

Research on the Competitiveness of Commercial Banks in China Based on Factor Analysis

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Abstract

Commercial banks are the most dynamic part of the banking sector and the financial industry in China, and their competitiveness level is related to the economic development of our country. Therefore, empirical analysis and correct evaluation of the competitiveness of commercial banks are of great significance to enhance the competitiveness of commercial banks, which can also maintain the healthy development of financial industry and market economy. In this paper, 15 listed commercial banks are selected as research samples. Factor analysis is used to analyze the 15 banks from four aspects: profitability, liquidity, security and development ability. The empirical results show that: the state-owned holding banks have competitive advantages in capital adequacy and profitability, which is mainly due to the long time of the establishment of state-owned banks, the large scale of business, and the stable period of development. The city commercial banks have a better development trend and pay more attention to the risk management of bank funds. According to the ranking of comprehensive scores, urban commercial banks are outstanding. The comprehensive competitiveness of state-owned commercial banks is at a medium level. As a whole, the comprehensive ranking of joint-stock commercial banks is not ideal. Merchants Bank only has outstanding performance and unbalanced development, implying the lack of competitiveness of China's joint-stock commercial banks in all aspects.

Keywords

Commercial Banks, Competitiveness, Factor Analysis

1. Introduction

In the modern financial organizational structure, commercial banks are always in the main position. As in China, the capital market is not mature enough and indirect financing is still dominant, the status of commercial banks is even more important. With the full opening of China's financial market and the rapid pace of foreign banks' landing, China's banking industry began to face the strong competition of foreign banks with mature market experience. Shao Xinli analyzed the operating efficiency, safety ability, business ability and human resources of representative commercial banks at home and abroad. It was found that there was a huge gap between Chinese commercial banks in participating in market competition,

especially in international market competition. It was proposed that Chinese commercial banks should speed up our own reform process, establish and improve the commercial banks in line with the requirements of market economy and international habits [2]. Yao Changhui analyzed the current situation of competition of commercial banks in China, and concluded that China's entry into WTO would bring great impact to our banks. The various financial risks faced by our commercial banks would be more exposed. It was imperative to enhance the competitiveness of our banks. It was proposed that we should strengthen the quality management of credit assets, improve the internal control system and vigorously develop the retail business and intermediary business with broad prospects [3]. Peng Qiuling constructed an evaluation system with 16 indicators from five aspects: liquidity,

security, profitability, development and scale, through the theoretical analysis of competitiveness. Empirical analysis was made on the competitiveness of listed commercial banks in China by factor analysis method, and relevant suggestions were put forward from both internal and external aspects to improve the competitiveness of commercial banks in China [4].

As the main body of banking and the most dynamic part of the financial industry, the competitiveness of commercial banks is related to the economic development of our country. Therefore, how to objectively and effectively evaluate the core competitiveness of commercial banks in China, analyze the strength of the core competitiveness of commercial banks will be an important issue, which should guide commercial banks to seize the opportunity, choose the correct market competition strategy, establish the correct promotion countermeasures, and ensure a smooth transition. This is not only of great significance to the development of China's banking industry, but also to deepen the reform of the financial system.

2. Analysis of the Development Status of Commercial Banks

With the development of economic and financial integration at home and abroad, commercial banks have emerged from scratch, from fewer to more, and foreign banks have gradually landed. At present, there are 56 large commercial banks, more than 10 medium-sized commercial banks and more than 100 small commercial banks in China, together with the increasing number of foreign banks and foreign holding banks, which have shown several remarkable characteristics in their development:

2.1. Grass-roots Banking

China's regional economic development is extremely unbalanced. In some economically underdeveloped areas and remote rural areas, the construction of the financial system is short and very weak. With the support of relevant policies, the government departments have paid more attention to these areas. In order to further solve the problems of agriculture, countryside and farmers, the financial regulators have given some preferential policies to the establishment of financial institutions and the management of finance and business in the corresponding areas, which has promoted the grass-roots development of commercial banks.

