Modelling macroeconomic security in the national security system of the state in the context of increasing threats and negative challenges

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Abstract

In the present conditions of national economics, characterised by high turbulence, wars and global crises, the issue of ensuring macroeconomic security is becoming critical. The ability of a state to maintain stability in the context of external and internal threats is a crucial factor in its sovereignty and sustainable development. The aim of the study is to develop a systemic model of Ukraine's macroeconomic security as a tool for ensuring the stable functioning of the economy in conditions of multifactorial risks. The methodological basis of the study is based on a systematic approach, economic and mathematical modelling, multifactorial regression analysis, indicative planning, scenario forecasting methods and risk management tools. The modelling takes into account the structural complexity of the economy, its transparency, multi-level nature and the interdependence of sectors. Particular attention is focused on building a logarithmic GDP model that takes macroeconomic factors into account. The study confirms the feasibility of using logarithmic models for scenario forecasting of GDP and formalising the interrelationships between macroeconomic indicators. The developed model of macroeconomic security serves as the basis for strategic planning in conditions of uncertainty. Further development of the model involves expanding the parametric composition, evaluating the effectiveness of adaptive strategies, and monitoring their impact on the economic stability of the state.

Keywords

security, national security, macroeconomic security, inflation, GDP, budget deficit, exports, imports, foreign exchange reserves, population, population welfare, model, modelling, risks, adaptation, scenarios, macroeconomic indicators

1. Introduction

The current conditions for the functioning of national economies are characterised by high volatility, multi-vector challenges and interdependence of global processes. The evolution of international political relations, the intense aggravation of economic conflicts, the impact of pandemics, military operations and energy crises significantly modify the parameters of macroeconomic stability. Under such conditions, ensuring macroeconomic security as a systemic component of national security is of particular importance. Macroeconomic security is defined as the ability of the economic system to withstand internal and external threats, while maintaining stability and ensuring the economic sovereignty of the state.

A balanced model of economic security makes it possible to identify risks, respond in a timely manner to critical environmental changes, and preserve the sovereignty and integrity of the socio-economic system. At the same time, the growth of negative impacts requires the development of approaches to modelling and adapting macroeconomic security, which determines the relevance of this study.

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2. Literature review

Recent years have been characterised by the growing interest of the scientific community in the issues of macroeconomic security in the context of hybrid threats, global economic turbulence and transformational changes in the structure of the world economy. Studies by domestic and foreign authors show a trend towards an interdisciplinary approach to security studies that combine economics, finance, political science, risk science and institutional theory [1, 2, 3, 4].

The basis of the article of the scientists [5] is the study of the essence of macroeconomic security, the prerequisites for the formation and determination of its place in the national security system of the state, determining the state of macroeconomic security of Ukraine in the conditions of war and outlining the main problems that have arisen as a result of the armed aggression of the Russian Federation and determining the directions for restoring the macroeconomic security of the national economy of Ukraine

The authors [6] studied the legal aspects of macroeconomic and national security, emphasizing that economic security is a component of national security, substantiated the need for interdisciplinary cooperation between lawyers and economists to formulate effective security strategies, paid attention to the combination of legal and economic approaches to national security, focusing on international experience and strategic compatibility with partner countries, focused on a comparative analysis of Ukrainian and international strategic

The study [2] provides a systematic analysis of the key parameters that determine the level of macroeconomic security of the state, with an emphasis on martial law conditions. The authors classify analytical parameters into three groups: general economic, financial and socio-economic security. Based on a retrospective analysis of the Ukrainian economy in 2022-2023, the author examines the impact of the war on key macroeconomic indicators (GDP, inflation, unemployment, budget structure). The main internal and external threats are identified and directions for strengthening the resilience of the national economy in wartime are proposed.

