Financial Security and Guidelines of the Strategic Development of Ukraine

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Abstract: The article examines the special conditions for ensuring financial security and guidelines for the strategic development of Ukraine on the basis of evaluating qualitative changes while maintaining stable rates of expanded reproduction and opportunities for self-determination of national interests in conditions of external influences. A methodology has been developed and a simulation-analytical model of financial security has been substantiated, based on established functional relationships between macro-financial factors, which, under the conditions of targeted interaction of identifiers of threatening symptoms of the imbalance of the financial system, provide guidelines for the country's strategic development. A static approach is used to determine the threatening symptoms of the financial system, which under the influence of crisis situations (especially during martial law in the country) are investigated using dynamic methods. The relationship between macro-financial factors and signs of the country's financial security is justified. Identifiers of typical macro-financial factors influencing the level of financial security of the country with an orientation to the development strategy are presented. The impact of banking, non-banking financial market, debt, budgetary, currency and monetary credit factors on the financial security of Ukraine in a discrete period is analysed. The relevance of the study lies in the creation and presentation of a simulation-analytical model of the estimated actual and projected volume of foreign exchange reserves of the financial pyramid of Ukraine, which embodies a balanced financial system, to cover the budget deficit and strategic development of the country.

Keywords: Macro-Financial Factors; Banking Sphere; Non-Banking Financial Market; Currency Market; Financial Pyramid.
JEL Codes: F52; F65; L1.

1. INTRODUCTION

The modern conditions for the recovery of the financial system of Ukraine after the military invasion of Russia on the territory of the country and the reproduction of European integration processes with the countries of the world make it necessary to strengthen the financial security of the state, economic entities and financial institutions. The financial system, based on the elements of the institutional infrastructure and typical strategies of financial operations of economic entities, has a constructive, destructive and neutral nature of spreading to model benchmarks of their strategic development and requires the study of micro- and macro-factors of financial security, taking into account the interests of all participants of this system (Omarkhanova et al., 2022; Kisiołek et al., 2021; Kudabayev et al., 2022). Taking this into account, financial science should reveal the limiting factors of the destructive financial system in the security context, especially during military aggression on the territory of Ukraine, acquiring at the same time extreme relevance, since the effectiveness of state influence is determined not only by the trends in the functioning of the national economy, but also by the financial support of the countries of the world in extraordinary and still unregulated situations.

In the conditions of a tense and unstable situation due to military actions in the country, it is important to realistically evaluate the possibilities of the state's influence on the financial operations of economic entities through the introduction of official institutions, since the decisive influence on the interests of business and financial institutions is carried out through formal and informal methods of assessing financial security. Formal and informal institutional factors of financial security on the basis of the financial system of the national economy were studied by such scientists as S. V. Bardash et al. (2021), N. O. Haman (2018), O. Ivashko (2015), V. O. Kasianenko et al. (2019), S. Lindenberg

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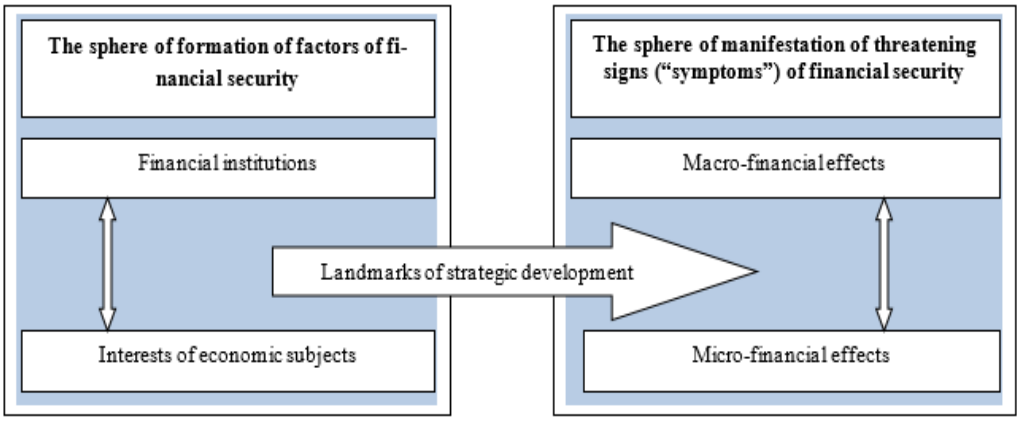

Fig. (1). Connections of Factors and Signs of Financial Security.

(1995), O. M. Pidkhomnyi andY. V. Kudlyak (2014), I. O. Revak (2010), L. Ross (1997), R. H. Snishchenko (2017), F. Schneider (2010), N. V. Trusova et al. (2021), N. Vyhovska et al. (2018), J. Wolfers and E. Zitzewitz (2004), M. M. Yermoshenko (2001),who examined the influence of state policy and the cooperative interaction of economic subjects using the mathematical apparatus of game theory.

It is important to note that research on financial security in Ukraine is conducted mainly in the direction of applied modern problems, with an in-depth study of micro- and macro-factors for forecasting and regulation of the financial system in the country, which have discrete periods in the legal and illegal sectors of the economy (Berezivskyi et al., 2021; Zaporozhets et al., 2020; Yaroshenko et al., 2020). This, in turn, does not provide a determination of the probability of cases of outflow of illegal assets abroad and loss due to fraudulent actions of financial capital intended for the reproductive process in the state's economy.

The priority of the research is the substantiation of the simulation-analytical model of financial security, based on the established functional relationships between macro-financial factors, which, under the conditions of the targeted interaction of the identifiers of threatening symptoms of the imbalance of the financial system, provide guidelines for the country's strategic development.

2. MATERIALS AND METHODS

The methodological toolkit for assessing financial security at the macroeconomic level stipulates the use of a static approach that allows identifying irreversible processes and threatening symptoms in the financial system under the influence of crisis situations (especially during martial law in the country) and which are investigated using dynamic methods. Thus, the macro-level influence of the previous states of the financial system is explained quite simply: the savings mobilized earlier have a direct impact on investments in subsequent periods (Boikos et al., 2022). That is, according to the neoclassical theory, any economic phenomenon reflects the influence of a wide range of budgetary, financial, credit and other factors of self-reproduction, and not just the amount of resources involved and the level of relative prices (Trusova et al., 2021).Therefore, systems of connections between factors and threatening signs (symptoms) in the context of financial security research have been proposed (Fig. **1**).

The use of probabilistic and analytical methods of assessing financial security in the analysis of mass phenomena in the country's financial system is associated with chaos. Chaos theory states that complex systems are extremely dependent on initial conditions, so small changes in the macro-financial environment lead to unpredictable consequences. At the same time, mathematical systems with chaotic behaviour are deterministic, that is, subject to a strict law and, in a certain sense, are ordered. Dynamic (deterministic) chaos differs from statistical (stochastic) one by the self-organization phase of the system, and is capable of forming fundamentally complex structures.

