

Stimulators of Credit Activity of Banking Institutions

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Abstract The functioning of the banking system, in the face of financial and economic shocks, is gaining global scale, and requires banking institutions to guarantee financial stability. The aim of the article is to consider the regulators of credit activity of banking institutions in the interbank market and the debt obligations of Ukrainian borrowers. A comprehensive methodological approach to assessing the stimulators of credit activity of banking institutions, which allows to model macroeconomic and local factors of credit risks of borrowers, scenarios for servicing their debt, given the safe level of profitability, liquidity in the interbank market in the current period is implemented. A comprehensive methodological approach to assessing the stimulators of credit activity of banking institutions on the basis of cognitive analysis and modeling of factors of the banking system, which are determined by stress testing when the exchange rate is changing. Interest rate fluctuations in the interbank market and liquidity in the country is proposed. The model of a complex assessment by a banking institution of the credit risk of a debtor-financial company when servicing its debt on the interbank market is presented. The cognitive analysis is carried out and the cognitive map of stimulators of crediting of the economy of Ukraine by banking institutions is constructed. Optimistic and pessimistic scenarios for changes in the lending activity of the banking system were identified, the growth of loans to residents was chosen as a desirable situation, taking into account the impact of inflation and devaluation of the hryvnia, as well as the growth index of the banking system. The integrated indicator of creditworthiness of borrowers and the

relationship between quantitative and qualitative indicators of credit risk with a factor load on debt service by financial companies of Ukraine are calculated.

Keywords Credit Resources, Exchange Rate, Banking System, Credit Risks, Credit Stimulators, Borrowers, Creditworthiness

1. Introduction

The functioning of the banking system, which should ensure the confidence of economic entities in the actions of credit regulators of banking institutions is in the environment that in the face of financial and economic shocks is gaining global scale, and requires banking institutions to guarantee financial stability. From the standpoint of financial market development and the peculiarities of the national banking system, the arsenal of stimulating instruments of credit activity ensures the functioning of the transmission mechanism of credit policy. However, the introduction of a floating exchange rate regime and the liquidation of a significant number of banks cause negative trends in the banking system of weak economies, intensifying risk management factors to determine the quality of credit use in redistributive processes and the real sector. This necessitates the implementation of strategic and tactical goals of banks and maintaining a stable competitive position in the expansion of foreign capital, as well as the intensification

of bank lending to restore the real sector.

At the same time, in-depth study of the factors under the influence of stimulators of credit activity of banking institutions form the general economic policy of the state to manage credit resources through suppliers of these resources, which create their supply in the interbank market, performing an important function in economy and society. In modern conditions, the importance of credit relations is growing significantly due to fundamental changes in the functioning and development of lending in the systemic transformation of social capital, which penetrates deeply into all phases of reproduction of production and consumption, covering all levels of the economy.

The scientists have studied the functioning and development of the banking system, in particular of the fundamental foundations of banking risk management were discussed in the works of such scientists as S. Kavun and M. Vorotyntsev [1], S. Cebenoyan and P. Strahan [2], S. Classens [3], X. Dimakos and K. Aas [4], R. Duttgupta and P. Cashin [5], C. Dziobek and C. Pazarbasioglu [6]. Tools and methods of regulating banking were studied by such scientists as: H. Bouakez and M. Normandin [7], A. Kireyev [8], R. Bachmann, O. Berg and E. Sims [9], J. Easaw, R. Golinelli and M. Malgarini [10]. The functioning of the transmission mechanism of credit policy has been the subject of study by the following scientists, T. Havranek and M. Rusnak [11], S. Zaheer, S. Ongena and S. Wijnbergen [12], V. Bruno and H. S. Shin [13], H. Uhlig [14]. The priority of this study is to implement a comprehensive methodological approach to assessing the stimulators of credit activity of banking institutions, which allows to model macroeconomic and local credit risk factors of borrowers, scenarios for servicing their debt, given the safe level of profitability in the interbank marketing the current period.

2. Materials and Methods

Crisis phenomena in the country's economy, stimulating banking activities exclusively by monetary measures are quite a difficult task, because only if the banking system is normalized, it is possible to forecast the risk, profitability and liquidity of banks' lending activities. At the same time, the regulation of credit risks in banking institutions requires the use of high-tech instruments, on the basis of which it is possible to adjust the credit policy of banks in the current, medium and long term [15; 16]. The authors have proposed a comprehensive methodological approach to assessing the stimulators of credit activity of banking institutions on the basis of cognitive analysis and modeling of factors of the banking system, which are determined by stress testing when the exchange rate changes, interest rate fluctuations in the interbank market

and liquidity in the country [17; 18].

Thus, the systematic stress testing of credit activity of banking institutions when changing exchange rate fluctuations, according to the methodology of the Basel Committee, involves monitoring the net open currency position of banking institutions for each type of foreign currency lending in the context of the following indicators: net current foreign currency lending position (all assets minus all liabilities, including accrued interest on credit accounts in foreign currency); net forward currency position (the total amount of payments received minus the total amounts paid for future credit and currency transactions, including currency futures and "swaps"); calendar of provided credit guarantees (or similar instruments) in foreign currency; net future income (expenses) that are not yet accrued on loans. For this purpose, a model of sensitive analysis is used, which includes the following indicators [19; 20]: F – net currency lending position (analysis is performed for the currency where monitoring has identified an increase in threatening trends); e – current exchange rate on the reporting date of crediting; A_{rw} – credit risk weighted assets at the reporting date; C – the amount of capital on the reporting date, directed to lending; Δe – change in the exchange rate during the crediting period [21; 22]. Accordingly, the impact of exchange rate fluctuations on the level of capital of a banking institution aimed at lending is determined by formula (1) [19]:

$$\Delta[C(e)/A_{rw}(e)] = \frac{\Delta e}{e} \times \frac{F}{C} \times \frac{C}{A_{rw}} \left(1 - \frac{\Delta A_{rw}}{\Delta C} \times \frac{C}{A_{rw}}\right) \quad (1)$$

Importantly, the relationship between the dynamics of the exchange rate and its impact on the capital of the banking institution aimed at lending has a linear relationship only if the change in the open currency position of lending is uniform [23; 24]. If a banking institution has a significant dynamic of growth of open currency lending position, the relationship between the exchange rate and its impact on capital directed to lending will be nonlinear, which will require the inclusion to stress testing indicators not only on-balance indicators but also off-balance ones [25; 26].

