STATISTICS IN TRANSITION new series and *STATISTICS OF UKRAINE, February 2023*
A New Role for Statistics: Joint Special Issue
Vol. 24, No. 1, pp. 145–168, DOI 10.59170/stattrans-2023-009
Received – 01.07.2022; accepted – 03.10.2022

Budgetary policy of Ukraine in time of challenges and its impact on financial security

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ABSTRACT

Ukraine has recently experienced a significant economic downturn as a result of the COVID-19 pandemic and the war caused by a large-scale military aggression of the Russian Federation. In conditions of the constant fluctuations of the national economy, the stimulating effect of the budgetary policy aimed at minimizing the consequences of such fluctuations and guaranteeing a sufficient level of financial security of the state becomes especially important.

The aim of the study is to deepen the theoretical and methodological foundations of the creation and implementation of budgetary policy in Ukraine, evaluation of its impact on the financial security in time of challenges.

The study uses methods of comparative analysis, grouping in the process of evaluating the current state of budgetary policy indicators, methods of normalization and standardization of data, modelling, and graphical analysis of data for normalizing the financial security indicators and determining the dynamics of financial security components. The materials and reports containing statistical data from the Ministry of Finance of Ukraine and the State Statistics Service of Ukraine served as the basis of the study.

We found out that the components of the financial security of the state in the face of the challenges posed by martial law and the pandemic do not take into account the impact of budgetary policy. We substantiated the thesis that the creation of Ukraine's budgetary policy under martial law requires adjustments to the financial security assessment system. The most statistically significant and reliable models of interrelation were selected for further use in multifactor modelling and forecasting the financial security of the state (on the basis of ranking the linear, polynominal, exponential, logarithmic and power dependencies within one-factor equations). It was experimentally proved that out of 122 statistically significant indicators, budgetary policy indicators such as the coefficient of financing the national

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functions, the coefficient of public debt service and redemption, and the coefficient of the proportionality of financing the national security agencies had the greatest impact on the financial security of Ukraine.
We also substantiated the scientific provisions behind the modelling of the level of financial security of Ukraine taking into account the impact of budgetary policy in the period of challenges. In the process of modelling, the indicators of budgetary policy were identified, while regression analysis revealed the factors influencing the budgetary policy.

Key words: budgetary policy, financial security, multifactor modelling, linear dependences, polynomial dependences, logarithmic dependences, power dependences.

1. Introduction

The challenges posed by the damage to the domestic economy caused directly by the coronavirus pandemic COVID-19, as well as by Russia's large-scale military aggression, have led to a significant economic downturn. In conditions of constant fluctuations of the national economy, the stimulating effect of the budgetary policy aimed at minimizing the consequences of such fluctuations, ensuring the stability of the budget, creating the necessary conditions for its fulfilment and ensuring the appropriate level of socio-economic development becomes especially important. The trend of recent years indicates a predominant focus of budgetary policy to cover current budget expenditures, rather than ensure the implementation of strategic tasks of state development and working out the measures to improve its financial security.

First of all, it is critical for Ukraine to restore the country's economic potential, which has suffered losses caused by the destruction or shutdown of the enterprises, as well as the destruction of the infrastructure. According to the expert estimates of the Ministry of Economy, as of April 1, 2022, the total (both direct and indirect) losses of Ukraine's economy due to the war, such as: declining GDP, cessation of investment, outflow of labour, additional spending on defence and social support, etc., reached almost 600 billion USD. At the same time, the International Monetary Fund (IMF) predicts a 35% drop in Ukraine's GDP according to the results of 2022, and the World Bank forecasts a 45% drop in GDP and 15% inflation.

In these conditions, the budgetary policy in the system of financial security should be aimed at minimizing risks in the budget sphere, determining the forms of interaction of its components, conducting economic transformations to improve financial security. That is why the search for new methods, forms and means of implementing budgetary policy for the purpose of ensuring the financial security of the state in modern conditions needs special attention.

The aim of the study is to deepen the theoretical and methodological foundations of the formation and implementation of Ukraine's budgetary policy in times of challenges and its impact on the state of financial security.

2. The second section

2.1. Problems

The theoretical basis of modern public finance theory, on which the budget policy is based, is the theory of pure public goods, which was developed in the works of P. Samuelson (1955), R. Musgrave (1994) and J. Buchanan (1997). The theory is based on the model of general equilibrium, which analyzes the activities of both the state itself and private economic entities, and taxes serve as prices of public goods. However, in a market economy, the state can provide not only public but also private goods. The methodological basis for solving such problems was laid by K. J. Arrow (1971).

Examining the influence of government on the formation of budgetary policy, C. Tiebout (1956), R. Musgrave (1959, 1986) and W. Oates (2008) assert that neither large-scale centralization of government nor fully decentralized power, consisting of many small and local jurisdictions are likely to be effective. The central government should focus on the provision of national public services, the benefits of which are distributed throughout the whole country and the provision of which has significant economies of scale. Typical examples are defence, international relations, national infrastructure, monetary policy, macroeconomic stabilization, income redistribution and poverty reduction policies.

W. Dziemianowicz (2004) paid considerable attention to the study of Central European countries that had successfully carried out economic and institutional transformation in the field of public finance, namely, in the policy of attracting foreign capital and its impact on economic development in Poland.

Most of the scientific papers of these economists are focused on identifying general trends in the functioning of public finance. Paying tribute to the development of the theoretical basis of budgetary policy and financial security, it should be noted that the impact of budgetary policy on the financial security of the state has not acquired a holistic scientific vision, and this necessitates further research. Particular attention needs to be paid to determining the performance indicators that should be used to assess the level of financial security. A strategic guideline for budgetary policy with regard to financial security requires scientific rethinking. The search for effective budgetary tools to increase the level of financial security remains relevant.

2.2. Materials and methods

To evaluate the economic and financial security of the state, the following methods are proposed: observation of key macroeconomic indicators and comparing them with the threshold values for which the world averages are taken; assessment of the country's economic growth rates according to the main macroeconomic indicators, as well as the dynamics of their change; methods of expert evaluation used to describe the

quantitative and qualitative characteristics of the studied processes. The first of these methods includes setting threshold values or indicators, i.e. in this case an indicator (indicative) approach is used, and it can be applied for the financial security. There are many papers dealing with indicative approach to the economic security of the country. They all differ mainly in the sets of economic indicators used. Besides, all these methods do not allow us to unequivocally assert the quantitative level of financial security.

