

The Determinants of the Performance of the Banking Sector: Evidence from City Commercial Banks in China

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Abstract: The performance of city commercial banks (CCBs) is consistently regarded as a key criterion for assessing their competitiveness within the industry. The continuous pursuit of performance growth remains a fundamental objective for every city commercial bank. This study examines the impact of internal risk governance, along with various internal and external factors, on the performance of CCBs. A total of 35 city commercial banks were selected for analysis from 2011 to 2022, categorizing the samples into state-owned and non-state-owned groups based on ownership structure. A two-way fixed-effects model was employed for this analysis. The findings indicate that: for state-owned banks, the improvement of internal risk governance has a greater positive impact on bank performance than for non-state-owned banks; for state-owned banks, income diversification has a positive effect on bank performance, while for non-state-owned banks, the impact of income diversification on bank performance is negative but not significant; this study also finds that the higher the proportion of non-state-owned holdings, the higher the bank performance.

Keywords: Bank Performance, City Commercial Banks, Internal Risk Governance

1. Introduction

City Commercial Banks (CCBs) are a vital component of the financial sector, contributing significantly to economic stability and national growth. However, in contrast to much larger state-owned national commercial banks and joint-stock commercial banks, the marketization level and business operation maturity of city commercial banks are relatively underdeveloped. Under the government's leadership, city commercial banks often bear the responsibility of financing local enterprises to promote the local economy [1]. Therefore, it is worth noting that this leads to an increase in credit risk, as many loans to local enterprises are not market-traded. Furthermore, compared to much larger state-owned national commercial banks, the level of government support for city commercial banks is quite limited. Unlike state-owned national commercial banks, which issue bonds to increase liquidity, city commercial banks primarily rely on retained profits and capital increases. Moreover, when facing a financial crisis, the government's implicit guarantee allows state-owned national commercial banks to maintain customer trust and resolve the crisis, while city commercial banks may be seen as the creators of non-performing assets and even face bankruptcy [2].

In recent years, city commercial banks have expanded their business outlets, with branches in various cities across the country. The large number of outlets has created significant job demand,

providing employment for 300,000 people. Additionally, they offer financial support to an increasing number of small and medium-sized enterprises in their start-up stages and contribute to local economic development based on regional characteristics. City commercial banks have gradually integrated into various sectors of society and are of great significance to China's financial system. By the end of 2022, the total assets of CCBs had exceeded 49.88 trillion yuan, reflecting a year-on-year increase of 10.7%, accounting for 13.1% of the assets of banking financial institutions [1].

However, due to their late start and relatively small scale, the performance of city commercial banks is highly susceptible to external factors. Their development is more likely to be constrained during financial reforms [3], which may contribute to their underperformance. As profit-oriented enterprises, performance is the primary goal for banks. Judging by the current development of CCBs, their performance remains weak. For instance, the performance of city commercial banks has continued to decline. According to data from the China Banking and Insurance Regulatory Commission in 2022, the growth rates of return on assets for city commercial banks from 2012 to 2022 were -0.04%, -0.04%, -0.07%, -0.2%, -0.1%, -0.8%, -0.14%, -0.02%, -0.13%, 0.03%, and -0.01%, respectively. This indicates that the performance of city commercial banks is shrinking year by year, significantly lower than in the past. The year-on-year growth rate of net profit declined from 40.83% in 2011 to 5.04% in 2019. This downward trend reflects a rapid contraction in the profitability of traditional interest-based businesses for city commercial banks. Additionally, the proportion of non-performing loans in bank assets increased significantly from 0.9% to 2.7% from 2011 to 2018, with a slight decrease after 2018.

Poor bank performance directly influences the stability of the financial system, as evidenced by the bankruptcy, restructuring, losses, and runs of city commercial banks. For example, on May 24, 2019, Baoshang Bank went bankrupt and was reorganized. On July 28, Bank of Jinzhou suffered a loss of 5 billion yuan. In 2020, a run occurred at Bank of Gansu, and its stock price crashed [4]. According to the "2021 Financial Stability Report," the central bank classified 13 city commercial banks as high-risk institutions. China's city commercial banking industry presents diverse risks, covering a wide range of issues [2].

Based on this, the study explores the factors affecting the performance of city commercial banks. Through empirical testing and analysis of various factors, the study aims to provide a more systematic understanding of their impact on the performance of city commercial banks and offer rich empirical evidence for promoting the development and transformation of these banks.

