ORIGINAL PAPER

DOI: 10.26794/2220-6469-2025-19-4-28-38
UDC 338.1(045)
JEL C82, F52, G01

Method of Selecting Threshold Values for Growth Rates of Economic Security Indicators

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ABSTRACT

The relevance. Monitoring of economic security has recently become increasingly important due to the emergence of new challenges and threats associated with the complication of the geopolitical situation. One of the methodological aspects of monitoring is the selection of a system of indicators and justification of their threshold values. **The purpose** of the article is to develop a methodology for threshold values of economic security. The subject of the study includes an analysis of existing approaches to defining the concept of threshold values and justifying their values for various monitoring models, as well as barriers that arise in the process of such justification, and finding ways to overcome them. **Novelty of the study:** a new method is proposed that uses a three-threshold model of monitoring economic security, and the growth rates of various socio-economic indicators as indicators. The first threshold is the threshold of system survival, the second threshold is associated with a possible violation of the stability of the system. The third threshold determines the target value of the indicator. **The theoretical and practical significance** of the study lies in the creation of a reliable tool for positioning economic security indicators, which can be effectively used, among other things, for analysing and forecasting economic crises.

Keywords: economic security; threshold values of indicators; single-threshold, two-threshold and three-threshold monitoring models; growth rates of indicators; survival threshold; threshold of violation of stability; threshold of target stability

For citation: **Mityakov S.N. Method for selecting threshold values for growth rates of economic security indicators.** ***The World of the New Economy.*** **2025;19(4):28-38. DOI: 10.26794/2220-6469-2025-19-4-28-38**

THRESHOLD VALUES FOR ECONOMIC SECURITY

The practice of using threshold values for economic security indicators has a deep history and it is successfully employed in various fields. In 1994, the idea appeared to use the apparatus of critical maximum values in the social sphere at the Institute of Socio-Political Research of the Russian Academy of Sciences (ISPR RAS). It was an important step in the development of economic security research in Russia. At that time the scale of 20 criteria with corresponding threshold levels was developed, which allowed assessing more precisely and objectively the state of the social sphere and identify potential threats [1].

In the early 2000s, the Section on Economic and Social Security of the Scientific Council under the Security Council of the Russian Federation approved a system of 19 indicators and threshold values which had been developed earlier.[1] In 2008, the Institute of Economics of the Russian Academy of Sciences (IE RAS) suggested an comprehensive system with 36 indicators and their threshold levels[2], which was refined in 2011 [2]. In 2017, the Strategy for the Economic Security of the Russian Federation was adopted for the period up to 2030. It included 40 economic security indicators,[3] many of which had already been used in research by the IE RAS scholars. Initially, the indicators lacked threshold values but received them after the Ministry of Economic Development of the Russian Federation published draft passports for economic security indicators.[4]

Let us consider different definitions of the category "threshold values" in the context of economic security. V.K. Senchagov called them "limit values, which (if disregarded) impede the normal development of the economy and social sphere and cause the development of destructive trends in the sphere of production and the people's standard of living" [3]. S. Yu. Glazyev and V.V. Lokosov interpret such "a value of an indicator, the deviation beyond the framework of which indicates the emergence of a threat to the economic functioning and the life of society triggered by the interruption of the ordinary course of the processes reflected by this indicator" [4, p. 24]. V.K. Senchagov and V.I. Avdiysky specify that these metrics in numerical form reflect the maximum permissible magnitudes and the failure to achieve threshold levels leads to a disruption in the normal functioning and progress of the socio-economic system [5].

Traditional interpretation of threshold values requires re-assessment, assuming the inevitability of a threat upon reaching a critical level of an economic security indicator. Rigid definitions prevailing in the scientific community in the late 20th and early 21st centuries demonstrate restricted empirical applicability. Analysis of the indicators' dynamics within a long time period has revealed that the majority of indicators remain permanently below the critical maximum level, which is not caused by the destruction of the economic system or the loss of its potential for self-development. In this regard, it is feasible to consider threshold values not as absolute barriers, but as reference benchmarks that combine non-optimal conditions of indicators of economic security. This transformation of the methodological approach is necessitated by the requirement to take into account the dynamic state of socio-economic processes and to adapt to external change of environment.

