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CREDIT PORTFOLIO MANAGEMENT OF COMMERCIAL BANKS: LITERATURE REVIEW

Jurayev Eldor Berdibekovich
Independent Researcher at Tashkent Kimyo Internatinal University

ABSTRACT
This paper examines the portfolio optimization of commercial bank credits. Efficient credit management is crucial for banking sector performance, especially after the mortgage bond crisis, which led banks to adopt more cautious lending and risk assessment practices. Credit portfolio quality reflects the role of lending in banking activities, the use of credit potential, and the risk level based on interest rates, margins, and loan performance. An optimal portfolio depends on economic conditions, bank risk tolerance, regulations, and borrower creditworthiness. Overall, it should be diversified, balanced, and aligned with national economic goals.
KEYWORDS: *Commercial Banks, Credits, Credit Portfolio, Management, Risks, Optimization.*

INTRODUCTION

Bank credit is one of the main sources of spending on productivity and economic services. However, because of the limitations in its amount, accurate planning is essential to optimize its allocation to applicants. On the other hand, successful functioning of the bank depends not only on workers' skills, their knowledge and experience, but also on the optimization of the whole process of making and implementation of management decisions. Modeling of bank financial activity is very important and difficult task, as the bank is a system in which deterministic and random processes take place simultaneously and that are interrelated by very complicated factors.

Furthermore, subjective management decisions are essential in bank activity. However, a bank interacts with the financial markets in the process of functioning, which are difficult to model. All these facts point at considerable complexity of creating an analytical model of bank financial activity, which can be used in practice.

The optimal credit portfolio in Uzbekistan's banking system would depend on various factors, including the current economic conditions, the risk appetite of the banks, the regulatory environment, and the creditworthiness of borrowers. However, in general, an optimal credit portfolio for banks in Uzbekistan should be well-diversified, balanced, and aligned with the country's economic development priorities.

Commercial bank may carry out credit, investment and other active operations only within available financial resources. Deposits are principal source of financial resources of commercial bank; they determine the scope and range of profitable operations of the bank. The main management instrument of credit activity is economic and mathematical methods and models.

It is important to say that attention must be given to the issue of risk and uncertainty in the distribution of bank credits. Risk is a part of banking due to the variety of banking operations, the status of bank capital, and limitations of its amount, the status of depositors' resources, and different financial status of each borrower. Risk management in banks is more sensitive and complex than risk management in other sectors of the economy. Risk recognition for each economic sector is of particular importance in the investment process of banks and financial institutions. By realizing the risks of each economic sector, banks can choose a set of economic sections, which ultimately decreases a portfolio's credit risk (Kuwornu et al., 2012; Wu & Liu, 2012).

Nevertheless, changing the structure of a bank's assets seems necessary. Banks must make arrangements by using appropriate portfolios to create conditions that allocate their credits in the best way possible by increasing the demand for loans (Eletter et al., 2010). Different methods can be used to determine optimum portfolios with a minimum risk and maximum returns. Markowitz portfolio theory has created a lot of changes in investor attitudes towards investing and is used as a powerful tool for optimizing portfolio combinations (Lai et al., 2006; Tlig & Dakhli, 2014).

