Integral assessment of the level of Ukraine's economic security: Modeling and economic analysis

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CHRONICLE	ABSTRACT
	The influence of military-political instability at the state security has special consequences and cannot be ignored. That is why the methods of economic security calculations should be adapted to modern conditions. Significant changes in economic, political, social conditions in Ukraine because of the influence of military events cause the necessity of developing approaches to calculations of economic security level. The article aims at analyzing active methods of calculations of economic security level to adapt their indicators to actual economic circumstances in Ukraine and the world. Indicators of the economic security have been composed of budget, money-credit, foreign exchange, debt, known banking financial market security, banking security. Every component of economic security has factors of war influence, which, as a result, correlates with the integral indicator of economic security. The relevance and indispensability of reinforcement of the economy's competitiveness on security foundations are substantiated. The authors' methods of calculation of an integral indicator of economic security have been suggested. A taxonomic indicator is used to measure the level of security. Conclusions regarding the preconditions, capacity, and availability of tendencies of economic security in regions of the country have been made. Strategic priorities of the state policy for reinforcement of economic security have been substantiated.

1. Introduction

Economic security is the condition of having stable income or other resources to support a standard of living now and in the foreseeable future. It includes continued solvency, predictability of the future cash flow of a person, or other economic entity, such as a country, employment security, or job security. Financial security more often refers to individual and family money management and saving. Economic security tends to include the broader effect of a society's production levels and monetary support for non-working citizens.

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As it has been mentioned in the strategic plans (Europe 2020) as a strategy for smart sustainable and inclusive growth (European Commission, 2019) and the New High-Tech Strategy "Innovations for Germany" (Federal Government, 2014), U.S. National Security Strategy (The White House Washington, 2017), Japan's New Growth Strategy (Ministry of Foreign Affairs of Japan, 2017), the forming of economic security competitive advantages of a country in the modern world becomes an increasingly essential factor of securing the growth of productivity and efficiency of economy and improvement of a country's position in the system of international labor division and the international market. It proves the need for implementation of public policy of support and boosting of innovative technological activity, digitalization, creation, and introduction of advanced technologies, digital production, results of scientific research and intellectual creative activity to secure sustainable competitiveness of national economy (Hrynkevych et al., 2020).

Meanwhile, in the course of forming and further implementation of public policy of maintenance of competitiveness economics, it is necessary to clearly understand its nature, factors, and components. We need to have the modern methods of analysis that can show the comprehensive picture of the condition, level, tendencies, and structural features of maintenance of economic security. Application of integral approaches to analysis that also include the system of indicators across the regions of a country has special importance. It helps to evaluate the condition of economic security, the competitiveness of modern economics, and detect interregional differentiation and misbalances.

In the past ill-considered fiscal, monetary policy, the imperfection of institutional support in the economic sphere, insufficient attention to the development of the potential of renewable energy sources and other priority sectors have led to collapses at the macroeconomic level, which, of course, results in significant financial problems for all businesses - both public and private sectors. These circumstances require an adequate assessment of the current state of economic security based on the actual economic, social, energy, military situation in Ukraine.

2. Literature review

The theoretical and methodological basis of methods for economic security evaluation has been defined by two aspects. The first one comprises intrinsic typological features of economic security that outline the boundaries and directions of further methods of its analysis because they allow for decomposition into internal components and elements. The second one encompasses in economic literature approaches to the analysis of economic development and maintenance of economic security. Regarding the first aspect, today we live in more complex times, nation-states do not only challenge us as strategic competitors. Rogue nations develop weapons of mass destruction even as stateless actors engage in terrorism. We are also in an intense economic competition with nations with whom we trade freely – yet our own free and fair trade often goes unreciprocated. Into this breach President Donald J. Trump comes with a new organizing principle for strategic policy: Economic security is national security (Real Clear Politics, 2018).

Economic security, in the context of politics and international relations, is the ability of a nation-state to follow its choice of policies to develop the national economy in the manner desired. Historically, the conquest of nations has made conquerors rich through plunder, access to new resources, and enlarged trade through controlling of the conquered nations' economy. In today's complex system of international trade, characterized by multi-national agreements, mutual inter-dependence and availability of natural resources etc., economic security today forms, arguably, as important a part of national security as military policy. Economic security has been proposed as a key determinant of international relations, particularly in the geopolitics of petroleum in American foreign policy after September 11, 2001 (Rupert, 2007*).*

In Canada, threats to the country's overall economic security are considered economic espionage, which is "illegal, clandestine or coercive activity by a foreign government in order to gain unauthorized access to economic intelligence, such as proprietary information or technology, for economic advantage" (International Business, 2019).