Two approaches are used to assess the risk of interest rate fluctuations in the systemic stress testing of credit activity of banking institutions: the gap model and the model of term lending structure [27; 28]. The basis for calculating the gap model (GAP analysis) is the difference between the interest income of banking institutions on their assets and interest expenses on credit liabilities. In this case, to determine the change in net interest income of a particular group of banks and certain types of assets and credit liabilities, when changing the interest rate ΔR_i , the change in the gap between interest rates GAP_i (formula (2)) is estimated [19]:

$$\Delta Net_{ij} = \sum_{j=1}^K \sum_{i=1}^N GAP_{ij} \Delta R_j \quad (2)$$

where: ΔNet_{ij} – change in net interest income by type of

net assets and credit liabilities in the group of banks; N – number of banks; K – number of types of net assets. The term loan structure model measures the compliance of loan terms by calculating and comparing their volume over the duration of the reporting period. The model is determined by formula (3) [19]:

$$D = \frac{\sum_{t=1}^N CF_t \times DF_t \times t}{\sum_{t=1}^N CF_t \times DF_t} = \frac{\sum_{t=1}^N PV_t \times t}{\sum_{t=1}^N PV_t} \quad (3)$$

where: D – term structure of crediting during the reporting period; CF_i – financial flow that is directed to lending and will be received or returned by the end of period N ; N – the end of the reporting period; DF_i – discount level equal where R – is the current value of the interest rate; PV_i – the current value of discounted financial flows, which is equal to $CF_t \times DF_t$. Determining the term structure of the loan portfolio of banking institutions for financial instruments is carried out using the share of these instruments in the total portfolio according to formula (4) [19]:

$$D = \sum_{i=1}^M x_i D_i \quad (4)$$

where: x_i – the share of the i -th financial instrument in the loan portfolio of the banking institution; D – term structure of crediting of the i -th financial instrument. The term lending structure model is used to assess interest rate risk by calculating the elasticity of the value of assets and credit liabilities to interest rate fluctuations [29; 30]. The higher the value of the term structure of lending, the more sensitive the price of assets and credit liabilities to interest rate fluctuations (formula (5)) [19]:

$$\frac{\Delta A(r_a)}{A(r_a)} = - \frac{D_a \Delta r_a}{(1+r_a)}; \quad \frac{\Delta L(r_l)}{L(r_l)} = - \frac{D_l \Delta r_l}{(1+r_l)} \quad (5)$$

where: $A(r)$ – the market value of the assets of the banking system; $L(r)$ – the market value of the credit obligations of the banking institution; D_a – term structure of assets; D_l – term structure of credit obligations; r_a – interest rates on relevant assets; r_l – interest rates on relevant credit obligations. The impact of interest rate fluctuations on capital directed to lending is determined by formula (6) [19]:

$$\Delta[C(r_a, r_l)/A_{rw}(r_a)] \cong - \frac{(L/A_{rw})}{(1+r_a)} \times GAP_D \quad (6)$$

where: GAP_D – is the gap between the term structure of assets and credit liabilities, determined by formula (7) [19]:

$$GAP_D = D_a - D_l \frac{1+r_a \Delta r_l}{1+r_l \Delta r_a}, \quad (7)$$

where: D_a – term structure of assets; D_l – term structure of credit obligations; r_a – interest rates on relevant assets; r_l – interest rates on relevant credit obligations.

Assessing the indicators of the loan portfolio of banking institutions, which is formed under the influence of threat factors, both in its structure and in the trend dynamics of credit settlement operations allows determining the amount of unforeseen losses that may

occur due to deteriorating credit quality of borrowers. In this context, it is necessary to take into account the cost part of the formed reserves with their inclusion in the cost of the loan and to calculate their standard deviation [31; 32]. Additionally, to determine the relationship between the loan portfolio and macroeconomic indicators by VaR models of regression analysis, the probability of structural changes in the banking system is determined in order to conduct medium-term forecasting of changes in the main parameters of its impact on the growth of doubtful loans. The value of the model parameters is checked with the help of expert evaluation, and, as a result, the financial stability of other segments of banking services is calculated [19].

It should be noted that determining the lending activity of banking institutions through assessing the financial condition of borrowers in the real sector of the economy, involves determining the reasons for the growth of leverage (ratio of equity to borrowed capital) of the corporate sector, which by 10% leads to an increase in doubtful debt in total loans by 1.8%; or real GDP growth by 1% reduces the level of doubtful debt by 2.6%. The value of the level of liquidity in the systematic stress testing of credit activity of banking institutions is defined as the fluctuation of the value of the gap between the maturity of assets and liabilities due to market risks. According to the IMF recommendations, the assessment of liquidity risk should be focused on the level of growth of the gap between highly liquid assets and credit liabilities [19].

It should be noted that stress testing of credit activity in the aggregate change of the above risks allows determining the rate of “transfer” of risks in the interbank market, given the amount of possible losses that may occur in groups of banks due to the spread of shock fluctuations. The most well-known channel of risk transfer is unsecured loans granted on the interbank market and determined by means of integrated stress testing, which takes into account changes in macroeconomic indicators and their impact on the financial condition of the banking system as a whole. If result of these fluctuations is a threat of loss of solvency by individual banks or groups of banks, then a possible scenario of spreading this phenomenon among other banks is built. At the same time, the process of stress testing transforms the regulators of credit activity of banking institutions, provides standardization of stress scenarios for different participants in the interbank market and forms a single algorithm for their action at the micro, macro and local levels. Thus, at the macro level, credit regulators of banking institutions are able to protect the interests of borrowers in the interbank market by preventing insolvency and ensuring the financial stability of banks.

