

REVIEW PAPER

# Directions of Fiscal Policy Transformation in the Crisis Period of Economic Development of Ukraine

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## ABSTRACT

The purpose of the study is to determine the directions of transformation of the country's fiscal policy at the expense of the main fiscal sources during the crisis period. The methods of analysis, interpolation, probabilistic analysis, entropy estimation and entropy production were used during the research. The article presents the results of the assessment of the dynamics of the main fiscal indicators of Ukraine in two time frames for the period 2011-2020 and for the period 2011-2022. It was determined that the expansion/extension of the period of assessment of the dynamics during the crisis of 2021-2022 made it possible to identify qualitative changes in the dynamics of fiscal indicators while maintaining their cyclicity. Such changes are especially destructive in the real sector of economy, which has led to a significant increase in the level of uncertainty of all fiscal indicators. Based on the results of the analysis of entropy production in the system of connections between fiscal indicators, directions for mitigating crisis phenomena in the economy of Ukraine are proposed. In particular, a change from a restrictive fiscal policy to a discretionary (stimulating) one and an increase in public expenditures aimed at stimulating the development of the real sector of the economy and consumption, which will determine positive economic dynamics with a lag of 9 months, are recognized as expedient.

## HIGHLIGHTS

- ① The article is devoted to the analysis of directions of transformation of the Ukraine' fiscal policy at the expense of the main fiscal sources in the crisis period.
- ② The obtained results demonstrated ascertained dissipation of the revenue part of the Consolidated Budget of Ukraine to a state of stagnation.
- ③ The practical significance of the research lies in proposing directions for mitigating crisis phenomena in the economy of Ukraine.

**Keywords:** Fiscal indicators, budget revenues, fiscal policy, uncertainty, entropy, entropy production

Currently, the world community is experiencing an important period of global transformations caused by natural processes, civilizational conflict, socio-political, economic and financial crises. Each individual national economy is subject to destructive external influences, which forces it to quickly apply various tools to overcome systemic risks and threats. The last decade has created such a package of systemic risks and threats for Ukraine that has put the entire national economy on the critical line.

Starting from the beginning of 2014 (when Russia's aggression against Ukraine began and Donetsk, Luhansk Oblast and Crimea were seized) and until the middle of 2022 (the full-scale war against

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Ukraine began on February 24, 2022), Ukraine's losses amounted to UAH 700 billion, including from occupation of Crimea UAH 118 billion. Economic losses from the COVID-19 pandemic in 2020 were at the level of 10% of GDP (Burakovsky, 2020), the partial recovery of the economy in 2021 amounted to 3.2% of GDP (Boyar and Makhnovets, 2021). The estimated losses of Ukraine as a result of the war in 2022 amounted to UAH 137.8 billion, the decline of the economy exceeded 30% of GDP (*The year of the great war of Russia against Ukraine in 10 figures*). Given the significant number of direct and indirect losses, significant human losses, environmental damage and general imbalance of the economy, the socio-economic system of the country needs immediate restoration.

For such a recovery, a judicious use of the usual tools of state administration and the involvement of a large number of resources are necessary. International financial assistance, direct participation of the world's leading countries in the reconstruction of Ukraine should be accompanied by country's own efforts to ensure overcoming the consequences of war. The period of martial law creates extraordinary challenges for financial policy in general and fiscal policy in particular. After all, among the most significant tools for ensuring economic growth, there are fiscal ones aimed not only at the formation of financial resources of the state, but also at stimulating the real sector of economy and solvent demand.

## LITERATURE REVIEW

A significant number of scientific works are devoted to the justification of the theoretical, methodological, and practical principles of using fiscal policies to regulate the direction of the country's economic development. The impact of a certain type of fiscal policy on economic development is interpreted quite widely. Thus, J. Keynes perceived fiscal policy as the most effective way of state regulation of economic growth, increasing the volume of consumption, enhancing the level of employment of the population (Keynes, 2018: 65). In the well-known work of A. Laffer, fiscal policy acts as a tool for stimulating the economic activity of economic agents through their incomes and incentives to work (Laffer, 1981: 29). J. Stiglitz determined that the main instrument of influence of fiscal policy is

tax pressure, and the consequence of its application is the well-being of the population (Stiglitz, 1999: 27-28). In the work of V. Sutormina, V. Fedosov, and V. Andrushchenko, it is stated that fiscal policy has effective tools of influence on the reproduction of the aggregate social product (Sutormina *et al.* 1992: 45).

