

Analysis of the Impact of Leverage Ratio Supervision On the Performance of Listed Commercial Banks

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Abstract: In 2008, the rapid spread of the sub-prime crisis In the United States led to the financial crisis globally, which had a huge impact on the world economic development and financial, especially on the banking industry. The main reason is the high leverage. In June 2011, China's regulatory authorities promulgated the Regulations on the Leverage Ratio of Commercial Banks based on Basel III, which strictly regulates the Leverage of Commercial Banks. Therefore, this paper aims to study Changes in leverage and the effect of leverage ratio supervision on the performance of listed Commercial Bank. Taking the annual report data of 16 listed commercial banks, this paper chooses relevant data to analyze the impact on three dimensions: profitability, safety and liquidity. Based on the three principles of banks, this paper analyzes the effect of the performance of listed commercial banks.

1. Introduction

1.1 Background and significance of research

1.1.1 Research background

In 2008, the sudden sub-prime mortgage crisis triggered a serious financial crisis, which brought a great negative impact on the global economy, every industry has been affected to a certain extent, especially the banking industry. Experts and scholars have attributed the financial crisis to the excessive leverage of financial institutions, while countries are aware that the banking industry has many problems, such as inadequate supervision by regulators, there are also many problems such as unqualified capital quality in financial institutions. Therefore, Basel III came into being at the G20 summit in 2010, which has rapidly become the bellwether of global banking supervision and provides an important basis for the supervision of leverage ratio in various countries.

Subsequently, in 2011 and 2015, China's Banking Regulatory Commission formally promulgated and revised the "measures for the management of leverage ratio of commercial banks", the Chinese version of the Basel Agreement, to ensure the effectiveness of leverage regulation in China. Commercial banks bear the brunt of the impact of macroeconomic policies, early realization of "risk control, deleveraging" on the stability of the financial system is of great significance.

1.1.2 Research significance

Banks are special enterprises. Based on China's huge size of listed banks and special national conditions, they basically constitute the majority of China's financial institutions. Banks basically control the lifeblood of the country's economy, therefore, the supervision and restraint on banks will inevitably have a huge impact on the entire financial market. The regulation of leverage ratio is important and indispensable, but the growth of Bank's performance and efficiency is also necessary. In the context of strong regulation, it is of great significance to study whether banks can maintain the growth of performance.

At the 2016 Central Economic Conference, the focus of the structural reform of side supply, namely debt deleveraging, was clearly pointed out. Now, the Politburo has proposed stable leverage, showing the leverage ratio to the country's economic and financial regulation, as well as the importance of reducing debt pressure to ensure economic development and asset quality. As the most important and

key financial institution, commercial banks play an important role of leverage in the market economy. Therefore, this study analyzes the impact of listed commercial banks performance on the background of strict regulation of leverage ratio, which is conducive to the transformation of banks in the new normal economy, to help banks stay competitive as they move away from high growth. This paper studies the exogenous event-the impact of leverage regulation on the performance of commercial banks, and puts forward effective recommendations.

1.2 Literature review

1.2.1 Research on the regulation of leverage ratio

Leverage regulation is like a double-edged sword, different scholars hold different views. In the practice of many countries, the regulation of leverage ratio is beneficial. Gombola et al. have studied the role of leverage regulation in capital management of US commercial banks, and concluded that there is a significant positive correlation between leverage ratio and income and capital management measures [1]. Yang and Li concluded the necessity of our country's leverage regulation and strengthen the supervision of off-balance sheet business by discussing the practice of US and Canada's leverage regulation [2]. By observing the increase of the average leverage ratio of financial institutions, Ban have verified the remarkable effect of the regulation of leverage ratio and that the regulation of leverage ratio is beneficial to China's regulatory system [3].

However, other scholars have questioned the regulation of leverage ratio from different angles. Kuzubaş simulated the financial network, and concluded that the difference of leverage ratio between commercial banks will worsen the systemic risk measurement, and the introduction of financial leverage makes many commercial banks can not meet the minimum capital requirement [4]. Liu and Zhang found that the banking sector had problems in maintaining stable leverage over a long period of time, and that the background of strong regulation caused significant structural changes in the balance sheets of the banking sector, making regulation much more difficult, regulatory rules and disclosure targets set by regulators have limitations that lead to risk prevention and loopholes in multiple regulations [5]. Dai says the leverage ratio is too simplistic, it cannot timely reflect the level of systemic risk, and the practice of China's leverage ratio regulation cannot copy "Basel III", the regulatory authorities should fully consider the overall situation of China [6].

The impact of leverage regulation has been widely discussed by scholars at home and abroad. More scholars stand in a more macro perspective, with more data to support the study of leverage effect on the economy. He and Peng crunched huge data from 96 countries and regions between 2003 and 2017 to empirically show that in the short term, leverage increases have a positive effect on economic growth, and in the long run, the increase of leverage ratio has the function of restraining economic growth. The economic benefit of the increase of leverage ratio is much less than the economic cost of its decrease, and the stability of the change of leverage ratio is also very important, the worse the stability, the greater the negative effect on the economy [7].

