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Ukrainian State Budget as a Result of Military Actions in the Russian-Ukrainian War

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Abstract

The purpose of the article is to analyse the impact of military expenditures on budget policy in times of war and to assess the effectiveness of the traditional budget model without dividing it into defense and civilian sectors in the context of economic changes. The research methodology combines quantitative and qualitative methods, including comparative analysis, synthesis of literature, analysis of statistical data and correlation analysis using JASP tools, as well as methods of systematization and generalization to identify key factors influencing budget policy. The use of these methods allows for a comprehensive assessment of the dynamics of budgetary indicators and the effectiveness of public financial management in wartime. The correlation analysis showed that the most significant relationship exists between GDP and public debt ($r = 0.917$ at $p < .001$), and between military spending and budget revenues ($r = 0.970$ at $p < .001$), indicating a strong influence of these factors on the budgetary situation. Modelling based on the X matrix allows forecasting budgetary indicators, including revenues and expenditures, depending on macroeconomic variables such as GDP and military spending, to further improve budget policy. By analysing the impact of military spending on Ukraine's budget policy, the article identifies the need to improve the financing of the defence sector to ensure macroeconomic stability in times of war. Given the increasing fiscal instability and limited opportunities for economic development due to the growth of military spending, the need to improve the financing of the defence sector was identified.

Keywords: Fiscal Risks, Public Debt, Public Finance, Public Finance Management, Public Financial Sustainability, State Budget.

Introduction

The public finances of Ukraine have undergone significant changes in the context of the Russian-Ukrainian war, which requires a review of the financial resources management policy and adaptation of the budget and tax system to new challenges. Political and social instability caused by the war has a significant impact on financial stability, creating new conditions for public administration. Against the backdrop of Ukraine's military aggression, the government's ability to quickly mobilize resources to meet defence needs, restore infrastructure, and support social programs becomes a crucial factor in the stability of public finances (1). In times of war, it is necessary to implement adaptive strategies to mitigate financial shocks, ensure budgetary flexibility, and maintain social services (2). In particular, in 2022, under the influence of the war, there was a significant reduction in non-tax revenues by 45%, a decrease in domestic budget resources due to the destruction of industry (GDP fell by 29.1%), the loss of part of the tax base, and an increase in military spending to 35% of GDP (3). This situation leads to a systematic increase in public debt, which requires immediate optimization of debt policy and active use of non-repayable financing to maintain economic stability (4). Therefore, effective debt management and broadening of the tax base are necessary conditions for ensuring long-term financial stability in the post-war period (5). Thus, Ukraine's public finances in times of war require flexible adaptation to new realities, ensuring stable financing of defence and social programs, and finding mechanisms of financial sustainability to overcome the economic crisis. In this context, it is important to study the experience of other countries that have experienced conflicts to

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develop optimal strategies for Ukraine.

Political and Social Instability

Studies that focus on political and social instability often provide an analysis of how these factors affect financial stability and the efficiency of public resource management. Political turmoil disrupts traditional financial management, requiring adaptive strategies to maintain economic stability and support defence efforts (1). Therefore, wartime conditions require governments to mobilize resources quickly to support military and social needs, which often lead to significant changes in budget priorities; and to respond effectively to crises, public administration needs to be restructured by increasing the flexibility and innovation of public finances (2). In this context, the introduction of adaptive budget and tax policies is crucial to mitigate financial shocks and maintain public service delivery, especially in the Ukrainian case, where military aggression has led to catastrophic destruction and increased threats to financial stability (6). In addition, changes in tax legislation and economic instability can significantly affect revenue generation, complicating financial management during war, requiring the adaptation of the accounting and taxation system to ensure transparency and efficiency, focusing on reducing the tax burden to maintain economic resilience (7). However, other scholars have noted that political instability can be both a problem and a catalyst for reforms in public financial management, suggesting that these reforms can lead to more resilient economic structures after conflict (1, 8, 9).

Countries in Military Conflicts

Countries in the midst of a military conflict or war are characterized by increased involvement of military expenditures, financing of infrastructure reconstruction and social programs. As the experience of Bosnia shows, the government's budget was largely dependent on humanitarian aid, and financial relations were formed with both the Bosnian government and Bosnian Serbs, which emphasizes the complexity of public finance management in the context of political and territorial fragmentation (10). In contrast, in Israel, the main allocation of military expenditures is to ensure national security, which is realized through significant funding from the state budget, which in turn stimulates the growth of military spending and inflationary financing, exceeding the gross national product (11). Instead, the current escalation of the conflict shows that military spending in Israel, as in other countries, can stimulate economic growth in the short term, but achieving sustainable economic development requires careful management of financing, including the use of debt for temporary expenditures and fiscal adjustments for permanent obligations, taking into account technological investments that stimulate long-term productivity (12).

An important aspect is the development of mechanisms to ensure financial stability in the face of blockades, sanctions, or external threats. In this context, the financial sector plays a key role in conflicts, as narrow development that exacerbates inequality contributes to social tensions and a weak financial system after a war threatens economic recovery; for example, during the Bosnian conflict, the war effort was financed by buying government debt, and differences between Bosnian Serbs and Muslims in the financial sector increased instability, as did the use of Israeli currency to obtain seignior age, which demonstrates the need for stronger financial regulation (13). Considering the impact of modern geopolitical conflicts on public finances, in particular on the growth of spending on military consumption and arms procurement in countries such as the Republic of Serbia, it should be noted that there is a need for a significant increase in public financial expenditures for the development and purchase of the latest weapons and military equipment, in particular based on technologies that radically change the balance of power, which creates additional challenges for the effective management of public finances in times of war (14).

A number of scholars have noted the importance of flexibility in the budget process and efficiency in public debt management in these circumstances. In addition, in post-conflict situations such as the West Bank and Gaza, Bosnia and Herzegovina, East Timor, and Afghanistan, the main challenge for public finance is to ensure effective financing and management of aid, public order, and addressing urgent short-term needs without neglecting long-term economic policy issues (15, 16). Therefore, it is necessary to design financing mechanisms to suit each specific context, promoting international cooperation, encouraging government capacity

building, and involving local communities and non-governmental organizations to ensure sustainable fiscal and institutional development. In addition, active communication and a clear understanding of the political and economic timeframe are essential to avoid unrealistic expectations and ensure effective reconstruction (17).

