the indicator approach are to determine the type, composition of indicators, their threshold values, depending on the type, level, and initial state of this system.

The functional analysis involves assessing the regional economic security in terms of its components. Economic, financial, investment-innovation, demographic, social, etc. constituents are most often used in assessing the economic security of the region. The main advantages of the functional approach include complex nature since the main processes that affect the level of economic security in the region are studied.

When ordering aggregate units in functional analysis, it is necessary to aggregate all the features of a set into one integral estimate. Aggregation of features is based on the provisions of the theory of “additive value”, according to which the value of the union equals the sum of the values of its components.

In addition, a method for monitoring and analysing the dynamics of the main indicators of economic security in the region has a widespread use in security science since it provides an opportunity to trace the change in time of the main indicators, to compare the characteristics of individual units of groups and aggregates in general, to study the structure of phenomena and laws of their development. However, these methods also have disadvantages associated with the determination of weighting coefficients and the relative change in the importance of the latest in time.

The use of methods of expert assessments (“brainstorming”, Delphi, PATTERN, synectic method, and analogy method) allows calculating the integral index of reliability of the region or risk assessment of the region with the application of logical rules of making decisions, which experts form on the basis of their own knowledge. However, expert methods have

their own disadvantages: difficulties with the search for competent experts, the complexity of the procedure for obtaining reliable information, the lack of guarantees of the reliability of the results in relation to the possible interest of experts in the evaluation results.

Methods of mathematical apparatus, including multivariate statistical analysis (correlation, regression, cointegration, component, factor, cluster, frequency, harmonic, spectral and cross-spectral analysis, time series analysis) allow calculating the dynamics of indicators of economic security in the region, identifying laws of past development, and evaluating the possibility of their transfer to the future. Among these methods, the cluster analysis method to group regions or countries by the level of threats to economic security is most often used (Ponomarenko, Klebanova, Chernova, 2004).

The methodology for determining the level of economic security in Ukraine is the basis for a modified methodology for assessing the economic security of regions. It differs from the methodology used at the macro-level, a list of indicators, which contains indicators of the region's development by life spheres (investment, foreign economic, scientific and technological, production, financial, energy, ecological, social). However, the use of the Methodological Recommendations for calculating the level of economic security of the state at the regional level may prove to be very costly both in terms of costs and time due to a large number of indicators that will slow down the efficiency of the determination of economic security.

The analysis conducted shows that in assessing the economic security of the region, it can find a wide range of methods and approaches that have advantages and disadvantages, which does not allow choosing one of them. A number of methods have theoretical-cognitive value and have not received a practical application, and some of them served as the basis for available methodological developments.

### 3.2. Analysis of methods for assessing the economic security of the region

Currently, in Ukraine there is no uniform methodology for assessing and diagnosing the state of economic security in the region and, accordingly, a generally accepted list of key indicators, their thresholds, algorithm for calculating the level of economic security in the region, which causes a high interest of scientists to study the economic security at the meso-level.

Thus, V. Muntiiian proposed a methodology for assessing the economic security in the region, which is carried out by different spheres of the economy, envisages the calculation of integral indicators and their threshold values for each of them, and is based on methods of expert assessments (Muntiiian, 1999). The latter, actually, holds back the application of the methodology over the complexity of obtaining expert assessments.

The methodology of A. Stepanenko and M. Herasymov involves the definition of an integral indicator of the economic security of the region based on the arithmetic mean values of standardized indicators that are stimulants or destimulants. Calculation of indicators of economic security of the region by this methodology is carried out in stages: standardization of indicators characterizing economic security; definition of the integrated assessment of the region; determination of coefficients of the economic security of the region (Stepanenko & Herasymov, 2002).

The methodology of estimation, analysis, and forecasting of economic security of the region by T. Klebanova and N. Chernova is based on methods of multivariate statistical analysis, econometric modelling, and adaptive filtration (Klebanova, Chernova, 2003). As the normative thresholds, the values of points of the upper (the best value of the indicator from the whole number of regions of Ukraine) and the lower (the worst value of a certain indicator from the whole number of regions of Ukraine) poles are used, which respectively indicate the state of the region by the indicator (safe or dangerous).

