

**APPLICATION OF QUANTITATIVE  
AND QUALITATIVE METHODS IN RISK  
MANAGEMENT OF CREDIT PORTFOLIO  
IN THE CONDITIONS OF THE BANKING SYSTEM  
OF THE REPUBLIC OF TAJIKISTAN**

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**Key words:** credit risk, credit portfolio, overdue debt, risk management, analytical and statistical methods, legal entities.

**Abstract**

In this article, an analysis of the fundamental methods of risk assessment and risk management of credit portfolio is conducted. In particular, complex and qualitative methods of risk management of credit portfolio studied in details, namely analytical, statistical and coefficient methods. Based on the coefficient method the author proposes a number of standards for the assessment of potential losses in credit activity.

**JAKOŚCIOWE ORAZ ILOŚCIOWE METODY W ZARZĄDZANIU RYZYKIEM  
KREDYTOWANIA W WARUNKACH SYSTEMU BANKOWEGO  
REPUBLIKI TADŻYKISTANU**

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**Słowa kluczowe:** ryzyko kredytowe, portfolio kredytowe, należności przeterminowane, zarządzanie ryzykiem, metody analityczne i statystyczne, podmioty prawne.

**Abstrakt**

W artykule zaprezentowano główne metody szacowania i zarządzania ryzykiem kredytowym. Odniesiono się do metod ilościowych przydatnych w szacowaniu i zarządzaniu ryzykiem. Wykorzystując zależności korelacyjne, zaprezentowano podejście ograniczające straty w działalności kredytowej.

## Introduction

Especially now days conditions of the banking sector principles of effective crediting and reliable methods of assessing credit risk acquire special importance.

Methods and tools to manage credit risks have passed a long process of development. Originally quantitative assessment of credit risk was limited by the determination of only the nominal value of the loan (BELYAKOV 2003). Subsequently, the ways to determine the cost of the credit product with considering the risk have been developed and the system of rating assessment of creditworthiness of the borrower became widespread (MATUTES, VIVES 2000). The current stage marked by the introduction of internal bank models of qualitative and quantitative risk assessment of loan portfolios (GONZALEZ 2005).

Delayed or not at all paid payments can lead to problems in cash flow and adversely affect the liquidity of the bank (ASSELT, ORWIN 2011). That is why bank should not only assess the risks related to untimely return or absence of return of issued credits, but also manage these risks (ELSINGER et al. 2004).

The process of credit risk management includes the following stages:

- quantitative assessment and monitoring of risk;
- selection and implementation of measures to change the amount of risk;
- control over the level of risk and the effectiveness of measures taken.

When performing last two stages it is necessary to:

1) constantly conduct comprehensive analysis of banking capabilities on assessment, administration, supervision, control and repayment of credits, safeguards and other credit instruments;

2) determine the adequacy of financial information received from the borrower and used in deciding whether to grant a credit;

3) periodically reassess the risks of each credit;

4) facilitate effective credit portfolio management, which can be achieved by bank with carrying out of not too restrictive credit policy;

5) assess the characteristics and quality of the credit portfolio;

6) timely detect the presence of the factors leading to a deterioration of the credit culture;

7) analyze the adequacy of established reserves for possible credit losses.

Efficient credit portfolio management can be achieved if:

– during setting a limit on the total amount of issued credits first of all will be considered such factors as the demand for credit, fluctuations of deposits and credit risks;

– stimulate the diversification of the credit portfolio and contribute to finding a balance between the maximum income and minimum risk by

construction of an appropriate mathematical model, in which along with credit risks are taken into account such factors of market risk as interest rates and exchange rates;

- allow some deviation from the established standards in case if there are constraints in percentage ratio of credits, issued to the commercial sector, the real estate sector, individuals and other credit categories (COLLETAZ et al. 2013);

- when choosing types of credit instruments not only rely on the experience of employees of the credit department, but also on the structure of the bank deposits and expected credit demand. In this case should be controlled or not issued at all certain types of credits, issuing of which previously led to the unexpected losses;

- use the differentiation of interest rates on various types of credits, basing this on changes in the values of costs and competitive factors. Interest rates should be sufficient not only to cover the costs of the bank on attracting resources and possible losses, but also provide an acceptable profit margin;

- identify and recognize the weakening of credit, especially in cases where there is a likelihood that the bank will not be able to get certain amounts in accordance with the conditions of the contract. Such weakening can be taken into account through reduction of the book value of the credit to the value of its implementation (based on the results of assessment) by the partial write-off or by introducing of relevant costs in the profit and loss report (creation of reserves);

- In the case of receiving incomplete and inaccurate financial information from the borrower a credit should be issued on condition that as the source of payments will be used liquid collateral. Here is necessary to have directives on financial reporting which have the auditor's conclusion and which does not have such. There should be established procedures for the analysis of credits by external auditors in order to provide periodic adjustment of the data.