M. Pasichnyi emphasizes that fiscal policy represents a tool for influencing investment and consumer demand, and has a long-term effect, and also serves as a mechanism for ensuring macroeconomic stabilization, which is enhanced in the case of close coordination with monetary policy (Pasichnyi, 2017).

M. Cieślukowski (2012), analyzing the budgetary stabilization policy carried out within the framework of the European Union during the crisis, focuses attention on the assessment of the role of the EU general budget in countering the crisis (of 2008), as well as internal (for each EU country) sources of anti-crisis implementation programs and recovery plans within the EU. Zsolt (2009) concludes that the crisis should be used as an opportunity to carry out budget reforms (which will increase trust in society), update budget rules and improve the quality of budget formation in the medium term. Therefore, changes in the budget policy in the field of budget formation should ensure an increase in the level of fiscal efficiency and regulatory potential of the budget system. The use of the budget mechanism should be carried out in a way that does not reduce or undermine the trust of economic subjects in the budget policy, authorized authorities and the state as a social institution.

Further development of approaches to the use of fiscal policy tools will provide an opportunity to increase the degree of adaptability of its influence on the socio-economic environment and the quality level of public finance management. V. Makogon (2021) focuses attention on determining the long-term vectors of the budget policy regarding the formation of the state budget in the system of economic cyclicity and claims that cyclicity, especially for an open model of the economy, such as the domestic one, is a factor that makes adjustments in the architecture of state budget revenues at stages of recession and economic recovery, which affects the overall level of financial and economic security.

Other scientists joined the continuation of the discussion and research on ways to achieve macroeconomic stabilization, the need to rethink the role of public financial institutions, strengthening the regulatory influence of the state budget formation system on the socio-economic development of the country in conditions of shocks and, in particular, the pandemic. Sawicki *et al.* (2021) investigated that the COVID-19 pandemic has led to financial stress in the medical industry, staff reductions due to institutional changes, which require proper planning. Faria-e-Castro (2020), studying the consequences of the coronavirus in the US in 2020, proved that liquidity stabilization programs will be more effective if the goal of fiscal policy is to stabilize employment in the most affected industries. Blanchard (2023) demonstrated what the optimal policy should look like by considering examples of fiscal policy in action: fiscal consolidation after the global financial crisis and the current combination of fiscal and monetary policy in the United States. Abad *et al.* (2020) write about fiscal rules for balancing the budget in the presence of mandatory (which cannot be reduced) and variable government expenditures (as a local tool for stabilizing the economy). Gootjesand de Haan (2022) found that fiscal rules should have a high level of fiscal transparency, while it is important to consider the volatility of fiscal policy to determine the impact of fiscal rules on fiscal adjustments. The issue of positive and negative consequences of the fiscal policy carried out by the government during the formation of the country's tax system was studied by M. G. Voloshchuk *et al.* (2021). Fiscal policy of Ukraine in conditions of budget decentralization was studied in detail by V. Martynenko (2019). Lysiak *et al.* (2022) carried out an assessment of the uncertainty of the dynamics of tax revenues from excise tax collection in the pre-war period (2019-2021), which made it possible to predict the onset of crisis periods of their reduction, with high convergence of results regardless of the scale of measurement, and accordingly provide recommendations for adjusting fiscal policy.

Currently, researchers note that the full-scale war on the territory of Ukraine has led to extraordinary challenges for fiscal policy. Chugunov *et al.* (2023) proves that the fiscal policy under such conditions is aimed at ensuring a balance between the

financing of the most important items of the budget and stimulating the recovery of the economy, therefore it requires a balanced approach in terms of increasing the efficiency of budget expenditures and assessing fiscal risks in a changing macroeconomic environment; it is also important to justify strategic budget policy priorities under martial law. Yu. Radionov (2023) outlined the priorities of fiscal policy under martial law for the post-war recovery of Ukraine's economy.

The determination of the target parameters of economic development in relation to the parameters of fiscal instruments (even taking into account their stochasticity or behavioral aspects of the connection) has a number of significant observations. Overcoming such concerns is possible under the condition of expanding the systemic approach in understanding the processes of budget revenue formation, which determines the relevance and purpose of this study. The purpose of the study is to determine the directions of transformation of the country's fiscal policy at the expense of the main fiscal sources in the crisis period of the economy. The separate tasks of the study were to determine: the main regularities of the dynamics of fiscal indicators; amount of chaos in their dynamics; directionality and significance of the mutual influence of fiscal indicators as both deterministic and indeterminate; direction of application of fiscal policy tools based on the obtained results.

