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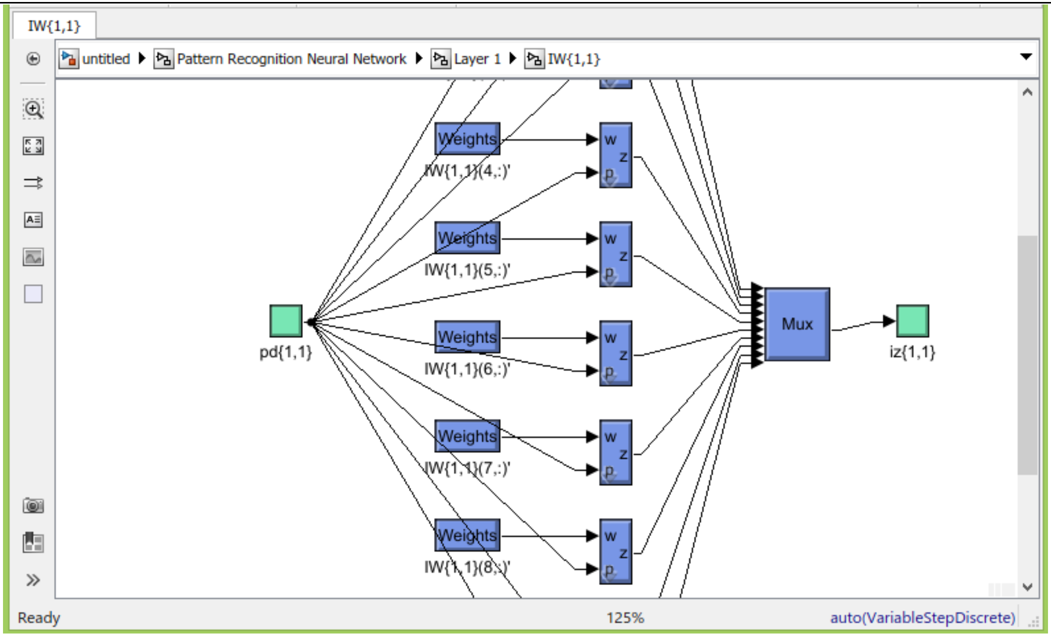

Fig.9. Weight matrix of the first layer (Received by the author)

Findings.

Thus, it is shown that to evaluate the performance indicators of the selected strategies in the management of knowledge, machine learning methods can be used to build a process model. In particular, the use of a neural network and a simulink module to select the type of performance indicators of strategies has been demonstrated. Further work in this direction should include an analysis of possible knowledge management strategies, the selection of dominant factors, the use of machine learning methods to select strategies.

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RISKS IN THE CREDIT ACTIVITIES OF BANKS OF UKRAINE

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Abstract

The strategic goal of the banking system of Ukraine is to ensure its sustainable development by achieving reliability, resilience to crises, improving the quality and efficiency of its activities. Banking risk management plays an important role in strengthening the country's banking system, increasing confidence in its depositors and investors.

All existing businesses make money with some risk. In this respect, banks are no different from them, however, success is achieved only when the risks that the banks take on are foreseen and are within defined limits. In the context of the transition to a market economy in the banking sector, the importance of correctly assessing the risk that the bank assumes when carrying out various operations is increasing.

The article deals with topical problems of credit risk management of commercial banks. Theoretical aspects of the nature of credit risk are investigated. The views of leading scholars on defining the concept of "credit risk" are outlined. The article investigates the structure of credit risk and ways to minimize it, taking into account credit risk indicators.

The reasons that cause credit risk are outlined. The techniques and measures of credit risk protection, which allow to minimize possible losses of commercial banks, are substantiated.

It has been proven that in order to succeed in a particular area of activity that is at increased risk, banks need to develop specific decision-making mechanisms. They should be able to assess what risks and to what extent the bank can take over; determine if the expected return justifies the appropriate risk. On this basis, measures should be developed and implemented to reduce the impact of risk factors.