### **The aim of the article – research approach**

The aim of this article is to set up the approach in reducing the level of risk activity of commercial banks. The complex formulas calculating the bank credit portfolio were elaborated and discussed.. Author refers to quantitative and qualitative methods that should be considered in risk management at commercial banks of the Republic Tajikistan.

## **The basic functions of commercial bank in the respect of risk**

As the credit function of the bank focused on the execution of following three main tasks:

- loans should be issued on a reasonable basis and with the confidence that they will be repaid;
- funds should be invested profitably in the interests of shareholders and investors;
- must satisfy the reasonable credit demand of borrowers (legal entities and individuals);

to test whether credit decisions are successful it is required periodically to analyze them, by selection of about 70% of the total amount and 30% of total bank credits. Analysis should also be subjected to at least 75% (in total) and 50% (by number) of foreign currency credits and all loans with a maturity of over one year. In addition, a detailed analysis of the quality of credit portfolio should cover:

- all credits to borrowers, amount of which is more than 55% of the total capital of the bank;
- all credits to shareholders and entities related to the bank;
- all credits, interest rates or repayment conditions which have been renegotiated or changed since the granting of the credit;
- all credits where payment of interest and (or) the principal amount is overdue by more than 30 days ( $PAR > 30$ ), including those credits on which interest was capitalized or prolonged;
- all credits, classified to categories as nonstandard, doubtful or problematic.

By such analysis it is necessary to assess the probability that the credit will be repaid and the fact that the classification of credit has been set by the bank in accordance with the rules of this method (ZHARIKOV et al. 2009).

The quality of the total credit portfolio and consequently the quality of credit decisions is determined by the size of the bank's portfolio of non-performing credits. Credits are considered non-performing when principal amount or interests on them overdue and not paid within 90 days or more. Assessment of the overall level of reserves in terms of non-performing credits shows how well the bank can handle credit risks (FINUCANE, HOLUP 2006).

When analyzing the portfolio of non-performing credits it is necessary to:

- classify credits (including principal amount and interests) by delay in payment of more than 30, 90, 180 and 360 days; by type of client and the nature of its economic activity in order to identify common trends and their impact on each borrower;
- find out the reasons of credit portfolio quality deterioration, the analysis of which will help to develop the necessary measures to change this situation;

– especially analyze all important information on non-performing credits in order to determine whether the situation is reversible, what can be done to increase the likelihood of credit repayment and were there any action to recover the funds (KOSTYUCHENKO 1990);

– check whether the level of reserves is sufficient for repayment of non-performing credits;

– determine by using of analytical method how the assets quality deterioration effect in the profit and loss of the bank.

There are many problems (other than those above) leading to a deterioration in the quality of the credit portfolio, the main ones are:

1) private interests (issuing of credit in excess of established limits to the management board members or major shareholders of the bank);

2) non-compliance with the principles of credit policies (issuing of overly risky credits or issuing credits on unsatisfactory conditions with full consciousness that credit principles are violated. In this case reasons may be the desire to get more profit, competitive pressures in the key markets of the bank or personal conflicts of interests.);

3) incompleteness of credit information (the borrower must be requested to provide all necessary financial reports, including that ones, which are not of an official nature. Credit file (folder) should contain information about the purpose of the borrowing, information for assessing risks, reports on the status and supervision of credit – monitoring, expert reports and minutes of meetings from discussions on credit) (HAO WANG et al. 20013);

4) loss of mindfulness (usually expressed as a lack of control over the old and familiar borrowers, confidence in the verbal information, ignoring the signs of anxiety in regard to the borrower, economy, region, industry sector, etc.);

5) lack of supervision (ineffective supervision invariably leads to the fact that the bank has incomplete information about the actions of the borrower over the duration of the credit. As a result, the initially secure credits can create problems or cause damages. In this case, to such an outcome could affect the principle “Loss of the sense of responsibility of the borrower”);

6) incorrect identification of risks at an early stage of their warnings by risk manager.

