Research Article

Bank Credit Structure Model Based on Big Data Financial Technology Innovation

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The credit business is the primary source of income for commercial banks, and the quality of credit business directly affects the operating efficiency and sustainable development of commercial banks. Constructing an evaluation model that can accurately measure the credit quality of commercial banks and then systematically analyze the distribution and evolution of credit quality is of great significance for judging the operating situation and pattern of credit assets of commercial banks in our country. This paper analyzes the credit asset quality of our country’s commercial banks from five aspects: credit asset scale, profitability, risk security, liquidity, and expansion capability, and uses computer extensive data analysis and structural equation model to analyze the 20 representative banks in our country. An empirical analysis is conducted in a commercial bank.

1. Introduction

The interest rate difference between deposits and loans is one of the primary profit sources of commercial banks in our country [1, 2]. Once there is a problem with credit assets, it will significantly impact the entire economic system. Therefore, it is necessary to continuously adjust and optimize the establishment of an evaluation index system for the quality of credit assets of commercial banks in our country and to evaluate and analyze the operating conditions of credit assets. As an intangible product of a country’s economic development, science and technology finance is inseparable from improving the level of science and technology. As a systematic, innovative, and holistic institutional arrangement for scientific and technological innovation activities and financial resource allocation, science and technology finance is vital to promoting our country’s economic restructuring and industrial transformation. Our country’s science and technology finance has developed rapidly in recent years. The government has issued a series of policy support, theoretical research has been deepened, and practical innovation has continued to innovate [1–5].

2. Definition of the Concept of Financial Technology

First, fintech is a combination of “finance” and “technology.” Since financial technology is currently in a stage of continuous development and a unified standard has not yet been formed in academia, the definition of financial technology is also completely open. According to the official definition of the Global Financial Stability Board, fintech refers to a series of innovations in the financial field; these innovative products can meet the new needs of customers or provide convenient services for the financial industry. This will drive the growth of financial institutions and affect the way financial institutions and markets serve consumers. Fintech is the product of combining a series of powerful technologies and financial demand scenarios. Its development not only involves many fundamental technologies, such as big data, mobile Internet, biometrics, and so on, but also involves digital twins, edge computing, human brain, and cutting-edge technologies such as machine combinations. In addition, a new generation of distributed technologies, such as directed acyclic graph, etc., will be included. From the definition of the above authoritative unit, it is easy to see that fintech is an innovation in the financial field which will bring
fundamental changes to financial institutions and even the entire financial industry.

3. Classification of Bank Credit Structure and Analysis of Influencing Factors

3.1. Analysis of the Connotation of Credit Structure. Credit is a credit activity for commercial banks and other financial institutions to issue monetary funds to the outside world. It is premised on specific borrowing rates and repayment conditions. Banks lend monetary funds in the financial market to the outside world in the form of loans. On the one hand, they can ensure the monetary funds needed for colonial expansion and reproduction, thereby promoting the healthy development of the national economy; at the same time, banks can also earn a certain amount of money from them, thereby ensuring the accumulation of its capital. As the pillar business of commercial banks, the credit business is an essential means for banks to make profits and an essential basis for adjusting the internal structure of banks. According to the nature of the loan, bank credit can be divided into a mortgage loan, secured loan, and credit loan. Among them, mortgage loans refer to the commercial bank’s right to control part of the enterprise’s property to a certain extent, and the secured loan is the right of the bank to recourse to the guarantor of the loan. A credit loan is a form in which a company obtains a loan based on its credit status (see Figure 1).

3.2. Classification of Credit Structure. From the perspective of bank operation development and social performance, the credit structure can be divided into multiple levels. Credit structure is generally divided into customer structure (personal loan and corporate loan), credit structure (credit loan and secured loan), and term structure (short-term loan and medium and long-term loans).

3.3. Research on Factors Affecting Credit Structure. Through the analysis of the credit structure, the characteristics of the bank’s loan business can be grasped, such as the main investment direction of the loan, the positioning of the customer group, and the regional distribution of the loan market [6, 7]. The credit structure of different banks varies due to the influence of internal and external factors.

