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The Impact of Macroprudential Capital Constraints on the Performance of Commercial Banks

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Abstract: The Basel III Accord takes macroprudential measures as an important approach to prevent financial systemic risks. Since China established the Macro Prudential Assessment (MPA) system in 2016, it has continuously improved the macroprudential policy framework. Nowadays, macroprudential policies have become an important means for China to deal with financial systemic risks. Macroprudential policies enhance the risk - bearing capacity of commercial banks through capital - related policy tools, which affects the operation mode and development direction of commercial banks to a certain extent, and thus has an impact on the performance of commercial banks. This paper selects the data of 136 commercial banks in China from 2013 to 2022 for empirical analysis, examines the impact of macroprudential capital constraint policy tools on the performance of commercial banks, and through the mediating effect test, finds that capital constraints can improve the performance of commercial banks by controlling bank risks.

1. Introduction

Since the outbreak of the financial crisis in 2008, governments around the world have continuously strengthened the management of financial risks. China experienced three rounds of quantitative easing in 2009, 2012, and 2014, relaxing financial supervision, which led to a sharp increase in financial risks, reaching a peak in 2015. Therefore, in 2015, China took preventing and defusing financial risks as a key economic task. China introduced the Macro Prudential Assessment system in 2016, reflecting the counter - cyclical adjustment policy idea. In 2017, the central government established the Financial Stability and Development Committee of the State Council, aiming to strengthen financial regulatory coordination and fill regulatory gaps. The 19th National Congress of the Communist Party of China proposed to "improve the dual - pillar regulatory framework of monetary policy and macroprudential policy". In 2022, the People's Bank of China began to implement the "Guidelines for Macroprudential Policies (Trial)".

In the context of the opening - up of the financial industry and the strengthening of financial supervision, commercial banks have started to explore new business models, innovate business models, and continuously improve their operating performance. This paper uses dynamic panels to examine the impact of macroprudential capital constraint policies on the performance of

commercial banks, which has practical significance for improving the performance of commercial banks. The characteristics of high leverage and pro - cyclicality of commercial banks are likely to trigger financial crises. Macroprudential policies, by constraining the capital of commercial banks, reduce the risks of commercial banks, maintain the stability of the financial system, prevent systemic risks, and are conducive to the sustainable operation of commercial banks and ensure the financing supply of commercial banks.

2. Literature Review

2.1 Factors Affecting the Performance of Commercial Banks

2.1.1 Equity Concentration

Many domestic and foreign scholars have studied the role of equity concentration within a company, but the results are inconsistent. Some researchers believe that the equity concentration of a company does not directly affect the company's performance. Demsetzh and Lehn [1]studied the performance of listed companies using accounting profit margins as an indicator and found that equity concentration had no significant impact on the company's performance. Some scholars believe that there is a negative correlation between equity concentration and company performance. Bian and Deng (2016) selected 115 commercial banks in China from 2007 - 2014 for analysis and found that the more dispersed the equity, the better the performance of commercial banks. The return on capital and return on equity were significantly reduced, proving that there is a significant negative correlation between equity concentration and the performance of commercial banks. Wen Gang [2] and others' research shows that banks with higher equity concentration are more likely to induce major shareholders to use their control rights for personal gain. Therefore, the performance of listed banks in China is negatively correlated with equity concentration. Other scholars believe that there is a positive correlation between equity concentration and company performance. Huang [3] selected listed banks in China from 2007 - 2018 as samples and found that banks with higher equity concentration had higher profitability. Zhang Da [4] believes that banks can improve the performance of commercial banks by enriching the equity structure while controlling the equity concentration.

2.1.2 Asset Size

Anbar and Alper[5] selected 10 commercial banks in Turkey from 2002 - 2010 as samples and found that the asset size had a significant positive effect on the profitability of commercial banks. The increase in asset size was conducive to improving the operating performance of commercial banks.

