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ASSESSMENT AND FORECASTING METHOD OF STATE STABILITY

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Abstract. In the article, the authors propose a method for assessing and forecasting the stability of the state. The relevance of the work is due to the complex military and political processes taking place in and around Ukraine, attempts at large-scale interference in internal affairs (including by military means), attempts to destroy Ukrainian statehood and make the country under total control, and the lack of a methodological apparatus that can be used to assess the state's ability to withstand external and internal threats and preserve its own identity and structural integrity. The authors analyze the content of the concept of "stability", offer their own interpretation of this term and identify the factors that significantly affect it. In accordance with these factors, the article presents a hierarchical system of indicators consisting of two main groups characterizing the ability of the state to withstand internal and external influences, and contains indicators that allow to assess the military capabilities of the country, the level of conflict potential, taking into account ethnic and religious problems, the state of its economy, social and political spheres, the ability of law enforcement agencies to counter internal threats, energy security and the level of corruption. *Subject of research*. Assessment and forecasting of state stability. *Methodology*. In order to obtain functions that explicitly describe the dependence of the state's stability on lower-level indicators, the proposed approach involves the use of the theory of experimental design to form a training sample for each of the groups of indicators, followed by its processing using the method of group consideration of arguments. This approach is demanding on the level of competence of experts, but it allows obtaining dependencies that can be used to directly calculate the value of the state's stability indicators, which is of great importance in the preparation and decision-making on ensuring Ukraine's national security. The authors propose an integrated approach to forecasting the level of stability, which will make it possible to obtain both exploratory and normative forecasts, and this will increase the validity of decisions on ensuring the national and military security of the State. *The purpose*. The article outlines the main provisions of the method of assessing and forecasting the stability of the state, which allows obtaining a numerical assessment of stability and forecasting its development over time, taking into account a wide range of indicators covering both civilian and military spheres of the state, and also allows taking into account possible external influences (destructive or positive). *Results*. The article presents the system of indicators by which it is proposed to assess the stability of the state, the general procedure for calculations using the proposed method, and some results of a numerical experiment which confirmed the efficiency of the proposed approach, its sufficiently high accuracy and clarity of the results obtained. The calculations show that Ukraine's overall level of stability has declined significantly since 2014, but there is reason to believe that the state has managed to maintain it and even gradually improve it amid large-scale aggression.

Key words: stability of the state, external and internal threats, military-political situation, method of group consideration of arguments, forecasting.

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1. Introduction

The military-political situation in the world, in the region, or between individual countries escalates when economic, diplomatic, and other instruments for regulating and solving internal and external problems exhaust their possibilities and one of the parties resorts to aggression to solve them.

In such circumstances, the ability of the state to counter internal and external threats and preserve its independence and territorial integrity is extremely important. After 2014, this became a vital issue for Ukraine.

In order to determine a strategy for countering threats, it is important to assess the potential of one's own country, to identify its strengths and weaknesses, as well as the conditions under which destructive processes in society and the state can escalate and lead to its destruction. This is especially important when a country is located in an unfriendly environment or is exposed to aggression. Therefore, determining the degree of stability of a state is an urgent scientific task.

The ability of a state to withstand internal and external threats has been considered in many works Sharp, 2010; Nayef R.F. Al-Rodhan, Kuepfer, 2007; Carment, 2003; Milliken, Krause, 2002; Orel, 2018; Reznikova, 2018; Goetze, Guzina, 2008). However, these works are mostly of a general theoretical nature and do not provide an answer to the question of how exactly the stability or resilience of a state is determined. The most interesting in this regard is the work (Goetze, Guzina, 2008), which is devoted to the assessment of the stability of the state to maintain the status of a "center of power". The general approach to such an assessment is noteworthy, but it is not without significant drawbacks. The proposed system of indicators does not fully reflect the set of factors that affect the stability of the state, and some of them are questionable (for example, the number of citizens suffering from alcoholism and drug addiction, which is considered a driving force behind internal unrest). Most of the indicators reflect purely economic issues, while military and social aspects are hardly considered. The main drawback is that the work does not provide a general form of the function for assessing the stability of the state. At the same time, the problem of forecasting changes in the stability of the state is not addressed at all.

The purpose of the article is to outline the main provisions of the method for assessing and forecasting the stability of the State, which would be free from the above shortcomings and would allow obtaining a numerical assessment of stability and forecasting its development over time.

2. The concept of state stability

The analysis has shown that there is currently no unified view of such terms as "state resilience" and "state stability". Often, these terms are used to mean the same thing. According to the authors, they are closely related, but not identical.