(1) The credit structure of banks is greatly affected by the local economic structure. The regional economic structure determines the credit structure of commercial banks. However, the loan business of commercial banks is not limited to the location of banking institutions, but also can cooperate with foreign banks to jointly issue loans to foreign enterprises with good reputation through joint loans or purchase loans from foreign commercial banks [6–11]. Therefore, the geographical distribution of banking institutions does not limit the regional distribution of bank loans.

(2) Loan interest rate structure: the loan yield structure refers to different loan yields, and banks are always willing to issue high-yield loans. With the help of the bank accounting costing software system, the bank can quickly calculate the rate of return of different types of loans to determine the critical loan types of the bank.

(3) Loan scale: the scale of bank loan funds is different, the loan strength is different, and the bank credit structure is also different. Commercial banks with larger loan scales mainly extend credit to large and
mature enterprises, while the credit structure of SMEs is mainly personal loans and SME loans.

(4) Personnel composition: the credit structure of commercial banks is affected by the experience and quality of the credit personnel. Commercial banks must be equipped with credit management personnel in line with the local economic structure to meet the needs of business development.

4. Determination of Evaluation Indicators of Bank Credit Structure Model

4.1. Author's Definition of Credit Quality. The quality of commercial bank credit assets is a relatively comprehensive concept that includes dynamic elements. It needs to consider the performance of the traditional “three characteristics” during the evaluation period and take into account the ability and trend of credit asset operation in the future period. Therefore, the quality of credit assets should be reflected in the profitability of credit assets and take into account the control of risk levels, the structural allocation of terms and objects, asset liquidity, and the ability to expand and develop. This paper will define and evaluate the quality of commercial banks’ credit assets from the aspects of credit asset scale, profitability, risk security, asset liquidity, and expansion capability and establish a more comprehensive credit quality evaluation system.

4.2. Credit Quality Evaluation Indicators. Based on the understanding of the quality of commercial banks’ credit assets, 21 indicators were selected, including scale, profitability, risk safety, asset liquidity, and expansion capacity. A comprehensive and scientific evaluation index system was established.

4.2.1. Scale Level. This paper selects two indicators of commercial banks’ scale of credit assets: the total amount of loans Q1 and the proportion of credit assets Q2 [12–19]. It is generally believed that a particular scale of credit is a necessary basis for quality. Taking the profitability of a commercial bank’s credit assets as an indicator, select loan profit rate Q3, asset profit rate Q4, net interest margin Q5, net interest margin Q6, interest income ratio Q7, and cost-to-income ratio Q8. There is a significant positive correlation between Q3–Q7 and the credit quality of commercial banks; Q8 reflects the cost of bank unit income and expenditure, and Q8 is negatively correlated with the credit quality of commercial banks.

4.2.2. Security Risks. From the perspective of credit asset risk level and risk control capability, seven indicators are selected, namely, non-performing loan ratio Q9, overdue loan ratio Q10, reserve coverage ratio Q11, loan loss reserve adequacy ratio Q12, loan provisioning ratio Q13, the largest customer loan ratio Q14, and capital adequacy ratio Q15. Q9 and Q10 are negatively correlated with the credit quality of commercial banks; Q11–Q15 have a significant positive correlation with credit quality. From the perspective of the liquidity level of commercial banks’ credit assets, two indicators are selected, namely, the loan-to-deposit ratio Q16 and the liquidity ratio Q17. Commercial bank credit quality is negatively correlated with Q16, and Q17 is positively correlated with commercial bank credit quality (see Figure 2).

4.2.3. Capacity Expansion. Taking the expansion capability of the commercial bank’s credit assets as an indicator, select the loan growth rate Q18, the deposit growth rate Q19, the net profit growth rate Q20, and the interest income growth rate Q21. There is a significant positive correlation between Q18–Q21 and the credit quality of commercial banks. The meaning and calculation method of the above indicators are shown in Figure 1.

5. Data Sources and Processing of Bank Credit Structure Models

This paper selects the 2010–2017 data of 20 commercial banks with assets exceeding one trillion in 2017. According to the data of the total assets of financial institutions of 252 trillion yuan in 2019, the assets of these 20 banks account for about 60% of the total assets of the banking industry. Their types include large state-owned, national, joint-stock, and city commercial banks [20–23]. Strong representation is seen in Figure 2. In order to facilitate comparison, the data are firstly processed without dimension.

