

# Financial Performance Evaluation of Chinese Listed Commercial Banks

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**Abstract** In the context of China's economic New Normal, the operating environment of China's listed commercial Banks is facing great changes. It is urgent for Chinese listed commercial banks to improve their financial performance so as to enhance their core competitiveness. This paper applies the factor analytic approach to assess the financial performance of 15 Chinese listed commercial banks, including 4 state-owned commercial banks, 8 national joint-stock commercial banks and 3 local city commercial banks as the object of our study. In this paper, a new financial performance evaluation system is constructed based on the financial data for these banks. A comparison of different types of banks and different banks of the same type is also conducted. Based on the comparison results, some suggestions are further provided to solve the current problems.

**Keywords:** *listed commercial bank, financial performance, factor analysis*

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## 1. Introduction

In recent years, China's macro economy has been in a New Normal state with economic growth slowing down, economic structure optimized, interest rate liberalization accelerated, Internet finance surging forward and money funds in the ascendant. Under this background, the operating environment of listed commercial banks in China is facing great changes. It is urgent to improve their financial performance in a targeted way so as to improve their core competitiveness. Hence, it is extremely important to analyze the financial performance of commercial banks and build a reasonable financial performance evaluation system.

In the literature, a sequence of empirical studies has investigated the issue of performance evaluation by various approaches, including data envelopment analysis, as in [1,2], economic value added evaluation [3], Camel model [4], panel data model [5] and principal component analysis [6]. Among all of the existing methods, factor analysis is widely used by scholars in this field. For instance, Reference [7] takes 42 commercial banks in Turkey as an example and makes quantitative analysis of banks' indicators to detect the reasons why commercial banks could go broke via factor analysis.

Generally speaking, the indicators selected by scholars to evaluate the financial performance of commercial banks can be divided into three categories. Firstly, indicators can be chosen from the perspective of asset, such as asset

scale, asset quality, and asset risk, as in [8-10]. Secondly, development ability can be considered as an indicator to promote the financial performance of commercial banks, as in [11,12]. Thirdly, market scale is a new perspective to evaluate the financial performance of commercial banks, as in [13,14].

In this paper, we select 15 listed commercial banks in China as the research object, including 4 state-owned commercial banks, 8 national joint-stock commercial banks, and 3 local city commercial banks. Based on the financial data of the 15 listed commercial banks in 2015, we extract 11 indicators that reflect the profitability, growth, security and liquidity of the bank respectively. Specifically, there are 7 positive indicators and 4 reverse indicators. On this basis, we construct a system for evaluating the financial performance of commercial banks. A comparison of different types of banks and different banks of the same type is also conducted. Based on the comparison results, some suggestions are further provided to solve the current problems.

The rest of the paper is organized as follows. The statistical methodology is presented in Section 2. Section 3 describes the data. The empirical results and discussion are provided in Section 4. Section 5 concludes.

## 2. Statistical Methodology

In the existing studies, the evaluation methods of financial performance mainly include EVA model, DuPont model, analytic hierarchy process, factor analysis and other

approaches. Among these approaches, factor analysis is the most widely used statistical analysis approach, which can extract fewer independent variables, so-called common factors, from various dependent variables to achieve the purpose of dimensionality reduction.

Suppose  $Z_1, Z_2, \dots, Z_p$  are  $p$  correlated indicators in consideration, the performance evaluation model can be described as follows.

$$\begin{aligned} Z_1 &= l_{11}F_1 + l_{12}F_2 + \dots + l_{1m}F_m + \varepsilon_1 \\ Z_2 &= l_{21}F_1 + l_{22}F_2 + \dots + l_{2m}F_m + \varepsilon_2 \\ &\vdots \\ Z_p &= l_{p1}F_1 + l_{p2}F_2 + \dots + l_{pm}F_m + \varepsilon_p \end{aligned} \tag{1}$$

where  $F_1, F_2, \dots, F_m$  are common factors,  $\varepsilon_1, \varepsilon_2, \dots, \varepsilon_p$  are special factors,  $p$  is the number of indicators,  $m$  is the number of common factors,  $l_{ij}$  is the factor loading of the  $i$ th indicator  $Z_i$  on the  $j$ th common factor  $F_j$ . The larger the factor loading  $l_{ij}$  is, the stronger the correlation of  $Z_i$  and  $F_j$  is.