Keywords: banking systems, risk, credit risk, currency risk, credit risk indicators, diversification, limits.

An unstable financial and economic environment that causes fluctuations in the financial and banking markets, a decline in the solvency of borrowers, errors in the legal aspects of bank activity, improperly formed strategies of banks - these are constant threats to the normal functioning of banking institutions, which cause their gradual and steady financial stability. In banking, the presence of risk is quite normal. You need to take reasonable risk to make a substantial profit. As the most profitable item of banking business and a significant portion of bank assets is the provision of loans, credit institutions are likely to suffer the most from credit risks. In the pursuit of profit, commercial banks are forced to take risks by cooperating with customers who have doubts about their reliability and solvency.

One of the most important principles of bank lending is that the loan granted must be repaid within the clearly specified terms of the loan agreement. Adherence to this principle is the key to the successful functioning of a commercial bank. Credit risk usually refers to the risk of the borrower defaulting on the initial terms of the loan agreement, that is, the non-repayment (in whole or in part) of the principal and the interest thereon in the contractual term.

The theoretical foundations of the study of the problem of credit risk management of the bank were reflected in a number of publications by such foreign scientists as E. Altman, J. Bessis, K. Brown, D. Duffy, S. Kabushkin, T. Koch, D. Lando, P. Rose. Significant contribution to the theory and practice of credit risk management of banks has been made by domestic scientists, in particular: G. Azarenkov, V. Vitlinsky, V. Vovk, K. Dyakonov, G. Karcheva, V. Kovalenko, V. Korneev, S. Naumenkova, V. Podchesova, L. Priydun, L. Primostka, I. Salo, V. Sidorenko, R. Slavyuk, N. Tkachenko, R. Shevchenko.

Credit risk is usually understood as the risk of the borrower defaulting on the initial terms of the loan agreement, that is, non-repayment (in whole or in part) of the principal amount of debt and interest thereon in the contractual maturity [4].

According to the NBU Regulation “On Determining the Amount of Credit Risk on Active Banking Operations by Banks of Ukraine” adopted on June 30, 2017, No. 351, credit risk is the amount of expected losses (losses) on an asset as a result of a debtor / counterparty default [10]. It is clear that the regulatory definition of credit risk presented is narrow enough, but it was formed in accordance with Basel III requirements.

There are several points to be made regarding credit risk. First, credit risk falls within the scope of financial risk and is closely linked thereto with interest, currency, industry and other banking risks. Thus, non-repayment of loans causes an increase in liquidity risk and bankruptcy risk. Second, credit risk for the bank is exacerbated by the fact that banks do not borrow from their own funds but from depositors and creditors. Third, the level of risk is constantly changing. This is because both banks and their clients operate in an economic, political and social dynamic environment, where conditions are constantly changing.

Credit risk is associated with a number of factors. It depends on exogenous factors (that is, "external" factors related to the state of the economic environment, the environment) and endogenous factors ("internal" caused by erroneous actions of the bank itself). Opportunities for managing external factors are limited, although timely actions can be mitigated by the bank to some extent to mitigate their effects and prevent major losses. Much attention should be paid to credit risk management through the leverage of the Bank's internal policies [1].

Credit risk is a whole set of risks associated with participants and elements of credit relations (Figure 1, Table 1).

It should be noted that most commercial banks of Ukraine until recently, when assessing credit risk on a specific agreement, took into account only one of its possible sources of financial capacity of the borrower (objective risk associated with the borrower).

Practice shows that many borrowers do not repay loans not because they are in a difficult financial situation, but because they simply do not want to do so. All this indicates that legal risk must be taken into account when assessing the risk of a specific loan agreement.