In the multi-authored monograph, edited by H. Kozachenko, the socio-economic component of the region's economic security is distinguished, which should be evaluated according to a number of criteria: the economy's ability to sustainably grow, the stability of the financial system of the region, the support of the region's scientific potential, the dependence of the regional economy on imports of the most important types of products, the relationship of the region with the countries of near and far abroad, the level of poverty and unemployment in the region, the quality of life of the population, demographic component (Kozachenko, Ponomarev, Lyashenko, 2003).

Z. Herasymchuk and N. Vavdiuk developed a methodology for the diagnosis of regional economic security that allows grouping regions according to the state of safety, risk, threat or danger depending on the intensity of the influence of negative factors by several features: firmness, stability and development ability, preconditions for autopoiesis, foreign economic openness, protection from potential conflicts (Herasymchuk, Vavdiuk, 2006). When selecting the threshold values of the economic security criteria of the region, the peculiarities of the region's development and the unified threshold values of economic security that have proved their usefulness in the countries of Western Europe are taken into account.

In the estimation of economic security, A. Sukhorukov used optimization models, methods of indicative, discriminant analysis, expert assessments, and scalarisation. He highlighted two theoretically meaningful ways to assess economic security and its components at the regional level:

identifying the probability of occurrence of certain threats and assessing the possibilities of their prevention,

elimination or mitigation, determining the degree of influence of some threats on the economic security of the region based on the k-means iterative method. The aggregate level of economic security in the region is determined using the method of adaptive Kalman-Bucy filter;

calculation of integral indexes – definition of the state of economic security of the region based on the analysis of the system of indicators, which allow holistically and adequately perceiving the nature of socio-economic processes due to their compliance with regional interests and standards of economic security (Sukhorukov, Kharazishvili, 2012).

For each indicator, the threshold, optimal lower and upper values are highlighted using:

modelling (development of macroeconomic models that adequately reflect the influence of internal and external factors in the current period);

analogue approach in choosing relevant indicators in the analogue countries;

legislative approach, which provides for the establishment of thresholds for indicators in the legislative framework;

implementation of experience of other countries;

expert evaluations and calculations by experts of international organizations.

A. Humeniuk developed a methodology for determining the integral indices of the components of economic security of regions based on the results of the vertical (dynamics of the level of security according to the selected components of the economic security of the region) and horizontal (changes in the separate components of regional security) analysis. In the system of economic security of the region, A. Humeniuk highlighted the investment, innovation, financial, foreign trade, food, social, and demographic components.

Comprehensive diagnostics of economic security by A. Humeniuk provides for the assessment of values of the indices in the security corridor. The state of economic security of the region is normal, in which the value of the index of the corresponding type of security is between the lower and upper limits. If the index value is between the upper norm and the upper limit or between the lower norm and the lower limit, then this corresponds to the pre-crisis state of economic security. If the value of the integral index goes beyond the lower or upper limit, this indicates a crisis security condition. The lower and upper limits are defined as the arithmetic mean of underdeveloped and highly developed countries of Central and Eastern Europe. As the value of the lower norm, the average value of the corresponding indicator of underdeveloped countries is taken, and for the upper one – the average indicator of developed countries of Eastern Europe (Humeniuk, 2014).

In order to assess the economic security of the region, I. Babets combined methodological approaches to the assessment of integral indicators of sustainable development with the methodology

for calculating the level of economic security in the region. This approach is based on the interconnection of sustainable development and economic security as socio-economic categories, their interconditionality and interdependence. On the basis of this, I. Babets developed a modified methodology for assessing the economic security of the region, which:

is based on provisions of the methodology for calculating the level of economic security of the state;

contains a list of indices, indicators of the region's development in terms of life spheres (investment, foreign economic, scientific and technological, production, financial, energy, ecological, social).