In Ukraine, the concept of economic security has been transformed, slightly different from that in the developed countries of the world. In particular, the following categories were included in the indicators of economic security by the Methodology for calculating the level of economic security, approved by the order of the Ministry of Economy of Ukraine 02.03.2007 № 60: budget, monetary, currency, debt, insurance, stock, banking. The updated Guidelines for calculating the level of economic security of Ukraine, approved by the order of the Ministry of Economic Development and Trade of Ukraine dated October 29, 2013 № 1277 preserved these groups of indicators, but insurance and stock security are combined in the category "Non-banking financial market security" (Ministry of Economic Development and Trade of Ukraine, 2007, 2013).

Researchers Senchagov (2005), Yatsenko (2008) and Ilyash (2014) allocate banking security in a separate structural element. The Guidelines for calculating the level of economic security of Ukraine considers debt security (protection of domestic and foreign debt) separately. Yatsenko also identifies such a component as foreign economic security, and Senchagov - security of extra-budgetary funds.

In our opinion, banking security is a component of the monetary one. Given the list of banking security indicators (the share of overdue loans in total loans granted by banks to residents of Ukraine, the ratio of bank loans and deposits in foreign currency,

the share of foreign capital in the authorized capital of banks, the ratio of long-term (over 1 year) loans and deposits, return on assets, the ratio of liquid assets to short-term liabilities, the share of assets of the five largest banks in the total assets of the banking system) this component can be fully integrated into monetary security with the subsequent combination of weight coefficients. A debt security, given the current crisis in the economy not only of Ukraine but also of many other countries, becomes especially relevant, which necessitates its allocation as a separate component.

Each component is of great importance and deserves separate research. However, these studies should be conducted systematically, examining the interactions between the components of financial security, as well as between other components of national security. In today's globalized environment, these issues are especially topical and our further research will be aimed at improving the methodology for calculating the level of economic security, taking into account the bioeconomic and food component.

According to researchers Vynnychenko and Esmanov (2014), the assessment of budget security should take into account a number of factors, namely the state of adoption of the state budget, the effectiveness of budget planning, the risks of deviations in the state budget, the impact of crises, etc. Another shortcoming of the domestic Methodology for assessing the level of economic security, scientists believe, is the concentration of indicators of the methodology only at the level of the budget deficit and external borrowings, which are used to service and repay public debt. At the same time, indicators that take into account the amount of revenues and expenditures of the state budget, which are the main components of the country's budget sphere, were not included (Rudyk, 2014).

Dyachek and Legenchuk (2013), Myronchuk and Panochyshyn (2017) note that the most significant shortcoming in the method of assessing the level of financial security is the neglect of such an important component as tax security. These researchers offer different sets of indicators to assess this component of financial security, including the ratio of tax revenues to the consolidated budget; the ratio of tax revenues to real and nominal GDP; the ratio of direct and indirect taxes; the ratio of indirect taxes to the level of consumer prices; tax debt indicator; tax rate indicator; the ratio of VAT to tax revenues; the level of concentration of tax revenues in state budget revenues, the level of taxation on the economy of the country, the level of concentration of tax revenues from foreign trade in state budget revenues, the level of tax debt of taxpayers, the level of tax burden, etc. (Dyachek & Legenchuk, 2013). This point of view of the authors can be fully justified by the fact that tax policy, along with budget (public expenditure policy) is a component of fiscal macroeconomic policy. Therefore, ignoring the impact of tax instruments in some way distorts the value of the final indicator of economic security.

Another problem considered by many domestic scholars is ignoring the factor of the financial condition of households (Rudyk, 2014; Mykytyn et al., 2017; Kramarenko et al., 2020; Andrusiv et al., 2020), referring to the fact that foreign authors, in particular American (Edsand, 2019), consider financial security as a sufficient amount of funds in citizens and households, which allows them to meet their needs as much as possible. This is why the stable functioning of the country's economic system is ensured (Ilyash et al., 2018; Melnyk et al., 2017; Akimova et al., 2017; Vasyltsiv et al., 2020). Agreeing with this view of the authors, however, we think that the financial security of the state at the macroeconomic level should take into account the security of micro-entities, such as households. Scientists (Vivchar et al., 2019) found that the riskiest components of an industrial enterprise financial security are investment and credit. The security of private businesses and public sector entities should also be considered. This approach is essentially hierarchical, while the allocation of such types of security as budget, currency, monetary, etc. is carried out on the essence of economic phenomena.

Myronchuk and Panochyshyn note that when assessing the level of security of the stock market in these guidelines, only two indicators are used - the level of capitalization of listed companies to GDP and the level of volatility of the PFTS index. Additional indicators of stock market security may be the capitalization of listed companies, the share of trading in the unorganized market in total securities trading, the share of domestic government bonds (OVDPs) in the amount of government debt on securities, OVDPs yield, the ratio of OVDPs yield to growth rates of GDP, etc. (Myronchuk & Panochyshyn, 2017).