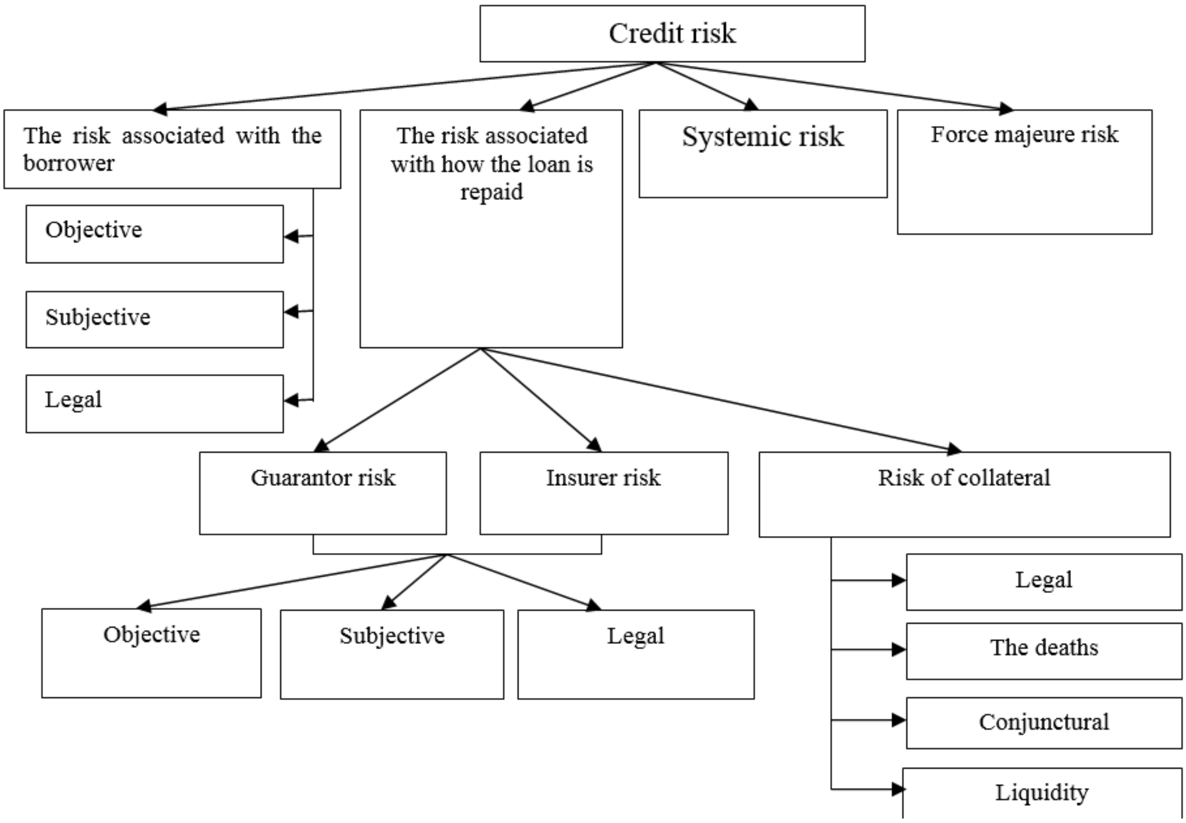

Fig. 1 Credit risk structure [5]

The main causes of bankruptcy of borrowers are: deficiencies in management, lack of effective systems of management information, inability to respond to changing market conditions and competition, concentration on unrealistic projects, taking into account the size of the enterprise, exaggeration of its own capabilities, ie very rapid expansion in the absence of capital adequacy, and a high proportion of borrowed funds [3].

Table 1

Characteristics of credit risk sources [3]

