

Ministry of Education and Science of Ukraine
Sumy State University
Educational and Scientific Institute of Business, Economics and Management
Department of Economic Cybernetics

BACHELOR'S QUALIFICATION WORK

on the topic “Modeling of the evaluation of the efficiency of the credit department
of the bank”

Completed student of 4th course, group AB-81a.en
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ABSTRACT

qualifying work of the bachelor

«MODELING OF THE EVALUATION OF THE EFFICIENCY OF THE CREDIT DEPARTMENT OF THE BANK»

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The relevance of the topic chosen for the study is determined by the fact that the development of the country is directly influenced by the success of banking, which depends on many factors. This includes the availability of financial, organizational, informational, material and technological resources, and features of the economic and legal field in which banks operate, and the product range of banks and the choice of sales channels for banking products and services, intensive use of new technologies and more. Without effective management of the ability of employees to achieve the overall goal of the bank is impossible. Therefore, the development of a banking institution largely depends on its staff, which is a decisive factor in competition.

The purpose of the qualification work is to develop an economic and mathematical model for evaluating the effectiveness of the credit department of the bank.

The object of the bachelor's qualification work are the processes of modeling the evaluation of the efficiency of the credit department of the bank.

The subject of research is economic and mathematical methods and models for assessing the effectiveness of the credit department of the bank.

The objectives of the study are: to characterize the theoretical foundations of the bank's credit department, to consider the organization of the bank lending process, to characterize the state of modeling efficiency assessment and analysis of commercial banks, to develop economic and mathematical model for assessing the efficiency of the bank's credit department, to make calculation of the model and make decision.

The information base is statistical data of financial statements of JSC Ukrsibbank, textbooks and scientific articles on the research topic.

To achieve the goal of the bachelor's thesis, the following methods were used: analysis, synthesis, economic and mathematical modeling, expert method, scientific generalization and comparison.

Theoretical and practical results of the study can be used by regional offices of the bank, other commercial banks, the National Bank of Ukraine to improve policies in the field of credit regulation in Ukraine.

Keywords: credit, modeling, bank efficiency, economic model, credit department.

The content of the qualifying bachelor's thesis is set out on 30 pages. The list of used sources from 51 names is placed on 5 pages. The work contains 9 tables, 4 figures, as well as 2 appendixes, placed on 2 pages.

Year of qualification work - 2022.

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TASK
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in the direction of training 051 Economic (Business analytics)
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Lapin Mykola Ihorovych

1. Topic of the work: Modeling of the evaluation of the efficiency of the credit department of the bank approved by order of the university 0325-VI from 09.05.2022.
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6. Qualification work is performed on the statistical data of the financial statements of JSC Ukrsibbank, textbooks and scientific articles on the research topic.
7. Indicative plan of qualification work, terms of submission of sections to the head and the maintenance of tasks for performance of the set purpose
Section 1. Theoretical foundations of the credit department of the bank.
Section 1 should consider the organization of the process of bank lending, methods and models for evaluating the effectiveness and analysis of commercial banks and describe the structure of the model.
Section 2. Implementation of the model of evaluating the efficiency of the bank's credit department

In section 2 it is necessary to make calculations on the constructed model. Draw appropriate conclusions.

8. Consultations on work:

Chapter	Consultant	Signature, data	
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INTRODUCTION

The success of banking is influenced by many factors. This includes the availability of financial, organizational, informational, material and technological resources, and features of the economic and legal field in which banks operate, and the product range of banks and the choice of sales channels for banking products and services, intensive use of new technologies and more. Without effective management of the ability of employees to achieve the overall goal of the bank is impossible. Therefore, the development of a banking institution largely depends on its staff, which is a decisive factor in competition.

Efficiency is a key problem of the economy, and the correct understanding of this category, the ability to accurately determine and calculate it, to find new reserves to increase it - the main professional purpose of economists.

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1 THEORETICAL FUNDAMENTALS OF THE BANK'S CREDIT DEPARTMENT

1.1 Organization of the bank lending process

It is undeniable that the proper organization of the bank lending process, the development of an efficient and flexible credit management system are the basis of financial stability and market stability of commercial banks (given the crucial place of credit operations in the portfolio of bank assets).

In modern conditions, in order to ensure the organization of effective lending activities, commercial banks develop their own internal credit policy and implement practical mechanisms for its implementation.

The bank's credit policy determines the tasks and priorities of the bank's lending activities, means and methods of their implementation, as well as the principles and procedure for organizing the actual lending process. The credit policy creates the basis for the organization of the bank lending process in accordance with the general market strategy of the bank and should clearly define the objectives of lending, appropriate documentation and methodological support and rules for their implementation.

Credit policy is developed taking into account the strategy and tactics of the bank in the field of active operations management and determines the main areas of lending:

- standards and criteria for the activities of bank employees responsible for issuing loans;
- main actions of managers who make strategic lending decisions;
- principles of assessment and control over the quality of credit management in the bank.

Responsibility for the development of credit policy and mechanisms for its implementation rests with the Credit Committee, which is usually headed by the first head of a commercial bank.

The development of internal credit policy requires the bank's management to clearly state the objectives of lending and determine how they coincide with the overall policy and strategy of the bank.

In general, credit policy should reflect the following key points:

- organization of credit activities;
- loan portfolio management;
- control over the credit process;
- limits on certain areas of lending;
- mechanism for supporting credit agreements;
- formation of reserves for possible losses on loans.

Ways and methods of implementing credit policy are formalized in the relevant internal bank documents, the main of which are:

- lending standards;
- credit instructions.

Lending standards contain samples of documents used by credit managers and executors, a list of actions of bank employees responsible for the process of bank lending. The main task of lending standards is to determine practical actions for the implementation of credit policy.

The following highlights should be reflected in lending standards:

- the procedure for collecting and analyzing financial information;
- requirements for securing loans, guarantees;
- rules for organizing the credit process;
- the procedure for assessing the creditworthiness of the borrower;
- preparation of credit documentation.

The content and structure of lending standards may differ from bank to bank, but they usually contain such important points.:

- description of the system of credit powers of bank employees;
- list of types of loans, the issuance of which corresponds to the credit policy of the bank, as well as the list of unacceptable for the bank types of loans;

- names of business areas and regions where the bank's lending activity is a priority;
- procedure for recovery of overdue credit debt.

The credit instruction is a description of consecutive actions on realization of concrete credit procedure. The instruction, which corresponds to a separate credit procedure, looks like a description of the sequence of interrelated steps with the definition of responsible executors and their powers. For example, the instructions may specify what should be the steps in the credit documentation process, what steps should be taken to track credit history, or what steps should be taken to minimize the proportion of problem loans in a bank's portfolio.

Thus, the lending procedure set out in the bank's credit instructions determines the specific stages of the bank lending process and ensures its implementation in accordance with the requirements of the bank's credit policy.

With regard to the personnel problem, highly qualified specialists with experience in financial and analytical work, well acquainted with the existing mechanism of legal regulation of credit relations, have the necessary knowledge in the field of market conditions, able to predict and monitor trends in the development of relevant areas of management, have practical skills in risk management of credit activities of commercial banks.