## Methodology

The research methodology is built on the indeterministic paradigm of scientific thinking, according to which public finance is a subsystem of the financial system in general, and as an element of the subsystem has the properties of heterarchy, emergence, openness, and relativism. The dynamics of the development of such a subsystem is determined simultaneously by both contingent regularities and the amount of chaos in it. We have previously described the methodical principles of uncertainty level research (2012). In order to solve individual research tasks, the following methods were used: analysis to assess the dynamics of the main fiscal indicators; interpolations to determine the cyclicity of their dynamics; probability analysis to estimate the parameters of the probability density lines of indicators; entropy estimates for measuring

the amount of chaos in the information about the quantitative parameters of indicators.

## RESULTS AND DISCUSSION

Data on the formation of revenues of the Consolidated Budget of Ukraine based on monthly statistical data were used to investigate the level of uncertainty. In particular, the following indicators were used: the volume of consolidated budget revenues ( $CBR$ ); the volume of tax revenues (tax revenues,  $TR$ ); the amount of receipts from corporate income tax (tax revenues from corporate income,  $TR_{ci}$ ); the amount of receipts from tax on the income of individuals (tax revenues from personal income,  $TR_{pi}$ ); the volume of revenues from internal taxes on goods and services (tax revenues from on goods and services  $TR_{gs}$ ); the volume of revenues from local taxes and fees ( $TR_{lf}$ ); the volume of revenues from other taxes and levies ( $TR_o$ ); volume of non-tax receipts ( $NTR$ ); the volume of receipts to trust funds ( $RTF$ ); the volume of receipts from the governments of foreign countries, the European Union, and international organizations (external receipts,  $ER$ ). All indicators are taken monthly for the periods 2011–2020 and 2011–2022 (*State finances*, n.d.). Initially, the research was conducted for the period 2011–2020; the task was to identify specific regularities in the dynamics of fiscal indicators, their convergence or differences, and the degree of uncertainty of these regularities. However, in the process of preparing materials for publication, the observations provided a significant amount of material regarding the distortion of the identified patterns and changes in the level of uncertainty of fiscal processes. Therefore, the results are presented in two time ranges: according to the data of 2011–2020 and 2011–2022. In the time range of 2011–2022, the trends in the dynamics of fiscal indicators are characteristic of the “natural” development of the economy. The time range of 2011–2022 is characterized by development with a significant impact of destructive factors the continuation of the COVID-19 pandemic (2021) and the large-scale war of the Russian Federation against Ukraine (2022). The systemic threats of 2021–2022 should have led (and led) to the transformation of Ukraine’s public finances in the context of the transformation of the national economy as a whole. At the same time, conducting the analysis separately for the periods

2011–2020 and 2021–2022 did not make sense, as this would mean a violation of the succession of states of the system in its evolutionary development.

The initial stage of the research was to identify the existence of a certain temporal regularity of the indicators’ dynamics with as much accuracy as possible (Table 1). With a high level of reliability, the existence of annual cyclicity was confirmed for almost all described fiscal indicators. In the following equations, the variable  $t$  corresponds to the linear numbering of time intervals, while the variable  $t'$  to the periodic numbering. The error of approximation, determined by the results of dispersion analysis, does not exceed 1.5%. The use of other forms of approximation did not make it possible to describe the dynamics lines with a reliability exceeding 90%.

The dynamics of fiscal characteristics is cyclical, which is confirmed with a much higher level of reliability. However, the length of the cycle is not stable, the existence of cycles of different lengths is observed. Such differences in the length of cycles are determined by the existence of a discrepancy in the phases of fluctuations of fiscal indicators. Coincidences according to the phases of fluctuations are observed for the volume of revenues to the consolidated budget, the volume of tax revenues, the volume of revenues from the personal income tax, the volume of revenues from local taxes and fees, the volume of receipts to trust funds. Other indicators have the phase specificity of cyclic oscillations. Such a phenomenon testifies to the contingency of the regularities of the dynamics of fiscal characteristics, the cause of which, most likely, is the heterogeneity of the processes budget revenues formation.