The most important issue for the bank is to assess and regulate the riskiness of credit portfolio as one of the main directions of effective management of credit activities of the bank. The main purpose of credit portfolio management is ensuring maximum profitability at a certain level of risk.

## The typical risk assessment according Tajikistan regulation

Risk assessment methodology of bank credit portfolio includes:

- qualitative analysis of aggregate credit risk of the bank, which consists of identifying risk factors (revealing of its sources) and requires deep knowledge, experience and intuition in this field. Speaking on the quality assessment of the bank credit portfolio also should be taken into account the availability of connected crediting and credit risk concentration;

- quantitative risk assessment of the bank credit portfolio, which involves determining the level (degree) of risk. Credit risk degree is a quantitative expression by which the bank assess the creditworthiness of borrowers and credit operations in general.

Qualitative and quantitative risk assessments of the credit portfolio are held at the same time, where analytical, statistical and coefficient methods are used to assess the risk of bank credit portfolio.

The analytical method is an assessment of possible losses (risk level) of the bank and carried out in accordance with the Instruction No. 177 of National Bank of the Republic of Tajikistan (hereinafter NBRT) “On procedure of forming and use of the reserve for potential losses and the fund to cover possible losses on loans”.

Methods of risk assessment of the bank credit portfolio in accordance with the Instruction No. 177 NB of RT provides an assessment of the risk level for each credit operation, taking into account the financial status of the borrower, his/her maintenance of credit debts and the quality level his/her maintenance. Then the loan should be classified into one of five categories of quality:

- I (the highest) quality category (standard loans);
- II quality category (non-standard loans);
- III quality category (doubtful loans);
- IV quality category (insecure loans);
- V (the lowest) quality category (uncollectible loans).

**Statistical assessment method** of the risk amount of bank credit portfolio allows assessing the risk level of credit portfolio on the basis of previous cases of occurrence of credit risks and the general state of the portfolio in the past. Statistical values show the importance of each characteristic for determining the level of risk.

The assessment of credit risk using the method of statistical analysis implies that the total risk exposure of the credit portfolio is reflected in its quality. Such an assertion provides a basis to interpret the variation of credit risks in relation to the agreements, constituting the bank credit portfolio, as a general indicator of the riskiness of credit activities.

The essence of the statistical method is as follows:

- statistical analysis of credit risks in relation to agreements, constituting the bank credit portfolio;
- characteristics of dispersion level of credit risks in the loan portfolio;
- establishing the magnitude and the frequency of credit risk.

The main tools of the statistical method for calculation and assessment of risks of bank credit portfolio are known from the general theory: dispersion, variation, standard deviation, the coefficient of variation and asymmetry (GOLDBERG 1990).

The probability of realization of the bank credit risk is characterized by a probability distribution. The basic statistical indicator for identification of such probability (risk level) is the standard deviation or coefficient of variation. Calculation of weighted average credit portfolio risk, its variance and standard deviation allows tracing the level of diversification of the bank credit portfolio (ROSE PETER 1995).

The use of such statistical values like positive and negative semi-variance, positive and negative average semi-quadratic deviation, as well as calculation of the asymmetry relatively to credit risks in relation to agreements constituting the credit portfolio gives the opportunity for the bank to determine the frequency of losses, depending on the number of cases with occurrence of relevant losses and the total number of risky cases in statistical data. The total losses from credit operations can be assessed as the total amount of the obligations of the borrower (or a group of borrowers) before the bank, multiplied by the probability of losses during the credit operations. Under the probability of losses from credit operations is understood the average (for the previous three-year period of bank performance) share of non-repaid credits and non-fulfillment of other liabilities by clients (or group of clients), which have similar characteristics, level of creditworthiness, the same level credit rating.

Statistical method for risk assessment of the bank credit portfolio is based on the analysis of statistical data related to the financial status of borrowers over a certain period of time. Such a study is the basis for the comparison of the actual frequency of the bank losses occurrence (which significantly affect the quality of credit portfolio) with predicted estimates.

The third method of risk assessment of the credit portfolio is the coefficient method. The essence of the method is to calculate the relative indicators to assess credit risks included in the bank credit portfolio, also to assess the calculated values which are compared with the normative assessment criteria, and on this basis the level of risk of the overall bank credit portfolio is determined qualitatively and quantitatively.