1.2.2 Research on the performance of Commercial Bank

With the development of performance evaluation in commercial banks, there are traditional single financial index evaluation, EVA, Comprehensive Evaluation methods such as balanced scorecard and camel evaluation system, and also combined with mathematical models, such as Data envelopment analysis, factor analysis, fuzzy mathematics evaluation, innovative analysis and evaluation of commercial banks. Zhang believes that with the transformation and development of commercial banks in the new era, the traditional performance evaluation system of commercial banks cannot meet the needs of the development of banks, and the performance evaluation system should cover more comprehensively and have more evaluation dimensions [8]. Li uses the principal component analysis method, establishes the performance appraisal system based on the three-character principle of the bank, calculates the comprehensive performance of each commercial bank. It is found that the favorable factors for the improvement of the performance are the state holding listed commercial banks and the improvement of the core and subsidiary Capital adequacy ratio [9]. Zou empirically found that

the coordination level of profit, safety and liquidity of banks gradually improved, which went through four stages, including moderate imbalance, low imbalance, reluctant coordination and moderate coordination. Coordination was constantly enhanced, and there was basically no difference among banks in 2011 [10]. Zhou takes industrial and Commercial Bank of China (ICBC) as an example, starting from the principles of three characteristics of commercial banks, and finds that ICBC has a high proportion of loan assets, low profitability and low return on investment assets [11].

There are many factors affecting the performance of commercial banks, which are mainly influenced by external and internal factors. The external factors are mainly the operation of the macro-economy, and the internal factors are considered by the banks themselves, such as bank size, internal governance, asset quality, etc., will have a direct or indirect impact on bank profitability. For example, Lei and Shi found that Green Credit has a positive effect on bank performance, and green credit has a beneficial effect on risk inhibition in the long run [12]. Liu et al. applied the fixed effect model to collect the panel data of 121 commercial banks from 2007 to 2016 by hand, and empirically concluded that there is a correlation between foreign equity participation, board characteristics and business performance [13]. Yao and Song conducted an empirical test and found that diversification has a negative impact on bank performance in the short term, but can improve performance in the long run, and there is a U-shaped relationship between diversification and performance [14].

1.2.3 A study on the impact of the regulation of leverage ratio on the performance of commercial banks

By modeling financial frictions, DeAngelo and Stulz found that leverage regulation not only promotes bank liquidity, but also enhances the competitiveness of commercial banks [15]. He and Ma found that while leverage regulation significantly improved the stability of commercial banks, high leverage reduced bank returns [16]. Shi found that the regulation of leverage ratio has a negative effect on the performance of commercial banks. Compared with state-owned banks, non-state-owned commercial banks have higher ROA at the same level of leverage ratio [17]. Zhong found that the regulation of leverage ratio can make the capital usage of commercial banks be restrained, risk preference be reduced, and the performance of commercial banks be reversed [18].

Since the performance of commercial banks is closely related to the risk, many scholars have studied the influence of the regulation of leverage ratio on the risk of commercial banks, and evaluated the safety and profitability of commercial banks more comprehensively. Yu and Zhu believe that the regulation of leverage ratio can promote bank risk management and strengthen bank risk prevention [19]. Chen and Zhang believed that leverage ratio regulation could help maintain the stability of bank structure, and found that the asset scale and liquidity level of commercial banks were positively correlated with the restraining effect of leverage ratio regulation on risk taking [20]. According to Zhang and Chen, leverage ratio regulation has the effect of risk mitigation, which increases the ratio of banks' own capital holding and improves their stability, and plays a more obvious role in an environment with poorer asset quality [21].

1.2.4 Literature review

Based on the above literature review, it is found that scholars have different opinions on the double-edged sword effect of the regulation of leverage ratio, and some scholars believe that the regulation of leverage ratio can effectively improve the asset quality of banks, thus reduces the bank's risk, and enhances the bank's income. But some argue that restrictions on bank assets will force bank management to target riskier businesses and highly leveraged hedging businesses, which is clearly against the purpose of regulation. The regulation of leverage ratio is a reform for China to adapt to the International Basel Agreement, and the reform is often carried out from top to bottom. How does the regulation of leverage ratio play a good or bad role on China's listed commercial banks, further research is needed. Based on the research of these scholars, this paper will study the impact of leverage regulation on the performance of Chinese listed commercial banks, recognize the role of double-edged sword, and make reasonable recommendations for improvement.

2. The regulation of leverage ratio and the basic theory of commercial bank performance

2.1 The theory of leverage regulation

2.1.1 Regulatory implications of leverage

The Basel III formula for calculating bank leverage is as follows:

Leverage ratio = core capital/ (total on-balance sheet assets + specific off-balance sheet assets)

In the formula, it is found that the numerator is the core capital, and the denominator is the total assets in the statement plus the balance of the specified off-balance sheet assets. It should be added that the denominator will subtract the common stock included in the Capital adequacy ratio formula, and the minimum leverage required to reach 3% during the parallel period. A transition period from January 1, 2013, to January 1, 2017, was also set.

China's banking regulatory commission promulgated the "management measures" in accordance with the status of China's banking sector formulated the formula as follows:

Leverage ratio = Level 1 net capital/adjusted balance of external and internal assets

Notable in the calculation of net tier 1 capital in molecular terms is the deduction of certain intangible asset such as goodwill, deferred income tax assets and loan loss provisions. The denominator consists of the sum of the adjusted assets in the balance sheet and the adjusted off-balance sheet assets. It also requires a leverage ratio of no less than 4 per cent, effective January 1, 2012.

2.1.2 Basel evolution

Huge upheavals in the financial sector, such as the collapse of the Bretton Woods system and the collapse of Franklin National Bank, have sharply increased systemic risk in global financial markets, it also made national regulators aware of the need to set up estimated bank regulators, and the Basel Committee on Banking Supervision was born in 1975. The Basel Committee has played an exemplary role in the supervision of the banking industry in various countries. The three editions of the Basel Agreement promulgated by the Basel Committee have provided a reference for the supervision of the banking industry in China, its development process is also the exploration and practice of banking supervision in China.