The efficiency of lending activities of a commercial bank directly depends on such indicators:

- profitability of credit operations;
- return on assets through credit operations;
- share of income from loans in total income;
- profitability of credit operations;
- profitability of credit operations;
- income per employee of the credit department.
- The most important stages of the credit process are:
 - receipt and consideration of a loan application;
 - direct interview with a potential borrower;

- creditworthiness assessment;
- preparation for the loan agreement;
- credit agreement;
- monitoring and quality control of issued loans.

The loan application together with the package of accompanying documents is received by the employee of the relevant credit department, who carries out its careful consideration. The loan officer then conducts a preliminary interview with the potential borrower.

1. General information about the borrower:

- form of ownership and organizational structure of the enterprise;
- term of active activity of the enterprise;
- main products;
- who is the owner;
- level of experience and qualification of managers;
- level of profitability of economic activity;
- who is the main supplier and consumer of enterprise products.

2. Credit issues:

- what amount the firm plans to borrow; what and how this amount will be spent;
- whether the forecast of financial needs is made correctly;
- whether the service life of the assets financed by the loan is taken into account.

3. Issues related to loan repayment:

- what incoming cash flows the firm receives during the operating cycle;
- what sources of cash the company plans to use to repay the loan;
- whether there are persons willing to provide a guarantee or surety, and what their financial situation is.

4. Loan security issues:

- what security can be pledged;

- who is the owner of the collateral;
- where it is stored;
- whether the collateral is under the full control of the borrower;
- how the valuation of the property offered as collateral was made;
- what are the costs of storing collateral.

5. Questions about the client's relations with other banks:

- with which banks the client cooperates;
- whether he received loans from other banks;
- whether there are outstanding loans and what their nature is.

After the interview, the loan officer must make a very important decision: to continue working with the loan application of this client or at this stage to refuse to issue a loan.

If the client's proposals do not meet in some respects the principles of the bank's policy and strategy in the field of credit operations, the loan application must be rejected.

It is necessary to explain to the applicant for what reasons the loan cannot be granted. If, based on the results of the interview, the loan officer decides to continue working with the client, he fills out the appropriate loan form and submits it together with the loan application and a package of supporting documents to the credit analysis department to assess the borrower's creditworthiness.

Creditworthiness is the presence of the borrower's counterparty bank prerequisites for obtaining a loan and its ability to repay the loan and interest on it in full and within the contractual period.

Ukrainian commercial banks develop their own internal regulations and methods of analyzing the creditworthiness of borrowers, which are usually based on the guidelines of the National Bank of Ukraine on the assessment of commercial banks' creditworthiness and financial stability of the borrower.

In banks, the implementation of all lending functions is concentrated in several structural units.

The function of granting loans is separated from the function of control over loans. In the credit department, the function of credit analysis is separated from the actual process of granting and issuing a loan. This helps to increase the level of objectivity of the loan assessment and more careful approval of the loan.

Organizational structure of the bank's credit function in figure 1.1.

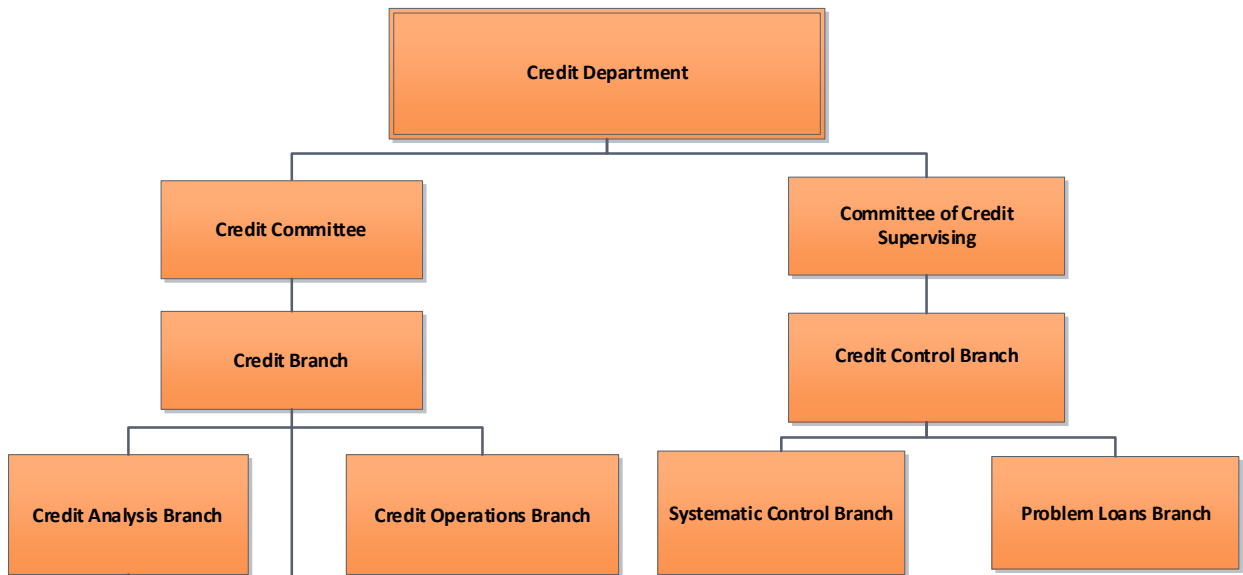


Figure 1.1 - Organizational structure of the bank's credit function

The credit department of a commercial bank and its branches is considered in the qualification work. The description of the functions is given below.

Functions of the credit analysis department

- Collection and processing of financial information about customers and prospective borrowers.
- Analysis of financial statements of loan applicants.
- Preparation of loan approval reports and other information needed to make loan decisions.
- Maintaining a file of credit information.
- Preparation of responses to requests for loans from other banks and other non-bank legal requests.

Functions of the credit operations department

- Preparation, registration and verification of basic documentation related to credit operations of the bank.
- Storage of credit files, including original contracts, collateral documents, warranty obligations, notices, etc.
- Registration of loans in accounting books, preparation of documentation for accounting entries in the general ledger.
- Maintaining the bank's legal rights to collateral by registering claims on the borrower and transferring ownership of the bank.
- Invoicing of clients for interest payments on loans, commissions and other fees.
- Report on the bankruptcy of the client, as well as the preparation of documentation warning of the expiration of the loan agreement.

One of the essential elements of the organization of the lending process is the definition of credit approval systems. The loan approval system can be one-tier, when the loan officer has individual authority to provide credit.

In order to reduce credit risk and the influence of subjective factors, banks usually limit individual powers by setting credit limits. Under such a system, the loan officer has the right to sign a loan agreement, and therefore this approach is sometimes called a "single signature" system.

Most often, banks use a "double signature" system in the lending process, which provides for the coordination of the final decision on the loan with a senior official - the head of the credit department (department). Under such a system, the loan officer reviews and analyzes the loan application, as well as makes and justifies its decision to grant a loan. The "double signature" system also has a limit on the amount of credit that can be granted to the borrower.