Khasanov and Korableva (2019) consider the practical possibilities of using the economic security index to solve management problems in the regions and related tasks, such as to assess the actions of regional authorities. Under the economic security of the region, the authors understand the integral characteristics of its economy, which reflects the level of its protection from development threats and takes into account the impact of social and financial factors. It is proposed to use the method of formation and evaluation of the integrated indicator of economic security as a key tool of regional governance, including as a method of assessing the quality of management, the consequences of decisions.

Recently, scientists have paid special attention to the study of such a component of economic security as energy security. A review of the literature shows that research has focused on expanding energy security, focusing on dimensions such as environmental sustainability and energy efficiency (Ang et al., 2015). Significant differences between studies are observed in the method of forming energy security indicators. Some aspects of energy security were considered in a study on energy production from biomass in Ukraine (Panukhnyk et al., 2019, 2020).

In the current military-political situation in Ukraine, the economic instability caused by the COVID-19 virus pandemic, it is appropriate to adapt this methodology for identifying weaknesses in economic security in general and financial security in particular, which occur in connection with military events. Each component of economic security must take into account the above factors, which in one way or another will eventually adjust the integrated indicator. Along with military security, the problem of energy, food and economic security of Ukraine is important, as they are crucial in the context of overcoming the risks faced by our country in modern conditions (Popadynets & Maksymiv, 2016; Wisz et al., 2018; Stehnei et al., 2019, 2020).

Therefore, currently there is a considerable and diversified basis of methodical approaches and methods of evaluation of economic security and its components. However, most of them provide the external comparison of countries by certain components of competitive advantages, opportunities, and development. There are also the methods of internal (within the economy of a certain country, region, companies) analysis, although they do not fully correspond to the nature of the evaluation of economic security and its competitiveness because they take into account other aspects. It is also reasonable to develop further the methods in terms of decomposition into separate components (GDP per capita, the volume of sold industrial products, foreign direct investment in the economy of Ukraine, the ratio of imports to exports, the average life expectancy at birth, inflation index, unemployment rate, energy intensity of gross domestic product, food consumption in households of Ukraine) with their further more profound analysis.

Many of the suggested approaches have some weaknesses related to omission of the weight of researched indicators in forming an integral index or to taking into account only the multivariate average values. Moreover, permanent technological dynamism and global impact of leading technologies on the development of national and regional economies stipulate the need for occasional adjustment of scientific methods by the change of the list of estimated indicators, increasing the reliability of data sources, providing of complete primary information and improvement of an algorithm of outcome indicator's calculation.

3. Materials and Methods

The authors' methods stipulate the calculation of an integral index of economic security (on the example of Ukraine). The methods consist of seven stages:

1) forming of indicators of economics security across Ukraine in the defined period (11 years – from 2009 till 2018) by two groups:

- group 1 – stimulant indicators: GDP per capita, the volume of sold industrial products, foreign direct investment in the economy of Ukraine, the ratio of imports to exports, the average life expectancy at birth;

- group 2 – indicators of disincentives: inflation index, unemployment rate, the energy intensity of gross domestic product, food consumption in households of Ukraine;

2) normalization of indicators;

3) determining indicators' weight in the group;

4) calculation of weighted indices of the groups of indicators;

5) determining a weight for each group of indicators;

6) calculation of integral indices by competitiveness groups;

7) construction of the integral index.

In this study a taxonomic indicator was used to measure the level of economic security. The taxonomic indicator is a synthetic measure that takes into account the influence of the values of the indicators on the level of development of the studied object, and the indicators are ordered by distance to some artificially constructed point called the development standard (Day, 1955).

The taxonomic analysis is based on the formation of a matrix of observations X of dimension $m \times n$ (where m is the number of periods, n is the number of features), which contains the most complete description of the studied object:

$$X = \begin{pmatrix} x_{11} & \cdots & x_{1j} & \cdots & x_{1n} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ x_{i1} & \cdots & x_{ij} & \cdots & x_{in} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ x_{m1} & \cdots & x_{mj} & \cdots & x_{mn} \end{pmatrix}$$

where i is a serial number of the period (i=1,…, m);

j is an indicator that characterizes the state of the studied object (j=1,…, n);

x_{ij} is a value j's indicator for i's period.

Assessment of the level of Ukraine's economic security is carried out by analyzing the existing system of indicators following the main areas of economic security: macroeconomic, industrial, financial, investment, foreign economic, social, demographic, energy, food.