Besides, one of the emerging directions is the "traffic light" model including three possible settings for indicators: red (danger), yellow (intermediate level), green (stable growth level) and two threshold levels involving the critical maximum and the target value of the indicator. In most cases, the latter has a subjective assessment

[1] Senchagov V.K., ed. Economic Security of Russia. Textbook. General Course. Moscow: Delo; 2005. 896 p.

[2] Economic Security Strategy in the Development of Indicative Plans for Long-Term and Medium-Term Socioeconomic Development. Monograph. Moscow: Institute of Economics, Russian Academy of Sciences; 2009. 232 p.

[3] Decree of the President of the Russian Federation dated May 13, 2017, No. 208, "On the Economic Security Strategy of the Russian Federation through 2030. URL: https://www.garant.ru/products/ipo/prime/doc/71572608/

[4] URL: https://www.interfax.ru/busi ness/656619

defined in strategic planning documents. This model is described in the author's article "Analysis of Crisis Phenomena in the Russian Economy Using Rapid Indicators of Economic Security" [6] and it is included in the recommendations of the Ministry of Economic Development[5] with two thresholds for most indicators defined in the Strategy for the Economic Security of the Russian Federation.[6] However, the status of the first threshold remains highly indefinite: it is hardly could be related to critical maximum, since no serious destruction of the economic system has occurred over a long observation period.

The article by A.B. Vissarionov and R.R. Gumerov describes a three-level scale model [7] with the first-level thresholds (critical) fix limit values when the country loses its economic and political independence, as well as the ability to oppose external impact, that indicates a threat to state sovereignty. The second level (transitive thresholds) occurs at a break point, when the system's stability and competitiveness significantly decrease, so that crisis management measures are required to restore its functioning. The third level, or target thresholds represent the desired values, fixed in strategic documents, when the system functions efficiently. In this case, the first-and-second-level thresholds are in fact 'floating', calculated as the average values of the indicators within the certain period. In Russia, the year of 1995 was a crisis year, when the catastrophic stage of shock therapy was mostly complete, and the year 2013 was transitional (before the 2014–2015 crisis) and accompanied by a slowdown in economic growth rates.

In addition to the abovementioned models, scholars advanced other models with a larger number of risk zones. For example, V.K. Senchagov and S.N. Mityakov [8] put forward a seven-level model for a better accuracy of positioning the indicator. However, it turned out inconvenient in operation due to its unwieldiness.

[5] URL: https://www.interfax.ru/busi ness/656619

[6] Decree of the President of the Russian Federation of May 13, 2017, No. 208, "On the Economic Security Strategy of the Russian Federation through 2030." URL: https://www.garant.ru/products/ipo/prime/doc/71572608/

ANALYSIS OF APPROACHES TO THRESHOLD VALUES SUBSTANTIATION

The substantiation of threshold values for economic security requires the aggregated application of various methods enabling to explore and interpret data, as well as to outline recommendations for decision-makers.

One of the basic methods is *time series analysis*. It enables to study dynamics of key economic indicators within a specific time-period, or, for instance, identify trends, seasonal variations, and cyclical fluctuations in such indicators as the inflation, or unemployment rates, or GDP. Thus, based on the obtained data, threshold values can be established when the indicators begin to threaten economic stability.

Another essential method is *regression analysis*, enabling to determine dependency between various economic variables and identify factors of the utmost impact on economic security. Regression models helps to estimate how changes in one indicator affect others and this allows to establish critical levels for each of them, for example, to identify which level of unemployment the economy starts causing instability.

One more widely used method is *scenario analysis*. It involves building various scenarios for the development of economic situation based on existing data and future prognosis, and helps to assess the circumstances leading to a transition into the risk zone, thereby determining measures to prevent negative outcome. Thus, a high-inflation level scenario may indicate when the economy starts to degrade, and this makes it possible to establish the corresponding threshold values.