The differences in the patterns of dynamics according to the data ranges of 2011–2020 and 2020–2022 are as follows:

- ♦ When the range is expanded, the initial level of the fiscal indicator ( $\alpha_0$ ) usually decreases. The level of its reduction is: for the volume of revenues of the Consolidated budget 63%; for the volume of tax revenues 21%; for the amount of revenue from income tax 24.22%; for the amount of income from personal income tax 295%; for the volume of revenues from internal taxes on goods and services 0.1%; for

**Table 1:** Description of lines of theoretical approximation of the dynamics of fiscal indicators

Group of data	Description of the line of theoretical approximation	Cyclicity		Approximation error
		Availability	Cycle length, months	
The volume of consolidated budget revenues, $CBR$				
According to 2011-2020 data	$CBR(t, t') = 14947 + 861 \cdot t + 2428 \cdot \cos(t') - 6368 \cdot \sin(t')$	+	6	0.0000
According to 2011-2022 data	$CBR(t, t') = 5481.9 + 1064 \cdot t + 4025 \cdot \cos(t') - 4209 \cdot \sin(t')$	+	24	$2.58 \cdot 10^{-13}$
The volume of tax revenues, $TR$				
According to 2011-2020 data	$TR(t, t') = 11521 + 718 \cdot t + 4203 \cdot \cos(t') - 4118 \cdot \sin(t')$	+	4	0.00001
According to 2011-2022 data	$TR(t, t') = 9121.7 + 774 \cdot t + 5250 \cdot \cos(t') - 4608.56 \cdot \sin(t')$	+	16	$5.26 \cdot 10^{-14}$
Tax revenues from corporate income, $TR_{ci}$				
According to 2011-2020 data	$TR_{ci}(t, t') = 2507 + 57.8 \cdot t + 113.45 \cdot \cos(t') + 921.3 \cdot \sin(t')$	+	12	0.00092
According to 2011-2022 data	$TR_{ci}(t, t') = 1899.6 + 71.99 \cdot t + 266 \cdot \cos(t') + 888 \cdot \sin(t')$	+	48	$6 \cdot 10^{-6}$
Tax revenues from personal income, $TR_{pi}$				
According to 2011-2020 data	$TR_{pi}(t, t') = 357.5 + 200.7 \cdot t + 383 \cdot \cos(t') - 936 \cdot \sin(t')$	+	12	$1.45 \cdot 10^{-13}$
According to 2011-2022 data	$TR_{pi}(t, t') = 1109 + 232 \cdot t + 616 \cdot \cos(t') - 1380 \cdot \sin(t')$	+	48	$3.9 \cdot 10^{-14}$
Tax revenues from on goods and services, $TR_{gs}$				
According to 2011-2020 data	$TR_{gs}(t, t') = 5665 + 359 \cdot t + 129.5 \cdot \cos(t') - 1659 \cdot \sin(t')$	+	6	0.00000
According to 2011-2022 data	$TR_{gs}(t, t') = 5657 + 361 \cdot t + 396 \cdot \cos(t') - 900 \cdot \sin(t')$	+	24	$2.4 \cdot 10^{-13}$
Tax revenues from local taxes and fees, $TR_{lf}$				
According to 2011-2020 data	$TR_{lf}(t, t') = -975 + 65 \cdot t + 105.66 \cdot \cos(t') - 392 \cdot \sin(t')$	+	12	$1.65 \cdot 10^{-13}$
According to 2011-2022 data	$TR_{lf}(t, t') = -847 + 62 \cdot t + 196 \cdot \cos(t') - 458 \cdot \sin(t')$	+	16	$2.5 \cdot 10^{-13}$
Tax revenues from other taxes and levies, $TR_o$				
According to 2011-2020 data	$TR_o(t, t') = 414.46 - 3.26 \cdot \cos(t') - 3.27 \cdot \sin(t')$	+	12	0.316
According to 2011-2022 data	$TR_o(t, t') = 416 + 0.25 \cdot t - 282 \cdot \cos(t') - 493 \cdot \sin(t')$	+	16	0.28
Non-tax receipts, $NTR$				
According to 2011-2020 data	$NTR(t, t') = 3037 + 138 \cdot t - 2541 \cdot \cos(t') + 550 \cdot \sin(t')$	+	12	0.00001
According to 2011-2022 data	$NTR(t, t') = 2018.4 + 157.8 \cdot t - 1424 \cdot \cos(t') + 192 \cdot \sin(t')$	+	48	0.0000
Receipts to trust funds, $RTF$				
According to 2011-2020 data	$RTF(t, t') = 106.8 + 3.6 \cdot t + 494.7 \cdot \cos(t') - 165.8 \cdot \sin(t')$	+	12	0.00000
According to 2011-2022 data	$RTF(t, t') = 67.72 - 0.07 \cdot t + 7.26 \cdot \cos(t') - 6.60 \cdot \sin(t')$	+	24	$3.17 \cdot 10^{-7}$
External receipts, $ER$				
According to 2011-2020 data	$ER(t, t') = 134.9 + 0.42 \cdot t + 21.7 \cdot \cos(t') - 99.6 \cdot \sin(t')$	+	12	$9.19 \cdot 10^{-14}$
According to 2011-2022 data	$ER(t, t') = -6147.1 + 132.09 \cdot t + 1157.37 \cdot \cos(t') + 1848 \cdot \sin(t')$	+	24	0.00000