Public finances during the ATO, Joint Forces Operation and the full-scale invasion of Russia

In Ukraine, research on public finance management during the outbreak of hostilities in 2014 and the full-scale invasion of Russia in 2022 is of great importance. Modern authors analyse how public finances have adapted to the new conditions, in particular, in the context of political instability and the crisis caused by the outbreak of hostilities in 2014 (18-23). In this context, in order to minimise the negative effects of fiscal consolidation on economic growth and employment, it should be implemented gradually, in particular through a gradual reduction of the structural budget deficit, while focusing on optimising the structure of taxes and expenditures, in particular reducing state subsidies to enterprises, increasing property and environmental taxes, and reducing public consumption expenditures (18). However, in the context of political instability and changing geopolitical priorities, it is necessary to make decisions to simplify business, make privatisation more attractive to entrepreneurs and beneficial for economic development, and take measures to protect investments and intellectual property (19). Similar conclusions have been previously studied and emphasise the need to apply mechanisms of state subsidies, budget financing of infrastructure projects, privatisation programmes, tax revenues, dynamics of federal budget expenditures, subsidy rationalisation policy, optimisation of budget expenditures, improvement of public debt management, improvement of the quality of public services, and reform of the tax system (20). Another important thing to add is the need to strengthen control over budget expenditures through transparency of operations, monitoring of budget implementation and consideration of recommendations of non-governmental institutions, as well as to increase budget revenues by increasing the progressivity of taxation of income and property of wealthy citizens and eliminating tax evasion (21). However, the growing risks of public finance in Ukraine necessitate reforms aimed at strengthening control over budget expenditures, limiting the deficit, improving debt policy, fiscal decentralisation, and combating the shadow economy to ensure macroeconomic stability and sustainable economic growth (22).

Instead, in the current environment, improving the management of budget operations involves limiting the attraction of emergency revenues, increasing tax revenues, off-budget resources, placing loans on the domestic market, limiting monetary financing of the deficit, replacing concessional financing with market borrowing, and providing mechanisms to maintain debt sustainability (23). In addition, the current situation with public finances against the backdrop of a full-scale war is characterized by a significant reduction in tax revenues caused by corruption and the shadow economy, which, necessitates structural changes, including the restoration of the national economy, fiscal reforms aimed at increasing the efficiency of tax mobilization, and expanding the tax base as a prerequisite for optimizing the public debt burden (5). Therefore, the systematic growth of Ukraine's public debt caused by a full-scale war requires urgent optimization of debt policy, focused on attracting non-repayable financing, negotiating debt restructuring, and creating a favourable investment environment to ensure financial sustainability (4). In turn, modern threats to the state's financial security, caused by transformational changes, require a comprehensive approach, which includes strengthening the financial potential of the real sector, ensuring currency stability, developing a balanced budget, improving debt policy and creating a favourable investment climate (24).

Special Financing Regime

The special funding regime applied in Ukraine before the full-scale invasion included changes in the budget process, such as the temporary suspension of Articles 33 and 751 of the Budget Code of Ukraine, which regulate the preparation of the budget declaration and local budget forecasts, i.e., the relevant documents were not developed and submitted in the usual manner (25); abolition of the application of Article 55 of the Code on protected expenditures (amendments to the

Budget Code of Ukraine, in particular paragraphs 22 and 221 of Section VI "Final and Transitional Provisions"), which allowed the allocation of budget funds under martial law (26); and the introduction of restrictions on the planning and implementation of budget expenditures, which concerned, in particular, the exercise of powers by the State Treasury Service of Ukraine and its territorial bodies, which affected the order and priority of expenditures (27).

One of the important aspects of such changes was the effectiveness of financial decision-making, as well as the limitation of projected budget revenues due to economic instability. Under these circumstances, the economic instability caused by the war is leading to a limitation of projected budget revenues, which suggests the need to strengthen budgeting, audit and reporting transparency to ensure efficient use of resources and guarantee timely assistance for Ukraine's recovery (28). Instead, with limited projected budget revenues due to economic instability caused by the war and other global crises, it is necessary to invest in domestic growth reserves, economic diversification and workforce skills development to maintain economic stability (29). The need for such changes is due to the fact that classical economic budgeting models (Keynesian, neoclassical, institutional) have limitations in the context of military conflicts, suggesting that these approaches should be integrated with ideological discourse and political priorities to create an adaptive budgetary mechanism that will ensure effective economic recovery after the crisis (30). Therefore, given that the war has caused numerous challenges for businesses, including disruptions in supply chains and limited access to resources, systematic implementation of adaptive business strategies, including investments in digitalisation and improvement of internal processes, is needed to ensure economic stability (31).

Purpose

The purpose of this research article is to analyze the impact of military spending on budget policy in times of war, to assess the effectiveness of the traditional budget model without dividing it into defence and civilian budgets, and to determine the feasibility of maintaining this model in the context of a changing economic situation. The article aims to investigate the relationship between public spending on the security sector, budget revenues and macroeconomic indicators, as well as to study the mechanisms for ensuring the financing of the defence sector**.**

The article is organized as follows to accomplish this purpose: the first section delineates the theoretical underpinnings and international experience of budget policy during wartime; the second section analyses Ukraine's public finances and the influence of military expenditures on budget priorities; the third section assesses the current budget model's effectiveness and suggests strategies for enhancing fiscal sustainability in post-war and wartime scenarios.

To achieve this objective, the structure of the article is organized as follows. The first section provides a comprehensive theoretical framework and explores international experiences in the implementation of budgetary policy under conditions of armed conflict, offering comparative insights into fiscal adaptations and strategies. The second section conducts an in-depth analysis of the dynamics of Ukraine's public finances, with particular emphasis on the transformative influence of military expenditures on budgetary allocations and revenue generation. The third section critically evaluates the effectiveness of the existing unified budgetary model, assesses its capacity to respond to wartime exigencies, and proposes evidence-based recommendations aimed at enhancing fiscal sustainability and resilience in both the on-going and post-conflict periods.

Methodology

The following methods were used in the study.

The synthesis of literature sources was used to identify the main conceptual approaches to assessing budgetary processes, in particular, the impact of macroeconomic factors on public finances, which allowed identifying existing scientific approaches and adapting them to the specifics of the period under study. Source selection was based on criteria of relevance to the wartime context, methodological rigor, and publication within the last ten years to ensure contemporary applicability.