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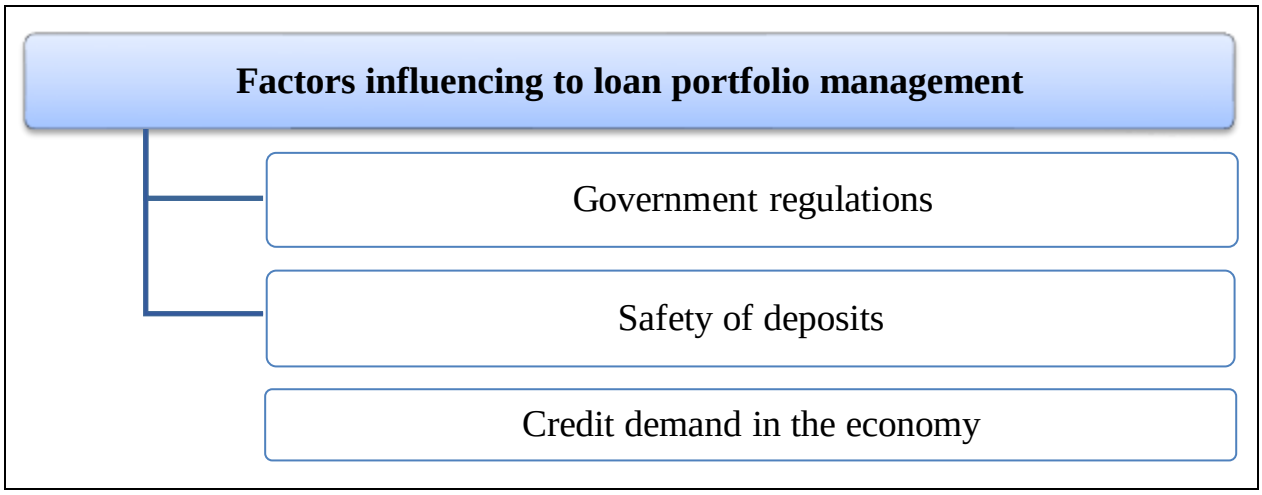
The prerequisite of building economic and mathematical model of a bank loan portfolio is the following conditions:

Table 1. The process of building economic and mathematical model to management loan portfolio[1]

Stages	The content of the stages for managing loan portfolio
Stage 1	The timing of the credit arrangement;
Stage 2	The calculation of annual and monthly crediting rates;
Stage 3	The determination of the conditions for loan repayment;
Stage 4	The determination of the home equity sum that can be used for the crediting process;
Stage 5	The determination of the risk magnitude as the probability of default of all types of credits
Stage 6	The use of current percent of credit repayments in the crediting process;
Stage 7	The determination of the period, at the beginning of which the calculation of profits is carried out;
Stage 8	Taking into account the liquidity ratios that regulate the credit activity of a commercial bank.

Based on the classic approach of modeling of credit portfolio, the paper focus literature review on models related to optimal structure of commercial bank loan portfolio. The purpose of this study is the demonstrate of existing models and the development of applied economic and mathematical model for finding profitable credit strategies of commercial banks.

Generally, three major factors influence the asset portfolio management behavior of banks, we can see in the below picture 1.



Pic 1. The major factors influence to portfolio behavior of banks

The main task of managing the efficiency of a bank is the task of optimizing the banking portfolio. For the purposes of this work, it is important to distinguish the concepts of "financial reliability" and "financial stability" of a banking organization (Zavyalova et al., 2017). In the authors' opinion, "financial reliability" characterizes the bank's ability to cover all current liabilities to customers (individuals and legal entities) at the expense of its own funds and reserves, without violating liquid liabilities.

LITERATURE REVIEW

Previous studies have reported the definitive modeling, and the next stage requires risk modeling without considering different economic conditions. Therefore, this study aims to provide a suitable model to help managers and bank officials achieve the best allocation of credits to applicants in different sections by considering economic conditions according to the limitations of the banking system. For this purpose, an interval non-linear multi-objective programming model has been used alongside a genetic meta-heuristic algorithm.

Internationally, K. Sealy, E. Baltensperger, H. Markowitz, M. Kleim, N. Murphy, N. Egorova, A. Smulov, and others drew on the problem of modeling of optimal loan portfolio. However, one of the most important tasks of

[1] *Nataliya Dzyubanovska (2014), "Optimization Model of Credit Strategy of Commercial Bank", The Russian Academic Journal | Vol. 28-2.*

commercial bank in the field of financial activity is to balance between profitability and risk and to find optimal combination in the form of trade-offs.

Given the importance of the selection and optimization of a portfolio, many studies have been performed in this field. For example, Jao (1971) used a linear programming model in an attempt to provide a model for the allocation of credit to Hong Kong's banks. In his study, the objective was to achieve the highest return on investment for Hong Kong's banks by considering constraints and limitations such as limitations of bank credits and legal restrictions. The results indicated that the obtained optimal model was different from the current pattern of banking credit distribution in different parts of the economy of Hong Kong. Chang et al. (2009) investigated portfolio optimization based on different scales for risk measurement and by using a genetic algorithm. Their main goal was to study the efficiency of the genetic algorithm for solving optimizing portfolio with different risk models. Their results indicate that smaller portfolios have better performance than large ones.