No less essential is the method of *expert assessments*, when specialists from various fields (economists, financiers, representatives of business and state structures) are involved in the process of substantiating threshold values. Their opinions and assessments complete quantitative methods with qualitative data, which eventually makes the final analysis more comprehensive and in-depth.

Besides, there exist a method of *comparative analysis*. It involves exploring the experience of other countries and regions, their approaches to defining economic security and threshold values, helping to find successful practices and adapt them to the conditions of a specific country.

Scholars engaged in this exploration, use to employ these methods in their works, however, this process of scientific substantiation of threshold levels appears to be quite problematic.

V.K. Senchagov suggests starting with the social sphere. He provides a substantiation for the critical threshold of the indicator of the population share with incomes below the subsistence minimum at a level of no more than 7 per cent. As for the gap between the incomes of the rich and the poor (the income quintile share ratio) it is barely 8 per cent (both indicators are adopted in accordance with world experience in preventing social catastrophes) [3]. Next, the scholar calculates the threshold value for the ratio of the average monthly income to the subsistence minimum level (no less than 3.5). Then he resorts to the financial sphere with threshold values for the ratio of the money supply M2 to GDP (not less than 50 per cent) and the volume of gold and foreign exchange reserves (not less than 250 billion USD). Subsequently, 36 indicators are substantiated which were proposed by the IE RAS. Notably, nowadays, some threshold levels have lost their relevance, and some others require revision.

S. Yu. Glazyev and V.V. Lokosov point out: "Most indicators of the state of the Russian economy are beyond the critical values reflecting its ability to reproduce. For long, the economy has been functioning in a mode of narrowed reproduction, despite the existing opportunities to transform accumulated savings into investments and convert gigantic natural rent into technological development. The situation is even worse regarding indicators that reflect the capability of the Russian economic system to develop." [4, p. 596]

The article by S.V. Raevsky, L.A. Belyaevskaya-Plotnik and N. Yu. Sorokina describes methodology for assessing the ranges of permissible values for indicators of the condition of the Russia's economic security [9]. The methodology may need indicators for which target and/or threshold values are not defined in official documents. The method seems to be insufficiently applicable to a certain limit for forecasting the behaviour of objects in the long term too.

I.V. Karavaeva, E.A. Ivanov and M. Yi. Lev make a critical analysis of the indicator passports in the Strategy for the Economic Security of the Russian Federation until 2030 [10]. Their assessment is quite justified, although not all of their conclusions seem well grounded. For instance, they and the Ministry of Economic Development of the Russian Federation claim that the maximum GDP growth rate is 1.5 per cent, and industrial production is 0 per cent. This means that the growth of other sectors of the economy must be of the exceeding pace.

According to M. Yu. Lev, the most notable indicators for determining threshold values have a sufficiently wide range of dimensions: in some cases, they serve as absolute indicators in various sectors, which makes it difficult to compare them [11]. Thus, the scholar suggests using dimensionless indices, since it solves the problem of factors' comparability and their reduction to uniform measurement indicators. Hence, the substantiation of economic security threshold values needs a comprehensive approach and various methods, each of which has its own pros and cons, while their combination leads to more accurate and validated results.

However, the following problems may occur:

1. During a long-term analysis using monetary indicators, due to inflation their threshold values need adjustment by means of deflators.
2. Occasionally, indicators lose their relevance for threat monitoring, as they significantly exceed threshold levels for a long time.
3. Since many indicators are composite (e.g. the ratio of the money supply to GDP), it requires analysing both the numerator and the denominator, which sometimes leads to certain defiance.
4. Substantiation becomes much more difficult for multi-threshold systems.

THE SYSTEM OF ECONOMIC SECURITY INDICATORS AND THE SUSCEPTIBILITY MATRIX

To solve the abovementioned problems, here we outline a system of indicators used for the operational analysis of economic security, particularly of economic crises.