To assess the credit activity of banking institutions and the occurrence of credit risks, a system PEARLS, is used, which includes 44 quantitative criteria for: P – protection, E – effective financial structure, A – ensuring the quality

of assets, R – rates of return, L – liquidity, S – signs of growth [33]. In addition, the methodology Fitch Ratings [34] to assess the credit activity of banking institutions takes into account five factors: operating environment (government rating, economic and business environment, financial market development, regulatory support); profile of debtors-financial companies servicing the debt (reputation, business model, organizational structure); management and strategy (quality of management, corporate governance, strategic goals); risk appetite (quality of underwriting, risk management, development, market risk); indicators of financial condition (asset quality, profit and profitability, capitalization and financial leverage, financing, liquidity and coverage). Each factor has a list of criteria according to which the rating of banking institutions is determined, on the basis of which interbank market participants can make informed decisions on granting or refusing credit resources to those issuers that raise funds under third party guarantees. A credit rating can reduce the cost of such a guarantee or increase the efficiency of raising funds without purchasing a guarantee. That is, the creditworthiness of the bank to secure liabilities in the rating from “AA” to “CCC” may differ by adding a sign “plus” (+) or “minus” (-) to determine the objective factors of credit risk and in particular, historically formed level (probability) of default.

According to the new requirements of the Basel Committee on Banking Supervision, the amount of minimum capital to cover credit risks is determined using two methods: the standardized approach and the method based on internal ratings (the latter has two versions – stock and progressive approach) [35]. In this case, the risk ratio (level of risk) can be determined depending on the category of the claim, the category of the debtor-bank, the external rating and acquire the values. The procedure for a comprehensive assessment of the credit activity of a banking institution, taking into account the credit risks of debtors-financial companies for debt service in the interbank market, is presented in Figure 1. At the same time, the procedure for assessing the credit risk of debtors-financial companies by banking institutions provides for [36]:

- introduction of an approach to the assessment of lending to borrowers based on the concept of expected losses for the last twelve months, according to which the key indicator of expected losses is the creditworthiness of the borrower;
- improvement of the formula for calculating the amount of credit risk of borrowers (8):

$$CP = PD \times [EAD - (C_{ol} Vad_j + RC)] \quad (8)$$

where: PD – the probability of default of the debtor; EAD – the borrower's debt; $C_{ol} Vad_j$ – the value of collateral, adjusted for the liquidity ratio of collateral; RC – other income, including insurance indemnities, financial guarantee, sale of property of the debtor or property guarantor, except for the pledged one.

Changing the model of assessing the creditworthiness of the borrower to calculate the amount of credit risk of banking institutions using economic and mathematical models includes crisis and pre-crisis periods and allows:

- to expand the range of calculation of threat factors to the level of credit risk in order to reduce the creditworthiness of the borrower, regardless of the results of the assessment of the economic and mathematical model;
- to apply a logistical model for assessing the borrower's creditworthiness according to a standardized approach in order to determine the limits of the latter's financial condition, taking into account the influence of factors identifying the level of credit risk for the banking institution (in particular, timeliness of the borrower's obligations under loans). If signs of high credit risk are triggered, the credit quality category will be reduced, even if the logistics model defines the loan as having a high quality;
- to expand the portfolio valuation of assets and define the main criteria for such valuation. Loans to business entities and individuals in the amount of up to 2 million UAH are evaluated by banking institutions on a portfolio basis;
- to improve the requirements for the list of collateral and their acceptability for banking institutions, only from the list of collateral that can be taken into account when determining the amount of credit risk.

