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Ontology of the Military Component of the Economic Security System of Ukraine

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Abstract. Given the changes in the resolution of global problems and conflicts, as well as the current geopolitical landscape, it is imperative for state leaders to reassess the importance of developing long-term economic sectors as components of the state's economic security. This is due to the shift from non-military means of resolving conflicts between countries to reliance on military measures. The temporary occupation of part of the territory of Ukraine and the resulting armed conflict necessitates a review and clarification of the military-economic component as an element of the state's economic security.

The article provides an analysis of different views on the components of the state's economic security. Having studied the use of mathematical methods in determining the level of economic security in Ukraine, the authors analyse the chronological changes in the results and identify differences in experts' opinions on its components. According to the current needs, the authors

determine the weight of each component in the aggregate, thus highlighting the military-economic aspect as the most important element of economic security in the legislation. In order to substantiate the importance of the military component in the system of economic security of the state, the authors propose to compare the coefficients of variation (a relative indicator characterising the variability of a feature), correlation (a measure of the relationship between two variables) and stability of the relationship.

By applying these coefficients, it became possible to determine the weight of individual elements in their aggregate, based on the nature of their impact on fluctuations in the level of economic stability in Ukraine, as outlined by the current methodologies used to calculate it. This method makes it possible to strengthen the identification of problems arising at the stages of medium- and long-term planning of priority sectors of the economy, while considering the relevance of the components of the economic security of the State.

Keywords: military security, economic security, weighting coefficient, stability of communication.

Introduction

The first attempts to develop a well-structured framework for calculating economic security in Ukraine date back to twenty years ago. Over the course of these two decades, a number of publications have been produced on the topic, most notably: Economic Security of Ukraine in the Context of Globalization and the Development of Crisis Processes in the World Economy, a publication containing methodological guidelines included in the list of scientific projects of the National Security and Defense Council of Ukraine for 2001-2008 (Methodological guidelines for calculating the level of economic security of Ukraine (2003) and methodology for calculating the level of economic security of Ukraine (2007)). These publications outline the basic principles of assessing the level of economic security, identify patterns and trends in the factors affecting it, and analyze the state of its various components. Drawing on a solid theoretical background and a significant amount of collected information, the researchers behind these publications selected the most applicable metrics, categorized them by individual components, developed a methodology for calculating both actual and threshold values, and conducted comprehensive annual assessments of Ukraine's economic security in recent years.

The Ministry for Development of Economy and Trade (On the The Ministry for Development of Economy and Trade (2013)) and the State Statistics Service of Ukraine have started to develop a comprehensive system for assessing the level of the economic stability of the country and its regions. Although the 2007 Methodology, also known as Order No. 60, had its merits, such as setting thresholds and using a formalized mathematical method to determine weighting coefficients, it also had its limitations. One of the drawbacks was the inability to compare integral indicators and thresholds on a single scale to assess the state of economic equilibrium. This data is crucial for the development of remedial measures. Determined to tackle these issues, the National Institute for Strategic Studies (NISS) has provided an analytical note that addresses the shortcomings of these methods (On Improving the Methodology of Integrated Assessment of the Level of Economic Security of Ukraine. Analytical Note. (2013)).

In 2013, the Ministry for Development of Economy and Trade of Ukraine declared the previous Methodology invalid and replaced it with new non-binding Methodological Recommendations under Order No. 1277 (On Approval of Methodological Recommendations for Calculating the Level of Economic Security of Ukraine (2013)). In December 2014, the National Institute for Strategic Studies proposed an improved methodology for assessing the level of economic security of Ukraine. This new and improved methodology envisaged the use of a multiplicative integral index, methods for

normalizing indicators, justification of thresholds, and weighting coefficients (On Improving the Methodology for Integral Assessment of the Level of Economic Security, 2014).

Voloshchuk (2017) tried to improve Order No. 60 using different scientific and methodological approaches to analyze the economic situation in Ukraine. The researcher noted that both national (On Approval of the Methodology for Calculating Integral Regional Indices of Economic Development (2003)) and foreign scholars often use advanced mathematical tools such as fuzzy set theory, linguistic variables, intersecting plane methods, discriminant analysis, and odd set theory to establish weighting coefficients for individual components of economic security. Two methods were proposed to improve the scientific and methodological approaches to determining the weighting coefficients of individual components of the State Budget expenditures.