1.2 Methods and models for evaluating the effectiveness and analysis of commercial banks

Today, in the conditions of overcoming the crisis, banks as financial institutions play a significant role in raising the demand of the population, in expanding the production of enterprises, in strengthening the economy of the whole country. It is no secret that in our time, banks have lost the trust of their customers, so the question is how to restore this trust. The answer is very simple - to increase the reliability of banks themselves, strengthen their financial condition, improve the quality of services provided, as well as make the conditions for providing these services more accessible, rational and unveiled.

In order to attract new customers, as well as not to repel regular ones, the bank must always be interested in financial stability, liquidity of its assets, reliability and solvency. The reliability of the bank today is becoming a priority and is very important. To determine the reliability of the bank first analyze its profits, as it is the main indicator of the effectiveness of its financial activities. Therefore, the calculation, analysis and forecasting of bank profitability and profitability is a necessary condition for its effective operation. Summarizing all the above, we can say that the analysis of commercial banks, as well as methods of its implementation is interesting and relevant for research.

The main tasks of the analysis of a commercial bank are to identify sources of revenue and cost reduction, search for reserves to increase profitability and profitability, ensure liquidity, strengthen financial stability and reliability of the bank, compliance with economic standards, minimize banking risks.

In the process of analyzing banking activities, it is necessary to use a method that will best contribute to its effectiveness.

The main methods of bank balance sheet analysis are the method of comparison, grouping, use of absolute and relative indicators, as well as graphical and tabular methods.

Method of comparison - allows you to determine the level and causes of deviations for different articles. You can highlight the most typical situations when using a comparison:

1) comparison of planned and actual indicators to assess the degree of implementation of the plan;

2) comparison of actual indicators with normative ones, which allows to control the bank's observance of various norms established by the NBU;

3) comparison of actual indicators with indicators of previous years (reporting periods) to determine trends in the bank's development;

4) comparison of the analyzed indicators of the bank with the indicators of other competing banks to determine the bank's position in the financial market for various indicators of financial activity;

5) comparison of different options for management decisions in order to choose the best; for example, when setting the interest rate on household deposits, choose the level that would provide the required amount of this type of banking resource, taking into account the availability of sufficient opportunities to serve depositors;

6) comparison of results of activity before and after introduction of any innovation; for example, the cost of acquiring a bank office in the city center can be offset by attracting solid customers, which will provide the bank with an increase in current account balances.

Grouping method - allows you to understand the essence of the processes being analyzed by systematizing balance sheet data. For example, by grouping the bank's income and expenses from providing loans and deposits to different customers, you can clearly show whether the costs are covered by the income received from the provision of these services.

The method of using absolute and relative indicators helps to characterize the quantitative size of loans, borrowed funds, bank capital and reflect the ratio of certain absolute indicators. The relative indicators include indicators of plan implementation, dynamics, structure (share), efficiency, etc. This method is one of

the key in the analysis of banking stability. With its help (through different coefficients) indicators of liquidity, solvency, profitability of the bank, etc. are estimated.

The graphical method helps to display the necessary information in a more visual and user-friendly form, for example, to reflect the dynamics of changes in the volume of loans granted for different years. Similarly, the tabular method of displaying analytical data is the most convenient and rational form of presenting analytical information about the object under study. With the help of tables it is easier to trace the relationships between the studied indicators.

All these methods can be applied to various objects of analysis, among which one of the most important objects in the study of banking is equity. In particular, the study of equity should begin with an analysis of its constituent elements, their share in total capital. The analysis of the bank's equity structure should be carried out in dynamics to track changes in its constituent elements, to determine trends in their development, the factors influencing their volume. It is important to compare the equity structure of a particular bank with similar indicators of other banks or with the average bank. It is necessary to take into account external factors that also affect the formation of equity, in particular the state of the country's economy.

Unprofitable activities of most economic entities, for example, reduce the ability of banks to increase the size of authorized capital through additional issues of shares, forcing them to look for other sources of resources. It is important to determine the value of some of its components during the analysis of equity, and then compare with the cost of borrowed and borrowed capital, which will allow us to determine the coefficient of autonomy (independence) of a commercial bank.

Equally important is the analysis of the bank's borrowed capital or liabilities. Since the bank is an institution that works mainly with borrowed funds, as a rule, their share in the bank's liabilities is at least 80%. A value less than this value means higher financial stability of the enterprise, but negatively characterizes its business activity. The analysis of the bank's liabilities begins with determining their amount on the balance sheet, then you need to describe the changes in the amount of the

bank's liabilities in the dynamics in absolute and relative terms. The main point in the analysis of liabilities is the study of the risks caused by the expansion of borrowed funds assumed by managers. To confirm the validity and effectiveness of attracting additional resources, you should compare the cost of attracting them with the profits from their use.

Profitability is one of the most important indicators of banking activity, as profit is the source of dividend payments to shareholders, the creation of bank funds, the basis for improving the welfare of bank employees. The formation of a commercial bank's profit is the result of various factors. These are the income and expenses of the bank, the impact of which on the profit and its components is obvious and is calculated by the method of direct calculation based on the additive factor model.

Very important factors that determine the amount of profit before tax are:

- the amount of capital of the bank, which is reflected in the liabilities of the balance sheet;
- the level of efficiency of the bank's assets is calculated as the ratio of the bank's income to total assets;
- the multiplier effect of capital is determined by the capital multiplier - it is the lever of bank management through which it must ensure the desired balance between equity and additional financial resources. In other words, it is the ability of the bank's capital to attract additional money into circulation without violating financial stability. The capital multiplier is determined by the ratio of total assets to the balance sheet capital of the bank;
- profitability of income - the ratio of profit before tax to the income of the bank.

And knowing the factors that affect the change in profit, you can study and analyze the change of the latter under the influence of various factors that will adjust and plan the bank, affect the amount of profit, forecast income and expenses needed to generate such income .

There are various methods of economic and statistical analysis of profitability and efficiency of a commercial bank:

- 1) analysis of efficiency using the relationship of partial performance indicators with the appropriate multipliers (eg, ROE);
- 2) determining the impact of certain factors on the profitability of the bank through the production function.

We need to develop more modern indicators that better meet the current requirements of the Ukrainian banking system. They can be based on methods of calculating the profitability of the bank, which are used in modern banking practice of other countries. Consider them.

An effective model of control and management of a commercial bank is the DuPont formula, according to which the analysis is carried out for a certain period. Special analysis is given to the analysis of financial leverage, because the overall level of banking risk is determined by operational and financial risks, and if the former is not high - the bank may allow a riskier policy with a higher value of the multiplier:

$$\text{ROE} = \text{ROA} * \text{Lf} \quad (1.1)$$

where ROA – net asset income;

Lf – capital multiplier (ratio of assets to bank capital).

The overall profitability of the bank can be determined using Gordon's model:

$$\text{Overall profitability} = \text{D1}/\text{P0} + (\text{P1} - \text{P0})/\text{P0} \quad (1.2)$$

where D1 – dividends at the end of the period;

P0 – the purchase price of the security;

P1 – share sale price.

