

**SCIENCE**  
**PROBLEMS.UZ**

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Actual problems of social and humanitarian sciences  
Актуальные проблемы социальных и гуманитарных наук

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**2023**

# **SCIENCEPROBLEMS.UZ**

## **ИЖТИМОЙ-ГУМАНИТАР ФАНЛАРНИНГ ДОЛЗАРБ МУАММОЛАРИ**

*№ 5/8 (3)-2023*

**АКТУАЛЬНЫЕ ПРОБЛЕМЫ СОЦИАЛЬНО-  
ГУМАНИТАРНЫХ НАУК**

**ACTUAL PROBLEMS OF HUMANITIES AND SOCIAL SCIENCES**

**ТОШКЕНТ-2023**

## **БОШ МУҲАРРИР:**

Исанова Феруза Тулқиновна

## **ТАҲРИР ҲАЙЪАТИ:**

### *07.00.00-ТАРИХ ФАНЛАРИ:*

Юлдашев Анвар Эргашевич – тарих фанлари доктори, сиёсий фанлар номзоди, профессор, Ўзбекистон Республикаси Президенти ҳузуридаги Давлат бошқаруви академияси;

Мавланов Уктам Махмасабирович – тарих фанлари доктори, профессор, Ўзбекистон Республикаси Президенти ҳузуридаги Давлат бошқаруви академияси;

Хазраткулов Аброр – тарих фанлари доктори, доцент, Ўзбекистон давлат жаҳон тиллари университети.

### *08.00.00-ИҚТИСОДИЁТ ФАНЛАРИ:*

Карлибаева Рая Хожабаевна – иқтисодиёт фанлари доктори, профессор, Тошкент давлат иқтисодиёт университети;

Худойқулов Садирдин Каримович – иқтисодиёт фанлари доктори, доцент, Тошкент давлат иқтисодиёт университети;

Азизов Шерзод Ўктамович – иқтисодиёт фанлари доктори, доцент, Ўзбекистон Республикаси Божхона институти;

Арабов Нурали Уралович – иқтисодиёт фанлари доктори, профессор, Самарқанд давлат университети;

Холов Актам Хатамович – иқтисодиёт фанлари бўйича фалсафа доктори (PhD), доцент, Ўзбекистон Республикаси Президенти ҳузуридаги Давлат бошқаруви академияси;

Шадиева Дилдора Хамидовна – иқтисодиёт фанлари бўйича фалсафа доктори (PhD), доцент в.б, Тошкент молия институти;

Шакаров Қулмат Аширович – иқтисодиёт фанлари номзоди, доцент, Тошкент ахборот технологиялари университети

### *09.00.00-ФАЛСАФА ФАНЛАРИ:*

Ҳакимов Назар Ҳакимович – фалсафа фанлари доктори, профессор, Тошкент давлат иқтисодиёт университети;

Яхшиликков Жўрабой – фалсафа фанлари доктори, профессор, Самарқанд давлат университети;

Ғайбуллаев Отабек Мухаммадиевич – фалсафа фанлари доктори, профессор, Самарқанд давлат чет тиллар институти;

Ҳошимхонов Мўмин – фалсафа фанлари доктори, доцент, Жиззах педагогика институти;

Носирходжаева Гулнора Абдукаҳхаровна – фалсафа фанлари номзоди, доцент, Тошкент давлат юридик университети;

Турдиев Бехруз Собирович – фалсафа фанлари бўйича фалсафа доктори (PhD), доцент, Бухоро давлат университети.

### *10.00.00-ФИЛОЛОГИЯ ФАНЛАРИ:*

Ахмедов Ойбек Сапорбаевич – филология фанлари доктори, профессор, Ўзбекистон давлат жаҳон тиллари университети;

Кўчимов Шухрат Норқизилович – филология фанлари доктори, доцент, Тошкент давлат юридик университети;

Салахутдинова Мушарраф Исамутдиновна – филология фанлари номзоди, доцент, Самарқанд давлат университети;

Кучкаров Раҳман Урманович – филология фанлари номзоди, доцент в/б, Тошкент давлат юридик университети;

Юнусов Мансур Абдуллаевич – филология фанлари номзоди, Ўзбекистон Республикаси Президенти ҳузуридаги Давлат бошқаруви академияси;

Саидов Улугбек Арипович – филология фанлари номзоди, доцент, Ўзбекистон Республикаси Президенти ҳузуридаги Давлат бошқаруви академияси.

