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Modeling the Impact of Shadow Financial Transactions on the Country's Financial Potential

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Abstract. *The article summarizes the arguments and counterarguments within the scientific debate on the issue of raising the level of the country's financial potential. The main goal of the conducted research is to model the impact of shadow operations on the level of the country's financial potential. Analysis of the dynamics of publication activity on issues of the shadow economy and financial potential in publications indexed by the Scopus and Web of Science databases, bibliometric analysis of the connection between the concept of the shadow economy and other economic categories made it possible to identify theories that are most closely related to this concept: theory innovative management, theory of liberalization, theory of political economy, institutional theory. The urgency of solving this scientific problem lies in the fact that in the conditions of a protracted economic crisis and active military operations on the territory of Ukraine, significant volumes of shadow operations negatively affect the attractiveness of the country from the side of international partners, the level of its financial stability, the ability to withstand economic and political risks. Methods of dynamic analysis, Erlang's formula, methods of regression analysis became the methodical toolkit of the conducted research, the period of the study was 2008-2021. The article presents the results of an empirical analysis of the financial potential of Ukraine, which showed a gradual increase in its level until 2021. At the same time, the forecast values of the level of financial potential in 2022 indicate its significant reduction and the need to implement a set of measures aimed at maintaining the macroeconomic stability of the country and its financial independence. The study empirically confirms and theoretically proves that the main drivers of the shadowing of the economy include: a low level of material or criminal responsibility for these actions, an excessive level of tax burden, the inability of the government to monitor the compliance of economic entities with existing norms and laws in the country. The results of the conducted research can be useful for public administration bodies in the context of improving the policy of countering shadowing of the economy as a component of increasing the country's financial potential.*

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Introduction

Trends in the development of the main components of the country's financial potential testify to their significant variability and dependence on a set of factors of the internal and external environment. An important place among the drivers of influence on the level of financial potential is occupied by the shadow economy. The current state of development of the national economy is largely due to the impact of the turbulent environment, which increasingly has a negative impact on the change in indicators of the country's economic and financial development and leads to an increase in the volume of shadow financial transactions. This determines the need to change the vectors of state financial policy by directing them to prevent the negative impact of shadowing on financial indicators.

The management of the country's financial resources is closely related to all elements of the system of general public administration, and the amount of state budget revenues depends on the level of the country's financial potential, which is usually understood as the totality of the financial resources of the government, business and population, which are formed under defined or actual values of resource, labor, investment and production potentials.

The complexity of this category and the ambiguity of approaches to its interpretation actualize the need for a more thorough study of the economic content of this concept, its role in the processes of state financial management, increasing the level of economic and financial well-being of the population, business of the country as a whole and the country in particular.

Literature Review

Scientific interest in this definition is due to the peculiarities of the functioning of the economy of Ukraine in crisis conditions. Negative manifestations of the protracted financial and military crisis in Ukraine increased the responsibility of state institutions for their decisions and financial results of their activities. Erroneous decisions of the government affect the indicators of economic and financial development of the country, and in some cases can lead to a decrease in the amount of revenues to the budgets, the level of income of the population, and the profitability of the enterprise. In these conditions, the requirements for the quality of information, on the basis of which management decisions are made, including regarding the volumes of real and potential financial incomes, are significantly increased.

Trend analysis of the number of searches for the concept of "financial potential" (Figure 1) allows us to draw a conclusion about the constant growth of interest in these questions.