The most important problem of characterizing financial security at the macro level is the definition of its main criteria and indicators. The basis for the formation of these indicators is the close relationship between the concept of "security" and the category of "risk".

The concept of risk in the economic security strategy contains two most important elements: risk assessment and risk management. Risk assessment is expert, probabilistic, in nature. Risk management involves potentially critical socio-economic situations in order to prevent, weaken and mitigate their effects. Thus, the assessment of the level of economic security allows, together with the analysis of risk factors, the use of categories of losses (damages) - actual, expected, potential, those that are compensated and not compensated.

In the process of research the following methods were also applied: the method of comparative analysis to specify the methodological foundations of the studying the impact of the budgetary policy; methods of statistical processing of information, comparative analysis, grouping in the process of assessing the current state of budgetary policy indicators; the method of normalization and standardization of data, graphical analysis of data when normalizing financial security indicators and determining the dynamics of financial security components.

The information base of the study consists of laws and regulations of the Verkhovna Rada of Ukraine and the Cabinet of Ministers of Ukraine, materials and reported statistical data of the Ministry of Finance of Ukraine, the State Statistics Service of Ukraine, materials of information and analytical bulletins, works of researchers, scientists and practitioners, personal analytical papers of the authors.

3. Results. Analysis of the current state of budgetary policy in the system of financial security

On February 24, 2022, the Verkhovna Rada of Ukraine imposed martial law because of Russia's direct full-scale invasion of Ukraine. According to Article 1 of the Law of Ukraine "On the legal regime of martial law" (2015), martial law is defined as a special legal regime that is introduced in Ukraine or in some of its localities in the event of armed aggression or a threat of attack and provides for the granting to the

relevant state authorities of the powers necessary to prevent the threat and ensure national security.

The problems of the countries affected by the war are quite acute as they face the task, firstly, of creating a dynamically developing economy and, secondly, of creating the conditions for increasing economic and social integration. Martial law crises in Ukraine has challenged traditional governance mechanisms. The events that take place in a state of martial law require a change in approaches to the analysis of economic dynamics and justification of budgetary policy measures.

Budgetary policy has a decisive impact on budget security, and the latter is one of the most important components of both financial and national security. Most scholars point out that all aspects of national security are interconnected and interdependent, with budget security being of particular importance, as there is no aspect of national security that does not directly depend on the level of budget security. At the same time, the level of budget security itself is to a great extent determined by the level of other aspects of national security. This reveals the dual nature of the category of budget security. Consideration of these relationships and interdependences between budget security and other aspects of national security is the basis for developing measures to avoid and overcome threats to the national interests of the state in the budget sphere.

The dependence of all elements of national security on its financial and budgetary component is extremely simple: lack of financial resources leads to underfunding of the most urgent needs in various spheres of life, such as: in economy, social security, military and law enforcement activities, in the field of health care and education, causing serious threats to these areas. The main disadvantage of most state programs in Ukraine in recent years has been that one or another path of development was proposed either as an ideological dogma (regardless of whether it was a program of the former state plan or liberal programs), or as a set of projects and expenses. During the transformation period, there was a traditionally high activity of proposing the theories and schemes which have not been confirmed by world science (2020).

The main purpose of the budget security system is the material (financial) support of the process of strengthening all spheres of national security without exception: defence, environmental, informational, demographic, economic, political, social and energy. In other words, budget security is a basic component of the entire state security system, the failure to ensure which will inevitably lead to the deprivation of funds for the organization and functioning of the state security system as a whole.

The main goal of the budget security is to constantly maintain the state of the budget system, which should be characterized by equilibrium, resistance to internal and external negative influences, the ability to ensure effective socio-economic development of the country in the period of challenges caused by both pandemics and martial law. The parameters of the state's budget security must ensure its internal and external equilibrium, and their values must be sufficient to ensure proper resilience of the system to the action of threats in the period of challenges.

Thus, the central element of the study of budget security issues is the system of its ensuring. An important aspect is to assess the effectiveness of its construction and performance.

We will continue the study of the impact of the budgetary policy on the level of financial security by analyzing four indicators of Ukraine's budget security, which have reflected its state in dynamics over the past 13 years. The data given in Table 1 show that during 2009–2021 in the budgetary sphere of Ukraine there were changes in different directions. Thus, in 2018 compared to 2009, the state budget deficit in relation to GDP decreased by 2.1 p.p. (percentage points). The deficit of budgetary and extra-budgetary funds of the general government sector in relation to GDP in 2018 compared to 2009 decreased by 3.4 p.p., reaching a maximum (of 0.13%) in 2016 and a minimum (of 3.6%) in 2009. The volume of consolidated budget revenues at the end of 2018 amounted to one third of GDP, with an increase of 4.4 p.p. compared to 2009 and reached 34.1% (maximum) in 2017 and 28.1% (minimum) in 2010. Total payments for servicing and redemption of public debt against state budget revenues in 2009 were at the lowest level (of 4.7%), increasing in 2018 by 7.8 p.p. and reaching the highest level (of 16.2%) in 2015.

Table 1. Indicators of budget security of Ukraine in 2009–2021

Indicator name	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1 The ratio of state budget deficit/ surplus to GDP, %	–3.75	–5.73	–1.75	–3.66	–4.25	–4.92	–2.27	–2.94	–1.60	–1.66	–1.96	–5.18	–3.63
2 Deficit / surplus of budget and off-budget funds of the general government sector,% of GDP	–3.60	–0.67	–0.84	–0.51	0.05	–0.23	–0.11	0.13	0.03	–0.21	0.07	–0.30	–1.70
3 The level of redistribution of GDP through the consolidated budget,%	28.82	28.07	29.54	30.53	29.08	28.74	32.79	32.81	34.08	33.26	32.45	32.82	30.45
4. The ratio of total payments for service and redemption of public debt to state budget revenues, %	4.72	7.30	7.82	7.44	10.14	14.29	16.24	15.80	14.05	12.53	12.03	11.27	11.80

Source: authors' calculations based on the Ministry of Finance of Ukraine and the National Bank of Ukraine.