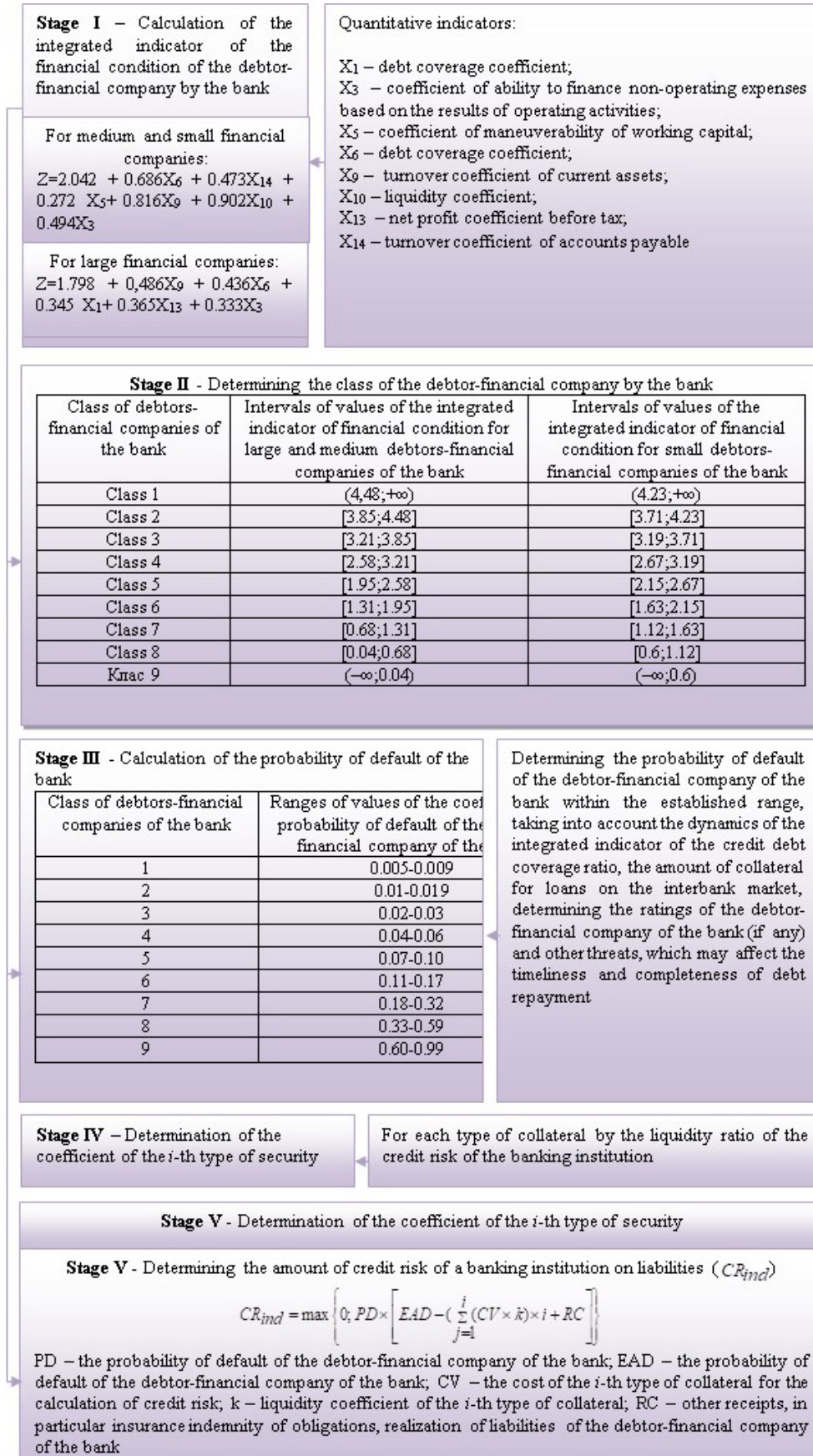


Figure 1. Model of a comprehensive assessment by a banking institution of the credit risk of a debtor-financial company when servicing its debt on the interbank market

3. Result and Discussion

Regulating the lending activity of banking institutions to lend to the economy is an important task for the state. Creating models that can assess the quantitative and qualitative impact of the main factors determining the dynamics of lending in the economy, makes it possible to identify a list of issues that need to be addressed in order to increase the lending activity of banking institutions and their interaction with financial companies. Cognitive modeling, as a cognitive component of the banking system as a whole, in contrast to standard mathematical models allows to assess the impact of qualitative indicators and is closely related to the influence of threat factors on the processes of situational analysis and forecasting of economic stimulators. Cognitive analysis involves several stages, which are shown in Figure 2.

In the stage of cognitive analysis, the authors identified the main factors on the basis of which the model of stimulators of lending to the economy was built. Table 1 shows their maximum and minimum values, which they acquired during 2015-2020, as well as their current value in 2020. In the second stage of cognitive analysis, after identifying the basic factors, the authors structured the system being modeled. To do this, a block diagram of the causal relationships of the elements of the system was built, which can be represented as a graph (cognitive map). The vertices of a graph are connected by an arc if one element is connected to another by causal relationship. Graph arcs in cognitive analysis and symbolically reproduce real causal chains that show which threat factor is causal and which is the consequence.

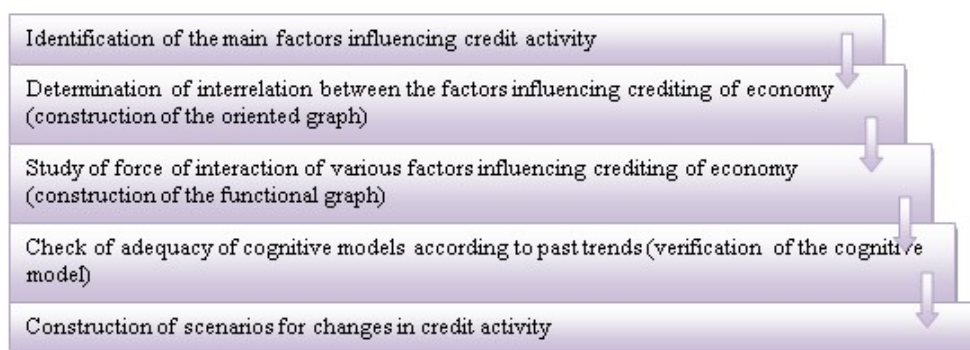


Figure 2. Stages of cognitive analysis of stimulators of lending to the country's economy by banking institutions [37]

Table 1. Indicators for building a cognitive map of stimulators of lending to the economy of Ukraine by banking institutions in 2015-2020

Indicators	Maximum value	Minimum value	Current value
Banking system development index	2.826	0.691	0.691
Loans to residents, taking into account the impact of inflation and devaluation of the hryvnia, billion USD	23.20	8.26	8.26
Deposits raised by banks, adjusted for inflation and devaluation, billion USD	14.23	7.19	7.20
Ratio of non-performing loans, %	54.5	3.9	52.9
Interest rate on National Bank of Ukraine (NBU) mobilization operations, %	18.5	1.8	15.6
NBU interest rate on refinancing instruments, %	25.2	7.2	19.2
The need for borrowed funds, index	0.8	0.6	0.6
Interest rates on new deposits attracted by banks, %	11.8	7.3	10.9
Index of the level of confidence in the banking system	0.8	0.2	0.45
Devaluation of the hryvnia, %	183.8	100.0	102.3
Number of operating banks	184	77	77

Source calculated by the author based on [38-41].

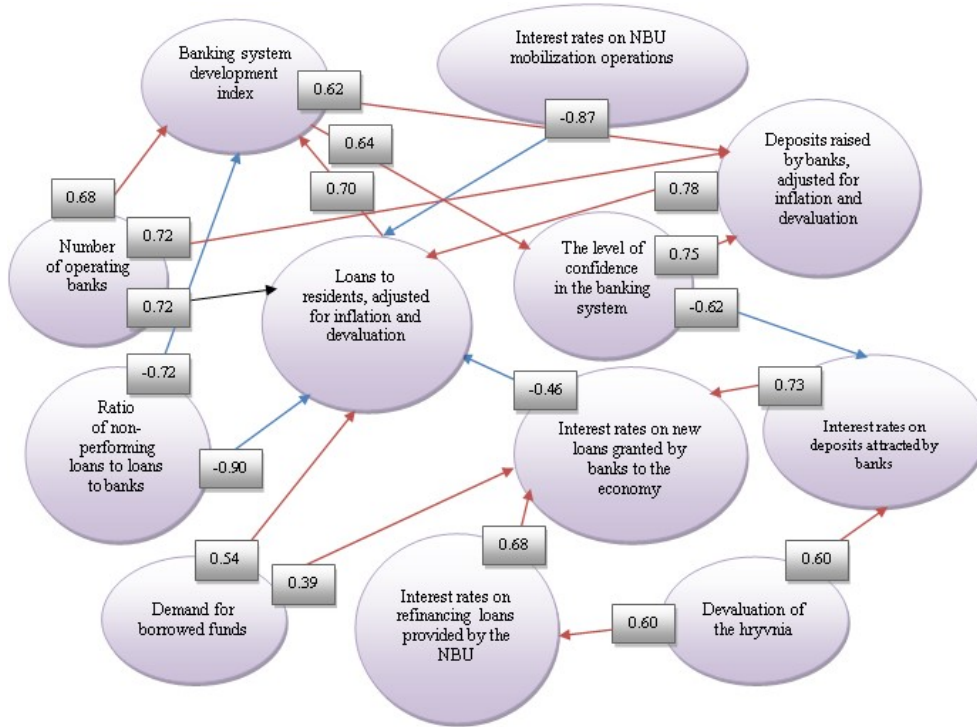


Figure 3. Cognitive map of credit stimulators of Ukraine's economy by banking institutions