Compared with other performance evaluation approaches, factor analysis with objective weights can reduce the influence of subjective factors on the empirical results. Meanwhile, factor rotation can improve the interpretability of the common factors, reducing the difficulty of the empirical analysis. In view of the advantages of factor analysis, this paper adopts the approach of factor analysis to evaluate the financial performance of 15 listed commercial banks in China.

### 3. Data Description

In this paper, we select 15 listed commercial Banks in China as the research object, which include 4 state-owned commercial banks (Industrial and Commercial Bank of China, China Construction Bank, Bank of China, Agricultural Bank of China), 8 national joint-stock commercial banks (China Merchants Bank, China CITIC Bank, China Everbright Bank, Huaxia Bank, Shanghai Pudong Development Bank, Industrial Bank Co., Ltd., China Minsheng Banking Corp., Ltd., Ping An Bank Co., Ltd.) and 3 local city commercial banks (Bank of Nanjing, Bank of Ningbo and Bank of Beijing Co., Ltd.). The financial data of these 15 listed commercial banks in 2015 are in our consideration to evaluate their financial performance.

Based on the data, this paper builds a financial performance evaluation system of commercial banks by adding growth to the "three properties" (profitability, liquidity, security). In the evaluation system, this paper selects return on total assets, return on equity, basic earnings per share and the cost-revenue ratio as the profitability indicators, deposit-loan ratio and current ratio as the liquidity indicators, asset-liability ratio, non-performing loan rate, provision coverage as the security indicators, and capital accumulation rate and growth rate

of total assets as the growth indicators, with 11 indicators in total. Among these 11 indicators, return on total assets, return on equity, basic earnings per share, current ratio, provision coverage, capital accumulation rate and growth rate of total assets are positive indicators, while cost-revenue ratio, deposit-loan ratio, asset-liability ratio, non-performing loan ratio are reverse indicators.

For purposes of subsequent analysis, the financial indicators are unified and standardized before factor analysis. The specific formula of unification is as follows,

$$x'_{ij} = \begin{cases} \frac{x_{ij} - \min_i\{x_{ij}\}}{\max_i\{x_{ij}\} - \min_i\{x_{ij}\}} & x_{ij} \text{ is a positive indicator} \\ \frac{\max_i\{x_{ij}\} - x_{ij}}{\max_i\{x_{ij}\} - \min_i\{x_{ij}\}} & x_{ij} \text{ is a reverse indicator} \end{cases} \tag{2}$$

where  $x_{ij}$  is the original indicator,  $x'_{ij}$  is the unified indicator,  $\max_i\{x_{ij}\}$  represents the maximum value of the  $j$ th index, and  $\min_i\{x_{ij}\}$  represents the minimum value of the  $j$ th index.

Furthermore, the Z-score method is employed to standardize the unified data. The specific formula of standardization is as follows,

$$z_{ij} = \frac{x'_{ij} - \bar{x}'_{\bullet j}}{s'_{\bullet j}} \tag{3}$$

where  $z_{ij}$  is the standardized indicator,  $\bar{x}'_{\bullet j}$  and  $s'_{\bullet j}$  are the mean and standard deviation of the  $j$ th indicator after .

After unification and standardized treatments, the original data of the above 11 indicators are all transformed to be suitable for factor analysis. Table 1 reports the descriptive statistics of the 11 indicators used before and after the transformation. From Table 1, we can see that, the variations among different indicators are quite large for the raw data, while the values of the transformed data are quite close, and the means as well as standard deviations of all indicators are almost the same. Obviously, the transformed data are more convenient for factor analysis.

### 4. Empirical Results and Discussion

In this section, factor analysis is applied to evaluate the financial performance of 15 listed commercial Banks in China based on the transformed financial indicators of 2015. Following the steps of factor analysis, the empirical results of factor analysis will be reported successively.

The first step is to employ KMO and Bartlett's test to verify whether the data is suitable for factor analysis. The test results are shown in Table 2. It can be seen from Table 2 that, the statistic value of KMO is 0.6402, and the  $p$  value of the Bartlett's test is 0.0000, indicating that there is a significant correlation between variables, and factor analysis is quite suitable for the data.