The purpose of the article [7] is to analyse the main parameters of Ukraine's macroeconomic security under martial law, as well as to identify the most influential factors that shape the current state and prospects of economic stability. The authors have studied the dynamics of key macroeconomic indicators (inflation, unemployment, debt policy, production, investment, and foreign exchange policy) and proposed a functional approach to the classification of influencing factors. Seven main groups are identified: fiscal, monetary, institutional, social, foreign economic, investment and geopolitical. Based on the study, recommendations are formulated to stabilise security parameters and create conditions for future economic growth.

According to the authors [3], Ukraine's economic security as a component of national security requires a comprehensive rethink in the context of a full-scale war and deep economic instability. The article analyses the key threats - the shadow economy, debt burden, unemployment, budget deficits, business unprofitability and fragmented digitalisation. The authors emphasise the need for end-to-end digital interaction between the levels of the economy - from business entities to the state - to effectively manage economic security.

The article [8] examines the impact of key macroeconomic determinants-military defense spending, non-performing loans, exchange rate fluctuations, foreign debt, and state reserves–on Ukraine's financial security under martial law. Using canonical correlation analysis, the study finds that 63.9% of the decline in financial security in 2022 can be attributed to shifts in these indicators following russia's full-scale invasion. The results highlight the direct and indirect negative effects of these factors and underscore the need for effective macroeconomic monitoring and management to maintain financial stability and support Ukraine's sustainable economic recovery.

The study [9] modelled the impact of the macroeconomic environment on economic security under martial law using a multivariate regression analysis based on 12 indicators. It is found that GDP volatility increased during the martial law period, and unemployment, inflation, balance of payments and informal employment became the key threats. The structure of threats has changed: the informal economy has come to the fore. The model allows quantifying the level of economic security and formulating recovery

and resilience policies in the context of protracted conflict.

The results of the study [10] point to macroeconomic stability as a key systemic component of Ukraine's economic and national security. The author emphasises the importance of maintaining low inflation, budgetary discipline and the economy's ability to withstand internal and external threats. The author emphasises the need to expand the range of stability indicators, including demographic, food security and social inclusion. Ukraine's economic security is assessed using an integral index based on nine sub-indices and more than 130 indicators. The study confirms the strategic role of macroeconomic stability in ensuring the country's resilience in the face of global and geopolitical instability.

The article [11] addresses the issue of monitoring and forecasting Ukraine's macroeconomic security amid global economic transformations. Using 19 indicators categorized as stimulants, nominators, and destimulants, the study applies statistical modeling, expert evaluation, regression analysis, and a modified principal component method to assess and forecast macroeconomic security and the level of shadow economy. Results show differences between expert and model-based assessments, with trends indicating potential stabilization by 2023–2024. The study emphasizes the importance of investment attraction and labor market stabilization for strengthening national security, and proposes a macroeconomic analysis framework useful for public policy planning.

The article [12] explores the concept of secure development in Ukraine through the lens of economic security and risk assessment. Emphasizing the importance of continuous risk monitoring, the author presents a methodology for quantitatively measuring risks that undermine national resilience. A practical risk assessment algorithm is developed and applied to evaluate economic vulnerabilities and generate a composite economic risk index. The study concludes that secure national development must rely on systematic risk identification, evaluation, and monitoring to enhance adaptability in a dynamic security environment.

The practical significance of the article [13] is to study the main problems of implementing strategic programmes of economic and macroeconomic security of Ukraine during a full-scale war. The levels of economic and macroeconomic security of the country before the outbreak of war are characterised. The author analyses the peculiarities of the modern approach to the search for new models and mechanisms that can ensure overcoming the consequences of a full-scale war, further stable economic growth and economic security of the State, and proposes to adopt detailed action plans to adjust the tasks of intensifying the development of the State.