Name of risk 1. Risk associated with the borrower, guarantor, insurer 1.1. Objective (financial opportunity) 1.2. Subjective (reputation) 1.3. Legal 2. Risk associated with the collateral 2.1. Liquidity 2.2. Conjunctural 2.3. The deaths 2.4. Legal 3. Systemic risk 4. Force majeure risk	Source characteristics
1. Risk associated with the borrower, guarantor, insurer 1.1. Objective (financial opportunity) 1.2. Subjective (reputation) 1.3. Legal	1.1. Inability of the borrower (guarantor, insurer) to fulfill its obligations at the expense of current cash proceeds or from the sale of assets 1.2. The reputation of the borrower (guarantor, insurer) in the business world, its responsibility and willingness to fulfill its obligations 1.3. Shortcomings in drawing up and execution of the credit agreement, the guarantee letter, the insurance contract
2. Risk associated with the collateral 2.1. Liquidity 2.2. Conjunctural 2.3. The deaths 2.4. Legal	2.1. Inability to realize the collateral 2.2. The subject of collateral may be impaired over the life of the loan agreement 2.3. The collapse of the collateral 2.4. Shortcomings in the drafting and execution of the pledge agreement
3. Systemic risk	Changes in the economic system that may affect the financial position of the borrower (e.g., tax law changes)
4. Force majeure risk	Earthquakes, floods, disasters, tornadoes, strikes, hostilities

The "distant alert" indications of the borrower's disadvantage can be attributed to: reduction of account turnover, request to defer repayments on previously extended loans (after the second extension, as the practice shows, the loan should be immediately transferred to the category of problematic ones), has grown in account management and others. For a bank that has lent to an individual borrower, the warning signals of distress are also: constant use of the client's overdraft at the marginal level; systematic excess of credit limits; difficulties of repayment of the loan: delays in payment of interest or principal amount of debt; unfavorable tendencies of change of financial ratios (lack of liquid assets, increase of share of borrowed funds); "pressure" on profits (large discounts on payments in cash and on short terms); non-payment of taxes; untimely provision of prompt and reliable financial information and more.

When making a loan, the bank necessarily manages the risk. There are several ways to do this: accept credit risk (this must be consistent with the bank's credit policy, and risk-return is the solution), or minimize it. To minimize credit risk, a bank can take many different actions (causing different changes) to combine them, providing the most optimal impact on risk [12].

Therefore, it would be advisable to take a closer look at all ways to minimize credit risk (Figure 2).

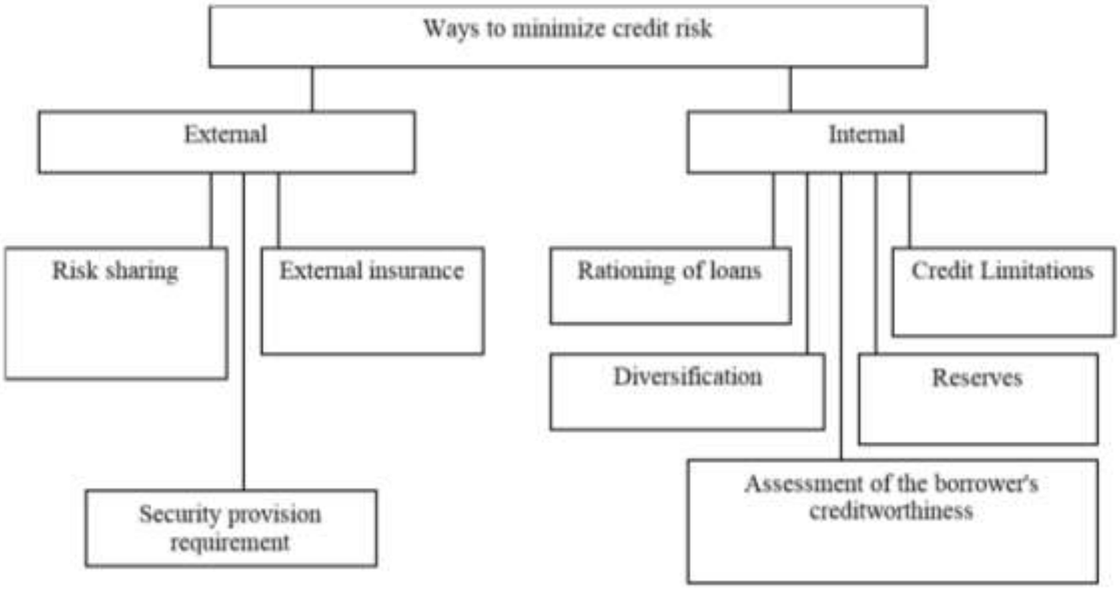

Fig. 2 Methods of minimizing credit risk [6]

Internal ways of minimizing credit risk are quite varied and relate mainly to intra-bank credit management. The main among them are: assessment of the creditworthiness of the borrower, limit, rationing, diversification, provisioning.