2.2. The Pace of Internationalization Is Accelerating

Under the background of economic globalization, the economic exchanges between countries around the world are getting closer and closer. Commercial banks need to cope with the dual competition of domestic and international markets at the same time, so there is a trend of transnational operation.

2.3. Business Convergence

The main business of every bank in our country is still based on traditional deposit and loan. Although the bank converts part of the interest income of loan into the income of intermediary business through its own accounting method, in the final analysis, the vast majority of bank profits still come from the interest difference between deposit and loan, which makes the products or services provided by each bank basically similar. Competition can only rely on price war with high interest rate as the main means. This also makes the competition between banks increasingly fierce.

3. Empirical Analysis of Commercial Bank Competitiveness

3.1. Selection of Research Samples

Fifteen representative listed commercial banks are selected for empirical analysis, including five state-owned holding commercial banks: Industrial and Commercial Bank of China, Agricultural Bank of China, Bank of China, China Construction Bank and Bank of Communications; seven joint-stock banks: China Everbright Bank, China Minsheng Bank, Huaxia Bank, China Citic Bank, Industrial Bank, China Merchants Bank and Ping An Bank; and three urban commercial banks: Bank of Beijing, Bank of Ningbo and Bank of Nanjing.

3.2. Establishment of Index System

When we study the competitiveness of commercial banks, we should consider three aspects: liquidity, security and profitability. In addition, in order to reflect the future development potential of commercial banks, development capacity should also be taken into account. Therefore, combined with the data published in the above 15 banks' annual report in 2017, this paper selects 11 indicators from four aspects: liquidity, security, profitability and development ability to measure the competitiveness of commercial banks. The specific evaluation index system is shown in Table 1 below:

Table 1. Evaluation Index System of Commercial Bank Competitiveness.

Primary Indicators	Secondary Indicators and Variables
Profitability indicators	Return on Assets-X1
	Return on assets-X2
Liquidity indicators	Liquidity ratio-X3
	Loan-to-deposit ratio-X4
	capital adequacy ratio-X5
	Core capital adequacy ratio-X6
Safety indicators	Non-performing loan rate-X7
	Provision coverage-X8
	Deposit growth rate-X9
Development capacity indicators	Loan growth rate-X10
	Net profit growth rate-X11

3.3. Data Processing and Inspection

3.3.1. Data Normalization and Standardization

According to the content of each commercial bank's annual report in 2017, we can get all the original data needed in the evaluation index system. Among the indicators of the evaluation index system, the ratio of loan to deposit and the ratio of non-performing loans are reverse indicators, so it needs to be treated positively before factor analysis. Then SPSS can be used to standardize the forward data.

3.3.2. Data Inspection

Before factor analysis, it is necessary to check whether the processed data are suitable for factor analysis. The main test indicators are KMO test and Bartlett spherical test. The closer the KMO value is to 1 in KMO test, the more suitable the original variables are for factor analysis. Generally, KMO value greater than 0.5 is considered to be factor analysis. In this paper, SPSS software is used to check the processed data. The results are shown in Table 2 below:

Table 2. KMO and Bartlett spherical test results.

Kaiser-Meyer-Olkin Measure of Sampling Sufficiency		0.567
Bartlett's sphericity test	Approximate chi square	177.712
	df	55
	Sig.	0.000

According to Table 2, the KMO value is $0.567 > 0.5$, and the significance probability of statistical value in Bartlett spherical test is $0.000 < 0.1$, which indicates that there is a high correlation between the data and it is suitable for factor analysis.

