Original Research Article

Research on the Efficiency of China's Listed Commercial Banks from the Perspective of Risk Management

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Abstract: Based on the panel data of 36 listed commercial banks in my country from 2014 to 2018, this paper takes Loan Loss Reserves (LLR) and Non-performing Loans (NPL) as undesired output, analyzes the impact of risk management factors on the efficieney of China's listed commercial banks, and provides a comprehensive A comparative study on the efficiency of four types of banks: joint-stock commercial banks, city commercial banks and rural commercial banks, and the Bootstrap method is used to analyze the factors affecting bank efficiency.

Keywords: Loan loss reserves; Non-performing loans; Undesired output; SBM model; Bootstrap method.

1. Introduction

At present, the domestic financial market is further opened to the outside world, the structural reform of the financial supply side continues to deepen, and the financial supervision is coordinated to promote, China's banking industry has ushered in new challenges, and the competition among banks is increasingly fierce. As a risk intermediary, commercial banks have to bear greater financial risks in order to obtain more profits, and a stable and effective financial system is very important. The 2019 China Banking Development Report pointed out that at the end of 2018, the balance of non-performing loans of commercial banks was 2,025.4 billion yuan, and the non-performing loan ratio was 1.83%, an increase of 0.09 percentage points compared with the end of 2017. Commercial banks should continue to strengthen the concept of comprehensive risk management, actively improve the risk management system, and constantly improve the comprehensive risk management ability. Therefore, considering the impact of risk factors on China's banking industry, an objective assessment of the efficiency of listed companies in China's banking industry is helpful to better understand the operating conditions of listed companies in China's banking industry, objectively reflect the development level of China's banking industry, give full play to the role of financial intermediation, and promote the overall development of China's economy.

2. Literature Review

Scholars at home and abroad have conducted in-depth research on the efficiency of banks and obtained a large number of scientific research results. In 2008, Pasioura began to apply DEA method to analyze bank efficiency by taking risk factors as output items[4]. Li Ping et al. used DEA method to estimate and compare the efficiency of 32 Chinese banks from 2002 to 2008[11]. Zhang Jianhua and other scholars used stochastic frontier method to study the technical efficiency of banks from the aspects of profitability and business expansion, and found that the efficiency of different types of banks in China is different, and joint-stock banks have the highest efficiency[18]. Huang Zhihong used Bootstrap-DEA method to make a comparative study on the efficiency of state-owned banks and joint-stock banks in China. However, the sample size selected in this paper was small and the analysis was not comprehensive enough. Only state-owned banks and joint-stock banks were evaluated[9]. Through SBM model and Luenberger index, Wang Bing and Zhu Ning found that non-interest income and non-performing loans are the main sources of inefficiency of Chinese banks[14]. Based on the Malmquist-Luenberger

and Torbit model of non-expected output, He Ping et al constructed the input-output index system of our country's listed commercial banks under the constraint of non-performing loans, and studied the sequential evolution and driving factors of the total factor productivity of our commercial banks. It is pointed out that the average growth rate of total factor productivity of China's listed commercial banks is 2.4%, and the bank size and the ratio of deposits and loans have a significant positive driving effect on the technical efficiency of commercial banks. LAN Yixin et al. included non-performing loans in the evaluation of bank operating performance and found that the time-lag effect of non-performing loans had a more obvious impact on the efficiency of joint-stock commercial banks and city commercial banks, while the impact on the efficiency of state-owned commercial banks was less obvious[10]. Wang Jia et al. used Bootstrap truncation regression method to test the influencing factors of the efficiency of 67 commercial banks in China, and found that the scale, profitability and innovation ability of banks are conducive to improving the technical efficiency of banks[15].

In the existing literature on bank efficiency, most of them use the traditional DEA model to study bank efficiency and gradually consider the impact of factors such as non-performing loans on bank efficiency[17], but they do not systematically assess bank efficiency from the perspective of risk management to consider whether the importance of risk management factors is fully considered in the operation process. In this paper, a non-radial and non-oriented SBM model including non-expected output is used to analyze the efficiency of China's listed commercial banks, and the problem of input and output relaxation of the traditional DEA model is solved by means of differential variables. Meanwhile, loan loss reserves and non-performing loans are taken as non-expected outputs, and the impact of risk management factors on bank efficiency is fully considered. More effective assessment of bank efficiency.