Based on the basic definitions of resilience and stability, it is more correct to speak of state stability in the context of the ability to withstand internal and external threats, especially in the event of an aggravation of the military and political situation.

Indeed, if stability is the ability of a system to function without changing its own structure and to be in equilibrium (Paris, 2011), the authors propose that the ***stability of the state*** is understood as its ability to function and to be preserved for a long time without drastic changes. In a broader sense, this is a condition of the state characterized by the existence of the necessary prerequisites and factors that ensure the preservation of territorial integrity and inviolability by the state, and the preservation of its identity, civil peace and harmony by society through the achievement of a balance of interests of various social actors and political forces, timely and legitimate resolution of emerging problems and contradictions in the field of politics through the mechanisms and means provided for by law.

The stability of the state, as well as the stability of society, is conditioned by the laws of functioning and development of society, the nature and methods of interaction of its subsystems, changes and evolution of which do not cause the destruction of the functional unity of the structure and their balance.

The stability of the state is primarily ensured by the political system of society and the effectiveness of its functions, which, in turn, depends on the mass support of citizens. At the same time, one should not forget about military power as an integral part of ensuring stability under the influence of external factors.

The main conditions that influence the level of mass support for the existing political regime are: the level of material security and social protection of citizens, the existence of democratic institutions and mechanisms that ensure public participation in the political process, the principle of equality and justice, security and legal guarantees for individuals. The system of laws in force in a society must change in accordance with new conditions and new challenges of the time. An indicator of the stability of a state is its ability to neutralize negative influences and threats from outside (subversion, international terrorism, economic blockade, political pressure, blackmail, disinformation, threat of force, etc.) Such negative influences can bring the state into a state of extreme instability and even destroy it. The outbreak of civil war or large-scale political violence by both

supporters and opponents of the existing order is particularly dangerous. That is why an adequate and timely response by the state to threats to its sovereignty, social interests and the security of its citizens is so important.

In general, the stability of the state depends on a combination of internal factors and external factors that manifest themselves in the form of potential claims by other countries or blocs (military threat).

That is, a state that seeks to preserve its independence and avoid falling under external control must be able to ensure its stability in the face of possible external and internal negative factors.

3. Procedure for assessing and forecasting stability

As the analysis of recent events shows, the aggravation of the military-political situation between two states does not always lead in an obvious way to an armed conflict. Increasingly, pressure on the state is exerted by non-military means (information, economic, social, etc.), including from within the country itself (Bohdanovych, Pavlovskyi, Solomytskyi, 2019). Thus, the importance of internal factors, which can sometimes be decisive, is growing significantly.

In general, the equation for assessing the level of stability can be written as follows:

$$S = f\left(V^{ins}, V^{outs}\right), \quad (1)$$

where V^{ins}, V^{outs} – the integral importance of the state's ability to withstand internal and external influence, respectively.

The choice of indicators that determine the value of V^{ins}, V^{outs} is important. For a comprehensive assessment of the impact, it is proposed to use a modified system of indicators, first proposed in (Development of methodological foundations). The novelty of this approach is that the list of indicators is chosen situationally, based on the adversary's strategy of influence on Ukraine. That is, the areas of state activity that will be primarily targeted are identified, and stability is assessed only for these areas. This approach will reduce the amount of calculations and focus on developing recommendations for stabilizing the situation in the most critical areas.

The hierarchy of indicators for assessing a country's ability to protect itself from insider threats, shown in Figure 1, will allow experts in the relevant field to use an acceptable number of indicators (Romanchenko, Butvin, Hvozd, Solomytskyi, 2018).

Thus, the ability to withstand internal threats is proposed to be viewed as a function of appearance:

$$V^{ins} = f\left(W_{VD}, I_{ES}, I_{GINI}, I_{CP}, I_{PRO}\right). \quad (2)$$

For each country, the indicator of domestic tension W_{VD} is defined as follows:

$$W_{VD} = f\left(I_{vc}, I_{ec}, I_s\right). \quad (3)$$

The indicator of the internal conflict situation (I_{vc}) is determined using such indicators as general conflict potential (I_{zcd}), ethnic (confessional) (I_{evd}) and political relations (I_{pvd}), and characterizes the level of danger of armed conflict within the state.

The overall conflict potential, in turn, is determined by the following partial indicators: i_{vc} is an indicator of internal conflicts; i_{tp} is an indicator of territorial manifestation; i_{sr} is an indicator of the impact of internal conflicts on the stability of the regime; i_{ivp} is an indicator of foreign military presence.

Ethnic relations are determined by the share of the dominant ethnic group in the country's population structure (i_{et}).