Presumably, the economic security of a country is described by a number of indicators, where $i = 1, \ldots, n$, and n is their total number. For simplicity, we assume that all indicators are dimensionless and homogeneous (based on a single principle). As such, we can select the growth rates of certain natural indicators, calculated as the ratio of the value in the current month to the corresponding value in the same month of the previous year, minus one. If measured in percentages, the specified ratio should be multiplied by 100.

The substantiation of the quantity and selection of specific indicators is determined by the requirement of updating and identifying threats for solving the tasks outlined in the Strategy for Economic Security. Besides, since the duration of a crisis can last for several months, one should consider the use of open official sources of information, the comparability of chronological data, their independence, and frequency of monthly updates.

Let us explore a few periods when crises hit economy. The number of the crisis is denoted by the letter j. So, $j = 1, \ldots, m$, where m signifies the total number of crises.

By the ***susceptibility*** of the i-th "positive" indicator of x_i, which, if increased, strengthens the level of economic security, to the j-th crisis y_{ij}, we perceive the maximum downslope of the growth rate relative to the zero mark, to be measured as a percentage. A 'negative' indicator, whose growth reduces the level of economic security, we consider the maximum increase of its growth rate relative to the zero mark.

During these calculations, we carried out preliminary processing of the initial data series. Thus, if a minor noise, or minor fluctuations occur we apply filtering via a five-point moving average. A pronounced trend in the series indicated that data was clear of fluctuations.

Table 1 demonstrates the results of estimation of the susceptibility for the percentage alterations of economic security indicators related to five crises that occurred in the Russian economy over the past 30 years (1998, 2009, 2015, 2020 and 2022).

By averaging the susceptibility of each of the indicators throughout all crises, one can obtain data to substantiate the critical maximum threshold value.

METHODOLOGY FOR SUBSTANTIATING THRESHOLD VALUES OF ECONOMIC SECURITY INDICATORS

In our case, the most adequate is the described above model suggested by A.B. Vissarionov and R.R. Gumerov [7]. However, we will use specific threshold indicators, not the average values of indicators during this interim.

First-level thresholds are associated with the concept of the ***sustainability*** of the economic system. G.N. Cherkesov and A.O. Nedosekin admit the expansion of this terminology for economic systems [12], and we define it as the capability of the economy to be resilient to external and internal shocks curbing the snowballing development of crises that could lead to massive economic losses and destroy the structure of consumption and production.

Economic system is liable to a variety of factors, such as global crises, political instability, natural disasters, technological breakdowns, etc. capable to disrupt its operation. The system's sustainability implies its ability to adapt to changes, minimise negative consequences (both short-term and long-term), and recover from shocks. When disruptions of sustainability reach a critical point, and the system cannot recover or adjust, this causes its destruction. Therefore, a key factor for sustainability is effective management.

In a developed crisis, it is necessary to determine a critical threshold for each indicator, at which level the system can still operate. Such a situation implies declining living conditions of the population, a slowdown of consumer demand, and capital outflow, which require urgent intervention by state bodies.

Table 1

Susceptibility of Growth Rates of Economic Parameters to Crises (in %)

i	Name of the indicator	*J* = 1	*J* = 2	*J* = 3	*J* = 4	*J* = 5
1	Industrial production	–9	–16.2	–1	–6	–1.8
2	Gross domestic product	–	–10.3	– 4.2	–6.32	– 4
3	Investments in the fixed capital	–7.8	–19.8	–13.8	–12.5	–
4	Index of consumer prices	–	6.8	9.9	0	11.66
5	Index M2 / Money supply M2 volume	–	–28.1	–11.7	0	–1.9
6	Overdue loan debt	–	60	42	24	26
7	Volume of household deposits	–	–11.3	–9.4	0	–12.8
8	Number of unemployed	–	49	10	40	0
9	Real wages	–	–11.8	–15.6	–5	–10
10	Volume of paid services for the population	–	–7	–3	–37.1	–5
11	Physical export quantity	–	– 49	–38	–35	–40
12	Physical import quantity	–	– 45	– 40	–12	– 35
13	Extractive industries	–	–5.5	0	–11.8	– 2.2
14	Manufacturing industries	–	–23.3	–1.1	–2.6	–1.8
15	Construction	–8	–18	– 6.1	–2.1	0
16	Freight capacity of transport	–	–18.8	–2.6	–7.9	–5.4
17	Retail trade turnover	–10	–9	–12	–9	–10

Source: calculated by the author.