2.1.3 Macroeconomic Factors

A large number of studies have shown that macroeconomic factors have a significant impact on the performance of commercial banks. Liu Minzhe [6]selected the data of 10 small and medium - sized listed banks from 2007 - 2016 and found that there was a negative correlation between GDP and the performance of commercial banks. Qiao Han et al. [7], based on the business model iceberg theory and the bank business model 7E model, took 16 listed commercial banks in China as the research object and found that there was a positive correlation between GDP and the performance of commercial banks. Some scholars also believe that GDP has no significant impact on the performance of commercial banks. Zhang Kun [8] and Chen Yihong[9] believe that there is no

significant relationship between GDP and the return on assets of commercial banks.

2.2 The Impact of Macroprudential Policies on the Risks of Commercial Banks

Xu Mingdong and Chen Xuebin [10] believe that when the capital is sufficient, commercial banks will reduce their risk - taking level to meet regulatory requirements. Yuan Kun and Rao Sufan [11] empirically found that in a stricter regulatory environment, most banks will choose to reduce their risk - taking level to achieve stable operations. Wang Aijian and Wang Jingyi [12] examined the role of macroprudential policies in stabilizing financial fluctuations under the DSGE framework and found that macroprudential policies can better assist monetary policies when the financial market is hit. Jung [13] explored the relationship between macroprudential supervision and systemic risks and found that macroprudential policies mainly based on capital constraints can reduce the systemic risks of commercial banks and also play a certain role in reducing the operating risks of individual banks. Zhao Shengmin and He Yujie [14] found that an increase in macro - financial risks will increase the credit risks and liquidity risks of commercial banks, but also reduce operating risks. Shao Mengzhu [15] found that the stronger the intensity of macroprudential policies, the stronger the risk - reducing effect. Yang Min and Liang Yinhe [16] empirically found that when commercial banks are undercapitalized and under strict supervision, they will increase their risk - taking, while when they are well - capitalized, they will reduce their risk - taking. Macroprudential policies can effectively reduce the risk - taking of commercial banks by setting requirements for the capital adequacy ratio. Huang Jicheng et al. [17] believe that macroprudential policies can weaken the transmission effect of the bank risk channel of monetary policies and alleviate the over - preference of banks under loose monetary policies. Anran Zhao [18] believes that when implementing macroprudential policies, it is necessary to consider the economic cycle and bank heterogeneity. Different banks respond differently to macroprudential policies. Commercial banks with lower capital adequacy ratios and smaller scales are more affected by macroprudential policies, and macroprudential policies are more effective in a loose economic period.

2.3 The Impact of Macroprudential Policies on the Performance of Commercial Banks

The core of macroprudential policies is capital supervision. This paper mainly reviews the research of domestic and foreign scholars on the impact of capital supervision on the performance of commercial banks, so as to explore the impact of macroprudential policies on the performance of commercial banks.

Gersbach [19] believes that commercial banks can effectively improve their performance only by maintaining an appropriate capital adequacy ratio. Z.Yakubu and A.Y.Affoi[20] studied and showed that there is a positive correlation between the capital adequacy ratio and the performance of commercial banks. Domestic scholar Li Sanjie[21] found that with the change of the core capital ratio, the performance of commercial banks showed a positive trend. Yao Yanyan [22] used the data of 11 listed commercial banks from 2007 - 2018 for empirical research and found that the capital adequacy ratio had a positive impact on the profitability of commercial banks. Some scholars also believe that there is a negative correlation between the capital adequacy ratio and commercial banks. Erna et al. [23] believe that there is an inverse relationship between the core capital of banks and the profitability of commercial banks.

Through the above literature analysis, it can be found that the supervision of commercial banks has gradually shifted from micro - supervision to macroprudential supervision, making the financial system more robust, reducing the over - optimism and moral hazard of commercial banks, and preventing systemic risks. At present, the effect of macroprudential regulation on the performance of commercial banks has not yet reached a unified conclusion. Although the results are inconsistent,

they still have important guiding significance.

