

An Empirical Study on the Impact of Financial Regulatory Indicators on the Non-Performing Loan Ratio of Commercial Banks in China

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Abstract. A high non-performing loan (NPL) ratio in commercial banks reduces banks' profits, weakens their profitability, and triggers market concerns about bank stability and reputation. For the broader economy, excessive non-performing loans may cause credit contraction, disrupt the normal functioning of financial markets, and restrain economic growth. The NPL ratio of commercial banks is affected by both macroeconomic and microeconomic factors. From the perspective of financial regulatory indicators, this paper investigates the impact of selected indicators on the NPL ratio of commercial banks. After reviewing domestic and international research progress, the paper provides a comprehensive analysis of the NPL ratio of Chinese commercial banks over the past decade, including overall trends, structural distribution, and differences across institutions. It then conducts theoretical analysis and selects data from 16 banks for panel data analysis to empirically examine the effects of provision coverage ratio, return on assets, loan-to-deposit ratio, and capital adequacy ratio on the NPL ratio. The results show that financial regulatory indicators have significant effects on the NPL ratio.

Keywords: financial regulation, non-performing loan ratio, commercial banks.

1. Introduction

Finance is the core of the modern economy. Since the 18th National Congress of the Communist Party of China, under the strong leadership of the CPC Central Committee with Comrade Xi Jinping at its core, China has unswervingly followed the path of financial development with Chinese characteristics and continuously promoted high-quality development of the financial sector.

Commercial banks play an important role in the financial sector. As a key indicator for evaluating banks' risk-taking and credit quality, the NPL ratio has a profound impact on banks' operations and development. For individual banks, an increase in non-performing loans directly pressures their financial condition. Specifically, such an increase first significantly weakens banks' profitability and thereby reduces profits; this trend affects not only short-term profit performance but also long-term sound operation. In addition, rising non-performing loans may trigger market doubts about bank stability and damage bank reputation; at the same time, an increase in non-performing loans may expose banks to crises and even bankruptcy. For the overall economy, excessive non-performing loans may lead to credit contraction, impair the normal operation of financial markets, and restrain economic growth.

Studying the determinants of the NPL ratio is important for banking stability and development. The NPL ratio has many influencing factors, among which financial regulatory indicators exert significant effects. Therefore, analyzing the determinants of commercial banks' NPL ratio from the perspective of financial regulatory indicators helps reveal the dynamics of the NPL ratio and provides theoretical support and practical guidance for regulators in formulating effective regulatory policies. This paper conducts theoretical and empirical analyses of how regulatory indicators used by financial regulators affect commercial banks' NPL ratio, examines the impact of financial regulatory indicators on the NPL ratio, and deepens the understanding of financial-system stability and banks' risk-management capacity.

2. Literature Review

2.1. Definition of the NPL ratio of commercial banks

Non-performing loans mainly refer to loans extended by commercial banks to borrowers under compliance and relevant risk-control requirements, for which borrowers fail to repay principal and interest on schedule for various reasons.

In 2001, the People's Bank of China issued a notice on the full implementation of the five-category loan classification system, requiring all banks in China to classify loans in detail based on borrowers' repayment capacity from 2002 onward. Specifically, loans are classified into five categories according to risk from low to high: pass, special-mention, substandard, doubtful, and loss. Among the five categories, substandard, doubtful, and loss loans are collectively defined as non-performing loans.

The NPL ratio, namely the ratio of total non-performing loans to total loans, is a core indicator of banks' asset quality. A high NPL ratio usually indicates that a bank bears greater credit risk because a larger proportion of the loan portfolio is exposed to possible default. Conversely, a lower NPL ratio is generally regarded as a sign of better asset quality. Therefore, commercial banks should establish a sound lending system and risk-control mechanism to reduce the NPL ratio, prevent the formation of non-performing loans, and safeguard bank assets.