Note: i — name of the indicator; *j* (1, …, 5) — levels of susceptibility to the crisis.

The possibility of the system's complete destruction depends on how many indicators have reached the critical level, how far the lowest ebb of the crisis, and how long the system stays in the danger zone. S. Yu. Glazyev and V.V. Lokosov, point out that "the selective capacity of the management system has a key importance in determining the possible duration of society's functioning beyond the boundaries of the critical maximum values, which characterise the state of its indicators. The system must be efficient to timely identify emerging threats, eliminate them, curb destructive processes, overcome emerging constraints, and find new development prospects [4, p. 592].

Furthermore, in order to establish ***survival thresholds*** (critical maximum levels) for the indicators presented in *Table 1*, we can assume that they are proportionate to the average level of susceptibility to crises: for example, from 0.5 to 0.8. The final decision, in our opinion, should be made by taking into account expert assessments in combination with retrospective data analysis. At the same time, we admit that the threshold value may eventually fluctuate with new factual data obtained.

The second threshold value for all indicators is assumed as zero, which means frozen growth or stagnation. We call this corresponding level ***the stability violation threshold***. It serves as a kind of alarm signal for the state and business, as it indicates the system's failure for development in real terms. In the context of global competition and technological progress, nought-growth can lead to a loss of competitiveness and a decrease in market share, as well as a drop of the living standards of population. Its long-lasting duration

Table 2

Threshold Values of Economic Security Indicators (in %)

Indicator growth rates, %	First threshold: survivability (based on susceptibility level)	Second threshold: disruption of stability	Third threshold: stability		
			Inversion of first threshold	Exceeding global average levels	Target values according to strategic planning documents
Industrial production	–6	0	6	5	7
Gross domestic product	–5	0	5	4	4
Investments in fixed capital	–10	0		4	5
Consumer price index	4	0	–4	–	-
Index M2 / Money supply M2 volume	– 8	0	8	–	-
Overdue loan debt	12	0	–12	–	-
Volume of household deposits	–5	0	5	–	-
Number of unemployed	12	0	–12	–	-
Real wages	–5	0	5	–	-
Volume of paid services for population	–4	0	4	–	-
Physical volume of export	–20	0	–	–	-
Physical volume of import	–20	0	–	–	-
Extractive industries	–4	0	4	–	-
Manufacturing industries	–7	0	7	–	5
Construction	–6	0	6	–	-
Freight capacity of transport	–6	0	6	–	-
Retail trade turnover	–6	0	6	–	-

Source: compiled by the author.

contributes to economic stagnation and increases the risk of crisis.

The third value is the ***target threshold*** or ***stability threshold***, which serves as a reference point, indicating the achievement of desired key economic indicators. In our viewpoint, due to a lack of information, its substantiation is the most complicated issue. Firstly, one should resort to strategic planning documents. Thus, the Decree on the National Development Goals of the Russian Federation for the Period up to 2030 and for the Future up to 2036[7] stipulates the requirement to maintain a GDP growth rate above the world average. Since the global medium is 3–3,5 per cent, it seems appropriate to set the threshold for

[7] Decree on the National Development Goals of the Russian Federation for the Period up to 2030 and for the Future up to. URL: http://www.kremlin.ru/events/president/news/73986

our annual indicator at no less than 4 per cent, which coincides to the recommendations of the Ministry of Economic Development of the Russian Federation.