The selection of literature sources was based on the following criteria: year of publication - no earlier than 2014, which ensures that the sources are relevant to the current stage of the military conflict; scientific relevance - sources containing

empirical analysis of budget policy, macroeconomic factors and their impact on public finance in times of crisis were used; source representativeness - preference was given to publications in peer-reviewed scientific journals, reports of international financial organisations (IMF, World Bank), as well as official data of the Ministry of Finance of Ukraine and the Open budget platform. This approach allowed us to ensure a high degree of reliability of the materials used and their relevance to the subject of the study. Comparative analysis was used to identify differences in budget indicators in different periods, as well as to assess the effectiveness of public financial management. The analysis included a comparison of data on revenues, expenditures, budget deficit, public debt, tax revenues, and macroeconomic factors such as GDP, inflation, unemployment, and investment activity.

The analysis of statistical data was used to assess the dynamics of budget indicators in 2014–2025. Official data from the Ministry of Finance, the Open budget platform and other official sources were used (32-40). The inclusion of this timeframe allowed for a balanced assessment of budgetary dynamics before and during the war, capturing both the onset of crisis and the government's fiscal responses. The sample period covers both pre-crisis years and periods of macroeconomic instability, which allows us to assess both the effects of the crisis and the results of the implemented public financial management policies.

The statistical data were grouped in Table 1 to conduct a correlation analysis of the relationship between various economic indicators in 2014–2024 using the Pearson's Correlations tool in the JASP statistical program; as well as to apply linear regression to determine the impact of various economic factors on financial indicators during 2014–2024. The main limitation of this study is the lack of a number of necessary data, which was compensated for by forecasting using the FORECAST.ETS function in Microsoft Excel, which applies exponential smoothing to generate time series forecasts. To ensure robustness, the forecasting method was cross validated by comparing its results with historical trends and known macroeconomic projections from national sources. Although extrapolated data inevitably introduce a margin of uncertainty, their integration was limited to cases where gaps would otherwise prevent meaningful analysis.

Table 1: Initial Data (32-40)

Period	Budget revenues (Y1)	Budget expenditures (Y2)	Budget deficit (Y3)	Public debt (Y4)	GDP (X1)	Inflation (X2)	Unemployment rate (X3)	Volume of foreign direct investment (X4)	Level of military spending (X5)	Tax revenues (X6)
2014	357084,2	430217,8	-78052,8	1100564,0	1566728	124,9	42928,9	410	27363,4	280178,3
2015	534694,8	576911,4	-45167,5	1572180,2	1979458	143,3	42760,5	-458	52005,2	409417,5
2016	616274,8	684743,4	-70130,2	1929758,7	2383182	112,4	42584,5	3810	59348,9	503879,4
2017	793265	839243,7	-47849,6	2141674,4	2982920	113,7	42386,4	3692	74346,2	627153,7
2018	928108,3	985842	-59247,9	2168627,1	3558706	109,8	42153,2	4455	97024	753815,6
2019	998278,9	1072891,5	-78049,5	1998275,4	3974564	104,1	41902,4	5860	106627,7	799776
2020	1076016,7	1288016,7	-217096,1	2551935,6	4194102	105	41588,4	-868	120374,1	851115,6

2021	1296852,9	1490258,9	-197937,4	2671827,6	5459574	110	41167,3	6687	127527,3	1107090,9
2022	1787395,6	2705423,3	-914701,7	4071683,1	5191028	126,6	40757,78932	1152	1142872,4	949764,4
2023	2671998	4014418,1	-1333110,7	5519483,9	6537825	105,1	40348,05106	4247	2097620,5	1203544,1
2024	3122713,4	4486682,7	-1358500,1	6980964,9	6720294,971	112	39938,3128	3116	2304475,1	1647189,6
2025	283224,90	353779,10	-70173,70	7067998,2	7437382,906	102	39528,57453	4735,890087	233470,3	132062,4

Note: data as of January 2025 are in italics; bold are projected values calculated by the author

A key limitation of the empirical part of this research is the incomplete availability of statistical data for certain periods and variables. As a result, projections and assumptions were introduced, which may affect the precision of the estimated relationships. Moreover, the assumption of linearity in the regression model may not fully reflect the complexity of budget dynamics under conditions of war and economic disruption. The method of systematization was used to classify the data obtained, identify the key factors influencing budget policy, and structure the information for further analysis. This made it possible to identify patterns and trends in the formation of budget indicators. The method of generalization was used to draw conclusions about the peculiarities of budget policy, its effectiveness, and projected changes in the financial system of the state. It made it possible to synthesize the results and identify areas for improving public administration in the field of finance.

Results

During the period of the full-scale invasion, the structure of the state budget of Ukraine underwent significant changes due to the prolonged military conflict, its gradual decline, and the reduction of support programs from allied countries, including the United States of America (USA). These factors, along with the urgent need for resources for the post-war recovery process, have determined the key parameters of the state's budget policy. According to estimates by the World Bank, the UN, and the European Commission published in February 2025, Ukraine's total needs for recovery and reconstruction after three years of war amount to USD 524 billion, which is three times higher than the total amount of the country's budget. This is almost three times the expected size of the country's economy in 2024 (41). The Government of Ukraine, with the support of donors, has allocated USD 7.37 billion for 2015. The government of Ukraine, with the support of donors, has allocated USD 7.37 billion for 2025 for priority areas such as housing, education, healthcare, and energy. However, a funding gap of USD 9.96 billion remains. However, there remains a financing gap of USD 9.96 billion to meet recovery and reconstruction needs (42). In addition, international aid to Ukraine is projected to decline significantly starting in 2025. Without new aid packages from the United States, military support could drop to €34 billion and financial assistance to €46 billion. If European donors also reduce their contributions, the total amount of aid to Ukraine could drop to about 55 billion euros (43). Therefore, to better understand these changes, it is advisable to analyze the structure of the state budget of Ukraine in 2021–2025 (data for 2025 are projected), which allows us to trace the dynamics of the main items of income and expenditure, the ratio of tax and non-tax revenues, the level of budget deficit, and trends in the share of international assistance in financing public needs, Figure 1.

