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GENERALISING THE SOLUTION TO THE PROBLEM OF LONG-TERM PLANNING IN A COMMERCIAL BANK

УЗАГАЛЬНЕННЯ РІШЕННЯ ЗАДАЧІ ДОВГОСТРОКОВОГО ПЛАНУВАННЯ В КОМЕРЦІЙНОМУ БАНКУ

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Захарченко В.І., Ширяєва Л.В., Акулюшина М.О. Узагальнення рішення задачі довгострокового планування в комерційному банку. Науково-методична стаття.

У статті представлено економіко-математичне обгрунтування методів управління фінансовими ресурсами комерційного банку – дохідними активами і робочими пасивами. Представлене дослідження у логічній послідовності висвітлює: загальну постановку завдання, тобто визначення змісту і виділення векторних величин фінансових потоків; задачу управління фінансовими ресурсами банку; уявлення економіко-математичної моделі фінансових потоків; алгоритм реалізації економіко-математичного моделювання фінансових потоків банка. Також проведено стислий аналіз стану банківської сфери України у 2022 р., закцентовано увагу на створенні моніторингової програми для України з боку МФВ. Зроблено наголос на розширенні застосування секторальних санкцій проти країни-агресора, а також у разі необхідності до капіталізації державних банків з боку держави з метою підвищення їх стійкості на ринку.

Ключові слова: банк, ресурси, потік, баланс, модель, ліквідність

Zakharchenko V.I., Shyriaieva L.V., Akuliushyna M.O. Generalising the Solution to the Problem of Long-Term Planning in a Commercial Bank. Scientific and methodical article.

The article presents the economic and mathematical justification of the methods of managing the financial resources of a commercial bank, i.e. income assets and operating liabilities. The presented study in a logical sequence highlights: the general statement of the task, that is, the definition of the content and selection of vector values of financial flows; the task of managing the bank's financial resources; the economic-mathematical model representation of financial flows; an algorithm for implementing economic and mathematical modeling of the bank's financial flows. A brief analysis of the state of Ukraine's banking sector in 2022 was also carried out, focusing on a monitoring program creation for Ukraine by the IMF. Emphasis was placed on the expansion of the application of sectoral sanctions against the aggressor country, as well as, if necessary, on the state-owned banks capitalization by the state in order to increase their stability on the market.

Keywords: bank, resources, flow, balance, model, liquidity

The last year and a half have been quite difficult for the country's economy and for the banking system in particular. The first significant problem was the cessation or significant reduction of bank lending. At the beginning of a full-scale invasion and military aggression, banking institutions began to freeze their credit programs. First of all, it concerned business loans and long-term mortgage and car loans for the public. In addition, banks began to massively remove credit limits from card accounts. So, for example, Privatbank removed the credit limit on 25 February 2022, but the possibility of this function was restored the very next day. A similar situation was observed at Monobank (Universal Bank), but later the credit limit was returned to UAH 10,000. from those previously approved. There were similar trends in FUIB and Raiffeisen Bank [3].

In today's difficult conditions, it is important for our country to look from a purposeful position at improving the methods of managing the bank's financial resources, which, from the point of view of the authors of this study, are not given enough attention.

Analysis of recent researches and publications

During the conduct of this research, we took into account the viewpoints of the following experts on the subject: O. Dzyublyuka [1], A. Vergun [2], S. Podik [15], V. Zakharchenko [6, 7], V. Kovalenko and his colleagues [8], O. Kopylyuk [9], M. Korol [10], S. Kupinsky and P. Kurmaeva [18], L. Matlogi [12], V. Mishchenko [11], K. Cherkashina [18] etc.

Thus, A. Vergu in his work comes to the conclusion that "Financial stability of a commercial bank is a systemic phenomenon that embodies a set of

methods and tools for influencing the basis of the component of financial stability" [2]. K. Cherkashina insists that: "the most acceptable way to solve certain problems in a banking institution (including low capitalization) is to conduct merger or acquisition procedures" [17]. S. Kulinskyi and P. Kurmaev encourage banks to switch from interest-bearing to non-interest-bearing activities under the influence of various monetary regimes and debt policies" [18]. M. Korol draws his own attention to modern banking tools: "Currently, the electronic payment system serves 96% of interbank transactions, which is a significant achievement for Ukraine" [10]. O. Kopylyuk sees the country's banking system already as part of another system of a higher hierarchical level, that is, she believes "... that the banking system is a component of the country's financial and credit system, which also includes the so-called parabanking system" [9], which is formed by specialized credit and financial institutions and financial instruments that are used in the financial market.