The authors [14] study the role of economic security as a key component of Ukraine's national security under martial law. The emphasis is placed on the relationship between economic sustainability and social welfare, structural transformations and global challenges. The main areas of economic security are analysed: macroeconomic, financial, production, foreign economic, social, investment and innovation, and food security. The threats arising from the full-scale aggression of the Russian Federation are outlined, and the need to implement a comprehensive state policy to counteract economic risks in a long-term conflict is substantiated

The article [15] analyzes the impact of force majeure crises-such as the global recession, annexation of Crimea, military conflict in Donbas, the COVID-19 pandemic, and the full-scale war in 2022-on the stable development of Ukraine's regions. Using official data from the State Statistics Service, the study demonstrates that these events produced multiplier and acceleration effects that negatively influenced gross regional product (GRP) dynamics. A heat map of GRP correlations revealed significant imbalances between economic and social development across regions. Linear regression modeling confirmed persistent regional disparities exacerbated by crisis and war conditions.

The article [16] is aimed at generalising the theoretical and methodological foundations of the integrated assessment of national security in the context of sustainable spatial development. The author considers national security as a socio-ecological and economic category that meets the principles of sustainable development. The author analyses the system of indicators of economic, energy, environmental and forest security, with an emphasis on the effectiveness of environmental taxation. Approaches to the formation of an algorithm for a comprehensive rating assessment of the components of national security, which should take into account the current social and environmental priorities of the state policy, are substantiated.

The result of the study [17] is the identification of key aspects of Ukraine's national economic security in the context of martial law and global challenges. The differences between economic security at the level of economic entities and the national level are analysed. It is emphasised that national economic security is critical for counteracting external and internal threats, especially in times of war, which exacerbates negative factors: outflow of investments, shadow economy, rising unemployment and public debt. The author concludes that it is necessary to find innovative solutions for Ukraine's rapid economic recovery and ensure its stable development in the future.

The aim of the scientists [18] is to build a relevant system dynamic model for assessing and forecasting the level of macroeconomic security in the medium term. A potential forecast was made, primary and alternative scenario forecasts were developed, and the mathematical expectation of key indicators according to the scenarios was calculated. Meanwhile, none of the developed forecasts characterized the state of the level of macroeconomic security precisely as optimal, which led to the conclusion that there is an urgent need to implement a system of measures to increase macroeconomic security.

The article of the scientists [19] is based on diagnosing the level of economic security of the national economy of Ukraine in the context of the long-term negative impact of Russian aggression. The authors systematised the components of economic security, analysed the dynamics of GDP, inflation, financial capabilities and demographic indicators. The authors identify the main destabilising factors and propose scientific and methodological approaches and practical recommendations for improving economic security that can be used in the formation of the state strategy.

The authors [20] considered the improvement of the factor assessment of the level of security of the national economy in the context of modern challenges. The necessity of taking into account new risks, such as cybersecurity and energy security, and the use of integral indicators for a comprehensive analysis of economic security is substantiated. An integrated approach to evaluation is proposed, which combines qualitative and quantitative methods and takes into account the relationship between different groups of factors. The practical significance of the study lies in the possibility of applying the results to develop a multifactorial forecast model of the country's security.

The study [21] revealed the relevance of forming a state policy of stable macroeconomic growth of Ukraine in the context of a full-scale war. The author substantiates a conceptual model of such growth, which includes 10 step-by-step steps aimed at overcoming systemic problems, macroeconomic stabilisation and transition to balanced development. The key stages of implementation of the model, as well as sectoral priorities of the policy aimed at supporting the basic sectors of the economy: industry, agriculture, transport, ICT and creative industries are identifi

Strategy [22] outlines the EU's vision for smart, sustainable, and inclusive growth over the decade. It sets five headline targets focusing on employment, innovation, climate and energy, education, and social inclusion to strengthen Europe's economy and competitiveness. The strategy emphasizes coordinated national reforms and EU-level initiatives to overcome structural weaknesses exposed by the global financial crisis and promote long-term resilience.

The study [23] evaluates the state of Ukraine's foreign economic security using the integrated assessment methodology developed by the Ministry of Economy of Ukraine. Based on ten indicators and data from 2004–2023, the research identifies key threats, including global crises, domestic political shifts, and the full-scale war with Russia. While periods of reform brought temporary improvements, the index sharply declined in 2022–2023 due to the war. The findings highlight the need to strengthen domestic resilience and export infrastructure to ensure sustainable foreign economic activity amid global and security challenges.