**Table 1. Descriptive statistics**

	Raw data					Transformed data				
	Max	Min	Median	Mean	Std.	Max	Min	Median	Mean	Std.
Return on total assets	1.25	0.81	0.96	0.99	0.13	2.03	(1.42)	(0.30)	0.00	1.00
Return on equity	18.89	14.53	17.09	16.74	1.36	1.57	(1.62)	0.25	0.00	1.00
Basic earnings per share	2.67	0.55	1.33	1.45	0.74	1.64	(1.21)	(0.16)	0.00	1.00
Cost-revenue ratio	35.01	21.59	27.67	28.04	4.20	1.54	(1.66)	0.09	0.00	1.00
Deposit-loan ratio	76.28	50.70	71.00	70.07	6.48	2.99	(0.96)	(0.14)	0.00	1.00
Current ratio	65.67	34.06	44.72	46.52	9.10	2.10	(1.37)	(0.20)	0.00	1.00
Asset-liability ratio	94.14	91.89	93.49	93.24	0.72	1.86	(1.24)	(0.34)	0.00	1.00
Non-performing loan rate	2.39	0.83	1.50	1.47	0.36	1.80	(2.57)	(0.08)	0.00	1.00
Provision coverage	430.95	150.99	167.81	205.29	78.14	2.89	(0.69)	(0.48)	0.00	1.00
Capital accumulation rate	59.88	14.72	21.01	22.94	11.27	3.28	(0.73)	(0.17)	0.00	1.00
Growth rate of total assets	40.46	7.76	15.71	17.45	8.82	2.61	(1.10)	(0.20)	0.00	1.00

**Table 2. KMO and Bartlett's test**

	KMO value	0.6402
	Approximate Chi-Square	124.1833
Bartlett's test of sphericity	Degrees of freedom	55.0000
	<i>p</i> value	0.0000

**Table 3. Total variance explained**

component	Before rotation			After rotation		
	Eigenvalue	Variance contribution rate (%)	Accumulative variance contribution rate (%)	Eigenvalue	Variance contribution rate (%)	Accumulative variance contribution rate (%)
1	4.9969	45.4263	45.4263	4.0388	36.7168	36.7168
2	1.7405	15.8231	61.2494	2.1295	19.3589	56.0756
3	1.5496	14.0872	75.3366	2.0460	18.6004	74.6761
4	1.0754	9.7765	85.1131	1.1481	10.4371	85.1131
5	0.8909	8.0991	93.2123			
6	0.4292	3.9015	97.1137			
7	0.1132	1.0289	98.1426			
8	0.0865	0.7866	98.9292			
9	0.0646	0.5876	99.5168			
10	0.0369	0.3355	99.8523			
11	0.0163	0.1477	100.0000			

**Table 4. Factor loading matrix before and after rotation**

	Initial factor loading matrix				Rotated factor loading matrix			
	$l_{i1}$	$l_{i2}$	$l_{i3}$	$l_{i4}$	$l_{i1}$	$l_{i2}$	$l_{i3}$	$l_{i4}$
Return on total assets	-0.5660	0.7271	0.2965	0.0101	-0.3552	0.8458	0.2652	-0.1591
Return on equity	0.4009	0.7434	-0.3786	-0.1829	0.1384	-0.0309	0.9080	-0.2133
Basic earnings per share	0.6442	0.3461	-0.6117	0.1015	0.2105	-0.4774	0.7898	0.1524
Cost-revenue ratio	0.2805	0.5956	0.0116	0.3180	0.1917	0.2801	0.5871	0.2735
Deposit-loan ratio	0.7989	0.1463	0.3616	0.0065	0.8599	0.0286	0.2091	0.0799
Current ratio	0.2127	-0.1585	-0.0673	0.9244	0.0588	-0.0922	0.0189	0.9576
Asset-liability ratio	-0.5601	0.3393	0.7267	0.1527	-0.1294	0.9499	-0.2466	0.0200
Non-performing loan rate	0.7020	-0.0492	0.2868	-0.1739	0.7640	-0.1226	0.0449	-0.0836
Provision coverage	0.9278	0.0370	0.2356	-0.1412	0.9234	-0.1940	0.2151	-0.0325
Capital accumulation rate	0.8819	-0.0556	0.3617	0.0430	0.9340	-0.1131	0.0738	0.1514
Growth rate of total assets	0.9453	-0.1272	0.1100	0.0248	0.8626	-0.3602	0.1554	0.1565

The second step is to determine the number of common factors. The total variance explained, including the eigenvalue, the variance contribution rate and the accumulative variance contribution rate of each component is shown in Table 3. From Table 3, it is easy to

see that, the eigenvalues of the first four components are all greater than 1, and their corresponding accumulative variance contribution rate exceeds 85%, indicating that the first four components have a comprehensive reflection of the 11 financial indicators without significant loss of

information. According to the minimum eigenvalue criteria, we choose the first four components as the common factors, that is  $(F_1, F_2, F_3, F_4)$ .