2.2. Determinants of the NPL ratio of commercial banks

From a macro perspective, Dimitrios, Angelos, and Vasilios (2012) analyzed the drivers behind the NPL ratio of Greek commercial banks and found that macro variables such as unemployment and interest rates significantly affect the NPL ratio. Based on Indian bank data, Rajan and Dhal (2003) revealed that loan maturity, cost, and bank size play non-negligible roles in non-performing loans. The empirical studies by Bernanke (1983) and Pesaran (2006) both show that intensified economic fluctuations increase loan-cost volatility, affect borrowers' repayment capacity, and thereby influence banks' non-performing loans. Studying Spanish banks from 1985 to 1997, Salas and Saurina (2002) found that favorable economic development improves borrowers' repayment capacity and reduces the NPL ratio. Mwanza Nkusu (2011), Tanaskovic (2015), and Jordan Kjosevski and Mihail Petkovski (2016) found that GDP growth has a negative effect on commercial banks' NPL ratio. For 21 commercial banks in the Baltic States during 2005–2016, Jordan and Mihail (2021) found that macro factors such as M2 growth and inflation reduce the NPL ratio. Alnabulsi Khalil, Kozarević Emira, and Hakimi Abdelaziz (2022) argued that the macroeconomic environment and institutional quality significantly affect the level of non-performing loans.

2.3. The impact of financial regulation on the NPL ratio of commercial banks

Financial regulation refers to the supervision and management of the financial industry and its institutions, conducted by governments or relevant authorities. Its core objectives are to ensure financial-system stability, fairness, and transparency; prevent financial risks; protect investors; and promote sound financial-market development.

From the perspective of financial regulation, Berger and Bouwman (2013) found that during financial crises, regulation can reduce banks' non-performing loan levels; in severe economic crises, stricter and more refined banking regulation and higher capital requirements significantly help maintain sound banking operations and reduce overall systemic risk. Simon H. Kwan (2003) found that the regulatory provision coverage ratio affects the NPL ratio by reducing banks' costs and increasing output. Studying non-performing loans in Japanese banks, Caballero, Hoshi, and Kashyap (2008) argued that stricter capital adequacy requirements may cause banks to reduce lending and thereby increase the NPL ratio. Using an international comparison of regulatory policies worldwide, Barth, Caprio, and Levine (2004) found no clear relationship between regulatory intensity and the NPL ratio; instead, they argued that transparency, regulator impartiality, and respect for market discipline more strongly affect the NPL ratio.

2.4. Literature assessment

Commercial banks constitute the core of the financial system, and their non-performing loan problems affect bank operations and may cause losses to the entire financial sector. Domestic and foreign scholars have clearly defined and studied non-performing loans. Under China's current five-category loan classification framework, substandard, doubtful, and loss loans are explicitly defined as non-performing loans. When analyzing determinants of the NPL ratio, scholars have adopted a combined macro and micro perspective and explored influences from different dimensions. At the macro level, indicators such as unemployment, interest rates, GDP growth, and inflation affect the NPL ratio differently. At the micro level, loan maturity, loan cost, and bank size also play important roles in changes in the NPL ratio. These micro factors directly affect banks' lending strategies and, to some extent, determine loan risk, thereby significantly affecting the NPL ratio.

Scholars have also studied how financial regulation affects commercial banks' NPL ratio. Some argue that stricter financial regulation can reduce banks' non-performing loan levels, especially during financial crises. Others maintain that regulatory intensity has no clear relationship with the NPL ratio and that transparency, regulator impartiality, and respect for market discipline are more influential. Some scholars have conducted empirical studies on the impact of certain financial regulatory indicators on the NPL ratio.

Existing research has rarely examined the NPL ratio from the perspective of financial regulatory indicators. Therefore, drawing on rich domestic and international findings, this paper considers the five categories of regulatory indicators and selects the capital adequacy ratio (CAR), provision coverage ratio (PCR), loan-to-deposit ratio (LDR), and return on assets (ROA) to discuss their effects on the NPL ratio.

3. Theoretical Analysis of the Impact of Financial Regulatory Indicators on the NPL Ratio of Chinese Commercial Banks

3.1. Effect of the provision coverage ratio on the NPL ratio

The provision coverage ratio is the ratio of loan loss provisions to total non-performing loans and is used to assess banks' reserve utilization in dealing with bad debts. The National Financial Regulatory Administration requires commercial banks to maintain a provision coverage ratio between 120% and 150%.