The article [24] aims to develop a model for assessing Ukraine's national economic security. It explores the concept of national economic security and its relation to state economic security, reviews existing assessment approaches. The study justifies the use of index- and indicator-based methods, identifies key sources of economic security, and proposes relevant indicators with qualitative interpretations. Visual linear profiles of Ukraine's national economic security are constructed based on the calculated indicators, considering the exclusion of distortions caused by military actions.

The study [25] analyses the challenges and strategic directions of Ukraine's post-war recovery in the context of large-scale destruction caused by Russian aggression. The emphasis is placed on the role of

digital technologies in ensuring transparency, efficiency and accountability of the recovery process. International experience is studied, and the risks and benefits of digital transformation are identified. It is proposed to create an integrated digital platform for monitoring financial flows and project management. The principles of recovery, which include rapid response, accountability, community engagement, and economic growth, are substantiated.

3. Aims and objectives

The purpose of the paper is to develop a comprehensive, scientifically based model of macroeconomic security as a key element of the national security system in the context of growing internal and external threats, global economic shocks and transformational challenges.

4. Materials and methods

In the context of ensuring the macroeconomic security of the state, the methodological basis of modelling plays a key role, as it allows formalising complex multi-level relationships between different sectors of the national economy, as well as identifying and assessing destabilisation factors. In the process of developing macroeconomic security models, classical and modern tools of economic and mathematical analysis are used to ensure adequate identification of threats, forecasting their consequences and selection of optimal response mechanisms.

The main methodological principles of macroeconomic security modelling are a systemic approach that considers the economy as a complex open dynamic system with many interconnected elements; complexity that takes into account both the internal structural characteristics of the economy and external global challenges; hierarchy that involves building models at the microeconomic, mesoeconomic and macroeconomic levels.

Quantitative assessment methods, including multivariate regression modelling, econometric models, fuzzy sets, assessment models based on a logical-linguistic approach, as well as tools for scenario analysis and time series modelling, are of great importance. In addition, composite indicators, which integrate multiple indicators into a single assessment system using weighting coefficients, demonstrate significant efficiency in determining the level of security.

Given the growing instability of the external environment, it is also advisable to include elements of risk management and disaster theory in the modelling, which allow identifying critical points of transition of the system to an unstable state. At the present stage, modelling taking into account the nonlinearity of economic processes, synergy effects and multiplier effects, which should be based on a systematic approach, is of particular importance [6, 26].

An important component of the methodology is the use of indicative planning and monitoring tools that allow adapting economic policy to a changing environment, which is a prerequisite for the formation of an effective system of anti-crisis regulation and long-term strategic planning based on the principles of sustainability, adaptability and institutional capacity of the state. In this context, the formation of a systemic model of macroeconomic security in the national security structure is a prerequisite for ensuring the stable functioning of the state in the face of internal and external threats. Such a model should reflect the integrity of the economic system, its resistance to destabilising factors, and provide for the existence of mechanisms of self-healing and adaptation.

The systemic model of macroeconomic security should be based on the concept of structural and functional interaction between the key elements of the macroeconomic environment, namely the financial and budgetary system, banking sector, foreign economic activity, industrial and production potential, energy, labour market and social sphere, which are modelled as interconnected subsystems and whose functioning should be balanced in accordance with national priorities.

One of the key conditions for the formation of such a model is the definition of target indicators of macroeconomic security of the state, including inflation, budget deficit, foreign exchange reserves, gross domestic product dynamics, exports, imports, and population dynamics. Indicators should be grouped

into subsystems and interconnected by logical dependencies, which allows assessing the current state of security, trends and projected changes [8].