Agrana et al. (2014) used goal programming to optimize loan portfolio management of a bank in Nigeria. Their results showed that the optimal portfolio differed from the portfolio created using the current model. Also, as a portfolio becomes more diverse, the superiority of the performance of the genetic algorithm becomes more significant when using the linear method. Dubinskas and Urbšienė (2017), using a genetic algorithm-based approach and MatLab software, examined the optimal investment portfolio for four selected companies in Lithuania. The results showed that the genetic algorithm-based portfolio reached a better risk-return ratio than the portfolio optimized using the deterministic and stochastic programming. methods. Metawaa et al. (2017) used a genetic algorithm called Genetic Algorithm Multipopulation Competitive Coevolution (GAMCC) to optimize a bank's financial goals in order to reduce risk and increase facility interest. Their results showed that the proposed model was effective and that its use reduced the facility monitoring time.

Orlova (2020) examined the development of new technologies and models for managing bank lending. The research material was the statistical data from the Bank of Russia. The methods of system analysis, methods of statistics and optimization methods were used. The results showed that the model for optimizing the structure of the loan portfolio was developed, providing a maximum return on the loan portfolio.

ANALYSIS AND RESULTS

OPTIMAL PORTFOLIO SELECTION MODEL

This section presents the portfolio selection model using a numerical example and the data set obtained from commercial bank in Uzbekistan. The value of the constraints was obtained by placing the data in the formulas. Therefore, the multi-objective optimization issue was solved using the weighted method for the following three models.

Today, forming an optimal loan portfolio is one of the important tasks and the main problem of the bank. The ultimate goal of any bank's credit policy is to create an optimally coordinated loan portfolio. The problem of forming an optimal loan portfolio and its solution in the presence of restrictions on the amount of available credit resources, their value, the interest rate on the loan, the terms of attracting resources, and its solution are the main and permanent issues for bank specialists to solve. When analyzing the credit portfolio of commercial banks of our country, it is of practical importance to consider the ratio of loans to total assets.

In order to organize the efficient crediting process with the help of rapid accumulation of funds, credits with the same expiration dates have different interest rates and different conditions of return. Some are traditionally paid, i.e. monthly interest, and the principle amount of the credit is at the end of the term; the others are returned with monthly interest and part of the principle amount of the credit, which is defined as following. Principle amount of the credit is divided into equal parts for the whole credit term.

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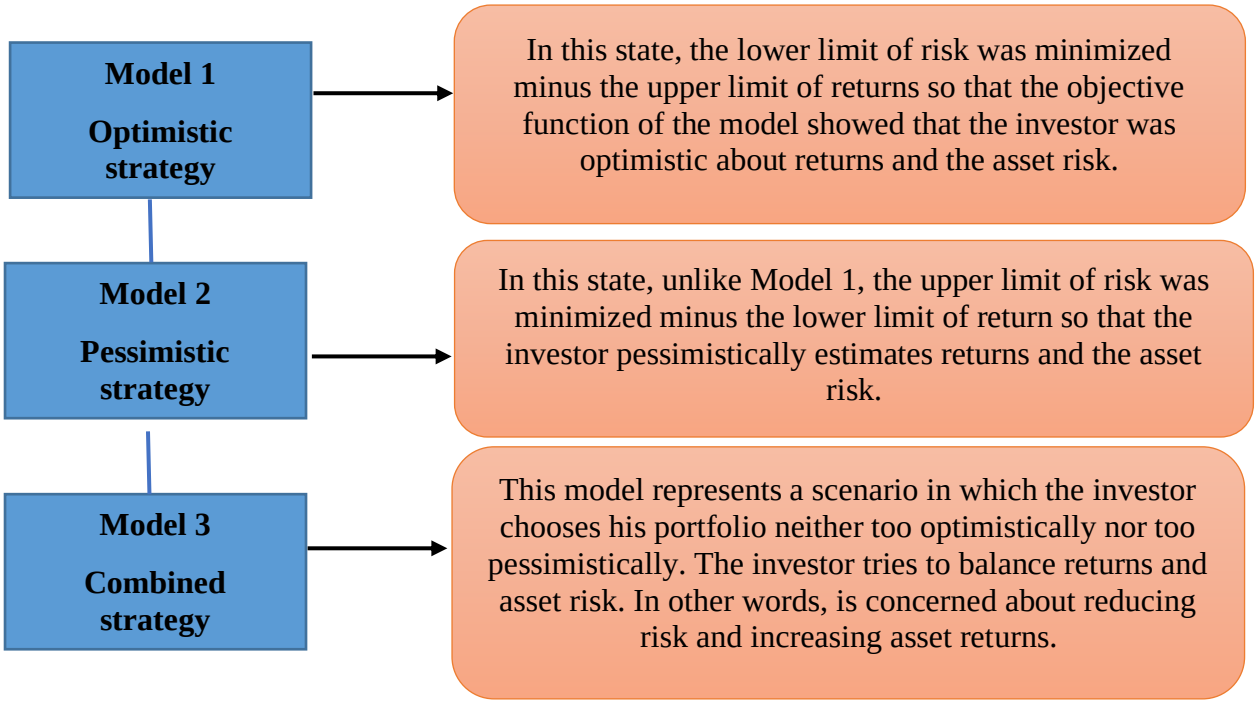
Table 2. The multi-objective optimization weighted methods[2]