The distance between the standardized values of indicators of Ukraine's economic security in certain years and the vector of the standard is calculated by the formula:

$$C_{i0} = \sqrt{\sum_{j=1}^{n}(z_{ij} - z_{0j})^2} \tag{1}$$

where C_{i0} is the distance between the standardized values of the indicators of Ukraine's economic security and the vector of the standard;

z_{ij} is a standardized value x_{ij} of economic security indicator;

z_{0j} is a standardized value i-s indicator in the standard;

 i is a serial number of the year of study;

j is a serial number of the indicator.

The average distance between the standardized values of the indicators and the vector of the standard is calculated by the formula:

$$\overline{C_0} = \sum_{i=1}^{m} C_{i0} \tag{2}$$

While the distance between the standardized values of economic security indicators and the vector of the standard is calculated for each year separately, the value of the average distance between the standardized values of indicators and the vector of the standard will be the same for 12 years. The total distance between the indicators and the standard is calculated by the following formula:

$$C_0 = \overline{C_0} + 2\sqrt{\frac{1}{m}\sum_{i=1}^{m}(C_{i0} - \overline{C_0})^2} \tag{3}$$

The obtained distances serve as a basis for calculating the level of economic security of Ukraine.

Deviation of indicators of i-th year from the standard is calculated by the formula:

$$d_i = \frac{C_{i0}}{C_0}$$
(4)

and the indicator of the security level is found by the formula:

$$K_i = 1 - d_i$$
(5)

4. Results and discussion

Based on the suggested methods the average values of integral indices of economic security in Ukraine are identified. The values of indicators of Ukraine's economic security for the studied period (2008-2019) are the elements of the matrix of observations, given in table 1. According to the analysis, there was an increase in all indicators in absolute terms, which is mainly due to inflation. However, in relative terms, the main indicators of economic security have increased. In particular, the size of GDP per capita increased almost fivefold, the volume of sold industrial products tripled, the volume of food consumption in households of Ukraine (per month per person) in % of total expenditures increased 1.5 times. Other indicators of economic security have undergone less significant transformations. In particular, the unemployment index increased by 2.6%, the import-export coverage ratio increased slightly (from 0.86 in 2008 to 0.91 in 2019), and indicators such as the inflation index and the energy intensity of gross domestic product decreased slightly. We should mention that in dollar terms, the volume of foreign direct investment in Ukraine's economy in 2019 remained at almost the same level as recorded in 2008 (29.5 and 32.9 trillion dollars, respectively). It reveals the caution of investors to invest in Ukraine's economy due to insufficient security and reliability.

Table 1
The main indicators characterizing the economic security of Ukraine

Indicators of economic security	Years											
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
GDP per capita, UAH	20502.8	19836.3	23603.6	28813.9	30912.5	31988.7	35834.0	46210.2	55853.5	70224.3	84192	96 346
Volume of sold industrial products, billion UAH	804.6	852.9	1065.8	1331.9	1400.7	1354.1	1428.8	1776.6	2158.0	2625.9	3018.1	2480.3
Inflation index (up to the previous year),%	122	112	109	105	100	101	125	143	112.4	113.7	109.8	104.1
Foreign direct investment in the economy of Ukraine, billion dollars USA	29542.7	35616.4	40053.0	44806.0	46293.5	53178.1	53704.0	38356.8	32122.5	31230.3	31606.4	32905.1
Coefficient of import coverage by export	0.86	0.97	0.95	0.93	0.90	0.90	1.05	1.09	1.01	0.95	0.90	0.91
Unemployment rate,%	6.9	9.6	8.9	8.7	8.2	7.8	9.7	9.5	9.7	9.9	9.1	9.5
Average life expectancy at birth	68.3	69.3	70.4	71.1	71.2	71.4	71. 4	71.38	71.7	71. 9	71.8	71.6
Energy intensity of gross domestic product toe/ thousand international dollars	0.205	0.196	0.206	0.200	0.192	0.183	0.173	0.159	0.158	0.149	0.148	0.147
Consumption of food in households of Ukraine (per month per person),% of total expenditures	48.9	50	51.6	50.1	53.9	50.1	51.9	62.5	64.9	60.4	68.6	63.4

Source: own research

Based on the nature of the impact of indicators on the level of Ukraine's economic security, the authors differentiated them into stimulants and disincentives. Stimulants have a positive impact on the integrated indicator of economic security; disincentives negatively affect it. According to the study, most indicators have a positive impact on economic security, in particular, GDP per capita, industrial output, foreign direct investment in Ukraine's economy, the rate of import coverage by exports, life expectancy at birth. Disincentives are inflation index, unemployment rate, the energy intensity of gross domestic product, food consumption in households in Ukraine. Given the different dimensions of indicators and the need to ensure their comparability, the authors standardized the values of indicators according to the following formulas (6) and (7).