### *12.00.00-ЮРИДИК ФАНЛАРИ:*

Ахмедшаева Мавлюда Ахатовна – юридик фанлар доктори, профессор, Тошкент давлат юридик университети;

Мухитдинова Фирюза Абдурашидовна – юридик фанлар доктори, профессор, Тошкент давлат юридик университети;

Эсанова Замира Нормуратовна – юридик фанлар доктори, профессор, Ўзбекистон Республикасида хизмат кўрсатган юрист, Тошкент давлат юридик университети;

Ҳамроқулов Баҳодир Мамашарифович – юридик фанлар доктори, профессор в.б., Жаҳон иқтисодиёти ва дипломатия университети;

Зулфиқоров Шерзод Хуррамович – юридик фанлар доктори, профессор, Ўзбекистон Республикаси Жамоат хавфсизлиги университети;

Хайитов Хушвақт Сапарбаевич – юридик фанлар доктори, профессор, Ўзбекистон Республикаси

Президенти ҳузуридаги Давлат бошқаруви академияси;

Асадов Шавкат Ғайбуллаевич – юридик фанлар доктори, доцент, Ўзбекистон Республикаси Президенти ҳузуридаги Давлат бошқаруви академияси;

Утемуратов Махмут Ажимуратович – юридик фанлар номзоди, профессор, Тошкент давлат юридик университети;

Сайдуллаев Шахзод Алиханович – юридик фанлар номзоди, профессор, Тошкент давлат юридик университети;

Ҳакимов Комил Бахтиярович – юридик фанлар доктори, доцент, Тошкент давлат юридик университети;

Юсупов Сардорбек Баходирович – юридик фанлар доктори, доцент, Тошкент давлат юридик университети;

Амиров Зафар Актамович – юридик фанлар бўйича фалсафа доктори (PhD), Ўзбекистон Республикаси Судьялар олий кенгаши ҳузуридаги Судьялар олий мактаби;

Жўраев Шерзод Юлдашевич – юридик фанлар номзоди, доцент, Тошкент давлат юридик университети;

Бабаджанов Атабек Давронбекович – юридик фанлар номзоди, доцент, Тошкент давлат юридик университети;

Раҳматов Элёр Жумабоевич – юридик фанлар номзоди, Тошкент давлат юридик университети;

### *13.00.00-ПЕДАГОГИКА ФАНЛАРИ:*

Хашимова Дильдархон Уринбоевна – педагогика фанлари доктори, профессор, Тошкент давлат юридик университети;

Ибрагимова Гулнора Хавазматовна – педагогика фанлари доктори, профессор, Тошкент давлат иқтисодиёт университети;

Закирова Феруза Махмудовна – педагогика фанлари доктори, Тошкент ахборот технологиялари университети ҳузуридаги педагогик кадрларни қайта тайёрлаш ва уларнинг малакасини ошириш тармоқ маркази;

Тайланова Шоҳида Зайниевна – педагогика фанлари доктори, доцент.

### *19.00.00-ПСИХОЛОГИЯ ФАНЛАРИ:*

Каримова Василя Маманосировна – психология фанлари доктори, профессор, Низомий номидаги Тошкент давлат педагогика университети;

Ҳайитов Ойбек Эшбоевич – Жисмоний тарбия ва спорт бўйича мутахассисларни қайта тайёрлаш ва малакасини ошириш институти, психология фанлари доктори, профессор

Умарова Навбаҳор Шокировна – психология фанлари доктори, доцент, Низомий номидаги Тошкент давлат педагогика университети, Амалий психологияси кафедраси мудири;

Атабаева Наргис Батировна – психология фанлари доктори, доцент, Низомий номидаги Тошкент давлат педагогика университети;

Қодиров Обид Сафарович – психология фанлари доктори (PhD), Самарканд вилоят ИИБ Тиббиёт бўлими психологик хизмат бошлиғи.

### *22.00.00-СОЦИОЛОГИЯ ФАНЛАРИ:*

Латипова Нодира Мухтаржановна – социология фанлари доктори, профессор, Ўзбекистон миллий университети кафедра мудири;

Сеитов Азамат Пўлатович – социология фанлари доктори, профессор, Ўзбекистон миллий университети;

Содиқова Шоҳида Мархабоевна – социология фанлари доктори, профессор, Ўзбекистон халқаро ислом академияси

### *23.00.00-СИЁСИЙ ФАНЛАР*

Назаров Насриддин Атакулович – сиёсий фанлар доктори, фалсафа фанлари доктори, профессор, Тошкент архитектура қурилиш институти;

Бўтаев Усмонжон Хайруллаевич – сиёсий фанлар доктори, доцент, Ўзбекистон миллий университети кафедра мудири.