In addition, it is proposed to be used for replacing absolute indicators with relative indicators in the assessment of economic security in the region and to take into account the possibility of identifying individual indicators based on the existing statistical base in Ukrainian regions. In the normalization of values of actual indicators, the maximum (for the indicator-stimulator of security) or the minimum (for the indicator-destimulator of security) value of the indicator selected by regions of Ukraine for the period under study is used. The integral indicator for each component of the economic security of the region is calculated according to a method similar to the calculations at the state level (the sum of products of normalized values of indicators on their weighting coefficients). Weighting coefficients are determined using the model of the main components of Statistica in the Factor Analysis module, which allowed minimizing the subjectivity of the assessment of economic security (Babets, 2013).

O. Preobrazhenska considered the regional component of economic security in its relation with the concept of sustainable development by such basic components of economic security of regions as investment and financial, and the index of sustainable development of the region calculated in the space of three dimensions (economic, environmental, and social) (Preobrazhenska, 2014).

The basis of the methodology for assessing the regional economic security by A. Tatarkin, O. Romanova, A. Kuklin, and V. Yakovlev are methods of comparative analysis. The advantages of their methodology are:

completeness of coverage of spheres of economic development of the region (the system of indicators of economic security in the region contains indicators of production, scientific and technical potential, food security, employment, living standards, budget and financial security, demographic processes, law and order, and environmental protection);

development of indices for the region's economic security to be considered normal, pre-crisis, and crisis;

ranking of regions according to the type of economic security by providing a score assessment of crisis situations using an expert method (Blagodatskikh & Bogatyrev & Bushuev i dr., 1998).

A. Illarionov developed a methodology for assessing the rate of economic growth of the region by the key macroeconomic indicators and their dynamics (Illarionov, 1998). The most important factor determining the economic and social characteristics of the region is its economic development level determined by the size of the gross regional product per capita. Therefore, various criteria of economic security are reduced to the factors that ensure the rate of economic growth per capita.

When assessing economic security of the region, some authors (K. Efremov, Ye. Georgadze, M. Kremlev, V. Fedorov, M. Sergeev, A. Fedoryshcheva, O. Ralchuk, V. Senchagov, T. Agapova) consider only the thresholds of economic security indicators, refusing to calculate the integral index of economic security in the region, which to some extent makes it impossible to assess its overall condition (Efremov, Georgadze, 2002; Kremlev, Fedorov, Sergeev, 2001; Fedoryshcheva, Ralchuk, 2002; Senchagov, 2002; Agapova, 2001).

V. Senchagov drew attention to the need to select indicators of economic security of the region, taking into account the specifics of the development of the regional system, by distinguishing two groups of indicators: indicators-criteria of economic security and additional analytical-information indicators (Senchagov, 2005).

E. Oleynikov used the classification of indicators of economic security, through which it is possible to analyse threats to economic security at the macro- and meso-levels and in certain sectors of the economy. For economic security, quantitative production indicator indicators were assigned, and partial macro-level indicators adapted to the region were used as social indicators (Oleynikov, Filin, Vidyapin i dr., 2005). However, in this case, the identification of threats to the economic security of the region is complicated by the lack of division of indicators by the main components of economic security.

The analysis of the methodical basis for assessing the economic security of the region revealed the lack of unity of views on the components of economic security and the list of indicators. A characteristic feature of the analysed methods for assessing the economic security of the region is the tendency to evaluate its individual components, rather than obtaining a comprehensive assessment of the region's economic security.

### 3.3. The proposed methodology for assessing the economic security of the region

In Ukraine, there are still no legislative guidelines approved for assessing the economic security of the region, the generally accepted list of key indicators, their thresholds, and the algorithm for calculating the integral index of regional economic security.

Therefore, it is expedient to present the results of the conducted research on the economic security of the region, which to some extent eliminated the noted disadvantages inherent in the analysed developments

in the methodological provision for assessing the economic security of the region.

For the systematic assessment of the regional economic security, a combination of indicator and functional analysis is most appropriate.