A deterministic system always develops in one way from a given starting point. When a non-linear deterministic system is subjected to external disturbances, the trajectory of its movement is constantly distorted. At the same time, the effect of the unsettled situation increases due to nonlinearity, and the system exhibits completely new dynamic properties. In the interaction between non-linear deterministic components and unsettled situations, dynamics that have an unconventional (non-linear) form arise. To determine the deterministic chaos of financial security in the country, the logistic function (formula 1) is used:

$$X_{n+1} = rx_n(1-x_n), \quad (1)$$

where X_{n+1} – is the bifurcation point of financial security in the country with self-reproducing financial flows between financial institutions and economic entities; r – state of financial security in the country with self-reproduction of financial flows; x – the point of movement of financial flows (Eden, 1988; Yaldin, 2011).

Discrete-type systems consist of similar elements that are not directly connected to each other, but connected only by a common relationship to the foreign economic and macro-financial environment. Rigid type of systems can be considered as the opposite of discrete. Often these systems have increased organization compared to the simple sum of their parts and have completely new properties. The destruction of

one element destroys the entire system. A centralized type of system contains one main link, which does not necessarily have a geometric organization, but which is at the center of the system and connects all the remaining links or even controls them. That is, the question arises: to what type should the modern financial system be classified? Obviously, when choosing between a centralized and a skeletal type, the signs of the first of them are more clearly expressed (Khodakivska et al., 2022).

3. RESULTSAND DISCUSSION

Financial institutions set the limits of the perception of the interests of economic subjects, but at the same time, the latter are able to change the institutional framework of the financial system of the economy in the country by imitating the behaviour of others, even if there are significant spatial and temporal distances between them, which can even cause dangerous macroeconomic effects over time (Bardash et al., 2021; Revak, 2010). Therefore, in our opinion, financial security is largely determined by the nature of resource flows in the economy. The functioning of economic entities is associated with various incoming and outgoing flows of resources, which, with threatening symptoms of financial security, can cause an excessive deficit or surplus of certain resources in individual entities, as well as create an operational or debt hazard (Schneider, 2010).Therefore, the lack of a clear methodology for the systematic analysis of financial security (it is classified as complex and non-standard) leads to the formation of multi-level systems, which are divided into three types: discrete (corpuscular), rigid and centralized (Ivashko, 2015; Babak et al., 2020).

According to the provisions of synergy, the exit of the country's financial security from a critical state occurs by a leap in the process of phase transition to a qualitatively new state with a higher level of orderliness and self-reproduction of financial flows (Shnypko, 2006; Kerimkhulleet al., 2022). A jump is an extremely non-linear process in which minor changes in the parameters of the financial system, which are the governing parameters, cause very significant changes in the country's financial security and are determined by a bifurcation point with a set of approximate options for the movement of financial flows (Prevention of criminal use…, 1988). The choice of the bifurcation point of the country's financial security is random and is made from a given set of possibilities that have the appropriate state of "stretching" the trajectory of financial flows. Synergy clearly states that it is not possible to "impose" on the financial system the desired vector of financial flows by external actions, but one can only choose an alternative path from the potentially possible ones (Kyrychenko and Shykova, 2011; Vyhovska et al., 2018).

Mathematical studies of this function reveal a cascade of bifurcations of financial security in the behavioural movement of financial flows, which is described by the above function. We note that the self-reproducing process of financial flows becomes chaotic in the state of financial security r>3.5. This process can have many options. So, at r=1.3, x0=0.1, the value of the buffering function of financial security after each of the 50 iterations is directed to a certain equilibrium point of the movement of financial flows; with a state of financial security equal to r=3.95, the given function will start from the point x0=0.1 of the movement of financial flows and will have a completely different form of the financial system. However, it is quite difficult to visually distinguish the trajectory of financial flows, even with the logistic function of financial security, in the process of generating 50 random numbers at different levels of threatening symptoms of risks and dangers (Kostruba, 2021; Cherunova et al., 2021).

First, the role of subjective factors of financial security is determined by certain features – either dissimulators (aggressors) or potential stimulators of strategic development. It is more clearly expressed in danger. Secondly, the realization of danger has a more deterministic nature compared to the manifestation of risk, in which a significant role belongs to random macroeconomic factors of the country's financial security (Sheryazdanova et al., 2020; Akbarov et al., 2018; Ginters, 2020). Thirdly, from the point of view of danger, it is possible to more clearly distinguish certain scenarios of favourable or unfavourable events for certain financial institutions and economic entities focused on strategic development. Their functionality will be determined by a limited set of scenarios that can be implemented.

That is, the set of options for the movement of financial flows of entities focused on strategic development, under the conditions of threatening symptoms of the country's financial security, will be limited and will have a discrete nature. Fourthly, the risk makes it possible to determine both negative and positive deviations from the expected result, due to the smoothing of the negative consequences of the hazard. In the structure of the analytical and simulation model of financial security, a qualitative assessment of the impact of the identifiers of typical macro-financial factors (signs of symptoms), which directly affect the orientations of the country's strategic development, is allocated (Table **1**).

Table 1. Qualitative Assessment of the Influence of Identifiers of Macroeconomic and Macro-Financial Factors on the Level of Financial Security of a Country Focused on Strategic Development.

Catastrophic Risk Zone $X_{crit}^{LR} - \ldots$	**Critical Risk Zone** $X_{danger}^{LR} - X_{crit}^{LR}$ $X_{unsatisf}^{LR} - X_{danger}^{LR}$	**Zone of Acceptable Risk** $X_{satisf}^{LR} - X_{unsatisf}^{LR}$	**Non-Risk Zone** $X_{opt}^{LR} - X_{satisf}^{LR}$ $X_{opt}^{LR} - X_{opt}^{LR}$
Qualitative assessment of the influence of identifiers of typical signs (symptoms) of banking factors			
The share of overdue debt on loans in the total amount of loans granted by banks to residents	The share of foreign capital in the authorized capital	–	Ratio of bank loans and deposits in foreign currency, %;