3. Research Methods

3.1 SBM Model with Undesired Outputs

The original DEA model was the CCR model proposed by Chames et al in 1978[1], which estimated the production boundary with fixed returns to scale. Later, Banker et al proposed the BCC model with variable returns to scale. Both models belong to the oriented DEA model and adopt the method of linear programming. The input optimization of input-oriented DEA and the output optimization of output-oriented DEA are carried out. However, when the input is excessive or the output is insufficient, the traditional orientation method will overestimate the efficiency of DMU. In order to make the calculation more accurate, the differential variable SBM model of non-directional model is adopted. Since banks have a wide variety of financial products, if only profits are used as output items, there will be deviations. Considering the reflection of risk factors on the operating efficiency of banks, loan loss reserve ratio and non-performing loans are taken as non-expected outputs, and an SBM model of non-expected outputs is constructed to evaluate the efficiency of listed companies in China's banking industry.

By adding the undesired output variable, the decision unit (x_0, y_0) is decomposed into $(x_0, y_0{}^g, y_0{}^b)$, where $y_0{}^g$ represents the expected output of the decision unit, and $y_0{}^b$ represents the undesired output of the decision unit. If the undesired output remains unchanged, the less the input, the more expected output, and the higher the relative efficiency; If both the input and the expected output are constant, reducing the undesired output will increase the efficiency value. Based on Kaoru Tone's SBM model[6], the efficiency evaluation model of China's listed commercial banks containing non-expected outputs is as follows:

$$Min\rho = \frac{1 - \frac{1}{m}\sum_{i=1}^{m}\frac{S_i^-}{x_{i0}}}{1 + \frac{1}{S_1 + S_2}\left(\sum_{r=1}^{S_1}\frac{S_r^+}{y_{r0}} + \sum_{r=1}^{S_2}\frac{S_r^b}{y_{r0}^b}\right)} \qquad (Eq.1)$$

$$s.t \quad x_0 = X\lambda + s^-$$
$$y_0^g = Y^g\lambda - s^g$$
$$y_0^b = Y^b\lambda + s^b$$
$$s^- \geq 0, s^g \geq 0, s^b \geq 0, \lambda \geq 0$$

ρ represents the efficiency value of decision making unit; S_i^- represents the input excess of type i; S_r^+ represents the output shortage of type r; $X\lambda$ and $Y\lambda$ represent inputs and outputs on the boundary, respectively. When $S^- = S^+ = 0$, $\rho = 1$ indicates that the DMU is on the efficiency boundary.

3.2 Bootstrap Methods

Bootstrap is a popular repeated sampling method in modern statistics, which is used to estimate standard error and calculate confidence interval. It was proposed by Efron in 1979 and is widely used in statistical analysis. The core of Bootstrap method is to construct self-help samples by resampling sample data, and perform inference about samples according to the resampling data, so as to model the population inferred according to the sample data.

The basic idea of Bootstrap method is as follows: suppose $\theta_0 = \theta(F_0)$ is the statistic of a certain distribution, such as $\theta_0 = \left\{\int x dF_0(x)\right\}^n$, and F_0 is the unknown population distribution function. Through repeated sampling, the empirical distribution $\hat{F}$ of the sample can be obtained to estimate the overall distribution F_0, and the Bootstrap estimate of the obtained θ_0 is $\hat{\theta}_0 = \left\{\int x d\bar{F}_0(x)\right\}^n$.

For a certain DMU, Y_i is the efficiency value and X_i is the explanatory variable value corresponding to this DMU. The analysis steps of the Bootstrap method are as follows:

(1) The estimate $\hat{\beta}_i$ of regression coefficient β_0 of the explanatory variable $Y_i = \beta_0 + \beta_1\beta X_{1i} + \cdots + \beta_m X_{mi}$ is obtained, where β_0 is the regression intercept and $\beta_m (i = 1, 2, \cdots, m)$ is the regression coefficient of the explanatory variable X_i.

(2) A new Bootstrap sample is generated by placing back the constant term for $n(k = 1, 2, \cdots b)$ times with equal probability of sample data.