3. Theoretical Analysis and Research Hypotheses

3.1 The Impact of Macroprudential Capital Constraints on the Performance of Commercial Banks

China's macroprudential policies take the capital adequacy ratio as a key indicator, requiring commercial banks to raise the capital adequacy ratio to a certain standard, and set counter - cyclical buffer capital and supplementary capital. Under macroprudential supervision, in order to meet the regulatory standards, commercial banks need to increase capital and reduce the proportion of risk - weighted assets to improve the capital adequacy ratio. These two methods will occupy the existing cash of banks, reduce the scale of risky credit, and reduce the interest income of banks. The reduction of the risky credit scale can make the operations of commercial banks more stable, reduce regulatory costs, and thus improve operating performance. In an environment of continuously strengthening supervision, the traditional businesses of commercial banks are affected, and it is difficult to obtain more profits by continuing the previous model. Therefore, commercial banks must change their operation modes and expand off - balance - sheet businesses. The transformation of the operation mode of commercial banks not only needs to meet the requirements of macroprudential capital supervision but also achieve the goals of safety, liquidity, and profitability of commercial banks, enabling banks to improve their operating capabilities while maintaining stable operations and expand their business scope, thereby improving the performance of commercial banks. Thus, this paper proposes Hypothesis H1.

Hypothesis H1: Macroprudential capital constraints have a significant positive impact on the performance of commercial banks.

3.2 Analysis of the Impact Mechanism: The Bank Risk - taking Path

If commercial banks take profit maximization as their operating goal, they may only focus on profits and ignore potential risks. However, if commercial banks want to achieve the coordination of safety, liquidity, and profitability, they need to actively take on and manage risks. In the daily operations of banks, commercial banks will appropriately adjust their risk preferences according to the situation, continuously change their credit and investment decisions, and achieve profit maximization. The economic cycle will increase the internal vulnerability of banks. During periods of economic prosperity, commercial banks will relax loan conditions and increase interest income, leading to the accumulation of risks. During periods of economic recession, borrowers are unable to repay loans, resulting in an increase in the credit risks faced by commercial banks. They may face the dilemma of being unable to recover loans and may even go bankrupt due to insufficient liquidity. Maintaining the capital adequacy ratio at a certain level allows commercial banks to withstand certain risks and set aside a certain amount of capital as counter - cyclical capital and supplementary capital. These capitals can alleviate the pro - cyclical problems of commercial banks and improve their ability to face systemic risks, thereby improving the performance level of commercial banks. China's macroprudential policies have strengthened risk management as a whole, regulated counter - cyclical risks, and prevented systemic risks, playing a positive role in the stability of commercial banks in China. Therefore, through macroprudential supervision of commercial banks, the liquidity risks, credit risks, and market risks of commercial banks can be reduced, thereby improving the performance of commercial banks. Thus, this paper proposes Hypothesis H2.

Hypothesis H2: Macroprudential capital constraints improve the performance of commercial banks through the path of reducing bank risks.

4. Empirical Analysis

4.1 Sample Selection and Data Sources

This paper uses the data of 136 commercial banks from 2013 to 2022 as samples. The variable data come from the CSMAR database, Bankscope database, National Statistical Yearbook, and the annual reports of various commercial banks. The data are processed by excluding the data of commercial banks with a large number of missing values and outliers, and 1360 data points are obtained. Based on this, empirical analysis is carried out to provide data support for policy recommendations.

4.2 Empirical Model and Variable Explanation

4.2.1 Empirical Model

This paper uses the system GMM method to conduct an empirical study on the relationship between macroprudential capital constraint policy tools and the performance of commercial banks. The Hansen test is used to judge whether the instrumental variables are excessive, and the AR(1) and AR(2) tests are used to check whether the residual terms are autocorrelated, so as to ensure the effectiveness of the estimation results. This paper establishes a dynamic panel data model, taking into account the influence of the lag period of the explained variable and endogeneity. The specific model is as follows:

$$ROA_{i,t} = \beta_0 + \beta_1 ROA_{i,t-1} + \beta_2 CAR_{i,t} + \sum y_k X_{k,i,t} + \varepsilon_{i,t} \quad (1)$$

Where i and t represent commercial banks and years, ROA represents the performance of commercial banks, CAR represents the capital regulatory pressure of commercial banks, and $X_{k,i,t}$ (k=1,2,3) represents the control variables. β0 represents the constant term, β1,β2, andy_k are all regression coefficients, and$\varepsilon_{i,t}$ represents the random error disturbance term.