of country, % Ratio of long-term (more than 1 year) loans and deposits, times; Return on assets, %	of banks, %; The share of assets of the five largest banks in the total assets of the banking system, %		Ratio of liquid assets to short-term liabilities, %
Qualitative assessment of the influence of indicators of typical signs (symptoms) of the non-banking financial market			
Capitalization level of listed companies, % of GDP	Insurance penetration level (insurance premiums to GDP), %	The share of insurance premium income of the three largest insurance companies in the total amount of insurance premium income (except life insurance), %	The level of volatility of the PFTS index, the number of critical deviations (-10%)
Qualitative assessment of the influence of identifiers of typical signs (symptoms) of debt factors			
Ratio of the volume of state and guaranteed state debt to GDP, %; Gross external debt to GDP ratio, %; The ratio of the volume of official international reserves to the volume of gross foreign debt, %; Average weighted yield of domestic state loan bonds (OVDP) on the primary market, %.	–	EMBI index (Emerging Markets Bond Index) and the country under study	–
Qualitative assessment of the influence of identifiers of typical signs (symptoms) of budgetary factors			
The ratio of the volume of aggregate payments for servicing and repayment of the state debt to state budget revenues, %	–	The level of redistribution of GDP through the combined budget, %	Ratio of deficit (surplus) of the state budget to GDP, %; Deficit (surplus) of budgetary and extrabudgetary funds of the general government sector, % of GDP
Qualitative assessment of the influence of identifiers of typical signs (symptoms) of currency factors			
Level of dollarization of the money supply, %	The share of loans in foreign currency in the total amount of loans granted, %	The difference between the forward and official national currency exchange rates, monetary units	Index of changes in the official exchange rate of the national currency against the USD, average for the period; Gross international reserves of the country, months of imports; Balance of purchase and sale of foreign currency by the population, million USD
Qualitative assessment of the influence of identifiers of typical signs (symptoms) of monetary factors			
The specific weight of long-term loans in the total volume of loans granted, %; The total volume of export of financial resources outside the country, billion USD	The specific weight of cash outside banks in the total amount of money supply (M0/M3), %; The share of consumer loans granted to households in the total structure of loans granted to residents, %	The difference between interest rates on loans provided by depository corporations in the reporting period and interest rates on deposits raised by depository institutions (except the National Bank), %; The level of the weighted average interest rate on loans provided by deposit corporations (except the National Bank) in national currency, relative to the consumer price index, %.	–

To determine the level of financial security under the influence of macro-financial factors $S(t)$ at the moment of time (t) it is proposed to use a generalized (integral) indicator based on a set of identifiers of threatening symptoms of the imbalance of the financial system or the so-called "pyramid of financial security of the country" (formula 2):

$$S(t) = \begin{Bmatrix} B(t), NBfm(t), D(t), Bd(t), \\ C(t), MC(t) \end{Bmatrix}, t \in [0, T], \quad (2)$$

Where $B(t)$ – identifiers of typical signs (symptoms) of banking factors; $NBfm(t)$ – identifiers of typical signs (symptoms) of factors of the non-banking financial market; $D(t)$ – identifiers of typical signs (symptoms) of debt factors; $Bd(t)$ – identifiers of typical signs (symptoms) of budgetary factors; $C(t)$ – identifiers of typical signs (symptoms) of currency factors; $MC(t)$ – identifiers of typical signs (symptoms) of monetary factors.

The model of the dynamics of the financial security level $I(t)$, that is the comparison of the actual indicators of the diamond of financial security with some base (corresponding values for previous years), has the form (formula 3):

$$I(t) = \left\{ \frac{B_f(t)}{B_b(t)}, \frac{NBfm_f(t)}{NBfm_b(t)}, \frac{D_f(t)}{D_b(t)}, \frac{Bd_f(t)}{Bd_b(t)}, \frac{C_f(t)}{C_b(t)}, \frac{MC_f(t)}{MC_b(t)} \right\}, \quad (3)$$

where $B_f(t), NBfm_f(t), D_f(t), Bd_f(t), C_f(t), MC_f(t)$ – are the actual values of the identifiers characterizing the level of financial security of the country at the time (t); $B_b(t), NBfm_b(t), D_b(t), Bd_b(t), C_b(t), MC_b(t)$ – basic values of identifiers characterizing the level of financial security of the country at the time t.

The assessment of the level of financial security of the country is carried out by weighing and summing up separate functional criteria (k_i) each of which is the ratio of the possible value of the identifier according to macro-financial factors (z_i) to the cost of measures to prevent the appearance of threatening symptoms of financial imbalance systems (s_i), i.e. (formula 4):

$$k_i = \frac{z_i}{s_i}, \quad i = \overline{1, n}, \quad (4)$$

where n – is the number of functional identifiers of the country's financial security.

In this case, the integral indicator of the level of financial security of the country $I(t)$ in period tis calculated according to formula (5):

$$I = \sum_{i=1}^{n} \lambda_i k_i, \quad (5)$$

where λ_i – is the specific weight of the significance of the i-th functional component.

The weighting factors may differ depending on the specifics of the functional features of the identifiers, as well as change for the same identifier at different stages of the study. A generalization of the methodological approach is the determination of the level of financial security of the country based on functional dependence (formula 6):

$$I = \alpha_1 f(x_1) + \alpha_2 f(x_2) + ... + \alpha_n f(x_n), \quad (6)$$

Where $x_1, x_2, ...x_n$ – identifiers of macro-financial factors of financial security of the country; weighting coefficients that reflect the importance of each identifier for ensuring the country's financia.l security.

Another approach to determining the level of financial security is to determine the degree in which the country has achieved some "ideal" state, which is the best from the point of view of strategic development guidelines for the future. According to this approach, the assessment of financial security is carried out on the basis of a comparison of the marginal and actual values of the identifiers of macro-financial factors. Indicators of the level of financial security of the country are normalized values of macroeconomic and macro-financial security factors (formula 7):

$$z_i = \left(\frac{P_{if}}{P_{ig}} \right)^b, \quad (7)$$

where P_{if}, P_{ig} – are, respectively, the actual and marginal values of the i-th macroeconomic and macro-financial factor of financial security; b– is a degree indicator.

The degree indicator (b) in formula (7) takes two values: for stimulating factors it is equal to 1, for dissimulating factors it is equal to -1. Limit values of macroeconomic and macro-financial factors are determined based on the condition of the minimum permissible level of financial security of the country. Normalized values of macro-financial factors of financial security of the country can be obtained using another approach, according to which the range of possible values of each identifier is divided into 5 intervals:

$$\begin{matrix} \left[x^n_{gr}, x^v_{por}\right), \left[x^n_{por}, x^n_{opt}\right), \left[x^n_{opt}, x^v_{opt}\right), \\ \left[x^v_{opt}, x^v_{por}\right), \left[x^v_{por}, x^v_{gr}\right) \end{matrix}, \quad (8)$$

where x^n_{gr}, x^v_{gr} – are the economically achievable minimum and maximum values of macro-financial factors or the lower and upper limits of the values of the indicator of the level of financial security of the country; $x^n_{зщк}, x^v_{зщк}$ – respectively, the lower and upper threshold values of the indicator, i.e., values that should not be exceeded; x^n_{opt}, x^v_{opt} – the minimum and maximum optimal values of the indicator. The value x^n_{opt} can be equal to x^v_{opt} then the interval $[x^n_{opt}, x^v_{opt}]$ is

converted to a point x_{opt}. Values $x^n_{gr}, x^n_{por}, x^n_{opt}, x^v_{opt}, x^v_{por}, x^v_{gr}$ in formula (8) are determined by the expert method. Then the normalized values are calculated according to formula (9):

$$z_i = \begin{cases} \dfrac{x_i - x^n_{gr}}{x^n_{por} - x^n_{gr}}, & x^n_{gr} \le x_i \le x^n_{por}; \\ \dfrac{\left(x_i - x^n_{por}\right) + x^*_n\left(x^n_{opt} - x_i\right)}{x^n_{opt} - x^n_{por}}, & x^n_{por} \le x_i \le x^n_{opt}; \\ 1, & x^n_{opt} \le x_i \le x^v_{opt}; \\ \dfrac{x^*_v\left(x_i - x^v_{opt}\right) + \left(x^v_{por} - x_i\right)}{x^v_{opt} - x^v_{por}}, & x^v_{opt} \le x_i \le x^v_{por}; \\ \dfrac{x^v_{gr} - x_i}{x^v_{gr} - x^v_{por}}, & x^v_{por} \le x_i \le x^v_{gr}, \end{cases} \quad (9)$$

where $x^*_n = 0$ and $x^*_v = 0$.