The cognitive map demonstrates how factors affect each other, the effect can be positive when the increase (decrease) of one factor leads to the increase (decrease) of another factor, and negative when the increase (decrease) of one factor leads to the decrease (increase) of another factor. The cognitive map of stimulators of lending to the economy by banking institutions of Ukraine is presented in Figure 3.

The model includes factors that both directly affect the performance indicator (red line) and indirectly (blue line). In addition, the model includes an index of the development of the banking system in order to assess the impact on it of stimulators of lending to the economy by banking institutions. Thus, among the factors that directly affect credit risks are loans granted to residents for the needs of borrowed funds, the number of operating banks and deposits attracted by banks (the connection force 0.39, 0.94 and 0.78 respectively). Factors that directly affect the opposite-interest rates on mobilization operations of the NBU, interest rates on new loans granted to the economy and the ratio of non-performing loans to loans (the connection force “minus” 0.87, “minus” 0.46 and “minus” 0.90 respectively).

Factors that additionally affect other components of the cognitive map include: interest rates on new deposits attracted by banks → interest rates on new loans granted by banks to the economy (connection force 0.73), interest rates on refinancing loans, provided by the NBU → interest rates on new loans granted by banks to the economy (connection force 0.68), hryvnia devaluation → interest rates on new deposits attracted by banks

(connection force 0.60), hryvnia devaluation → interest rates on new loans granted by banks to the economy (connection force 0.60), the need for borrowed funds → interest rates on new loans granted by banks to the economy (connection force 0.54), level of confidence in the banking system → deposits attracted by banks (connection force 0.75), number of operating banks → deposits attracted by banks (connection force 0.72), number of operating banks → banking system development index (connection force 0.68), the need for borrowed funds → loans, given to residents, (connection force 0.39), banking system development index → level of confidence in the banking system (connection force 0.64), deposits attracted by banks → banking system development index (connection force 0.62), loans to residents → banking system development index (connection force 0.70). Factors that negatively affect the components of the cognitive card include: the level of confidence in the banking system → interest rates on new deposits attracted by banks (connection force “minus” 0.62), the ratio of non-performing loans to loans → index of development of the banking system (connection force “minus” 0.72).

Thus, the general relationship between the factors is 0.70, which indicates that the growth of the index of the banking system requires incentives for lending to the economy by banking institutions in real terms (taking into account the effects of inflation and devaluation), and not only in nominal terms confirmed by the research. The model was confirmed reflecting the constructed cognitive map. Modeling the situation revealed a discrepancy

between the forecast of its development, obtained with the help of a cognitive map and the actual development of the situation in the past. The construction of the cognitive map was performed by direct and inverse verification. Direct verification is based on the analysis of the plausibility of the processes that lead to changes in the values of factors in the forecast; reverse – to establish the plausibility of forecasts of the situation in the past [42].

In Figure 4 with the help of the tools of the program “Canvas”, the results of cognitive modeling of stimulators of lending to the economy are presented, which shows the predicted change of credit risk factors of banking institutions (“Output”) under the influence of factors (“Input”).

The result of the forecast is the percentage deviation of the value of the factor due to the initial increase in its current value. The consonant value of the factor, which is more than 0.5 and characterizes the reliability of the calculation, is also given. Thus, in the case of a simultaneous change in such factors as the interest rate on

mobilization operations of the NBU (decrease by 5.1%), the ratio of non-performing loans to loans (decrease by 9.4%), the devaluation of the hryvnia (decrease by 8.2%) and interest rates on new deposits attracted by banks (decrease by 3.3%) there is a corresponding change in a much larger number of factors: the index of the banking system development (increase by 7.9%), loans to residents, taking into account impact of inflation and devaluation of the hryvnia (growth by 8.9%), deposits attracted by banks, taking into account inflation and devaluation (growth by 0.8%), interest rates on new loans to the economy (decrease on 8.0%), the level of confidence in the banking system (growth on 1.5%), interest rates on new deposits attracted by banks (decrease on 8.1%). Thus, the change in performance factors: loans to residents, taking into account the impact of inflation and the devaluation of the hryvnia, as well as the index of the banking system development are under the influence of direct and indirect factors.

Indicators	Input	Current value in 2020 p.	Output	Consonance
Banking system development index		0.691	growth by 7.9% to	reliably (0.97)
Loans to residents, taking into account the impact of inflation and devaluation of the		8.26	growth by 8.9% to 9.00 billion USA	reliably (0.97)
Interest rate on NBU mobilization operations	decreases by 5.1%	15.6	decreases by 5.1% TO 14.8%	almost reliably (0.87)
Deposits raised by banks, taking into account inflation and devaluation		7.20	growth by 7.25 billion USA	reliably (0.97)
Ratio of non-performing loans to loans granted	decreases by 9.4%	52.9	decreases by 9.4% to 47.9%	almost reliably (0.87)
Devaluation of the hryvnia	decreases by 8.2%	2.3	decreases by 8.2% to	almost reliably (0.87)
Interest rates on new loans to the economy		17.2	decreases by 8.0% to 15.8%	reliably (0.97)
Index of confidence in the banking system		0.45	growth by 1.5% to 0.46	almost reliably (0.87)
Interest rates on new deposits attracted by banks	decreases by 3.3%	10.9	decreases by 8.1% to 10.0%	almost reliably (0.87)

Figure 4. The results of cognitive modeling of credit activity of banking institutions in lending to the economy of Ukraine

The authors have built scenarios of credit activity of the banking system for lending to the economy, by comparative analysis of various actions that affect the current situation. Optimistic and pessimistic scenarios for changes in the credit activity of the banking system were identified (Figure 5), and the authors chose the growth of loans to residents as a desirable situation, taking into account the impact of inflation and devaluation of the hryvnia by 8.3% and growth of the banking system development index by – 9.5%. Thus, the cognitive model allows to obtain predictive alternative situations (compared scenarios), which significantly improves the quality of credit risk assessment and calculation of the integrated creditworthiness of borrowers in the interbank market – financial companies, which are divided by creditworthiness classes.