Specifically, a higher provision coverage ratio indicates that the bank has stronger capacity to withstand potential risks and implies a lower probability of non-performing loans. A high coverage ratio means the bank has sufficient reserves to cover possible losses from non-performing loans, thereby significantly reducing the potential impact of non-performing loans on overall financial conditions. When the provision coverage ratio is high, banks are more capable of dealing with non-performing loan risk, which helps improve soundness and sustainability and may keep the NPL ratio low. Conversely, if the provision coverage ratio is low, banks may face insufficient funds when confronting non-performing loan risk, which may push the NPL ratio up. In addition, a low provision coverage ratio may cause regulatory concern, prompting higher requirements on banks' operations and capital adequacy and further increasing operational uncertainty, which may also raise the NPL ratio. Therefore, the paper proposes:

Hypothesis 1: The provision coverage ratio has a negative effect on the NPL ratio.

3.2. Effect of return on assets on the NPL ratio

Return on assets is a key indicator measuring the net income generated per unit of assets in bank operations. In evaluating bank profitability, ROA provides an intuitive perspective on the efficiency and effectiveness of asset utilization. Its level directly reflects a bank's comprehensive strength in asset allocation, operation and management, and risk control.

Overall, higher ROA means stronger capacity to create profits from assets, which helps improve financial conditions and reduce the NPL ratio. When firms' profitability improves, their repayment capacity also rises, reducing the risk of overdue repayment. If a bank has a high ROA, it indicates strong management and profitability. This means the bank pays more attention to risk management and adopts stricter loan-approval standards, thereby reducing the occurrence of non-performing loans. Higher ROA may negatively affect the NPL ratio, that is, reduce the NPL ratio. On the other hand, if a bank's ROA is low, it may indicate poor operating conditions and weak profitability. In such cases, the bank may be more inclined to take higher risks in pursuit of higher returns, increasing the likelihood of non-performing loans and raising the NPL ratio. Therefore, the paper proposes:

Hypothesis 2: Return on assets has a negative effect on the NPL ratio.

3.3. Effect of the loan-to-deposit ratio on the NPL ratio

The loan-to-deposit ratio is the ratio of bank loans to deposits and reflects banks' use of funds. From the perspective of profitability, a higher loan-to-deposit ratio means banks convert more deposits into loans, thereby increasing profit margins. From the perspective of risk resistance, however, an excessively high loan-to-deposit ratio may expose banks to liquidity risk, meaning banks may not have sufficient cash reserves to meet customer withdrawals when needed, causing a payment crisis.

Loans are relatively risky; therefore, if the loan-to-deposit ratio is high, banks bear greater credit risk. If banks use a large amount of deposits for loans while loan quality is low, the risk of overdue payments or bad debts increases, pushing up the NPL ratio.

In addition, an excessively high loan-to-deposit ratio reduces banks' liquidity and makes it difficult for banks to respond quickly to customer withdrawals. This may force banks to sell assets or seek other funding sources to meet customer needs, increasing operating costs and risks. At the same time, liquidity risk may also trigger market concerns about banks' credit, further intensifying the rise in the NPL ratio.

The higher the loan-to-deposit ratio, the larger the proportion of total loans to total deposits, and the more aggressive banks may be in using funds, favoring riskier loan projects. This may lead to negligence in loan review and management and increase the risk of non-performing loans.

A high loan-to-deposit ratio leads to a high NPL ratio, while a lower loan-to-deposit ratio reduces the NPL ratio. Therefore, the paper proposes:

Hypothesis 3: The loan-to-deposit ratio has a positive effect on the NPL ratio.

3.4. Effect of the capital adequacy ratio on the NPL ratio

The capital adequacy ratio, the ratio of total bank capital to risk-weighted assets, is an important benchmark for measuring solvency and risk-bearing capacity. Its core purpose is to effectively restrain the expansion of risky assets, fully protect depositors and other creditors, and promote sound operation and development of banks and other financial institutions. The capital adequacy ratio significantly affects commercial banks' NPL ratio.

If a commercial bank has sufficient capital, it has stronger risk-resistance capacity. When non-performing loans increase, a high capital adequacy ratio enables banks to absorb potential losses with more own capital, thereby reducing the impact of non-performing loans on overall financial conditions.

Banks' credit and risk-management policies are also affected by capital adequacy requirements. To maintain a high capital adequacy ratio, banks may evaluate loan applicants' credit more prudently, thereby reducing the occurrence of non-performing loans. Meanwhile, banks may strengthen post-lending management and identify and dispose of potential non-performing loans in a timely manner.