Unsolved aspects of the problem

From the analysis of scientific works on the topic of increasing the stability of the banking system in general and individual financial institutions, it is possible to see a decrease in scientists' interest in the market conditions formalization of the functioning of domestic banks with the help of economic and mathematical methods. Perhaps this is due to the rapid change in external conditions or the insufficiency of proven methods.

The aim of the article is to optimize the financial resources management of a commercial bank (working liabilities and income assets) based on economic and mathematical methods of managing these resources.

The main part

Commercial banks (CB) of Ukraine are doing quite well, even in spite of the military aggression. This is due to the fact that the banking system entered the war well-capitalized and deeply reformed since 2015. From the operational viewpoint, the system is now functioning smoothly. However, there are certain restrictions as part of anti-crisis measures designed to reduce economic shocks and capital outflows. Definitely, this creates inconvenience. But, from the viewpoint of operational sustainability, even in spite of very high operational risks, which are increasing in view of the energy terror, the Ukrainian banking system demonstrates stable results. So, in 2022, profits decreased by more than three times. In January-November 2022, banks earned almost UAH 20 billion, although in the previous year, these figures reached UAH 66 billion. But let's pay attention that CBs continue to lend and work, even despite the drop in profitability and unfavorable conditions [3].

At the end of 2022, an agreement was signed between the NBU and the IMF, which formed the basis of a monitoring program with specific parameters of the future major financing program. As for the conditions of the monitoring program, it is a set of measures aimed at increasing tax revenues and revitalizing the domestic borrowing market, ensuring the long-term stability of the financial sector, curbing monetary financing, as well as improving public administration and transparency of state institutions. The program does not provide for the funds provision, but it is important because it is a kind of test for receiving funds already under the next expanded financing program, which is already being implemented this current year [3].

The monitoring program creates an opportunity for the IMF to demonstrate the leadership it absolutely justly claims and has effectively demonstrated in the past, i.e. the creation of a coalition that should ensure the necessary level of financing for Ukraine's needs in 2023. This is huge money in terms of spending, at least $38 billion. The USA and other partners of Ukraine have, it seems, absolutely undeniable support and understanding of Ukraine's needs. But it is important that the aid meets both the sufficiency criterion and the timeliness criterion of receipt.

The powers of the NBU include responsibility for macro-financial and price stability [5]. In terms of financial stability, a structural guideline has been fixed, i.e. it is necessary to prepare a technical task for conducting a diagnosis of the state of the banking system, and then make an assessment of the assets quality and carry out subsequent stress testing with the development of further plans and concepts that will ensure the stability of the domestic banking sector in the future. That is, today we have to determine what the financial system needs to do tumorrow, or the day after tomorrow so that it becomes a full-fledged large-scale participant in the reconstruction program. This system will function smoothly, stably and provide the necessary level of confidence.

First, let's analyze the state of the banking system last year. The main features were: the banking system of Ukraine stopped growing and generally reacted with negative indicators to the continuation of the Russian Federation’s war against Ukraine; the quality of the CB's loan portfolios has been deteriorating, and so far shows non-critical unprofitability; analysts expect the situation with the quality of loan portfolios to continue to deteriorate, but in general they believe that the banking system of Ukraine, thanks to state-owned banks with foreign capital, will surely overcome the crisis caused by military aggression [14].

The three leaders in the 2022 reliability rating of bank deposits were headed by Kredobank. According to the National Bank of Ukraine, in the nine months of 2022, Kredobank completed its activities with a profit of UAH 68.45 billion, the bank's net interest income reached UAH 1.547 billion, and net commission income amounted to UAH 354 million. In nine months, the bank formed a very good reserve from the standard of regulatory capital (H2): with a standard of at least 10%, the bank received a value of the standard at the level of 18.65% [14]. In the following months, Kredobank maintained a large volume of reserves of capital adequacy and liquidity, its activity remains profitable (Table 1).