The third step is to interpret the common factors. Table 4 reports the factor loading matrix. Seen the rotated factor loading matrix from Table 4, the practical meanings of the 4 common factors can be easily explained. For the first common factor, the factor loading of capital accumulation rate, which reflects the growth ability, is the highest, so it is named as growth factor. For the second common factor, the factor loading of asset-liability ratio, which reflects the security capability, is the highest, so it is named as security factor. For the third common factor, the factor loading of return on equity, which reflects the profitability, is the highest, so it is named as profit factor. For the fourth common factor, the factor loading of current ratio, which reflects the flow capacity, is the highest, so it is named as flow factor.

The fourth step is to calculate the factor score. For each commercial bank, we can calculate the factor scores of the above four common factors including growth factor,

security factor, profit factor and flow factor. The specific formula is as follows:

$$\hat{F}_j = b_{j1}Z_1 + b_{j2}Z_2 + \dots + b_{j,11}Z_{11} \quad (j = 1, 2, 3, 4) \quad (4)$$

where  $\hat{F}_j$  represents the factor score of the  $j$ th common factor,  $Z_1, Z_2, \dots, Z_{11}$  are the indicators from item 1 to item 11, and  $b_{j1}, b_{j2}, \dots, b_{j,11}$  are the corresponding component score coefficients of the  $j$ th common factor, which can be found in Table 5.

The factor scores and rankings of Chinese listed commercial banks are shown in Table 6. It can be seen from Table 6, state-owned commercial banks have the best security, the worst growth performance and the moderate profitability and liquidity. Moreover, the national joint-stock commercial banks have the best profitability, the worst safety, the moderate liquidity and growth. In addition, local city commercial banks have the best growth, the worst liquidity, safety and profitability.

Table 5. Component score coefficient matrix

	Common factor			
	Growth factor	Security factor	Profit factor	Flow factor
Return on total assets	-0.0134	0.4184	0.2121	-0.0617
Return on equity	-0.0554	0.0129	0.4820	-0.2047
Basic earnings per share	-0.1101	-0.2057	0.3971	0.0937
Cost-revenue ratio	0.0099	0.2183	0.3081	0.2551
Deposit-loan ratio	0.2526	0.1520	0.0099	0.0100
Current ratio	-0.0695	0.0205	0.0033	0.8634
Asset-liability ratio	0.1251	0.5079	-0.0947	0.0900
Non-performing loan rate	0.2321	0.0382	-0.0732	-0.1423
Provision coverage	0.2487	0.0293	-0.0008	-0.1121
Capital accumulation rate	0.2674	0.0846	-0.0774	0.0599
Growth rate of total assets	0.1977	-0.0617	-0.0301	0.0539

Table 6. Factor scores and rankings of Chinese listed commercial Banks

	Growth Factor		Security Factor		Profit Factor		Flow Factor	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank
ICBC	-0.1991	6	2.0681	1	0.2762	6	-0.9979	11
CCB	-0.3403	11	1.7971	2	0.3544	5	-0.2618	8
BOC	-0.3086	9	1.2075	3	-1.2627	14	0.4915	6
ABC	-0.6586	13	0.0449	7	-0.5695	11	-0.3070	9
CMB	-0.9189	15	-0.2274	8	0.8326	3	1.9017	1
CITICB	-0.1551	4	-1.0353	14	-1.3178	15	0.1952	7
CEB	-0.2579	7	0.1889	4	-0.9178	12	1.1340	2
HXB	-0.8797	14	-1.4173	15	-0.0882	7	-1.2548	15
SPDB	-0.3892	12	-0.4021	10	1.9348	1	-1.0023	12
CIB	-0.3049	8	-0.5813	11	1.9047	2	1.1218	3
CMBC	-0.3102	10	0.0858	6	-0.1405	8	-0.3253	10
PINGAN	-0.1611	5	-0.8006	13	-0.9745	13	0.6752	5
NJCB	3.0471	1	0.1879	5	0.4010	4	0.8685	4
NCBC	1.2848	2	-0.7294	12	-0.2628	10	-1.1226	14
BOB	0.5518	3	-0.3869	9	-0.1697	9	-1.1162	13