When the capital adequacy ratio declines, banks may need to replenish capital by issuing stocks or bonds to maintain the required level. This increases financing costs and affects profitability. A decline in profitability may further aggravate non-performing loan problems.

In summary, a high capital adequacy ratio helps reduce the risk of the NPL ratio; a low capital adequacy ratio exposes banks to higher solvency risk and leads to a higher NPL ratio. Therefore, the paper proposes:

Hypothesis 4: The capital adequacy ratio has a negative effect on the NPL ratio.

4. Empirical Analysis of the Impact of Financial Regulatory Indicators on the NPL Ratio of Chinese Commercial Banks

4.1. Variable selection

Based on existing domestic and international research and indicator disclosure by the National Financial Regulatory Administration, this paper selects four regulatory indicators required by financial regulators—the provision coverage ratio (PCR), return on assets (ROA), loan-to-deposit ratio (LDR), and capital adequacy ratio (CAR)—as explanatory variables to investigate the impact of financial regulatory indicators on the NPL ratio. Considering that the NPL ratio is also affected by other factors, four control variables are selected. The variable system and calculation formulas are shown in Table 1.

Table 1. Variables and indicator selection

Type	Variable	Calculation formula	Data processing
Dependent variable	NPL ratio (NPL)	Non-performing loans / total loans	NPL ratio $\times 100$
Explanatory variables	Provision coverage ratio (PCR)	Asset impairment provisions / non-performing loans	Provision coverage ratio $\times 100$
	Return on assets (ROA)	Net profit / total assets	ROA $\times 100$
	Loan-to-deposit ratio (LDR)	Loans / deposits	LDR $\times 100$
	Capital adequacy ratio (CAR)	Capital / risk-weighted assets	CAR $\times 100$
	GDP growth rate (GDP)	(Current period – previous period) / previous period	GDP growth rate $\times 100$
Control variables	Inflation rate (CPI)	(Current price level – base price level) / base price level	Inflation rate $\times 100$
	Cost-to-income ratio (CI)	Operating expenses / operating income	Cost-to-income ratio $\times 100$
	Debt-to-asset ratio (DAR)	Total liabilities / total assets	Debt-to-asset ratio $\times 100$

4.2. Sample selection and data sources

The National Financial Regulatory Administration classifies Chinese commercial banks into five categories. This paper aims to study the impact of financial regulation on commercial banks' NPL ratio nationwide. Considering that city commercial banks have certain regional characteristics and mainly serve the regions where they were established; although their businesses have expanded rapidly nationwide in recent years, they differ from national commercial banks; rural commercial banks share the defects of city commercial banks and have special service objects, making them unsuitable for comparison with national commercial banks; and foreign-funded banks have limited total assets and business in China and little impact on results, these three categories are excluded. Based on the above reasons and considering data availability, this paper finally selects 16 commercial banks for empirical analysis. The selected banks are: Bank of China, Agricultural Bank of China, Industrial and Commercial Bank of China, China Construction Bank, Bank of Communications, China Merchants Bank, Shanghai Pudong Development Bank, China CITIC Bank, China Everbright Bank, Hua Xia Bank, China Minsheng Bank, China Guangfa Bank, Industrial Bank, Ping An Bank, China Zheshang Bank, and China Bohai Bank.

This paper collects data for the above banks from 2009 to 2023. Data are obtained from the official website of the National Financial Regulatory Administration, banks' financial statements, and the CSMAR database.

4.3. Descriptive statistics

As shown in Table 2, the maximum NPL of the selected sample banks is 2.91 and the minimum is 0.10, revealing differences in NPL ratios across banks. Meanwhile, the standard deviation of NPL is relatively small, indicating that NPL ratios of commercial banks are generally stable. Among explanatory variables, PCR and CAR differ substantially across sample banks. The mean PCR and CAR are 244.08 and 13.01 respectively, both above Chinese regulatory requirements and generally sound; however, the standard deviations and maxima/minima show large differences across sample banks in risk-bearing capacity and capital levels. The LDR standard deviation is 13.69, indicating some differences among sample banks in loan-scale management. For ROA, the indicator fluctuates little and differences in profitability among sample banks are generally small. No control variable shows extreme values and the data are stable.

