DIRECTIONS FOR FORMING INVESTMENT RELATIONS BETWEEN BANKS AND SMALL BUSINESSES
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Abstract: *in modern conditions, the automation of all investment processes in the interaction of banks and small businesses is a key goal of long-term relations between entities, and especially the development of the financial market, since a serious difference between the international segment and the national one is the daily completion of various transactions around the clock. And this can only be achieved through the introduction of advanced digital technologies.*
Keywords: *entrepreneurship, small business, government incentives, cooperation.*

НАПРАВЛЕНИЯ ФОРМИРОВАНИЯ ИНВЕСТИЦИОННЫХ ОТНОШЕНИЙ МЕЖДУ БАНКАМИ И МАЛЫМ БИЗНЕСОМ
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Аннотация: *в современных условиях автоматизация всех инвестиционных процессов во взаимодействии банков и малого бизнеса – это ключевая цель долгосрочных отношений между субъектами, а особенно развития финансового рынка, так как серьёзным отличием международного сегмента от национального является ежедневное совершение различных сделок круглосуточно. А этого можно добиться исключительно при внедрении передовых цифровых технологий.*
Ключевые слова: *предпринимательство, малый бизнес, государственное стимулирование, сотрудничество.*

The need to improve investment relations between banks and small organizations is due to the need to increase investment, which is the main problem considered in the dissertation research. The main investor is a commercial bank. Since confidence in the activities of small businesses as a whole is currently reduced in the country, and one of the factors for its increase is the need for a commercial bank to obtain maximum profitability, the author proposes to introduce a software product into the activities of commercial banks. The information platform will be based on two economic and mathematical models:

1. An economic and mathematical model for optimizing the cost of investment cooperation between a commercial bank and a small organization, taking into account the presence of intra-industry competition and the amount of funds that a commercial bank is ready to invest.

2. An economic and mathematical model for optimizing investment income for a commercial bank, which will increase their confidence in the activities of small businesses.

Accurate identification of the optimal profitability of small business investment projects, based on its economic potential, is a key component in the work of commercial banks, which affects the effectiveness of interaction and, accordingly, the indicators that determine it: revenue and net profit.

Calculation of effective profitability for a commercial bank in the structural divisions of risk management and lending will provide an opportunity to invest in timely funds for small companies in significant and profitable projects for the state and the international community.

Thus, a reliable calculation of the optimal values of the cost of investment cooperation and the income that will be received by a commercial bank when making an investment operation will contribute to the development of not only small businesses in the regions, but also the financial market.

Let us consider the general content of the economic and mathematical model for optimizing the cost of investment cooperation between a commercial bank and a small organization, considering the presence of intra-industry competition and the amount of funds that a commercial bank is ready to invest.

Let us take the following notation in calculating the optimal cost of a transaction between a commercial bank and small organizations:

L - the number (list) of investment projects that are included in the potential group of investments of a commercial bank according to its available funds;

$k = 1, L$ is the serial number of the selected investment project;

F_k - the total number of small organizations offering to conclude a deal on a similar investment strategy;

fk is the number of substitute banks that are also ready to invest their financial resources in this project.

To effectively use the economic-mathematical model to optimize the cost of investment cooperation between a commercial bank and a small organization, it is necessary to calculate the competitive environment parameter in accordance with formula (1):

$$\alpha_k = \frac{f_k - 1}{F_k - 1} \tag{1}$$

Let's assume that the total number of small organizations offering the same resource investment strategy includes 15 companies, and the number of substitute banks willing to invest their financial resources in this strategy is 20 units, then the competitive environment parameter according to these conditions in the economic and mathematical model will be 1.357:

$$\alpha_k = \frac{20 - 1}{15 - 1} = 1{,}357$$

In order to arrive at the final result according to the first model of the Invest Business information platform, it is necessary to reflect the minimum interest rate of return from the first equation, which is shown in formula (2):

$$\begin{cases} 1 + mk_{\min k} = (1 + mk_{\max k}) * (1 - ds_k) \\ mk_{\min k} = (1 + mk_{\max k}) * (1 - ds_k) - 1 \end{cases} \tag{2}$$

Where

$mk_{\max k}$ - the base (effective) interest rate of return, which is set taking into account the investment service program of a commercial bank;

$mk_{\min k}$ - actual (minimum) interest rate of return adjusted for bank risk;

ds is an adjustment for banking risk when an investment transaction is made by a commercial bank.