(3) The regression analysis was carried out for each Bootstrap sample, and the estimated $\hat{\beta}_{ni}$ of regression coefficient β_{ni} corresponding to $Y_{ni} = \beta_{n0} + \beta_{n1}X_{n1i} + \cdots + \beta_{nm}X_{nmi}$ was obtained, and $\bar{\beta}_i = \sum_{n=1}^{b} \frac{\hat{\beta}_{ni}}{b} (i = 1, 2, \cdots, m)$ was calculated using $\hat{\beta}_{ni}$.

Bootstrap method can solve the problem of insufficient samples in the research center by using repeated sampling, and estimate the population as accurately as possible through limited sample information, so as to provide decision-making basis.

4. Evaluation of Efficiency of Listed Commercial Banks in China

4.1 Description of Input-output Indicators

In the selection of input-output index, considering the availability of data of listed commercial banks in China, referring to previous research literature, combining the characteristics of intermediary method and production method to determine the input-output index. Total assets, fixed assets and operating expenses are taken as inputs, operating income, total loans and net profit are taken as expected outputs, and loan loss reserves and non-performing loans are taken as non-expected outputs. Table 1 describes the indicators.

4.2 Sample Data Selection

In this study, 36 listed commercial banks were selected, and the listed commercial banks in China were divided into four categories by referring to the list of banking financial institutions as of the end of December

2018 published by the China Banking and Insurance Regulatory Commission (CBRC), as shown in Table 2. The sample period is 2014-2018, and the data sources are China Finance Yearbook, Bankscope database and annual reports of listed commercial banks in China.

Table 1   Description of input-output indicators.

Input-output item	Indicator Name	Indicator Description	Unit
Input items	Total assets x1	All assets of the enterprise	
	Fixed assets x2	Fixed assets minus accumulated depreciation of fixed assets	
	Operating expenses x3	All expenses incurred during the business process	
Output items	Expected output — Operating revenue g1	Reflect the total operating revenue generated during the operating process	Million yuan
	Expected output — Total loan amount g2	Reflecting the total amount of loans for loan business, including various types of loans, overdrafts, discounting, acceptance bills, receivables, development letters of credit, export bills, etc	
	Expected output — Net profit g3	Profit retention after deducting income tax from total profit	
	Unexpected output — Loan loss reserve b1	Reflecting the bank's ability to withstand loan losses	
	Unexpected output — Non performing loan b2	Reflecting abnormal or problematic loans from the bank.	

Table 2   Classification of listed commercial banks in china.

Type name	Bank name	Quantity
Large state-owned commercial banks	Industrial and Commercial Bank of China, Agricultural Bank of China, Bank of China, Construction Bank, Bank of Communications, Postal Savings Bank	6
Joint-stock commercial banks	China CITIC Bank, Everbright Bank, Huaxia Bank, Ping An Bank, China Merchants Bank, Pudong Development Bank, Industrial Bank, Minsheng Bank, Zhejiang Commercial Bank	9
City Commercial Bank	Ningbo Bank, Zhengzhou Bank, Qingdao Bank, Suzhou Bank, Jiangsu Bank, Hangzhou Bank, State Bank, Xi'an Bank, Nanjing Bank, Shanghai Bank, Changsha Bank, Chengdu Bank, Guiyang Bank	13
Rural Commercial Bank	Jiangyin Bank, Zhangjiagang Bank, Qingnong Commercial Bank, Wuxi Bank, Chongqing Rural Commercial Bank, Changshu Bank, Zijin Bank and Sunong Bank	8

4.3 Empirical Analysis

This paper uses MAXDEA8.3 software for data processing, and calculates the efficiency of China's listed commercial banks from 2014 to 2018 from two aspects, never taking into account risk management factors and taking into account risk management factors, and calculates the overall efficiency of China's listed commercial banks and the efficiency values of different types of banks. The specific results are shown in Table 3.

As can be seen from Table 3, when measured under the non-expected output SBM model, the efficiency value of listed commercial banks in China is 0.82 without considering risk management factors, and 0.89 after considering risk management factors. The efficiency value of listed commercial banks without considering risk management factors is lower than that under adding risk management factors, and the efficiency value of banking industry is improved after adding risk management factors. This shows that the efficiency of China's listed commercial banks is gradually improving, and remarkable achievements in dealing with non-performing loans. Risk management factors such as loan loss reserves and non-performing loans have not had an impact on the operation of China's listed commercial banks.