Political relations depend on the following indicators: i_{sar} – an indicator of the presence of illegal separatist or anti-government movements in the country; i_{isr} – an indicator of the presence of legal secessionist movements in the country; i_{zv} – an indicator of attempts at unconstitutional change of power or coups d'état.

Similarly, other indicators depend on lower-level indicators (Zghurovskyi, 2008; Zghurovskyi, 2009).

Given that the stability of the state under the influence of external influence in the event of an aggravation of the military-political situation will depend mainly on the strength of the national armed forces and their ability to withstand the enemy, external stability is proposed to be considered as a function of appearance:

$$V^{outs} = f\left(\left(W_{GFP1}, W_{GFP2}, \ldots, W_{GFP\,N}\right)_A, \left(W_{GFP1}, W_{GFP2}, \ldots, W_{GFP\,N}\right)_B\right), \quad (4)$$

where $W_{GFP\ N}$ is the Nth indicator according to GlobalFirepower (GFP) (GlobalFirepower) for countries *A* and *B* being compared. The GFP includes values that characterize the armed forces and are related to resources, finances, and geography (55 indicators in total).

To determine the explicit form of the functions *S*, V^{ins}, V^{outs}, and other lower-level functions, it is proposed to use the group method of data handling (GMDH), which is intended for mathematical modeling of multivariate data (Ivakhnenko, Yurachkovsky, 1987).

This approach is described in detail in (Butvin, Solomytskyi, Didichenko, 2016; Solomytskyi, 2020).

Based on the results of the obtained statistical data, the level of stability is forecasted for a certain period of time. Usually, given the non-stationarity of the processes under study, the forecast horizon does not exceed 3-5 years. In the course of forecasting, two