Table 1. Top 11 banks with the highest level of deposit reliability rating

Name of bank	Deposit rating level	Final rating in points
1. JSC " Kredobank "	rd.1 (pi)	10,0207 _
2. Raiffeisen Bank JSC	rd.1 (pi)	9.9699
3. JSC Kredi Agricole Bank"	rd.1 (pi)	9.8953
4. JSC CB "Privatbank"	rd.1 (pi)	9.8110
5. Pravex Bank JSC	rd.1 (pi)	9.6775
6. JSC " Ukrsibbank "	rd.1 (pi)	9.6700
7. Piraeus Bank MKB JSC	rd.1 (pi)	9.2355
8. JSC AB " Ukrgasbank "	rd.1 (pi)	8.8851
9. JSC " Proctedit Bank"	rd.1 (pi)	8.7072
10. JSC " Ukrsimbank "	rd.1 (pi)	8.4796
11. JSC "Oschadbank"	rd.1 (pi)	8.0139

Source: compiled by authors on materials [14]

All four banks with a state share, which are actively working in the retail business, are included in the group of banks with reliable deposits. Privatbank was once again the most successful among state-owned banks. It is an almost permanent member of the rating, it is included in the TOP-10 banks with reliable deposits. In the first nine months of 2022, Privatbank completed its operations with a profit in the amount of UAH 13.828 billion [14].

The activity of Oschadbank could deserve a positive assessment. The share of problem loans in its loan portfolio at the beginning of the IV quarter of 2022 was 45.66%. We will remind that in 2019 the share of problem loans in Oschadbank decreased by 10.44%, and in 2022 it decreased by another 5.46%.

Ukrgasbank showed unprofitable work. As of October 1, 2022, the share of NPLs in its loan portfolio was 16.73%. According to the reporting data published by the NBU, the bank ended 9 months of 2022 with a net interest income of UAH 3.766 billion and a loss of UAH 3.358 billion.

Ukreximbank ended 9 months of 2022 with net interest income of UAH 3.296 billion and net commission income of UAH 0.785 billion. The bank's net loss after taxation for the nine months of 2022 is UAH 7.906 billion.

Thus, the overall trend is that two-quarters of state-owned banks experienced large losses in the three quarters of 2022. If this trend is maintained, Ukrgasbank and Ukrsimbank will be required to recapitalize the state. The war was one of the main reasons for the unprofitability of state-owned banks.

It can be seen from the analysis carried out during the researched period that many CBs have a situation where their financial activity is not defined by a clear goal, which is why they do not have a hierarchical structure of financial management. The absence of such a structure of the CB is being tried to be compensated by creating various committees – credit, financial, management of assets and liabilities of strategic development, etc. Such collegial bodies make an attempt to coordinate the current financial activity of banks, which in this case is built on a hierarchy of common values. This also shows the shortcomings of corporate governance in the banking sector. Market efficiency due to the implementing the corporate governance principles does not appear by itself, but is the result of joint efforts of the entire business community and authorities. Creating the conditions for such a consensus is quite a challenging task. But if such a task is solved by the top management of the CB, one can expect sustainable economic growth.

In corporate management, based on the common values implementation, it is the controlling influences and individual current states of the system that can be changed as a result of these influences. The general values that replace the CB are usually not clearly defined financial performance goals:

— the need to maximize profit during active-passive operations;
— normative requirements of the NBU for the parameters of the CB balance sheet;
— the need to minimize risks based on the introduced limits (on counterparties, dealers, the types of individual operations, the amount of currency positions, etc.);
— the principles of funding the CB's resources and the requirements for a positive margin by the CB areas of activity or types of operations.

Regarding the CB, which is a hierarchical system in terms of organizational form, the practical management of financial activities is not targeted. At the same time, an unexpected paradox appears – all activities of the CB, except for the main one, i.e. financial, are targeted! We will try to determine ways to eliminate such a paradox.

1. General formulation of the task: defining content and selecting vector quantities.

Let us assume for the initial date $t_0 \in \hat{T}$, where $\hat{T}$ is the permissible set of planning intervals of the CB, when its initial position is set:

$$I(t_0)=<B_0, P_0> \in \hat{I}, \; B_0 \in \hat{B}, P_0 \in \hat{P}, \qquad (1)$$

where from the set of $\hat{I}$ possible states determined by the initial balance B_0 and the flow of payments P_0 in accordance with the requirements of the credit and deposit policy of the CB (its obligations), as well as not completed on date t_0. The symbol < ... , ... > will denote set vectors, the elements of which are separated by commas. Here $\hat{B}$ та $\hat{P}$ are the corresponding permissible sets for the parameters of the balance sheet and payment flows of the service contracts signed by the KB, respectively. And we will

also remind: "the flow of payments is the sequence of carrying out calculated monetary transactions regarding the collection of debt (additional flow) and the repayment of one's financial obligations (negative flow) for a certain time with an indication of the terms and amount of payments" [4].