After finding the normative value of macro-financial security factors, a comprehensive rating indicator of the country's financial security level is used (formula 10-12):

$$I = \sqrt{\sum_{i=1}^{m}\left(1 - z_i\right)^2}, \quad (10)$$

$$I = \sum_{i=1}^{m}\left|1 - z_i\right|; \quad (11)$$

$$I = \max_i\left|1 - z_i\right|. \quad (12)$$

where, m – number of identifiers of macro-financial factors of financial security of the country; z_i – number of identifiers of macro-financial factors of financial security of the country (Kyrychenko and Shykova, 2011; Rozhko et al., 2020; Shnypko, 2006; Temporary method of comprehensive…, 2008; Yaldin, 2011).

This approach makes it possible to analyse various factors that determine the balanced state of the financial system and the dynamics of the country's strategic development. To find the distance between the level of financial security of the studied country and the "reference" country, other limits of the distance between objects are used (Table **2**).

Thus, mathematical experiments in assessing the level of financial security of the country convincingly prove that the synergy between simulation and analytical models with the possibility of highlighting self-reproducing processes in the financial system based on effective indicators of typical signs (symptoms) is rigidly determined and depends on the depth of shocks (Haliantych et al., 2021; Sabirova et al., 2018). Even with a slight change in some factors, it may turn out to be catastrophic. In this respect, the fact of a high level of adaptability of financial institutions and economic entities to economic shocks should be regarded as a certain probable randomness of their functioning with a certain vector of movement of financial flows in the general financial system of the country with a time period that represents the real and potential value of financial security in the deterministic safe state of macro-financial factors.

An acceptable level of financial security of the state creates conditions for stable, reliable functioning of the entire system of state finances, which eliminates the occurrence of a financial crisis, default, destruction of financial flows, failures in providing the main participants of economic activity with financial resources, disruption of the stability of monetary circulation (Monetary and credit statistics, 2022; Performance indicators of the…, 2022).From the point of view of financial security as a criterion of the effective financial policy of the state regarding the formation of favourable conditions for the activation of the activities of economic entities, it is necessary to determine the state of protection of the national interests of Ukraine from external and internal threats in the banking, insurance, budget, debt, currency, monetary credit spheres (Bardash et al., 2021; Kasianenko et al., 2019). At the same time, the question arises, what exactly is the state of the country's security against external threats? These are: the possibility of avoiding or confronting external threats that aim to reduce the country's creditworthiness by increasing dependence on external factors; ensuring the flexibility of legislation during economic transformations; meeting the need of subjects of financial relations for financial resources, which will ensure sustainable growth of the country's economy; ensuring the accepted level of financial stability of the country for a certain forecasted period (Trusova et al., 2021; Kostruba and Kulynych, 2020).

Calculation of the level of financial security of the country based on macro-financial factors involves in-depth identification of threatening symptoms by their spheres of influence, namely banking, non-banking financial market, debt, budget, currency and monetary credit. Thus, the level of influence of banking security factors includes seven identifiers that are meaningfully focused on the evaluation of the credit portfolio, the structure of deposits, the liquidity of assets and their distribution in the system itself (Poltorak et al., 2021; Ivanov et al., 2021; Makhazhanova et al., 2022). The share of overdue loan arrears in the total volume of loans granted by banks to residents of Ukraine for 2012-2021 is consistently in the zone of critical values and represents a threat to the country's financial security.

Table 2. Characteristics of the Country's Financial Security Levels.

Level of Financial Security	Threshold Value of the Level of Financial Security	Characteristics of the State of the Enterprise
Supporting	no more than 0.05	Instability of financial security. The country is on the verge of financial security, as it may lose it with a slight imbalance of the financial system and a decrease in the profits of economic entities
Minimum	0.06-0.1	The country is financially secure and is able to support it in the next 1-2 years
Very low	0.11-0.19	The magnitude of macro-financial identifiers of the country's financial security allows maintaining a balanced financial system in the current period, but endangers it in the near future
Low	0.2-0.29	The value of the macro-financial identifiers of the country's financial security allows maintaining a balanced financial system in the current period and in the nearest (1-2 years) perspective
Average	0.3-0.49	The value of the macro-financial identifiers of the country's financial security allows to maintain a balanced financial system in the current period and in the medium (2-4 years) perspective, as well as to lay guidelines for strategic development
High	0.5-0.7	The value of the macro-financial identifiers of the country's financial security, which takes into account the main requirements for balancing the financial system, allows you to preserve the strategic guidelines of development and has significant advantages for the countries of the world
Very high	more than 0.7	The value of macro-financial identifiers of the financial security of the country, which takes into account all the requirements of balancing the financial system, allows to have significant strategic advantages of development and to be a leader among the countries of the world

Source: built by the authors.

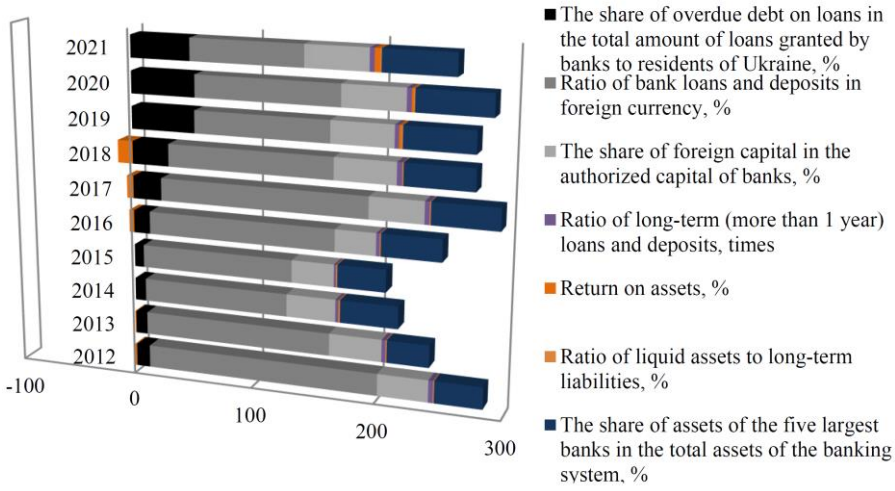

Fig. (2). Identifiers of the Influence of Banking Factors on the Financial Security of Ukraine for 2012-2021, %.