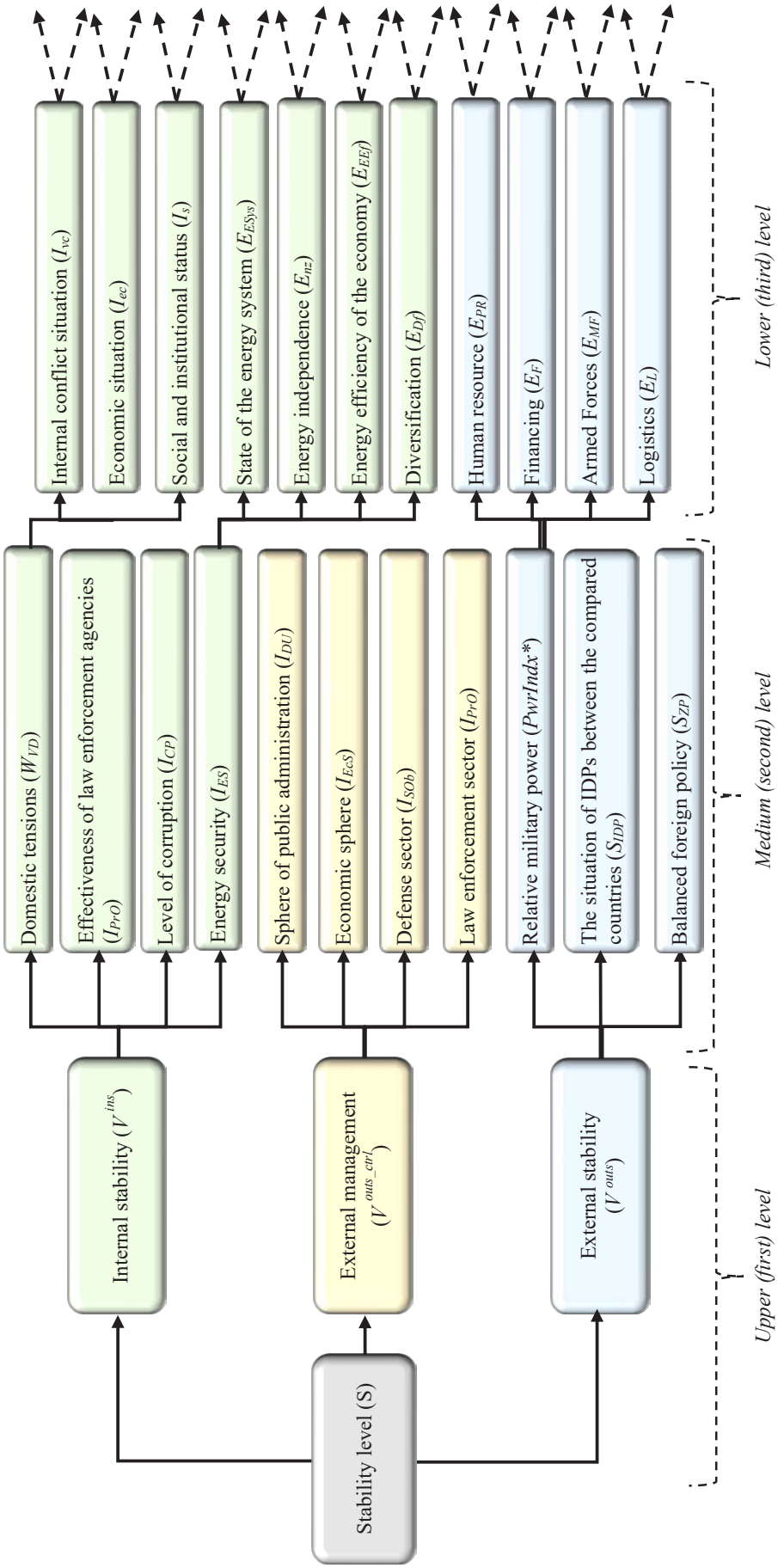

Figure 1. The system of indicators that determine the level of stability of the state.

Source: developed by the authors

types of forecasts are developed: exploratory (what will happen if the existing trends continue) and normative (what needs to be done to achieve the desired state (optimization of indicators)). The forecasting is based on the GMDH and will be discussed in more detail in the following publications. The results of the assessment and forecasting are analyzed to determine critical indicators (Development of methodological foundations; Zghurovskyi, 2008), which will allow developing appropriate recommendations to ensure an appropriate level of stability and eliminate problematic issues in the areas of state activity.

4. Practical calculation example

A numerical experiment was conducted to evaluate the performance of the proposed approach.

Thus, the following expression was obtained for the stability level indicator:

$$S = -0,720703 + 1,9668 \sqrt[3]{V^{ins}} \sqrt[3]{V^{outs}} . \quad (5)$$

The accuracy of the obtained function is quite high, as the average error modulus (AEM) and root mean square error (RMSE) are about 0.2, while the coefficient of determination was 0.97. The diagram of the function is shown in Figure 2.

Similarly, the dependencies for the remaining indicators were obtained explicitly, but due to their rather large size, they are not presented in this article. Provided that the experts in the respective fields were sufficiently trained, all functionalities had a sufficiently high accuracy (the coefficient of determination in the training sample was not lower than 0.85, and in the test sample – not lower than 0.75). Based on the results, an appropriate model was built in the AnyLogic program, which showed high sensitivity to changes in the input data.

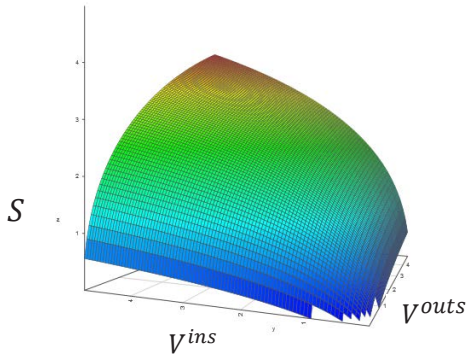

Figure 2. Graph of dependence of the stability level indicator

Source: developed by the authors

On the basis of the obtained data, the change in the level of stability was predicted for the next five years (Figure 3). The forecast was developed according to the methodology outlined in (Solomytskyi, 2020) for cases of stability as its own time series and as a function of lower-level indicators. The calculations show that the stability of the state remains low, which is primarily due to socio-economic factors and is complicated by the aggression of the Russian Federation against Ukraine, i.e. external influencein the military, information and conflict spheres.

The developed regulatory forecast showed that to ensure the required level of stability ($S \geq 3,5$), it is necessary to ensure $V^{outs\_nec} \geq 3,6$ and $V^{ins\_nec} \geq 3,93$, which are not expected to exceed 3.18 and 2.28, respectively (see Figure 4).

5. Conclusions

The proposed method of forecasting the stability of the state in the face of changing circumstances allows quantifying the level of stability of the state