On some requested date $t_n \in \hat{T}$ formed requirements characterizing the goal of the financial activity of the KB from the permissible set of goals $\hat{A}$:

$$A_{(t)} = <C_1(t), C_2(t), C_3(t), P_r(t), L_t, R> \in \hat{A},$$
$$C_1 \in \hat{C}_1, C_2 \in \hat{C}_2, C_3 \in \hat{C}_3, P_r \in \hat{P}_r, L \in \hat{L}, \quad (2)$$
$$R \in \hat{R},$$

where $C_1(t)$, $C_2(t)$ are the parameters of the target assignment and resource placement from a set of acceptable values $\hat{C}_1$ and, $\hat{C}_2$ respectively; $C_3(t)$ – necessary costs from a set of acceptable values $\hat{C}_3$; $P_r(t)$,L_t and R – requirements for ensuring profitability, liquidity and acceptable risk of financial activity within the limits of tentatively defined sets $\hat{P}_r$, $\hat{L}$, $\hat{R}$.

It can be assumed that the financial activity of the KB has a description in the form of the following equation:

$$I(t) = f[I(t_0), A(t), u(t), t],$$
$$A(t) \in \hat{A}, \; u(t) \in \hat{U}, \quad (3)$$

where f is a vector function that determines the process of financial activity of the CB; u(t) – a vector of management actions from the permissible set of general management $\hat{U}$, which is represented by volumes, rates and terms-conditions under which financial resources are placed (raised).

It is necessary to find the final states of the CB $I(t_n)$, the functioning of which is subject to description according to equation (2) and control parameters u(t) from the set of admissible control $\hat{U}$, which will ensure the transition of the CB to such a state from the initial state $I(t_0) \in \hat{I}$ time $T=t_n-t_0 \in \hat{T}$ subject to the fulfillment of target requirements (1).

2. The task justification. Formulated in this way in a general form, the task of managing the financial resources of the CB in general terms can have quite a lot of acceptable solutions. To choose the optimal one from them, it is necessary to formulate additional requirements for the management process, for example, in the form of a functional (performance indicator – either the decision is made at a minimum – min, or at a maximum – max):

$$F(t, I, u) \rightarrow extr, \; t \in \hat{T}, \; I \in \hat{I}, \; u \in \hat{U}. \quad (4)$$

The addition to the conditions of the task (1)-(3) of the requirement to ensure the extremum of the functional leads to the setting of the general task of managing the financial resources of the CB to the class of tasks of the optimal distribution of the organization's resources.

3. General representation of the economic-mathematical model of financial flows of CB.

Long-term (for a period of more than one year) planning in the CB is intended for financial justification of long-term prospects of its development and financial activity and assumes the solution of the following tasks:

a) justification of the strategic goals and objectives implementation from the CB top management;

b) annual plans formation of the CB financial activity.

a) – assumes:

a1) the forecast of the CB financial status of according to the signed contracts and with the achieved characteristics of active-passive operations;

a2) forecasting the behavior of the parameters that determine the situation in the sectors of the financial, investment and money markets;

a3) formibg the scenario variants of financial solutions for the implementation of strategic goals and tasks of the CB top management;

a4) optimization of long-term financial activity plans (perhaps with the help of computer software – COMFAR, etc.) according to one of the criteria, which determines additional goals of managing financial resources.

b) – assumes the calculation of indicators, the main of which are:

b1) management parameters in the form of an attraction program and a resource placement program;

b2) basic (those controlled) and additional program parameters;

The solution of this class of problems is usually carried out in accordance with the general financial planning task of using the economic-mathematical apparatus for calculating the financial planning model of the CB in a relatively distant perspective. According to the principles of decomposition, such a model, as a rule, operates with fairly generalized parameters. In the future, the parameters of the main financial flows of the KB should be used as model variables.

4. Algorithms for implementation of economic and mathematical modeling of the CB financial flows. The financial flow is the volume of receipts or payments of funds – CF_i (t), i =1, 2, ..., n (n is the number of financial flows of the CB involved in the model) – which is represented as a function of time t. At the same time, the funds received by the CB create a financial flow (by the way, "cash flow is a collection of cash receipts and payments distributed over time, generated by the economic activities of enterprises" [4]). Financial flows associated with the internal redistribution of funds can be called internal.

Financial flow $CF_i(t)$ is presented as a set or sum of homogeneous elements $dCF_i(t)$, by which we mean any one-time transfer of funds related to a given flow and occurring at time t, and belonging to the planning interval.

$$CF_i(t) = CF_i(t_0) + \sum_{p=t_0}^{t} dCF_i(p), \quad (5)$$

where $CF_i(t_0)$ is the value of the ith financial flow at the beginning of the planning interval.