The complexity of applying the coefficient method for assessing the overall risk of bank credit portfolio occurs when comparing the calculated parameters

to standard values, since the values of some calculated indicators may correspond to the relevant normative criteria, and others – not. In this case should be selected a general indicator for determining the risk level.

A comprehensive risk assessment of bank credit portfolio envisages simultaneous conducting of quantitative and qualitative assessments of the credit risk.

### Formulas of risk assessment

The optimal method of quantitative risk assessment of the bank credit portfolio is a methodology for assessing the risk degree of bank credit portfolio. This is a mathematical procedure for structuring and provision of hierarchical set of indicators that determine the actual level of risk and provide the ability to choose effective methods of its regulation. The process of building an integrated system of risk assessment of bank credit portfolio starts with the formation of the hierarchical structure of these integral indicators.

Possible (expected) amount of losses on the credit portfolio – is the most important characteristic of credit risk, because it is the center of the probability distribution. The importance of this indicator lies in the fact that it shows most plausible value of the risk level, and is defined as follows:

$$S_p = \sum_{i=1}^n S_i \times p_i(c)$$

the formula for calculating of the expected absolute value of the losses on the credit portfolio in general, where:

$S_i$  – amount of issued credits to the group  $i$  of counterparties (by industry sector),

$i = 1, n$ ;

$p_i(c)$  – credit risk relative to group  $i$  of counterparties.

This indicator is a generalized quantitative characteristic, which does not allow making a decision about the application of the basic methods of credit portfolio risk management (diversification or concentration). However, to make a decision it is necessary to determine the degree of variability of the credit portfolio risk. For this purpose two closely related categories: dispersion and standard deviation are applied, for calculations of which it is necessary to determine the average weighted risk of bank credit portfolio by the following formula:



$$\partial = \frac{\sum_{i=1}^n s_i \times p_i(c)}{\sum_{i=1}^n s_i} = \frac{s_p}{\sum_{i=1}^n s_i}.$$

The above indicator is the base value for the calculation of the credit risk variation in relation to agreements of group  $i$  of counterparties, which constitute the bank credit portfolio.

The dispersion of credit risk in relation to agreements of group  $i$  of counterparties, which constitute of the bank credit portfolio can be defined as follows:

$$V(p) = \sum (P_i(c) - \partial)^2 \times \frac{S_i}{S},$$

where:

$S = \sum_{i=1}^n S_i$  – i.e. the sum of the overall bank loan portfolio in the equivalent.

The above indicator represents the variation of the characteristic throughout researched set under the influence of all the factors contributing to this variation.

The results of the analysis are more visible if the indicator showing the spread of a random variable expressed in same measure units as the random variable itself. For these purposes is used the standard deviation of credit risk in relation to agreements of group  $i$  of counterparties, which constitute the bank credit portfolio:

$$\sigma(p) = \sqrt{V(p)},$$

The calculation of this indicator allows determining closeness of relationship between productive and grouping factor characteristics. It has the following limits:  $0 < \sigma(p) < 1$ , otherwise, calculation of deviation would be incorrect – mathematical error. If  $\sigma(p)$  tends to 0, grouping characteristic less and less effect on the productive characteristic, if  $\sigma(p) \rightarrow 1$  – the changes of productive characteristic more and more varies depending on a grouping characteristic.

Dispersion and standard deviation characterize the level of credit risk dispersion in relation to credit agreements and the average weighted risk of the credit portfolio. These indicators show the diversification of the credit portfolio in relation to the risk. The larger are the values of dispersion and standard deviation, the more diversified is the bank credit portfolio in relation to risk. Dispersion and standard deviation show the level of dispersion of credit risk in relation to credit agreements both in a better way (their values are less than

< average weighted credit portfolio risk) and worse (their values are more > than the average weighted credit portfolio risk). Therefore, these indicators do not give an opportunity to clearly assess the degree of riskiness of the credit portfolio. For this purpose, it is more expedient to use such indicator of risk as semi-variance.

Depending on the result of the deviation of credit risk in relation to the agreements of the credit portfolio from average weighted credit risk, semi-variance of risk on credit agreements may be positive or negative.