3.4. Factor Analysis

Factor analysis is a statistical analysis method for dealing with multivariate data. Its basic idea is to condense a large number of original variables into a few factor variables by

minimizing the loss of information, and use them to generalize and explain a large number of observation facts with intricate and complex relationships, so as to establish the most concise and basic conceptual system and reveal the most essential relationship between things. The mathematical model is as follows:

$$\begin{cases} x_1 = \alpha_{11}F_1 + \alpha_{12}F_2 + \cdots + \alpha_{1m}F_m + \alpha_1\varepsilon_1 \\ x_2 = \alpha_{21}F_1 + \alpha_{22}F_2 + \cdots + \alpha_{2m}F_m + \alpha_2\varepsilon_2 \\ \cdots \cdots \cdots \\ x_p = \alpha_{p1}F_1 + \alpha_{p2}F_2 + \cdots + \alpha_{pm}F_m + \alpha_p\varepsilon_p \end{cases}$$

In formula: x_1, x_2, \cdots, x_p denotes p original variables with a mean value of 0 and a standard deviation of 1; F_1, F_2, \dots, F_m represents m factor variables; α_{ij} is factor load; $\varepsilon_1, \varepsilon_2, \cdots, \varepsilon_p$ are special factors. The above models can also be expressed in matrix form:

$$X = AF + \alpha\varepsilon$$

In formula: X is the original variable, F is the factor variable, A is the factor load matrix, α is factor load, ε is and special factor.

3.4.1. Basic Steps of Factor Analysis

1. To confirm whether the original variables to be analyzed are suitable for factor analysis.
2. Constructing factor variables.
3. Rotation method is used to make factor variables more explainable.
4. Calculate the Score of Factor Variables.

3.4.2. Extraction of Common Factors

According to the criterion that factor contribution rate is more than 85%, principal component analysis is used to extract common factors. The factors extracted by SPSS statistical software are used to explain the total variance of the original variables as shown in Table 3:

Table 3. Total variance explained by factor analysis.

Ingredients	Initial eigenvalue			Extract Square Sum Loading			Rotating Square Sum Loading		
	Total	Variance	accumulation	Total	Variance	accumulation	Total	Variance	accumulation
F ₁	4.609	41.902	41.902	4.609	41.902	41.902	4.099	37.263	37.263
F ₂	3.513	31.941	73.843	3.513	31.941	73.843	3.987	36.247	73.510
F ₃	1.268	11.530	85.373	1.268	11.530	85.373	1.305	11.862	85.373
F ₄	0.855	7.768	93.141						
F ₅	0.392	3.566	96.707						
F ₆	0.217	1.977	98.684						
F ₇	0.065	0.591	99.275						
F ₈	0.032	0.292	99.568						
F ₉	0.028	0.253	99.821						
F ₁₀	0.013	0.120	99.941						
F ₁₁	0.007	0.059	100.000						

From Table 3, we can see that the eigenvalues of the first three factors are greater than 1 and the cumulative variance contribution rate reaches 85.373%. This shows that the information represented by the first three factors can fully reflect most of the information of the original data. Therefore, three common factors F_1, F_2 and F_3 are selected in this paper.

The factor load matrix obtained is shown in Table 4:

Table 4. Factor Load Matrix.

Index	Common factor		
	F ₁	F ₂	F ₃
X10	0.795	-0.302	-0.046

Index	Common factor		
	F ₁	F ₂	F ₃
X6	-0.793	0.569	0.124
X8	0.790	0.567	-0.159
X7	0.777	0.538	-0.115
X2	-0.711	0.671	0.008
X1	-0.706	0.314	-0.207
X5	-0.527	0.813	0.096
X4	0.546	0.702	0.046
X11	0.636	0.645	-0.125
X9	0.340	0.564	0.541
X3	0.141	-0.226	0.922

3.4.3. Nomenclature Interpretation of Factor

Table 5. Factorial Load Matrix after Rotation.