**Note:** calculated by the authors.

the volume of revenues from local taxes and fees 13.12%; for the volume of non-tax revenues 33.55%; for the volume of revenues to the trust funds 36.6%; for the volume of revenues from the governments of foreign states, the European Union, international organizations 4656%;

- ♦ For all fiscal characteristics, the acceleration of linear growth rates compared to their initial values is characteristic. Thus, for the volume of consolidated budget revenues, such growth rates are 5.7% (2011–2020) and 19.40% (2011–2022), for the volume of tax revenues 6.2% (2011–2020) and 8.48% (2011–2022), for the volume of revenues from corporate income tax 2.3% (2011–2020) and 3.78% (2011–2022), for the volume of revenues from personal income tax 56.2% (2011–2020) and 20.9% (2011–2022), for the volume of revenues from internal taxes on goods and services 6.3% (2011–2020) and 6.38% (2011–2022), for the volume of revenues from local taxes and fees 6.6% (2011–2020) and 7.32% (2011–2022), for the volume of non-tax revenues 4.5% (2011–2020) and 7.81% (2011–2022), for the volume of revenues to trust funds 3.5% (2011–2020) and 0.1 % (2011–2022). An interesting result of the research is the fact that legally determined external financing compared to the total volume of revenues of the consolidated budget is only 0.899%. At the same time, the range of cyclical fluctuations for fiscal characteristics is at least 79% of their legally determined value;
- ♦ The characteristics of the dynamics cycles for each fiscal indicator are changing. The length of the cycle and the range of cyclic fluctuations increase significantly. In some cases, the attenuation of cyclic oscillations is observed, that is characteristic of a synergistic system in which autopoiesis stops. A particularly pronounced attenuation of cyclical fluctuations is observed for the volume of revenues from corporate income tax. In turn, the dynamics of fiscal indicators related to consumption and functioning of subsystems is more stable.

Random fluctuations, the so-called “white noise”, have a significant impact on any economic characteristic. Entropy and entropy production were used to measure uncertainty. Let us note that

the definition of entropy makes sense only under the assumption that the process is completely random. In this study, we believe that the process of forming fiscal indicators is both regular and random. Differences in the patterns of dynamics, a significant range of cyclical fluctuations determine a much greater variability of fiscal characteristics in the range of 2011–2020 than in the range of 2020–2022. We can assume a significant increase in instability in the processes of budget revenue formation in the period of 2021–2022.

The results of assessing the level of uncertainty of fiscal indicators (Table 2) for the period 2011–2020 differ significantly from such results for the period 2011–2022, while the changes are fundamental, although the length of the sample has changed by 20%. In particular, the entropy of the dynamics of fiscal indicators measured in the period 2011–2020 is significantly higher than the entropy of the dynamics of fiscal indicators measured according to the data of 2011–2022. This proves that the processes of budget revenue formation in the period 2011–2020 were less defined, than in the period 2011–2022, are subject to a much greater influence of random factors. According to fiscal indicators, both dissipation and growth of entropy are observed the production of entropy by the amount of income from personal income tax and the amount of income to trust funds is positive. Analysis of the level of uncertainty of fiscal indicators for the period 2011–2020 proves that the processes of budget revenue formation have passed the peak of the crisis and had signs of uncertain growth, however, for the period 2020–2022, the dissipation of fiscal indicators has increased to such an extent that it is possible to assert that the crisis has passed through the peak.