From the main provisions of the methodical guidelines (Guidelines for calculating the level of economic security of Ukraine 2013) it is clear that financial security indicators can acquire features of 3 main types: indicators-stimulants (type C), the growth of which clearly leads to an increase in the level of financial security; disincentive indicators (type B), the growth of which clearly leads to a decrease in the level of financial security; mixed action indicators (type A), which, growing to a certain optimal level, behave as stimulants, but their further increase has a negative impact on the level of financial security, which corresponds to the behaviour of the disincentive.

Given the characteristic values, the first three indicators of the budget security were indicators of type A, which is taken into account when normalizing them (Table 2).

Table 2. Normalized indicators and sub-index of budget security of Ukraine

Indicator name	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1.Normalized ratio of the state budget deficit/surplus to GDP	0.550	0.147	1.000	0.533	0.250	0.384	0.654	0.788	1.000	1.000	1.000	0.202	0.526
2.Normalized deficit/surplus of budget and off-budget funds of the general government sector	0.199	0.734	0.768	0.703	1.000	0.645	0.623	1.000	1.000	0.641	1.000	0.940	0.460
3.Normalized level of redistribution of GDP through consolidated budget	0.918	0.993	0.846	0.764	0.892	0.926	0.614	0.612	0.528	0.583	0.637	0.612	0.770
4.Normalized ratio of total payments for service and redemption of public debt to state budget revenues	1.000	0.780	0.746	0.771	0.590	0.314	0.184	0.213	0.330	0.431	0.465	0.516	0.480
5 Subindex of budget security	0.663	0.646	0.841	0.689	0.668	0.550	0.513	0.650	0.719	0.669	0.778	0.558	0.551

Source: authors' calculations based on the Ministry of Finance of Ukraine and the National Bank of Ukraine.

The data in Table 2 show that in 2014 and 2015, as well as in 2020 and 2021, the value of the sub-index of budget security corresponded to an unsatisfactory level of 0.550-0.513 and 0.550-0.551, respectively. Such values can be explained by the fact that in 2014 Ukraine faced the largest challenges of the 21st century, including the economic crisis, the military conflict in the East, the annexation of Crimea by Russia. The decline in domestic demand and weak external demand led to a decline in real GDP in 2014 by 6.8%. In 2020–2021, the challenges were caused by the COVID-19 pandemic and the development of the global economic and social crisis, the largest in decades (Heyets, V., Lunina, I., 2021). Ukraine was in a state of intensive circulation of an infectious disease caused by the coronavirus SARS-CoV-19 (Stiglitz, 2020) and needed sufficient financial resources, which was a key factor in increasing budget expenditures and, in turn, reflected on budget security indicators. Recently, the government has faced the need to make complex budgetary policy decisions related to rising defence and security spending amid limited budget revenues, in conditions of significant economic and political uncertainty.

The study of the place and role of budgetary policy in the system of ensuring financial security involves, in addition to determining the indicators of assessment of budgetary policy, the implementation of analytical procedures to assess its impact on the state of financial security. The main purpose of this assessment is to determine the reliability, statistical significance and adequacy of the impact of key factors of budgetary policy, which most influenced the state of financial security during 2009–2021, and which can be used to work out the prospects for developing the budgetary policy.

The authors propose a number of additional indicators of financial security and substantiate their expediency and importance in considering the objective impact of budgetary policy on banking security, non-banking financial market security, debt security, budget security, currency security and monetary security. Among these indicators are: coefficient of participation of the National Bank of Ukraine (NBU) in the state budget: the share of revenues from the NBU in state budget revenues; the coefficient of influence of non-state pension funds (NPF): the ratio of the amount of pension contributions of NPF to the income of the Pension Fund of Ukraine itself; the coefficient of efficiency of Domestic Government Bonds (DGB): the ratio of DGB revenues to consolidated budget expenditures; the coefficient of public debt service: the share of costs for servicing and redemption of public debt in the consolidated budget expenditures; the coefficient of proportionality of financing of the national security agencies: the ratio of expenditures on public order, security and the judiciary to expenditures on defence; the coefficient of debt dependence: the volume of expenditures for servicing and redemption of public debt to gross domestic product (GDP); the coefficient of devaluation stability of the budget revenue base: the ratio of consolidated budget revenues to hryvnia UA – dollar USA exchange rate;

the coefficient of budget dependence on crediting: the share of crediting in the consolidated budget expenditures; the coefficient of household income stability: the ratio of consumer loans, given to households, to households income. In order to ensure the objectivity of the study, calculations of the proposed indicators were made for their further use in the assessment system (Table 3).

Table 3. Dynamics of the proposed additional indicators of budgetary policy in the system of financial security during 2009–2021

Indicators	The value of the indicator by year												
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Coefficient of participation of the NBU in the state budget	2.41	6.46	3.78	6.82	8.35	6.39	11.56	6.19	5.59	5.45	5.03	3.10	1.47
Coefficient of influence of NPF	0.76	0.78	0.79	0.83	0.95	1.09	1.11	1.70	1.19	0.99	0.89	0.84	0.76
Coefficient of efficiency of DGB	6.09	10.66	6.87	8.00	9.98	12.71	1.46	4.42	3.09	5.20	16.57	16.22	15.61
Coefficient of debt service	3.43	4.63	6.08	6.01	7.09	9.94	12.96	11.66	10.55	10.31	8.77	7.60	8.30
Coefficient of proportionality of financing the national security agencies	2.52	2.55	2.47	2.53	2.66	1.64	1.06	1.21	1.19	1.22	1.33	1.34	1.44
Coefficient of debt dependence	1.12	1.57	1.90	1.85	2.36	3.31	4.45	4.10	3.74	3.62	3.02	2.89	2.80
Coefficient of devaluation stability of the budget revenue base	26.92	30.32	39.49	43.31	42.44	30.04	24.48	24.12	29.83	34.12	49.90	51.01	60.92
Coefficient of budget dependence on crediting	0.92	0.36	1.14	0.87	0.11	0.95	0.45	0.22	0.20	0.15	0.29	0.33	0.26
Coefficient of household income stability	15.33	11.17	9.96	8.58	8.87	8.91	5.92	4.95	4.60	4.67	4.64	4.22	4.56

Source: authors' calculations based on the Ministry of Finance of Ukraine and the National Bank of Ukraine.