Table 3 Efficiency measurement results of listed commercial banks in china.

Bank code	Bank name	Efficiency value		Efficiency changes
		Failure to consider risk management factors	Consider risk management factors	
1	Ping An Bank	1.00	1.00	Invariant
2	Ningbo Bank	0.64	0.87	Increase
3	Jiangyin Bank	0.66	0.59	Decline
4	Zhangjiagang Branch	0.69	0.76	Increase
5	Zhengzhou Bank	0.92	0.94	Increase
6	Qingdao Bank	0.63	0.75	Increase
7	Qingnong Commercial Bank	0.78	0.76	Decline
8	Suzhou Bank	0.59	0.60	Increase
9	Shanghai Pudong Development Bank	1.00	1.00	Invariant
10	Huaxia Bank	0.87	0.85	Decline
11	Minsheng Bank	0.76	0.82	Decline
12	China Merchants Bank	1.00	1.00	Invariant
13	Wuxi Bank	0.77	0.83	Increase
14	Jiangsu Bank	0.83	0.88	Increase
15	Hangzhou Bank	0.82	1.00	Increase
16	Xi'an Bank	1.00	1.00	Invariant
17	Bank of Nanjing	0.69	0.93	Increase
18	Chongqing Rural Commercial Bank	0.88	0.92	Increase
19	Changshu Bank	0.74	1.00	Increase
20	Industrial Bank	0.90	0.90	Invariant
21	Bank of Beijing	1.00	1.00	Invariant
22	Shanghai Bank	1.00	1.00	Invariant
23	Agricultural bank	0.76	0.68	Decline
24	Bank of Communications	0.71	0.90	Increase
25	Industrial and Commercial Bank of China	1.00	1.00	Invariant
26	Changsha Bank	0.85	1.00	Increase
27	Postal Savings Bank	0.47	0.82	Increase
28	Everbright Bank	0.39	0.71	Increase
29	Chengdu Bank	0.95	0.94	Decline
30	Zijin Bank	0.77	0.77	Invariant
31	Zhejiang Commercial Bank	0.88	0.90	Increase
32	Construction Bank	1.00	1.00	Invariant
33	Bank of China	0.92	1.00	Increase
34	Guiyang Bank	0.78	1.00	Increase
35	China CITIC Bank	0.97	0.97	Invariant
36	Sunong Bank	0.77	0.79	Increase
37	Overall efficiency	0.82	0.89	Increase
38	Large state-owned commercial banks	0.81	0.90	Increase
39	Joint-stock commercial banks	0.86	0.91	Increase
40	City Commercial Bank	0.82	0.92	Increase
41	Rural Commercial Bank	0.76	0.86	Increase

Specifically, among the 36 banks, 8 banks have the highest efficiency value and achieve DEA effectiveness. The banks that have achieved DEA effectiveness include 2 large state-owned commercial banks (ICBC and China Construction Bank), 3 joint-stock commercial banks (Ping An Bank, Pudong Development Bank and China Merchants Bank), 3 city commercial banks (Bank of Xi 'an, Bank of Beijing and Bank of Shanghai), and none of the rural commercial banks has achieved DEA effectiveness. Of the 36 banks, 18 banks' efficiency values increased, 11 banks' efficiency values remained unchanged, and 7 banks' efficiency values decreased. Figure 1 clearly shows the difference in efficiency between listed commercial banks without risk factors and those with risk factors.
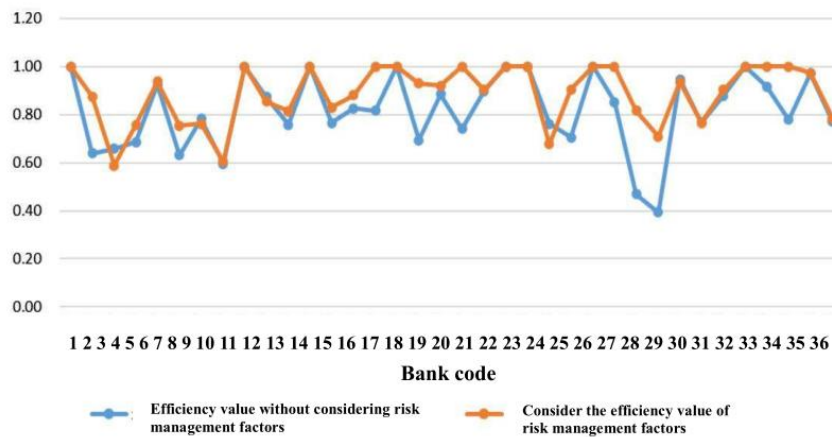

Figure 1 Comparison of the efficiency of china's listed commercial banks without and with risk manage ment considerations.

