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Optimization Model of Credit Strategy of Commercial Bank

ABSTRACT
Economic and mathematical model of credit management of commercial banks is developed. The model allows obtaining optimal strategies of variant calculations of this kind of banking services. The procedure of quantitative solution of this problem is substantiated to help to make optimal decisions in reference to allocation of assets.
Key words: *bank, deposit, credit, loan portfolio, model and optimal management.*

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.

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.

Based on the classic approach of modeling of credit portfolio, we model optimal structure of commercial bank loan portfolio.

The purpose of this study is the use of existing models and the development of applied economic and mathematical model for finding profitable credit strategies of commercial banks in Ukraine and abroad.

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.

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

1) the timing of the credit arrangement;
2) the calculation of annual and monthly crediting rates;
3) the determination of the conditions for loan repayment;
4) the determination of the home equity sum that can be used for the crediting process;
5) the determination of the risk magnitude as the probability of default of all types of credits and the calculation of default risk by periods;
6) the use of current percent of credit repayments in the crediting process;
7) the determination of the period, at the beginning of which the calculation of profits is carried out;
8) Taking into account the liquidity ratios (H4, H5 and H6) that regulate the credit activity of a commercial bank.

amount of the credit is at the end of the term; the o
credit, which is defined as following. Principle amou

We accept that funds received from loan interest o
next period.

We introduce the following notation: r_i — monthly i
S_t — the amount of payments received from credits
of default of i-type credit; u_{it} — the risk value of def
$u_{i2}= p_i(1-p_i)$; $t=3$, $u_{i3}= p_i(1-p_i)^2$.; D_{jt} — the amount of a
on lead time on investment ; z_j — monthly percentag

Taking into account the conditions described abov
problem.

The target function of the problem

$$Z = \sum_{t_i=1}^{T_i} \sum_{i=1}^{n}$$

Accom

1 Balance condition

2 Balance conditions

$$\sum_{i=1}^{n} x_{i2} + \sum_{j=1}^{m} z$$

$$S_1 = x_{1,1} + \frac{x_{1,3}}{\tau_3} + \frac{x_{1,5}}{\tau_5} +$$

3 Balance conditio

$$\sum_{i=1}^{n} x_{i3} + \sum_{j=1}^{m} z_j D_{j2}$$

$$S_2 = x_{1,2} + 2 \cdot \left(\frac{x_{1,3}}{\tau_3} + \frac{x_{1,5}}{\tau_5} + \frac{x}{\tau} \right.$$

4 Restriction

6 Restrictions accounting the implementation of current liquidity standards by periods:

$$\sum_{i=1}^{18} x_{i1} \geq 0{,}4 \sum_{j=1}^{5} D_{j1}$$

$$\sum_{i=1}^{18} x_{i2} \geq 0{,}4 \sum_{j=1}^{5} D_{j2}$$

$$\sum_{i=1}^{18} x_{i3} \geq 0{,}4 \sum_{j=1}^{5} D_{j3}$$

7 Restrictions for size of average risk of credit defaults:

$$\frac{\sum_{i=1}^{n} \sum_{t_i=1}^{T_i} u_{it} \cdot x_{it_i}}{\sum_{i=1}^{n} \sum_{t_i=1}^{T_i} x_{it_i}} \leq U^*$$

8 Restrictions that determine the marginal sum of volume of credit:

$$\sum_{i=1}^{n} \sum_{t_i=1}^{T_i} x_{it_i} \leq K_0$$

9 Restrictions for nonnegative variables:

$$x_{it_i} \geq 0, i = \overline{1,n}; t_i = \overline{1,T_i}$$

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). It should be noted that the optimization model is quite flexible. Additional restrictions can be added to it, with the help of which the current situation of credit and deposit activities is modeled. For example, these may be the restrictions accounting known volume of credits at the beginning of the crediting period, the current values, and necessary reserve funds. If the desirable amount of profit is noted in the target function, then we obtain necessary scheme of credit allocation for periods and types. In addition, if necessary, you can change the amount of the deposit incomes.

We use software application package EXEL to obtain numerical solutions of constructed model.

Optimization algorithm indicates the direction of the search; conjugate gradient method is selected, which is used to solve big optimization problems. During the solving of the problem with this search method, the large number of iterations is performed; this gives the possibility to obtain accurate results.

At the end of the period (at the beginning of the first month of the next quarter) maximum profit and the scheme of credit arrangement on volume, types and periods is obtained.

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

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Mathematical Mo of Indicators of B and Taxation Sys

ABSTRACT
The complex of mathematical models of investigate cast their change and plan revenues and expenditu constant and variable coefficients, nonlinear nons dynamics of the total amount of state and local bu
Key words: *model, budget, dynamics, approximat*

The empirical analysis of reported data is carrie of budget expenditures. However, on the basis of su indicators, to reveal the dependence of dynamics of mathematical models of dynamics of investigated bu

55 indicators that describe revenues and expendit dynamics and structure of revenues and expenditure

Revenues and expenditures of state and local budget planning of budget expenditures and their incidence on c that indicators $z_i(t)$ that describe revenues and expendit their transfers ($i=\overline{54,55}$) and revenues and expenditure indicators $z_i(t)$, ($i=\overline{1,55}$) to be simulated with the system

In the simplest approximation the system of lin between indicators $z_i(t)$, ($i=\overline{1,55}$):

$$\frac{d}{dt}\begin{bmatrix} z_1 \\ z_2 \\ \dots \\ z_{55} \end{bmatrix} =$$

where: a_{ij} ($ij=\overline{1,n}$) — constant parameters, found by