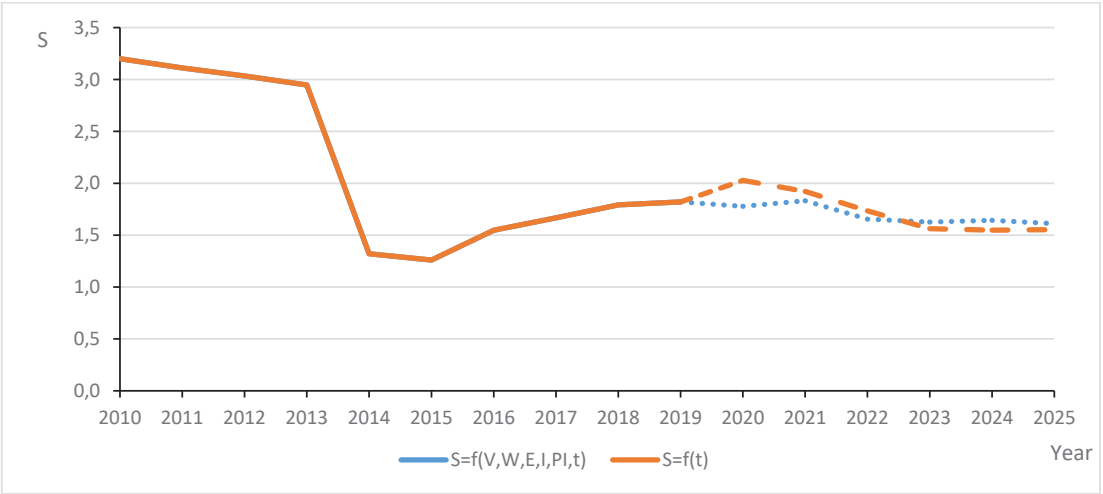

Figure 3. Forecast of changes in the level of stability by 2025

Source: developed by the authors

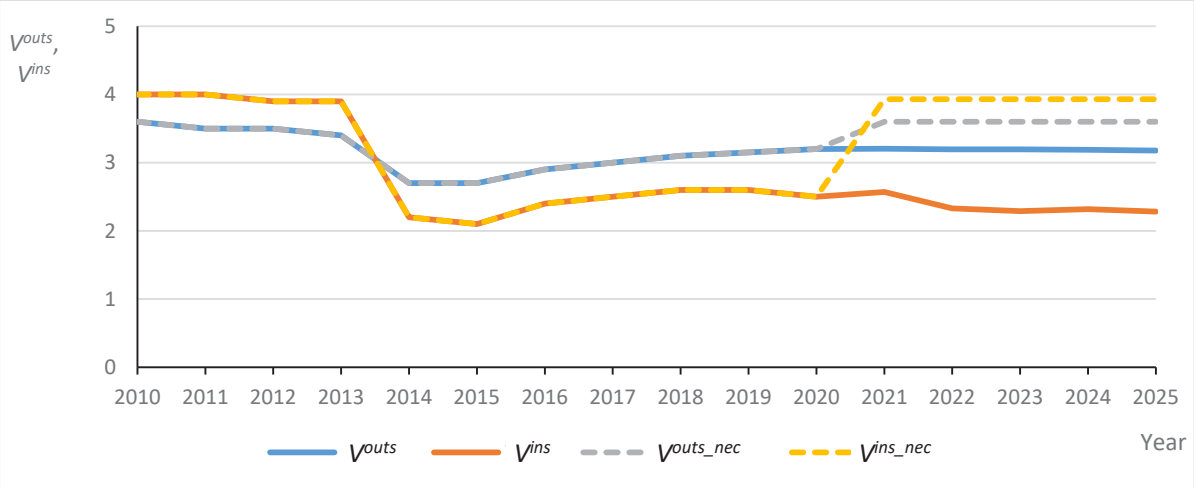

Figure 4. Results of regulatory forecasting of stability indicators

Source: developed by the authors

under the influence of internal and external factors. It works with a large number of indicators that sufficiently reflect the main factors influencing the stability of the state both from the inside and from the outside, while the indicators in the calculations can be varied depending on the strategy of influencing the state chosen by the enemy. For the first time, it is proposed to take into account the indicator of external governance in various spheres of state activity. The method, based on the theory of planning experiments and GMDH, allows to develop two types of forecasts – exploratory and normative, with different depth of detail. The method will allow to substantiate measures to maintain and increase the stability of the state under the influence of external and internal factors, taking into account the level of financing.

The calculations show that Ukraine's ability to maintain its own stability is at such a low level that a number of measures need to be taken to improve the situation. At the same time, analyses and calculations have shown that the most critical areas, in addition to the military, due to Russia's large-scale invasion of Ukraine are socio-economic, where the situation is complicated by external influence in the information and internal conflict spheres, as well as a high level of external control in vital areas of the state (politics, economy), and the situation in the religious sphere has recently become more acute.

The construction of a normative forecast (the solution of an optimization problem) made it possible to determine the rational values of the indicators on which the stability of the state depends. At the same time, the calculations show that it is impossible to achieve them in the near future if the current level of financing is maintained.

Another area of research is to determine the appropriate thresholds at which the state is at risk of losing its stability and, as a result, its integrity, or ceasing to exist altogether, and to develop an approach for selecting the indicators necessary for the calculations in each case.

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