The data given in Table 3 show that the studied indicators had different vector dynamics. Thus, the coefficient of proportionality of financing national security agencies in 2021 compared to 2009 decreased more than twice, reaching the highest value of 2.7 in 2013, and the lowest one of 1.1 in 2015. Such a significant reduction in this indicator tells about a significant increase in defence spending caused by hostilities.

The coefficient of participation of the NBU in the state budget is declining from its highest value of 11.6 in 2015 to its lowest one of 1.47 in 2021. Over the past three years, there has been a negative trend towards a gradual decline in the share, i.e. from 5.45% in 2018 to 1.47% in 2021, which indicates a significant reduction in revenues from the NBU activity in the state budget revenues. The ratio of NPF pension contributions to PFU own revenues increased by 1.3 times, reaching the highest value of 1.7 in 2016 and the lowest value of 0.76 in 2021. This indicator tells about the underdevelopment of the NPF system, as their pension contributions are less than 1% of the PFU's own income in 2009-2013 and 2018-2021. Over the last five years, this figure has been declining, indicating a further decrease in the share of NPFs in pension insurance in Ukraine.

The coefficient of efficiency of DGB during 2019-2021 is growing compared to the previous period. The rapid, abrupt increase in the coefficient took place in 2019 and then it decreased slightly to 15.61 in 2021. This indicates the active implementation of DGB as one of the methods of solving debt problems caused by challenges, and increasing of the budget deficit. It should be noted that a special feature of government domestic borrowing in the last two years is also the fact that a significant part of DGB was purchased by non-residents. The high level of profitability attracts foreign investors. At the beginning of 2020, out of the total DGB package, non-residents owned bonds worth UAH 118.8 billion, i.e., almost 15% of their total volume.

The coefficient of proportionality of financing of the national security agencies indicates an increase in defence expenditures relative to expenditures on public order, security and the judiciary since 2014 after the start of hostilities in eastern Ukraine and the annexation of Crimea. Consolidated budget revenues, expressed in million USD at the end of 2018, amounted to 34.1 billion USD, having increased by 12.5% compared to 2009. At the same time, in 2009-2013 there was an increase in consolidated budget revenues in USD by 40%, and in 2014 a reduction by 41% and a further reduction to 76% in 2016 compared to 2013 took place. The consolidated budget revenues in USD in 2018 accounted for only 80% of 2013. Further growth took place in the period from 2019 to 2021. Such changes occurred due to the growth of the US dollar against hryvnia by 3.4 times over the past decade. The coefficient of budget dependence on crediting at the end of 2018 was only 0.15, having decreased by 0.8 in 2009, reaching the highest value of 1.14 in 2010 and the lowest one of 0.11 in 2013.

To assess the impact of budgetary policy on the state of financial security of the country, we consider the methods of factor analysis, the most acceptable for the purposes of our study. Assessing the impact of each indicator of budgetary policy on the integral index of financial security allowed us to conclude that it is necessary to use standard tools for data graphical analysis. This will help to determine the factor dependence between the selected indicators of budgetary policy and to objectively

assess the state of financial security in the public sector. The following dependence equations are considered:

1) linear dependence , as

$$y = a_0 + a_1 x, \tag{1}$$

where y is the resulting feature or dependent variable (in our case - the integral index of financial security; x - factorial feature or independent variable (in our case - the studied indicator of budget policy);

a1 is the regression coefficient, showing by how many unities the resulting feature changes with the growth of the factor feature by 1;

a0 is a constant showing the value of the resulting feature at x = 0;

2) polynomial dependence, as

$$y = a_0 + a_1 x + a_2 x^2; \tag{2}$$

3) exponential dependence, as

$$y = a_0 \cdot \exp(a_1 x); \tag{3}$$

4) logarithmic dependence, as

$$y = a_0 + a_1 \cdot \ln(x); \tag{4}$$

5) power dependence, as

$$y = a_0 \cdot x^{a1}. \tag{5}$$

We find it expedient to consider the level of approximation R^2 (coefficient of determination), which shows the statistical significance and reliability of the dependence equation, as a criterion for selecting one or another dependence. The initial condition for the statistical significance and reliability of the dependence equation is the value of $R^2 > 0.5$.

Figure 1 presents five models of the dependence of the integral index of financial security on state budget expenditures as a percentage of GDP. It should be noted that among the indicators of budgetary policy, the coefficient of redistribution of expenditures in relation to GDP is one of the few whose impact on the level of financial security of Ukraine is described by five statistically significant dependences. According to the results of the trend analysis, five equations of approximation were obtained. For factor analysis in terms of our study, we consider it appropriate to use the equations coefficient of determination R^2 of which is larger than 0.5. The conducted study indicates the significance and reliability of all obtained equations, but the quadratic equation has the highest level of reliability, which is 69%. Besides, all graphs of the

dependence equations illustrate the negative slope, i.e. the inverse relationship – the growth of the factorial feature leads to a decrease of the effective feature.