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## **ОАК Рўйхати**

Мазкур журнал Вазирлар Маҳкамаси ҳузуридаги Олий аттестация комиссияси Раёсатининг 2022 йил 30 ноябрдаги 327/5-сон қарори билан тарих, иқтисодиёт, фалсафа, филология, юридик ва педагогика фанлари бўйича илмий даражалар бўйича диссертациялар асосий натижаларини чоп этиш тавсия этилган илмий нашрлар рўйхати (Рўйхатга) киритилган.

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Телеграм канал: [https://t.me/scienceproblems\\_uz](https://t.me/scienceproblems_uz)

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**Ziyodilloev Khushnud Rahimboevich**  
Senior Teacher at Department of "Finance",  
Kimyo International University in Tashkent  
Email: [ziyodilloyev.xushnud@mail.ru](mailto:ziyodilloyev.xushnud@mail.ru)

### **PORTFOLIO OPTIMIZATION OF COMMERCIAL BANK CREDITS: A LITERATURE REVIEW**

**Abstract.** This paper examines the portfolio optimization of commercial banks' credits, with a focus on the banking sector's efficiency. Following the mortgage bond crisis, banks have become more cautious in allocating financial resources and assessing risks. Evaluating the credit portfolio's efficiency and quality is crucial in determining the role of credit operations, effective credit utilization, risk levels, interest rates, loan income, interest margin and overdue loans. The optimal credit portfolio in Uzbekistan's banking system depends on factors such as economic conditions, risk appetite, regulations, and borrower creditworthiness. In general, an optimal credit portfolio for Uzbekistani banks should be well-diversified, balanced and aligned with the country's economic development priorities.

**Keywords:** commercial bank, credit, credit portfolio, optimization, risks, literature review.

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**Ziyodilloyev Xushnud Rahimboyevich**  
Toshkent Kimyo Xalqaro Universiteti,  
"Moliya" kafedrasida katta o'qituvchi,

### **TIJORAT BANKLARINING KREDIT PORTFELINI OPTIMALLASHTIRISH: ADABIYOTLAR SHARHI**

**Annotatsiya.** Ushbu maqolada tijorat banklarining kredit portfelini optimallashtirish masalalari ko'rib chiqilib, bank sektorining samaradorligiga alohida e'tibor qaratilgan. Ipoteka obligatsiyalari inqirozi natijasida banklar moliyaviy resurslarni taqsimlash va risklarni baholashda ehtiyotkorona munosabatda bo'lishdi. Kredit portfelining samaradorligi va sifatini baholash kredit operatsiyalarining rolini, kredit salohiyatidan unumli foydalanishni, kreditlash operatsiyalarining tavakkalchilik darajasini, foiz stavkalarini tahlil qilish, kreditning rentabelligi, foiz stavkalari va muddati o'tgan kreditlarni aniqlashda muhim rol o'ynaydi. O'zbekiston bank tizimidagi optimal kredit portfeli iqtisodiy sharoit, tavakkalchilikka chidamlilik, tartibga solish va qarz oluvchilarning kreditga layoqatligi kabi omillarga bog'liq. Umuman olganda, O'zbekiston banklari uchun maqbul kredit portfeli yaxshi diversifikatsiyalangan, mutanosib va mamlakat iqtisodiyotini rivojlantirish ustuvor yo'nalishlariga mos bo'lishi kerak.

**Kalit so'zlar:** tijorat bankari, kredit, kredit portfeli, optimallashtirish, risklar, adabiyotlar tahlili.

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**Зиёдиллоев Хушнуд Рахимбоевич**  
старший преподаватель,  
Ташкентский Международный Университет Кимё

### **ОПТИМИЗАЦИЯ ПОРТФЕЛЯ КРЕДИТОВ КОММЕРЧЕСКИХ БАНКОВ: ОБЗОР ЛИТЕРАТУРЫ**

**Аннотация.** В данной работе рассматривается оптимизация портфеля кредитов коммерческих банков с акцентом на эффективность банковского сектора. В результате кризиса с ипотечными

облигациями банки стали более осторожными в распределении финансовых ресурсов и оценке рисков. Оценка эффективности и качества кредитного портфеля играет важную роль в определении роли кредитных операций, эффективного использования кредитного потенциала, уровня риска кредитных операций, анализа процентных ставок, доходности от кредитов, процентной маржи и просроченных кредитов. Оптимальный кредитный портфель в банковской системе Узбекистана зависит от таких факторов, как экономические условия, риск терпимость, регулирование и кредитоспособность заемщиков. В целом, оптимальный кредитный портфель для узбекских банков должен быть хорошо диверсифицирован, сбалансирован и соответствовать приоритетам экономического развития страны.