"Basel I", with Capital adequacy ratio as its regulatory core, mainly evaluates the risk coverage and resilience of banks, and constructs the regulatory framework for the evolution of the Basel II. At its heart was the specification of Capital adequacy ratio calculations, and as the financial system became more complex, the shortcomings of Basel I became apparent, with its simplistic measures and standards, and there are some deficiencies in the study of risk measurement and capital adequacy. The new background has given the Basel II new regulatory requirements. The Basel Committee has studied and put forward the Basel II.

"Basel II" is an important supplement and breakthrough to the first edition of Basel II, and has made three achievements: first, building a three-pillar international banking regulatory framework; second, third, the internal model measurement is introduced for the first time, but many deficiencies have been found in practice, such as arbitrage, regulatory difficulties, capital pro-cyclical and so on, that triggered the 2008 global financial crisis.

"Basel III" is the continuation and improvement of "Basel II", focusing on improving the three pillars of the first pillar of the "minimum capital requirements. First, higher requirements are put forward for the quality and quantity of capital, the core capital should play a leading role in the total capital, and the relevant capital deductions should be deducted clearly and strictly, and the coverage of risk should be expanded. Secondly, more detailed and broader macro-prudential management has been added, and finally, the scope of risk-monitoring indicators, such as the introduction of liquidity-monitoring indicators, and the range of instruments has been expanded, and a lower leverage ratio for risk appetite as an effective complement to Capital adequacy ratio.

2.2 Theory of commercial bank performance

2.2.1 Performance definition and evaluation

Performance has different objects and definitions, which can be for individuals or enterprises, and enterprise performance evaluation, according to the definition given by the Ministry of Finance, refers to the rational use of the principles of mathematical statistics and operational research, to ensure objectivity, fairness and accuracy through unified standards and certain procedures, using quantitative and qualitative comparative analysis, with a specific index system that meets the needs of different enterprises, to make a comprehensive evaluation of the operating benefit and the operator's performance in a period of time. The importance of performance evaluation is self-evident. The continuous changes of economic structure and enterprises make the method of performance evaluation develop rapidly:

(1) Financial evaluation stage

Before 1980, enterprise performance evaluation was only limited to financial analysis, based on the relevant financial ratio, to investigate the debt-paying ability, operating ability, etc. , the most representative are the wall scoring method, the Du Pont System of Financial Analysis. Wall Marking Way measures profitability, debt repayment and other capabilities through seven financial indicators, by giving weight to the relevant capabilities to obtain the total score, thus evaluating the level of enterprise credit. The advantage is that the operation method is simple and convenient, but the basis and weight rationality of the selection of financial indicators cannot be proved; the independence of the selection of indicators is completely different between the Du Pont System of Financial Analysis and Wall Marking Way, with the ROE as the core and the internal links among the various financial indicators as the link, it is easy to examine the impact of each level of indicators on the Yield valve. The advantage lies in the coherence integrity, the determination of the subordinate index to the overall index, the data is easy to obtain, but the authenticity of the data cannot be guaranteed, time and risk factors are not included in the scope of examination.

(2) Value evaluation stage

The economic value added (EVA) method was developed from the Japanese "surplus income" theory, and was first proposed by American companies. Instead of satisfying the enterprise value evaluation, the enterprise profit needs to deduct the opportunity cost of capital, the introduction of opportunity cost makes Eva reflect the real value of the enterprise. The advantage of EVA is that it avoids the defect that the residual income is influenced by the accounting standard, and it takes the cost of capital into the study of economic profit and value, it is inevitable that managers have short-sighted behavior, and it is still limited to financial indicators, ignoring the non-financial dimensions of the diversity of enterprises.

(3) Comprehensive Evaluation stage

Enterprise performance evaluation is no longer limited to financial analysis based on financial indicators, but developed into a comprehensive evaluation taking into account the requirements of Enterprise Sustainable Development, learning and growth, management, and so on, the balanced scorecard is a good example. BSC takes the company strategy as the foothold, decomposes it layer by layer, and realizes the company strategy goal by achieving the operable small goal. According to the survey, BSC was adopted by 60% of the big banks as early as 1996. The emergence of BSC is a reform of enterprise performance evaluation, which makes the performance evaluation transition from traditional single financial index to Comprehensive Evaluation System, however, the BSC operation threshold is higher, the design is more difficult, the revision is more difficult.

2.2.2 Performance evaluation methodology for this article

Performance evaluation at home and abroad has developed so far, and it is still based on financial management. The size of the enterprise, the characteristics of the industry, the stage of development and so on all affect the choice of performance evaluation methods, therefore, this paper chooses to use financial evaluation methods, combining the regulatory requirements of the regulatory authorities and the characteristics of commercial banks-the three-sex principle, select appropriate evaluation

indicators. Profitability has always been the primary objective of business operations, the ultimate goal is to maximize the interests of shareholders, the profitability of the typical Yield value, and so on, avoid the possible uncertainty on reputation, profit and other aspects of adverse impact, the main indicators of security measures, Capital adequacy ratio, non-performing loans, provisioning coverage; Liquidity refers to the ability of commercial banks to meet customers demand for loans and withdrawals. The common indicators of security are loan-to-deposit ratio, liquidity ratio and cash recovery ratio of assets.

3. An analysis of leverage ratio and performance of listed commercial banks in China

3.1 Leverage ratio of listed commercial banks in China

Taking into account the release of relevant documents of the China Banking Regulatory Commission, 2012 is a turning point, this paper will select 16 banks listed on the a-share market that have a greater impact on China's banking system as representatives, through the use of database and transcribing financial statements to obtain the 2010-2018 level of leverage and related performance evaluation of financial indicators data, to grasp the current level of leverage and the status of bank performance.