Positive semi-variance of credit risk in relation to agreements on the group  $i$  of counterparties, which constitute the credit portfolio can be defined as:

$$\text{PSV} = \sum_{i=1}^n t_i^2 \times \frac{S_i}{S},$$

where:

- $n$  – volume of credit portfolio (number of agreements from all customer groups of bank);
- $t_i$  – positive deviation of credit risk in relation to agreements (constituting the bank credit portfolio on the group  $i$  of counterparties) from the average weighted credit risk, i.e.:

$$t_i = \begin{cases} 0, & p_i(c) \geq \partial \\ p_i(c) - \partial, & p_i(c) < \partial \end{cases}$$

Negative semi-variance of credit risk in relation to agreements on the group  $i$  of counterparties, which constitute the credit portfolio is defined as:

$$\text{NSV} = \sum_{i=1}^n l_i^2 \times \frac{S_i}{S},$$

where:

- $n$  – volume of credit portfolio (number of agreements from all customer groups of bank);
- $l_i$  – negative deviation of credit risk in relation to agreements (constituting the bank credit portfolio on the group  $i$  of counterparties) from the average weighted credit risk, consequently:

$$l_i = \begin{cases} 0, & p_i(c) \leq \partial \\ p_i(c) - \partial, & p_i(c) > \partial \end{cases}$$

Also, positive and negative semi-quadratic deviation of credit risk in relation to agreements (constituting the bank credit portfolio on the group  $i$  of counterparties) should be determined. For this purpose the following formulas can be used:

$$psv = \sqrt{PSV}, nsv = \sqrt{NSV}$$

where:

$psv$  – positive average semi-quadratic deviation of credit risk in relation to agreements (constituting the bank credit portfolio on the group  $i$  of counterparties);

$nsv$  – negative average semi-quadratic deviation of credit risk in relation to agreements (constituting the bank credit portfolio on the group  $i$  of counterparties).

The higher is the positive semi-variance (positive average semi-quadratic deviation) of credit risk in relation to agreements on credit portfolio and the lower is their negative semi-variance (negative average semi-quadratic deviation), the lower is the level of credit portfolio risk.

The use in the analysis of only two indicators (average and standard deviation) can lead to incorrect conclusions. The standard deviation inadequately characterizes the risk of shifted distributions, because it is ignored that the majority of variability accounted for a “good” (right), or “bad” (left) side of the expected profitability. Therefore, when analyzing asymmetric distributions take an additional indicator – the coefficient of asymmetry of credit risk in relation to agreements (constituting the bank credit portfolio on the group  $i$  of counterparties). It is a normalized value of the third central moment and determined by the formula:

$$a = \frac{\sum_{i=1}^n S_i}{S} \times (p_i(c) - \bar{p})^3 / \sqrt{V^3(p)} - \text{the asymmetry coefficient}$$

The lower is the coefficient of asymmetry ( $a$ ), the lower is the risk of the credit portfolio, as unfavorable deviations of credit risk in relation to credit portfolio agreements from the average weighted credit portfolio risk with a relatively large weight placed on the right are the closest to the average weighted credit portfolio risk (deviates less from it to an unfavorable direction). In turn, the respective (favorable) values of the credit risk in relation to credit portfolio agreements are far removed from the average weighted portfolio risk.

The value of risk of the bank credit portfolio can be determined by the relative values (as a percentage of portfolio), which express the degree of uncertainty in the implementation of management decisions, show the structure of the credit portfolio, acting as a qualitative characteristic of bank credit risk.

In relative values, the risk of bank credit portfolio can be defined as follows:

$$K_P = \frac{K_1 + K_2}{2} = \frac{K_1 + K_{21} + K_{22} + K_{23} + K_{24}}{2},$$

where:

- $K_1$  – volatility of the credit portfolio risk;
- $K_2$  – the proportion of loan debts, which are non-standard, in aggregate amount of issued credits;
- $K_{21}$  – the proportion of non-standard loans in the total credit portfolio;
- $K_{22}$  – the proportion of doubtful loans in the total credit portfolio;
- $K_{23}$  – the proportion of problematic loans in the credit portfolio;
- $K_{24}$  – the proportion of insecure loans in credit portfolio.

The indicator characterizing the variability of the tendency of risk level at a given time interval is the volatility of the risk of the credit portfolio, defined as follows:

$$K_1 = \frac{\partial \times nsv}{psv}.$$

Volatility of aggregate credit risk is a indicator based on the standard deviation of credit risk in relation to agreements (constituting the bank credit portfolio on the group  $i$  of counterparties).