It is interesting to observe that the production of entropy, measured in the time interval 2011–2022, is recorded at minimum values for almost all fiscal indicators approximately in the range of -0.05 - +0.05 units. A similar phenomenon testifies to the approach of state finances in 2021–2022 to a state of stagnation, while in 2011–2020 a significant negative production of entropy was observed.

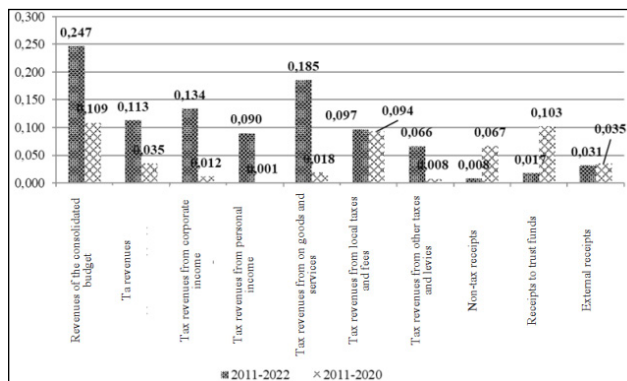
Despite the fact that the entropy of the empirical values of fiscal indicators is mainly formed by the entropy of deviations from the lines of theoretical approximation, the level of uncertainty of their

**Table 2:** General characteristics of the level of uncertainty of fiscal indicators

Indicator	Time interval	Entropy of dynamics		Average annual entropy		Average annual entropy production	
		According to empirical data	According to deviations from the lines of theoretical approximation of dynamics	According to empirical data	According to deviations from the lines of theoretical approximation of dynamics	According to empirical data	According to deviations from the lines of theoretical approximation of dynamics
CBR	2011–2020	2.9263	2.6798	4.6301	4.1763	-0.3001	-0.0502
	2011–2022	2.5923	2.1700	4.2870	5.6911	-0.3840	-0.0961
TR	2011–2020	2.8034	2.6803	4.8555	5.0314	-0.2733	-0.0516
	2011–2022	2.9282	2.5578	4.6069	5.1924	-0.2625	0.0547
TR <sub>ci</sub>	2011–2020	2.2689	2.8236	4.7707	4.8515	-0.1456	-0.1050
	2011–2022	1.9543	2.5863	4.5426	5.2453	-0.0921	-0.0515
TR <sub>pi</sub>	2011–2020	2.7844	2.8741	4.7523	4.7560	-0.3421	0.1343
	2011–2022	2.6411	2.4065	4.9031	5.3874	-0.3540	0.0526
TR <sub>gs</sub>	2011–2020	2.8290	2.8522	4.7182	4.8061	-0.3502	-0.0818
	2011–2022	2.9463	2.4887	4.6562	5.5932	-0.2871	-0.0509
TR <sub>if</sub>	2011–2020	2.7902	3.1824	4.6457	4.2487	-0.3408	-0.1300
	2011–2022	2.9558	2.7193	4.5182	5.0037	-0.2911	-0.1540
TR <sub>o</sub>	2011–2020	2.6559	2.6447	4.8849	4.9218	0.0038	-0.0231
	2011–2022	2.6391	2.4954	4.8518	5.1968	0.0142	0.0930
NTR	2011–2020	1.5578	1.8655	5.3477	5.7316	-0.1149	-0.2062
	2011–2022	1.6039	2.1350	5.6427	5.6896	-0.1521	-0.1822
RTF	2011–2020	2.4748	2.5450	4.6391	5.1687	0.1141	0.1232
	2011–2022	2.4637	2.5725	5.1998	5.1123	0.0881	0.0535
ER	2011–2020	1.8394	2.0966	4.2477	4.4033	-0.0333	-0.0254
	2011–2022	0.6466	1.9587	5.1115	5.2576	-0.2377	-0.2674

Note: Calculated by the authors.

dynamics differs significantly according to the data of 2011–2020 and 2011–2022 (Fig. 1).