It is necessary to focus attention on the change in the trend of the actual values of banking factors of financial security of Ukraine, which are within the critical interval. The positive trend of 2012-2015 to reduce the share of overdue loans in the banking system from 11.2% to 7.7% changed in 2016 to an upward trend and fluctuated until 2021 in the range from 49% to 53%. A qualitative assessment of the ratio of long-term (more than 1 year) loans and deposits, as well as the profitability of assets and their impact on the level of financial security, is not absolutely unambiguous. Threatening symptoms of the Ukrainian banking system were observed, namely, the number of long-term deposits was in 3.8 times less than the number of long-term loans. This is proof of the lack of practice of institutional forms of savings among citizens of Ukraine, which, in turn, is explained by regular currency shocks and a catastrophic decrease in the purchasing power of the national monetary unit (Fig. **2**).

The non-banking financial market in Ukraine is represented by insurance companies, insurance-reinsurance brokers, credit unions, financial companies and pawnshops. The list and content of four identifiers of the influence of the non-banking market of Ukraine on the level of financial security takes into account the influence of the state of the insurance services market and the stock market. It was established that among the set of factors threatening the non-banking financial market, the level of capitalization of listed companies, which reflects the valuation of capital circulating on the stock market, stands out as an unstable trend. It should be

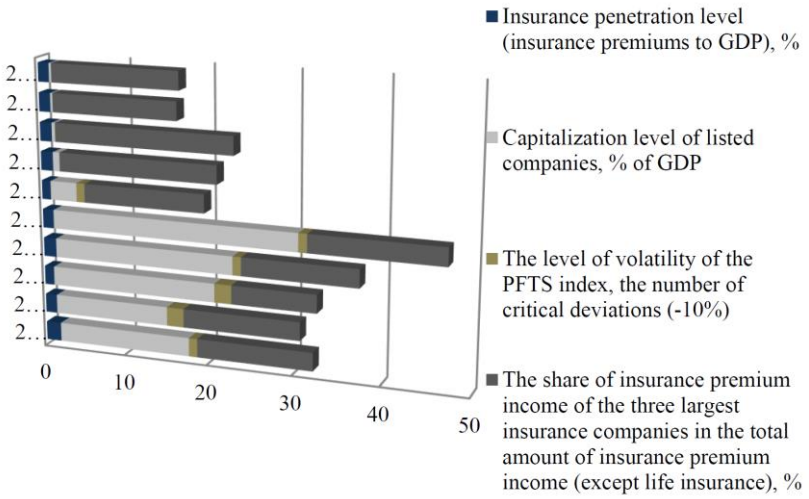

Fig. (3). Identifiers of the Influence of Factors of the Non-Banking Financial Market on the Financial Security of Ukraine For 2012-2021, %.

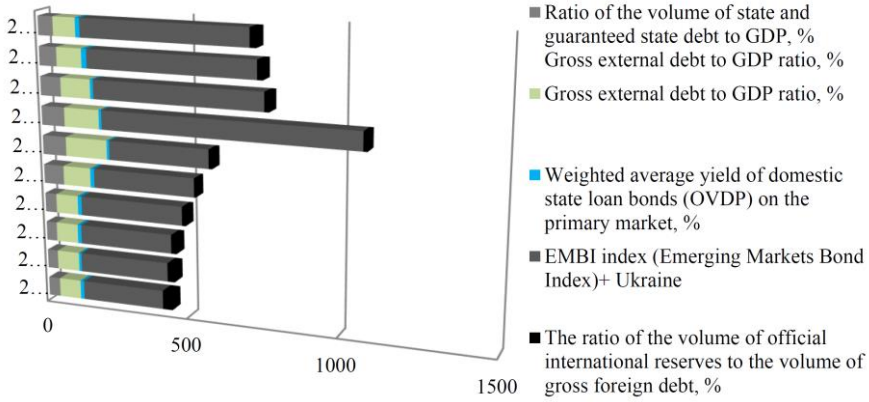

Fig. (4). Identifiers of the Influence of Debt Factors on the Financial Security of Ukraine for 2012-2021, %.

noted that, unfortunately, the market of insurance services is not developing in Ukraine.

The level of penetration of insurance into the financial market and its impact on financial security is determined by the percentage ratio of gross insurance premiums of companies to GDP. Thus, for 2012-2021, a tendency to decrease this identifier was observed – from 1.8% to 1.33% (Fig. **3**).

Debt and budget factors of Ukraine's financial security are considered together, since there is a dialectical relationship between them (the budget deficit is financed through state borrowing). But, at first glance, the vectors of a qualitative assessment of the influence of the specified identifiers of the level of financial security of Ukraine are divergent. Thus, in Ukraine for 2012-2021, external debt prevails over internal debt (Fig. **4**).

Since 2017 there is a clear tendency to decrease the ratio of both the volume of gross external debt to GDP and the volume of state and guaranteed debt. Public debt arises as a result of financial borrowing by the state, and guaranteed public debt – as a result of the state assuming guarantees for the obligations of third parties.

Gross foreign debt as of a certain date is the total amount of debt as of a certain date for all existing obligations of residents to non-residents requiring payment of principal and/or interest at any time in the future (Foreign debt, 2022; Ukraine's gross foreign debt, 2022; Yield domestic state loan bonds…, 2022). According to its statistical coverage, it takes into account all sectors and areas and, in fact, embodies the total amount of funds temporarily involved in the national economy. The reduction of the difference between the gross public debt and the public debt from 62% to 26% GDP deserves separate positive assessment.

This ensured the efficiency of the functioning of the financial system and increased GDP growth rates during the study period. However, there is no correlation between these changes in the dynamics of the ratio of the state budget deficit to GDP.

The ratio of the state budget deficit to GDP and directly to GDP growth is more concise (Fig. **5**).

During 2012-2021, the budget of Ukraine was constantly in deficit, even in periods when there was a positive increase in GDP. It should be noted that all analysed indicators have a single basis and are expressed as a percentage of GDP, which methodically ensures their comparability. The volume of Ukraine's GDP reflects the scale and potential of the financial system.