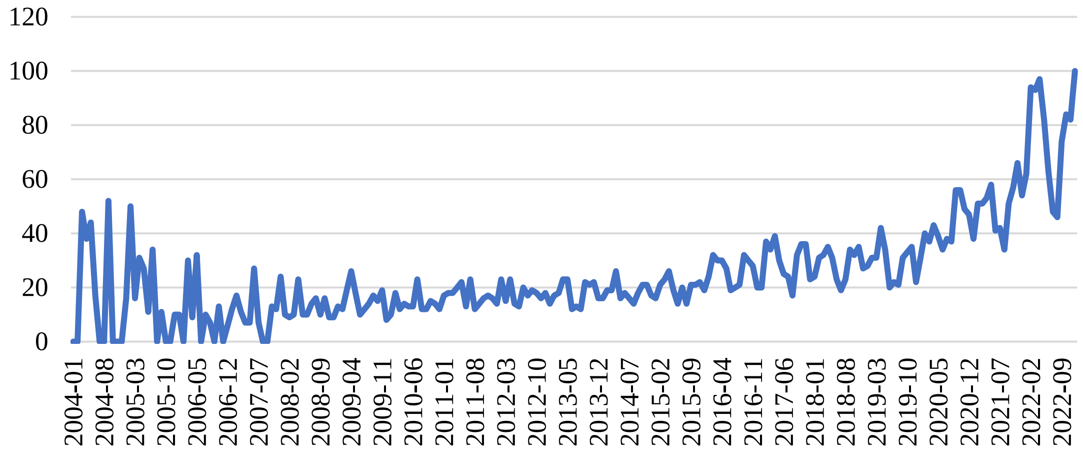

Figure 1. The number of searches for the term "financial potential" in Google

Source: built by the author using the Google Trends toolkit.

At the same time, despite the important role of financial potential in the system of state financial management of the country, there are no unambiguous interpretations of the content and components of this concept in the academic environment.

The results of the systematization of scientific approaches to the interpretation of the financial potential of the country (Davydenko et al., 2020; Rigon et al., 2020) allow us to distinguish several concepts:

– resource (quantitative) concept, according to which the financial potential is interpreted as a set of financial resources of the country that interact with each other using various communication channels;

– a target (qualitative) concept that interprets financial potential as the ability to use the country's financial resources, the ability to achieve set goals.

– a functional concept, which under the financial potential understands a set of functions, the performance of which contributes to the realization of these abilities.

At the same time, most scientists study the financial potential from the perspective of the resource concept, basing its assessment on the arithmetic method (financial potential is the sum of all financial resources available in the country), emphasizing the simplicity of its use and the significant saving of time spent on forcing the necessary array of data.

At the same time, in our opinion, this concept has a number of limitations, including:

- the financial potential is considered as the sum of all the financial resources available in the country, at the same time eliminating the possibility of their partial use;

- the presence of a significant amount of financial resources is not a guarantee of their effective and targeted use;

– the resource concept does not take into account the entire set of relationships and cash flow channels.

The target concept is devoid of these shortcomings, as it allows to evaluate the entire set of relationships that arise during the movement of financial resources, to take into account the specifics of these processes. At the same time, this concept does not allow assessing the actual level of the country's financial potential, which greatly complicates the processes of financial planning and forecasting.

In our opinion, it is optimal to use a comprehensive approach to understanding the financial potential of the country, which should be based on taking into account the functional relationships (budgetary, investment, credit) between economic entities (state, business, credit and financial organizations, households and external organizations) arising in the process of using financial resources.

The implementation of measures aimed at increasing the level of the country's financial potential is an important element of ensuring the country's macroeconomic stability and functioning on the principles of economically sustainable development.

However, today, the country's financial potential is influenced by a number of factors, both exogenous and endogenous, timely identification and consideration of the multiple effects of which influence serves as an important component of the state's financial policy.

One of the most influential inhibitors of the country's economic development is the shadow economy. According to the results of the structural analysis of the shadow sector of the economy, money is often the object of manipulation by participants in shadow operations (Safuan et al., 2021; Remeikienė et al., 2021; Fedajev et al., 2022; Buszko, 2022). Increasingly, economic entities direct their efforts to distort their financial, accounting or tax reporting in the direction of reducing the declared amount of income, hiding part of the results of their activities. As a result, this leads to a decrease in the level of their financial and investment potential, a decrease in the rate of economic development of the country, etc (Abror, 2015; Shpak et al., 2021).

Estimating the level of financial potential is important for the formalization in the quantitative dimension of the country's potential to generate the necessary amount of financial resources. Thus, the value of the financial potential is a reflection of the maximum possible amount of financial resources generated by the country during a certain period of time (Baranov, 2015; Becke, 1968; Dreher & Schneider, 2010; Hamzah et al., 2021; Werlin, 1974).

At the same time, according to the qualitative approach, the value of the financial potential allows to assess the effectiveness of using the existing potential in the country, the quality of the state financial policy, and to determine the amount of financial reserves currently available in the country.

We propose to evaluate the country's financial potential in terms of its four components (Figure 2).