Note: ICBC is Industrial and Commercial Bank of China; CCB is China Construction Bank; BOC is Bank of China; ABC is Agricultural Bank of China; CMB is China Merchants Bank; CITICB is China CITIC Bank; CEB is China Everbright Bank; HXB is Huaxia Bank; SPDB is Shanghai Pudong Development Bank; CIB is Industrial Bank Co., Ltd.; CMBC is China Minsheng Banking Corp., Ltd.; PINGAN is Ping An Bank Co., Ltd.; NJCB is Bank of Nanjing; NCBC is Bank of Ningbo; BOB is Bank of Beijing Co., Ltd.

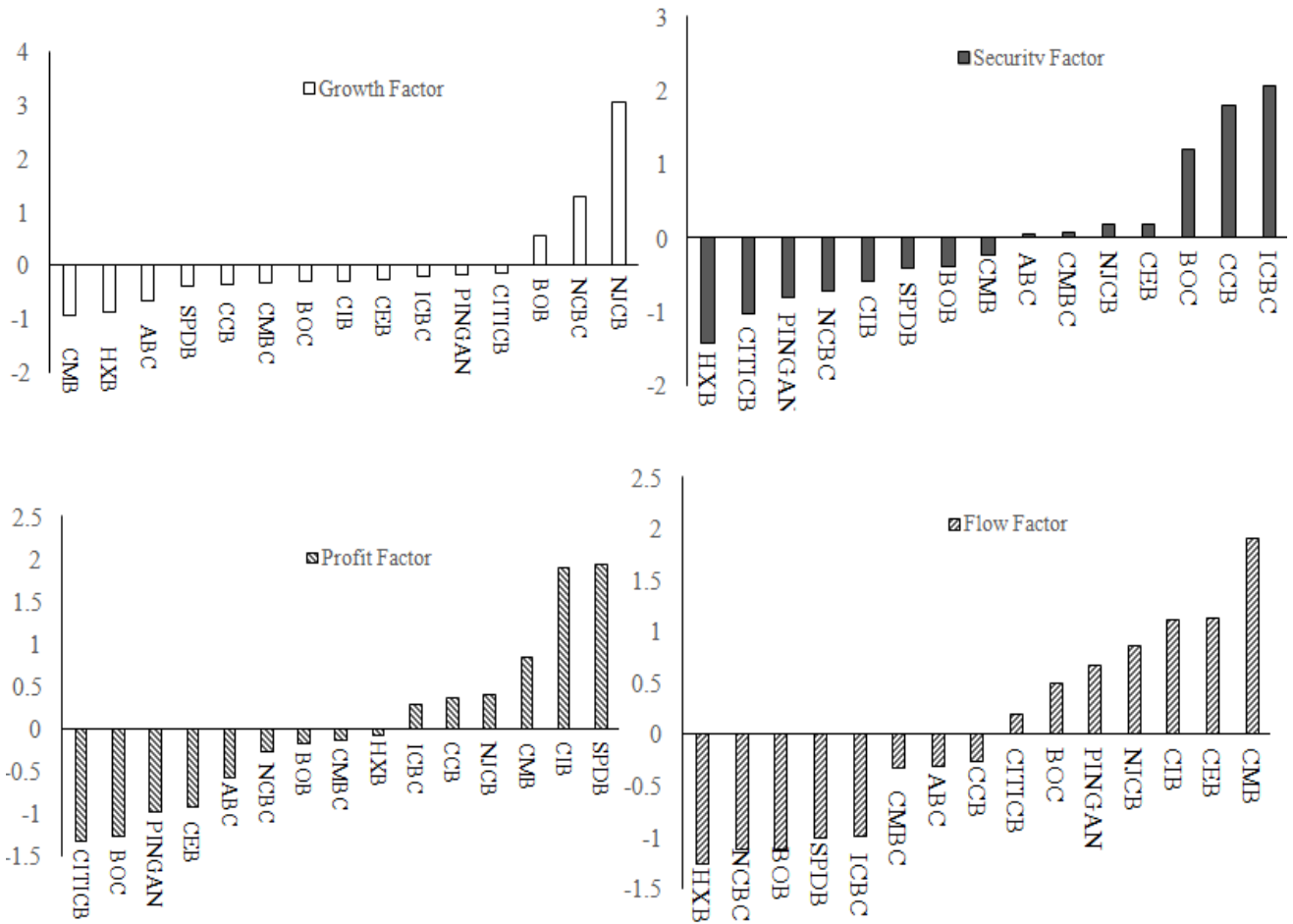


Figure 1. Factor scores and rankings of Chinese listed commercial banks

To make the comparison results more intuitively, Figure 1 plots factor scores for different commercial banks in the four abilities. As for the growth factor, the factor scores of state-owned commercial banks and national joint-stock commercial banks are all negative, while the scores of local city commercial banks are all positive and large in the magnitude, indicating that the growth of local city commercial banks is obviously superior to the other two types of banks. It is worth mentioning that Bank of Nanjing has the highest factor score among 15 listed commercial banks, which indicates that Bank of Nanjing has great potential for development. For the security factor, the factor scores of state-owned commercial banks are all positive and high, while the scores of national joint-stock commercial banks and local city commercial banks are basically negative and low, indicating that the security of the state-owned commercial banks is obviously superior to the other two types of banks. Specifically, the score of the Agricultural Bank of China is obviously lower than that of other state-owned commercial banks, and the scores of China CITIC Bank, Huaxia Bank and Ping An Bank are obviously lower than other national joint-stock commercial banks, indicating that the security of these banks needs to be improved urgently. In the light of the profit factor, the internal variations of different banks of the same type are quite obvious, and the overall score of the national joint-stock commercial banks is higher than the other two types of banks. Considering the flow factor, the scores of all types of banks have obvious differences.