A typical diagram of the main financial flows of the KB can be provided in the form of an information graph of the model of its financial activity (Fig. 1), on which each element of $dCF_i(t)$ can be at any time t in one of the states-nodes D_i (i =1, 2, …, n), marked as a circle:

D_1 – are involved CBs in the form of various temporary resources (for example, from financial sanctions against the aggressor country used by Ukraine's allies);

D_2 – are resources placed in the form of an income asset, and D_{21} – includes non-returned assets, (it should be clarified: "bank assets are resources accumulated during the bank's activity, which in the future will give economic profit and contribute to the inflow of funds into the banking institution" [4]);

D_3 – which are included in the composition of current allowable expenses (D_{31} – advance payments at the expense of future profit, D_{32} – expenses attributed to the cost price, D_{33} – expenses at the expense of net profit, D_{34} – other non-interest expenses);

D_4 – are used in settlements with creditors for previously accepted obligations in the form of repayment of the principal debt (D_{41} – repayment in the form of interest);

D_5 – which are included in the composition of resources subject to reservation in the NBU funds;

D_6 – are accumulated in the form of current gross income subject to taxation (D_{61} – received in the form of non-interest income);

D_7 – are received in the form of payment of the principal debt for receivables (D_{71} – received in the form of interest);

D_8 – are included in short-term liquid assets (cash receipts);

D_9 – are payments in the form of income tax payments;

D_{10} –are received in the form of balance sheet profit;

D_{11} –are transferred to the mandatory reserve fund of the NBU;

D_{12} –are paid in the form of property tax of the KB;

D_{13} – are received or transferred as client payments;

D_{14} – are paid in the form of income tax payments.