4.2.2 Variable Explanation

Commercial Bank Performance: The return on equity (ROE) is the ratio of net profit to total capital, and the return on assets (ROA) is the ratio of net profit to total assets. Since commercial banks can increase the return on equity by increasing liabilities, using the return on equity may ignore the risk of high liabilities of banks. The return on assets covers various aspects of commercial banks' assets, liabilities, and profits and losses, and can more comprehensively reflect the profit - making ability of commercial banks. Therefore, this paper selects the return on assets as an indicator to measure the performance of commercial banks.

Proxy Variables for Macroprudential Capital Constraint Tools: Domestic scholars often choose the capital adequacy ratio as a proxy variable for capital constraint tools. This paper adopts the research method of Jing Zhongbo and Fang Yi (2018) and selects the capital regulatory pressure (CAR) as a proxy variable for capital constraint tools, that is, the difference between the actual capital adequacy ratio and the reciprocal of the required capital adequacy ratio.

Control Variables: Based on the review of the literature, this paper selects the GDP growth rate, M2 growth rate, bank size, and equity concentration, and introduces a dummy variable to measure whether the macro - policy has been introduced. It is recorded as 0 before 2016 and 1 after 2016.

The meanings and calculation formulas of the above - selected variables are shown in the following table:

Table 1. Variable Selection and Meaning Explanation

Meaning	Symbol	Name	Formula
Commercial Bank Performance	roa	Return on Assets	Net Profit / Total Assets
Capital Constraint Tool	CAR	Capital Adequacy Ratio	1 / Actual Capital Adequacy Ratio - 1 / Required Capital Adequacy Ratio
Control Variable	gdp	GDP Growth Rate	(Current GDP - Previous GDP) / Previous GDP
	m2	M2 Growth Rate	(Current M2 - Previous M2) / Previous M2
	size	Bank Size	Total Asset Size of the Bank
	top	Equity Concentration	Shareholding of the Largest Shareholder
	mpa	Introduction of Macroprudential Policy	Recorded as 0 before 2016 and 1 after 2016.
Mediating Variable	npl	Non - Performing Loan Ratio	Total Non - Performing Loans / Total Loans

4.3 Descriptive Statistics and Correlation Analysis

4.3.1 Descriptive Statistics

Table 2 shows the descriptive statistical results of the entire sample. The mean value of the explained variable, return on assets, is 0.81%, and the standard deviation is 0.35, indicating that the overall sample is profitable, and there are significant differences in the return on assets of different commercial banks. For the explanatory variable, the capital regulatory pressure of commercial banks, the minimum value is - 0.086, and the maximum value is - 0.029, indicating that the selected commercial banks all meet the capital adequacy ratio requirements. The mean value of the mediating variable, non - performing loans, is 1.57%, and the standard deviation is 0.87, indicating that there are large differences in the risks of different commercial banks.

Table 2. Descriptive Statistics of All Commercial Banks in the Sample

Name	Mean	Standard Deviation	Minimum Value	Maximum Value
roa	0.8135	0.3536	0.0500	1.8300
CAR	-0.0507	0.0101	-0.0865	-0.0298
top	23.3717	23.7196	4.2000	100.0000
gdp	6.2200	1.9205	2.2000	8.4000
m2	10.4000	2.0677	6.9900	13.5900
mpa	0.7000	0.4584	0.0000	1.0000
Ln_size	26.1145	1.7499	19.0998	31.3101
npl	1.5730	0.8758	0.0100	18.4500

4.3.2 Correlation Analysis

According to Table 3, the correlation coefficient between capital regulatory pressure and return on assets is significantly negative at the 1% level. It can be seen that there is a negative correlation between capital regulatory pressure and the return on assets of commercial banks, which is consistent with Hypothesis 1 of this paper. At the same time, the correlation coefficient between the non - performing loan ratio of commercial banks and capital regulatory pressure is positive, and the correlation coefficient between the non - performing loan ratio and the return on assets of commercial banks is significantly negative at the 1% level, which is in line with Hypothesis 2. Therefore, from the perspective of the positive or negative nature and magnitude of the correlation coefficients, the correlation strength between capital regulatory pressure and the return on assets of commercial banks can meet the research requirements of this paper.