The optimal interest rate of return on an investment project, taking into account the existing competitive environment among small organizations, is calculated by formula (3):

$$\overline{mk_k} = \alpha_k * mk_{\min k} + (1 - \alpha_k) * mk_{\max k} \tag{3}$$

Suppose that with an effective interest rate of return of 15% and an actual interest rate of 11%, the optimal interest rate of return on an investment project, taking into account the existing competitive environment among small organizations, will be 9.56%.

In the economic and mathematical model for optimizing the cost of investment cooperation between a commercial bank and a small business, the following conditions are accepted:

mk* - target value of the average interest rate for the selected list of investment projects;

$0 < wk < 1$ is a weight coefficient characterizing the significance of the i-th investment project. Here the condition is observed that the sum of the weight coefficients for each investment project should not exceed

b unit;

mkk is the unknown predicted value of the interest rate for the i-th investment project.

Based on the foregoing, we will build the following model for optimizing the cost of investment cooperation between a commercial bank and a small business, which is presented in formulas (4), (5):

$$\sum_{k=1}^{L}(mk_k - \overline{mk_k})^2 \to min \tag{4}$$

$$\sum_{k=1}^{L} w_k * mk_k = mk^* \tag{5}$$

The presented problem according to the first optimization model is solved exclusively using the method of indefinite Lagrange multipliers, which is illustrated in formula (6):

$$mk_k = \overline{mk_k} + w_k * \Delta$$
$$\Delta = \frac{(mk^* - \sum_{k=1}^{L} w_k * \overline{mk_k})}{\sum_{k=1}^{L} w_k^2}$$

(6)

The next step is to calculate the optimal cost of investment cooperation using formula (7):

$$P_i = C_i * (1 + mk_i)$$

(7)

Where

C_i are the costs of providing financial services by an intermediary for investing in the i-th investment project.

Now let's consider the general content of the economic and mathematical model for optimizing investment income for a commercial bank, which will increase their confidence in the activities of small businesses.

Let us take the following notation in calculating the optimal return on investment projects for a commercial bank:

$q=(q\_1,q\_2,…,q\_n)$ – predicted profitability for selected investment projects;

$q^\wedge*=(⟦q\_1⟧ \wedge*, ⟦q\_2⟧ \wedge*, ⟦q\_n⟧ \wedge*)$ – target return on selected investment projects;

$r=(r\_1,r\_2,…,r\_n)$ – return on investment;

$c=(c\_1,c\_2,…,c\_n)$ – cost of capital investment in the project;

$p=(p\_1,p\_2,…,p\_n)$ - sale price of rights in a small business investment project.

C - the amount of financial resources of a commercial bank, which is planned to be invested in an investment project;

X – plan for investment profitability within the framework of the investment cooperation strategy.

Based on the second economic and mathematical model, the optimization of investment income for a commercial bank is calculated using formulas (8), (9), (10):

$$f(q) = \sum_{i=1}^{n} r_i^2 (q_i - q_i^*)^2 \rightarrow min$$

(8)

$$\sum_{i=1}^{n} p_i q_i = X$$

(9)

$$\sum_{i=1}^{n} c_i q_i = C$$

(10)

There is a linear relationship between the values of X and C, which is expressed in the product of the turnover ratio of the financial resources of a commercial bank by the amount of funds planned to be invested in the project.

We admit the fact that there is no strict restriction from the point of view of the fulfillment of the identities reflected in formulas (9), (10). Using the linear programming method, let's add a criterion to the second model, calculated by formula (11):

$$F(q) = \alpha_1 \sum_{i=1}^{n} r_i^2 (q_i - q_i^*)^2 + \alpha_2 [\sum_{i=1}^{n} p_i q_i - X]^2 \rightarrow min$$

(11)

Finally, we obtain a linearly dependent equality in formula (12):

$$(\alpha_1 r_i^2 + \alpha_2 p_i^2) * q_i + \alpha_2 p_i \sum_{k=1}^{n} p_k q_k = \alpha_1 r_i^2 q_i^* + \alpha_2 p_i X$$

(12)

In order to implement the presented algorithm according to economic and mathematical models that make it possible to increase the efficiency in the interaction between commercial banks and small businesses, an obligatory element is the introduction of an information platform into the internal environment of the bank, which will lead to an improvement in financial and economic results in banking and small organizations after receiving the necessary financial resources.

In modern conditions, the automation of all investment processes in the interaction of banks and small businesses is a key goal of long-term relations between entities, and especially the development of the financial market, since a serious difference between the international segment and the national one is the daily completion of various transactions around the clock. And this can only be achieved through the introduction of advanced digital technologies.

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