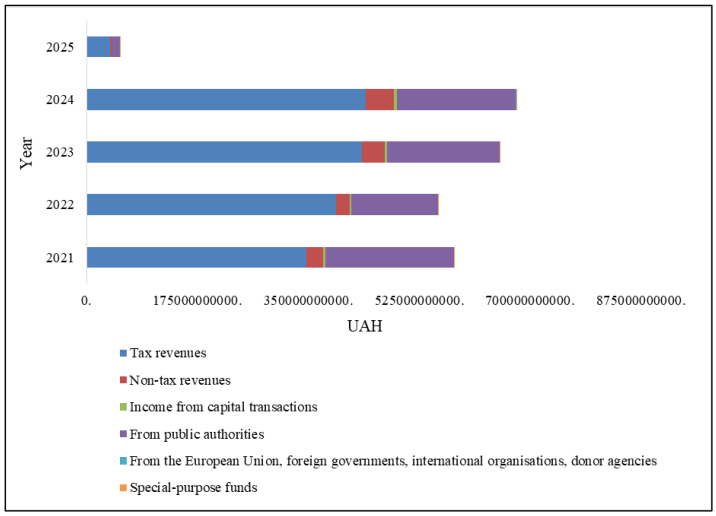

Figure 1: Structure of the State Budget of Ukraine in 2021–2025 (40)

The dynamics of the structure of the state budget of Ukraine in 2021–2025 demonstrates significant transformations caused by external shocks, including a full-scale war, macroeconomic challenges, and the need to restructure the financial system. Against the backdrop of steady growth in budget revenues in the pre-war period, after 2022, there will be a sharp change in the proportions of revenues and expenditures. A significant increase in international financial assistance in 2022–2025 (data for 2025 are projected) will compensate for the loss of the tax base caused by the destruction of industrial facilities and a decline in economic activity. At the same time, the rapid increase in defense spending is accompanied by a budget deficit, which requires intensified tax mobilization and fiscal consolidation. An examination of the dynamics of state budget indicators in a wider time frame (2014–2025) reveals key trends: the evolution of budget policy under the influence of crisis phenomena, the role of external financing in maintaining macroeconomic stability, and the impact of force majeure on the long-term sustainability of public finances (Figure 2).

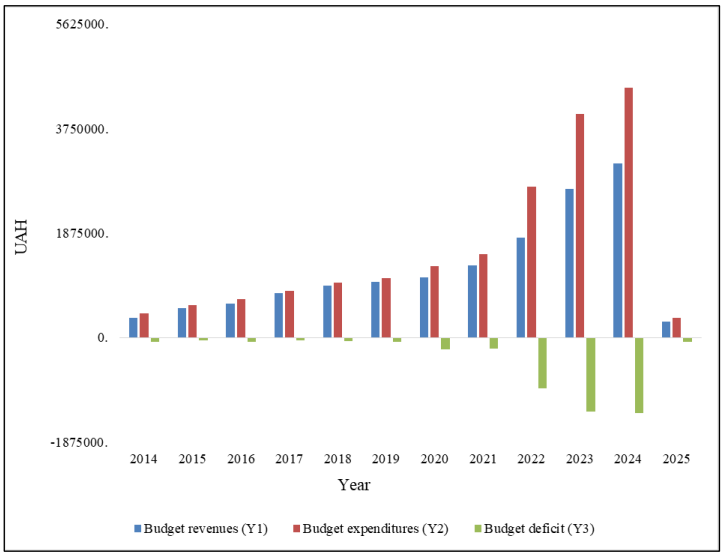

Figure 2: Dynamics of Indicators of the State Budget of Ukraine for 2014–2025 (Based on Open budget, 40)

The analysis of the dynamics of the structure of the state budget of Ukraine for the period 2021–2025 shows dramatic changes caused primarily by military operations and the need to adapt the financial system to new macroeconomic challenges. The main trends observed in the structure of budget revenues are fluctuations in tax and non-tax revenues, a significant increase in

external financial support (in 2023, more than 50% of total budget revenues), and growing problems with fiscal stability.

In the pre-war period (2021), the budget was characterized by relative balance, a high share of tax revenues (about 80% of total revenues), an increase in revenues from economic activity (by 12.3% compared to 2020), and an increase in funding for infrastructure projects (by 18.7%) (44). However, already in 2022, under the influence of the war, there was a significant reduction in non-tax revenues (by 45%) and a decrease in domestic budgetary resources due to the destruction of industrial enterprises (GDP decline by 29.1%), the loss of part of the tax base, and the need to direct funds to defence needs (an increase in military spending to 35% of GDP) (3). In 2023, the financial system adapted to the new conditions, which was reflected in an increase in tax revenues (by 17.5% compared to 2022), but fiscal capacity remained limited due to large-scale budget expenditures, primarily on the defence sector (almost 50% of the total budget). At the same time, there was an increase in international assistance, which became a key factor in maintaining macroeconomic stability (total financial support from partners exceeded USD 42 billion) (45). In 2024, economic growth was hampered by the energy crisis and the consequences of hostilities, which led to a slowdown in budget revenue growth (only +5.2% compared to 2023) and a significant level of dependence on external financial injections (43% of total budget revenues). At the same time, there was a certain recovery in non-tax revenues (up 12.8%) and capital revenues (up 9.4%), indicating a partial stabilization of economic activity (46).

The budget for 2025 is characterized by the persistence of structural imbalances: the dominance of defence spending (expected to be more than 40% of the budget), a reduction in social financing (by 8.5% compared to 2024), and a high deficit (about 18% of GDP), which necessitates the attraction of international financial assistance. The key challenges remain the decline in the state's fiscal capacity, the instability of the macroeconomic environment, the need to increase the efficiency of tax mobilization (the tax burden on the economy has increased to 38% of GDP) and optimize spending policy (47). Thus, the analysis of Ukraine's budget structure for 2021–2025 indicates a profound transformation of the public finance system due to military challenges, the need to adapt to crisis conditions, and the search for effective mechanisms of financial sustainability.

Effective public financial management is a critical aspect of macroeconomic stability, especially in times of political instability, military conflicts and economic crises. Given the current challenges facing Ukraine's public finances, it is necessary to analyze in detail the main problems and ways to solve them by synthesizing the current scientific literature in the field of public finance (Table 2).