The assessment of the economic security of the region using the indicator approach is based on the definition of the system of indicators of economic security of the region and their limit values. The representativeness of the system of indicators, which describes the region's economic security, directly affects the reliability and objectivity of its assessments.

Indicators of economic security of the region are statistical indicators of the region's economy, which most fully characterize its phenomena and trends, describe the current state of the economy of the region in comparison with the previous stages. They consist mainly of normative characteristics and indicators that describe threats to the regional security, are guidelines that determine the boundary of negative processes, signalling the weakening of economic security. Their values warn about possible threats and dangers (Kosevcov, Zinjko, 1996).

The procedure for determining the integrated assessment of the region's economic security is presented in Figure 1.

For an integrated assessment of the level of economic security in the region, we select indicators that fully and comprehensively reflect the level of economic security.

The set of indicators for assessing the economic security of the region is marked as  $X$ . It is divided into subset  $X_i$  according to the content of indicators.

Then the set  $X$  is a union  $X = \bigcup_{i=1}^n X_n$ , where the subsets of  $X_i$  do not intersect in pairs. We denote the number of indicators in the subset  $X_i$  as  $m_i$  and the  $j$ -th indicator in the subset  $X_i$  as  $x_{ij}$ . We have equality  $X = \left\{ \left\{ x_{ij} \right\}_{j=1}^{m_i} \right\}_{i=1}^n$ .

The following indicators are selected for the study.

1) Subset  $X_1$  – financial security indicators:

$x_{11}$  – local budget revenues (in % to GRP),

$x_{12}$  – efficiency of using revenues,

$x_{13}$  – the budget expenditures index (taking into account transfers) per capita,

$x_{14}$  – the ratio of the sum of received transfers to the sum of budget revenues transferred to the state budget,

$x_{15}$  – the ratio of tax and non-tax revenues to the local budget, %,

$x_{16}$  – the share of tax revenues in the total revenues of the local budget, %,

$x_{17}$  – the share of official transfers in the total revenues of the local budget, %,

$x_{18}$  – transfers from the state budget (in % to GRP).

2) Subset  $X_2$  – social security indicators:

$x_{21}$  – the ratio of average wages and subsistence level, times,

$x_{22}$  – the ratio of the average wage in the region and the average wage in the country,