From the comparative analysis of the efficiency value of the classification of banking institutions (Figure 2), it can be found that the efficiency value of all kinds of listed commercial banks has improved after considering risk management factors, and the improvement of urban commercial banks and rural commercial banks is more obvious, which indicates that risk management factors have a greater impact on the operation of these two types of commercial banks. Strengthening risk management factors is conducive to its steady operation and development. Regardless of whether risk management factors are considered, the efficiency of large state-owned commercial banks is basically equivalent to the overall efficiency level of listed commercial banks in our country. Large state-owned commercial banks are the main body of Chinese commercial banks and the important force to promote the development of Chinese banking. The efficiency of joint-stock commercial banks and city commercial banks is higher than the overall efficiency level, which is the vitality of China's banking industry. The efficiency of rural commercial banks is lower than the overall efficiency level of listed commercial banks in China, and needs to be further improved.
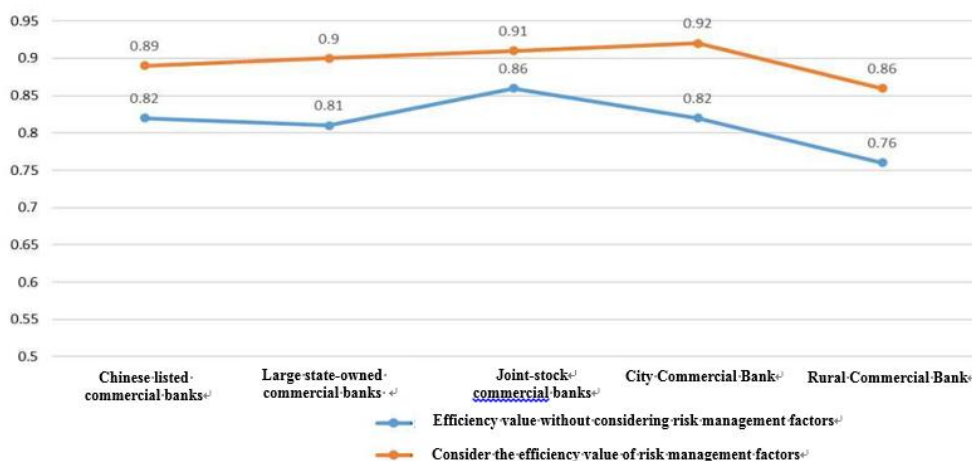

Figure 2 Comparison of the efficiency of four types of banking institutions of listed commercial banks in china.

5. Analysis of Factors Affecting Efficiency

With comprehensive reference to previous relevant literature, most of the factors affecting bank efficiency are analyzed from the aspects of profitability, risk control, asset liquidity, asset scale and allocation, cost control and return on assets[7],[12],[16],[19]. Taking into account the perspective of risk management and the availability of data, this study mainly selects factors such as profitability, risk control ability, asset allocation ability, cost control ability and asset scale degree as the influencing factors of the efficiency of China's listed commercial banks from the micro aspect.

5.1 Profitability

As an enterprise, the operation purpose of banks is to make profits, through which the healthy development of banking activities can be guaranteed. Numerous research results have also proved that profitability is a major factor affecting the efficiency of banks[13]. Return on equity (ROE) was chosen to measure profitability.

5.2 Risk Control Capacity

The liquidity of assets can measure the bank's ability to cope with the withdrawal of cash, which is the guarantee of the bank's stable operation. Liquidity risk has become an important part of risk management in commercial banks. To improve the risk control ability of banks, reasonable asset liquidity arrangement can effectively prevent bank failure and guarantee the steady operation of banks. Select asset liability structure (LCD) to reflect the risk control ability and measure the liquidity of assets.