Sharpe's model is used to study the expected rate of return:

$$E(R) = R_f + [E(R_m) - R_f] * B, \quad (1.3)$$

where $E(R)$ – expected rate of return;

R_f – risk-free interest rate;

R_m – market rate of return;

$[E(R_m) - R_f]$ – risk – premium;

$E(R_m)$ – expected market rate;

B – correction factor that determines market risk.

Model using the production function.

Regardless of the classification definition, all factors of production are used to produce economic goods. Suppose that in a very simplified production process, one factor is used to produce some one material good. This can be represented as a formula:

$$Q = F(A) \quad (1.4)$$

where Q — economic good;

A — factor of production;

F — function.

In this case, the economic good is the result of one factor. In reality, the production process is much more complex and it uses, as a rule, not one but many factors (Fig. 1.2).

If the production process is on the AA line, the production factor is used optimally and is constantly reproduced; if below this line, the factor of production is used in part; if above the AA line, this factor is overused. In the last two cases, the balance of the production process is disturbed, which will lead either to a shortage

of factors or to the need for additional quantities. Thus, the most efficient use of the factor of production is a condition for further increase in production, a condition for expanded production of a product.

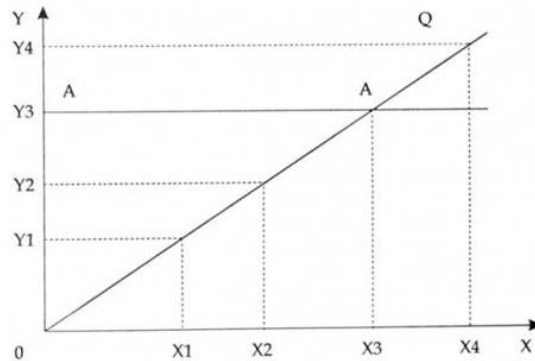


Figure 1.2 - Graph of the production function

Since the production process has costs and results, the question arises about the production function. The fact is that the theory of factors of production is based to some extent on the use of mathematical, modeling apparatus, which are factor models in the form of mathematical dependence, linking the value of production with the use of production factors that determined this result.

The production function is the technical ratio between the amount of resources used by producers and the volume of products produced on this basis. The production function can be used both at the macroeconomic level, where it reflects the dependence of total output in monetary terms, and at the microeconomic level.

At the microeconomic level, each firm has its own, different from other economic entities production function. At the same time, the production function can be applied to individual industries, types of production and even to the production of a separate unit of the enterprise.

As a rule, the production function has theoretical significance, but is not devoid of practical application. It is widely used by economists to assess individual resources that provide economic growth. The first option in this regard was the so-called Cobb-Douglas production function, the content of which is the analysis of the dependence of production on the use of two main resources - capital and labor.

Further development of the theory of production function took place in the direction of analysis of such a factor as time. Analysis of the use of this factor meant the process of transition from statistical estimates of the Cobb-Douglas production function model to dynamic estimation taking into account the impact of technological progress on output, then the greatest achievements in the study of the function belong to American economists R. Solow and E. Denison.

R. Solow calculated an indicator that characterizes the materiality of technical progress and reflects the effectiveness of new investments in connection with significant technical and technological changes in the production process.

E. Denison studied the indicator of non-materialized technical progress, which reflects the qualitative changes in the economy as a consequence of uninvested costs. The development of technical progress in accordance with this concept is possible through improving the level of education, staff skills, better work organization, etc.

Thus, the production function indicates that there are many options for producing a certain amount of production due to a certain set of factors of production. Improving technological parameters that maximize the volume of production of a particular type of product is always reflected in the new production function.

The production function can be used to calculate the minimum amount of costs required to produce any volume of production. The ratio of the set of factors of production and the maximum possible volume of products produced as a result of this set of factors, and reveals the essence of the production function.

Model using the production function - the dependence of any indicator of the efficiency of the enterprise (it may be the volume of production, the amount of profit) and the amount of resources or costs.

Its main advantages are the ability to give a qualitative analysis of the bank, to recreate the links between different performance indicators and the amount of resources spent, to describe the functioning of the system as a whole. The application of this method makes it possible not only to obtain information about the efficiency

of the bank, but also to identify quantitative relationships that characterize the impact of various factors, the strength of their impact on the overall rating of the bank.

1.3 Description of the structure of the model

The qualification work used a model to assess the effectiveness of credit departments of the bank (its branches). It is the credit department that strongly influences the movement of the bank's financial resources and brings a significant share of income from all operations provided by the bank. Therefore, the study of analysis and construction of performance evaluations is important.

The choice of model variables is based on the description of the simulation problem. Construction of this model involves the identification of all parameters and grouping. The following indicators will be used in the model:

1. Income from credit operations;
2. Average amount of credit investments for the period;
3. Average amount of assets;
4. Bank income, total;
5. Interest income from loans;
6. Interest expenses;
7. Expenses of the credit department;
8. Interest costs for attracting resources;
9. Profit from credit operations;
10. Average credit investments;
11. The average number of employees in the department.

All input indicators have an absolute scale of measurements, the values allowed for them - $(0; \infty)$. Denote the indicators from X_{i1}, \dots, X_{i11} .

So we get the following input variables:

1. Income from credit operations X_{i1} ;
2. Average amount of credit investments for the period X_{i2} ;
3. Average amount of assets X_{i3} ;

4. Bank income, total X_{i4} ;
5. Interest income on loans X_{i5} ;
6. Interest expenses X_{i6} ;
7. Expenses of the credit department X_{i7} ;
8. Interest costs for attracting resources X_{i8} ;
9. Profit from credit operations X_{i9} ;
10. Average credit investments X_{i10} ;
11. The average number of employees in the department X_{i11} .

Where i – is the number of branches ($i = 1: n$), n – s the number of branches.

We rank m branches, it is carried out according to n indicators. Then the set of all values of indicators in this group can be represented as a matrix:

$$X = \begin{pmatrix} x_{11} & \dots & x_{1j} & \dots & x_{1n} \\ x_{m1} & \dots & x_{mj} & \dots & x_{mn} \end{pmatrix} \quad (1.5)$$

where $i = 1, \dots, m$ – indicator number,

$j = 1, \dots, n$ – branch number.

All indicators are different and therefore the next step should be the normalization of indicators. To do this, replace the matrix X with a matrix Z :

$$Z = \begin{pmatrix} z_{11} & \dots & z_{1j} & \dots & z_{1n} \\ z_{n1} & \dots & z_{nj} & \dots & z_{nn} \end{pmatrix} \quad (1.6)$$

where
$$z_{ij} = \frac{x_{ij} - \bar{x}_j}{\sigma_j}$$

where \bar{x}_j - the average value of the j th indicator for all branches:

$$\bar{x}_j = \frac{1}{m} \sum_{i=1}^m x_{ij} \quad (1.7)$$

where σ_j^2 - variance of the value of the j th indicator:

$$\sigma_i^2 = \frac{1}{m} \sum_{j=1}^n (x_{ij} - \bar{x}_i)^2 \quad (1.8)$$

Carrying out the rationing procedure removes the influence of absolute values and variations in the values of the indicators themselves. At the next stage the formation of the standard ("reference branch") is carried out. For this purpose in any line the maximum value of the corresponding indicator depending on what its optimum size with addition of standard - deviation is chosen.

$$z_j^e = \max_j (z_{ij}) + \sigma_j^2 \quad (1.8)$$

where, σ^2 - standard deviation.