The use of this indicator in comparing the degree of risk of bank credit portfolio in different periods of assessment makes it possible to determine the risk diversification (concentration) of the bank credit portfolio. It can show clearly in what direction and to what extent the quality of the credit portfolio changes.

Indicator characterizing quality of the bank's credit portfolio management is  $K_2$ , which is the proportion of loan debts that are non-standard in the total amount of issued credits. This coefficient is calculated by summing the  $K_{21}$ ,  $K_{22}$ ,  $K_{23}$ ,  $K_{24}$ , the calculation of which is required for the identification of factors of changes in proportion of loan debts that are non-standard.

One of the first indicators characterizing quality of the bank credit portfolio is the proportion of non-standard loans (PAR < 30) in the total volume of credit portfolio:

$$K_{21} = \frac{\text{non - standars loans}}{\text{the total volume of bank credit porfolio}} \times 100.$$

Reducing of this coefficient gives a signal for the bank that it is necessary to increase the monitoring efficiency of counterparties' financial status, which own the largest loans.

The next step in the calculation of the proportion of overdue debts in the total bank credit portfolio is to determine the proportion of doubtful loans in the total volume of bank credit portfolio:

$$K_{22} = \frac{\text{doubtful loans}}{\text{the total volume of bank credit porfolio}} \times 100.$$

For the bank it is important to monitor the clients experiencing some specific difficulties and control the volume of credit transactions with them. For this purpose it is necessary to determine the proportion of problematic loans in the credit portfolio.

$$K_{23} = \frac{\text{problematic loans}}{\text{the total volume of bank credit porfolio}} \times 100.$$

The value of this indicator should not exceed 5% of the net bank credit risk.

The most significant impact on the quality of the credit portfolio has the proportion of uncollectible loans as the risk from such operations is equal to the sum of total debt (100% of the risk).

$$K_{24} = \frac{\text{uncollectible loans}}{\text{the total volume of bank credit porfolio}} \times 100.$$

The value must strive to zero, and the high value of this indicator may adversely affect the liquidity of the bank.

According to the results of a comprehensive analysis of the aggregate bank credit risk can be determined its degree as follows (according to the recommendations of the Basel Committee).

Table 1

Qualitative risk assessment	Quantitative risk assessment
Acceptable risk level	0–20%
High risk level	more than 21%

Under the credit portfolio with an acceptable level of credit risk should be considered a credit portfolio that provides profitability to the bank even upon the occurrence of all possible risks. The credit portfolio of high risk is characterized by a level of risk for credit operations, the implementation of which in full threatens the overall functioning of the bank, i.e. in the case of the implementation of all the risks the own resources of bank are not enough to cover them, which could lead to the bankruptcy of the bank. However, taking into account the specifics of regional economic development, the banking business, political situation, this indicator can be revised on a time interval.

A comprehensive risk level assessment of the bank credit portfolio should be held not less than 1 time per quarter.

The following groups of credit indicators are used for ongoing monitoring of the credit portfolio and overall policy of the bank in general:

- profitability indicators of credit investments;
- quality indicators of credit portfolio management;
- indicators of the adequacy of reserves for covering potential losses;
- integrated indicators of aggregate credit risk of the bank.

Table 2

Coefficient	Description	Calculation	Formula	Standards
1	2	3	4	5
Profitability coefficients of credit investments				
The coefficient of net profitability of credit investments – K1	Allows assessing the profitability of the credit portfolio.	Interest income – Interest expense / Amount of the credit portfolio.	$I_i - I_e / CP \text{ total} \cdot 100\%$	> 0.75 (monthly)
The coefficient of net profitability of Capital K2	Shows the proportion of interests of Bank margin in its capital (invested funds in the banking business)	Interest income – Interest expense / Bank Capital	$I_i - I_e / C \text{ total} \cdot 100\%$	> 3 (monthly) > 36 (annual)
The coefficient of net profitability of assets K3	Shows net profitability of all assets of Bank	Interest income – Interest expense / Asset	$I_i - I_e / A \cdot 100\%$	> 0.5 (monthly)