The portfolio selection model, the scope of granted credits through xiti (it=1,2,…, n; n=18), ti - a period of time a month for the i-type credit , Ti — the set of periods for the i-type credit, a quarter; (aiti) - a matrix that shows the process of providing the i-type credit in the period ti or the lack of it:

$$a_{it_i} = \begin{cases} 1, \text{if i - type credit is given in period } t_i; \\ 0, \text{ if i - type credit is not given in period } t_i; \end{cases}$$

Funds received from loan interest of the previous period, and refunded credits are used for credit arrangement in the next period. Model introduced the following notation:

ri — monthly interest rate for i-type credit;
i — the period for which the i-type credit is granted;
St — the amount of payments received from credits granted with special conditions in the period t;
SK — bank stock;
pi — probability of default of i-type credit;
uit — the risk value of default of i-type credit in the period t, it is calculated as following: t=1, ui1= pi; t=2, ui2= pi (1–pi); t=3, ui3= pi (1–pi),
Djt — the amount of available deposit funds of j -type in the period t,
m — the number of deposit types on lead time on investment;
zj — monthly percentage rate on deposits payment of j-type.
The target function of the problem is the highest income yield at the beginning of the next period:

$$Z = \sum_{t_i=1}^{T_i} \sum_{i=1}^{n} r_i x_{it_i} - \sum_{t=1}^{T} \sum_{j=1}^{m} z_j D_{jt} \to \max, t_i \in T_i$$

Taking into account the conditions described above and introduced notation, we form the economic and mathematical model of the problem. The given economic and mathematical model enables obtaining the optimal scheme of the crediting process, which is divided monthly, that allows us to trace the funds movement, calculate idle balances and direct them to acquire marketable instruments, provide short-term interbank credits and deposit in another bank.

[2] Independently prepared by the researcher.

Since the model is designed for one quarter (3 months), bankers can orientate themselves in the current situation, summarize their activities per quarter, and make adjustments in the subsequent period (it may be a change of rates and credit conditions, which is important in a competitive environment and economic instability). Quantitative analysis of different scenarios provides a selection of profitable option for the bank, the estimate of the probability of a bad situation and makes it possible to develop an adequate plan of action. Using simulation models one can evaluate and analyze alternative scenarios of profit and risk management. In the process of optimization modeling, banks can develop their own models that account the specificity of their activity the most closely or use already created ones.

CONCLUSION

To build an optimal credit portfolio in the banking system, several key factors must be considered. Diversification across various sectors—such as manufacturing, agriculture, construction, and services—helps reduce sector-specific risks. Effective risk management is essential, including robust credit scoring, due diligence, and clear credit risk policies. Aligning credit allocations with government economic priorities, like infrastructure development, enhances strategic impact. Customer segmentation also plays a role, allowing banks to tailor credit products to the specific needs of SMEs and large corporates. Finally, compliance with regulatory requirements, including capital adequacy and lending limits, is critical. In sum, an optimal credit portfolio should be diversified, balanced, risk-conscious, and aligned with both regulatory frameworks and national development goals.

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