Based on the classification of loans, the commercial bank creates a reserve for each group of loans. The reserve should be formed in full in accordance with the amounts of actual credit arrears by risk groups and the established level of the reserve [6].

Table 2

Credit classification [6]

Debt repayment Financial condition (class)	Good	Weak	Insufficient
А	Standard	Under control	Substandard
Б	Under control	Substandard	Questionable
В	Substandard	Questionable	Hopeless
Г	Questionable	Hopeless	Hopeless
Д	Hopeless	Hopeless	Hopeless

The standard loan debt reserve is formed quarterly at the expense of last year's earnings. Provision for non-standard debt - at the expense of expenses in the quarter in which the loan was provided. If the estimated amount of the reserve is reduced, the Bank directs the excess amount to increase revenues.

Table 3

Levels of provision for loan groups [6]

Groups of loans	Reserve Level (Risk Level)
- standard loans	1%
- loans under control	5%
- sub-prime loans	20%
- Doubtful loans	50%
- bad loans	100%

Credit risk indicators at the macroeconomic level should be considered on the basis of the indicators presented in Table 4.

Thus, an analysis of the situation pre-crisis 2009-2010 showed that one of the reasons was the rapid increase in lending in the pre-crisis years, when the share of total credit portfolio of Ukrainian banks in assets exceeded 85% at the generally accepted safe level of 65-70%. and the loan portfolio to GDP ratio reached a maximum of 83.6%. This trend is observed today.

Table 4

Credit Risk Indicators of Ukrainian Banks in the period 2009–2017,% [7]

Indicators	Years								
	2009	2010	2011	2012	2013	2014	2015	2016	2017
The ratio of loans to GDP	83,6	81,8	67,4	61,2	55,9	59,9	64,2	48,8	42,21
Share of loans in total assets of Ukrainian banks	85,5	84,9	80,1	78,1	72,3	71,3	76,4	76,9	57,90
The ratio of reserves to loans granted	6,1	16,4	19,7	19,1	17,3	14,4	20,4	33,3	48,15
Share of overdue credit debt	2,3	9,4	11,2	9,6	8,9	7,7	13,5	22,1	55,11

Thus, the share of overdue credit indebtedness as of 01.10.2018 amounted to 56, 44%, the share of reserves to the granted periods during the same period amounted to 33,29%.

An important role in assessing the level of credit risk belongs to its regulatory values, which are intended to prevent its excessive concentration in banks.

The Bank's economic standards, as evidenced by the NBU, form the basis of a system of limits set to limit and minimize credit risk in banks.

According to the official data, throughout January 1, 2011 - October 1, 2018, banks' compliance with almost all credit risk norms is observed (Table 5).

Table 5

Analysis of compliance by banks of Ukraine with credit risk standards for the period 2011-2018,% [7]

Normative	Years							
	2011	2012	2013	2014	2015	2016	2017	2018
Standard for maximum credit risk per counterparty (H7)	21,56	21,04	20,76	22,10	22,33	22,01	22,78	20,49
High Credit Risk Ratio (H8)	169,21	161,21	164,46	172,91	172,05	250,04	364,14	233,41
Maximum Credit Risk Ratio for Bank Related Transactions (H9) (Introduced by the Resolution of the Board of the National Bank of Ukraine dated June 8, 2016 # 361)							31,19	19,94

Thus, a retrospective analysis of the current state of credit activity of Ukrainian banks allows to identify the following negative aspects, which necessitate strengthening of control over credit risks and finding ways to minimize them: deterioration of the quality of banks' credit portfolios, which is manifested in the increase in the share of overdue and negatively classified debt; significant volumes of loans issued by banks are denominated in foreign currency, which in case of depreciation of the national currency leads to an increase in debt load on borrowers and an increase in the level of credit risk; increase of credit risk in the banking sector of Ukraine for transactions with bank related entities.