Table 2: Problems in Public Finance Management

Problems	Description of the Problem	Possible Solutions and Approaches	Sources
Political and socio-economic instability	Political upheavals can disrupt traditional financial management, requiring adaptive strategies to maintain stability in wartime and economic crises.	Adaptive budget and tax policy, restructuring of public administration to increase flexibility and reduce the tax burden.	Chletsos and Sintos (1); Volosiuk *et al.* (2);Voznyak and Dmytryk (6)
Increased financing needs	Military spending and infrastructure reconstruction have a significant impact on public finance management in a context of political and territorial fragmentation.	Developing mechanisms to ensure financial stability, prudent debt management, and support for international cooperation and local initiatives for sustainable development.	Addison *et al.* (13); Miloradovic (14); Schiavo-Campo (17)
Decrease in tax revenues	The full-scale war in Ukraine has led to a significant reduction in tax revenues, making it difficult to finance public needs.	Improving the management of budget operations, attracting domestic loans, restructuring debt policy, and fighting corruption and the shadow economy.	Kudryashov (22); Hasanov *et al.* (20); Bei et al. (4)
Problems with fiscal stability	Amidst military operations and political instability, it is difficult to balance short-term needs with long-term economic growth.	Use of debt funds for temporary expenditures, fiscal adjustments for permanent liabilities, and investments in technology to stimulate long-term economic development.	Ilzetzki (12); Nitzan and Bichler (11)
Need to attract international assistance	In countries experiencing conflict, international assistance can be critical to maintaining economic stability.	Developing context-specific financing mechanisms, promoting international cooperation, and engaging non-governmental organizations in economic reconstruction.	Hertic *et al.* (10); Schiavo-Campo (17)
The need to increase the efficiency of tax mobilization	The systematic growth of public debt due to military operations necessitates an increase in tax mobilization.	Fiscal reforms to improve the efficiency of the tax system, broaden the tax base, and combat tax evasion.	Sidelnykova (5); Voznyak and Dmytryk (6)

Thus, the systemic transformation of public finances caused by the hostilities necessitates an urgent need to improve the mechanisms of budget planning, debt policy, and tax mobilization. Of particular difficulty is the need to simultaneously cover critical defense and socio-economic expenditures amid unstable revenue sources, which increases the risks of fiscal fragility. Declining external assistance and a growing budget deficit require a combination of financing approaches, including domestic borrowing, structural tax reforms, and the development of public-private partnerships. In addition, uncertainty about the duration of hostilities and the conditions of post-war recovery creates additional challenges for forecasting macroeconomic parameters that form the basis of the budget process. Therefore, to substantiate

structural changes in the public finance system, Pearson correlation coefficients and their statistical significance were calculated (Table 3). Assessment of correlations allows us to identify how changes in key economic indicators (such as GDP, inflation, unemployment, etc.) affect the country's budget situation.

Table 3: Correlation Analysis

Correlation		Pearson's Correlations			
Variable		**Budget Revenues (Y1)**	**Budget Expenditures (Y2)**	**Budget Deficit (Y3)**	**Public Debt (Y4)**
GDP (X1)	Pearson's r	0.598	0.611	-0.615	0.917
	p-value	0.040	0.035	0.033	< .001
Inflation (X2)	Pearson's r	-0.189	-0.154	0.088	-0.391
	p-value	0.557	0.633	0.786	0.209
Unemployment rate (X3)	Pearson's r	-0.588	-0.616	0.643	-0.955
	p-value	0.044	0.033	0.024	< .001
The volume of foreign direct investment (X4)	Pearson's r	0.122	0.076	0.009	0.234
	p-value	0.705	0.816	0.977	0.464
Level of military spending (X5)	Pearson's r	0.943	0.970	-0.987	0.731
	p-value	< .001	< .001	< .001	0.007
Tax revenues (X6)	Pearson's r	0.933	0.888	-0.786	0.395
	p-value	< .001	< .001	0.002	0.203

Conducting this analysis is important for understanding the internal linkages between economic indicators and budgetary policy, which allows for the development of more effective strategies for managing public finances based on the identified correlations. For example, the strong positive correlation between the level of military spending and budget revenues (r = 0.97 at p = < .001) indicates that defense spending should be taken into account in budget planning. Therefore, it is important to draw a diagram of the relationship between economic factors and budget policy, as shown in Figure 3.

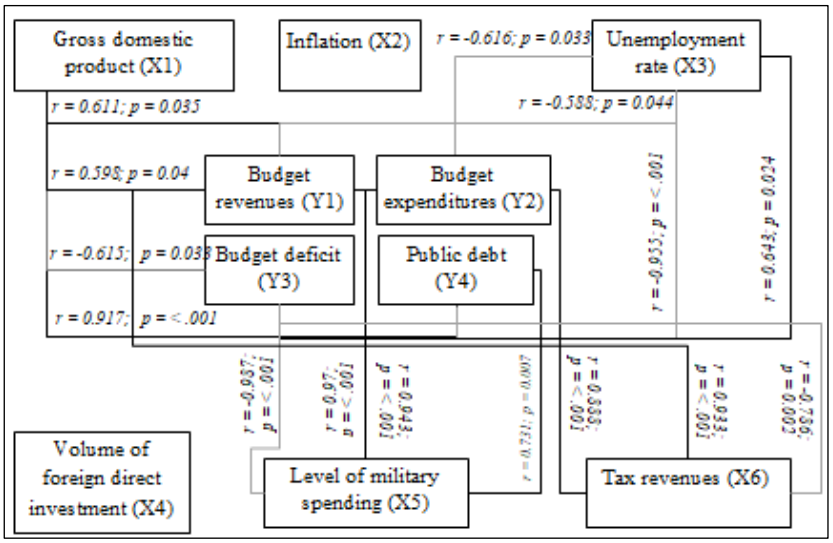

Figure 3: Scheme of Interrelations between Economic Factors and Budget Policy

For further application of linear regression methods and analysis of the impact of various factors on financial indicators, it is important to form a matrix X, which serves as the basis for determining the dependencies between various economic parameters, allowing predicting the value of budget indicators under certain conditions. An econometric model built in this way

allows you to describe the relationships between the identified variables. This is important for accurate forecasting and evaluation of the effectiveness of economic policy. The X matrix is formed by including a column of units for the constant and the values of the independent variables for each year based on the original data (Table 4).

Table 4: The Structure of the Matrix X for Building an Econometric Model

	1	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
	357084,2	534694,8	616274,8	793265	928108,3	998278,9	1076016,7	1296852,9	1787395,6	2671998	3122713,4
	430217,8	576911,4	684743,4	839243,7	985842	1072891,5	1288016,7	1490258,9	2705423,3	4014418,1	4486682,7
	-78052,8	-45167,5	-70130,2	-47849,6	-59247,9	-78049,5	-217096,1	-197937,4	-914701,7	-1333110,7	-1358500,1
	1100564	1572180,2	1929758,7	2141674,4	2168627,1	1998275,4	2551935,6	2671827,6	4071683,1	5519483,9	6980964,9
X^T =	1566728	1979458	2383182	2982920	3558706	3974564	4194102	5459574	5191028	6537825	6720294,971
	124,9	143,3	112,4	113,7	109,8	104,1	105	110	126,6	105,1	112
	42928,9	42760,5	42584,5	42386,4	42153,2	41902,4	41588,4	41167,3	40757,78932	40348,051006	39938,3128
	410	-458	3810	3692	4455	5860	-868	6687	1152	4247	3116
	27363,4	52005,2	59348,9	74346,2	97024	106627,7	120374,1	127527,3	1142872,4	2097620,5	2304475,1
	280178,3	409417,5	503879,4	627153,7	753815,6	799776	851115,6	1107090,9	949764,4	1203544,1	1647189,6

Thus, for an in-depth analysis of the dependencies between budget indicators and key macroeconomic factors, a matrix of independent variables (matrix X) was formed based on official statistics collected during 2014–2025. Its structure includes the following factors: GDP, inflation, unemployment, foreign direct investment, military spending, and tax revenues.