5.3 Asset Allocation Capacity

The loan is the most important asset of the bank, and the operation of the bank depends heavily on the liability, so the asset allocation ability of the bank will affect the efficiency of the bank. The loan-to-deposit ratio (LADS) was selected to reflect the asset allocation capability and measure the asset allocation of banks.

5.4 Cost Control Capability

As the profit growth of domestic commercial banks began to decline, banks' control and management of operating costs became more refined. The cost control ability is more closely related to the efficiency of banks. Cost-income ratio (CIR) was selected to reflect cost control ability.

5.5 Degree of Asset Size

The scale of bank assets is the core index of a bank's ability to be lower than the risk. When the scale of bank capital reaches a higher level, the bank's ability to resist risks will be enhanced, which will promote the improvement of bank efficiency. LN total assets (LNASSET) were selected as a measure of asset scale to reflect the impact of scale on efficiency.

In view of the above factors that affect the efficiency of banks, such as profitability, risk control ability, asset allocation ability, cost control ability and asset scale degree, the index is explained, and the relevant variables of the four types of banking institutions are described and summarized by referring to the classification of banks. Pearson correlation test was conducted for each variable to avoid the existence of autocorrelation and multicollinearity between each variable. It is not difficult to find that the correlation coefficients among variables affecting bank efficiency are all low, which indicates that there is no multicollinearity problem among the influencing factors of listed commercial banks in China.

Based on the analysis of the influence factors of the efficiency of listed commercial banks in our country, the regression model of listed commercial banks in our country can be obtained:

$$y_{it} = \beta_0 + \beta_1 ROE_{it} + \beta_2 LCD_{it} + \beta_3 LADS_{it} + \beta_4 CIR_{it} + \beta_5 LNASSET_{it} + \varepsilon_{it} .$$

Where: y_{it} is the bank efficiency value of China's listed commercial banks from 2014 to 2018, β_0 is the intercept term, $\beta_1 \sim \beta_7$ is the regression coefficient of explanatory variables, and ε_{it} is the random effect that

changes independently with individuals and time.

This paper estimates the coefficients of the factors affecting the efficiency of listed commercial banks in China in view of the two cases of non-risk management factors and risk management factors. In order to ensure the effectiveness and reliability of statistical promotion, Bootstrap was used for self-sampling, with 2000 iterations. The calculation results are shown in Table 4.

When risk management factors are not considered, the three factors of return on equity, loan-to-deposit ratio and cost-to-income ratio are significant at the 10% level, and the two factors of return on equity and loan-to-deposit ratio have a positive relationship with the efficiency of listed commercial banks in China, while the cost-to-income ratio has a negative relationship with the efficiency of listed commercial banks in China. This shows that profitability and asset allocation ability will help to improve the efficiency of Chinese commercial banks, while cost control ability will hinder the efficiency of Chinese listed commercial banks.

When risk management factors are considered, return on equity and loan-to-deposit ratio are still significant at the 5% level, and have a positive relationship with the efficiency of listed commercial banks in China, but the cost-income ratio is not significant, but still have a negative relationship with the efficiency of listed commercial banks in China. This shows that after considering risk management factors, profitability and asset allocation ability will still help to improve the efficiency of listed commercial banks in China, while the improvement of cost control ability, although conducive to the improvement of banks' operating conditions, will no longer have a certain hindering effect on the efficiency of listed commercial banks in China.

Table 4　Regression results of factors affecting bank efficiency.