It should be noted that in Ukraine in 2019-2020 there was an increase in overdue loans (Figure 6). Such changes are due to the emergence of difficulties for borrowers to service obligations under loan agreements due to the spread of crises in the national economy of Ukraine. In the period from 2016-2018, the amount of overdue loans decreased, which is explained by the beginning of the stabilization of the national economy. The increase in

non-performing loans of banking institutions led to an increase in allocations to loan loss provisions, which led to an increase in the cost of managing non-performing loans in the banks' loan portfolio and a decrease in the return on bank capital.

To calculate the integrated indicator of creditworthiness of borrowers of credit resources of banking institutions 15 financial companies of Ukraine were selected. Assessment of the creditworthiness of the borrower-financial institution is carried out by calculating the integrated indicator of the financial condition of the debtor using the logistics model (formula (9)) [43]:

$$Z = \beta_0 + \sum_{i=1}^n \beta_i \times x_i \tag{9}$$

where: Z – an integrated indicator of creditworthiness; β_0 – a free member of the logistics model, the value of which is updated by the NBU; β_i – coefficients of the logistics model, which are determined taking into account the importance of indicators; x_i – indicators determined on the basis of financial ratios, calculated according to the information data of the debtor, taking into account the ranges established by the NBU for each financial indicator.

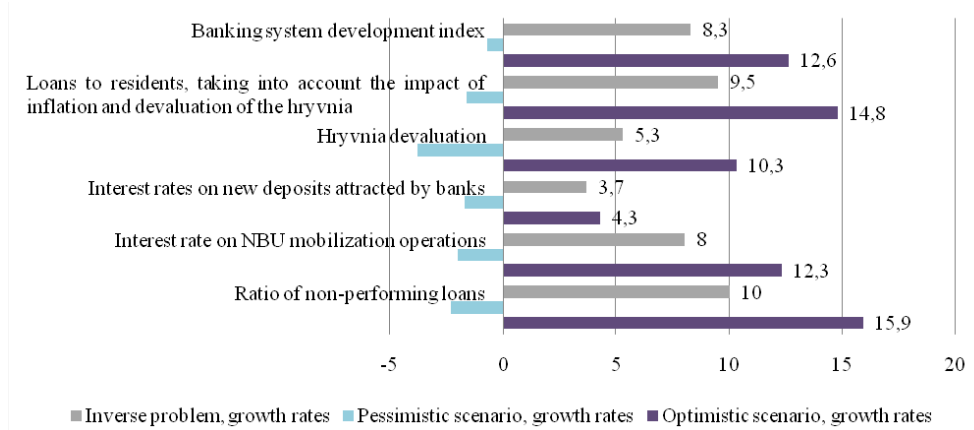


Figure 5. Forecast scenarios for changes in the credit activity of the banking system for lending to the economy of Ukraine

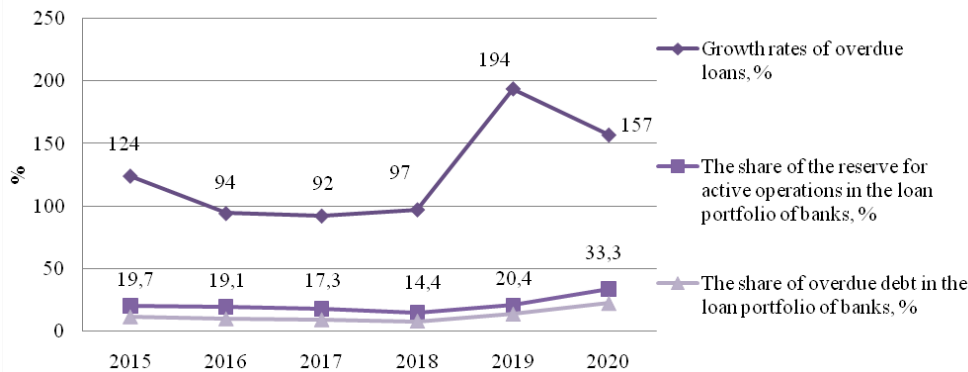


Figure 6. Dynamics of the share of reserves for active operations and the share of overdue debt in the loan portfolio of banking institutions of Ukraine for 2015-2020, % [39-41]

Comparison of average values of integrated indicators of financial condition for different types of financial institutions is presented in Table 2.

To determine the quantitative and qualitative measure of the impact of the type of financial company on the value of partial creditworthiness indicators, a correlation analysis was performed using “fictitious” variables. The establishment of the closeness of the relationship between the type of financial company and the values of creditworthiness (Table 2) was carried out on the Cheddock scale [43; 44] (Figure 7).The cluster distribution of financial companies according to the normative values of the coverage ratio (X1), the coverage ratio of non-current assets with equity (X3), the return on

equity ratio (X4), the rate of return on sales by financial results from operating activities (X5), return on assets ratio on net income (X6), current assets turnover ratio (X7), current assets turnover ratio (X8), ratio debt coverage capital (X9), debt coverage ratio (X10), net profit before tax ratio (X11), financial expenses coverage ratio based on operating results (X12).

Thus, according to the results of a qualitative assessment of the degree of influence of the criterion of the type of financial companies on the value of partial creditworthiness indicators (Figure 8) it is established that the influence of the independent variable on indicators X1, X6, X11 is very high, on indicators X3-X5, X7-X10, X12 – high, and on the indicator X2 – noticeable.