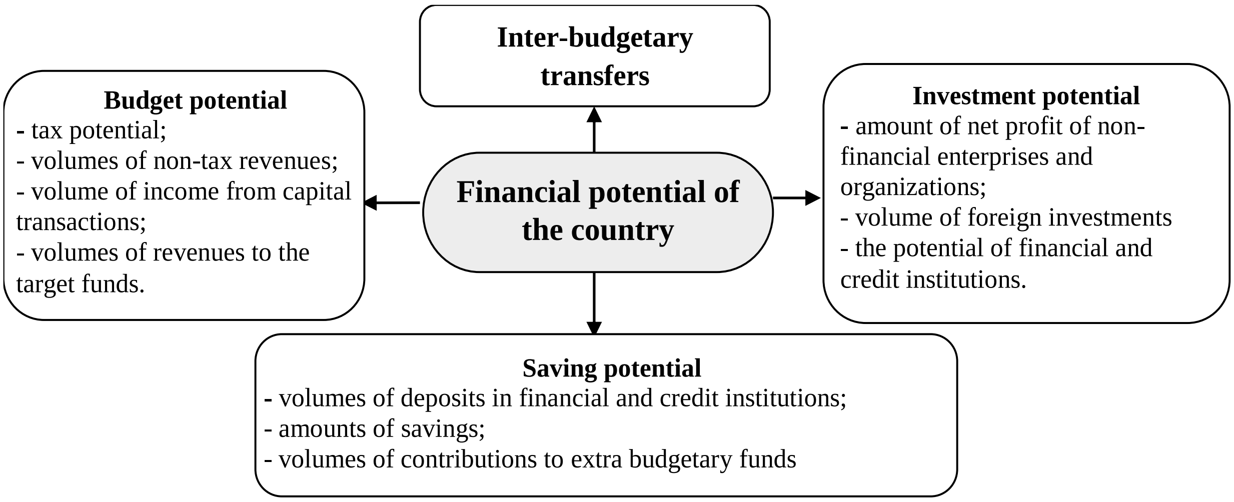

Figure 2. Components of the country's financial potential

Source: developed by the author.

Methodology and research methods

The assessment of the total amount of the country's financial potential will be carried out in the following stages:

- bringing indicators to a comparable form by calculating their normalized values;
- ranking of indicators using the sigma-limited parameterization method;
- evaluation of the integral indicator using Erlang's formula.

At the first stage, using the minimax approach, we will bring the analyzed indicators to a comparable form. Since all indicators analyzed by us are stimulator indicators, normalization will be carried out using the following formula:

$$fp_{int} = \frac{fp_{it} - min\, fp_{it}}{max\, fp_{it} - min\, fp_{it}}, \quad (1)$$

$$fp_{it} \geq fp_{it} normmax$$
$$fp_{it} \leq fp_{it} normmin$$

where fp_{in} – the actual value of the i-th indicator of the financial potential of countries in year t;

$fp_{it} normmax$ – the maximum normalized value of the i-th indicator of the country's financial potential;

$fp_{it} normmin$ – the minimum normalized value of the i-th indicator of the country's financial potential;

$min fp_{it}$ – the minimum value of the i-th indicator of the country's financial potential for the period under study;

$max fp_{it}$ – the maximum value of the i-th indicator of the country's financial potential for the period under study.

At the next stage of the research, we will evaluate the integral level of the country's financial potential using the Erlang formula. The advantages of using this approach are that it allows you to take into account the priority of indicators and the strength of their influence on the integral indicator. The integral level of the country's financial potential is calculated according to the formula:

$$\mathrm{FP_t} = 1 + \frac{fp_{1t}}{1!} + \frac{(fp_{2t})^2}{2!} + \frac{(fp_{2t})^3}{3!} + \frac{(fp_{2t})^4}{3!} + \cdots + \frac{(fp_{nt})^{11}}{11!} \quad (2)$$

where FP_t – is the integral level of the country's financial potential in the t-th year;

fp_{it} – the normalized value of the first-ranked indicator of the integral level of the country's financial potential in the t-th year;

1! – one factorial;

fp_{it} – the normalized value of the second-ranked indicator of the integral level of the country's financial potential in the t-th year;

2! – two factorial:

fp_{nt} – the normalized value of the n-th ranking indicator of the integral level of the country's financial potential in the t-th year.