Calculation of quasi-distances R_{ij} from any branch to the standard of calculations according to the formula:

$$R_i = \sum_{j=1}^m \alpha_j (z_{ij} - z_i^e)^2 \quad (1.9)$$

Figure 1.3 shows a conceptual diagram of the model.

Weights are calculated by expert method.

A branch that has a minimum value – R_i should be considered more efficient because it is closer to the reference model.

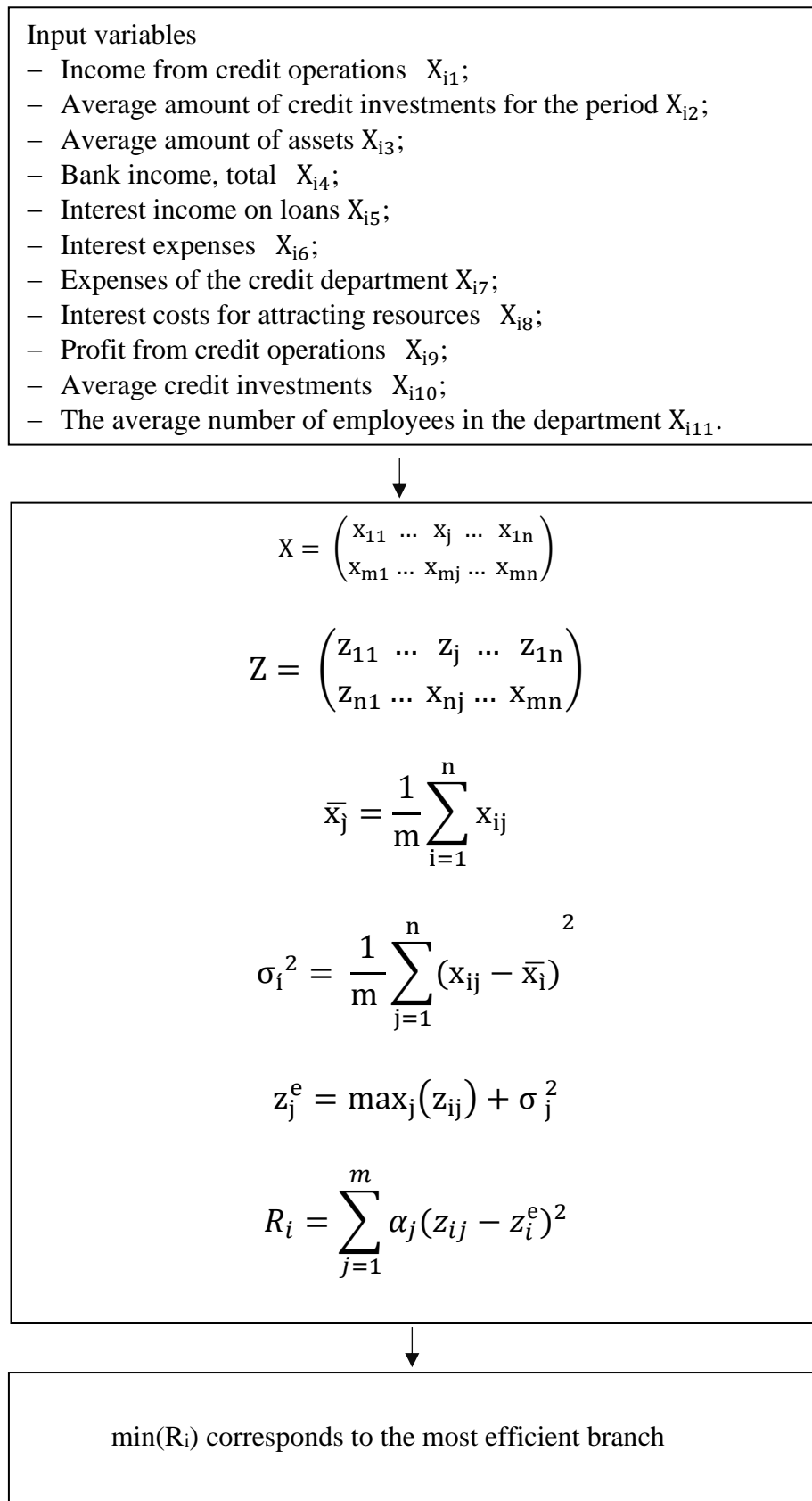


Figure 1.3 - Conceptual scheme of the study

2 IMPLEMENTATION OF THE BANK'S CREDIT DEPARTMENT EFFICIENCY EVALUATION MODEL

To implement the built model used the software Microsoft Office Excel.

The model was built on the example of eight Ukrsibbank branches on eleven performance indicators.

The input data are presented in tables 2.1, 2.2, 2.3.

Table 2.1 - Input data

Ukrsibbank Branches	Income from credit operations	The average amount of credit investments for the period	Average assets	Bank income, total
Kyiv	745263	11539	945658	563847
Sumy	285748	10457	845669	456966
Chernihiv	148596	8569	632558	360156
Poltava	198745	7845	714583	422877
Dnipro	365887	6458	685996	394550
Zaporizhzhia	514782	12577	722334	471445
Zhytomyr	674468	14226	623444	496332
Cherkasy	226986	20646	721963	679449

Table 2.2 - Input data

Ukrsibbank Branches	Interest income from loans	Interest expenses	Credit department costs	Interest costs for attracting resources
Kyiv	268447	68456	10855	17552
Sumy	254782	72411	8944	12745
Chernihiv	232773	54789	9266	13447
Poltava	193668	49116	7413	11245
Dnipro	294778	51442	9655	9656
Zaporizhzhia	218956	61322	8177	16774
Zhytomyr	244778	41222	9115	14882
Cherkasy	251479	43709	16134	20118

Table 2.3 - Input data

Ukrsibbank Branches	Profit from credit operations	Average credit investments	The average number of employees in the department
Kyiv	184887	14772	24
Sumy	145769	18745	18
Chernihiv	139688	17477	14
Poltava	164478	7662	12
Dnipro	142339	8756	21
Zaporizhzhia	139426	7983	14
Zhytomyr	148667	6223	15
Cherkasy	85846	10699	18

Since all eleven indicators are incomparable with each other, the next step is to normalize. To calculate the normalized values, it is necessary to calculate the mean value for each of the indicators, standard deviation and variance. Normalized data are presented in tables 2.4, 2.5, 2.6. To calculate these indicators, we use the built-in function "ABS" to obtain the absolute value.