In accordance with the Consolidated Strategy for the Development of the Manufacturing Industry of the Russian Federation until 2030 and for the Period up to 2035, by this time the target volume of domestic yield of machine-tool and instrumental products should surpass 150 billion rubles. To reach such level, the average annual production growth of the industry must be at least 5 per cent. Moreover, the objective of the federal project "Development of the Machine-Tool and Instrumental Industry" is to increase production by 103 per cent throughout 2022–2030, which is on average 9,3 per cent per annum [13].

The second method to determine target thresholds is to fix them at the level (or slightly above) of the forecasted world-average growth rates of the corresponding indicators. Finally, if they are not available in strategic planning documents, as initial approximation, one can set them by inverting the critical thresholds, which will allow for determining realistic target values, accounting for the specifics of all indicators, and maintaining their counterbalance. However, then target thresholds may look too exaggerated, so this is good to be applied only to indicators with low sensitivity to crises.

In conformity with the abovementioned aspects, *Table 2* illustrates three possible options for estimating target thresholds for different indicators.

Figures 1–3 demonstrate the dynamics of three economic security indicators: the growth rates of industrial production, the physical volume of exports, and the money supply M2 (in comparable prices) throughout January 1997-January 2025. The dotted lines indicate threshold levels (the third threshold in Figs. 1–3 is presented as the inverse of the first one).

The analysis demonstrates that the growth rates of the physical volumes of exports and imports are mostly prone to crises. There are several reasons to it. Firstly, international trade has a multiplier effect. Secondly, the reduced availability of trade financing hindered export-import operations for entities. Thirdly, the demand for many goods of international trade is more elastic relatively to incomes and expectations than for items consumed domestically.

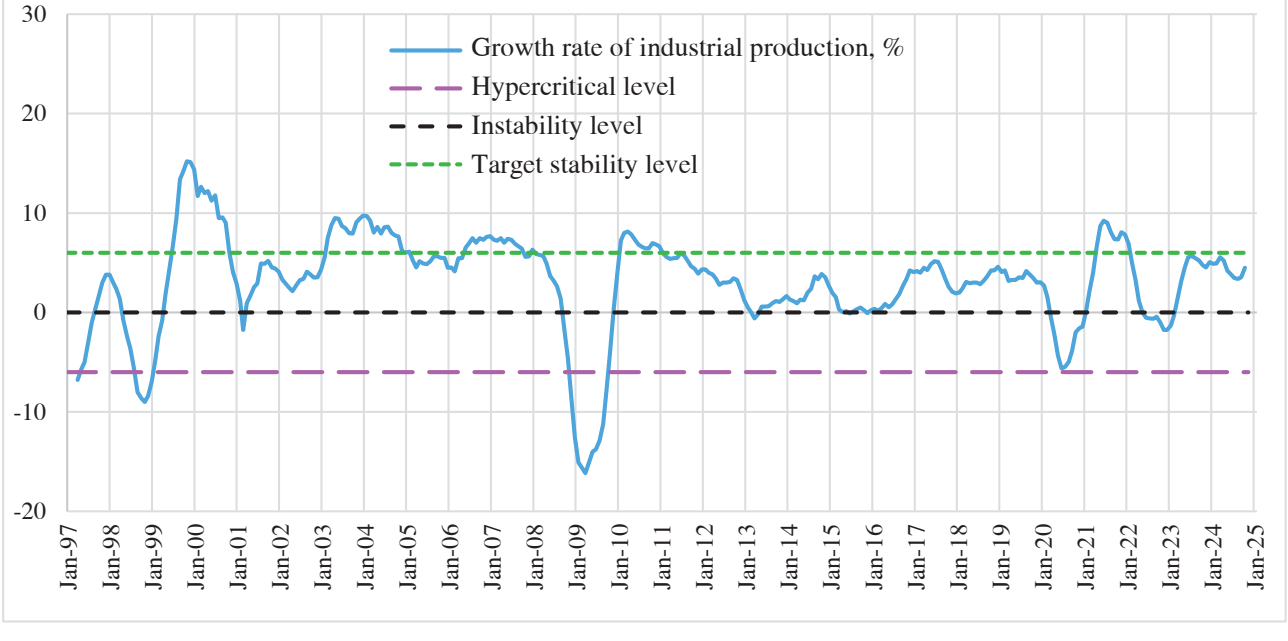

Fig. 1. **Dynamics of Industrial Production Growth Rate with Indication of Thresholds (Processing — Moving Average, in %)**

Source: compiled by the author.