One of the advantages of these methods is that they rely on weighting coefficients rather than calculated values, as well as macroeconomic and financial indicators that reflect the current state of the economy. One of the aforementioned methods involves analyzing the breakdown of the state budget expenditures, while the other - analyzing the breakdown of gross value added. This analysis allowed to identify the integral components of Ukraine's economic security. Ukrainian academics, like Dovhenko (2022), Karpenko (2023), and Podmazko (2023) also devoted a lot of attention to studying the distinction between the components of military and economic security and exploring the development of the economy in the face of modern challenges. At the same time, Semenenko and Abramova (2021-2022) emphasized the importance of not only delineating military and economic security but also defining its internal and external components.

In his research, a Ukrainian scholar Shevchuk (2023) strives to develop the theoretical framework, create methodological approaches, and provide science-based practical recommendations for improving the economic security of Ukraine. Another Ukrainian academic Pikhotskyi (2022) examined the major trends and existing methodological approaches used to assess the economic security of the state. Rudyk (2020) explored the process used to model the assessment of the state's economic security level. The assessment of regional economic security levels was extensively studied by Monteiro (2020) and Kodratenko (2023).

Methodological Framework

One of the most important roles of the government is to ensure Ukraine's economic security, as it is a cornerstone of national security. However, at present Ukraine is faced with a dilemma, as the country has to not only follow the highly prioritized strategic path of integrating into the European economy but also simultaneously defend its territories and the rights and freedoms of its citizens (Constitution of Ukraine (2006)). The military component, which is an important part of any country's national security, plays a significant role in ensuring internal economic integration, preserving the domestic market, and maintaining territorial integrity. Given the need for sufficient funding, protection from external and internal threats, and the use of military force (armed forces), a new concept emerges - the military-economic security of the state.

At the same time, it is important to recognize that the European economy is still a battleground for competing national interests. Hence, there is value in creating a coherent and customized system and methodology for measuring the economic security of the state, just as there is value in creating a framework for assessing the impact that the changes in individual components have on the overall level of the state's economic security. The aforementioned approach, among other things, can help curb the potential negative effects of providing expedited external access to the national economy, increase the competitiveness of the national economy, protect local manufacturers, and contribute to more effective cooperation with international financial and economic institutions.

The National Institute for Strategic Studies has also offered calculated weighting coefficients for the elements of the integrated index of economic security. These coefficients were separated by both changes in the structure of the index and changes in the significance of each element.

Nevertheless, despite extensive scientific research dedicated to determining the level of economic security, experts have failed to reach a consensus.

Findings

There are several methods used around the world to comprehensively define the components of economic security. In broad terms, these methods can be divided into two categories: quantitative and qualitative. In Ukraine, defining the elements and indicators that make up the military economic component of the state's economic security system would ensure a more holistic assessment of the country's development and economic stability. Furthermore, this process would be instrumental in identifying the most effective measures to be taken to ensure the required level of economic security (According to Table 1) and simultaneously counter destructive external and internal influences.

In 2023 the Central Research and Development Institute of the Armed Forces of Ukraine invited 54 industry experts to conduct a survey to determine the importance of the economic security components in the period from 2011 till 2023. The results of this survey are shown in Table 1.

Table 1. Components of Ukraine's economic security (as defined by methods for calculating the level of state's economic security)

Order No. 114	**Order No. 60**	**National Institute for Strategic Studies**	**Order No. 1277**	**National Institute for Strategic Studies**	**Central Research and Development Institute of the Armed Forces of Ukraine**
-	Macroeconomic	Macroeconomic	Macroeconomic	-	Macroeconomic
Investment	Investment	Investment	-	-	Investment
Innovation	-	Innovation	-	Innovation	Innovation
Financial	Financial	Financial	Financial	Financial	Financial
-	Foreign economic activity	Foreign economic activity	Foreign economic activity	Foreign economic activity	Foreign economic activity
Social	Social	Social	Social	Social	Social
-	Food	Food	Food	Food	Food
Demographic	Demographic	Demographic	Demographic	-	Demographic
Energy	Energy	Energy	Energy	Energy	Energy
-	Manufacturing	-	Manufacturing	Manufacturing	Manufacturing
-	-	-	-	Transport	-
-	Science and technology	-	-		Science and technology
Foreign trade	-	-	-	-	-
-	-	-	Investment and Innovation	-	-
-	-	-	-	-	Military economic