Table 2.4 - Normalized data

Ukrsibbank Branches	income from credit operations	the average amount of credit investments for the period	average assets	bank income, total
Kyiv	1,554	0,000	1,924	0,816
Sumy	0,485	0,241	1,004	0,233
Chernihiv	1,094	0,663	0,957	1,184
Poltava	0,871	0,824	0,202	0,568
Dnipro	0,129	1,134	0,465	0,846
Zaporizhzhia	0,531	0,231	0,131	0,091
Zhytomyr	1,240	0,599	1,040	0,153
Cherkasy	0,746	2,031	0,134	1,951

Table 2.5 - Normalized data

Ukrsibbank Branches	interest income loans	interest expenses	credit department costs	interest costs for attracting resources
Kyiv	0,763	1,167	0,337	0,864
Sumy	0,319	1,518	0,371	0,520
Chernihiv	0,396	0,046	0,252	0,318
Poltava	1,667	0,550	0,939	0,952
Dnipro	1,619	0,343	0,107	1,410
Zaporizhzhia	0,845	0,534	0,656	0,640
Zhytomyr	0,006	1,251	0,308	0,095
Cherkasy	0,212	1,030	2,295	1,603

Table 2.6 - Normalized data

Ukrsibbank Branches	income from credit operations	average credit investments	the average number of employees in the department
Kyiv	1,457	0,672	1,735
Sumy	0,067	1,498	0,248
Chernihiv	0,149	1,234	0,743
Poltava	0,732	0,806	1,239
Dnipro	0,055	0,579	0,991
Zaporizhzhia	0,159	0,739	0,743
Zhytomyr	0,170	1,105	0,496
Cherkasy	2,063	0,175	0,248

After the normalized indicators have been calculated, the reference company is calculated. According to the developed model, the reference branch is formed from the maximum values of each indicator for all branches with the addition of standard deviation. Therefore, the built-in functions "MAX" and "STANDARD DEVIATION" will be used.

Table 2.7 - Standard deviation and standard model

Indicators	Standard	The standard deviation
Income from credit operations	2,013	0,458
The average amount of credit investments for the period	2,675	0,644
Average assets	2,547	0,622
Bank income, total	2,576	0,625
interest income loans	2,294	0,627
Interest expenses	2,028	0,509
Credit department costs	3,006	0,711
Interest costs for attracting resources	2,112	0,518
Profit from credit operations	2,874	0,761
Average credit investments	1,913	0,451
The average number of employees in the department	2,243	0,509

Weights are used to calculate quasi-distances. The calculation of these coefficients is carried out by experts. The experts were selected from among the employees of the Sumy branch of Ukrsibbank JSC. A survey of five experts in the field of lending was conducted to identify the benefits of performance indicators of credit departments of branches.

Expert assessments are presented in Table 2.5, questionnaire in Appendix B. The built-in SUM function and others were used to process the questionnaires. Weights were calculated as a share of the total estimates. Less weight is better, because we are oriented on minimum of quasi-distance.

Table 2.8 - Expert estimates and weights

Indicators	1 st expert	2 nd expert	3 rd expert	4 th expert	5 th expert	sum	weight coefficient.
Income from credit operations	3	1	2	1	1	8	0,024
The average amount of credit investments for the period	2	6	4	5	2	19	0,058
Average assets	7	2	5	3	3	20	0,061
Bank income, total	9	4	6	4	5	28	0,085
Interest income from loans	4	3	3	2	4	16	0,048
Interest expenses	6	5	7	7	6	31	0,094
Credit department costs	11	8	8	6	11	44	0,133
Interest costs for attracting resources	8	7	9	8	10	42	0,127
Profit from credit operations	5	10	1	11	7	34	0,103
Average credit investments	1	9	10	9	8	37	0,112
The average number of employees in the department	10	11	11	10	9	51	0,155

The next step is to calculate quasi-distances and ranks for each branch. The rank of each branch was calculated using the built-in function "RANK".

Table 2.9 - Calculation of quasi-distances and ranks of branches

Ukrsibbank Branches	Quasi-distances	Rank
Kyiv	2,314233958	2
Sumy	3,562372702	7
Chernihiv	3,125894643	4
Poltava	2,598444241	3
Dnipro	3,442225861	6
Zaporizhzhia	3,740010478	8
Zhytomyr	3,349126094	5
Cherkasy	2,201811024	1

Analyzing this dynamics, we see that the most efficient credit department in the Cherkasy branch, respectively, the least effective are Zaporizhzhia, Sumy and Dnipro regions.

Figure 2.1 shows a graphical representation of the ranked branches in the regions.

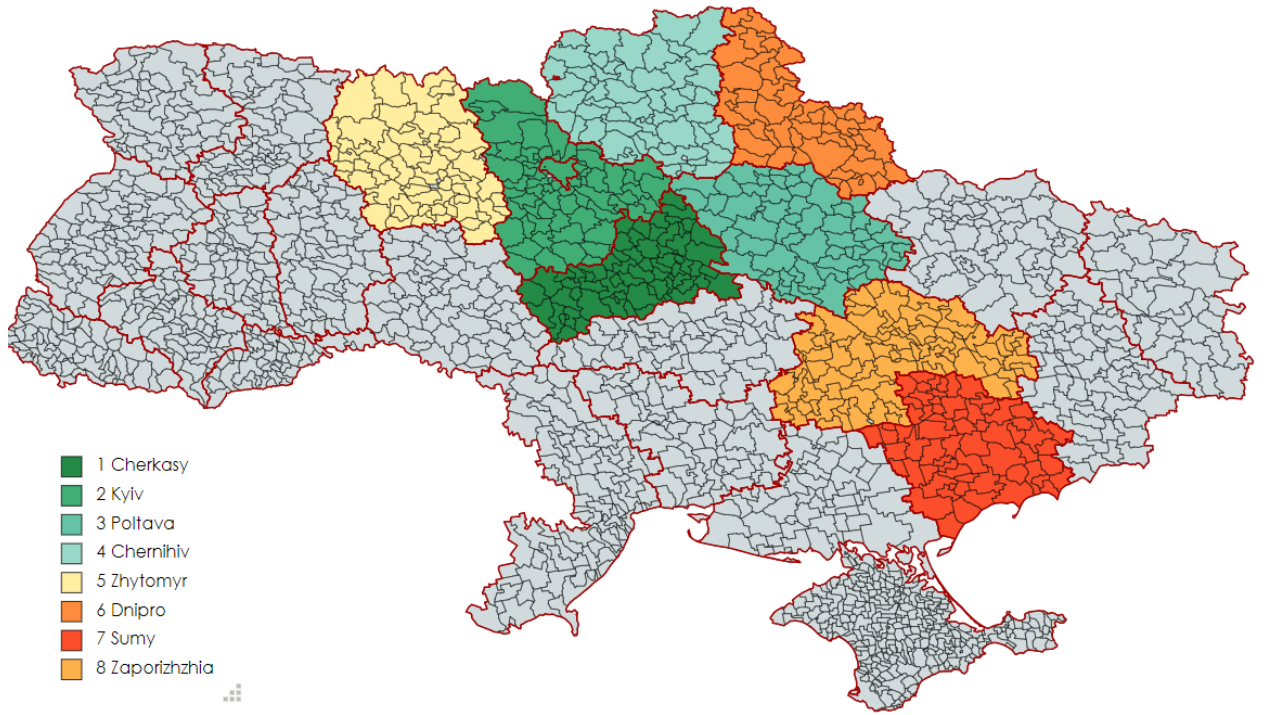


Figure 2.1 – Ranked branches

CONCLUSIONS

It can be concluded that the bank's credit department occupies a large share in the total income of the bank. Improving efficiency is an important goal to further increase the bank's income.