cont. table 2

1	2	3	4	5
The coefficient of net profitability of credit investments K3.1		Interest income – Interest expense / Credit investments bringing income – “working assets”	$I_i - I_e / S(+)$ · 100%	> 0.925 (monthly)
The coefficient of overall profitability of “working assets” K4	Characterizes the real profitableness of credit investments	Interest income (received) / Credit investments bringing income – “working assets”	$I_i / C(+)$ · 100%	> 2.2 (monthly)
The coefficients of the quality of management of bank credit portfolio				
The coefficient of useless credits in the Bank’s assets K5	Characterizes the quality of the bank credit portfolio management in relation to volumes, non-performing credit investments, credits with prolonged and overdue payment dates	Credit investments, not bringing income / Bank’s assets	$C(-) / A$ · 100%	< 0.5
The coefficient of proportion of overdue debts in the Bank’s assets K5.1.		Overdue credits / Assets	$C_{overdue} / A$ · 100%	< 1.5
The coefficient of useless credits in credit portfolio K6	Details the assessment of the quality of credit portfolio management	Credit investments, not bringing income / Total credit investments (the volume of credit portfolio)	$C(-) / C_{total}$ · 100%	< 1.5
The coefficient of the proportion of overdue debts in credit investments K6.1	Characterizes the quality of the loan portfolio	Overdue debt / credit investments	$C_{overdue} / C_{total}$	< 5%
Coefficient of total credit portfolio K7	Demonstrates the degree of aggressiveness of the bank’s credit policy, insufficiency or overloading of its credit portfolio. It is considered that if the level of this indicator exceeds 65%, the bank’s credit portfolio is overloaded and there is a requirement for reorientation of credit resources in the other	Total credit investments / Assets	$C_{total} / A$ · 100%	50-75

cont. table 2

1	2	3	4	5
	direction, such as investment in Central Bank, the National Bank of Tajikistan.			
Coefficient of utilization of deposit funds K7.1.		Credit investments / Deposits	$C_i/D$	< 1
The coefficient of the flowing credit portfolio K8	Characterizes the proportion of short-term credit investments in the total credit portfolio.	Short-term credit investments/Credit investments	$C_{s-t./C_{total}} \cdot 100\%$	< 90
The coefficient of the current credit portfolio K8.1.	Characterizes the dynamics of growth of credit investments over the period	Credit investments for the current period/Credit investments for the previous period		Average value by system
The coefficients of reservation of credit portfolio				
Coefficient of the overall sufficiency of actual established reserves for possible credit losses (hereinafter RPCL) K9	Shows the actual degree of protection of the bank credit portfolio from the overall risk.	Actual established reserves for possible credit losses (RPCL)/Credit investments	RPCL actual/ $C_i \cdot 100\%$	> 10
Coefficient of the sufficiency of reserve K10	Characterizes the completeness (deviation) of established special reserve for covering potential losses on credits.	Actual established reserves for possible credit losses/ Estimated reserve for possible credit losses (according to this method)	RPCL actual. /RPCL estimated $\cdot 100\%$	> 100
Coefficient of the write-off of the credit from RPCL K10.1.	Characterizes the proportion of credits actually lost for the Bank (hopeless to repayment).	The amount of write-off from RPCL / Credit investments		< 1.5
Integrated indicators of aggregate bank credit risk				
Coefficient of "aggressiveness" of the Bank credit policy K11	This indicator shows the direction of the credit policy of the bank.	Credit investments /Raised funds of the Bank.	$C_i/R_f \cdot 100\%$	53-78
The coefficient of the overall risk of credit portfolio K12	Allows more clearly determine the quality of the credit portfolio in relation to credit risk.	(Credit investments – forecasted bank losses (FBL))/ Credit investments	$(C_i - FBL) / C_i \cdot 100\%$	> 90



cont. table 2

1	2	3	4	5
Normative coefficients: Amount of the credit risk for one or more (group of interrelated) borrowers K13.1		The aggregate amount of requirements of the Bank to the borrower (AARBB) or a group of interrelated borrowers in equivalent/Capital	AARBB/Cap. · 100%	< 25
Amount of the aggregate (major) credit risks K13.2		The aggregate amount of major credit risks (AAMCR)/Capital	AAMCR/Cap. · 100%	< 500

Source: own elaboration.