In order to take into account changes in the main macroeconomic indicators and their impact on the current budget policy, the formation of the vector Y as part of the construction of an econometric model is a necessary step. The vector Y will be used in the regression analysis to establish the causal relationships between economic factors. Thus, the vector Y contains the value of the dependent variable (Y) for each year in Table 5.

Table 5: Formation of the Y Vector for Econometric Modelling of Fiscal Policy

	357084,2		430217,8		-78052,8		1100564
	534694,8		576911,4		-45167,5		1572180,2
	616274,8		684743,4		-70130,2		1929758,7
	793265		839243,7		-47849,6		2141674,4
	928108,3		985842		-59247,9		2168627,1
Y1=	998278,9	Y2=	1072891,5	Y3=	-78049,5	Y4=	1998275,4
	1076016,7		1288016,7		-217096,1		2551935,6
	1296852,9		1490258,9		-197937,4		2671827,6
	1787395,6		2705423,3		-914701,7		4071683,1
	2671998		4014418,1		-1333110,7		5519483,9
	3122713,4		4486682,7		-1358500,1		6980964,9

In the study, the vector of the endogenous variable Y is constructed as a multidimensional system entity that integrates key aggregates of fiscal policy that represent its financial and economic impact on macroeconomic stability. In particular, the component Y1 reflects the amount of budget revenues; Y2 records the amount of budget expenditures; Y3 characterizes the size of the budget deficit, which is considered an indicator of fiscal balance and as a source of potential debt burden; Y4 represents the amount of public debt as the accumulated result of deficit financing. Thus,

the vector Y is an integrated indicator of the fiscal state, which allows for a holistic modelling of the dynamics of fiscal processes within the framework of structural and institutional analysis.

The next step in the analysis is to change the direction of the vectors and optimize computational procedures to obtain the regression parameters. In this case, regression analysis is used to determine the relationships between economic parameters using the results of regression analysis. Thus, the transposition results are a prerequisite for obtaining accurate calculations. XTX was calculated as follows:

$$(X^TX)_{1,1} = 11$$
$$(X^TX)_{1,2} = 14182682,6$$
$$(X^TX)_{1,3} = 18574649,5$$
$$(X^TX)_{1,4} = -4399843,5$$
$$(X^TX)_{1,5} = 32706974,9$$
$$(X^TX)_{1,6} = 44548381,97$$
$$(X^TX)_{1,7} = 1266,9$$
$$(X^TX)_{1,8} = 458515,7532$$
$$(X^TX)_{1,9} = 32103$$
$$(X^TX)_{1,10} = 6209584,8$$
$$(X^TX)_{1,11} = 9132925,1$$

Matrix transposition means bringing the resulting matrix to the required form for further matrix multiplication to correctly calculate regression coefficients and other statistical parameters. The transposed matrix X is presented in Table 6.

Table 6: Transposed Matrixes X in the Process of Calculating Regression Coefficients

	-609,9292071	0,000148	-8,9E-05	-0,00015012	-5,1E-06	-6,5E-06	0,028737066	0,013958	0,000546	-5,82125E-05	-3,84818E-06
	574,2680904	-6,5E-05	-3,9E-07	6,3749E-05	4,78E-06	7,58E-06	-0,012521859	-0,01316	-0,00064	6,46246E-05	7,1141E-06
	1033,711915	-0,00019	6,94E-05	0,00017503	8,96E-06	1,26E-05	-0,084072718	-0,0235	-0,00099	0,00011358	2,01381E-05
	-1030,78809	0,000462	-0,00034	-0,00043901	-5,2E-06	-1,2E-05	0,086927676	0,02335	0,001243	-0,000117026	-3,64885E-05
MINVERSE =	-573,2946973	-0,00046	0,000513	0,00045439	-7,2E-06	-6,9E-06	0,013876899	0,013229	0,000229	-5,25058E-05	1,46688E-05
	496,1462415	2,99E-05	-5,1E-05	-1,5403E-05	1,21E-06	1,08E-06	-0,022036328	-0,01131	-0,00014	2,84988E-05	-5,24231E-06
	235,5494763	-8,7E-07	-2,7E-05	-7,0961E-07	2,29E-06	3,43E-06	-0,032978027	-0,00533	-0,00039	2,67179E-05	2,79464E-06
	-8,262595397	0,000116	-0,00013	-0,00012503	1,75E-06	3,12E-06	0,008250989	0,000125	-5,5E-05	1,34672E-05	3,91709E-06
	-239,6980092	-7,4E-05	0,000117	7,8819E-05	-3,4E-06	-5,9E-06	0,028756755	0,005451	0,000402	-4,14282E-05	-6,01011E-06
	157,8884664	9,76E-06	-3,8E-05	-1,2995E-05	2,29E-06	4,37E-06	-0,018743115	-0,00359	-0,00027	2,75152E-05	1,89177E-06

-34,59159097	2,95E-05	-2,4E-05	-2,8724E-05	-4,7E-07	-1,2E-06	0,003802667	0,000786	6,39E-05	-5,23143E-06	1,06459E-06

The variables (i.e., the X matrix and the Y vector) were subjected to regression analysis to establish a quantitative link between macroeconomic determinants and fiscal indicators. In the process of modelling, the matrix X was transposed to further calculate the product XTY, which is a key step in the least squares regression analysis. The calculation of XTY is necessary to determine the vector of regression coefficients in linear regression methods. That is, the calculation of XTY allows us to understand how changes in economic indicators (reflected in the X matrix) affect changes in budget indicators (reflected in the Y vector). The next step is to assess the accuracy of the model, as shown in Table 7.