The process of identifying threats should be based on a multidimensional analysis that assesses the frequency, probability of occurrence and scale of impact of each risk. It is advisable to use risk matrices, expert assessments, scenario planning, and indicator analysis, which allows determining the threshold values of key indicators of economic security. As a toolkit, the article uses a multi-level structure of the model, which includes strategic (long-term), tactical (medium-term) and operational (short-term) levels of both analysis and management. At each level, appropriate development scenarios are formed, which take into account both the basic conditions of stability and the relevant scenarios in the event of an aggravation of crisis phenomena [11].

The model pays special attention to the identification of structurally unstable elements that have the lowest ability to resist destabilising influences, including critical dependence on energy imports, balance of payments deficits, reduced investment attractiveness, and social threats, which allow for the development of preventive risk management mechanisms and reduce the likelihood of crisis processes.

The development of a systemic model of macroeconomic security should also be based on a comprehensive approach that takes into account macroeconomic determinants, domestic institutional capacities, and foreign policy risks integrated into a single functional structure for monitoring, forecasting, and response.

In the context of macroeconomic security modelling, an important step is to assess the effectiveness of models of response to identified threats. Such an assessment should include an analysis of the system's ability to detect destabilising signals in a timely manner and its ability to respond adaptively in the face of rapid changes in the external and internal environment.

Risk response models are theoretically classified according to the degree of complexity and coverage: from basic algorithmic approaches to complex integrated systems that combine econometric forecasting, machine learning, indicator dashboards and scenario modelling mechanisms. Under conditions of high uncertainty, it is the combined models that integrate quantitative and qualitative parameters that demonstrate the highest efficiency in predicting crisis trends and minimising losses.

The effectiveness of the models was assessed based on key criteria, including forecasting accuracy, flexibility and adaptability to new data, economic feasibility of implementation, resource efficiency and scalability, as it is important to consider the availability of feedback mechanisms to correct decisions in real time.

The use of stress testing to test the viability of selected response models in the face of sharp shocks, such as currency fluctuations, energy crises, epidemiological threats, etc., is of high practical value, allowing for timely identification of weaknesses in existing mechanisms for ensuring economic resilience and development of compensatory strategies. The effectiveness of the models should also be assessed in terms of their integration into national development strategies, coherence with public administration policies, ability to increase institutional trust and ensure transparency of decision-making.

An important stage in the strategic management of macroeconomic security (Figure 1) is the assessment of the effectiveness of risk response models, which allows to justify the choice of optimal adaptation tools and increase the resilience of the national economy to external and internal challenges.

Taking into account the theoretical and methodological foundations [2, 7, 8, 16, 19] of macroeconomic security and its role in the national security system, it is advisable to further focus the study on empirical modelling of the relevant dependencies in order to assess the impact of key macroeconomic indicators on the GDP level in the medium and short term based on the data in Table 1.

An analysis of the dynamics of Ukraine's macroeconomic indicators in 2013-2024 shows a shift in the economic paradigm under the influence of political, security, and global factors that arose and escalated during the hostilities and the pandemic.

The gross domestic product has been growing steadily in nominal terms, from UAH 1,454.9 billion in 2013 to approximately UAH 7,658.6 billion in 2024. However, in real terms, this growth was largely driven by inflation and the devaluation of the hryvnia. The sharpest GDP growth was recorded in 2021, as the economy recovered from the COVID crisis, but growth slowed in 2022 due to the full-scale invasion of Russia. In some years, such as 2014, 2015, 2022, and 2023, real GDP losses were the result of