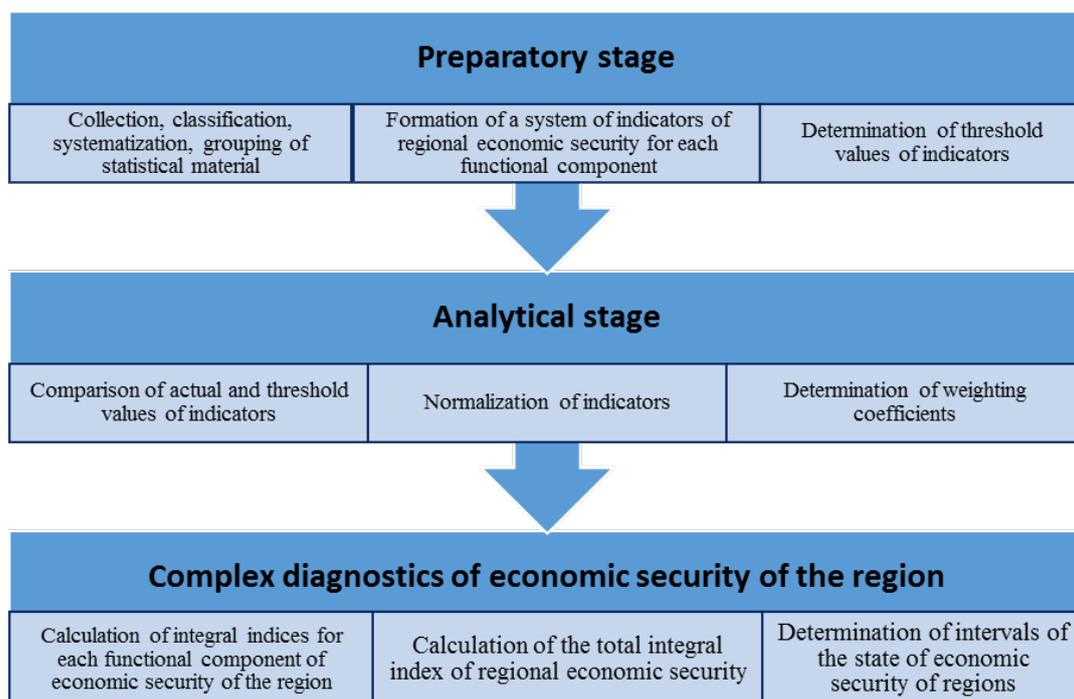


Figure 1. The algorithm of an integrated assessment of the economic security of the region

Source: compiled by the author

$x_{23}$  – the unemployment rate of the able-bodied population (according to the ILO methodology), %,  
 $x_{24}$  – the level of long-term unemployment in an able-bodied age (the ratio of the number of unemployed over six months to the total number of unemployed), %,  
 $x_{25}$  – the share of the population living below the poverty line, or the share of the population with incomes below the subsistence level, %,  
 $x_{26}$  – the share of utility costs in the total household consumption expenditure, %,  
 $x_{27}$  – consolidated budget expenditures on healthcare, % to GRP,  
 $x_{28}$  – consolidated budget expenditures on education, % to GRP.  
 3) Subset  $X_3$  – mesoeconomic security indicators:  
 $x_{31}$  – Gross Regional Product Index,  
 $x_{32}$  – index of GRP per one economically active citizen,  
 $x_{33}$  – the share of the economically active population in the region’s population, %,  
 $x_{34}$  – Industrial Production Index,  
 $x_{35}$  – Agricultural Production Index,  
 $x_{36}$  – Retail Trade Index.  
 4) Subset  $X_4$  – investment-innovative security indicators:  
 $x_{41}$  – capital investments (in % to GRP),  
 $x_{42}$  – foreign direct investments (in % to GRP),  
 $x_{43}$  – the volume of foreign direct investments per one economically active citizen, (at the end of the year), USD,  
 $x_{44}$  – the share of industrial enterprises that introduced innovations in the total number of industrial enterprises, %,  
 $x_{45}$  – the share of innovative products in sold industrial products, %.

5) Subset  $X_5$  – foreign economic security indicators:  
 $x_{51}$  – export-import coverage ratio, times,  
 $x_{52}$  – export dependence ratio (in % to GRP),  
 $x_{53}$  – import dependence ratio (in % to GRP),  
 $x_{54}$  – the share of enterprises engaged in FEA, %.  
 6) Subset  $X_6$  – demographic security indicators:  
 $x_{61}$  – depopulation rate, %,  
 $x_{62}$  – total fertility rate, per mil,  
 $x_{63}$  – total mortality rate, per mil,  
 $x_{64}$  – population migration rate, %.

For the study, the period of duration of T years and several regions were chosen. The value of the  $x_{ij}$  indicator for the p-th region in the t-th year is marked as  $x_{ij}^{pt}$ . All indicators from the X set are divided into two subsets – stimulants (their growth indicates an increase in the level of economic security in the region) and destimulants (their growth indicates a decrease in the level of economic security in the region).

For each  $x_{ij}$  indicator, the threshold value  $\lambda_{ij}$  is defined. For indicators-stimulants, the real value should exceed the corresponding threshold value, and for indicators-destimulants – on the contrary.

For each  $x_{ij}$  indicator, the mean square deviations  $\sigma_{ij}$  are determined by the formula

$$\sigma_{ij} = \sqrt{\frac{\sum_{p=1}^P \sum_{t=1}^T (x_{ij}^{pt} - \bar{x}_{ij})^2}{PT}}$$

where P – the number of regions studied,  
 $\bar{T}$  – duration of the studied period (in years),  
 $\bar{x}_{ij}$  – the average value of  $x_{ij}$  for the studied period in all regions studied.