Besides, the overall score of the local city commercial banks is the lowest. Among the local city commercial banks, only Bank of Nanjing has positive factor score, while the factor scores of Bank of Ningbo and Bank of Beijing are both negative and low. In addition, only Bank of China has positive factor score among the state-owned commercial banks, while the other banks have lower scores, especially for Industrial and Commercial Bank of China. For the national joint-stock commercial banks, China Merchants Bank, China Everbright bank and Industrial Bank Co. all have higher scores, while the scores of Shanghai Pudong Development Bank and Huaxia Bank are low. The differences of factor scores for the national joint-stock commercial banks are quite huge and the development of liquidity is unbalanced.

The fifth step is to calculate the synthesis score. To provide an overall picture of the financial performance of Chinese listed commercial banks, we calculate the synthesis score, which is the weighted average of factor scores for each bank by using the variance contribution rate of each common factor as weights. The specific formula is as follow,

$$S = W_1\hat{F}_1 + W_2\hat{F}_2 + W_3\hat{F}_3 + W_4\hat{F}_4 \quad (5)$$

where  $S$  is the synthesis score,  $\hat{F}_1, \hat{F}_2, \hat{F}_3, \hat{F}_4$  are the factor scores of the four common factors, which are obtained by Equation (4), and  $W_1, W_2, \dots, W_m$  are the corresponding weights of the four common factors.



Table 7. Synthesis scores and rankings of Chinese listed commercial Banks

	Comprehensive			Comprehensive	
	Score	Ranking		Score	Ranking
ICBC	0.1781	3	SPDB	-0.0658	7
CCB	0.1540	4	CIB	0.1476	5
BOC	-0.0790	8	CMBC	-0.1789	11
ABC	-0.4024	14	PINGAN	-0.2711	12
CMB	-0.1501	10	NJCB	1.5554	1
CITICB	-0.4009	13	NCBC	0.3215	2
CEB	-0.1057	9	BOB	0.5518	3
HXB	-0.7590	15			