Table 7: Calculation of XTY to Determine the Relationship between Economic and Budget Indicators

	357084,2		430217,8		-78052,8		1100564
	7,58341E+12		8,18215E+12		-6,40596E+11		2,22977E+13
	1,14471E+13		1,27189E+13		-1,30264E+12		3,58446E+13
	-3,49024E+12		-3,69254E+12		2,10531E+11		-9,423E+12
X^TY1	3,03556E+13	X^TY2	3,22439E+13	X^TY3	-1,93782E+12	X^TY4	7,09292E+13
	4,44717E+13		4,77956E+13		-3,47698E+12		8,90199E+13
	1363205557		1631788357		-275039049,1		3233047212
	5,94627E+11		6,83307E+11		-90757416042		1,22508E+12
	57380760947		86852204200		-29364668675		1,30713E+11
	1,6592E+13		2,49279E+13		-8,27806E+12		3,42737E+13
	2,85195E+13		4,09765E+13		-1,24071E+13		6,37566E+13

XTY was calculated by multiplying the XT matrix by X (XTY), which allows us to form a normal system of equations to determine the regression coefficients. The obtained values indicate a high level of variability and significant covariances between some independent variables between GDP, military spending, and tax revenues, which confirms the preliminary results of the previous correlation analysis.

The results of the XTY calculation indicate that the relationships between the vectors of independent variables and dependent parameters are consistent. This allows you to obtain the values necessary to estimate the regression coefficients and further forecast budget indicators.

The inverse matrix is calculated to obtain the exact parameters of the linear regression, which allows you to see how each independent variable affects the specified dependent variables. The results of the inverse matrix calculation are shown in Table 8.

Table 8: Inverse Matrix for Estimating Linear Regression Parameters

	7263778213		7922417201		-691763838,5		14943355861
	-6635870155		-7173933751		568537281,5		-13991705618
	-1,1757E+10		-1,2622E+10		922526184,8		-24556819440
	11230455654		1,1744E+10		-576900755,1		22543896237
	7484915287		8617993595		-1151375300		17427151292
MMULT1 =	-6481942329	MMULT2 =	-7324490798	MMULT3 =	865092848	MMULT4 =	-13591294647
	-2720698193		-2957873456		249172119,7		-5847040816
	390865978,9		501220383		-111978037		245423125,3
	2496516921		2624293152		-139549410,4		5789451241
	-1663949639		-1752297230		96690105,24		-3736675507
	392913605,1		421180720		-30529250,47		775358835,7

Further inverting the XTY matrix allows us to calculate the parameter estimates of the regression model. The values given in the inverse matrix (MINVERSE) indicate that the model is mathematically correct, does not contain collinear variables of a critical level, and therefore the results can be used for forecasting.

The results of calculating the inverse matrix are further used to assess the effectiveness of current financial strategies based on the created mathematical models. They indicate a high level of correlation between variables, which confirms the correctness of the calculations.

Creating a graph of residuals is an important step in checking the quality of the model and its compliance with real data. The residuals help to assess how accurately the model describes the available data. Ideally, the residuals should be random (without a clear structure or trend), which indicates that the model has correctly captured the relationships between the variables. If the residuals show systematic patterns, this indicates possible errors in the model, such as omission of important variables or incorrect choice of the functional form of the model. The generated graph (Figure 4) shows a comparison of actual and predicted values of variables using the estimated model. The X-axis shows the indices of observations or the corresponding variables, and the Y-axis shows the value of the residuals (the difference between the actual and predicted values).

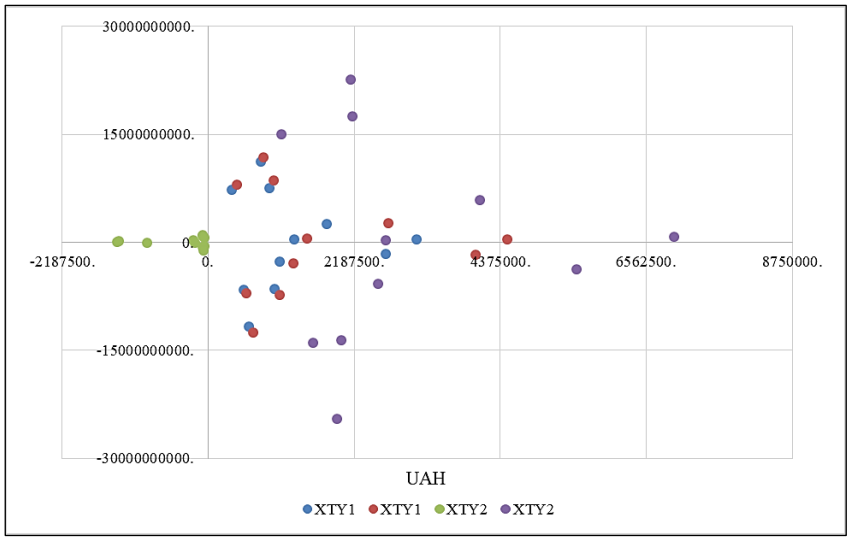

Figure 4: Graph of Residuals of Predicted and Actual Values of the Model

The visualization of the modelling results shows that there are some systematic deviations between the actual and predicted values. Given that the residuals are evenly distributed around zero with no obvious trends, it is worth emphasizing the sufficient quality of the model.

According to the coefficients, tax revenues (X6) and the level of military spending (X5) have the strongest positive impact on budget revenues (Y1). This suggests that in the context of an armed conflict, an increase in defines spending is accompanied by an intensification of economic activity, which generates additional fiscal resources. Similarly, GDP growth (X1) has a statistically significant positive impact on budget revenues and expenditures, confirming the macro-financial stability of the model.

The negative correlation between inflation (X2) and budget indicators (in particular, the deficit) indicates the destabilizing effect of price volatility on the ability to finance budgetary needs. There is also a clear negative correlation between unemployment (X3) and public debt (Y4), which is logically explained by the reduction in social spending when the number of unemployed decreases or economic growth increases.

Thus, the modelling results allow us to conclude that the constructed econometric model is statistically reliable and can be used for short- and medium-term forecasting of budget indicators. In combination with the correlation analysis, the model forms a reliable tool for analytical support of the processes of formulation and implementation of fiscal policy in Ukraine.