Table 2. Average values of integrated indicators of creditworthiness of financial companies for 2015-2020, according to the Resolution of the NBU No. 351

Financial companies	Values of integrated creditworthiness indicators		Financial companies	Values of integrated creditworthiness indicators					
FC2	3.300		FC10	2.548					
FC5	3.260		FC20	2.408					
FC3	3.220		FC23	2.388					
FC1	3.167		FC19	2.288					
FC18	3.143		FC8	2.233					
FC13	3.137		FC6	2.230					
FC7	3.135		FC12	1.845					
FC21	2.960		FC11	1.730					
FC15	2.915		FC9	1.663					
FC22	2.875		FC17	1.310					
FC24	2.847		FC16	1.072					
FC14	2.808		FC25	0.827					
FC4	2.572								
Intervals of values of the integrated indicator of the financial condition of financial institutions by creditworthiness classes									
Economic activity (sections D, E, H, I, J, K, L, M, N, O, P, Q, R, S, T, U), in particular financial and insurance activity	class 1	class 2	class 3	class 4	class 5	class 6	class 7	class 8	class 9
	more than +4.23	from +4.23 to +3.71	from +3.71 to +3.19	from +3.19 to +2.67	from +2.67 to +2.15	from +2.15 to +1.63	from +1.63 to +1.12	from +1.12 to +0.60	less than +0.60

Source: authors' own calculations according to data [36].

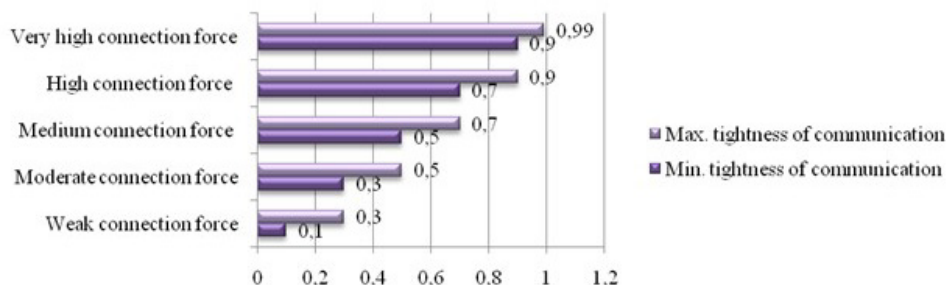


Figure 7. Cheddock scale to determine the quality of connection

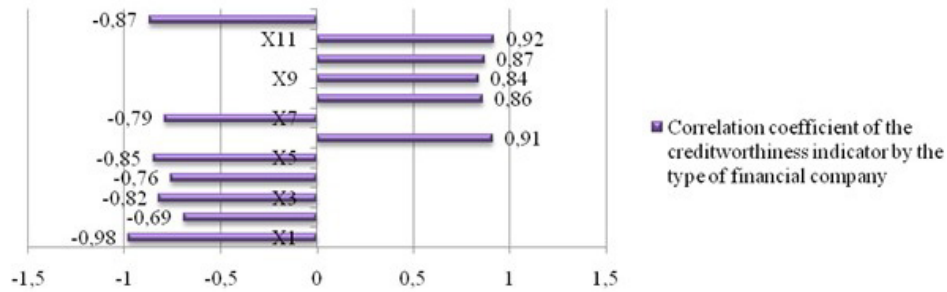


Figure 8. Assessment by banking institutions of credit risk of financial companies of Ukraine and its impact on the creditworthiness of borrowers

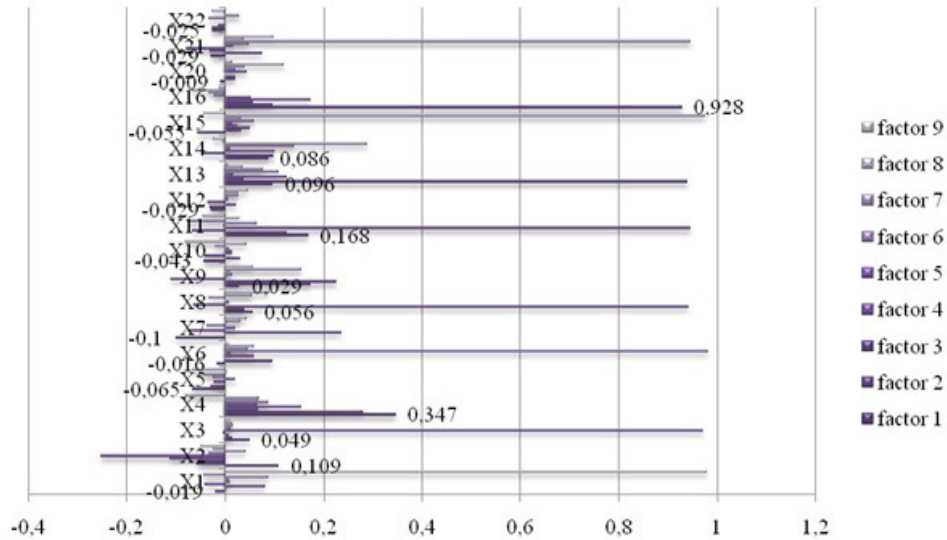


Figure 9. The close relationship between the quantitative indicators of creditworthiness of financial companies in Ukraine and the selected credit risk factors

The cluster analysis of the influence of the type of financial company on creditworthiness indicators to determine the credit risk of banking institutions of Ukraine proves that the distribution of the aggregate sample of financial companies depends on their specifics, as the structure of the formed clusters corresponds 50% to the structure of analyzed financial companies. In addition, a correlation analysis of the impact of financial institutions' specialization on credit ratios has shown a strong correlation between most financial ratios and financial companies.

To determine the factor structure of orthogonal turnover, in the process of which the value of the factor load of the creditworthiness of financial companies increases, and in other cases – decreases and forms the level of credit risk of banking institutions, the principal components method is used. This uses a procedure Varimax that maximizes the variation of the factor load squares for each component and simplifies the interpretation of the selected general threat factors [45-46].

In determining the credit risk of banking institutions while meeting the need for credit resources of financial companies, an assessment of their creditworthiness was made on the basis of nine factors that explain 72.4% the variability of the result. The presence of nine factors is

due to the diversity of indicators that characterize all aspects and activities of financial companies (liquidity, solvency, financial stability, business activity and profitability). Each of the selected factors includes all analyzed financial ratios, and their significance in the factor load should be 0.70. According to the results of the turnover of the procedure Varimax, a factor load was obtained (Figure 9), which shows the correlation between indicators and factors for the analyzed financial companies.