**Ключевые слова:** коммерческий банк, кредит, кредитный портфель, оптимизация, риски, обзор литературы.

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## 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 [2; p 43-52].

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. 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 [3; p 85-90].

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 optimize bank loan portfolio**

Stages	The content of the stages
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.

### 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 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, a linear programming model in an attempt to provide

a model for the allocation of credit to Hong Kono's banks [6]. In this study, the objective was to achieve the highest return on investment for Hong Kono'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 [7; p 40-47].

Agrana et al. (2014) used goal programming to optimize loan portfolio management of a bank in Nigeria [2; p 43-52]. 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 [8; p 66-78]. 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 [6; p 75-82]. Their results showed that the proposed model was effective and that its use reduced the facility monitoring time.

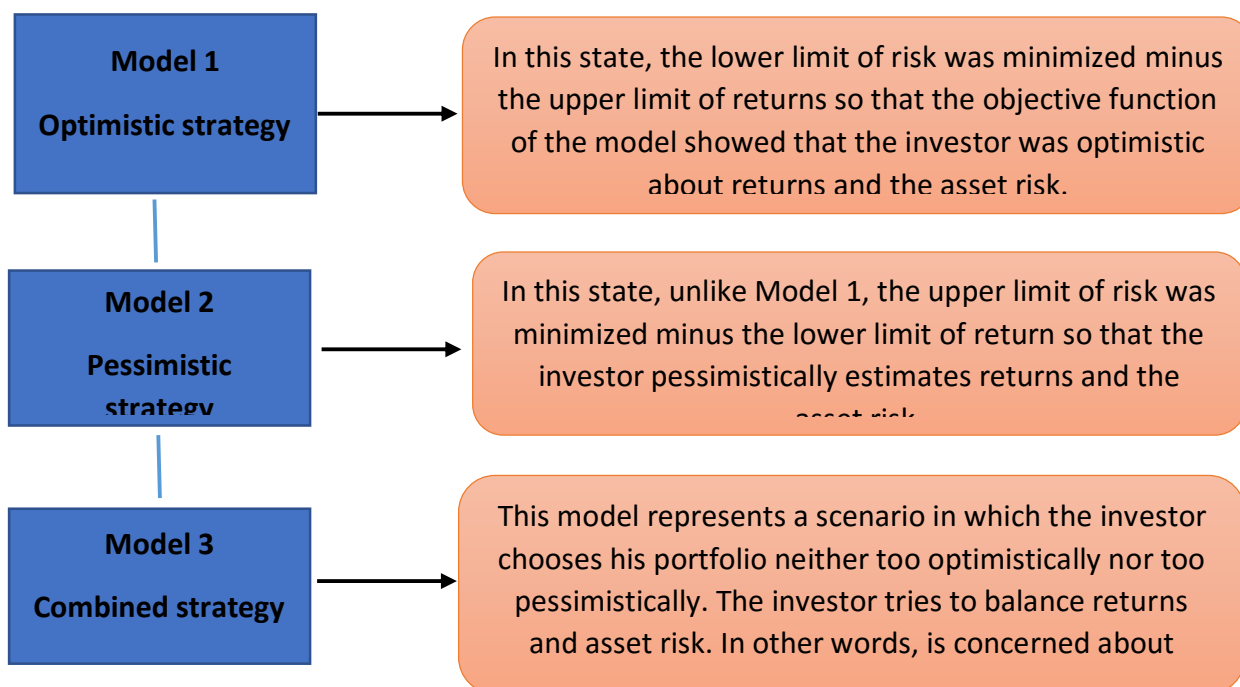
Orlova (2020) examined the development of new technologies and models for managing bank lending. The research material was the statistical data from the Bank of Russia. The methods of system analysis, methods of statistics and optimization methods were used. The results showed that the model for optimizing the structure of the loan portfolio was developed, providing a maximum return on the loan portfolio [4; p 144].