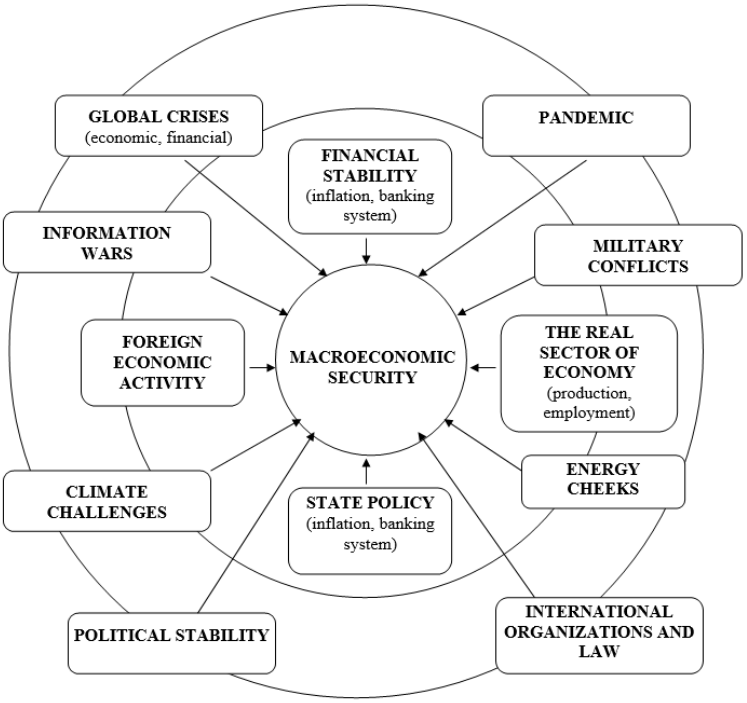

Figure 1: Model of macroeconomic security in the national security system of the state.

Table 1
Key Macroeconomic Indicators of Ukraine for 2018-2024

Year	GDP (UAH billion)	Inflation (%)	Budget deficit (% of GDP)	Exports (UAH billion)	Imports (UAH billion)	Foreign exchange reserves (USD million)	Population (million people)
2013	1454.9	0.5	-4.45	505.8	615.2	20415.71	45.55
2014	1586.9	24.9	-4.98	645.6	677.7	7533.33	45.43
2015	1988.5	43.3	-2.28	832.1	819.0	13299.99	42.93
2016	2383.2	12.4	-2.94	930.0	1001.6	15539.33	42.76
2017	2982,9	13,7	-1,60	1151,8	1306,1	18808,45	42,58
2018	3558,7	10,9	-1,66	1286,6	1550,4	20820,43	42,2
2019	3974,6	7,9	-1,96	1295,1	1551,0	25302,16	41,9
2020	4194,1	2.7	-5,18	1326,4	1461,2	29132,89	41.7
2021	5459,6	9.4	-3.63	1855.7	1986,7	30940,95	41.5
2022	5191,0	26,6	-17,62	1609,1	2325,9	28494,46	40.0
2023	6537,8	5,1	-20,39	1323,8	2325,9	40514,43	39.0
2024	7658,6	12,0	-24,2	1605,4	2725,8	43795,35	35.8

inflationary processes, as nominal growth does not indicate an increase in economic well-being and macroeconomic security. At the same time, in 2022-2023, the pace slowed due to military operations that led to a reduction in production, destruction of facilities, and disruption of logistics in several territories. Inflation dynamics demonstrate an undulating pattern with peaks in 2015 (43.3%) and 2022 (26.6%). In 2015, inflation was driven by a deep financial crisis, devaluation of the national currency, loss of control over some territories, and in 2022 by military operations, destruction of infrastructure, rising energy costs, rebuilding of energy infrastructure, and external pressure on prices. At the same time, the decline in inflation to 5.1% in 2023 reflects the NBU's effective targeting of its monetary policy, supported by IMF loan programmes and stabilisation injections from international aid.

The state budget deficit has remained a systemic problem throughout the analysis period, but since 2020, it has been growing at a significant rate. While in 2013-2019, the deficit ranged from 2-5% of GDP, in 2022 it reached 17.62%, and in 2024 it is projected to reach 24.2%. The main factors behind the deepening deficit were the growth of military and social spending, a drop in economic activity of business entities, which reduced the tax base, and the need to cover critical import needs. The significant burden on the budget is partially offset by external borrowing and grant programmes, but fiscal sustainability remains at risk, which negatively affects macroeconomic security.