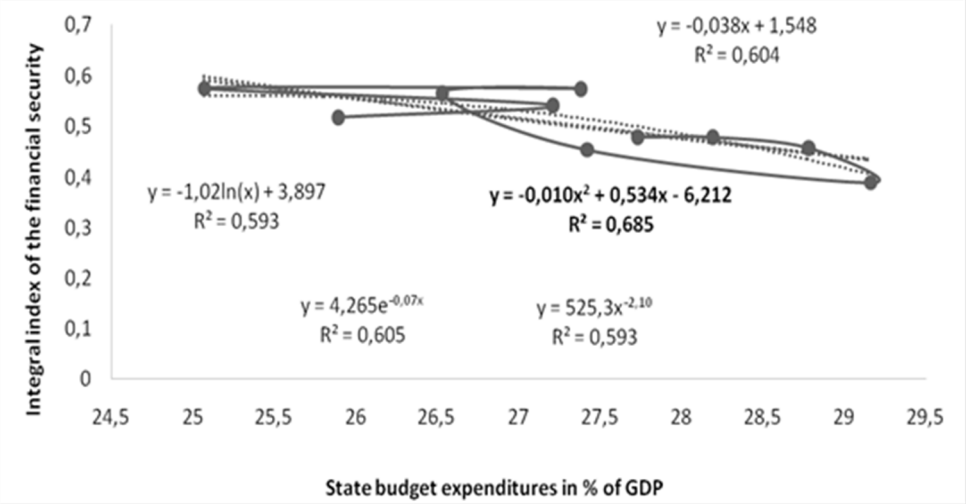

Figure 1. Results of modelling interrelation between the coefficient of redistribution of expenditures in relation to GDP and the integral index of financial security of the state

Source: developed according to Table 1, Table 2.

Similarly to Figure 1, the models of influence of all indicators of budgetary policy have been developed, the equations of linear dependences of an integral index of financial security of the state for 122 indicators of budgetary policy have been obtained as well as the corresponding values of coefficients of determination. Of 122 equations obtained, only 19 were statistically significant and reliable ($R^2 > 0.5$), that is only 15.6% (Table 4). According to the linear model, the greatest influence on the level of financial security of Ukraine is exerted by such budget policy indicators as the coefficient of financing national functions (reliability 79.5%), the coefficient of proportionality of financing of the national security agencies (reliability 78.3%), the share of defence expenditures in the consolidated budget (reliability 73.2%) and the coefficient of budget dependence on crediting (reliability 70.3%).

Given the large number of results obtained on the impact of budget policy on financial security, in the future we will consider only models of interrelation with high reliability ($R^2 > 0.5$) based on the linear function (see Table 4), quadratic function (second order polynomial, Table 5), exponential function (Table 6), logarithmic function (natural logarithm, Table 7) and power function (Table 8).

Table 4. Results of modelling the impact of budget policy indicators on the level of financial security of Ukraine using linear dependence

Indicator name	Equation of linear regression	R^2
1. Coefficient of redistribution of state budget expenditures relative to GDP	$y = -0.0382\,x + 1.5482$	0.6048
2. Coefficient of efficiency of local budget revenues by tax sources	$y = -0.0051\,x + 0.93$	0.5090
3. The share of revenues from indirect taxes in the consolidated budget	$y = -0.0314\,x + 2.2128$	0.6070
4. Coefficient of direct taxes in the tax revenues of the consolidated budget	$y = 0.0314\,x - 0.9281$	0.6070
5. Coefficient of financing national functions	$y = -0.0234x + 0.8242$	0.7951
6. The share of expenditures on national functions in the state budget	$y = -0.0113x + 0.7292$	0.6786
7. Coefficient of budget dependence on crediting	$y = -0.0158x + 0.6273$	0.7028
8. The share of expenditures for public debt service in the state budget	$y = -0.0086x + 0.6188$	0.6531
9. The share of defence expenditures in the consolidated budget	$y = -0.0241x + 0.6237$	0.7323
10. The share of defence expenditures in the state budget	$y = -0.013x + 0.6172$	0.6688
11. The share of expenditures on economic activities in the consolidated budget	$y = 0.0228x + 0.2613$	0.6021
12. The share of expenditures on economic activities in the state budget	$y = 0.0105x + 0.3665$	0.6351
13. The share of expenditures on environmental protection in the consolidated budget	$y = 0.2781x + 0.2727$	0.4984
14. The share of expenditures on health care in the consolidated budget	$y = 0.0362x + 0.1101$	0.4956
15. The share of expenditures on education in the consolidated budget	$y = 0.0207x + 0.1099$	0.5952
16. Expenditures on servicing and redemption of public debt in % to GDP	$y = -0.0437\,x + 0.626$	0.6956
17. The share of spending for servicing and redemption of public debt in expenditures	$y = -0.0158\,x + 0.6338$	0.678
18. Coefficient of proportionality of financing the national security agencies	$y = 0.0788\,x + 0.3534$	0.7829
19. Coefficient of devaluation stability of the budget revenue base	$y = 7 \cdot 10^{-6}\,\mathrm{x} + 0.2758$	0.645

Source: compiled and calculated by the authors

Table 5. Results of modelling of the impact of budget policy indicators on the level of financial security of Ukraine using polynomial dependence

Indicator name	Equation of quadratic regression	R^2
1. Coefficient of redistribution of state budget expenditures relative to GDP	$y = -0.0106\,x^2 + 0.5347\,x - 6.2126$	0.6857
2. Deficit of local budgets	$y = -5 \cdot 10^{-10}x^2 - 2 \cdot 10^{-8}x + 0.5353$	0.5874
3. Coefficient of budget deficit (surplus) of local budgets relative to GDP	$y = -0.0479\,x^2 - 3 \cdot 10^{-5}x + 0.5354$	0.5900
4. The share of revenues from indirect taxes in the consolidated budget	$y = -0.008\,x^2 + 0.833\,x - 21.226$	0.7167
5. The share of revenues from indirect taxes in local budgets	$y = -0.0079\,x^2 + 0.0521\,x + 0.4862$	0.7571
6. Coefficient of direct taxes in the tax revenues of the consolidated budget	$y = -0.008\,x^2 + 0.7597\,x - 17.563$	0.7167
7. The share of revenues from direct taxes in local budgets	$y = -0.0079\,x^2 + 1.5239\,x - 73.104$	0.7571
8. Expenditures on national functions in the consolidated budget	$y = 1 \cdot 10^{-5}x^2 - 0.0034x + 0.6794$	0.5574
9. Expenditures on national functions in the state budget	$y = 2 \cdot 10^{-5}x^2 - 0.0037x + 0.6626$	0.5678
10. Coefficient of budget dependence on crediting	$y = -0.0029x^2 + 0.0307x + 0.4718$	0.8456
11. The share of expenditures for public debt service in the state budget	$y = -0.0011x^2 + 0.0213x + 0.455$	0.8186
12. The share of defence expenditures in the consolidated budget	$y = 0.0059x^2 - 0.0859x + 0.7595$	0.7649
13. The share of defence expenditures in the state budget	$y = 0.0033x^2 - 0.0743x + 0.8543$	0.7805
14. The share of expenditures on public order, security and the judiciary in the consolidated budget	$y = 0.075x^2 - 1.3173x + 6.2371$	0.5722
15. The share of expenditures on economic activities in the consolidated budget	$y = -0.0025x^2 + 0.0758x - 0.012$	0.6186
16. The share of expenditures on economic activities in the state budget	$y = 0.0002x^2 + 0.0044x + 0.4016$	0.6378
17. The share of expenditures on environmental protection in the consolidated budget	$y = -0.3897x^2 + 0.9794x - 0.0323$	0.5099
18. The share of expenditures on health care in the consolidated budget	$y = 0.0341x^2 - 0.6895x + 3.9192$	0.7286
19. The share of expenditures on health care in the state budget	$y = 0.0263x^2 - 0.1092x + 0.5428$	0.7715
20. The share of expenditures on education in the consolidated budget	$y = 0.0022x^2 - 0.0607x + 0.8603$	0.6057