According to the "management measures", the index of leverage ratio is composed of the sum of the net capital at the first level of the molecular item and the balance of the risk assets inside and outside the table after the adjustment of the denominator. By looking at the statements of 16 listed companies and calculating the 2010-2018 leverage levels:

Table.1. Leverage levels of listed commercial banks

Short for bank	2010	2011	2012	2013	2014	2015	2016	2017	2018	Mean value
Industrial and Commercial Bank of China	4.69	4.86	5.14	5.90	6.50	7.48	6.96	7.51	7.79	6.31
Agricultural Bank	4.38	4.53	4.72	5.21	5.73	6.33	6.27	6.23	6.30	5.52
Construction Bank	4.81	5.15	5.41	6.01	6.51	7.28	7.03	7.52	8.05	6.42
Bank of China	5.02	4.96	5.30	5.54	6.18	7.03	7.06	6.98	6.94	6.11
Bank of communications	4.75	4.49	5.41	5.55	6.10	6.70	6.86	6.88	6.78	5.95
Bank of Beijing	5.11	4.64	5.58	5.12	5.50	5.33	5.75	6.58	6.14	5.52
Bank of Nanjing	6.54	5.55	5.37	5.01	4.37	5.59	5.25	5.21	5.42	5.37
Bank of Ningbo	5.00	5.76	4.85	4.62	5.02	5.40	5.08	4.84	6.18	5.19
Ping An Bank	3.31	4.12	3.80	4.20	4.25	4.94	5.49	5.69	5.75	4.62
Pudong Development Bank	4.58	4.30	4.27	4.63	5.09	5.37	5.47	6.19	6.68	5.18
Hua Xia Bank	2.70	3.87	3.79	4.20	4.46	5.02	5.77	6.12	7.06	4.78
Minsheng bank	4.57	4.34	4.03	5.06	4.95	5.61	5.19	5.81	6.04	5.07
China Merchants Bank	3.31	3.94	4.05	4.18	4.97	5.54	5.75	6.29	6.61	4.96
Industrial Bank Co.	4.20	3.83	4.26	5.75	6.45	5.23	5.25	5.89	6.12	5.22
China Everbright Bank	3.87	3.85	3.69	4.82	5.13	5.95	5.44	6.45	6.29	5.05
CITIC Bank Limited	4.17	4.54	4.76	4.73	4.97	5.26	5.47	6.18	6.37	5.16
Mean value	4.44	4.55	4.64	5.03	5.39	5.88	5.88	6.27	6.53	5.40

Looking at the leverage ratios of 16 listed banks between 2010 and 2018 from the table above, although the bank's leverage level in 2010 did not reach the Basel III level of 3% , only 2.7% , however, the Basel Accord has not been implemented in time, and therefore all the requirements have been met. Based on the standard of 4% stipulated in China's "administrative measures", in addition to the above-mentioned leverage level of Huaxia Bank in 2010 of 2.7% , there are still a small number of banks whose leverage ratio does not meet the requirements of our country's banks, and the substandard data are all from joint-stock banks. Therefore, it can be preliminarily judged that state-owned banks require a higher leverage ratio, in addition to the greater role of leverage regulation in the regulation of joint-stock banks, all banks have had leverage ratios above 4 per cent since the regulatory implementation

date of 2012, further explained that each bank under the supervision pressure all achieves the standard, the supervision effect is remarkable.

The listed commercial banks selected in this paper are divided into state-owned banks (ICBC, ABC, CCB, Bank of China, Bank of Communications), City Bank (Bank of Beijing, Bank of Nanjing, Bank of Ningbo) and joint-stock banks (others), the average leverage ratios of the three types of banks are calculated as follows:

Table.2. Average leverage ratios of three types of commercial banks

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018
State-owned bank	4.73	4.80	5.20	5.64	6.20	6.97	6.84	7.02	7.17
Joint-stock bank	3.84	4.10	4.09	4.70	5.03	5.36	5.48	6.08	6.83
City Bank	5.55	5.32	5.27	4.92	4.96	5.44	5.36	5.54	7.01

Draw the following line chart based on the average leverage of the three types of banks in the table above:

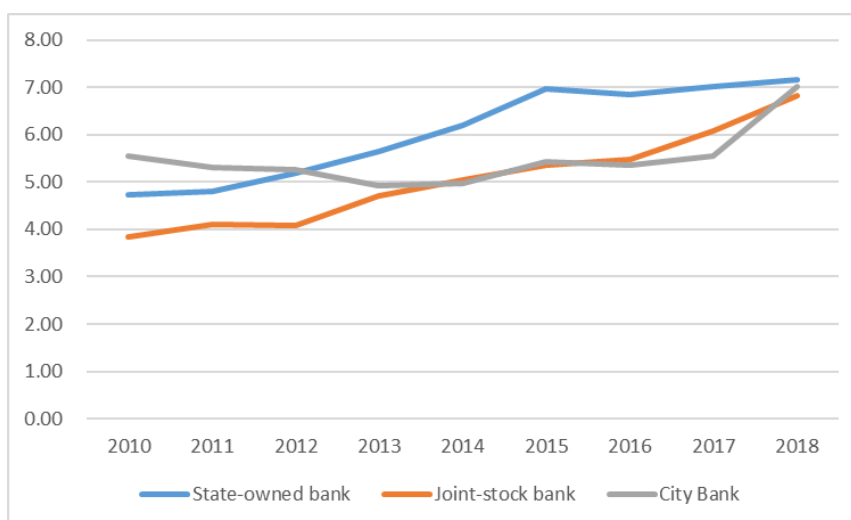


Figure 1. Trend chart of average leverage of three commercial banks

According to the above chart, the leverage levels of large state-owned commercial banks and joint-stock commercial banks have risen in tandem, with a marked acceleration from 2012 and a gradual slowdown from 2015 onwards, hold level. By contrast, except for 2018 to reach 7% , the city commercial bank leverage ratio has been very stable, basically maintained at about 5% , experienced a gradual decline, a gradual rise, a steep rise process; From the vertical perspective, the leverage ratio of city banks in 2010-2012 is significantly higher than that of state-owned banks and joint-stock banks, and that of state-owned banks in 2012-2018 is significantly higher than that of the other two categories, with the steady rise in the leverage of state-owned and joint-stock banks, there will be little difference between the three in 2018.

Large state-owned banks play an important role in China's financial system and play an important role in avoiding systemic financial risks. According to the regulatory requirements of the CBRC, the adjustment period of leverage ratio of systemically important banks is relatively short, it needs to be adjusted to the regulatory requirements before 2013, and non-systemically important banks have to relax the regulatory time limit by the end of 16 years. Therefore, China's commercial banks have already met the transitional arrangements of the regulation of leverage ratio.

3.2 Performance of listed commercial banks in China

In the performance index system based on the above three principles of banks, the profitability of commercial banks is reflected by the rate of return on assets, which measures the use effect of assets in the process of banking operation, it is also an important indicator of how well international commercial banks are doing; the Capital adequacy ratio reflects the ability of banks and other financial

institutions to withstand risk, before the regulation of leverage ratios as a measure of a firm's ability to take on debt risk, the Capital adequacy ratio has long been a risk indicator for regulators; in 2015, the loan to deposit ratio went from a statutory regulatory indicator to a liquidity indicator. Therefore, Roe, Capital adequacy ratio and loan-to-deposit ratio are taken as the evaluation indexes, and the data of 2010-2018 are selected according to the above in time series.

3.2.1 Current profitability

To describe the current situation of profitability of listed commercial banks, this paper selects the most commonly used profitability index-Yield value, which measures the level of return on shareholders' equity, great on behalf of the commercial banks to achieve the maximum interests of the shareholders of the operating objectives.

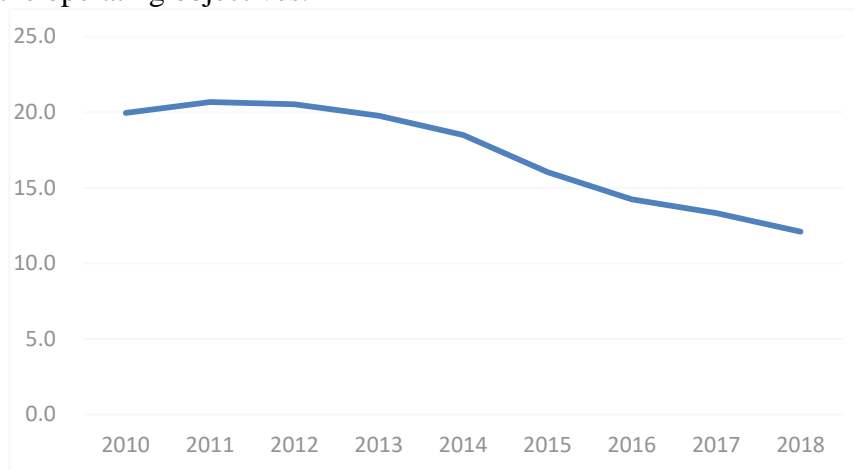


Figure 2. Average Yield value of 16 banks

As can be seen from figure 3.2 above, the average Yield value of the 16 listed commercial banks in 2011-2018 showed a significant downward trend, with the rate of decline ranging from moderate to slightly steep, most banks peaked in 2011 or 2012 and have been on a downward trend since, while a few have been slow to respond, declining since 2013, thus, since 2014, all commercial banks have seen a steady decline in Roe, further explaining the overall trend from flat to steep.

The large state-owned banks have the fastest decline in Roe, which is adjusted at the beginning of the policy, and the regulation of leverage ratio is the most binding and the most demanding Bank of Nanjing and Bank of Ningbo are the two city banks with the slowest response and the smallest fluctuation, and their leverage ratio remained high among other banks in 2018. It is further explained that the requirements and binding force of the policy on different types of banks are different.

3.2.2 Status of security

For the description of the current security situation, select the special indicators of banking supervision-Capital adequacy ratio. Based on the 2010-2018 average of the 16 listed commercial banks, the Capital adequacy ratio chart is as follows:

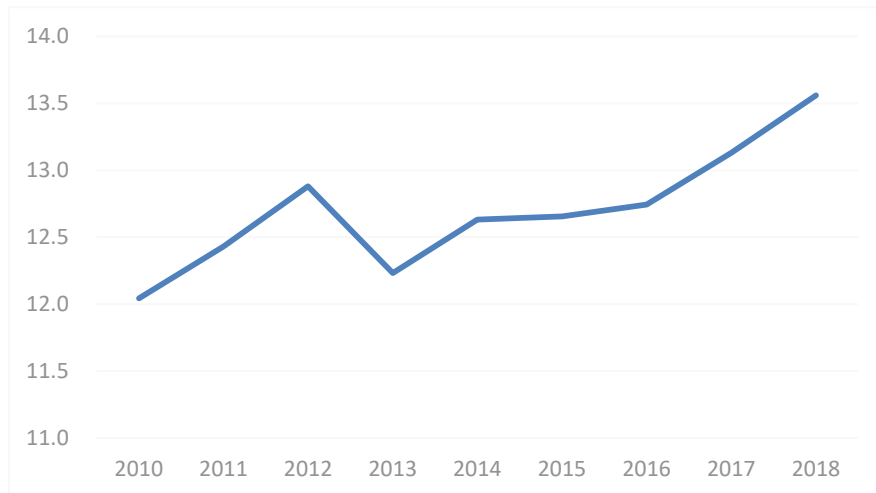


Figure 3. Average Capital adequacy ratio of 16 banks

An analysis of the chart above shows that the average Capital adequacy ratio of banks showed a general upward trend from 2010 to 2018, with only a significant decline in 2013 due to the updating of the Capital adequacy ratio rules, has a certain influence on the statistical results. All of these banks have met the regulatory requirements of the China Banking Regulatory Commission, according to the Capital adequacy ratio, which requires no less than 8 percent.

3.2.3 Current liquidity

For the analysis of liquidity, this paper selects the bank's special index-loan-to-deposit ratio to measure. Based on the 2010-2018 average loan-to-deposit ratio of the 16 listed commercial banks, the following zigzag chart is drawn:

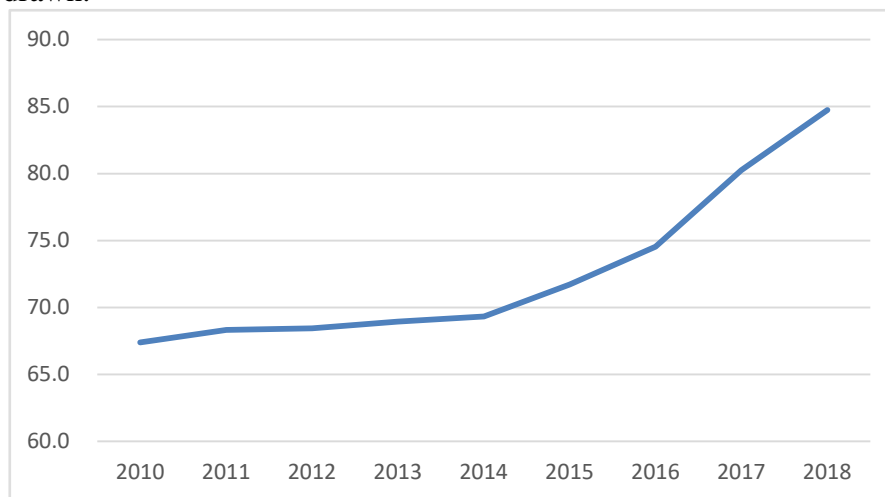


Figure 4. Average loan-to-deposit ratio of 16 banks

As can be seen from the above chart, the average loan-to-deposit ratio of banks has shown an upward trend, rising from a moderate to a steeper rate, with a significant increase since 2014. The reason for this is that the maximum ratio limit of 75% was removed in 2015 the loan-to-deposit ratio of 16 banks is 105.2% and 109.9% respectively from 2017 to 2018. SPDB obviously faces serious liquidity risk Industrial and Commercial Bank, Agricultural Bank, construction bank these three state-owned banks loan-to-deposit ratio has been maintained at 60%-70% , that its liquidity is good; And the loan-to-deposit ratio of Nanjing Bank and Ningbo Bank, two city banks, is basically maintained at about 60% , indicating that the liquidity of these two city commercial banks is strong.

According to the above analysis of the current situation of leverage ratio, after the promulgation of Basel III, China's regulatory authorities have updated such regulatory indicators and requirements as leverage ratio, Capital adequacy ratio, etc. , china's commercial banks also actively adjust the banking

business and structure, so that the level of leverage gradually increased, and all meet regulatory requirements. The performance of commercial banks to describe the status quo, China's commercial banks become less profitable, stronger security, poor liquidity.

4. An empirical analysis of the impact of leverage ratio regulation on the performance of listed commercial banks

4.1 The mechanism of leverage ratio regulation influencing the performance of commercial banks

The regulation of leverage ratio makes the supervision authority put forward higher requirement to the bank's safety, and has some conflict with the bank's ultimate profit target. The supervision of leverage ratio aggravates the contradiction between these three principles, which makes commercial banks must take into account the three principles in their operation, and promote the sustainable and healthy development of banks based on safety. Under the new market background of interest rate marketization and financial disintermediation, it has promoted the transformation and innovation of commercial banks, while the regulation of leverage ratio is like a double-edged sword hanging over the head of commercial banks, forcing commercial banks to balance profitability, safety and liquidity in the new form of business.

(1) Profitability

So far, commercial banks' profits mainly come from a large number of traditional main business, and there is no doubt that the regulation of leverage ratio is a challenge to the structure of banking business. Although the regulation of leverage ratio is put forward for the long-term profit and sustainable development of the bank, it is a self-innovation to the asset quality, management level and business structure, but in the short term, a large number of credit assets cannot be restricted for bank profit, the invisible opportunity cost will be detrimental to profit growth. However, in the 10 years since the implementation of the regulation of leverage ratio, the profitability of commercial banks is likely to be affected in the short term, therefore proposed the hypothesis 1: the regulation of leverage ratio will have a negative impact on bank profitability.

(2) Safety

In order to meet the regulatory requirements, it is necessary to reduce the proportion of assets and liabilities by reducing the denominator or increasing the numerator, so as to ensure the safety of commercial banks. But this also makes commercial banks have to choose the higher risk off-balance sheet innovation business, cannot rely on the traditional, safe, low-risk deposit and loan business to make profits, this may have an adverse impact on the safety of commercial banks. In the practice of the supervision of leverage ratio in Chinese banks, the supervision authorities pay more attention to the safety and higher standard of asset quality and management, so it is assumed that the supervision of leverage ratio has a positive impact on the safety of banks.