Discussion

The results of the study indicate a deep interconnection between economic factors and budgetary policy in times of war, which necessitates a flexible response to changes. In particular, the correlation analysis revealed a positive correlation between the level of military spending and state budget revenues ($r = 0.97$ at $p = < .001$). This confirmed the need to plan security and defence spending in Ukraine to ensure the long-term stability of the country's public finances during the war. Chletsos and Sintos note that the high level of military spending mainly reflects the priorities of the state, while stimulating the introduction of fundamentally new financial reforms that allow for the creation of an economic structure oriented towards recovery after the war (1). It is worth noting the relevance of taking into account the impact of military spending on other aspects of budget policy. In this context, the strong correlation found between defence spending and the budget deficit ($r = -0.987$ at $p = < .001$) suggests that military spending is increasing, which generally occurs without appropriate compensating measures; and, therefore, in the short term, may worsen the country's financial stability by increasing the debt burden. As noted by Kudryashov, in such circumstances, it is necessary to limit emergency revenues, as well as to develop and implement effective strategies to increase tax revenues to the overall financial system (23). The proposed measures will help to balance budget expenditures. The correlation analysis also shows that changes in the unemployment rate have a

significant impact on the budget deficit (r = 0.643 at p = 0.024). In other words, in this case, it is necessary to apply comprehensive measures to stimulate the labour market and increase economic activity in order to reduce the state budget deficit. Our findings are in line with Tsutsunashvili *et al.,* who argue that investing in the development of internal reserves and labour force qualifications will help stabilize the economy and, consequently, the budgetary situation (29). The correlation between GDP and public debt (r = 0.917 at p < .001) fully justifies the statement of Metelenko et al. about the need to optimize debt policy to ensure financial sustainability in the face of economic instability (24). In this context, the author emphasizes the need to restructure public debt, attract non-repayable financing, and create a favourable investment climate.

It should be noted that preserving the traditional model of the state budget without dividing it into defence and civilian budgets is appropriate given the need to preserve the integrity of the current budget policy. The proposed model allocates budget funds depending on the current challenges arising from military operations. However, despite this, the traditional approach prioritizes spending on the security and defence sector. According to the correlation analysis, there is a very strong positive correlation between military spending and budget revenues (r = 0.97 at p < .001), which confirms the importance of financing the defence sector; at the same time, high levels of military spending lead to an increase in the budget deficit (r = -0.987 at p < .001). Thus, it is worth emphasizing the need to apply an adaptive approach to public finance management. When using this approach, it is proposed to include the integration of various economic models and strategies for effective economic recovery after military conflicts (30). In addition, the prospect of using innovative approaches, in particular by investing in digitalization and improving internal processes, should be considered. Increasing innovation activity in this context will primarily contribute to the stabilization of business activity in the post-war period (31). Thus, the results of the study indicate the prospects of applying an integrated approach to budget and public finance management in wartime. An integrated approach in this sense includes both internal and external factors, such as military spending, tax revenues, unemployment, and macroeconomic indicators.

Another critical dimension of ensuring fiscal sustainability in wartime is the implementation of effective tax reforms. As emphasized by Kudryashov, under conditions of heightened fiscal pressure due to military expenditures, the restructuring of tax policy is necessary to limit emergency revenue mechanisms and replace them with more sustainable sources (22). This aligns with the findings of Sidelnykova, who underline that improving tax mobilization requires both structural reform of tax administration and the broadening of the tax base (5). In particular, a transition to digital tax infrastructure and enhanced oversight of tax compliance are crucial to minimizing losses caused by shadow economic activities. Additionally, Voznyak and Dmytryk highlight that increasing fiscal capacity during conflict involves coordinated efforts to reduce tax evasion, eliminate inefficient exemptions, and create incentives for formal sector expansion (6). The effectiveness of such reforms is particularly important in contexts like Ukraine, where the state's capacity to finance both defence needs and socio-economic recovery largely depends on the robustness and flexibility of its revenue system. Therefore, tax reform is not merely a fiscal tool but a strategic mechanism of financial stabilization that enables a more balanced and adaptive budget policy.

Regarding the structure of the budget itself, the preservation of a unified state budget – without formal separation into defence and civilian components-apparently appears justified given the necessity of maintaining policy coherence and budgetary flexibility during on-going hostilities. According to Markuts and Roberto, this model allows for dynamic reallocation of resources in response to new security challenges (16). For instance, a dual-budget model may improve the planning for civilian reconstruction, facilitate targeted donor funding, and enhance transparency and accountability in defence spending. However, according to Stamos, such a model can also lead to reduced flexibility in inter-sectoral reallocation, legal complexity, and ineffective coordination in times of uncertainty (48). Consequently, investigating hybrid or modular frameworks in the post-war era may contribute to more effective financial governance, even though the

conventional integrated budget structure is still practically appropriate under the current conditions of war. Such frameworks could incorporate digital innovations, real-time fiscal monitoring, and scenario-based planning to support both defence imperatives and socio-economic renewal. In this context, increasing innovation activity and investing in the modernization of budgetary procedures may significantly enhance the resilience of public finance management.

Conclusion

The results of the study primarily include an assessment of the impact of current military spending on Ukraine's budgetary policy in times of war. The assessment was made by analysing the effectiveness of the existing budget model without dividing it into defence and civilian sectors. Second, the study examines the role of growing public spending on the security and defence sector in terms of state budget revenues and related macroeconomic indicators. Thirdly, the study provides an overview of the current mechanisms of financing the Ukrainian defence sector. Based on the findings of the study, conclusions and recommendations for changes in Ukraine's budget policy in the context of a protracted war were formulated. In addition, the relevant transformations that have occurred as a result of the protracted war and intensified hostilities, which are also accompanied by the impact of changes in external financial flows on macroeconomic stability, were analysed. Based on the results of the analysis of the budget structure and the dynamics of revenues and expenditures, the author has determined the level of influence of international financial assistance and the need to adapt the national financial system to new challenges caused by the military conflict and the changing global geopolitical landscape. This study is useful for developing recommendations for improving public financial management in times of war and uncertainty and for effectively financing the recovery process of Ukraine and other countries in the process of military conflict, political instability, or economic crisis.

Abbreviations

GDP: Gross Domestic Product, UN: United Nations, USA: United States of America, USD: United States Dollar.

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Author Contributions

Serhii Petrukha: Methodology, Writing – Original Draft, Nina Petrukha: Writing – Reviewing, Editing, Data Curation, Dmytro Konovalenko: Writing – Reviewing, Editing, Preparation, Roman Miakota: Writing – Original Draft, Formal Analysis, Visualization, Vadym Gubanov: Writing – Reviewing, Editing, Data Curation, Formal Analysis.

Conflict of Interest

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