### **Analysis and results**

This section introduces a portfolio selection model, which is demonstrated through a numerical example using real data obtained from a commercial bank in Uzbekistan. The constraints in the model were determined by inputting the relevant data into the formulas, allowing for a comprehensive analysis.

Efficient credit management is crucial for ensuring the rapid accumulation of funds. To achieve this, credits with the same maturity dates are offered with varying interest rates and distinct repayment conditions. Some credits follow the traditional repayment method, where borrowers make monthly interest payments, and the principal amount is due at the end of the loan term. Conversely, there are credits that involve monthly interest payments along with partial repayment of the principal amount. Specifically, the principal amount is divided into equal parts and repaid over the entire credit term.

Optimal portfolio selection model. To address the multi-objective nature of portfolio optimization, the weighted method was employed. This approach enables the simultaneous consideration of multiple objectives and provides a systematic framework for decision-making. The portfolio selection model was applied to three different scenarios, each with its own set of weights.



**Picture 1. The multi-objective optimization weighted methods<sup>1</sup>**

The portfolio selection model, the scope of granted credits through  $x_{it}$  ( $i=1,2,\dots, n$ ;  $n=18$ ),  $t_i$  - a period of time a month for the  $i$ -type credit,  $T_i$  — the set of periods for the  $i$ -type credit, a quarter;  $(a_{it_i})$  - a matrix that shows the process of providing the  $i$ -type credit in the period  $t_i$  or the lack of it:

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

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:

$r_i$  — monthly interest rate for  $i$ -type credit;

$i$  — the period for which the  $i$ -type credit is granted;

$S_t$  — the amount of payments received from credits granted with special conditions in the period  $t$ ;

$SK$  — bank stock;

$p_i$  — probability of default of  $i$ -type credit;

$u_{it}$  — the risk value of default of  $i$ -type credit in the period  $t$ , it is calculated as following:  $t=1, u_{i1}= p_i$ ;  $t=2, u_{i2}= p_i (1-p_i)$ ;  $t=3, u_{i3}= p_i (1-p_i)$ ,

$D_{jt}$  — the amount of available deposit funds of  $j$ -type in the period  $t$ ,

$m$  — the number of deposit types on lead time on investment;

$z_j$  — 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:

<sup>1</sup> Independently prepared by the researcher.

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

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.

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.

#### **Findings of the paper**

Some key factors to consider when building an optimal credit portfolio model in banking system, include:

**Diversification:** Banks should aim to diversify their credit portfolios across various industries and sectors to minimize the impact of sector-specific risks. This may include allocating credit to sectors such as manufacturing, agriculture, construction, and services.

**Risk management:** Banks should have effective risk management systems in place to monitor and manage credit risk. This may include developing credit scoring models, conducting thorough due diligence on borrowers, and implementing credit risk management policies.

**Government priorities:** Banks should align their credit portfolios with the government's economic development priorities. For example, if the government is prioritizing infrastructure development, banks may allocate more credit to infrastructure projects.

**Customer segmentation:** Banks should segment their customer base and tailor their credit offerings based on the specific needs of different customer segments. This may include offering different types of credit products to small and medium-sized enterprises (SMEs) versus large corporates.

**Regulatory compliance:** Banks should ensure that their credit portfolios are in compliance with relevant regulations and guidelines, such as those related to capital adequacy and lending limits.

**Limitation.** The most important constraints and limitations of the studied bank regarding its ability to provide credits to customers in the economic sections are as follows:

The first limitation is the budget limitations. The bank's budget limitations include the total Rial volume of facility types that bank allocates to its various economic sections.

The second limitation is the ratio of facilities to deposits, one of the limitations that can be imposed by the bank's board of directors. A higher ratio is traditionally associated with higher risk since a high ratio indicates lower liquidity, undesirable economic processes, or withdrawal of deposits.

The third group of limitations is represented by the legal limitations from the Central Bank. Based on the instructions of the Central Bank, specialized banks were obligated to grant at least 90% of their facilities for their main mission. As a result, a maximum of 10% of their total facilities can be offered to firms from areas outside of their expertise to the applicant's departments with the restriction.

Overall, an optimal models of credit portfolio for banks would be one that is well-diversified, balanced, and aligned with the country's economic development priorities, while also effectively managing credit risk and complying with relevant regulations.

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[scienceproblems.uz@gmail.com](mailto:scienceproblems.uz@gmail.com)

**Боғланиш учун телефонлар:**

(99) 602-09-84 (telegram).