(3) Liquidity perspective

The reduction of the assets in the denominator results in a contraction in the scale of credit, the restriction of off-balance-sheet investments results in the failure of high-risk and high-yield businesses, the use of funds is severely restricted by strong regulation, and the loan-to-deposit ratio will rise, makes the bank liquidity become poor, therefore proposed the hypothesis 3: the leverage ratio supervision has the negative influence to the bank liquidity.

4.2 Variable selection

(1) The explanatory variable

The explained variable is an indicator of the performance of commercial banks. This paper selects Yield value, Capital adequacy ratio and loan-to-deposit ratio, which are three typical indicators, each represents the profitability, safety and liquidity of the bank.

(2) Explanatory variable

The explanatory variable of this paper is the level of leverage.

(3) Control variables

According to the above, there are many internal and external causes of performance impact, among which the direct and indirect factors are numerous, and the commercial banks selected are all large-scale, high market value and high similarity banks, therefore, we do not consider in this paper; in the external cause, the macro-economy will have an impact on the performance of commercial banks, so we take the GDP growth rate as the control variable shared by the three explained variables, GDP growth: $(GDPT-GDPT-1)/GDPT-1$.

4.3 Model and indicator setting

4.3.1 Model settings

In this paper, the panel data model is used for empirical analysis. From the cross-section point of view, we can observe the observation values of several individuals at a time cut-off point. From a longitudinal time perspective, it is possible to observe the observations of a study individual at different points in time. Because the panel data model observes the 2D data, the degree of freedom is increased, and therefore the multi-collinearity between the explanatory variables can be avoided as much as possible, which makes the empirical results more accurate and more explanatory. The panel data model typically has the following expression:

$$Y_{i,t}=\alpha_0+\alpha_1X_{i,t}+\alpha_2Z_{i,t}+u_{i,t} \quad i=1, 2, \dots, N, t=1, 2, \dots, T \quad (1)$$

In the above formula, i and t respectively represent the data of each bank in each year. N and T respectively represent the total number of research objects and the number of periods. $Y_{i,t}$ represents explained variables, which in this paper are return on equity (ROE), capital adequacy ratio (CRAR) and loan-to-deposit ratio (LR). $X_{i,t}$ represents explanatory variable, i.e., leverage ratio level (GGL). $Z_{i,t}$ represent control variables, namely GDP growth rate (GGDP). α_0 is the parameter of the constant term of the model, α_1 is the coefficient of the explanatory variable, α_2 is the coefficient of the control variable, and the $u_{i,t}$ is the random error term.

The specific panel model is set as follows:

$$ROE_{i,t}=\alpha_0+\alpha_1GGL_{i,t}+\alpha_2GGDP+u_{i,t} \quad (2)$$

$$LR_{i,t}=\alpha_0+\alpha_1GGL_{i,t}+\alpha_2GGDP+u_{i,t} \quad (3)$$

$$CRAR_{i,t}=\alpha_0+\alpha_1GGL_{i,t}+\alpha_2GGDP+u_{i,t} \quad (4)$$

Among them, $ROE_{i,t}$ represents the bank's annual return on assets. $LR_{i,t}$ represents the deposit to loan ratio. $CRAR_{i,t}$ represents the Capital adequacy ratio. $GGDP$ represents the growth of GDP in the year T over the previous year. $GGL_{i,t}$ represents the leverage ratio.

4.3.2 Target setting

Based on the assumptions presented in the theoretical analysis of 4.1 above, it is concluded that as the level of leverage increases, the return on assets will decrease in the opposite direction, and the ratio of Capital adequacy ratio to deposits will increase, moving in the same direction.

Table.3. Indicator setting and description

Variable property	Name	Abbreviations	Definition
Explanatory variable	Yield valve	ROE	Net Profit/shareholders' equity
	Capital adequacy ratio	CRAR	Tier 1 capital/risk-weighted assets
	Loan-to-deposit ratio	LR	Total loans/deposits
Explanatory variable	Leverage ratio	GGL	Net Tier 1 capital/adjusted balance of external and internal assets
Control variable	GDP growth rate	GGDP	(GDPT-GDPT-1)/GDPT-1

4.4 Analysis of results

(1) Unit root test

The results of the unit root test are shown in the following table:

Table.4. Unit root test results

Inspection Index	LCC test		After the first difference	
	ROE	Check value	-3.4420	-
P value		0.0003	-	-
CRAR	Check value	-4.6905	-	-
	P value	0.0000	-	-
LR	Check value	3.3099	Check value	-4.8333
	P value	0.9995	P value	0.0000
GGL	Check value	0.1544	Check value	-4.8301
	P value	0.5613	P value	0.0000
GGDP	Check value	-36.1086	-	-
	P value	0.0000	-	-

Analysis of the table above shows that the variables used in this paper are stable under the 5% significance level, and the unstable loan-to-deposit ratio and leverage ratio are also stable after the first-order differential treatment.

(2) Hausman test

Table.5. Hausman test results

Inspection Index	P value	Test results
ROE	0.0062	Fixed-effect model
CRAR	0.0021	Fixed-effect model
LR	0.0553	Random effects model

As can be seen from the table above, at the 5% significance level, the return on assets and the Capital adequacy ratio use the fixed-effect model, and the loan-to-deposit ratio uses the random-effect model.