As a result of the study, the main goal of the study was achieved - to assess the effectiveness of the bank's credit department.

In the qualification work the theoretical bases of activity of credit department of bank were characterized, the organization of process of bank crediting is considered, the state of modeling of estimation of efficiency and the analysis of activity of commercial banks is characterized, the economic and mathematical model of estimation of efficiency of credit department of bank is developed. departments and the least efficient departments, a system of criteria (indicators) for performance evaluation was formed and a quantitative evaluation was conducted on the basis of Ukrsibbank's branches.

As a result, we obtained data that allowed us to assess the effectiveness of the credit department of the bank's branches and further on the basis of these data to make recommendations, forecasts and changes in the loan portfolio and personnel management.

REFERENCES

1. Потійко Ю.А. Теоретичні і практичні аспекти аналізу діяльності українських банків // Фінанси України. - №3. – 2002. – С. 129-133.
2. Климова О.О. Аналіз прибутковості комерційних банків // Фінанси України. - №3. – 2005. – С. 112-116.
3. Буряк А. В. Особливості визначення ефективної діяльності банку / А. В. Буряк // Фінансово-кредитна діяльність : проблеми теорії та практики: зб. наук. праць. Випуск 1(8)/2010. Частина II. – Харків, 2010. – С. 41-46.
4. Алексеєнко М. Д. Капітал банку : питання теорії і практики: Монографія / М. Д. Алексеєнко – К. : КНЕУ, 2002. – 276 с.
5. Костюк А. Н. Корпоративное управление в банке: монографія / А. Н. Костюк. – Сумы : ГВУЗ «УАБД НБУ», 2008. – 332 с.
6. Євдокімова Ю. Ю. Управління прибутковістю банку / Ю. Ю. Євдокімова // Проблеми формування і розвитку фінансово-кредитної системи України: збірник наукових статей. – Харків : Константа, 2004. – 212 с.
7. Примостка Л. О. Фінансовий менеджмент у банку : підручник / Примостка Л. О. – [2-ге вид., доп. і перероб.]. – К. : КНЕУ, 2004. – 468 с.
8. Кириченко О. Банківський менеджмент : навч. Посібник / Кириченко О., Гіленко І., Ятченко А. – К. : Основи, 2004. – 671 с.
9. Веб-сайт: <https://my.ukrsibbank.com/>
10. Іршак О.С. Макроекономічне прогнозування розвитку банків з державним капіталом в Україні / Іршак О.С. // Науковий вісник НЛТУ України. – 2013. – Вип. 23.12 – С. 334-340.
11. Казарян О. Г. Вплив цифрової економіки на діяльність банків України [Електронний ресурс] / О. Г. Казарян // Причорноморські економічні студії. – 2019. – Вип. 38(2). – С. 98-102.
12. Квасницька Р.С. Процес формування інвестиційної стратегії банку [Електронний ресурс] / Р.С. Квасницька // Електронна бібліотека ХНУ. – Режим

доступу:

http://elar.khnu.km.ua/jspui/bitstream/123456789/6591/1/Kvasnitska_tezu.pdf. –

Назва з екрану

13. Кіндрацька Л.М. Бухгалтерський облік у комерційних банках України / Л.М. Кіндрацька [Електронний ресурс]. – Режим доступу : <http://ukrkniga.org.ua/ukrkniga-text/65/4/>.

14. Кльоба Л. Г. Банківська інвестиційна діяльність на ринку цінних паперів [Електронний ресурс] / Л. Г. Кльоба // Економіка та держава. – 2016. – № 6. – С. 20-24.

15. Ковальчук К.Ф. Банківські операції, навчальний посібник / К.Ф. Ковальчук, І.В. Вишнякова, Л.М. Савчук, І.Г. Сокиринська. – К.: Центр навчальної літератури, 2013 — 326 с.

16. Коженко К.А. Підходи до класифікації факторів, що впливають на стійкість банківської установи / Коженко К.А. // Науковий вісник ХДУ. – 2015 р. – № 2. – С. 191–195.

17. Конєв Д.В. Моделювання та прогнозування фінансово-економічних процесів перехідного періоду / Конєв Д.В. // Международный научный журнал «Интернаука». – 2017 – № 7 (29) – С. 83-87

18. Корнєєв Ю. В. Діяльність ринку банківських послуг в Україні з урахуванням зарубіжного досвіду / Ю. В. Корнєєв // Юридичний вісник. Повітряне і космічне право. – 2017. – № 3. – С. 124-129.

19. Косарева І. П. Ліквідність банку: сутність та вплив основних факторів на діяльність банків / І. П. Косарева, Д. О. Крамська // Причорноморські економічні студії. – 2018. – Вип. 29(1). – С. 99-103.

20. Котковський В.С. Визначення інноваційного потенціалу банків України в умовах глобалізації / В. С. Котковський // Економіка та суспільство. – 2018. – №7. – С. 551–554.

21. Кучерук І. В. Депозитні операції комерційних банків України, їхня організація та депозитна політика / І. В. Кучерук // Формування ринкових відносин в Україні. – 2012. – № 12. – С. 93–97.

22. Литвин Н. Концептуально-правові засади складання фінансової звітності банками України / Н. Литвин // Науково-практичний журнал «Бухгалтерський облік і аудит», 2012. — С. 48–53.

23. Ліквідність банківської системи України: Науково-аналітичні матеріали /В.І. Міщенко, А.В. Сомик та ін. – К.: Національний банк України; Центр наукових досліджень, 2008. – Вип.

24. Несторенко Ж.К. Фінансова звітність банків: порядок складання та необхідність узгодження з МСФЗ / Ж.К. Несторенко // Економічний простір : зб. наук. праць. – 2010. – № 35 – С. 232–241.

25. Радченко Н.Г. Методичні підходи до оцінки ефективності депозитної політики банку / Радченко Н.Г. // Збірник наукових праць Таврійського державного агротехнологічного університету. – 2014. – №3 (27) – С. 161-166.

26. Фінансова звітність «Райффайзен Банк Аваль» [Електронний ресурс] – Режим доступу: https://ex.aval.ua/about/bank_reports/

27. Фінансовий аналіз у банку [Електронний ресурс]. – Режим доступу : 94 http://n-auditor.com.ua/uk/component/na_archive/232?view=material – Дата доступу : 11.12.20. – Назва з екрану.