Index	Common factor		
	F ₁	F ₂	F ₃
X6	0.976	-0.116	0.046
X2	0.976	0.023	-0.061
X5	0.942	0.244	0.048
X10	-0.793	0.309	0.035
X1	0.717	-0.222	-0.277
X8	-0.214	0.959	-0.071
X7	-0.221	0.925	-0.028
X11	-0.046	0.912	-0.052
X4	0.071	0.881	0.109
X9	0.166	0.604	0.579
X3	-0.190	-0.144	0.929

Factor load matrix shows the initial factor solution, so it is difficult to explain the meaning of factor. In order to better explain the factors and make them named and interpretable, the maximum variance orthogonal rotation method is used to rotate the factor load matrix by SPSS statistical software. The rotating factor load matrix is shown in Table 5.

From the rotating factor load matrix, the first factor F₁ has higher loads on core capital adequacy ratio (X6), capital adequacy ratio (X5), return on assets (X2), return on assets (X1), loan growth rate (X10), and its factor loads are 0.976, 0.942, 0.976, 0.717 and -0.793, respectively. Core capital adequacy ratio and capital adequacy ratio mainly reflect the capital adequacy of banks. They are the basis for the safe operation and development of commercial banks. Return rate of assets and return rate of assets reflect the profitability of banks. Loans, as the most important way for commercial banks to use assets, can also reflect the profitability of commercial banks from different aspects. Therefore, factor F₁ can be named as security and profitability factors.

The second factor F₂ has higher load on reserve coverage (X8), non-performing loan rate (X7), net profit growth rate (X11), loan-deposit ratio (X4) and deposit growth rate (X9), with factor loads of 0.959, 0.925, 0.912, 0.881 and 0.604, respectively. Reserve coverage rate and non-performing loan rate mainly measure the ability of commercial banks to manage risks. Net profit growth rate and deposit growth rate reflect the ability of commercial banks to develop. Loan-deposit ratio reflects the liquidity of commercial banks' development. Therefore, factor F₂ is a more comprehensive index, which can be named risk management and development capacity factor.

The third factor, F₃, has a higher load on the liquidity ratio (X3), which is 0.929. The liquidity ratio mainly reflects the liquidity of commercial banks, so the third factor F₃ can be named liquidity factor.

3.4.4. Factor Score Calculating and Ranking

After completing the naming of the factors, it is necessary to calculate the factor score coefficient, so as to get the weight of each index. The score coefficient matrix of each factor is estimated and output by regression method. The results are shown in Table 6:

Table 6. Factor Score Coefficient Matrix.

	Common factor		
	F ₁	F ₂	F ₃
X1	0.161	-0.023	-0.177
X2	0.242	0.038	-0.009
X3	-0.014	-0.083	0.725
X4	0.049	0.224	0.050
X5	0.245	0.090	0.066
X6	0.243	-0.002	0.081
X7	-0.028	0.233	-0.071
X8	-0.027	0.243	-0.105
X9	0.084	0.136	0.434
X10	-0.188	0.054	-0.018
X11	0.014	0.236	-0.082

According to the factor score coefficient matrix and the standardized value of the original variables, the scores of each factor of commercial banks can be calculated, and then the scores of each common factor of commercial banks can be ranked by using the function.

The specific results are shown in table 7:

Table 7. Factor Ranking.

Bank	F ₁	Ranking	F ₂	Ranking	F ₃	Ranking
ICBC	0.06707	1	0.84242	8	0.21312	7
IBC	0.04715	4	0.97246	5	0.22990	5
ABOC	0.04790	3	0.81667	9	0.22673	6
CCB	0.05928	2	0.89282	7	0.19815	9
BOCM	0.03842	5	0.76103	13	0.30203	3
CEB	0.02770	6	0.77105	10	0.32000	1
CMBC	0.01289	11	0.74195	15	0.12725	11
HXB	0.02310	8	0.76298	12	0.21067	8
ECITIC	0.01006	12	0.76565	11	0.14291	10
CIB	0.01915	10	0.96589	6	0.30908	2
CMB	0.02507	7	1.06400	4	0.06665	13