For each subset  $X_i$ , the vectors  $A_{i1}$ ,  $A_{i2}$  and  $A_{i3}$  are constructed. Dimensions of these vectors are equal to the number of mi indicators in the sets of  $X_i$ . The components of the vector  $A_{i1}$  are the threshold values of  $\lambda_{ij}$  of the set  $X_i$ , the components of the vector  $A_{i2}$  represent the difference  $\lambda_{ij} - \sigma_{ij}$  between the threshold values and the mean square deviations of the indicators, the components of the vector  $A_{i3}$  – the difference  $\lambda_{ij} - 2\sigma_{ij}$  between the threshold values and the doubled mean square deviations of the indicators. These vectors are used to determine the threshold, critical, and satisfactory values of integral estimates.

Denote the components of the vector  $A_{i1}$  through  $x_{ij}^1$ , the vector  $A_{i2}$  – through  $x_{ij}^{20}$ , the vector  $A_{i3}$  through  $x_{ij}^{30}$ . We get equalities  $x_{ij}^1 = \lambda_{ij}$ ,  $x_{ij}^2 = \lambda_{ij} - \sigma_{ij}$ ,  $x_{ij}^3 = \lambda_{ij} - 2\sigma_{ij}$ .

The given values of the indicators are determined by the formula  $x_{ij}^{pt} = \frac{x_{ij}^{pt}}{\lambda_{ij}}$ . A similar transformation is also used for the components of the  $A_{ik}$  vectors, where  $k=1,2,3$ , resulting in vectors:  $\overline{A}_{i1} = (1, 1, \dots, 1)$ ,  $\overline{A}_{i2} = \left(1 - \frac{\sigma_{ij}}{\lambda_{ij}}\right)_{j=1}^m$ ,  $\overline{A}_{i3} = \left(1 - \frac{2\sigma_{ij}}{\lambda_{ij}}\right)_{j=1}^m$ .

For each  $x_{ij}$ , the maximum and minimum values from the set

$$\left\{ \left\{ v_{ij}^{pt} \right\}_t = 1 \right\}^T \cup \left\{ 1; 1 - \frac{\sigma_{ij}}{\lambda_{ij}}; 1 - \frac{2\sigma_{ij}}{\lambda_{ij}} \right\}$$

are defined, that is, from the set of derived values of this indicator, supplemented by the values of components of the vectors  $\overline{A}_{i1}, \overline{A}_{i2}, \overline{A}_{i3}$  corresponding to this indicator. The resulting minimum and maximum values are marked accordingly  $v_{ij}^{max}$  and  $v_{ij}^{min}$ .

Let us turn from the resulted values of indicators to their normalized values. For indicators-stimulants, normalized values are determined by equality

$$w_{ij}^{pt} = \frac{v_{ij}^{pt} - v_{ij}^{min}}{v_{ij}^{max} - v_{ij}^{min}}$$

and for indicators-destimulants – equality

$$w_{ij}^{pt} = \frac{v_{ij}^{max} - v_{ij}^{pt}}{v_{ij}^{max} - v_{ij}^{min}}$$

Similar transformations are performed for components of  $\overline{A}_{i1}, \overline{A}_{i2}, \overline{A}_{i3}$  vectors and  $\overline{A}_{i1}, \overline{A}_{i2}, \overline{A}_{i3}$  vectors are obtained.

Integral assessments of certain types of economic security are obtained by the formula

$$W_i^{pt} = \sum_{j=1}^m a_{ij} w_{ij}^{pt}$$

where  $W_i^{pt}$  – an integrated assessment of the level of the i-th type of security in the p-th region for the t-th year,

$a_{ij}$  – weighting coefficient reflecting the influence of the j-th factor on the integral estimation of the i-th type of economic security.

To determine the coefficients  $a_{ij}$ , a covariance matrix of the parameters included in the set  $X_i$  is determined. The coefficients  $a_{ij}$  are proportional to the squares of components of the eigenvector of this matrix, which corresponds to its maximum eigenvalue.