At the last stage of the assessment, a qualitative interpretation of the level of the country's financial potential is carried out in the following intervals:

$$\begin{cases} higt: \ FP_t \geq 0.75 \\ above\ average: 0.5 \ \leq FP_t < 0.75 \\ average: 0.25 \ \leq FP_t < 0.5 \\ low: FP_t < 0.25 \end{cases} \quad \textbf{(3)}$$

In the future, the influence of the shadow economy on the financial potential will be investigated by constructing a regression equation of dependence of the following form:

$$FP(t) = d_0 \times i_1^{d_1}(t - l_1) \times i_2^{d_2}(t - l_2) \times i_3^{d_3}(t - l_3) \times i_4^{d_4}(t - l_4) \quad (4)$$

where $\mathrm{FP(t)}$ – is the level of the country's financial potential in the t-th period;

d_0, d_i – individual parameters of the model that formalizes the impact of the i-th shadow transaction on the level of financial potential;

i_i – i-th shadow financial transaction;

l_i – time lag.

Results

The normalized values of input indicators for assessing financial potential for Ukraine for 2007-2021 are given in Table 1.

Table 1. Normalized values of indicators for assessing financial potential for Ukraine for 2007-2021

	TR	TP	$T_{ax}R$	CO	FN	FCO	SAV	NP	FDI	PFCO
2007	0.961	0.855	1.000	1.000	1.000	0.987	1.000	1.000	0.987	0.985
2008	1.000	1.000	0.966	1.000	1.000	0.969	1.000	1.000	1.000	1.000
2009	0.966	1.000	0.855	1.000	1.000	0.975	1.000	1.000	0.966	1.000
2010	0.831	1.000	0.875	1.000	1.000	0.959	1.000	0.987	1.000	1.000
2011	0.830	1.000	1.000	1.000	1.000	1.000	1.000	0.966	1.000	1.000
2012	1.000	0.958	1.000	1.000	1.000	1.000	1.000	0.999	0.858	1.000
2013	1.000	0.855	0.849	1.000	1.000	1.000	1.000	0.997	1.000	1.000
2014	0.945	0.855	1.000	1.000	0.987	1.000	1.000	1.000	1.000	1.000
2015	1.000	0.889	1.000	0.959	0.999	0.958	1.000	1.000	1.000	1.000
2016	1.000	0.930	0.993	0.875	1.000	0.966	0.987	1.000	1.000	1.000
2017	1.000	1.000	1.000	0.956	0.966	1.000	0.987	1.000	1.000	1.000
2018	0.958	0.928	1.000	1.000	1.000	1.000	0.966	1.000	1.000	1.000
2019	0.965	1.000	1.000	0.988	0.971	1.000	0.999	1.000	1.000	1.000
2020	0.947	0.969	0.987	0.959	1.000	1.000	0.966	1.000	1.000	1.000
2021	0.988	1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Source: World Bank (2022), The State Statistics Service of Ukraine (2022), The Ministry of Finance of Ukraine (2022), The National Bank of Ukraine (2022), European Commission (2022).

The values of the normalized indicators range from -1 to +1.

At the next stage of the assessment of the country's financial potential, a ranking of the indicated indicators, from the most to the least priority, will be carried out using the construction of a Pareto diagram using the method of sigma-limited parameterization. The construction of this diagram allows you to visualize the priority of indicators. The STATISTICA software product will serve as a methodological tool of the

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research.

The construction of the Pareto diagram requires the use of an additional indicator – GDP, which characterizes the level of economic development of the country and most generally reflects the state of the country's financial development. Analysis of the dynamics of changes in GDP per capita in Ukraine is carried out in Figure 3.