Table 5. Results of modelling of the impact of budget policy indicators on the level of financial security of Ukraine using polynomial dependence (cont.)

Indicator name	Equation of quadratic regression	R^2
21. The share of expenditures on education in the state budget	$y = -0.0025x^2 + 0.0653x + 0.1142$	0.5219
22. The share of expenditures on education in local budgets	$y = 0.0045x^2 - 0.263x + 4.2718$	0.5121
23. Coefficient of stability of revenue base of local budgets	$y = -72.165\,x^2 + 145.15\,x - 72.453$	0.6778
24. Coefficient of deficit (surplus) of local budgets	$y = -72.165\,x^2 + 0.825\,x + 0.5366$	0.6778
25. Coefficient of debt dependence relative to GDP	$y = -0.0268\,x^2 + 0.1059\,x + 0.4501$	0.8582
26. Coefficient of public debt service and redemption	$y = -0.0036\,x^2 + 0.043\,x + 0.4271$	0.8907
27. Coefficient of budget dependence	$y = -61.452\,x^2 + 40.856\,x - 6.2477$	0.5720
28. Coefficient of proportionality of financing of the national security agencies	$y = -0.0004\,x^2 + 0.0804\,x + 0.3522$	0.7829
29. Coefficient of influence of NPF	$y = 0.2978\,x^2 - 0.8482\,x + 1.037$	0.5559
30. Coefficient of devaluation stability of the budget revenue base	$y = -1 \cdot 10^{-10}x^2 + 1 \cdot 10^{-5}x + 0.1524$	0.6494

Source: compiled and calculated by the authors.

As a result of modelling the impact of budget policy indicators on the level of financial security of Ukraine using polynomial dependence, 122 quadratic dependences were obtained, of which 30 equations were statistically significant and reliable ($R^2 > 0.5$), which is 24.6% of their total, with the greatest impact on the level of financial security of Ukraine by quadratic function exerted by such indicators of budget policy as: the coefficient of public debt service and redemption (reliability 89.1%); the coefficient of debt dependence relative to GDP (reliability 85.8%); the coefficient of budget dependence on crediting (reliability 84.6%), and the share of public debt service expenditures in the state budget (reliability 81.9%). At the same time, the reliability of quadratic functions was higher than that of the linear ones, and the coefficient of proportionality of financing of the national security agencies was ranked only fifth with the same reliability.

Table 6. The results of modelling the impact of budget policy indicators on the level of financial security of Ukraine using exponential dependence

Indicator name	Exponential regression equation	R^2
1. Coefficient of redistribution of state budget expenditures relative to GDP	$y = 4.2659 \exp(-0.078\ x)$	0.6058
2. The share of revenues from indirect taxes in the consolidated budget	$y = 17.446 \exp(-0.065x)$	0.6236
3. Coefficient of direct taxes in the tax revenues of the consolidated budget	$y = 0.0255 \exp(0.0653x)$	0.6236
4. Coefficient of financing national functions	$y = 0.964\exp(-0.048\ x)$	0.7928
5. The share of expenditures on national functions in the state budget	$y = 0.7921\exp(-0.023x)$	0.6710
6. Coefficient of budget dependence on crediting	$y = 0.6451\exp(-0.033x)$	0.7085
7. The share of expenditures for public debt service in the state budget	$y = 0.6332\exp(-0.018\ x)$	0.6522
8. The share of defence expenditures in the consolidated budget	$y = 0.6378\exp(-0.049x)$	0.7146
9. The share of defence expenditures in the state budget	$y = 0.6288\exp(-0.026x)$	0.6467
10. The share of expenditures on economic activities in the consolidated budget	$y = 0.305\exp(0.0464x)$	0.5960
11. The share of expenditures on economic activities in the state budget	$y = 0.3798\exp(0.0211x)$	0.6087
12. The share of expenditures on health care in the state budget	$y = 0.286\exp(0.1543x)$	0.7290
13. The share of expenditures on education in the consolidated budget	$y = 0.2255\exp(0.0419x)$	0.5789
14. Coefficient of debt dependence relative to GDP	$y = 0.6429 \exp(-0.09x)$	0.6964
15. Coefficient of public debt service and redemption	$y = 0.6538 \exp(-0.032x)$	0.6842
16. Coefficient of proportionality of financing of the national security agencies	$y = 0.3689 \exp(0.1596x)$	0.7635
17. Coefficient of devaluation stability of the budget revenue base	$y = 0.3165 \exp(0.00005x)$	0.6183

Source: compiled and calculated by the authors.

When modelling the impact of budget policy indicators on the level of financial security of Ukraine using exponential dependence, 122 equations were obtained, with only 17, i.e. 13.9% of the total, being statistically significant and reliable ($R^2 > 0.5$). It was established that the greatest impact on the level of financial security of Ukraine according to the exponential model is exerted by such budget policy indicators as: the coefficient of proportionality of financing of the national security agencies (reliability 76.4%); the share of expenditures on health care in the state budget (reliability 72.9%); the share of defence expenditures in the consolidated budget (reliability 71.5%) and the share of expenditures on public debt service in the consolidated budget (reliability 70.9%). The equations of logarithmic dependence are summarized in Table 7.