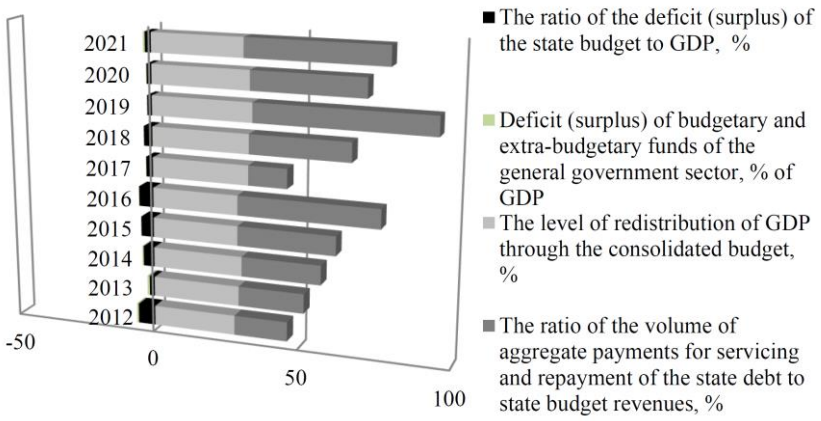

Fig. (5). Identifiers of the Influence of Budgetary Factors on the Financial Security of Ukraine for 2012-2021, %.

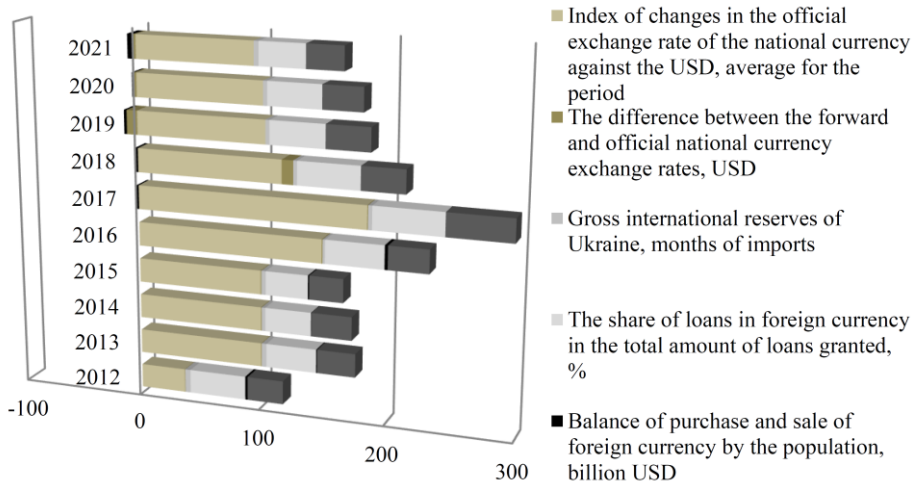

Fig. (6). Identifiers of the Influence of Currency Factors on the Financial Security of Ukraine for 2012-2021, %.

The practice of using gross external debt to finance the deficit of public expenditures is generally accepted, but under certain conditions. First, the total amount of debt service should not grow faster than the increase in government revenues. Secondly, the functioning of the financial system must demonstrate a sufficient level of strategic development to form a positive assessment of its potential among foreign partner countries for problem-free attraction of additional credit resources if necessary.

The degree of compliance of the financial system of Ukraine with the first condition allows to assess the influence of the identifier of the volume of aggregate payments for servicing and repayment of the state debt to the revenues of the state budget, which, with the exception of 2017, was stably at a critical level.

The negative trends of the prospects of the macro-financial situation of the Ukrainian market force the state to increase the yield of domestic state loan bonds on the primary market to ensure domestic financial borrowing. During the period 2012-2021, the specified identifier was within the critical interval for six years.

Thus, the second condition of the positive practice of state borrowing is not fulfilled. As a result, the main determinant of the state of financial security under the influence of debt and budget factors is the lack of control of the targeted movement of financial flows in the self-reproduction of the financial system and the balancing of the budget process.

A qualitative assessment of the impact of identifiers of currency and monetary factors on the financial security of Ukraine is shown in Figs. (**6-7**).

Their threatening symptoms confirmed the interdependence of the influence. Thus, the level of dollarization of the money supply makes it impossible to directly determine the total money supply in circulation at a certain period of time and significantly limits the tools for its regulation.

Currency “shocks” occur in the national economy every five to seven years. Households chose the strategy of preserving the purchasing power of their incomes by withdrawing their equivalent in national currency from circulation and converting it into USD.

Taking into account the level of the shadow economy, mostly non-institutional forms of saving are used and funds simply “are at home”. The specific weight of non-bank cash in the total money supply in 2012-2021 was at the level of 26-28%. Therefore, the identification of a qualitative assessment of the impact of these factors forms a conditional potential threat to the country’s financial security.

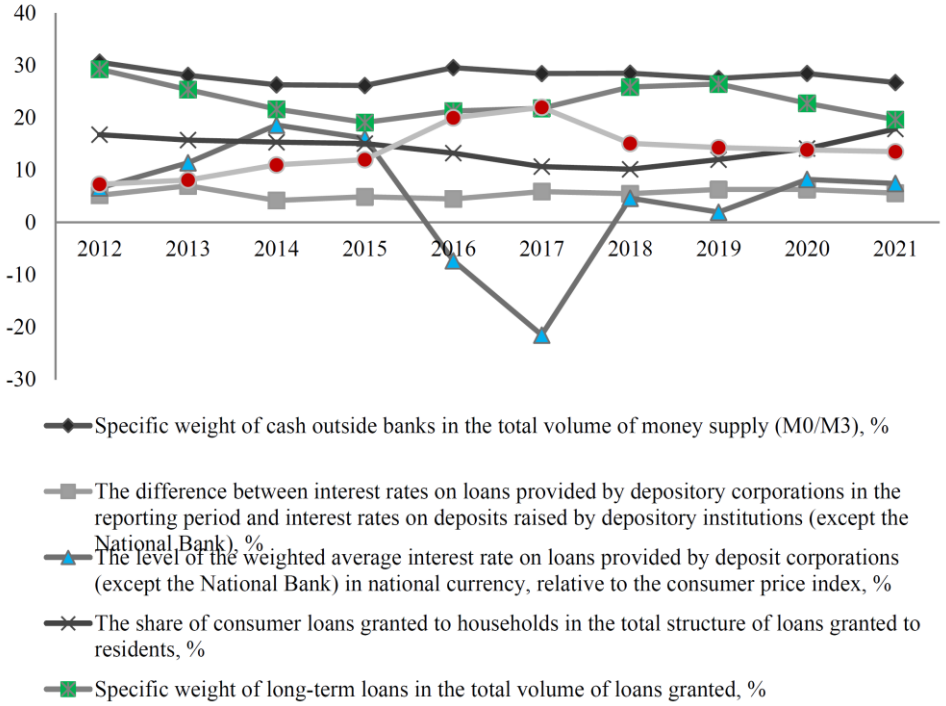

Fig. (7). Identifiers of the Influence of Monetary and Credit Factors on the Financial Security of Ukraine for 2012-2021, %.