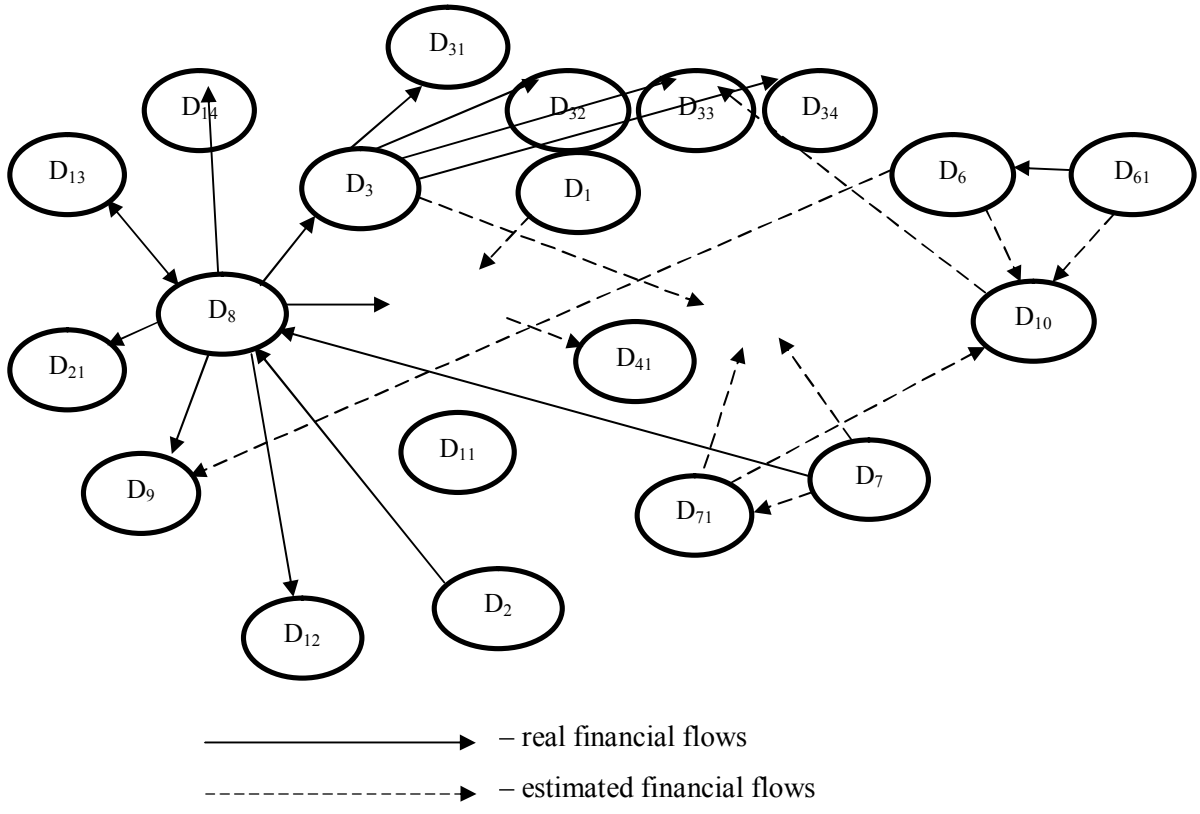

Figure 1. Generalized Diagram of the Main Financial Flows in a Commercial Bank
Source: the authors' own elaboration

Today, the urgent issue of financial sanctions is on the agenda of the State Budget Service, namely, introducing the separate sanctions only for certain institutions that provide the Russian Federation's financial services, not only does not contribute to their effectiveness, but also affects their effectiveness. To create conditions for expanding mechanisms for avoiding sanctions restrictions. The Russian Federation constantly raises the issue of the USA introducing sectoral sanctions against all the Russian Federation's financial institutions, in particular the Central Bank and its subsidiaries in the aggressor country and abroad, in order to minimize the possibility of avoiding the imposition of individual sanctions. The Ukrainian authorities representatives participate in many international conferences. The

issue of the participation of other persons who are not subject to sanctions. We believe that expanding the sectoral sanctions implementation will be a strong signal for other countries to strengthen their investment policies.

5. The problem formulation in economic and mathematical models of CB financial flows.

Given: let's assume that on the initial date t_0 belongs to T* and the initial state of the KB is determined formally:

$$I(t_0) = <B_0, P_0> \in I^*, B \in B^*, P_0 \in P^*. \quad (6)$$

For the triple end date t_k, which belongs to T*, the requirements are formulated, i.e., the target parameters are provided with the attraction of C_1 and placement of C_2, non-operating expenses C_3, balance profit P_r, liquidity L, risk R and accounting standards N, which are characterized in the planning period (t_0, t_k), as well as the goals of development and financial activity of the CB:

$$A = <C_1, C_2, C_3, P_r, L, T, R, N> \quad (7)$$

from the admissible set of goals A*.

The target parameters are caused by the following dependencies:

$$t_0 \in T, I(t_0) = (B_0, P_0), I(t_0) \in T^*, B_0 \in B^*, P_0 \in P^*. \quad (8)$$

On the date $t_k \in T^*$, the requirements for C_1, C_2, C_3, P_r, L, R, N are set, which are characterized in the planning period (t_0, t_k) by the goals of development and financial activity of the CB:

$$A = (C1, C2, C3, P_h, L, R, N), A \in A^*. \quad (9)$$

Thus, the formalization has been carried out, the financial flows equation, the control of U(t) and its limitations were determined.

The task is as follows: to find $I(t_k)$, $V(t) \in U^*$, which ensures the transition of the KB to such a state from the state $I(t_0)$ during the time $T = t_k - t_0$ under the conditions of execution of A.

Additional criteria are required for a single solution:

a) the total amount of involved resources for the period $T = t_k - t_0$ –

$$Q_1 = C_1(t_k) - C_1(t_0) \rightarrow \min, \quad (10)$$

b) the average cost of the involved resources for the period $T = t_k - t_0$ –

$$Q_2 = \frac{1}{T} \sum_{\Delta t_j} [V_{i1}(t+\Delta t_j) * \Delta t_j] \rightarrow \min, \quad (11)$$

c) the average return on placement of KB resources for the period $T = t_k - t_0$ –

$$Q_3 = \frac{1}{T} \sum_{\Delta t_j} [V_{i2}(t+\Delta t_j) * \Delta t_j] \rightarrow \min, \quad (12)$$

d) average diverted resources of the KB for the period $T = t_k - t_0$ from mandatory reserve funds –

$$Q_4 = \frac{1}{T} \sum_{\Delta t_j} [C_1(t + \Delta t_j) * \Delta t_j] \rightarrow \min. \quad (13)$$

We will try to provide a brief description of the established task. The basis for the long-term planning process implementation is the scheme of the model for calculating the CB financial flows. In our case, it is a nonlinear system of finite-difference equations containing about fifty unknown quantities, six of which are control parameters. A significant complication in the system is provided by the delay of the control influence V (t), which is a feeling, so to speak, of the physics of the processes in the KB that are being modeled.