For indicators-stimulants:

$$z_{ij} = \frac{x_{ij} - \bar{x}_j}{\sigma_j} \tag{6}$$

For indicators-disincentives:

$$z_{ij} = \frac{\bar{x}_j - x_{ij}}{\sigma_j} \tag{7}$$

where z_{ij} is a standardized value of x_{ij} indicator;

$\bar{x}_j$ is an average value of j-s indicator;

σ_j is a standard deviation of j-s indicator

As a result of the standardization of indicator values, the authors formed a matrix Z of standardized values of indicators of Ukraine's economic security.

$$Z = \begin{pmatrix}
-1.01 & -1.03 & -0.88 & -0.67 & -0.58 & -0.54 & -0.39 & 0.03 & 0.42 & 1.01 & 1.57 & 2.06 \\
-1.28 & -1.21 & -0.9 & -0.52 & -0.42 & -0.49 & -0.38 & 0.12 & 0.67 & 1.35 & 1.92 & 1.14 \\
-0.77 & 0.09 & 0.35 & 0.7 & 1.13 & 1.04 & -1.03 & -2.58 & 0.06 & -0.05 & 0.28 & 0.78 \\
-1.17 & -0.43 & 0.11 & 0.69 & 0.88 & 1.72 & 1.78 & -0.09 & -0.85 & -0.96 & -0.92 & -0.76 \\
-1.4 & 0.28 & -0.03 & -0.33 & -0.79 & -0.79 & 1.51 & 2.12 & 0.89 & -0.03 & -0.79 & -0.64 \\
2.35 & -0.73 & 0.07 & 0.29 & 0.86 & 1.32 & -0.85 & -0.62 & -0.85 & -1.07 & -0.16 & -0.62 \\
-2.52 & -1.57 & -0.53 & 0.14 & 0.23 & 0.42 & 0.42 & 0.4 & 0.71 & 0.89 & 0.8 & 0.61 \\
-1.28 & -0.88 & -1.33 & -1.06 & -0.7 & -0.3 & 0.15 & 0.78 & 0.82 & 1.22 & 1.27 & 1.31 \\
1.1 & 0.94 & 0.7 & 0.92 & 0.36 & 0.92 & 0.66 & -0.91 & -1.26 & -0.6 & -1.81 & -1.04
\end{pmatrix}$$

Formation of the vector of the standard $P_0 = (z_{01}, \cdots, z_{0n})$ is carried out by selecting from the columns of the matrix Z the maximum value for indicators-stimulators and the minimum for indicators- disincentives.

$P_0 = (2.06, 1.92, -2.58, 1.78, 2.12, -1.07, 0.89, -1.33, -1.81)$. Determination of the taxonomic indicator of the level of Ukraine's economic security is performed by calculating additional indicators, such as the distance between observations and the reference vector, the average and maximum distances of deviations from the standard, the level of danger. The results of the calculation are presented in table 2.

Table 2
The results of the calculation of the taxonomic indicator of the level of Ukraine's economic security

Indicator	Years											
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
The distance between the standardized values of the indicators and the vector of the standard, C_{i0}	8.71	6,98	6,50	6,43	6,70	6,98	4,75	4,06	4,96	5,28	5,64	5,81
The average distance between the standardized values of the indicators and the vector of the standard, $\bar{C}_0$						6.07						
The total distance between the indicators and the standard, C_0						10.24						
Deviation of indicators of i -th year from the standard, d_i						0.85						
Security level indicator, K_i						0.15						

Source: calculated by Statistical Yearbook, 2018

The taxonomic indicator of the level of security calculated in this way synthetically characterizes the changes in the value of the features of the studied indicators of Ukraine's economic security. Its most important advantage is that the taxonomic indicator is one integral feature showing the direction and scale of changes in the processes described by the set of output data.

The taxonomic indicator of the level of economic security comprehensively characterizes the impact of changes in the values of indicators on the overall state of Ukraine's economic security. The values of the security level indicators are in the range from 0 to 1. Therefore, the division of states within the range of values is proposed to be carried out based on the golden ratio method. Its essence is to divide the studied segment into two unequal parts so that the ratio of the length of the entire segment to the length of the larger part is equal to the ratio of the length of the larger segment to the length of the smaller segment (Matthews, Fink, 2001). By placing the obtained points in the range of values of the indicator of the level of economic security, we obtained a scale for determining the security status of five intervals, each of which characterizes a certain security status (Table 3).

Table 3
Scale for determining the state of economic security

Intervals of values of security level indicators	Security status
0.855−1	Secure
0.619−0.854	Unstable
0.383 − 0.618	Crisis
0.147 - 0.382	Critical
0−0.146	Dangerous

Source: own research

The use of the proposed scale allows economic interpretation of the results of the calculation of the level of Ukraine's economic security. It enables to compare the results of state regulation of economic security in the dynamics. At the same time, the main purpose of the security status scale is the ability to make decisions on the application of regulatory actions in cases where the current security status does not meet the optimal level defined in the relevant strategies or management programs.