Table 2. Descriptive statistics

Variable	Mean	Std. dev.	Max	Min	Obs.
NPL	1.28	0.44	2.91	0.10	240
PCR	244.08	166.42	1398.05	105.37	240
LDR	81.78	13.69	118.00	55.00	240
ROA	0.93	0.25	1.47	0.29	240
CAR	13.01	2.45	33.86	8.88	240
GDP	8.62	1.72	12.00	5.20	240
CPI	2.17	1.26	5.39	-0.71	240
CI	31.47	5.67	56.68	12.38	240
DAR	93.20	1.35	96.67	90.16	240

Source: CSMAR database and official websites of banks.

4.4. Unit-root tests

Because this paper uses 15-year time-series data for sample banks, the long time span may produce non-stationarity and spurious regression; therefore, unit-root tests are conducted to judge data stability. It is generally considered that the series is stationary if two of the three tests pass. Results are shown in Table 3.

Table 3. Unit-root test results

Variable	LLC test	IPS test	ADF test	Conclusion
NPL	-3.3654***	-1.3038*	60.2607***	Stationary
PCR	-7.3971***	-2.0890**	87.0426***	Stationary
LDR	-3.6752***	-2.3866***	32.8148	Stationary
ROA	-3.4544***	-1.0057	48.4292**	Stationary
CAR	-1.7952**	-3.5740***	54.5765***	Stationary
GDP	-4.0129***	-2.0685**	52.5710**	Stationary
CPI	-7.5172***	-8.0548***	178.1792***	Stationary
CI	-3.2646***	-1.4821*	52.3558**	Stationary
DAR	-1.4051*	-2.3436***	48.7911**	Stationary

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

As shown in Table 3, the test results indicate that the variables are stationary and no spurious regression exists.

4.5. Regression analysis

According to the F test and Hausman test, this paper uses a fixed-effects model for empirical analysis. The model is specified as:

$$NPL_it = \beta_0 + \beta_1 PCR_it + \beta_2 LDR_it + \beta_3 ROA_it + \beta_4 CAR_it + \beta_5 GDP_it + \beta_6 CPI_it + \beta_7 CI_it + \beta_8 DAR_it + \lambda_i + v_t + \varepsilon_it$$

where $i = 1, 2, \dots, 16$ denotes sample banks; $t = 1, 2, \dots, 15$ denotes time periods. NPL_it is the NPL ratio of bank i in period t , and the other variables are defined similarly. λ_i is the individual fixed effect, v_t is the time fixed effect, and ε_it is the error term of bank i in period t .

Model regression results are shown in Table 4.

Table 4. Regression results for the full sample model

Variable	Coefficient	t-value
β_0	7.2642***	2.74
PCR	-0.0013***	-10.06
LDR	0.0019	0.81
ROA	-0.6558***	-5.59
CAR	-0.0289***	-2.65
GDP	0.0302**	2.02
CPI	-0.0421***	-3.04
CI	-0.0287***	-5.62
DAR	-0.0437	-1.61
Goodness of fit	$R^2 = 0.71$; F-statistic = 10.72; Prob(F-statistic) = 0.0000	

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

As shown in Table 4, R^2 is 0.71 and the F statistic passes the test at the 1% significance level, indicating satisfactory model fit and high significance; the model can effectively explain the impact of financial regulatory indicators on commercial banks' NPL ratio. The regression results lead to the following conclusions:

First, commercial banks' provision coverage ratio is significantly negatively correlated with the NPL ratio and plays a significant role in reducing the NPL ratio. The empirical result is consistent with the preceding theoretical analysis and hypothesis: increasing the provision coverage ratio significantly strengthens commercial banks' risk-management capacity, enables banks to deal with non-performing loans more efficiently, and ultimately reduces the NPL ratio.

Second, the loan-to-deposit ratio is not significantly correlated with commercial banks' NPL ratio and has no significant effect on it. This result is inconsistent with the earlier hypothesis. The phenomenon may be related to the types of sample banks: large state-owned banks and joint-stock banks have strong risk-management awareness and mechanisms, diversified business structures, weakened sensitivity of the loan-to-deposit ratio, and thus reduced impact on the NPL ratio. The sample banks in this paper are all large state-owned banks and joint-stock banks; therefore, the loan-to-deposit ratio is insignificant in the regression.

Third, return on assets is significantly negatively correlated with commercial banks' NPL ratio. Consistent with the preceding theoretical analysis and hypothesis, banks with higher ROA have more complete loan-granting systems and are better able to assess loan conditions accurately, thereby reducing the NPL ratio.