Table 3 Correlation Analysis of Commercial Banks in the Sample

	roa	CAR	top	gdp	m2	mpa	ln_size	npl
roa	1.000							
CAR	-0.099***	1.000						
top	-0.283***	-0.277***	1.000					
gdp	0.248***	0.089***	-0.004	1.000				
m2	0.247***	-0.152***	-0.008	0.009	1.000			
mpa	-0.400***	-0.150***	0.011	-0.402***	-0.712***	1.000		
ln_size	0.015	0.215***	0.141***	-0.109***	-0.106***	0.169***	1.000	
npl	-0.345***	0.029	-0.075***	-0.062**	-0.109***	0.121***	-0.196***	1.000

*Note: *** , ** , and * indicate significance at the 1%, 5%, and 10% levels, respectively.*

4.4 Empirical Results Analysis of the Impact of Macroprudential Capital Constraints on the Performance of Commercial Banks

Due to the possible lag of the explained variable in the model, in order to solve the endogeneity problem, this paper uses the system GMM method to estimate the model. Table 4 - 4 shows the empirical results of the impact of macroprudential capital constraints on the performance of commercial banks. In the autocorrelation test, AR(1) is less than 0.1 and AR(2) is greater than 0.1, indicating that there is no second - order serial correlation in the residual terms. The P - value of the Hansen test is greater than 0.1, indicating that the instrumental variables are effective. Therefore, the model setting of this paper is robust and reasonable.

Table 4 shows that there is a significant negative correlation between capital regulatory pressure and the return on assets of commercial banks. The smaller the capital regulatory pressure, that is, the higher the capital adequacy ratio of commercial banks, indicates that macroprudential capital - constraint - type tools have a significant positive effect on the performance of commercial banks. The increase in the capital adequacy ratio is conducive to improving the performance of commercial banks. The core of macroprudential policies is capital supervision. Increasing the capital adequacy ratio can prevent the risk of the expansion of risky assets of commercial banks, reduce bad outputs, and thus promote the benefits of commercial banks. Moreover, raising capital requirements will strengthen the supervision of commercial bank operations by shareholders and enhance the stability of the internal systems of commercial banks, thereby reducing the operational risks of commercial banks.

Table 4. Estimation Results of the Impact of Macroprudential Capital Constraints on the Performance of Commercial Banks

	roa
l.roa	0.551*** (9.17)
CAR	-6.826* (-1.90)
gdp	-0.001 (-0.55)
m2	-0.009** (-2.33)
mpa	-0.206*** (-7.35)
ln_size	0.039** (2.04)
top	-0.657 (-1.61)
AR(1)	0.000
AR(2)	0.515
Hansen test	0.874

*Note: *** , ** , and * indicate significance at the 1%, 5%, and 10% levels, respectively.*

4.5 Empirical Analysis of the Mediating Effect

According to the theoretical analysis in Chapter 3, the implementation of macroprudential

policies can reduce the risks of commercial banks, thereby improving their performance. The risk - taking of commercial banks can be measured by the expected default frequency (EDF), the Z - score, and the non - performing loan ratio (NPL). However, it is difficult to obtain detailed data on the expected default frequency of Chinese commercial banks. Meanwhile, the Z - score mainly measures the bankruptcy risk and is not suitable for the Chinese commercial banking system. The non - performing loan ratio reflects the default situation of commercial banks in their business activities. Therefore, this paper selects the non - performing loan ratio as the mediating variable. This paper uses the step - by - step regression test method to analyze the impact of macroprudential capital constraint policies on the performance of commercial banks through bank risk - taking. The models are as follows:

$$ROA_{i,t} = \beta_0 + \beta_1 ROA_{i,t-1} + \beta_2 CAR_{i,t} + \sum y_k X_{k,i,t} + \varepsilon_{i,t} \quad (2)$$

$$NPL_{i,t} = \alpha_0 + \alpha_1 NPL_{i,t-1} + \alpha_2 CAR_{i,t} + \sum \theta_k X_{k,i,t} + \varepsilon_{i,t} \quad (3)$$

$$ROA_{i,t} = \mu_0 + \mu_1 ROA_{i,t-1} + \mu_2 NPL_{i,t} + \mu_3 CAR_{i,t} + \sum \sigma_k X_{k,i,t} + \varepsilon_{i,t} \quad (4)$$