Source: developed by the authors with due regard for: the Methodology for Calculating Integral Regional Indices of Economic Development. Order of the State Statistics Committee of Ukraine No.114 (2003); Methodology for Calculating the Level of Economic Security of Ukraine. Order of the Ministry of Economy of Ukraine No.60 (2007); Methodology of Integrated Assessment of the Level of Economic Security of Ukraine. National Institute for Strategic Studies (2013); Methodological Recommendations for Calculating the Level of Economic Security of Ukraine. Order No.1277 (2003).

The Ministry for Development of Economy and Trade of Ukraine is the main government agency in charge of the state policy on economy and trade. It was established in 2011 as the successor to the Ministry of Economy of Ukraine. It can be argued that both Order No.60 and Order No.1277

were developed by the same organization, albeit post-reorganization. However, it is important to underline that unlike Order No.60, Order No.1277 has an advisory nature. Consequently, as of today, there is no established methodology to effectively determine the level of economic security in Ukraine, nor is there a standardized system to define its components or a clear list of parameters and their respective thresholds. For instance, comparison of the identified weighting coefficients of different economic security components for 2007, 2013, and 2014 shows that the significance of the components varied year to year. This variability may also be contingent on the state's adherence to its strategic course and, therefore, additional funding.

Table 2. Weighting coefficients of the Ukraine's economic security components (as defined by methods for calculating the level of state's economic security)

No.	Components of Ukraine's Economic Security	Order No. 60	Order No. 1277	National Institute for Strategic Studies	Central Research and Development Institute of the Armed Forces of Ukraine
1	Demographic	0.0836	0.0913*	0.1412**	0.1123**
2	Energy	0.1324**	0.1148	0.1380**	0.1043
3	Food	0.1108	0.1007*	0.1374	0.1022
4	Social	0.0808*	0.1013	0.1341	0.0877*
5	Innovation	-	-	0.1337	0.0865*
6	Foreign economic activity	0.0901	0.1095	0.1273	0.1054
7	Financial	0.1127	0.1294**	0.0898	0.0998
8	Investment	0.0939	-	0.0572*	0.0972
9	Macroeconomic	0.1005	0.1224**	0.0409*	0.1009
10	Manufacturing	0.0769*	0.1218	-	0.1187
11	Science and technology	0.1183**	-	-	0.1101
12	Investment and Innovation	-	0.1089	-	-
13	Military economic	-	0.1089	-	0.1215**

Source: developed by the authors with due regard for: the Methodology for Calculating Integral Regional Indices of Economic Development. Order of the State Statistics Committee of Ukraine No.114 (2003); Methodology for Calculating the Level of Economic Security of Ukraine. Order of the Ministry of Economy of Ukraine No.60 (2007); Methodology of Integrated Assessment of the Level of Economic Security of Ukraine. National Institute for Strategic Studies (2013); Methodological Recommendations for Calculating the Level of Economic Security of Ukraine. Order No.1277 (2003).

Notes: * – the worst values; ** – the best values.

In light of recent events, the authors suggest that it may be worthwhile to explore the possibility of decoupling military and economic security components of Ukraine's economic security. This idea has garnered the support of such esteemed scholars as Pomazko (2023), Kodratenko (2023), and Dovhenko (2022). Comparing the results of various calculations, such as the strength of association (K_n), (calculated based on the findings of Schmidt, 2020), the correlation

coefficient ($r\,y\,x_{n}$) (calculated based on the findings of Gujarati, 2007), and the coefficient of variation (kV_n) (calculated based on the findings of Tolbatov, 2003).

the researchers were able to estimate the non-dimensional coefficient of variation (kV_n) to determine the consistency of changes in the economic security components compared to their average value (1). If it is greater than 30%, this indicates a significant discrepancy between the calculated value and the average.

$$kV_n = \frac{\sigma_n}{\overline{X_n}} * 100\,\%, \tag{1}$$

where, σ_n is the range of sample variance; $\overline{X_n}$ is the weighted arithmetic mean of the sample; *n* is the quantitative parameter of observations.