For clarity, a graph of the dynamics of change in the level of economic security of Ukraine is presented in Fig.1. According to the study, the level of economic security was unstable during the analyzed periods and ranged from 0.15 to 0.6. The lowest value (0.15) was observed in 2008, and the highest (0.6) in 2015. The highest values of the integrated indicator of economic security of Ukraine were observed in 2014 (0.54), 2015 (0.6) and 2016 (0.52), and the lowest in 2008 (0.15), 0.32 in 2009 and 2013, and in 2012 its value was 0.35.
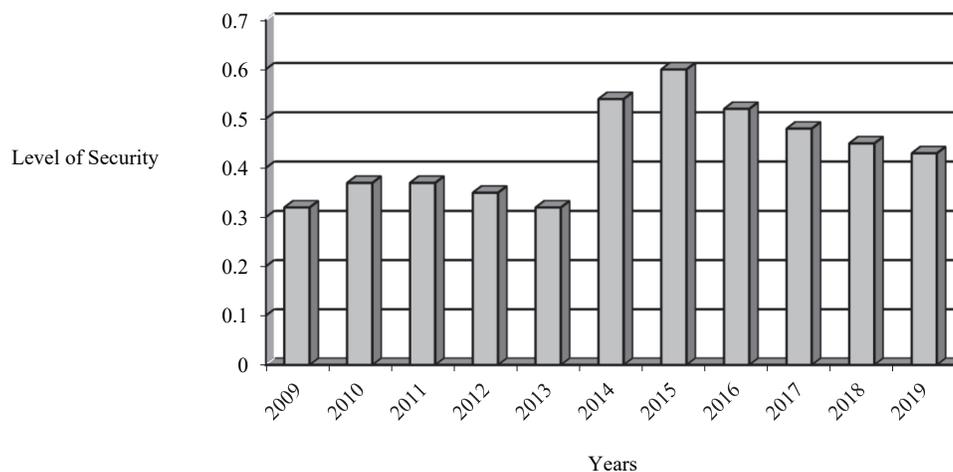

Fig. 1. Dynamics of change of the integrated indicator of the level of Ukraine's economic security for the period 2008-2019

Source: own research

Analyzing the calculated values of the indicator of the level of Ukraine's economic security and identifying the corresponding security status, we see that during the twelve-year study period (2008-2019) the country has not achieved a secure state of economic security. During 2008-2015 the level of economic security of Ukraine was characterized mainly by increasing dynamics, which allowed Ukraine's economic security to overcome the critical state in which it was during 2008-2013, and to achieve a state of crisis. During 2016-2019, the indicator of the level of economic security was characterized by declining dynamics, which did not allow to achieve an unstable state, but continued the crisis of economic security of Ukraine. Achieving a secure state of economic security of Ukraine is possible only if the growth of indicators characterizing each of the areas of economic security is provided by comprehensive state regulatory mechanisms. Creation of new facilities for high technology production, boosting innovative activity in basic economy sectors, development of bioeconomy, introduction of the concept of circular economy in all spheres of society, the establishment of export-oriented technology-intensive domestic production,

creation and expansion of the activity volumes of integrated trade-production and scientific-technological systems are the most important issues for strengthening Ukrainian economics and economic security.

5. Conclusion

Based on the suggested analysis, methods for the integral indicators of economic security across Ukraine have been evaluated. The paper determines the average and low values of integral index peculiar to the country, boosting the need to improve state policy of maintaining the reinforcement of national economic security and economy's competitiveness. Now, under the conditions of war and economic and social losses from Covid-19, innovative technological modernization of existing and forming new industries of the real economy sector (e.g. bioeconomy) as the basis of national economy competitiveness should become the strategic goal of state policy. Implementation of state policy is secured by the formed basic conditions and their harmonization with further strategic priorities, as it works in European Union Countries: the creation of new products in technology-intensive industries with available resources capacity; an increase of the share of production based on the use of technologies of the fifth and sixth technological modes; an increase of the share of industrial production in basic economic sectors due to creation of new products with technological innovations; an increase of the share of industrial enterprises that introduce innovative products and technologies; an increase of the volumes and share of production and realization of innovative products (services); increase of export of technology-intensive products; an increase of the number of integrated entities that produce and sell technology-intensive products (services) with the participation of industrial enterprises and entities of IT, innovation, investment, and R&D sectors.