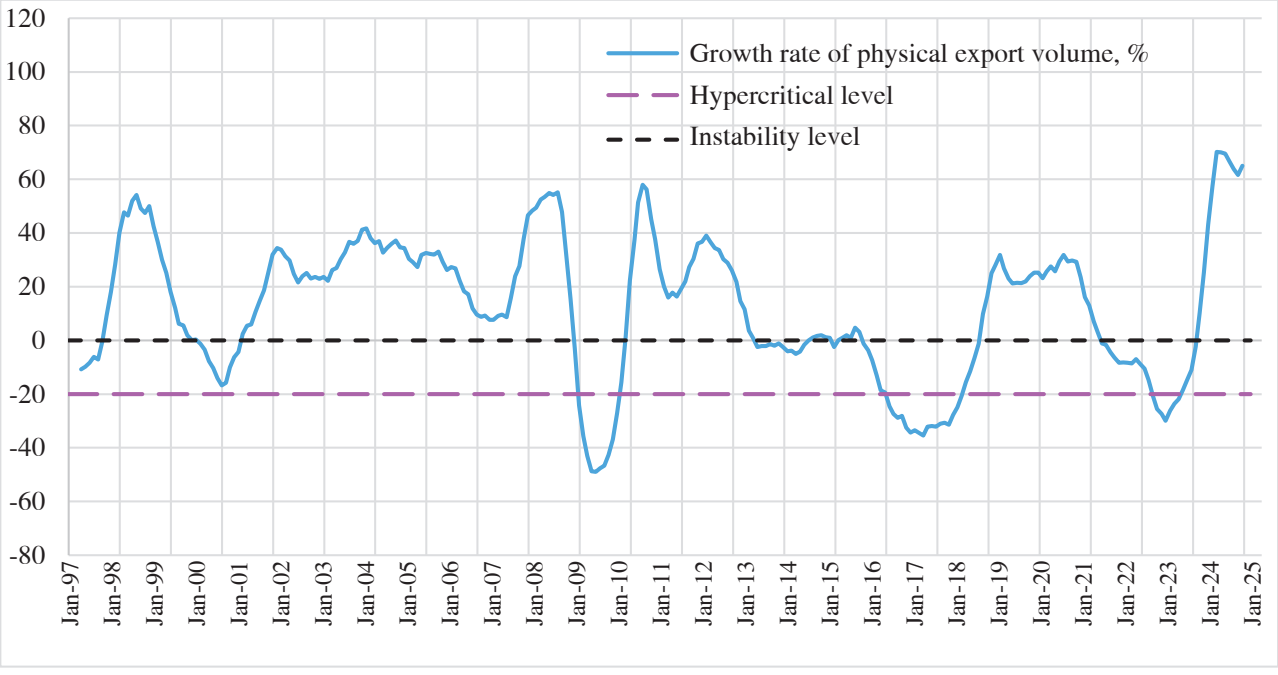

Fig. 2. **Dynamics of the Growth Rate of Physical Export Volume with Indication of Thresholds (Processing — Moving Average, in %)**

Source: compiled by the author.