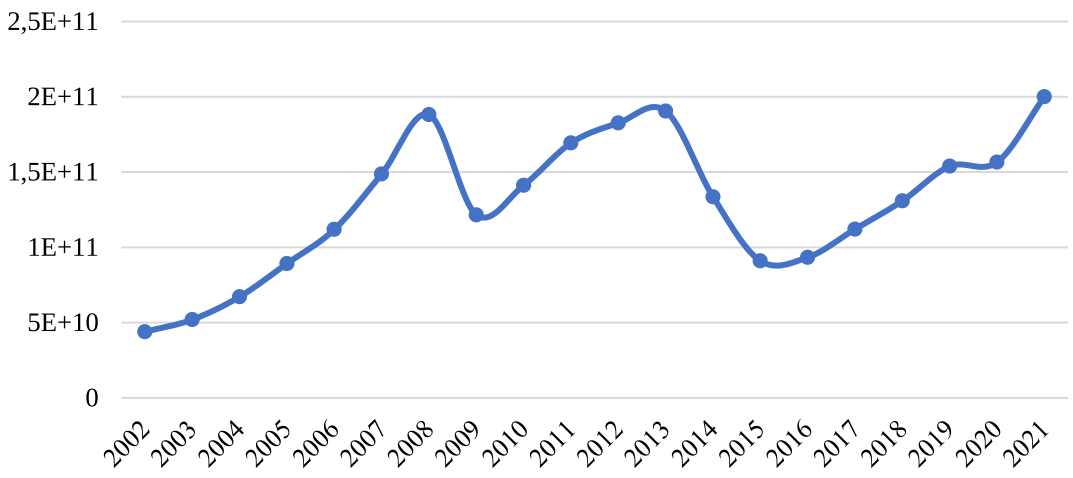

Figure 3. Dynamics of changes in GDP in Ukraine for 2002-2021, current US$

Source: World Bank (2022).

During the analyzed period, there is an increase in the volume of GDP in national currency and significant fluctuations in its values in US dollars. The analysis allows us to single out 2 critical points of its significant decline - 2009 and 2015, which coincide with the periods of the global financial and political crisis in Ukraine.

Based on the above analyzed indicators of the country's financial potential and GDP per capita values, we will construct a Pareto diagram (Fig. 4) using the sigma-limited parameterization method. This will allow us to determine the priority of indicators when summarizing them into an integral indicator.

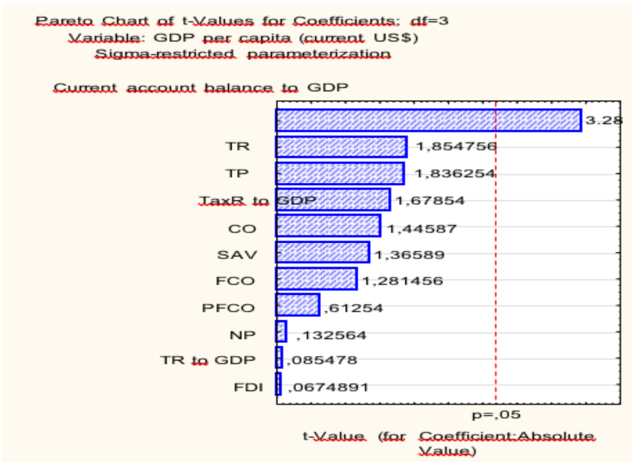

Figure 4. Pareto diagram of t-values of the significance of the influence of financial potential assessment indicators on GDP per capita

Source: author's calculations.

Based on the results of the construction of the Pareto Chart shown in Figure 3, we will rank the indicators for assessing the financial potential: rank 1 – the amount of non-tax revenues; rank 2 – tax potential; rank 3 – interbudgetary transfers; rank 4 – the share of the country's exports in world exports; rank 5 – volume of income from capital transactions; rank 6 – amount of savings; rank 7 – volumes of deposits in financial and credit institutions; rank 8 – potential of financial and credit institutions; rank 9 – volume of net profit of non-financial enterprises and organizations; rank 10 – volumes of contributions to extra budgetary funds; rank 11 - volume of foreign investments.

Based on the proposed approach, we will evaluate the level of the financial potential of Ukraine for the period 2007-2021 (Figure 5). The dynamics of changes in the integral level of the financial potential of Ukraine shown in Figure 4 prove the dependence of this indicator on the level of economic and political stability in the country. Thus, during periods of economic and political transformation, the level of financial potential of Ukraine significantly decreased. According to the results of 2021, the level of the financial potential of Ukraine was 0.84 units, which indicates its high level and the highest values for the analyzed period.