Thus, factor 1 includes the ratio of coverage of non-current assets by equity (X16) with loads 0.928, which indicates an increase in financing of non-current assets through equity and increase the financial stability of the financial company; factor 2 embodies the coverage ratio (liquidity of the third degree) (X13) with the load 0.94, which means a high level of solvency of the financial company in the medium term; the structure of factor 3 is determined by the turnover ratio of current assets (X8) with load 0.942; factor 4 with significance 0.945 characterizes the turnover ratio of fixed assets (X11); factor 5 is determined by the coefficient of coverage of financial costs by operating results (X3) with significance 0.970 and characterizes the efficiency of operating activities of the company; factor 6 is significant

for the quick liquidity ratio (X6) with the load 0.981; in the structure of factor 7 the key is the turnover ratio of current assets(X21) with load 0.946; factor 8 is determined by a significant coefficient of financial independence (X15) with a load 0.975; factor 9 is the most significant (with the load 0.979) and determines the level of debt coverage(X1), which allows the financial company to service the debt to banking institutions [47-49].

Based on the model of comprehensive credit risk assessment of a banking institution (Figure 10), a qualitative assessment of the credit activity of financial companies was performed on the following indicators: growth rates of financial services provided by financial companies of Ukraine (K1), growth rates of financial services provided by financial companies (K5), the share of the financial company in the market volume of financial services (K7), the duration of business activity of the financial company (K8), the share of financial company assets in total market assets (K9), the number of structural units of the financial company (K10), the number of activities carried out by the financial company (K11), the indicator of the effectiveness of the management of the financial company (K14), the region of location (K15), the application of measures to influence the financial company (K16).

The closeness of the relationship between the qualitative indicators of credit risk of banking institutions and a certain factor load on debt service of financial companies is presented in Figure 10.

The data of Figure 10 show that factor 1 with load 0.99 includes an indicator of growth rates of financial services provided by financial companies of Ukraine (K5), which determines the growth potential of the market in which the borrower-financial company operates; factor 2 characterizes the performance of the management of a financial company (K14) with a load 0.98; factor 3 with load (0.97) is marked by an indicator of the number of structural units of the financial company (K10), which characterizes the level of diversification of the financial company to service credit debt to the banking institution;

factor 4 determines the cluster of the region, which includes a financial company (K15); factor 5 includes an indicator of the growth rate of financial services provided by financial companies in Ukraine (K1), with a load 0.99 and characterizes the growth potential of the market in which the borrower operates.

Thus, the formed system of quantitative and qualitative indicators using correlation and factor analysis to assess the credit risk of banking institutions by factor load on debt service by Ukrainian financial companies create the basis for credit scoring in unpredictable environmental variables. The selected indicators take into account the industry specifics of financial companies, do not have a high functional dependence and allow characterizing the formation of threat factors for lending to the banking system of the state economy and borrowers in particular. Today, the banking system is faced with such an atypical situation as the liquidation of a significant number of banks, which negatively affects its development, as well as causes other important issues that need to be addressed. These are, in particular, low credit activity of banking institutions, shortage of long-term resources, and insecurity of property rights during the liquidation of banks.

In addition, there are disparities in bank balance sheets by terms and currencies, the lack of solvent borrowers, which in turn determines the focus of banking institutions on short-term operations. Stimulating the development of the banking system, in the authors' opinion, can now take place in the following two areas: 1) lending to the government by buying IGLBs and making a profit from mobilization operations conducted by the NBU (the way the banking system is moving today); 2) lending to the economy – the path to be followed, because the main purpose of the banking system – to stimulate the economy by providing loans, not lending to the government. It is lending to the economy that directly has a positive effect on the development index of the banking system and the lending activity of banking institutions to meet the needs of borrowers.

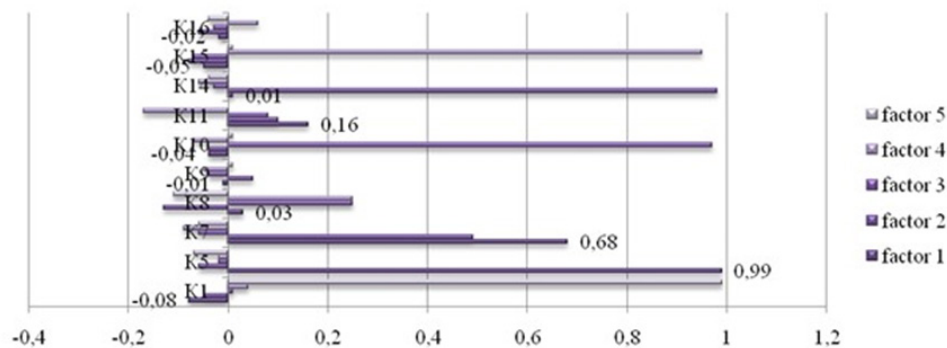


Figure 10. The close relationship between the qualitative indicators of credit risk and the factor load on debt service by financial companies of Ukraine

4. Conclusions

The authors consider it necessary to develop regulations that establish the optimal level of credit risk of solvent borrowers who are able to service loans, especially against the background of the growth of problem loans. The problem of lack of lending is due not only to high interest rates on loans, but also to significant credit risks, which banks are not ready to take. At the same time, the situation with the large number of non-performing loans is largely due to the rapid devaluation of the hryvnia, given the significant share of loans to the economy in foreign currency, and, consequently, the inability to meet commitments. Borrowers should be aware of the risks involved in foreign currency lending. At the same time, it is impossible to predict the possibility of a supercritical level of devaluation for borrowers, as the practice of such a large-scale devaluation of the national currency in Ukraine is not widespread. Future research opportunities are in the exploring other forms and contexts of credit activity, governance relationship, detailed forecast models considering future policies. This aspect of research may close the gaps in the study. In the meantime, in the authors' opinion, the National Bank of Ukraine, as a regulator, should ensure the stability of the national currency and prevent its fall.

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