Fourth, the capital adequacy ratio is significantly negatively correlated with commercial banks' NPL ratio; the earlier hypothesis is supported. This paper argues that a higher capital adequacy ratio helps reduce commercial banks' non-performing loans, whereas a lower capital adequacy ratio leads banks to take aggressive measures to replenish capital, thereby increasing the NPL ratio. Therefore, the capital adequacy ratio has a negative effect on the NPL ratio.

4.6. Robustness check

To test the robustness of the conclusions, this paper replaces the control variable CI with SIZE and re-estimates the regression. Results are shown in Table 5.

Table 5. Robustness-check regression results

Variable	Coefficient	t-value
β_0	7.7556**	2.16
PCR	-0.0017***	-12.08
LDR	0.0014	0.55
ROA	-0.5041***	-4.00
CAR	-0.0265***	-2.26
GDP	0.0089	0.51
CPI	-0.0270**	-1.83
SIZE	0.0486	0.96
DAR	-0.0728**	-2.50
Goodness of fit	$R^2 = 0.67$; F-statistic = 6.37; Prob(F-statistic) = 0.0000	

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

As shown in Table 5, after replacing the control variable, the effects of the explanatory variables on the dependent variable remain unchanged, indicating that the conclusions are robust.

4.7. Heterogeneity analysis

To further examine the degree to which financial regulatory indicators affect different types of commercial banks, according to the bank classification of the National Financial Regulatory Administration, the full sample is divided into large state-owned banks and joint-stock banks for heterogeneity analysis. Separate regressions are conducted for the two groups, with results shown in Table 6.

Table 6. Heterogeneity-analysis regression results

Variable	Large state-owned banks: coefficient	Joint-stock banks: coefficient
β_0	11.7004***	1.8386
PCR	-0.0051***	-0.0012***
LDR	-0.0139**	0.027
ROA	-0.4797***	-0.6252***
CAR	-0.0123*	0.0281
GDP	-0.0416**	0.0194
CPI	-0.0103	-0.0036**
CI	0.0239**	-0.0315***
DAR	-0.0844**	-0.0068
Goodness of fit	$R^2 = 0.89$; F-statistic = 18.11; Prob(F-statistic) = 0.0000	$R^2 = 0.75$; F-statistic = 5.65; Prob(F-statistic) = 0.0000

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

The regression results show that the results for PCR and ROA are consistent with those in the full-sample regression. However, LDR and CAR have significant negative effects on large state-owned banks but insignificant effects on joint-stock banks, which differs from the full-sample regression; the two types of banks are heterogeneous in the effects of the loan-to-deposit ratio and capital adequacy ratio on the NPL ratio.

5. Conclusions

This paper deeply explores the impact of financial regulatory indicators on commercial banks' NPL ratio. Through theoretical and empirical analyses, the following conclusions are drawn:

(1) With continuous improvement of the financial regulatory system and gradual policy adjustments, the overall NPL ratio of Chinese commercial banks remains controllable, showing the important role of financial regulation in maintaining financial-system stability and promoting sound banking development.

(2) Empirical analysis finds that, overall, financial regulatory indicators such as provision coverage ratio, return on assets, and capital adequacy ratio significantly affect commercial banks' NPL ratio. Specifically, the provision coverage ratio has a negative effect on the NPL ratio: the higher the provision coverage ratio, the stronger banks' risk resistance and the lower the NPL ratio. The capital adequacy ratio has a negative effect: the higher the capital adequacy ratio, the stronger banks' risk resistance, the lower the risk of non-performing loan formation, and the lower the NPL ratio. Return on assets also has a negative effect: the higher the ROA, the lower the NPL ratio. The loan-to-deposit ratio has no significant effect on the full sample banks. For large state-owned banks and joint-stock banks separately, the effects of provision coverage ratio and return on assets are broadly consistent with the full sample, while the effects of loan-to-deposit ratio and capital adequacy ratio are heterogeneous across the two types of banks.

(3) The results also show that financial regulation plays an important role in promoting sound bank operations and preventing financial risks. Meanwhile, they remind commercial banks to pay more attention to risk management during operations, improve loan quality, reduce the NPL ratio, and ensure stable and sustainable development of the financial system.

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