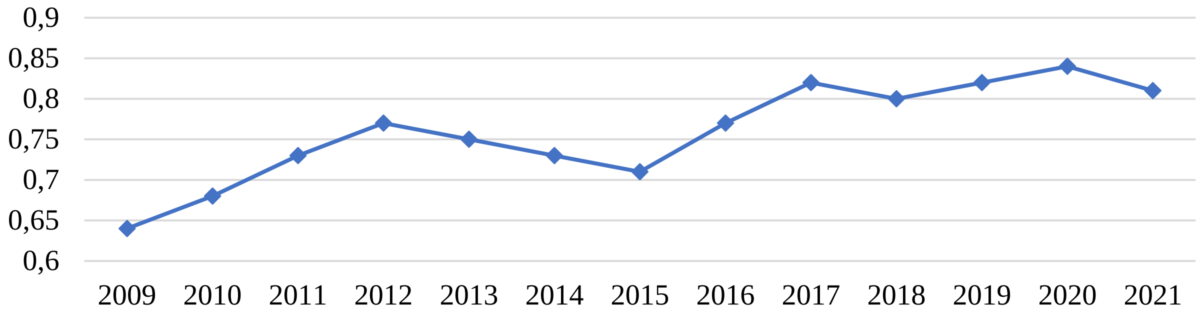

Figure 5. Dynamics of changes in the integral level of the financial potential of Ukraine

Source: author's calculations.

Thus, the developed methodological principles for assessing the financial potential can serve as a basis for forecasting the level of financial development of the country, timely introduction of preventive measures aimed at minimizing/neutralizing the risks of deterioration of indicators of its economic and financial development.

We will model the influence of the shadow economy on the level of the country's financial potential by analyzing 11 indicators that characterize the country's financial development and form an integral level of financial potential.

The results of F. Schneider's research presented by the International Monetary Fund will be used as the level of the shadow economy. In addition, the influence of the shadow economy on the level of financial potential will be analyzed in terms of the following transactions: investment transactions with signs of fictitiousness, the amount of tax payments not received by the budget, the level of shadow employment of the population.

At the first stage, we will conduct a comparative analysis of trends in changes in the level of the shadow economy and the financial potential of Ukraine for the period 2007-2021 (Figure 6).

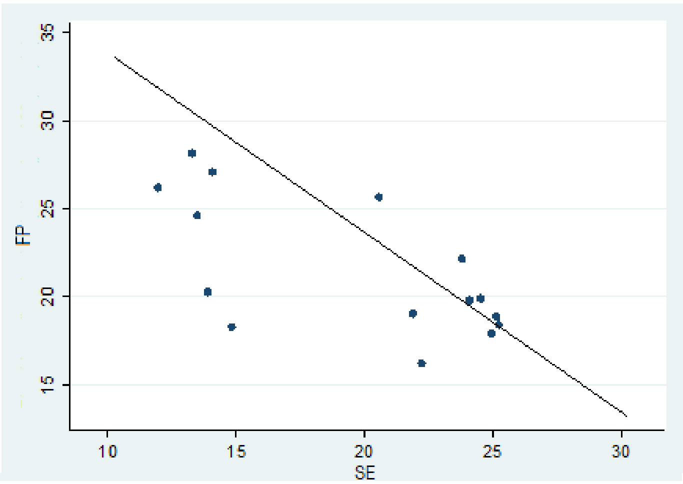

Figure 6. Comparison of the levels of the shadow economy and the financial potential of 10 countries of the world for the period 2007–2021

Source: built by the author based on his own calculations.

The results of the comparative analysis presented in Figure 9 prove the existence of an indirect influence of the shadow economy on the level of the country's financial potential. Thus, the growth of the level of the shadow economy leads to a decrease in the level of the country's financial potential, which can be related to the deterioration of the indicators of the country's financial development due to the concealment of a significant amount of financial resources, and not to their direction in the official sector of the economy.

The results of the calculation of the individual parameters of the model, which determine the nature of the dependence between the analyzed indicators using regression analysis, are shown in Table 2.

Table 2. Results of the regression analysis of the influence of shadow transactions on the financial potential of Ukraine

Indicator	Coefficient	Standard error	t-statistic	Lower 95%	Upper 95%
Y	2.44125	0.006254	425.41	2.0250545	3.63256
u1	0.32458	0.0003654	24.23	0.0021456	0.004125
u4	0.22547	0.0001785	32.47	0.0012564	0.003256
u5	0.19985	0.0002145	20.87	0.0017245	0.002346
u6	0.4565	0.0001982	-36.56	0.0032256	0.005654

Source: own calculations.