Foreign trade volumes have also undergone significant transformations. Until 2021, exports had positive dynamics, but since 2022 they have been declining amid the destruction of infrastructure, the blockade of ports, and a decline in agricultural and metallurgical production. Imports remain high at UAH 2,725.8 billion in 2023, largely due to the need for energy resources, military equipment, and humanitarian goods. The gap between exports and imports in 2023-2024 will reach over UAH 1121.4 billion, which will have a negative impact on the balance of payments and require further foreign exchange interventions, which will in turn lead to an increase in the macroeconomic security of the state.

The National Bank of Ukraine's foreign exchange reserves, which decreased to USD 7.5 billion in 2014, are expected to grow in the coming years. In subsequent years, the NBU's foreign exchange reserves grew, largely due to the stabilisation of macroeconomic policy, foreign aid, and debt restructuring. In 2024, reserves exceeded USD 43.7 billion. This was achieved due to the active attraction of external financing (grants, loans), as well as currency control and restructuring of external debts, which became an important factor in ensuring currency stability and debt servicing.

Demographic dynamics indicate a systemic decline in the population: from 45.5 million people in 2013 to an estimated 35.8 million people in 2024. This trend is driven by both natural decline and significant migration, especially during periods of active hostilities. The demographic crisis, in turn, affects the labour market, consumption and the long-term growth potential of macroeconomic security.

Thus, the macroeconomic situation in Ukraine in 2013-2024 shows both signs of the economy's adaptation to the crisis and vulnerability to external shocks. Despite the GDP growth in nominal terms, most structural indicators indicate a tense nature of economic development, which requires a balanced fiscal and monetary policy, international support and structural modernisation of the economy.

5. Results and discussions

Given the identified trends, the next step of the study is to formalise the relationships between macroeconomic factors by building a regression logarithmic model, which will allow quantifying the role of each indicator in GDP formation and conducting scenario forecasting in the context of the macroeconomic security of the state. On the basis of correlation and regression analysis, a multivariate logarithmic model of the impact of indicators on GDP is built and the quality of the statistical model is determined (Table 2):

$$\begin{aligned}\log(GDP_t) =& \beta_0 + \beta_1 \cdot \log(Inflation_t) + \beta_2 \cdot \log(Export_t) \\ &+ \beta_3 \cdot \log(Import_t) + \beta_4 \cdot \log(Reserves_t) + \varepsilon_t,\end{aligned} \tag{1}$$

$$\begin{aligned}\log(GDP_t) =& -3.23 - 0.004 \cdot \log(Inflation_t) + 0.474 \cdot \log(Export_t) \\ &+ 0.352 \cdot \log(Import_t) + 0.529 \cdot \log(Reserves_t) + \varepsilon_t.\end{aligned} \tag{2}$$

Thus, the logarithmic model has a very high accuracy ($error \approx 1\%$).

The model explanation: if exports grow by 1%, GDP grows by about 0.47%, if imports grow by 1%, GDP grows by 0.35%, if reserves grow by 1%, GDP grows by 0.53%, and the impact of inflation is almost neutral.

Table 2
Regression Statistics of the Model

Indicator	Value
RMSE	0.0113
R^2 (Coefficient of Determination)	0,9977
Ajusted R^2	0,9862

It should be noted that population and budget deficit growth are excluded from the formula, although a decline in population and a rise in the budget deficit are associated with a weakening economy, in times of war these processes can be accompanied by GDP growth (Table 3), due to increased public spending (including in the military sector), mobilisation of international financial assistance, business adaptation to new realities, high inflation, and the reorientation of the economy towards export-oriented and digital sectors.