Table 7. Results of modelling the impact of budgetary policy indicators on the level of financial security of Ukraine using logarithmic dependence

Indicator name	Logarithmic regression equation	R^2
1. The share of expenditures on national functions in the state budget	$y = -0.213\ln(x) + 1.1377$	0.6373
2. Coefficient of financing national functions	$y = -0.315\ln(x) + 1.3229$	0.7688
3. Coefficient of direct taxes in the tax revenues of the consolidated budget	$y = 1.4459\ln(x) - 5.0182$	0.6164
4. The share of revenues from indirect taxes in the consolidated budget	$y = -1.692\ln(x) + 7.2659$	0.5990
5. Coefficient of redistribution of state budget expenditures relative to GDP	$y = -1.026\ln(x) + 3.8972$	0.5938
6. The share of expenditures on economic activities in the consolidated budget	$y = -0.1\ln(x) + 0.7004$	0.5616
7. The share of defence expenditures in the state budget	$y = -0.089\ln(x) + 0.7261$	0.5093
8. The share of defence expenditures in the consolidated budget	$y = -0.119\ln(x) + 0.6845$	0.7551
9. The share of expenditures for public debt service in the state budget	$y = -0.114\ln(x) + 0.7415$	0.7077
10. Coefficient of budget dependence on crediting	$y = 0.2403\ln(x) - 0.0604$	0.6141
11. The share of expenditures on economic activities in the state budget	$y = 0.1239\ln(x) + 0.193$	0.6012
12. The share of expenditures on environmental protection in the consolidated budget	$y = 0.2472\ln(x) + 0.5532$	0.5048
13. The share of expenditures on health care in the state budget	$y = 0.2583\ln(x) + 0.1759$	0.7228

Table 7. Results of modelling the impact of budgetary policy indicators on the level of financial security of Ukraine using logarithmic dependence (cont.)

Indicator name	Logarithmic regression equation	R^2
14. The share of expenditures on education in the consolidated budget	$y = 0.3821\ln(x) - 0.6189$	0.5878
15. The share of expenditures on education in the state budget	$y = 0.1649\ln(x) + 0.1332$	0.5017
16. Coefficient of debt dependence relative to GDP	$y = -0.098\ln(x) + 0.5958$	0.5587
17. Coefficient of public debt service and redemption	$y = -0.102\ln(x) + 0.7108$	0.5244
18. Coefficient of proportionality of financing of the national security agencies	$y = 0.1398\ln(x) + 0.4226$	0.7830
19. Coefficient of devaluation stability of the budget revenue base	$y = 0.2325\ln(x) - 1.907$	0.6509

Source: compiled and calculated by the authors.

According to the data in Table 7, when modelling using a logarithmic equation, 19 statistically significant and reliable equations were obtained ($R^2 > 0.5$), which is 15.6% of the total. According to the results of calculations, the greatest impact on the level of financial security of Ukraine according to the logarithmic model is exerted by such budgetary policy indicators as: the coefficient of proportionality of financing of the national security agencies (reliability 78.3%), the coefficient of financing national functions (reliability 76.7%), the share of defence expenses in the consolidated budget (reliability 75.5%,) and the share of expenditures on health care in the state budget (reliability 72.3%). It should be noted that the obtained factors are also the factors of greatest influence in linear and exponential models.

Table 8. Results of modelling the impact of budgetary policy indicators on the level of financial security of Ukraine using the power dependence

Indicator name	Power regression equation	R^2
1. Coefficient of redistribution of state budget expenditures relative to GDP	$y = 525.38\,x^{-2.104}$	0.5936
2. The share of revenues from indirect taxes in the consolidated budget	$y = 629568\,x^{-3.515}$	0.6146
3. Coefficient of direct taxes in the tax revenues of the consolidated budget	$y = 5 \cdot 10^{-6}x^{3.0071}$	0.6341
4. Coefficient of financing national functions	$y = 2.6684x^{-0.643}$	0.7638

Table 8. Results of modelling the impact of budgetary policy indicators on the level of financial security of Ukraine using the power dependence (cont.)

Indicator name	Power regression equation	R^2
5. The share of expenditures on national functions in the state budget	$y = 1.8223x^{-0.435}$	0.6305
6. Coefficient of budget dependence on crediting	$y = 0.7499x^{-0.206}$	0.5662
7. The share of expenditures on public debt service in the state budget	$y = 0.7899\ x^{-0.183}$	0.5112
8. The share of defence expenditures in the consolidated budget	$y = 0.7208x^{-0.241}$	0.7338
9. The share of defence expenditures in the state budget	$y = 0.808x^{-0.231}$	0.6844
10. The share of expenditures on economic activities in the consolidated budget	$y = 0.158x^{0.491}$	0.6098
11. The share of expenditures on economic activities in the state budget	$y = 0.2683x^{0.2483}$	0.5744
12. The share of expenditures on health care in the state budget	$y = 0.2574x^{0.5233}$	0.7057
13. The share of expenditures on education in the consolidated budget	$y = 0.0517x^{0.7721}$	0.5710
14. Coefficient of debt dependence relative to GDP	$y = 0.6043\ x^{-0.202}$	0.5601
15. Coefficient of public debt service and redemption	$y = 0.7666\ x^{-0.21}$	0.5303
16. Coefficient of proportionality of financing of the national security agencies	$y = 0.4242\ x^{0.284}$	0.7682
17. Coefficient of devaluation stability of the budget revenue base	$y = 0.0039\ x^{0.4685}$	0.6287

Source: compiled and calculated by the authors.

The results of the calculations show that the greatest impact on the level of financial security of Ukraine according to the power model is exerted by budgetary policy indicators such as: the coefficient of financing national functions (reliability 76.4%); the coefficient of proportionality of financing of the national security agencies (reliability 76.8%); the share of defence expenditures in the consolidated budget (reliability 73.4%) and the share of expenditures on health care in the state budget (reliability 70.6%).