Credit risk management techniques should be considered at the micro, macro and meso levels.

Microeconomic methods of credit risk management include: at the level of individual credit - analysis (creditworthiness of the borrower and individual credit), structuring, documentation, control; at the loan portfolio level - diversification, internal banking limits, provisions, securitization, hedging.

At the macroeconomic level, it is advisable to divide the methods of bank credit risk management at the national level (creation of state guarantee funds, unification of legislative and regulatory framework, integration of the information space in the state) and at the level of the banking system of Ukraine (monitoring of credit risk of the banking system, supervision of credit accumulation).

The level of credit risk management is of the greatest interest as it leads to the unification of credit risk assessment and management approaches through the development of measures for international financial information interaction, the creation of stabilization funds and the definition of international credit ratings.

The conducted research shows that in Ukraine it is necessary to continue work on minimizing credit risk both at the level of banks and at the legislative level. As at present the processes of credit risk minimization in Ukraine have specific features and problems, which have been specified above, the development of an effective tool for minimizing credit risk of banks, taking into account the identified shortcomings and outlined prospective ways of minimizing it, should be considered as a relevant direction for further research.

The internal and external factors, which in the short term may lead to an increase in credit risks in the activities of banks, include:

– unstable socio-economic and political situation in the country;

– insufficient effectiveness of preventive control and early response measures;

– lack of a single financial information space as a nationwide system for collecting, processing, storing and analyzing information about borrowers;

– the imperfection of domestic legislation on the settlement of bad debts;

– instability of the client base;

– a significant amount of foreign currency denominated loans, which in the event of a devaluation of the national currency increases the debt load on individual borrowers;

– volatility of foreign markets, etc. [13].

The process of minimizing banks 'credit risk is also adversely affected by the imperfection of the legislation on creditors' rights protection. Banks do not have sufficient leverage to act on unscrupulous borrowers, who in various ways evade their commitments and hinder the Bank from exercising its right to satisfy its loan requirements. Commercial banks' ability to dispose of collateral is very limited. Bill 1558-1, in addition to the conditions for the restructuring of foreign currency loans, also contained a two-year moratorium on the alienation of mortgaged property of debtors and guarantors.

The issue of effective credit risk management is one of the major problems for each individual bank and the banking system of Ukraine in general, as lending operations account for the largest share of banking operations and generate the highest revenue for banks and require greater efforts by bank executives optimal risk management for these operations, since credit risk is a leading position in the banking risk system.

To create effective credit risk management, it is necessary to improve the existing methodological basis for managing the bank's credit risk and to create a single methodology for assessing the borrower's creditworthiness, as well as the algorithm for forming credit procedures by banks.

Credit protection is a common way of selling credit. The Bank, based on its assessment of the loan portfolio, may sell some of the loans provided to other investors. Through this transaction, the bank is able to repay the funds that were invested in credit (in whole or in part). The effect of such operations is multifaceted. First, by selling low-yield assets, resources are released to finance more profitable assets; secondly, asset sales slow down the growth of bank assets, which helps the bank's management to strike a better balance between the increase in bank capital and the risk associated with lending; third, this reduces the relevant items of the bank's balance sheet (those that characterize its performance not on the best side).

So a number of US banks use a credit rating system built on four groups of key indicators:

- firm liquidity;
- capital turnover;
- raising funds;
- profitability indicators.

Another method of minimizing credit risk used by banks and requiring reliable information about the borrower is insurance.

The database is constantly being updated, and the advent of computers has greatly simplified the technique of administering the database, although costs have increased financially.

The task of Ukrainian banks is to use the experience already developed by developed countries. First, it is already proven in practice; secondly, it will save money and time for the banking system; thirdly, it can serve as a basis for modern developments of domestic specialists.