Table 3
Model-projected Data by Year and Scenario

Year	Inflation	Export	Import	Reserves	GDP	Script
2025	9	2000	3500	45000	4886789	Realistic
2026	8	2150	3600	46000	5164908	Realistic
2027	7.5	2300	3700	47000	5444564	Realistic
2025	8.55	2100	3325	47250	5039020	Optimistic
2026	7.6	2257.5	3420	48300	5325803	Optimistic
2027	7.125	2415	3515	49350	5614170	Optimistic
2025	9.9	1800	3850	40500	4548463	Pessimistic
2026	8.8	1935	3960	41400	4807327	Pessimistic
2027	8.25	2070	4070	42300	5067621	Pessimistic

Despite the full-scale military operations, Ukraine's macroeconomic dynamics in recent years have been characterised by an increase in nominal gross domestic product (GDP). However, this growth cannot be unequivocally interpreted as an improvement in the economic well-being of the population.

GDP, as an aggregate indicator of economic activity, reflects the total value of goods produced and services provided within the national economy, but does not take into account internal socio-economic imbalances, such as uneven income distribution, human losses, infrastructure degradation and reduced labour potential. Consequently, GDP growth may be accompanied by an actual deterioration in the living conditions of the general population.

A large-scale expansion of public spending, in particular in the areas of defence, logistics and infrastructure, has been identified as one of the factors that ensure the growth of macroeconomic indicators in the context of military conflict. According to the classical model of calculating GDP (as the sum of consumer spending, investment, public procurement and net exports), the growth in the share of public procurement is a direct driver of GDP growth. Expenditures on armaments, supplies for the Armed Forces of Ukraine, rapid deployment of logistics networks, and investments in the restoration of critical infrastructure form a significant amount of economic activity of business entities, which directly affects GDP growth in nominal terms [9].

External financing, including loans, grants, and military support from Western partners, should be recognised as an important component of modern economic support. Much of these resources go into domestic economic circulation, boosting domestic demand, stimulating trade, and ensuring currency stability by increasing foreign exchange reserves. At the same time, the impact of international aid on the economy is not limited to direct financial effects: it also creates expectations of stability, maintains confidence in the national currency, enables the government to maintain social benefits and finance critical areas for macroeconomic security. However, such stability is partly artificial and depends on political conditions, not just market mechanisms, which creates potential risks if external support

declines.

The economy's adaptation to the war is manifested in changes in the structure of production and business activity. The business sector is transforming in line with new challenges: military production is growing, the role of the information technology sector is strengthening, and new logistics hubs and medical clusters are being created. This adaptation allows for basic macroeconomic security, even in the event of a significant loss of resource and territorial potential.

One of the key characteristics of the current economic situation is high inflation, which directly affects nominal GDP growth. Rising prices for goods and services lead to an increase in the total value of national production, which is reflected in GDP growth, despite the fact that the real volume of output may remain stable or even decline. Inflationary processes are caused by a combination of factors, including disruptions in supply chains, the energy crisis, devaluation expectations and higher costs of imported components. Thus, inflation plays the role of a nominal driver of GDP growth, which at the same time does not contribute to the real welfare of the population.

The processes of partial de-occupation of the territories and the gradual recovery of economic activity in the liberated regions play a special role in ensuring positive dynamics. The restoration of trade, services, and production capacity is contributing to the formation of local economic growth clusters, which make a positive contribution to macroeconomic indicators at the national level.

6. Conclusions

The study shows the high sensitivity of Ukraine's economy to external shocks, while confirming the existence of certain adaptation mechanisms. The built logarithmic model revealed a significant impact of exports, imports, and foreign exchange reserves on GDP growth, which allows it to be used for scenario forecasting. The resulting forecasts show that under a realistic scenario, GDP will grow between UAH 5-6 trillion by 2027. The pessimistic scenario indicates a potential slowdown due to external risks, including a decline in international support. The optimistic scenario shows that economic growth is possible if exports increase and the domestic economy and macroeconomic security of the country stabilise.

Thus, the strategic goal is to build a sustainable macroeconomic security system with a focus on macroeconomic security by diversifying the economy, minimising dependence on imports, and strengthening the institutional capacity of the state.

Declaration on Generative AI

The authors have not employed any Generative AI tools.

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