Certain difficulties in solving the given problem occur in the case of the need to forecast the acceptable values of a number of quantities in conditions of significant uncertainty. Such values can include: control parameters for the processes of attracting $V_1(i)$ and placing $V_2(t)$ of financial resources; parameter describing the dynamics of client funds D_{13}.

The way out of the situation of uncertainty for control parameters consists in the formation of an interval restrictions system, which determine the areas of possible changes of such parameters. Such areas are subject to periodic clarification in the process of long-term planning of the CB financial activity.

The situation with client payments depends precisely on the structure of the client base, which determines the dynamics of client payments and the possibility of any correct forecasting of values characterizing client wealth. All Ukrainian CBs can be conditionally divided into two groups according to the customer characteristics: (1) CBs that have one large client, the assets on whose accounts are several times higher than the turnover on the accounts of other clients (these are, first of all, monopolistic enterprises, fuel and energy complex, expert- oriented firms); (2) KB without large clients.

The dynamics of client wealth (D_{13}) in the first group is determined by the combined trend of the client wealth of a large enterprise and the wealth of all other clients of the CB. At the same time, the fortunes of smaller clients can be predicted with sufficient probability. As practice shows, the fortunes of large business entities are difficult to predict using statistical patterns and technical analysis methods. Additional information is required, i.e. of a non-financial nature, which can sometimes be obtained with the help of competitive intelligence activities. In this case, it is possible to change the ratio of the amplitude of the minimum and maximum values of the sum of assets depending on the term of the analysis period. And this, in turn, requires the development of specific approaches to the creation of models for forecasting joints on the accounts of large enterprises.

There is a tendency to a significant decrease in the volume of business lending, as the CBs often refuse to grant loans due to increased rates and fear that the entrepreneur will not be able to return the funds. A decrease in the volume of business lending was observed until 24 February 2022, however, the start of a full-scale war and the worsening of the economic situation only intensified this trend.

The presence of the above-mentioned problems does not prevent the use of computational schemes for the CBs that have powerful clients, which is confirmed in the simulation process by decomposing the general financial planning problem. Thus, the function of the task of current planning should include daily calculations of client payments, which will be related to the task of ensuring current liquidity. And for long-term planning, the issues of long-term liquidity remain. But it should be remembered that the problems of long-term liquidity are solved by the tasks of ensuring current liquidity.

In the task of long-term financial planning in the CB, it is necessary to ensure the connection between different types of liquidity, namely – to take into account the making of payments by clients according to average indicators, which can be determined by the amount of daily fortunes of highly liquid assets in the form of target requirements to ensure current liquidity. These target indicators provide a solution to the problem of balance between profitability, liquidity, and risk parameters. Therefore, it is clear that the task of short-term liquidity is assigned to the task of current planning in the KB.

6. Results of solving the problem of long-term planning in the CB.

Summing up, it is possible to single out the following main initial indicators of the CB real financial flow:

— the minimum necessary volumes of CF_1 (t_k) and the dynamics of CF_1 (t) of the resources involved in the planning interval;
— necessary planned amounts of CF_2 (t_k) and the dynamics of CF_2 (t) allocation of resources during the planning interval;
— allowable values of the weighted average characteristics of passive instruments – cost V_{i1} (t) and time V_{t1}(t) of attraction, we remind: "bank operations are passive – bank operations to attract funds through increasing deposits and issuing securities are the main source of banking resources" [4];
— permissible values of weighted average characteristics of the main active instruments – yield V_{i2} (t) and placement time V_{t2} (t);
— planned financial flows of the CB payments for accounts payable: principal payments – CF_4 (t), interest from CB receipts for receivables – CF_{41} (t), principal amounts – CF_7 (t), interest – CF_{71} (t);
— $CF_{11\ (t)}$ deductions to the mandatory reserves fund of the NBU (mutual settlements for deposited reserves);
— planned amounts of CF_9 (t), CF_{12} (t) and CF_{14} (t) tax deductions to the budget in the planned period;
— in addition, as additional indicators of the planning results, it is possible to consider the parameters of the calculated financial flows CF_5 (t), CF_6 (t), CF_{10} (t), as well as the parameters of the aggregated balance KB – B(t), which is calculated using the initial balance B (t_0) and parameters of real/estimated financial flows.

7. Conclusions from the above. Thus, to solve the given problem, it is necessary to form the initial values of the financial flow parameters CF_{and} (t). And here, two fairly equal approaches may be possible: the assignment of zero initial conditions CF_{and} (t_0) = 0 (except for CF_8 (t), which is determined from the data of the initial balance) and the calculation of the initial values of the variables CF_{and} (t_0) in the form aggregates of balance accounts. In the first case, the results of the decision are the increments of the variables CF_t (t) for the planning period, and in the second – the new values of the balance aggregates. It seems that such an approach should be used, which ensures work with values smaller in volume.