– If  $K11 > 70\%$ , we can assume that the bank carries out “aggressive” credit policy (in the aggressive policy the upper limit is – 78%, when exceeding this limit it means that the bank carries out unreasonably dangerous credit activity). If  $Ka < 60\%$ , this means that the bank carries out “cautious” credit policy (in cautious credit policy the lower limit is set at 53%, if the value of indicator is less than 53%, then it is likely that the bank can have a threat of shortfall in profits and can have losses);

– when calculating K12 the indicator FBL (forecasted bank losses) for the reporting date is determined as the aggregate amount of reserves for possible loan losses, loans and similar debts, formed in accordance with the instruction No. 177 NBRT. It is considered that the higher is the value of the forecasted bank losses, the higher is the risk in its credit activities and in the existing credit portfolio;

– when calculating K13.2, a large credit for a commercial bank is considered a credit, a loan or a letter of credit in the amount exceeding 5% of the bank’s capital (in accordance with standards, established by National Bank of Republic of Tajikistan).

Fourth, the final group of indicators (of aggregate risk of credit portfolio) is complex, integrated indicators of aggregate bank credit risk. These are the main indicators for assessing the quality of bank credit portfolio, for the characterization of the profitability of credit investments, for determination of the quality of the credit portfolio management and for analyzing the sufficiency of reserves for covering possible losses on credits. These indicators are called integrated because in their calculation are not used aggregates of financial coefficients from different groups.

The level of profitability of the bank credit investments with taking into account the coefficient of losses is reflected by the coefficient  $C_p$  (Credit profitability).

$C_p$  is calculated as ratio of the difference between net interest income and credit losses to total credit investments

$$C_p = (I_i - I_e - CL) / C_{i_{total}} \cdot 100\%$$

The coefficient of the quality of credit portfolio management (CQCPM) shows the risk degree of credit investments with regards to their distribution into risk groups, which is carried out on the basis of data on the duration of overdue loans and on the quality of the security for the credit.

This coefficient is defined as the ratio of the volumes of different groups of credits (weighted in order to define the risk degree on non-repayment of credit), to the total amount of credit investments, and is calculated using the formula:

$$CQCPM = \sum_{n=1}^n (X_n \cdot K_n) / C_{total} \cdot 100\%$$

where:

$n$  – is the number of credit investment risk groups.

The coefficient CQCPM allows numerically assessing the quality of credit portfolio management. However, at all advantages of this method of calculation it is not deprived of significant deficiency.

In order to address the deficiencies it is recommended to use other integrated indicator – the coefficient of total risk of bank credit (CTRBK), which takes into account the degree of sufficiency of reserve.

$$CTRBK = (C_{total} - CL) / C_{total} \cdot L1,$$

where:

L1 – the coefficient of sufficiency in establishing the reserve.

The coefficient L1 is calculated as follows:

$$L1 = (C_{total} - CL) / (C_{total} - FL).$$

If the difference between the indicators CL and FL (forecasted losses) is insignificant or absent, the value of the indicator L1 tends to one, i.e. the impact of this indicator on the value of the credit risk is close to zero. With the

indicator L1 it is real to show the impact of the factor of sufficiency in establishing the reserve for credits to coefficient of credit risk CTRBK. Substituting the indicator L1 in the formula for calculating of CTRBK, we get the following equation:

$$\text{CTRBK} = ((C_{\text{total}} - \text{CL}) * (C_{\text{total}} - \text{CL})) / C_{\text{total}} \cdot (C_{\text{total}} - \text{FL}).$$

The closer is the value of CTRBK to one, the better is the quality of the credit portfolio in relation to repayment and sufficiency of reserve. If CTRBK = 1, there is no risk and forecasted losses are equal to zero. The closer is the indicator CTRBK to the zero point, the higher is the value of the aggregate credit risk.

## Conclusion

According to the previously described method of calculation of the coefficient of aggregate credit risk (which considers the factor of sufficiency of reserve), the risk assessment of bank credit should take into account not only the possible actions of the borrower, which lead to the formation of the problem on loan debt, but also the application or lack of protective measures by the bank. These measures are characterized first of all by the amounts of required estimated reserve and actual established reserve for possible losses on credits.

We consider it necessary to carry out general monitoring of credit risk in the overall credit portfolio of the bank for the timely assessment of the “problemness” of credit portfolio, and also to carry out on a regular basis the analysis of the overall credit activities of the bank by regions.

In our opinion, this model is a comprehensive assessment of the level of possible losses on crediting, which allows the bank not only to limit the extent in amounts of issuing credits, but also to take into account the real solvency of client. This, in turn, will allow a commercial bank optimally structure its portfolio of assets in the aspect of credit operations.

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