(3) Model result

Table.6. Panel model test results

Inspection Index	Coefficient	R-squared
ROE	Constant term	1.227
	GGL coefficient	-3.096***
	GGDP	0.304*
CRAR	Constant term	-7.942
	GGL coefficient	0.817***
	GGDP	0.150**
LR	Constant term	61.30
	GGL coefficient	5.599***
	GGDP	-0.175

As can be seen from the table above, using leverage ratio as explanatory variable to explain ROE, loan-to-deposit ratio and Capital adequacy ratio has good explanatory power, p value is significant and fit degree is fair.

From the above results, we can know that when the leverage ratio rises by a unit, the Yield value falls by 3.096 units, the impact is negative if leverage goes up by a unit and the Capital adequacy ratio goes up by 0.817 units, the effect is positive. Assumption 2: Leverage Regulation has a negative effect on bank safety; if leverage goes up by a unit, loan-to-deposit ratio changes 5.599 units, the impact of negative, Assumption 3: leverage ratio regulation will have a negative impact on bank liquidity established. To sum up, leverage ratio has positive effect on the security of commercial banks and negative effect on the profitability and liquidity, which is consistent with the analysis of the status quo.

5. Suggestions to commercial banks based on the regulation of leverage ratio

5.1 From a regulatory perspective

(1) Different types of commercial banks should be regulated and treated differently in terms of their leverage ratio. In the above analysis of the current leverage ratio, except in 2018, the leverage ratio of state-owned banks is significantly higher than that of city banks and joint-stock banks, and the three types of bank leverage ratio change there is obvious heterogeneity. Although regulators have given non-systemically important banks a longer adjustment period, the same leverage requirements often create two problems. First, put greater pressure on the small and medium-sized banks, which are not mentioned in this article. Due to factors such as the source of funds, the efficiency in the use of funds, etc. , the small and medium-sized banks obviously have a big short board, a single regulator could create more risk for small and medium-sized banks, rather than an opportunity for them to reverse course. Second, it could also provide more responsibility and leadership to systemically important banks such as state-owned banks, unified supervision is not conducive to the long-term development of state-owned banks and the stability of the level of leverage, but limited the process of development and transformation. Therefore, it is necessary to establish a higher and more reasonable leverage ratio for state-owned banks to prevent the occurrence of systemic financial risks, it should be properly distinguished from the standards of state-owned banks.

(2) Improve the information disclosure mechanism of leverage ratio, and display the leverage ratio directly and completely. In the process of data collection, leverage ratio is undoubtedly the most difficult. In the source, there is no direct discovery of leverage ratio from the conventional database for disclosure, basically through the calculation and annual reports to extract the income. Therefore, we can find that leverage ratio, as an important regulatory indicator, is not perfect and direct information disclosure. In the calculation rules, there is no detailed disclosure of the subject in the calculation formula, making the level of leverage is not clear enough. There is therefore a risk of Information asymmetry, arbitrage and leverage between the regulated and the regulated. Therefore, we should improve the disclosure system of leverage ratio, make full use of the Internet platform and database system, and present the leverage ratio data to the stakeholders more directly and

comprehensively, the regulation of leverage ratio is not only regulated by the CBRC, but also can arouse the supervision and attention of the masses, and enhance the confidence of the masses in the banking and financial industry.

5.2 From a commercial bank perspective

(1) Developing off-balance sheet businesses and strengthening business innovation. With the development and renewal of the financial field, the operation of commercial banks is facing more and more challenges. A variety of internet financial products are springing up one after another. The source of business and the share of commercial banks are segmented by the market. In addition, the rise of the third-party payment platform also makes the bank's payment and receipt business suffered a heavy blow. The new era and new background put forward higher requirements for commercial banks, in order to play a leading role in the increasingly competitive financial market. This paper suggests that commercial banks actively implement regulatory policies to adjust their asset structure, actively develop financial derivatives, wealth management and other off-balance sheet businesses to promote diversification of sources of capital, and join hands with internet finance, construction of internet banking and internet business.

(2) Expand the channels of capital replenishment and establish a long-term effective capital replenishment mechanism. According to the leverage formula, there are two ways to meet the 4 per cent regulatory standard: by adding molecules or reducing the denominator. The first-class net capital of China's commercial banks is mainly common equity. Common equity is beneficial to improve the capital quality of banks, but the cost of absorbing common equity is too high. The denominator of the leverage ratio formula is the balance of assets in and out of the balance sheet. Although reducing the denominator can enhance the bank's leverage ratio, reducing the balance of assets is contrary to the goal that the bank pursues to expand the size of its assets, it also means that banks may be exposed to greater risk. Therefore, if banks want to improve the quality and scale of capital, they should establish long-term effective capital replenishment mechanism. This paper suggests that we can develop preferred stock or convertible bond to enrich the channel of capital expansion. Taking advantage of the low cost, dual characteristics of preferred stock and the flexible conversion of convertible bonds, both the quality of capital and the size of capital, to meet regulatory requirements.

6. Conclusions

Under the macro background of leverage ratio supervision, listed commercial banks should accelerate the business structure adjustment of commercial banks, adapt to the new trend of The Times, and realize the steady growth of profitability and liquidity level of assets and liabilities business in the restructuring. At the same time, on the premise of diversification and adequacy of capital sources, further improve asset quality and security. Under leverage long-term effective supervision mechanism, avoid bubbles for the development of growth, strengthen quality management of assets and increase systemic risk analysis and prevention of banking industry and find reasonable protection, effective control of commercial bank changes in the degree of leverage with maintaining leverage stability, dominant in China's long-term economic development, protect the safety of the commercial Banks stable operation.

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