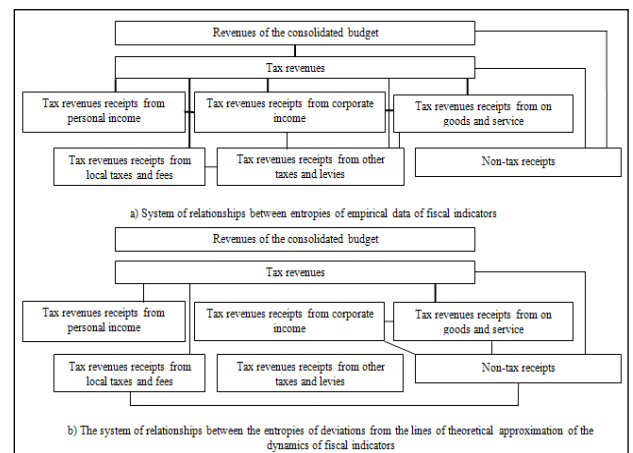


\*Developed by authors.

**Fig. 1:** The level of uncertainty of the fiscal indicators dynamics

The uncertainty of the dynamics increased significantly for all fiscal indicators, and their grouping by the level of uncertainty also changed (Table 3). In particular, the filling of the group of fiscal indicators with a high level of uncertainty has become more voluminous.

The induction of uncertainty in the processes of budget revenue formation is illustrated by the systems of interrelationships between entropies (Fig. 2) and entropy productions (Fig. 3) of fiscal indicators.



\*Developed by the authors.

**Fig. 2:** System of relationships between entropies of fiscal indicators

**Table 3:** Grouping of fiscal indicators by level of uncertainty

Level of uncertainty	According to data from 2011 to 2020	According to data from 2011 to 2022
Minimum ( $H_D < 0.01$ )	Personal income tax, Other taxes and fees	Non-tax receipts
Average ( $0.01 < H_D < 0.1$ )	Tax revenues from all types of taxes, Tax revenues from corporate income, Tax revenues from goods and services, Tax revenues from local taxes and fees, Non-tax receipts, External receipt	Tax revenues from personal income, Tax revenues from local taxes and fees, Tax revenues from other taxes and levies, Receipts to trust funds, External receipt
High ( $H_D > 0.1$ )	Revenues of the consolidated budget, receipts to the trust funds	Revenues of the consolidated budget, Tax revenues from all types of taxes, Tax revenues from corporate income, Tax revenues from on goods and services

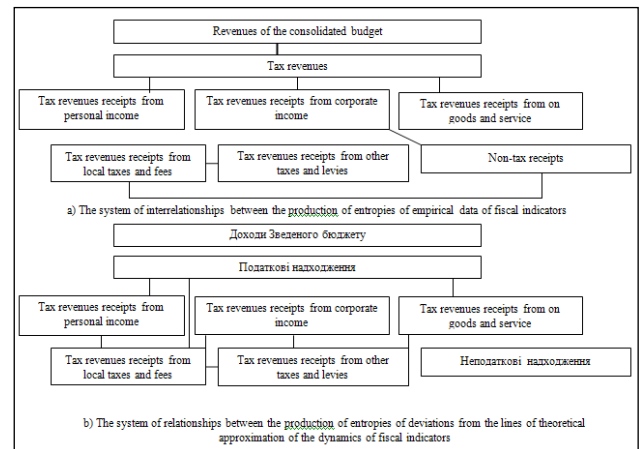
The presented systems of interrelationships between entropies/entropy productions of fiscal indicators and their balances illustrate the classical understanding of the mechanism of budget revenue formation and the emergence or induction of uncertainty in it. In particular, there is a connection between the induction of uncertainty in the system of fiscal indicators of the type:

$$\begin{array}{ccccc}
 TR_{yf} & TR_o & & & \\
 \uparrow & & & & \\
 TR_{ci} & \rightarrow & TR & \rightarrow & CBR \\
 TR_{gs} & \rightarrow & \updownarrow & & \uparrow \\
 & & TR_{pi} & & NTR
 \end{array}$$

where the source of uncertainty in the system of fiscal indicators is tax revenue from corporate income ( $TR_{ci}$ ), and tax revenues from goods and services ( $TR_{gs}$ ). The uncertainty of the latter affects the uncertainty of tax revenues from personal income ( $TR_{pi}$ ). The complex of mutually induced uncertainties  $TR_{ci}$ ,  $TR_{gs}$ ,  $TR_{pi}$  determines random fluctuations of tax revenues as a whole ( $TR$ ), and through them consolidated budget revenues ( $CBR$ ). Random fluctuations in non-tax revenues ( $NTR$ ) play a certain role in shaping the uncertainty of consolidated budget revenues. It is interesting that the uncertainty of tax revenues from local taxes and fees ( $TR_{lf}$ ) and from other taxes and fees ( $TR_o$ ) is determined by the uncertainty of revenues from corporate income tax.