The net assets of banks in Ukraine, for example, increased by 7.5% in the 3rd quarter of 2022 and exceeded the pre-war level (refer to the dictionary: "active financial funds, precious metals and precious stones, securities, debt obligations and debt claim rights that are not classified as securities..." [4]). The volumes of deposit certificates of the NBU were mainly increasing, which is a positive trend [16]. FUIB, PrivatBank, Oschadbank, Ukreximbank, Raiffeisen Bank increased their assets most significantly. We see that there are three state banks in this list, and the participation of these financial institutions in the state program of preferential lending "5-7-9%" played not the least role in this positive dynamic. Among the largest banks that reduced assets, it is possible to name "Sens Bank" (formerly "Alfa Bank"), "Pivdenny" and "Taskombank". As a result, in 11 months of 2022, the net assets of the banking system increased by 10%. Against the background of inflation of more than 20% and the appreciation of foreign currency, this is a rather modest figure.

Conclusions

Nowadays, on the initiative of the National Bank of Ukraine, systemically important banks are implementing an important power banking project, i.e. establishing borders on the basis of ordinary bank branches for providing financial services to clients in conditions of a long-term lack of power supply. The project aims to ensure that departments can function normally even in critical conditions. From the viewpoint of banking practice, this experience will be extremely important.

The well-established functioning of the Ukrainian banking system is undoubtedly an advantage, and it must be supported and expanded as much as possible. This requires a detailed audit of its assets, which the NBU must conduct in accordance with the monitoring plan for 2023. The CBs do not carry out recapitalization during 2022, but this does not mean that individual CBs do not need it. On November 22,

2022, the National Bank of Ukraine announced plans to launch a broad investigation into the state of domestic banks in 2023.

During the inspection, special attention will be paid to systemically important banks, including 14 Oschadbank, PrivatBank, Ukrgasbank, Ukreximbank, Ukrsibbank, Raiffeisen Bank and Sens Bank. The NBU pays special attention to systemically significant banks, as their stability and solvency directly affect the banking and financial system of Ukraine.

The launch of the monitoring program is an important stage in the formation of new relations between war-torn Ukraine and the IMF, which has legitimate rights to leadership in such matters as the formation of a donor coalition and the provision of aid. It has provided financial support to Ukraine during the war.

Abstract

The study is dedicated to the economic and mathematical substantiation of the methods of managing the financial resources of a commercial bank, namely, income assets and operating liabilities. The research paper consists of a general statement of the task, i.e. defining the content and allocating vector values of financial flows; tasks of managing the bank's financial resources, which are formulated and defined in terms and can have acceptable solutions.

The economic-mathematical models of financial flows in long-term planning are defined and the strategic goals and objectives set by the bank's managers and the quality of the formed annual financial activity plans are implemented. The study presents an algorithm for implementing the economic and mathematical modeling of the bank's financial flows, as well as a justified formulation of the problem in the model of long-term financial flows, and generalized results of its solution. From the conducted analysis for the period under study, it can be seen that in many commercial banks, there is a situation where their financial activity is not determined by a clear goal, which is why they do not have a hierarchical structure of financial management. Banks try to compensate for the lack of such a structure by creating various committees – credit, financial, asset and liability management, strategic development, etc. Such collegial bodies make an attempt to coordinate the current financial activity of banks, which in this case is built on a hierarchy of common values. This also shows the shortcomings of corporate governance in the banking sector. Market efficiency due to the corporate governance principles implementation does not appear by itself, but is the result of joint efforts of the entire business community and authorities.

Creating the conditions for such a consensus is quite a difficult task. But in the case of solving such a task by the top management of a commercial bank, you can expect sustainable economic growth. A brief analysis of the state of the banking sector of Ukraine in 2022 was also carried out, attention was focused on the creation of a monitoring program for Ukraine by the IMF, and emphasis was placed on expanding the application of sectoral sanctions against the aggressor country, as well as in case of need for recapitalization of state-owned banks by the state in order to increase their stability on the market. It is noted that the functioning of the Ukrainian banking system in modern conditions is definitely an advantage that should be supported and increased as much as possible. For this, a detailed audit of its assets is required, which the NBU must carry out under the terms of the monitoring program during 2023.

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