Bank	F ₁	Ranking	F ₂	Ranking	F ₃	Ranking
PAB	0.01937	9	0.75958	14	0.26588	4
BOB	-0.01514	13	1.11229	3	0.07168	12
NBB	-0.04942	15	1.90875	1	-0.10322	14
NJB	-0.04022	14	1.85058	2	-0.13119	15

After calculating the score of each factor, the comprehensive score of each commercial bank can also be calculated according to the variance contribution rate of each factor (see Table 3). The calculation formula is as follows:

$$F = 41.902\% * F_1 + 31.941\% * F_2 + 11.53\% * F_3$$

According to the single factor scores of commercial banks and the above formulas, the comprehensive competitiveness scores and rankings of commercial banks can be obtained, as shown in Table 8:

Table 8. Comprehensive Ranking of Factor Scores.

Bank	Composite score	Ranking
ICBC	0.32175	8
IBC	0.35688	5
ABOC	0.30706	9
CCB	0.33286	7
BOCM	0.29400	11
CEB	0.29478	10
CMBC	0.25706	15
HXB	0.27767	13
ECITIC	0.26525	14
CIB	0.35217	6
CMB	0.35804	3
PAB	0.28139	12
BOB	0.35720	4
NBB	0.57706	1
NJB	0.55912	2

4. Conclusion

4.1. Analysis of Factor F₁

Factor F₁ is a factor of security and profitability. It mainly reflects the information of core capital adequacy rate, capital adequacy rate, asset return rate, asset return rate and loan growth rate. From the factor score table, we can see that the state-owned holding banks such as Industrial and Commercial Bank of China, China Construction Bank and Bank of China rank in the top ranking, while the city commercial banks rank behind. This shows that the state-owned holding banks have competitive advantages in capital adequacy and profitability, which is mainly due to the long time of the establishment of state-owned banks, the large scale of business, and the stable period of development.

4.2. Analysis of Factor F₂

Factor F₂ is a factor of risk management ability and development ability. It mainly reflects the information of reserve coverage, non-performing loan rate, net profit growth rate, loan-deposit ratio and deposit growth rate. In this factor ranking, the overall performance of urban commercial banks

is outstanding, the collective occupies the top three places, Ping An Bank ranks the lowest and the last. Development ability reflects the growth of banks, and risk management ability reflects the ability of banks to control capital risk. Through the ranking, we can see that the city commercial banks have a better development trend and pay more attention to the risk management of bank funds. There are great differences between joint-stock commercial banks. Industrial Bank and China Merchants Bank have more competitive advantages, Minsheng Bank and Ping An Bank perform poorly, which need to further improve the credit risk management system and strengthen the comprehensive competitiveness.

4.3. Analysis of Factor F₃

Factor F₃ is the liquidity factor, which mainly reflects the liquidity of commercial bank development. In this factor score, Everbright Bank, Industrial Bank and Bank of Communications ranked the top three, indicating that they have a better ability to access liquidity. From the original data, it can be seen that all commercial banks have reached the regulation of the CBRC that the liquidity ratio is not less than 25%, maintained a high liquidity ratio, guaranteed the short-term solvency of banks, and effectively prevented potential liquidity risks.

4.4. Comprehensive Analysis

From the perspective of comprehensive competitiveness, all indicators have different degrees of impact on the competitiveness of banks. According to the ranking of comprehensive scores, urban commercial banks are outstanding, which may benefit from the fact that urban commercial banks in China are still in the expansion period of development, and their development ability is significantly better than other banks. The comprehensive competitiveness of state-owned commercial banks is at a medium level. Although they have competitive advantages in terms of security and profitability factors, their advantages are relatively single and not obvious, which leads to their comprehensive ranking is not high. As a whole, the comprehensive ranking of joint-stock commercial banks is not ideal. Merchants Bank only has outstanding performance and unbalanced development, implying the lack of competitiveness of China's joint-stock commercial banks in all aspects.

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