It is proposed to supplement the Methodology for calculating the level of economic security of the state with indicators formed based on factors influencing military security with certain critical values. This is especially true in modern conditions for Ukraine when the aggressor country is identified. For preventive purposes, it would be appropriate to take into account such factors for other countries with which the closest economic ties can be traced to identify possible threatening economic dependence.

References

Akimova, L., Yakymchuk, & A., Simchuk, T. (2017). Applied project approach in national economy: Practical asects. *Scientific Bulletin of Polissia*, 2(10-2), 170-177. https://doi.org/10.25140/2410-9576-2017-2-2(10)-170-177

Ang, B. W., Choong, W. L., & Ng, T. S. (2015). Energy security: Definitions, dimensions and indexes. *Renewable and Sustainable Energy Reviews, 42,* 1077-1093 https://doi.org/10.1016/j.rser.2014.10.064

Andrusiv, U., Kinash, I., Cherchata, A., Polyanska, A., Dzoba, O., Tarasova, T., & Lysak, H. (2020). Experience and prospects of innovation development venture capital financing. *Management Science Letters*, *10*(4), 781-788. https://doi.org/10.5267/j.msl.2019.10.019

Day, A.C.L. (1955) The taxonomic approach to the study of economic policies. *The American Economic Review, 45,* 64-78. Retrieved from https://www.jstor.org/pss/1811583

Dyachek, S. M., & Legenchuk Yu. O. (2013). Otsinka rivnya finansovoyi bezpeky derzhavy: problemy ta shlyakhy vyrishennya [Assessment of the level of financial security of the state: problems and solutions]. *Bulletin of ZhSTU, 2*(64), 219-226.

Edsand, H.-E. (2019). Technological innovation system and the wider context: A framework for developing countries. *Technology in Society*, *58*, 101–115. https://doi.org/10.1016/j.techsoc.2019.101150

European Commission. (2019). Europe 2020. A strategy for smart sustainable and inclusive growth. Retrieved from https://www.//ec.europa.eu/europe2020/index_en.htm

Hrynkevych, O., Sorochak, O., Panukhnyk, O., Popadynets, N., Bilyk, R., Khymych, I., & Yazina, V. (2020). Competitiveness of higher education system as a sector of economy: conceptual model of analysis with application to Ukraine. In: Ahram T. (eds) Advances in Intelligent Systems and Computing HSI 2020, AISC 1131, pp. 439-445. https://doi.org/10.1007/978-3-030-39512-4_69

Ilyash, O. (2014) The principles of State Regulation in the Sphere of Socio-economic Security of Ukraine. *Economic annals – XXI, 7-8(1),* 24-28.

Ilyash, O., Dzhadan, I., & Ostasz, G. (2018). The influence of the industry's innovation activities indices on the industrial products' revenue of Ukraine. *Economics and Sociology*, *11*(4), 317–331. https://doi.org/10.14254/2071-789X.2018/11-4/21

International Business. (2019). Publications Global National Security and Intelligence Agencies Handbook Volume 1. Inc., 6 edition.

Khasanov, R. Kh., & Korableva, A. A. (2019). Economic security index as a tool to assess the development of agroindustrial regions. *Economic Policy, 14*(6), 82-101 https://doi.org/10.18288/1994-5124-2019-6-82-101

Kramarenko, I., Irtyshcheva, I., Shults, S., Stegney, M., Blishchuk, K., Boiko, Y., Popadynets, N., Samotiy, N., Rogatina, L., & Hryshyna, N. (2020). The model of economic system management for the Black Sea region of Ukraine in the sustainable development context. *Accounting, 6(4), 387–394.* http://doi.org/10.5267/j.ac.2020.5.003

Matthews, J. G., & Fink, K. D. (2001). Numerical methods. Using MATLAB. 3rd edition. SPb. Williams.

Melnyk, M., Korcelli-Olejniczak, E., Chorna, N., & Popadynets, N. (2018). Development of Regional IT clusters in Ukraine: institutional and investment dimensions. *Economic Annals-XXI, 173*(9-10), 19-25. https://doi.org/10.21003/ea.V173-03

Ministry of Foreign Affairs of Japan. (2017). Growth Strategy Japan. Retrieved from https://www.mofa.go.jp/files/000272312.pdf

Ministry of Economic Development and Trade of Ukraine. (2007). Pro zatverdzhennya Metodyky rozrakhunku rivnya ekonomichnoyi bezpeky Ukrayiny [On approval of the Methodology for calculating the level of economic security]. Retrieved from http://search.ligazakon.ua/l_doc2.nsf/link1/ME07222.html

Ministry of Economic Development and Trade of Ukraine. (2013). Pro zatverdzhennya Metodychnykh rekomendatsiy shchodo rozrakhunku rivnya ekonomichnoyi bezpeky Ukrayiny [On approval of Methodical recommendations for calculating the level of economic security of Ukraine]. Retrieved from https://ips.ligazakon.net/document/ME131588

Mykytyn, T., Yakymchuk, A., & Valyukh, A. (2017). Management of Protected Areas of Ukraine's Polissia: International Experience. *Problems and Perspectives in Management. 15(*1), 183-190. https://doi.org/10.21511/ppm.15(1-1).2017.05

Myronchuk, V.M., & Panochyshyn Yu. M. (2017). Otsinka rivnya finansovoyi bezpeky v Ukrayini [Estimation of the level of financial security in Ukraine] *Scientific Journal of Uzhhorod National University: Series: International Economic Relations and World Economy, 13*(2), 31-34.