The correlation coefficient (2) was used to measure the impact that the changes in different economic security components had on its overall level. The correlation coefficient (ryx_{n}) was applied to measure the extend of the impact that the changes in different economic security components (X_{n}) had on its overall level (Y). The sample variance can be calculated by examining the quantitative parameter of observations, designated n, in combination with the weighted arithmetic mean of the entire population. Correlation dependence of more than 70% was believed to indicate a strong impact.

$$r\,y\,x_{n} = \frac{\sum d_{X_{n}}\, d_Y}{\sqrt{\sum d_Y^2 \sum d_{X_{n}}^{2}}}, \tag{2}$$

where $d_{X_{n}}^{2}$ is the standard deviation for X_{n}; d_Y^2 is the standard deviation for Y.

Using the strength of association coefficient (K_{n}) it was possible to determine both the strength of the association and the nature of the impact (direct/inverse) the changes X_{n} had on Y. The association is considered strong if the obtained result is higher than 0.7 and is calculated using the formula:

$$K_{n} = 1 - \frac{\sum \left| d_Y - b_{n}\, d_{X_{n}} \right|}{\sum d_Y}, \tag{3}$$

where b_{n} are the parameters of equations of individual factor variables; d_Y is the magnitude of deviations in the coefficients representing the comparison of empirical values of the effective feature; $d_{X_{n}}$ is the magnitude of deviations in the coefficients representing the comparison of empirical values of the factorial features.

Having carried out multiple calculations following the guidelines of Order No.60, the researchers were able to identify the strongest association (K_{n}) between the changes in the level of the economic security (Y) and changes in the levels of its constituent elements, such as manufacturing and social security (Table 3). At the same time, the researchers also found that changes to demographic and science and technology components had the lowest overall impact on the level of

the economic security. The calculations of the correlation coefficient ($r\,y\,x_n$) confirmed the significant extend of the mutual impact the aforementioned X_n have on the changes in Y. In contrast, the results obtained using the kV_n coefficient indicate the inconsistency in the annual changes of X_n relative to Y, which may indicate the unpredictable development of the selected parameters for economic security components, etc. Calculations carried out by the researchers at the National Institute for Strategic Studies indicate the strongest association (K_n) between the changes in the level of the economic security (Y) and changes in the levels of its constituent elements, such as energy and financial security (Table 3). At the same time, the researchers at the National Institute for Strategic Studies also found that changes to manufacturing and social security components had the lowest overall impact on the level of the economic security. The calculations of the correlation coefficient ($r\,y\,x_n$) and kV_n confirmed the significant extend of the mutual impact the aforementioned X_n have on the changes in Y.

Table 3. Results from calculating the coefficients: of the strength of association (K_n), correlation coefficient ($r\,y\,x_n$), and coefficient of variation (kV)

Components of Ukraine's Economic Security	kV_n		ryx_n		K_n	
	Order No. 60 (1997–2007), in %	**Central Research and Development Institute of the Armed Forces of Ukraine (2011– 2023), in %**	**Order No. 60 (1997–2007)**	**Central Research and Development Institute of the Armed Forces of Ukraine (2011–2023)**	**Order No. 60 (1997–2007)**	**Central Research and Development Institute of the Armed Forces of Ukraine (2011–2023)**
Demographic	6,92**	4.09	0.8579*	0.7494	0.4882*	0.2932
Energy	9.78	3.58**	0.9122	0.7560	0.4953*	0.2988
Food	22.44	3.98	0.9528	0.7494	0.7251	0.2715
Social	24.92	4.34*	0.9926**	0.5377*	0.8894**	0.1032*
Innovation	-	4.17*	-	0.6512	-	0.2733
Foreign economic activity	40.99*	4.17	0.9194	0.2794*	0.6453	-0.1088*
Financial	19.70	3.77**	0.9812	0.8879**	0.8014	0.5155**
Investment	43.85*	3.82	0.9815	0.7022	0.8153	0.2688
Macroeconomic	18.53	3.95	0.9777	0.7373	0.7912	0.2805
Manufacturing	19.57	-	0.9889**	-	0.8778**	-
Science and technology	3.66**	-	0.9096*	-	0.4418*	-
Military economic	-	3.58**	0.9096*	0.7560**	0.4418*	0.2985**

Source: calculated by the authors.
Notes: * – the worst values; ** – the best values.