Bank institution type	Not considering and considering risk factors	Factors affecting bank efficiency						Sample size
		ROE	LCD	LADS	CIR	LNASSET	(Constant term)	
Large state-owned commercial banks	Failure to consider risk management factors	0.163 (1.15)	-0.787* (-2.00)	-0.219 (-0.67)	-0.378 (-0.48)	0.217 (0.36)	1.002 (1.41)	30
	Consider risk management factors	-0.225 (-1.24)	-0.0787 (-0.17)	1.217 (1.86)	2.375* (5.83)	1.749*** (3.77)	-1.701* (-2.31)	30
Joint-stock commercial banks	Failure to consider risk management factors	0.145 (0.66)	0.0872 (0.18)	-0.00187 (-0.01)	-0.401 (-1.92)	-0.855 (-1.73)	1.486* (2.18)	45
	Consider risk management factors	0.0706 (0.18)	0.745 (0.90)	0.413 (0.56)	-0.0964 (-0.24)	0.182 (0.37)	0.180 (0.20)	45
City commercial bank	Failure to consider risk management factors	0.900*** (4.74)	0.248 (0.62)	0.778 (1.50)	-0.639* (-2.49)	-0.322 (-1.17)	0.24 (0.44)	65
	Consider risk management factors	0.928** (3.12)	0.388 (0.64)	0.661 (0.88)	-0.667 (-1.80)	0.435 (1.46)	0.0288 (0.04)	65
Rural commercial bank	Failure to consider risk management factors	0.943*** (5.85)	0.0479 (0.08)	0.753 (1.44)	-0.162 (-0.86)	0.270 (0.48)	-0.380 (-0.57)	40
	Consider risk management factors	0.763*** (3.62)	0.610 (0.82)	1.420 (1.64)	0.0632 (0.17)	0.406 (0.56)	-1.041 (-1.00)	40
Total	Failure to consider risk management factors	1.105*** (8.43)	0.344 (0.86)	0.975** (2.68)	-0.335*** (-3.83)	-0.194 (-1.20)	-0.207 (-0.47)	180
	Consider risk management factors	0.642** (2.81)	0.676 (1.56)	0.841* (2.00)	-0.236 (-1.45)	0.169 (0.96)	-0.263 (-0.53)	180

There is a significant positive correlation between the return on equity and the efficiency value of urban commercial banks and rural commercial banks at the level of 5%, which indicates that profitability is an important factor affecting the efficiency of urban commercial banks and rural commercial banks when risk management factors are taken into account or not. The scale of these two types of banking institutions is generally small, and the effect of profitability is more obvious. However, the scale of large state-owned commercial banks and joint-stock commercial banks is too large, and the effect of profitability is not obvious. After considering

risk management factors, the cost-input ratio and asset scale of large state-owned commercial banks are significantly positively correlated with the efficiency value, which indicates that the cost control difficulties brought about by large state-owned commercial banks will affect the efficiency improvement, and the asset scale will also affect the efficiency of banks. Considering risk management factors, we should improve the cost control ability and increase the total assets. It will bring about the improvement of the efficiency of large state-owned commercial banks.

6. Conclusions and Recommendations

This paper uses the non-expected output SBM model to measure the efficiency of 36 listed commercial banks in China from 2014 to 2018. The results showed that: First of all, the efficiency value of listed commercial banks in our country without considering risk management factors is lower than that of taking risk management factors into account, and has improved, which indicates that the efficiency of listed commercial banks in our country is gradually improving, and they have achieved remarkable results in dealing with non-performing loans. Risk management factors such as loan loss reserves and non-performing loans have no impact on the operation of listed commercial banks in our country. Then, 2 large state-owned commercial banks, 3 joint-stock commercial banks and 3 city commercial banks have the highest efficiency value, achieving DEA effectiveness, while no rural commercial bank has achieved DEA effectiveness. Thirdly, large state-owned commercial banks are the main body of China's commercial banks and an important force to promote the development of China's banking industry. Their efficiency is basically equivalent to the overall efficiency level. The efficiency of joint-stock commercial banks and urban commercial banks is higher than the overall efficiency level, which is the vitality of the vigorous development of China's banking industry, while that of rural commercial banks is lower than the overall efficiency level. Need to be further improved; Finally, after considering risk management factors, the efficiency of all kinds of banks has been improved, and the improvement of urban commercial banks and rural commercial banks is more obvious, which indicates that risk management factors have a greater impact on the operation of these two types of commercial banks.

This paper analyzes the influence factors on the efficiency of the listed commercial banks in our country through the Bootstrap method. The conclusion is that the return on equity and the loan-to-deposit ratio are significant and positive regardless of whether risk management factors are not taken into account. Without considering risk management factors, the cost-income ratio is significant and negative. Considering risk management factors, the cost control ability of banks is improved, and the hindrance of cost-income ratio efficiency is no longer obvious. The effect of profitability on the efficiency of urban commercial banks and rural commercial banks is more significant than that of large state-owned commercial banks and joint-stock commercial banks. Considering risk management factors, large state-owned commercial banks will improve their efficiency by controlling costs and increasing total assets.

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