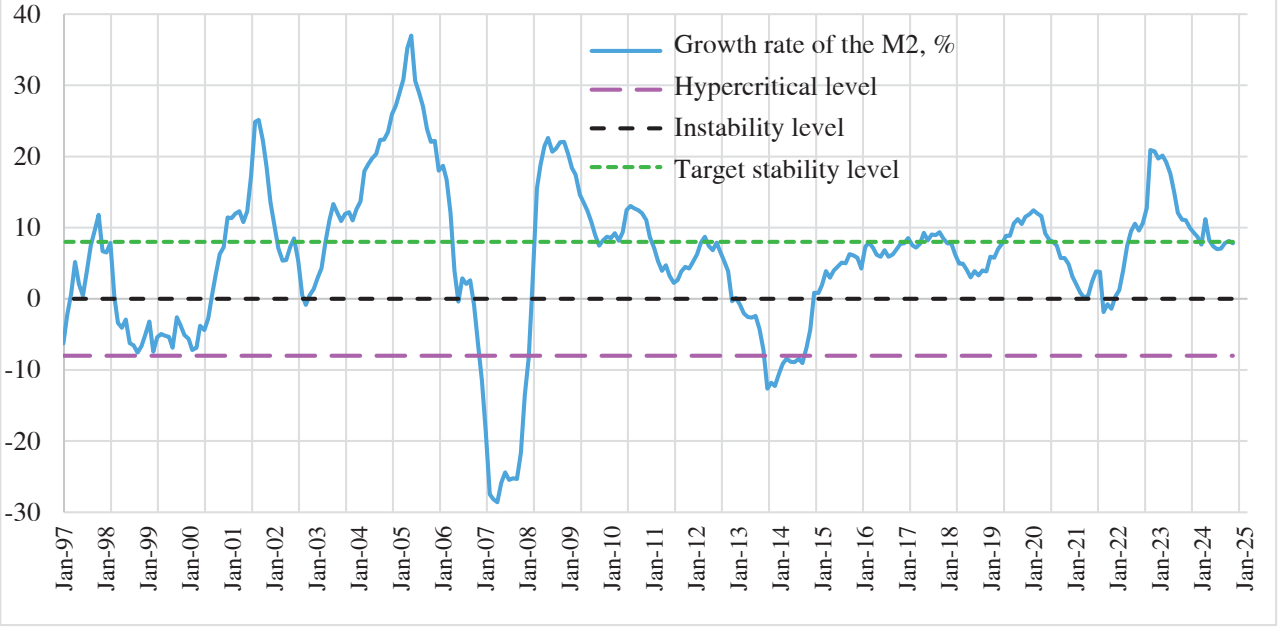

Fig. 3. **Dynamics of the Growth Rate of the M2 Money Supply with Thresholds Indicated (Processing — Cleared of Trend, in %)**

Source: compiled by the author.

CONCLUSIONS

The given research provides a literature survey aimed to determine threshold values for economic security indicators. The primary methodological challenge is linked to differences in their dimensionality, which led to the objective of advancing homogeneous indicators in the form of growth rates of specific indicators of the national socio-economic development.

As a result, a system of seventeen indicators has been elaborated, the advantages of which are the data collection of monthly frequency, facilitating analysis of the development of economic crises, as well as a unified methodology of calculation that excludes the seasonal component.

Moreover, the article introduces the concept of an indicator's susceptibility to a crisis defined as the maximum decrease in its growth rate relative to the zero mark, which is measured as a percentage. A susceptibility matrix has been compiled based on the dynamics of indicators, taking into account the impact made on them by five contemporary crises.

The given research also employs a monitoring model that includes three threshold levels. The first, survival threshold, is based on the author's concept of the sustainability of the economic system as its ability to withstand external and internal shocks deescalating the snowballing process of crises. The second threshold, linked to the violation of stability, is adopted for all indicators in the form of a zero growth rate. Three different options are described for calculating the third threshold of target stability. The first one is associated with the inversion of the first threshold and can be used with insignificant indicator susceptibility to a crisis. The second one refers to the necessity of exceeding the world average growth rates of the corresponding indicators, and the third one to the direct or indirect inclusion in strategic planning documents.

The given methodology can be employed for the operational monitoring of economic security, including the analysis and forecasting of crises, but, like any other method, it should be applied correctly, in view of its limitations.

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Conflicts of Interest Statement: The author has no conflicts of interest to declare.

The article was received on 14.07.2025; revised on 05.08.2025 and accepted for publication on 20.08.2025. The author read and approved the final version of the manuscript.