The obtained results prove that the source of uncertainty in the system of fiscal indicators is the process of formation of added value and its taxation

at the stage of distribution. Since the dissipation in this process is still significant, the destruction or transformation of the budget revenue generation system has not yet stopped.



*\*Developed by the authors.*

**Fig. 2:** The system of interrelationships between the production of entropies of fiscal indicators

The action lag in inducing uncertainty in the system  $TR_{ci} \rightarrow TR$  is 9 months, therefore, it is possible to achieve sustainable economic growth through the use of fiscal instruments during this period of time. The main lever for ensuring the positive production of entropy should be the corporate income tax, the additional value added tax, which due to a lag of 4 months will ensure an increase in entropy in personal income tax receipts, and after 6 due to the connection  $TR_{gs} \rightarrow TR$  volume growth in tax revenues. Entropy in connection  $TR_{pi} \rightarrow TR$  can speed up the induction of uncertainty over a period of 4 months or slow it down depending on the direction of fiscal policy in personal income taxation.



The period of 04.2016–07.2017 was a clearly expressed period of dissipation in the processes of budget revenue formation. However, in 2021–2022, as a result of the action of systemic dangers, a sharp dissipation of the state finance system took place, which determined its stay in a state of stagnation.

## CONCLUSION

Assessment of regularities in the dynamics of the main fiscal characteristics (the volume of revenues of the consolidated budget; the volume of tax revenues, the volume of revenues from the corporate income tax, the volume of revenues from the personal income tax, the volume of revenues from internal taxes on goods and services, the volume of revenues from local taxes and fees, the volume of revenues from other taxes and fees, the volume of non-tax revenues, the volume of targeted revenues, the volume of revenues from the governments of foreign states, the European Union, international organizations) demonstrates significant differences in the general patterns of dynamics with a significant range of fluctuations. It is possible to state a complete transformation of the patterns of the dynamics of the volume of revenues from the governments of foreign states, the European Union, international organizations, significant transformations of the dynamics of fiscal indicators related to the real sector of the economy and minor transformations of fiscal indicators related to consumption. Therefore, the stability of the functioning of the national economy of Ukraine and state finances is currently ensured by external financing and active consumption.

The uncertainty of the dynamics of fiscal indicators is determined by the influence of crisis factors, and only then by the uncertainty of the “white noise” of their random deviations from the lines of cyclical dynamics. The grouping of fiscal indicators by the level of uncertainty according to the data of the period 2011–2020 was as follows: indicators with a minimum level of uncertainty of dynamics (personal income tax, other taxes and fees); with an average level of uncertainty of dynamics (tax revenues for all types of taxes, corporate income tax, internal taxes on goods and services, local taxes, non-tax revenues, revenues from foreign countries, the European Union, international organizations); with a high level of uncertainty of the dynamics

(revenues of the consolidated budget, receipts in the target funds). The measurement of the uncertainty of the dynamics of the same group of indicators in the period 2011–2022 showed a significant increase in the group of indicators with a high level of uncertainty at the expense of groups with a low and medium level.

The estimation of entropy production of fiscal indicators made it possible to determine two periods of dissipation (04.2016–07.2017) and (01.2021–12.2022). The source of inducing uncertainty in the formation of budget revenues is income from the corporate income tax and income from internal taxes and duties on goods and services, which is extrapolated to all tax revenues and revenues of the Consolidated Budget. Since the state finance system is currently in a state of stagnation, which is confirmed by practically zero production of entropy according to the vast majority of fiscal indicators, the main task is currently to stimulate its positive production. The peculiarities of entropy generation in the system of connections between fiscal indicators made it possible to propose directions for overcoming crisis phenomena in the formation of budget revenues, due to the need to stimulate the production of entropy. For fiscal policy, it is advisable to change the vector from restrictive to discretionary one. The main tools should be to reduce corporate income taxation (provided the risk of tax evasion is reduced) and the cost of goods and services. A significant increase in government spending and demand stimulation is also appropriate. If such stimulation is not carried out, then in the event of a negative “black swan”, the destruction of the system of public finances as a whole is highly likely. The expected effect of stimulating the production of entropy in the formation of budget revenues is achieved within the first 9 months after their implementation.

The obtained results can be of practical importance for ensuring the growth of budget revenues in both crisis and post-crisis periods and preventing systemic destructive phenomena.

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