Panukhnyk, O., Popadynets, N., & Fedotova, Y. (2019). Analysis and modeling of factor determinants of food provision at consumer market of Ukraine. *Global Journal of Environmental Science Management, 5(SI):* 215-226. https://doi.org/10.22034/GJESM.2019.05.SI.24

Panukhnyk, O., Yakubiv, V., Shults, S., Maksymiv, Y., Hryhoruk, I., Popadynets, N., Bilyk, R., Fedotova, Y., & Bilyk, I. (2020) Application of Economic and Legal Instruments at the Stage of Transition to Bioeconomy. In: Ahram T. (eds) Advances in Artificial Intelligence, Software and Systems Engineering. AHFE 2019. *Advances in Intelligent Systems and Computing, 965*, 656-666 Springer, Cham. https://doi.org/10.1007/978-3-030-20454-9_64

Popadynets, N., & Maksymiv, Yu. (2016) Development of the market of solid biofuel in Ukraine under current conditions. *Economic Annals-XXI, 159*(5-6), 93-96.

Real Clear Politics. (2018). Why Economic Security Is National Security. Retrieved from https://www.realclearpolitics.com/articles/2018/12/09/why_economic_security_is_national_security_138875.html.

Rudyk, N. V. (2014). Finansova bezpeka v systemi upravlinnya derzhavnymy finansamy [Financial security in the system of public finance management]. *Scientific Bulletin of Kherson State University, 5*, 128-133.

Rupert, M. (2007). *International Relations Theory.* Oxford: Oxford University Press.

Senchagova, V.K. (Ed) (2005) Ekonomicheskaya bezopasnost' Rossii [Russia's economic security]. Moskva: Dyelo.

Stehnei, M., Irtyshcheva, I., Boiko, Y., & Khaustova, K. (2019). Strategic Priorities and Effectiveness of the Implementation of the State Policy for Sustainable Agricultural Development in Ukraine. *Public Policy and Administration*, *18*(2), 194-208. https://doi.org/10.13165/VPA-19-18-2-02

Stehnei, M., Irtyshcheva, I., Popadynets, N., Danylo, S., Rogatina, L., Bogatyrev, K., Boiko, Y., Hryshyna, N., Ishchenko, O., Voit, O. (2020). Business process management in the food industry under the conditions of economic transformations. *Management Science Letters, 10*(14), 3243-3252. doi: 10.5267/j.msl.2020.6.014

The White House Washington. (2017). National Security Strategy of the United States of America. Retrieved from https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905-2.pdf

Vasyltsiv, T., Irtyshcheva, I., Lupak, R., Popadynets, N., Shyshkova, Y., Boiko, Y., & Ishchenko, O. (2020) Economy's Innovative Technological Competitiveness: Decomposition, Methodics of Analysis and Priorities of Public Policy. *Management Science Letters, 10*(13), 3173–3182. https://doi.org/10.5267/j.msl.2020.5.004

Vivchar, O., Krzywkowska, J., Mykhailyshyn, L., Kohut-ferens, O. (2019). Information-analytical provision of financial security of industrial enterprises: determinants, evaluation of indicators and mechanisms of strength. *Journal of Vasyl Stefanyk Precarpathian National University*, *6*(3-4), 55-66. https://doi.org/10.15330/jpnu.6.3-4.55-66

Vynnychenko, N. V., & Esmanov, O. M. (2014). Otsinka stanu finansovoyi bezpeky v Ukrayini [Assessment of the state of financial security in Ukraine]. *Economic annals – XXI, 3-4* (2), 47-51.

Wisz, G., Nykyruy, L., Yakubiv, V., Hryhoruk, I., Yavorsky, R. (2018). Impact of Advanced Research on Development of Renewable Energy Policy: Case of Ukraine. *International Journal of Renewable Energy Research, 8*(4), Retrieved from https://www.ijrer.org/ijrer/index.php/ijrer/article/view/8688

Yatsenko, N. M. (2008). Ponyattya ta struktura finansovoyi bezpeky [The concept and structure of financial security]. *Economic space*, *12*, 170-174.