Therefore, it should be noted that solving the problem of credit risk management requires theoretical developments in this field and practical skills of bank employees to analyze and minimize the possible costs associated with credit activity, refusal of banks from fast loans, the use of more transparent and effective methods of verification solvency and solvency of borrowers. It is also necessary to draw on the experience of foreign banks in managing credit risks.

Therefore, to ensure the efficiency of banking activities, which is a priority in the current conditions of development of the country, the transition to a system of credit risk analysis and management is necessary. This requires improvement of the credit risk management system, both from the banks and from the banking regulatory and supervisory body.

The main vectors of public credit risk management policy should be:

- improving the legal framework based on common principles of credit risk management and ensuring its harmonization with the requirements of the Basel Committee;

- introduction of differentiation of credit risk standardization and application of relevant norms in banking regulation mechanisms;

- expanding the scope of research and development of methods, models, techniques of analysis and assessment of credit risk, forecasting its development;

-development of general management technology based on risk-oriented approach;

- improvement of the monitoring system in the direction of providing information base for credit risk assessment;

- introduction of new effective forms of analysis, assessment, examination and control of credit risk at different stages of the credit process;

-formation of a modern institutional and infrastructure base for regulating credit activity and risk management itself;

- improvement of the education system and provision of training of specialists in the field of credit risk management;

- development and implementation of risk culture, public discussion and awareness of bank employees.

For banks, the following areas are: - the transition from credit risk management of individual loans to risk management of the credit portfolio, as in a crisis environment generally accepted approaches to risk management lose effectiveness. The essence of the portfolio concept is to diversify and suggest that portfolio risk may be lower than the risk of each of its components due to the allocation of resources among various assets [13].

Application of the portfolio concept in the work of the bank will allow to achieve the following credit risk management measures:

1) eliminate the factors that caused the greatest losses from bad loans, in particular through the specific definition of the target market; significant concentration of credit investments in the context of borrowers, industries or regions; untimely application of measures

of response by employees of the credit department to indicators, which indicate the insolvency of the borrower; absence of legal procedures for termination of the credit agreement with the least negative consequences;

2) determine the maximum amount of problem loans, which can be calculated as the ratio of the amount of projected losses (carried out through the analysis of migration of problem loans) to the total volume of loans in dynamics;

3) introduce credit concentration limits in the context of borrowers, industries or regions by structuring credit operations, determining their optimal amounts and terms; - Analytical management of the assets and liabilities of the bank in terms of balancing their terms, because the use of attracted funds for certain transactions should be similar to the ways of their mobilization. This prudent approach will prevent excessive spending of risky operations and will encourage them to refuse them, limited to a certain percentage of each profit center. Optimal definition of "profit centers" (profit zones) is also very important as they help to solve the problem of arrears.

Thus, we consider the conceptual directions of credit risk management of the bank and their implementation, along with the improvement of the method of assessing the creditworthiness of the borrower and working with problem loans, are the basic basis for optimizing lending at the micro level and intensifying lending to the real sector at the macro level. Only a comprehensive implementation of these measures, in our view, will be able to provide better credit risk management in the conditions of economic growth and in crisis conditions in the economy, and thus to achieve effective functioning of banks on the basis of increasing their level of profitability. At the same time, this is only possible through the combined efforts of the NBU, the state and banks. Due to the fact that the function of banking supervision in our country is entrusted to the NBU, the further direction of the development of banks' credit risk management system and the effectiveness of their credit policy will depend on the effectiveness of its implementation.

Credit risks carry the greatest risk for commercial banks in the context of securing and maintaining their financial soundness, so the introduction of new, more efficient methods of assessment, management and, therefore, the prevention of credit risks should be a priority for the development of the Ukrainian banking system. In addition, there is a need to continue working to minimize credit risk, both at the commercial banks and at the legislative level. In particular, further research is needed on the use of integrated credit risk management systems, which are a vital element of commercial bank management.

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