Thus, in the process of assessment of the impact of budgetary policy indicators on the level of financial security of the state the most statistically significant and reliable

equations of interrelation were determined in each group of statistical dependencies, as well as key factors of influence. The results of the assessment of the impact of budgetary policy on the financial security of the state are summarized in Table 9.

Table 9. Summarized results of modelling the impact of budgetary policy indicators on the level of financial security of Ukraine

Model name	Number of equations	Average determination coefficient R^2
1. Linear	19	0.6575
2. Polynomial (quadratic)	30	0.6956
3. Exponential	17	0.6629
4. Logarithmic	19	0.6070
5. Power	17	0.6151
Total	102	0.6549

Source: compiled and calculated by the authors according to Tables 4–8.

The results of the analysis of the impact of budget policy indicators on the level of financial security of Ukraine are characterized by a tendency to recur in different models of interrelation. These indicators interact with each other, responding accordingly to changes in budgetary policy. Given the above, it can be concluded that the following indicators have a significant impact on the level of financial security:

I. *Indicators of efficiency of budgetary policy of revenues and expenses*:
1. Expenditures on national functions in the state budget.
2. Expenditures on national functions in the consolidated budget.
3. Deficit of local budgets.
4. The share of expenditures on national functions in the state budget.
5. Coefficient of financing national functions.
6. The share of expenditures on public debt service in the state budget.
7. Coefficient of budget dependence on crediting.
8. The share of expenditures on public order, security and the judiciary in the consolidated budget.
9. The share of defence expenditures in the state budget.
10. The share of defence expenditures in the consolidated budget.
11. The share of expenditures on economic activities in the state budget.
12. The share of expenditures on economic activities in the consolidated budget.
13. The share of expenditures on education in the state budget.
14. The share of expenditures on education in the consolidated budget.
15. The share of expenditures on education in local budgets.
16. The share of expenditures on health care in the state budget.
17. The share of expenditures on health care in the consolidated budget.

18. The share of expenditures on environmental protection in the consolidated budget.
19. Percentage share of revenues from indirect taxes in the consolidated budget.
20. Percentage share of revenues from indirect taxes in local budgets.
21. Coefficient of direct taxes in the tax revenues of the consolidated budget.
22. Percentage share of revenues from direct taxes in local budgets.
23. Coefficient of efficiency of local budget revenues by tax sources.
24. Coefficient of redistribution of state budget expenditures relative to GDP.

II. *Indicators of dependence of budget expenditures on revenues:*

25. Coefficient of stability of the revenue part of local budgets.
26. Coefficient of deficit (surplus) of the local budgets relative to GDP.
27. Coefficient of deficit (surplus) of the local budgets.
28. Coefficient of debt dependence relative to GDP.
29. Coefficient of public debt service and redemption.

III. *Indicator of effectiveness of inter-budget policy:*

30. Coefficient of budget dependence.

IV. *Additional indicators of budgetary policy in assessing the level of financial security:*

31. Coefficient of proportionality of financing of the national security agencies.
32. Coefficient of debt dependency.
33. Coefficient of debt service.
34. Coefficient of influence of NPF.
35. Coefficient of devaluation stability of the budget revenue base, million USD.

Thus, in assessing the impact of budgetary policy on the state of financial security of the country, the authors performed the following tasks:

1) to ensure the objectivity, breadth and comprehensiveness of the factor analysis of the level of financial security of Ukraine, calculations were made for 122 absolute and relative indicators, which represent most aspects of modern budget policy, 35 of which have a significant impact on financial policy;
2) by the criterion of statistical significance and reliability of the regression equation (coefficient of determination $R^2 > 0.5$) the ranking of one-factor equations of linear, polynomial, exponential, logarithmic and power dependences was carried out, which allowed to select the most statistically significant and reliable models of interrelation for use in multifactor modelling and forecasting of financial security of the state;
3) it has been experimentally proved that of 122 statistically significant indicators the following indicators of budget policy have the greatest impact on the level of financial security of Ukraine: the coefficient of financing national functions (linear dependence), coefficient of debt service (polynomial dependence), coefficient of

proportionality of financing the national security agencies (exponential, logarithmic and power dependences).

4) it was found out that the most reliable groups of equations relative to the influence on the state of financial security are the group of polynomial (quadratic) dependences with the highest average reliability of 69.6%, the group of exponential equations with average reliability of 66.3% and the group of linear dependencies with average group reliability of 65.8%.

4. Conclusions

It was determined that the components of the state's financial security in the face of martial law and pandemic do not take into account the impact of budgetary policy. Therefore, in the course of comprehensive integrated assessment of the financial security of the state, additional indicators were proposed, such as: the coefficient of the NBU's participation in the state budget; the coefficient of influence of NPF; the coefficient of DGB efficiency and the coefficient of debt service; the coefficient of debt dependence, and the coefficient of proportionality of financing of the national security agencies; the coefficient of devaluation stability of the budget revenue base; the coefficient of the household income stability and the coefficient of budget dependence on crediting.

In the course of assessing the impact of budgetary policy on the state of financial security of the country, the expediency has been justified to consider 122 absolute relative indicators which represent most aspects of modern budgetary policy as factorial features of the level of financial security of Ukraine. The most statistically significant and reliable models of interrelation have been selected for their further use in multifactor modelling and forecasting of financial security of the state based on ranking of one-factor equations of linear, polynomial, exponential, logarithmic and power dependences. It has been experimentally proved that out of 122 statistically significant indicators, the greatest impact on the level of financial security of Ukraine is exerted by such budgetary policy indicators as the coefficient of financing national functions, the coefficient of public debt servicing and redemption, the coefficient of proportionality of financing of the national security agencies.

It is proved that the formation of Ukraine's budgetary policy in the period of challenges, under martial law in particular, requires adjustments to the indicators of the financial security assessment system. As a result of the analysis, the preconditions for developing a comprehensive multifactor model of financial security of Ukraine as a basis for forecasting and developing strategic guidelines for improving the level of financial security, taking into account the factors influencing budgetary policy, have been formulated.

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