The determined individual parameters of the econometric model allow us to formalize the dependence between the level of the shadow economy and indicators of investment development of Ukraine, taking into account the time lag of their maximum impact using the following equation:

$$FP(t) \quad = \mathrm{d}^{2.441} \times i_1^{0,325}(t) \times i_2^{0,225}(t-1) \times i_3^{0,199}(t-1) \times i_4^{0,456}(t) \qquad (2)$$

The simulation results confirm the conclusions about the dependence of the country's financial potential on shadow financial transactions. Shadow investment operations and shadow employment of the population exert the strongest influence on the level of financial potential. Thus, an increase in equal employment by 1% leads to a decrease in the level of the territory's financial potential by 0.07%.

The results of the conducted research form the basis for the development of new and improvement of existing recommendations for the prevention of shadow transactions in the context of increasing the level of the country's financial potential.

One of the most important components in this direction should be the toolkit for early diagnosis of potential threats to the country's financial potential, which lead to turbulence in the middle of the country's economic system; assessment of the sensitivity of individual components of the financial potential to these risks; implementation of measures to neutralize the destructive influence of shadow operations on the country's financial potential.

A significant number of shadowing channels of the economy dictates the need to diversify the toolset for the implementation of the country's state financial policy, the main of which are:

- measures aimed at minimizing the participation of money market entities in shadow operations;
- increasing the efficiency of the processes of financial monitoring and control over the movement of funds, digitization of financial transactions, etc.;
- strengthening countermeasures against the activities of money market entities, in particular banking institutions. Of great importance for minimizing the volume of shadow transactions on the money market is the development of a methodology and assessment of the effectiveness of risk management of the participation of money market subjects in shadow transactions, which are based on the methods and principles of regulating the activities of banking institutions, correlated with the general strategy of asset management and liabilities of money market subjects;
- improvement of the country's tax policy from the point of view of optimizing the level of the tax burden, minimizing the amount of tax gaps (as the difference between the actual and potentially possible amounts of tax revenues to the budget);
- strengthening of control by state authorities and optimization of the country's investment policy in order to counteract the implementation of dubious investment transactions, legalization of illegally obtained income through offshore jurisdictions.

The implementation of these measures will reduce the volatility of individual financial indicators of the country's development, increase the ability of the financial system to resist manifestations of turbulence in the external environment, and ultimately increase the level of the country's financial potential.

Conclusions

One of the most important indicators of the country's economic development is the level of financial potential, as a characteristic of its financial stability, the ability to effectively attract and manage financial resources, maintain a sufficient level of its financial stability. At the same time, this indicator is influenced by a number of factors that may negatively affect the country's financial stability. One of these indicators is the level of the shadow economy.

In the work based on the systematization of approaches to the interpretation of the financial potential of the country, the most characteristic features of this concept and the concepts of its formation are highlighted. Based on the results of the analysis, it was concluded that the understanding of financial potential should be based on taking into account the functional relationships (budgetary, investment, credit) between economic entities (state, business, credit and financial organizations, households and external organizations) that arise in the process of using financial resources. According to the results of the study of the shadow economy, it was concluded that the main drivers of the growth of the level of the shadow economy should include: a low level of material or criminal responsibility for these actions, an excessive level of tax burden, the inability of the government to control compliance by economic entities with existing norms and laws in the country. Thus, these factors should be considered as the main components of the policy of countering the shadowing of the economy and increasing the level of the country's financial potential.

The results of the assessment of the level of financial potential of Ukraine for the period 2007-2021 proved the significant dependence of this indicator on the level of economic and political stability in the country - during periods of economic and political transformations in the country, the level of financial potential significantly decreases.

Taking into account that the most significant influence on the level of financial potential is carried out by shadow investment operations and shadow employment of the population, the primary measures for the prevention of the implementation of shadow operations in the context of increasing the level of the country's financial potential should include the introduction of tools for early diagnosis of potential threats to the country's financial potential, improving the efficiency of processes financial monitoring and control over the movement of funds, digitization of financial transactions; strengthening of monitoring of the activities of the subjects of the country's money market, in particular banking institutions, improvement of tax policy, strengthening of control by state authorities, optimization of the country's investment policy.

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