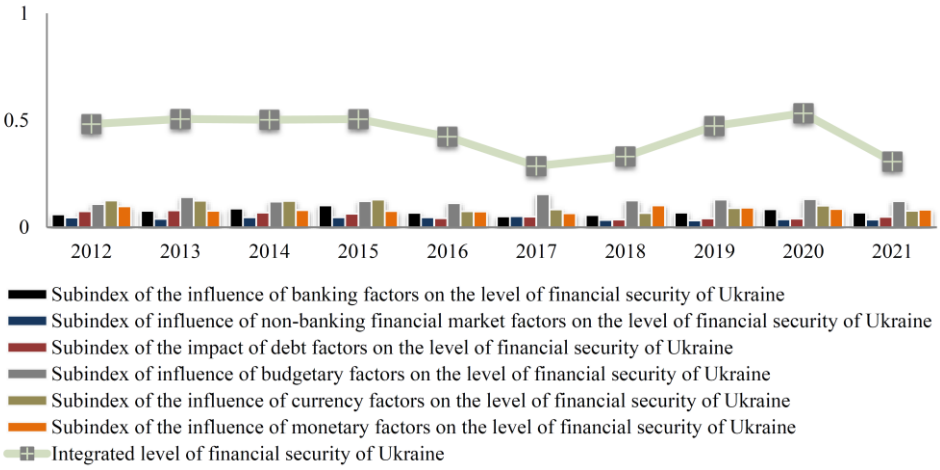

Fig. (8). Integrated Level of Financial Security of Ukraine According to the Set of Sub-Indices of Macro-Financial Factors, for 2012-2021, %.

Under conditions of actual uncertainty and unpredictability of the exchange rate of the national currency, long-term lending loses its feasibility. Under such conditions, it becomes urgent for residents to withdraw financial resources outside the country under various schemes of corporate obligations, which allows to return financial flows to the economy of Ukraine in the form of direct foreign investments, avoiding taxation, increasing the level of monetization and, accordingly, the efficiency of the functioning of the financial system on stabilization level of financial security of the country.

This conclusion confirms the formation of an indicator of the total volume of export of financial resources outside the country during four years at a critical level and four years at a dangerous level for 2012-2021.

A generalization of the dynamics of assessments of sub-indices of macro-financial factors and their influence on the integrated level of financial security of Ukraine for the period 2012-2021 is presented in Fig. (**8**). Thus, the dynamics of all sub-indices is characterized by a significant fluctuation amplitude and the absence of a positive trend. The change in the qualitative assessment regarding the nature of the intervals of the sub-indices of banking factors and factors of the non-banking financial market occurred four times in 2012-2021, the sub-indices of budgetary and monetary factors – three times, and the sub-indices of debt and currency factors – twice (Meoli et al., 2022).

The formation of the dynamics of the integral level of financial security of Ukraine within two intervals – dangerous and unsatisfactory – is quite natural. The “plateau” of the period

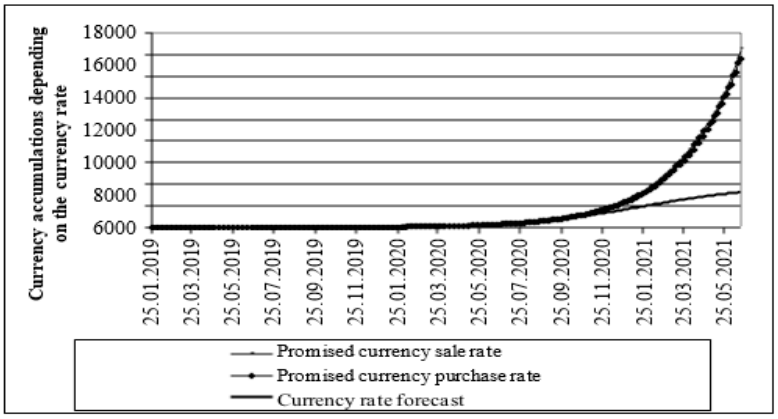

Fig. (9). Approximate Actual and Forecast Volume of Currency Accumulation in the Pyramid of Financial Security of Ukraine to Cover the Budget Deficit From 25.01.2019 to 25.05.2021.

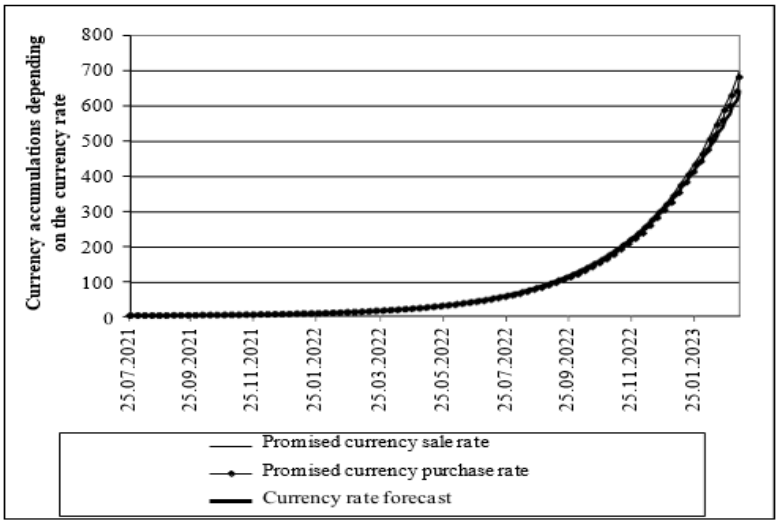

Fig. (10). Approximate Actual and Forecast Volume of Currency Accumulation in the Pyramid of Financial Security of Ukraine to Cover the Budget Deficit From 25.07.2021 to 25.01.2023.

2012-2015 had a balanced growth of the sub-index of banking factors while the trajectory of downward dynamics of the sub-index of debt factors. It was possible to overcome the threatening consequences in 2016-2017 only in 2019-2020, but there was no stable recovery. The fall in the integral level of financial security of Ukraine in 2021 was a consequence of the cumulative effect of a sharp decrease in the sub-indices of banking and currency factors against the background of the four-year downward trend of the sub-index of monetary and credit factors. Thus, at the end of 2021, the integral level of financial security of Ukraine stopped in a dangerous interval at the level of 2015.

In the direction of the determined impact of the spread of threatening symptoms of macro-financial factors on the level of financial security, a simulation and analytical model that embodies a functional pyramid, which is a reference point for the strategic development of the country and constructs a system of currency accumulation that grows over time to cover the deficit budget and balancing of the financial system, was used (Eden, 1988; Exchange rate, 2021; National security strategy of Ukraine, 2020; Strategy of economic security of…, 2021; Yaldin, 2011).

The model of the pyramid of financial security, which arises when debt covers the budget deficit, forms an aggregated dynamic model of financial flows in the general financial system of the state, which includes only those flows that directly and most affect financial stability. In the context of strategic development guidelines, the functional of the pyramid of financial security must be considered as a component of debt, budgetary, monetary and currency factors of security, which can stabilize and balance the country's financial system until currency accumulations increase in bank accounts and ensure the budget is filled with tax revenues from the banking and non-banking segment of the financial market (Kerimkulov et al., 2015; Chuzlov et al., 2019; Karnitis et al., 2022).