Among them, i and t represent commercial banks and years respectively. NPL is used to measure bank risk, and CAR measures the degree of capital constraints under macro - prudential policies. $X_{k,i,t}$(k=1,2,3) represents the control variables. β_0 α_0 $\mu_0$represents the constant term, and β_1 β_2 y_k α_1 α_2 θ_k μ_1 μ_2 μ_3 $\sigma_k$are all regression coefficients. $\varepsilon_{i,t}$represents the random error disturbance term. Table 5 shows the test of the mediating effect of macro - prudential capital constraints on the risk - taking and performance of commercial banks. All the models pass the AR(1) and AR(2) tests, indicating that there is no second - order serial correlation in the residual terms. The p - values of the Hansen tests are all above 0.1, indicating the validity of the instrumental variables. Therefore, the model settings are robust and reasonable. There is a significant positive relationship between capital regulatory pressure and non - performing loans, which means that macro - prudential policies can reduce capital regulatory pressure and thus lower bank risks, confirming Hypothesis 2. When the non - performing loan ratio is added to the model, as shown in Table 6, the regression coefficients of both the non - performing loan ratio and capital regulatory pressure are significant, indicating that capital regulatory pressure can improve the performance of commercial banks through bank risk - taking.

Table 5 . Results of the First - Step Analysis of the Mediating Effect

	npl
l.npl	-0.632*** (-3.69)
CAR	47.182* (1.82)
gdp	0.631*** (3.79)
m2	0.421*** (3.96)
mpa	3.539*** (3.46)
ln_size	-0.370 (-1.10)
top	0.111** (2.21)
AR(1)	0.000

AR(2)	0.127
Hansen test	0.361

*Note: *** , ** , and * indicate significance at the 1%, 5%, and 10% levels, respectively.*

Table 6 . Results of the Second- Step Analysis of the Mediating Effect

	roa
l.roa	-0.632*** (-3.69)
npl	
CAR	47.182* (1.82)
gdp	0.631*** (3.79)
m2	0.421*** (3.96)
mpa	3.539*** (3.46)
ln_size	-0.370 (-1.10)
top	0.111** (2.21)
AR(1)	0.001
AR(2)	0.493
Hansen test	0.475

*Note: *** , ** , and * indicate significance at the 1%, 5%, and 10% levels, respectively.*

5. Conclusions and Policy Recommendations

Based on the existing literature, this paper empirically studies the impact of macroprudential policies on the performance of commercial banks and draws the following conclusions: Macroprudential policies have a significant positive impact on the performance of commercial banks. Increasing the capital adequacy ratio can enhance the risk - bearing capacity of commercial banks, making their operations more stable and enabling them to provide higher expected returns to customers. An increase in the capital adequacy ratio can also promote the improvement of the internal technical and management levels of commercial banks, reduce management costs, and thus improve performance. Capital constraints enable commercial banks to have sufficient reserves to handle non - performing assets, effectively respond to systemic risks, and ensure the continuous and stable development of commercial banks' operations. Macroprudential policies can promote the performance of commercial banks through the bank risk - taking channel. Based on the above research, this paper puts forward the following suggestions: First, commercial banks should increase their capital adequacy ratios, improve their capital structures, adjust the structure of risky assets, and reduce high - risk businesses to ensure stable operations. Second, improve the quality of bank assets. Establish and improve risk assessment and internal audit systems, conduct thorough loan eligibility reviews, and reduce the likelihood of non - performing loans. Third, regulatory authorities should implement differential supervision of commercial banks, with different levels of supervision for different types of banks, to reduce regulatory costs and improve the performance of

commercial banks. Fourth, improve the macroprudential regulatory system, perfect the evaluation index system, and coordinate macroprudential policies with other regulatory policies.

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