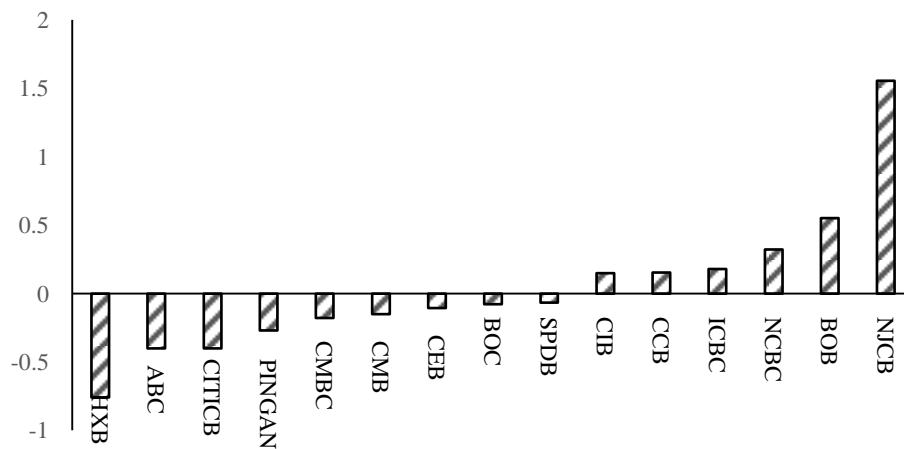


Figure 2. Synthesis scores of Chinese listed commercial Banks

For each commercial bank, we substitute the factor scores and the corresponding weights of the four common factors into Equation (5). The synthesis scores and rankings of Chinese listed commercial banks can be obtained, which are shown in Table 7. According to Table 7, the local city commercial banks rank at the top of the list, the state-owned commercial banks are the second, and the national joint-stock commercial banks rank at the bottom. This finding is in accordance with our expectations.

To depict the comparison results more clearly, Figure 2 plots the synthesis scores of Chinese listed commercial banks with bars. It can be seen from Figure 2 that, the financial performance of different types of listed commercial banks and different listed commercial banks of the same type shows a clear trend of differentiation. For the state-owned holding commercial banks, Agricultural Bank of China has the synthesis score far below the other banks, even stays at the end of the rankings among all types of banks, and the other three banks are at the moderate level among all types of banks. For the national joint-stock commercial banks, except Industrial Bank Co., the rest banks are all negative, indicating national joint-stock commercial bank's comprehensive financial performance is quite poor, especially for China CITIC bank and Huaxia bank. In view of local city commercial bank, the synthesis scores of the three Banks are all positive and their scores are much higher than other banks. Among them, the synthesis score of Bank of Nanjing is much higher than

the other two banks. It is easy to see the integrated financial performances of local city commercial banks are the best among all types of banks, and Bank of Nanjing has the best comprehensive financial performance in the 15 banks.

## 5. Conclusions

In this paper, we apply factor analysis to assess the financial performance of Chinese listed commercial banks. Based on a list of financial indicators of 15 listed commercial banks, including 4 state-owned commercial banks, 8 national joint-stock commercial banks and 3 local city commercial banks in 2015, we construct a financial performance evaluation system consisting of four aspects including growth ability, security ability, profit ability and flow ability, which can comprehensively reflect the financial performance of Chinese listed commercial banks. A comparison of different types of banks and different banks of the same type is also conducted.

Based on the comparison results, some suggestions are further provided to solve the current problems. First of all, the poor growth of state-controlled commercial banks is caused by the low degree of corporatization, so it is necessary to strengthen the management of corporatization and strategic operation. Specific improvement measures include: forming a good corporate governance structure, reducing the arbitrariness and subjectivity of decision-

making; establishing a system of vertical management system and horizontal supervision, restriction system with clear rights and responsibilities, mutual checks and balances; strengthening the role of human resources, senior managers should strengthen their strategic vision, middle managers should accumulate practical experience, and grassroots employees should enhance their sense of belonging and identity; clearing future strategic planning, with forward-looking strategic objectives and feasible detailed implementation procedures. Secondly, the poor security of the national joint-stock commercial banks is mainly due to excessive non-performing loans and inadequate risk management. Specific improvement measures include: optimizing asset structure and reducing risks through decentralized operation; coordinating the allocation of working capital and strengthen the monitoring and management of liquidity risk; strictly carrying out customer credit investigation, improving the return rate of credit funds, forming a virtuous circle of funds; reasonably matching the repayment period of assets and liabilities and maintain a high level of solvency at all times. Thirdly, there are many reasons for the poor liquidity of local city commercial banks, but the fundamental reason is that the liquidity supply and demand does not match. Therefore, measures should be taken to facilitate the matching. Specific improvement measures include: strengthening liquidity forecast, estimating liquidity surplus, and balancing liquidity supply and demand; liquidity needs can be met in various ways, for example, seasonal liquidity needs can be met through borrowing, and periodic liquidity needs can be met through cash holdings; improving the sensitivity and adaptability to changes in the external environment, and choosing the liquidity supply channel with low financing cost. Finally, the government should also strengthen the supervision of financial market and promote the orderly competition of financial market.

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## Statement of Competing Interests

The authors have no competing interests.

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