Modelling based on the logistic function (Formula 1) shows more realistic dynamics of growth in the flow of currency accumulation on the interbank market and the formation of incoming financial flows for their redistribution to cover the budget deficit in relation to dynamic currency fluctuations between interest on loans and deposits, which are compared with forecast indicators (Figs. **9-10**).

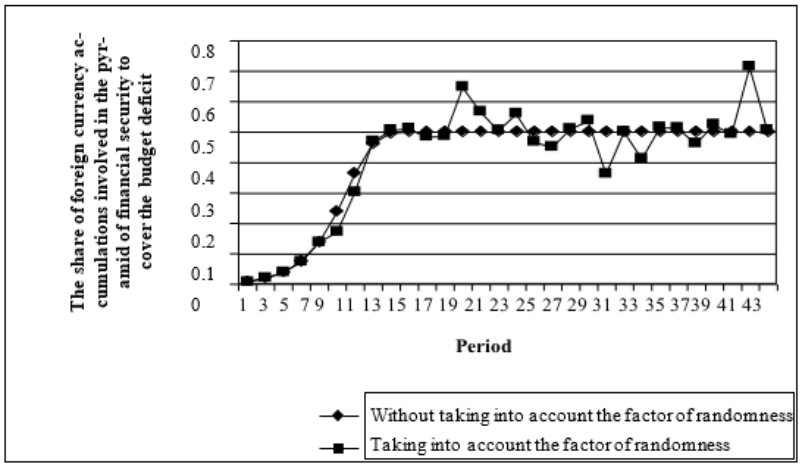

Fig. (11). The Share of Foreign Exchange Accumulation Involved in the Pyramid of Financial Security, Without Taking Into Account and Taking Into Account the Randomness Factor of the Budget Deficit.

The proposed model of the functioning of the pyramid of financial security makes it possible to divide discrete periods through iterations of interconnected indicators related to currency savings of economic entities, the amount of resources of financial institutions, the size of the credit portfolio of banking institutions, tax revenues to the budget, etc. It is possible to use both a deterministic version of the model and to take into account the factor of randomness. Depending on the level of the attacking potential of currency accumulation in the pyramid of financial security, a greater or lesser share of the national currency savings available in the economy is involved in it.

As mentioned above, the ideas of currency accumulation in the pyramid of financial security are spread similarly to the shape of the logistic function graph. Therefore, it is quite appropriate to use the Verhulst logistic equation. Accordingly, the share of foreign currency income that is involved in the pyramid of financial security for the current period is calculated according to formula (13):

$$SCS_t = A_{fp} \times SCS_{t-1} \times (1 - SCS_{t-1}), \quad (13)$$

Where *SCS*– the share of currency accumulation involved in the pyramid of financial security for a certain period; A_{fp}– the level of the attacking potential of currency accumulation in the pyramid of financial security to cover the budget deficit; t – period.

The factor of randomness in the involvement of currency flows in the pyramid of financial security can be expressed using the formula (14):

$$FR = random^{\wedge}(LFRIMS \times \sin g(0.5 - random), \quad (14)$$

where FR– the factor of randomness in the involvement of currency flows in the pyramid of financial security; $random$– a random number in the range from 0 to 1; $\sin g$ – a function of the sign of a number, which can have the following values: -1, 0, 1; LFRIMS – the level of influence of the factor of randomness in the involvement of currency flows in the pyramid of financial security (with LFRIMS = 0 there is no randomness, the model will be deterministic).

The share of currency accumulation that is involved in the pyramid of financial security for the period, taking into account the factor of randomness of the budget deficit, is determined by formula (15):

$$SCS\_FR_t = SCS_t \times FR, \quad (15)$$

Where SCS_GR_t – the share of currency accumulation that is involved in the pyramid of financial security for the period, taking into account the factor of randomness of the occurrence of a budget deficit; SCS_t– the share of the currency load that is involved in the pyramid of financial security for the current period, without taking into account the factor of randomness of the occurrence of a budget deficit; FR– the factor of randomness of the budget deficit when foreign exchange accumulations are involved in the pyramid of financial security; *t*– period(Eden, 1988; Yaldin, 2011).

Differences in the behaviour of deterministic and stochastic models are presented in Fig. (**11**). The graph reflects the situation in which the level of the potential of currency accumulation in the pyramid of financial security to cover the budget deficit is (A=2.0) and the level of influence of the factor of randomness of the budget deficit in the period of attracting currency flows into the pyramid of financial security is (LFRIMS = 0.1).These parameters are taken conditionally. The model makes it possible to adapt them to different specific situations.

Partial limitation of the factors of the randomness of the budget deficit in the pyramid of financial security of currency accumulation due to the increase in the level of dollarization of the money supply will allow direction of the vector of financial flows for future compensations and restructuring of debt obligations for the external debt of Ukraine, converting one financial instrument into another on the interbank currency borrowing market for stabilization level of financial security of the country.

4. CONCLUSIONS

Thus, from the standpoint of forming the foundations of financial security and guidelines for the strategic development of the country, it is necessary to develop a conceptual structure of financial flows, which, according to the classical theory of probabilities, is based on the gambling model and leads to simplified views on the balancing of the financial system of Ukraine. Simplification of projected calculations of the level of financial security, which embodies the compositional integrity of macro-financial factors in a dynamic period of events, from the standpoint of the country's strategic interests, must be regarded as exceeding its requirements for currency accumulation in relation to the debt obligations of financial institutions, but without unnaturally high income indicators or profitability. Record indicators of tax revenues to the state budget in a certain period may be accompanied by excessive withdrawal of taxpayers' resources and, accordingly, a narrowing of the tax base in the next period. Financial claims and obligations usually arise as a result of very real settlement processes. However, some of them are the result of actions caused by a conflict of interests: a debt burden artificially imposed on the state; a loan obtained on the basis of false information, which no one is going to return; claim for payment of insurance compensation for a falsified insurance case, etc. At the same time, claims and debts may be not only the result, but also the cause of conflicts.

Evaluating global financial security in this context, it is worth noting that in the global economic space there are no financial systems based on laws or agreements binding on all countries. Monetary means currently used on a global scale, such as the US dollar or the British pound, are legally purely national currencies, the international status of which has not been fixed by any international conventions. This causes some problems. The absence of international agreements in the field of the use of national currencies as world money leads to the fact that the resident states of world currencies do not have any obligations recorded at the level of a contract before the world community. These states can act in the financial sphere, guided only by their own interests, and the consequences caused by these actions for other countries may not be taken into account. But other states, legally, are free in their actions or inaction in relation to these currencies. And this is understandable, since in our time there are more than two hundred sovereign states that are equal in international legal terms. However, the removal of protection from non-resident money (used as world money) can have serious consequences for national and international money circulation. Therefore, global financial security should require countries to create special bank reserves of world currencies.

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