This means that over different time periods, even despite using the same methodology for calculations (Table 3), researchers noticed variations in the significance of different economic security components. Therefore, the annual revision of the weighting coefficients for different

economic security components serves more of an educational than a practical purpose. Consequently, the authors believe that it would be advisable to draft a piece of legislation, like the Concept (Strategy) for the Development of Ukraine's Economic Security or military-economic security, setting out the hierarchical order for the economic security components prioritized for a given period of time according to the strategic agenda of the state. In addition, it is necessary to adopt a unified approach to determining the potential (medium- and long-term) and actual levels of the state's economic security and military economic security in the nearest future.

Discussions

While studying various research papers, publications, and guidelines on assessing the economic and military security of the state, researchers discovered an inconsistent and insufficient methodological approach to determining the necessary indicators of the state's military economic security, its level and availability of resources. This flaw in the methodology causes several issues, for example, failure to take into account the correlation between the level of military economic security of the state and projected resource capabilities in long-term and medium-term defense planning. Furthermore, as noted by Gomes (2023) and Bapuji (2023), there is a lack of a methodology for assessing the economic component of the state's military security based on the evaluation of available resources, and there is also a gap in the methodology when it comes to evaluating the levels of various allocated resources based on the assessment of relevant components (Karantounias (2023)). In the end, all of this renders it impossible to justify the effective adjustment of the economic component of military security and indicators of resource allocation (Getmanets (2023)). Given the current environment of ongoing reforms in the Armed Forces of Ukraine and limited financial resources, there is a need for research to determine the long-term trajectory for the development of the Armed Forces of Ukraine. This debate is extremely relevant today, as there are many conflicting opinions on how to best assess the correlation between the level of military security of a state and its resource availability. Despite the myriad of points of view, there is no definitive and consistent approach to addressing this issue.

Conclusions

Unfortunately, at present, there is no legislative framework that could regulate the notion of a unified system of elements comprising Ukraine's economic and military economic security or define an unambiguous mathematical approach to be applied when calculating the level of said economic security. Recently the Ministry for Development of Economy and Trade of Ukraine has issued legally non-binding guidelines for calculating the level of the state's economic security, thus, in light of recent events, one cannot definitively state that it is unlikely that the military economic security component will be added to the definition of Ukraine's economic security. The weighting coefficients for different economic security components were calculated by the Ministry for Development of Economy and Trade of Ukraine, the National Institute for Strategic Studies for 2007, 2013, and 2014, as well as by the Central Research and Development Institute of the Armed Forces of Ukraine for 2023 assign priority to different components in terms of how much they can influence the overall level of Ukraine's economic security.

Having carried out extensive analysis relying on the statistical data from the Ministry for Development of Economy and Trade of Ukraine, the results of expert assessment from the National Institute for Strategic Studies, and using the strength of association and correlation coefficients, the researchers were able to not only study the highest and lowest impact that the changes in specific components had on the overall level of the economic security but also look at the permanence of these results taking into account the coefficients of variation. The results of the calculations show a discrepancy between the extent of the impact that changes to certain components have on the overall level of economic security in the annual assessment and for a separate period, even if the same

methodology is used. Thus, the authors believe that their approach might be useful for drafting concepts (strategies) for the development of Ukraine's economic security or military-economic security that would also set out the hierarchical order for the economic security components prioritized for a given period of time according to the strategic agenda of the state, current financial capabilities, etc.

Further research should focus on developing recommendations for the application of the proposed methodology in the existing system of medium- and long-term defense planning.

Recommendations

The findings presented in this paper will be of interest to researchers analyzing the economic security components, as well as ministries dealing with the issues of medium- and long-term planning and allocation of financial resources to the sectors of the Ukrainian economy.

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