28. Шумська С.С. Економіка в умовах трансформації / Шумська С.С. // Науковий журнал «Економіка і прогнозування». – 2015. – №3 – С. 12- 19.

29. Alessi L. 'Real time' early warning indicators for costly asset price boom/bust cycles / L. Alessi, C. Detken [Електронний ресурс] – Режим доступу: <http://www.suomenpankki.fi/pdf/162869.pdf>

30. An increasing role for competition in the regulation of banks // International competition network antitrust enforcement in regulated sectors subgroup 1. – BONN JUNE 2005 [Електронний ресурс] – Режим доступу:: <http://www.internationalcompetitionnetwork.org/uploads/library/doc382.pdf>

31. Article 109j, Treaty on European Union // Official Journal of the European Communities. – № 191. – 29 July 1992. – [Електронний ресурс] – Режим доступу: <http://eurlex.europa.eu/en/treaties/dat/11992M/htm/11992M.html>.

32. Barro R. J. Convergence / R. J. Barro, X. Sala-i-Martin // Journal of Political Economy. – 1992. – № 100. – P. 223–251.

33. Barro R. J. Convergence across states and regions / R. J. Barro, X. Sala-i-Martin // Brookings Papers on Economic Activity. – 1991. – № 1. – P. 107–158.

34. Barro R. J. Economic Growth / R. J. Barro, X. Sala-i-Martin. – Cambridge, Massachusetts; London, England, MIT Press, 2004. – P. 47-56.

35. Basel III leverage ratio framework and disclosure requirements. Basel Committee on Banking Supervision, January 2014. [Электронный ресурс] – Режим доступа: www.bis.org/publ/bcbs270.htm

36. Basel III: A Global Regulatory Framework for More Resilient Banks and Banking Systems. December 2010 (rev June 2011): Basel Committee on Banking Supervision, 2010. [Электронный ресурс] – Режим доступа: <http://www.bis.org/publ/bcbs189.pdf>

37. Basel III: The Liquidity Coverage Ratio and Liquidity Risk Monitoring 261 Tools. January 2013: Basel Committee on Banking Supervision, 2013. [Электронный ресурс] – Режим доступа: <http://www.bis.org/publ/bcbs238.pdf>

38. Borio C. Asset prices, financial and monetary stability: exploring the nexus / C. Borio, Ph. Lowe [Электронный ресурс] – Режим доступа: <http://www.bis.org/publ/work114.pdf>

39. Borio C., Drehmann M. Towards an operational framework for financial stability: “fuzzy” measurement and its consequences / C. Borio, M. Drehmann [Электронный ресурс] – Режим доступа: <http://www.bis.org/publ/work284.pdf>

40. Caprio J. Episodes of systemic and Borderline financial crises. World Bank. October / Caprio J., Klingebiel D. – 1999.

41. Carson C. S. Financial Soundness Indicators: policy paper / C. S. Carson. – Washington : The International Monetary Fund, 2011. – 43 p. 359. Carson C. S., Ingves S. Financial Soundness Indicators / C. S. Carson, S. Ingves // International Monetary Fund. – 2003. – May, 14. – P. 43

42. Chien – Ta, Ho, Dauw-Song, Zhu. Performance measurement of Taiwan's commercial banks, in: International Journal of Productivity and Performance Management, Vol. 53, 2004. – No. 5, pp. 425-434.

43. Drucker P. The Effective Executive: The Definitive Guide to Getting the Right Things Done // Peter F. Drucker/ New York: Collins. 2006. – 208 p.

44. Gwahula R. Measuring efficiency, effectiveness and performance of Tanzanian commercial banks: A two stage analysis / Gwahula Raphael, Hei Shi Jiao /European Journal of Business and Management. Vol. 5. – No. 7, 2013. – P. 196-206. Режим доступа: [http://pakacademicsearch.com/pdf-files/ech/517/196-206%20Vol%205,%20No%207%20\(2013\).pdf](http://pakacademicsearch.com/pdf-files/ech/517/196-206%20Vol%205,%20No%207%20(2013).pdf)

45. Indicators [Электронный ресурс] //Financial sector// The World Bank. – Режим доступа: <http://data.worldbank.org/indicator/>

46. Jaouadi S. Exploring Effectiveness and Efficiency of Banks in Switzerland. International Journal of Academic Research in Business and Social Sciences // Said Jaouadi, Ilhem Zorgui April 2014, Vol. 4, No. 4. – P. 313-325.

47. Karlaftis M.G. A DEA Approach for Evaluating the Efficiency and Effectiveness of Urban Transit Systems. EJOR 152. – 2004. – P. 354-364.

48. Moradi-Motlagh, Amir; Saleh, Ali Salman; Abdekhodae, Amir; Ektesabi, Myhkan. Efficiency, effectiveness and risk in Australian banking industry World Review of Business Research, Vol. 1, no. 3 (Jul 2011), pp. 1-12.

49. Mouzas S. Efficiency versus Effectiveness [Электронный ресурс] – Режим доступа: <http://www.impgroup.org/uploads/papers/4729.pdf>

50. Pitter L.C. Principle of Money and the Financial Markets / L.C. Pitter, W.L. Silbek. – N.-Y.: Basic Books, 2008. – 246 p.

51. Thorsten Beck, Ed Al-Hussainy. Financial Structure // The World Bank. – [Электронный ресурс] – Режим доступа: <http://www.siteresources.worldbank.org>

Appendix A

SUMMARY

Lapin M. I. Modeling of the evaluation of the efficiency of the credit department of the bank. Qualifying work of the bachelor. Sumy State University, Sumy, 2022.

The theoretical bases of the bank's credit department are determined, the organization of bank lending process is considered, the state of modeling efficiency assessment and analysis of commercial banks' activity is characterized, the economic-mathematical model of bank credit department's efficiency assessment is developed, the developed model is implemented efficiency of their credit departments.

Keywords: credit, modeling, bank efficiency, economic model, credit department.

АНОТАЦІЯ

Лапін М. І. Моделювання оцінки ефективності діяльності кредитного відділу банку. Кваліфікаційна робота бакалавра. Сумський державний університет, Суми, 2022.

В роботі визначено теоретичні основи діяльності кредитного відділу банку, розглянуто організацію процесу банківського кредитування, охарактеризовано стан моделювання оцінки ефективності та аналізу діяльності комерційних банків, розроблено економіко-математичну модель оцінки ефективності кредитного відділу банку, проведено практичну реалізацію розробленої моделі та проранжовано філії АТ Укрсиббанк за рівнем ефективності їх кредитних відділів.

Ключові слова: кредит, моделювання, ефективність банку, економічна модель, кредитний відділ.

Appendix B

Questionnaire

Please evaluate the impact of the proposed indicators on the efficiency of the bank's credit department. A score of 1 has the greatest impact and a score of 11 has the least.

Indicators	Score
Income from credit operations	
The average amount of credit investments for the period	
Average assets	
Bank income, total	
Interest income from loans	
Interest expenses	
Credit department costs	
Interest costs for attracting resources	
Profit from credit operations	
Average credit investments	
The average number of employees in the department	