Threshold, critical, and satisfactory value of the obtained integral estimation are calculated on the basis of coefficients  $a_{ij}$  and components of vectors  $\overline{A}_{i1}, \overline{A}_{i2}, \overline{A}_{i3}$ . The components of the vector  $\overline{A}_{i1}$  are designated as  $\{a_{i1j}\}_{j=1}^m$ , components of the vector  $\overline{A}_{i2}$  as  $\{a_{i2j}\}_{j=1}^m$ , components of the vector  $\overline{A}_{i3}$  as  $\{a_{i3j}\}_{j=1}^m$ . Then the threshold value of the integrated assessment of the economic security of the region is determined by equality  $Q_i = \sum_{j=1}^m a_{ij} a_{i1j}$ , the critical value – by equality  $K_i = \sum_{j=1}^m a_{ij} a_{i2j}$ , satisfactory value – by equality  $G_i = \sum_{j=1}^m a_{ij} a_{i3j}$ . These values divide the interval  $[0; 1]$ , which includes all the values of the integrated assessment of the region's economic security, into the following areas:

- area of the satisfactory state from  $G_i$  to 1;
- area of the unsatisfactory state from  $Q_i$  to  $G_i$ ;
- area of the critical state from  $K_i$  to  $Q_i$ ;
- area of the completely unsatisfactory state from 0 to  $K_i$ .

Having assessed the state of economic security of the region by each functional component, an integrated assessment of the region's economic security is generally determined by the formula

$$W^{pt} = \sum_{i=1}^n \eta_i W_i^{pt}$$

where  $W^{pt}$  – an integrated assessment of the level of economic security in the p-th region for the t-th year,

$W_i^{pt}$  – an integrated assessment of the level of the i-th type of security in the p-th region for the t-th year,

$\eta_i$  – weighting coefficient reflecting the importance of the i-th type of security.

Since the security of all functional components is equally important, the value  $\eta_i = \frac{1}{n}$  is taken for all types. Threshold, critical, and satisfactory values for an integrated assessment of the economic security of regions are as follows:

$$Q = \sum_{i=1}^n \eta_i Q_i, K = \sum_{i=1}^n \eta_i K_i, G = \sum_{i=1}^n \eta_i G_i$$

On the basis of these values, areas of satisfactory, unsatisfactory, critical, and absolutely unsatisfactory state of economic security of the region are identified.

Assessing the economic security of the region using the proposed methodological recommendations allows fully taking into account the impact of threats on the economic security of the region, comprehensively assessing the economic security of the region using a system of indicators. The obtained assessments of the region's economic security are useful for making decisions in order to avoid destructive processes of socio-economic development of regions.

#### 4. Conclusions

The results of the research conducted on the methodological basis for assessing the economic security of the region show that the use of monitoring

and analysis methods of key economic indicators, on the basis of which the integral indicators of components of regional economic security and the overall integral indicator are calculated, allows us to carry out a comprehensive analysis of the current state of economic security, to determine its positive and negative tendencies in general and by separate functional components.

The proposed methodology for assessing the economic security of the region includes the following stages: preparatory, analytical, comprehensive diagnostics of the region's economic security. At the preparatory stage, a selection of indicators is carried out that fully and comprehensively reflect the level of economic security; their division into stimulants (the growth of which increases the level of economic security of the region) and destimulants (the growth of which reduces this level); definition of the threshold value for each indicator.

The analytical stage involves comparing the actual and the threshold values of the indicators, the definition of the adjusted values of the indicators, the choice of the maximum and minimum values from the set of adjusted values obtained, the transition from the adjusted values of the indicators to their normalized values, the calculation of weighting coefficients for each indicator.

At the stage of comprehensive diagnostics of the region's economic security, integrated estimates of individual components of economic security, the integral index of economic security of the region in general, and the intervals of satisfactory, unsatisfactory, critical, and absolutely unsatisfactory state of economic security of the region are calculated.

Further research directions are related to the calculation and analysis of the state of economic security of regions of Ukraine, determination of the degree of influence of threats on the regional economic security, development of a model for ensuring regional development security.

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