Then, the original data are uniformly converted into standardized data in the range of [0, 100] by the extreme value method.

Exploratory factor analysis shows that the theoretical index of commercial banks’ credit quality evaluation index system is KMO = 0.702 > 0.6, and the Bartlett sphericity test
has a significant level of Sig. = 0.00 < 0.05. The principal component analysis method was used to reduce the data dimension, and three common factors were selected under the condition that the eigenvalue was more significant than 1, and the cumulative variance contribution rate reached 73.069% (see Table 1).

The first common factor includes deposit growth rate, loan growth rate, net profit growth rate, and interest income growth rate, which generally reflects the expansion of credit assets. The second public factor, net interest spread and asset return rate, generally reflects the profitability of credit assets. The third common factor includes the liquidity ratio and the loan-to-deposit ratio, which generally reflects the liquidity of credit assets. The analysis results are shown in Figure 3.

The above analysis shows that the credit quality of commercial banks in our country has prominent structural characteristics. Different types of commercial banks have different credit quality performances. At the same time, the changes in the time dimension of the overall commercial bank credit quality deserve attention. Although the accuracy of the analysis conclusion is affected by research methods, index comprehensiveness, data accuracy, cycle, and other factors, in view of the consistency and corresponding comparability of the above factors to the evaluation objects, it is still necessary to make an in-depth and systematic analysis on the reasons for the differences and dynamic changes of bank credit quality structure, so as to improve the efficiency of financial resource allocation and prevent the breeding of financial risks.

In recent years, due to the large-scale operation of banks and the need to maximize shareholders’ wealth, the development of credit asset optimization models has shown a trend of diversification. As can also be seen from the above, the objective function can minimize unexpected losses, optimize capital use, and maximize the Sharpe ratio. To a certain extent, the design of the objective function reflects the different understandings of relevant parties on credit risk, large-scale operation, and target management. The second data source is different, such as default probability, correlation, and so on. Risk exposure El, probability of

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**Table 1: Analysis of the evaluation indicators of credit quality of commercial banks.**

<table>
<thead>
<tr>
<th>Index</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deposit growth rate</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>Loan growth rate</td>
<td>0.877</td>
</tr>
<tr>
<td>Net profit growth rate</td>
<td>0.729</td>
</tr>
<tr>
<td>Interest income growth rate</td>
<td>0.729</td>
</tr>
<tr>
<td>Loan provision ratio</td>
<td>0.157</td>
</tr>
<tr>
<td>Overdue loan ratio</td>
<td>-0.424</td>
</tr>
<tr>
<td>Provision coverage ratio</td>
<td>0.497</td>
</tr>
<tr>
<td>Loan ratio of the top ten customers</td>
<td>-0.493</td>
</tr>
<tr>
<td>Net interest margin</td>
<td>0.405</td>
</tr>
<tr>
<td>Return on assets</td>
<td>-0.318</td>
</tr>
</tbody>
</table>

**Figure 3: Effectiveness index factor analysis of evaluation index system rotation component matrix.**

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default, specific loss given default, El period, and the correlation between different risk exposures are the main contents of credit portfolio credit risk management. There is a common trend in the collection and use of these data, that is, the consistency and continuity of data and the sensitivity to credit risk measurement, which is obvious in the Basel agreement. The credit transfer matrix is different until the asset is transferred to the final state (e.g., loan maturity, refinance, default, and so on). Many rating agencies currently provide credit asset credit quality transition matrices, such as Moody’s, Standard & Poor’s, KVM, and so on. Although the specific results of various rating agencies on the relevant indicators are not the same, the conclusions are the same [24–30].

6. Conclusions

In short, the bank credit structure model based on big data financial technology innovation has made valuable explorations in optimizing loan portfolios, both in theory and in practice. However, its shortcoming is that it is impossible to give the best or most appropriate credit asset allocation conclusion based on the basic requirements of the Basel Capital Accord and the characteristics of bank risk management. Therefore, the practical basis of the bank credit structure model of big data financial technology innovation needs to be further enriched, but it is also challenging to have a relatively general guiding significance for the specific business operations of commercial banks.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

References