2. Literature Review

There is an ongoing debate in both policy and academic circles regarding the relative importance of various drivers of bank performance. The existing literature can be categorized into two main approaches. The first approach analyzes bank performance from the perspective of internal factors, including asset quality, asset-liability structure, management quality, and business strategy [5, 6, 7, 8]. It extensively discusses various internal factors that reflect bank-specific characteristics, with particular focus on financial indicators. The second approach examines bank performance from the perspective of external factors, including the economic environment, technological advancements, and the regulatory framework [9, 10, 11, 12]. These external factors create a dynamic ecosystem within which City Commercial Banks operate. The performance of these banks is intricately linked to the nation's economic health, the regulatory policies they must adhere to, the technological disruptions they must navigate, and the level of competition they face.

Zhang et al. [13] integrate internal risk management and external regulation into their framework, discussing their effects on bank risk-taking behavior. This research allows for the quantification of the quality of internal risk governance. However, Zhang et al.'s study has limitations. Their study primarily focuses on CCBs, but their research sample includes all commercial banks. This sample

limitation may render the results less applicable to CCBs. Moreover, CCBs often have unreasonable ownership structures, and highly concentrated ownership may undermine internal risk governance. In particular, high concentrations of state-owned ownership are associated with lower governance quality, and government intervention is detrimental to bank performance in civil law countries [2, 13]. Hence, this study extends the framework of Zhang et al. by incorporating ownership concentration. Additionally, although bank diversification has become a trend, its suitability for various banks remains controversial. The information asymmetry introduced by diversification may encourage increased risk-taking behavior [14, 15]. Therefore, this study also considers diversification.

This study explores the impact of internal risk governance, capital regulatory pressure, ownership concentration, and income diversification on the performance of CCBs. It differs from previous research in several ways. First, there is no consensus in the conclusions of prior literature, possibly due to the heterogeneity of characteristics across different banks [2, 16, 17, 18]. These studies analyzed whether the impact varies by size, bank type, and ownership type (state-owned or not), among other factors. This study builds on the work of Zhou et al. [2], Chen et al. [8], and Hersugondo et al. [19] to conduct a heterogeneity analysis based on ownership type. Second, while extensive research has investigated the individual impacts of internal and external factors, a comprehensive understanding of how these factors collectively shape CCB performance remains elusive. This study incorporates internal risk governance, external regulatory pressure, ownership concentration, and diversification into its framework, systematically examining the interactions and interdependencies between these variables.

2.1. Hypothesis Development

2.1.1. The Effect of Internal Risk Governance on Bank Performance

When owners and operators pursue different goals, operators may focus more on maximizing their own interests rather than those of the firm. Without a well-designed mechanism to mitigate these conflicts, the interests of all company owners could eventually be harmed. Risk governance ensures the effectiveness of corporate governance decisions regarding risk management and the implementation of actions [20]. In this context, agency theory provides a framework that links corporate governance with business performance. For instance, by establishing an internal risk management system, shareholders can monitor and require managers to maximize profits and avoid high-risk projects that may negatively impact bank performance. Therefore, a well-developed internal risk management mechanism can effectively oversee agents, align their actions with shareholder interests, prevent risky decisions, and enhance the bank's earnings performance.

Some examples of risk governance practices discussed in the literature include the appointment of chief risk officers to the board of directors, the formation of board-level specialized risk committees, and the establishment of formal norms regarding risk appetite [7, 20, 21].

With the liberalization of policies and joint-stock reforms, non-state-owned banks, including those with private corporate shareholding, foreign individual shareholding, and individual shareholding, have emerged. The ongoing trend promotes mixed ownership reforms in city commercial banks, allowing the introduction of non-state capital to facilitate mixed investments or joint operations between state and non-state entities. Some studies argue that this diversification will positively impact bank performance [22]. It is suggested that the participation of non-state ownership brings the benefit of mutual supervision and balance, leading to decisions that reduce operational risk and improve long-term bank performance. For example, the introduction of strategic investors can increase core capital, as they are generally perceived to have significant capital strength. Additionally, such investors are believed to improve capital efficiency due to their advanced management experience, which allows banks to adopt more sophisticated business concepts and management methods [18]. Diversified

investment entities and ownership structures can also mitigate the shortcomings of debt financing and reduce financing risks.

The impact of internal governance on bank performance may vary depending on factors such as bank size, bank type, and ownership structure [7,13,22,23,24,25,26]. Wang et al. [23] argue that the effect is heterogeneous across different bank characteristics. Aljughaiman and Salama [7] compared Islamic and conventional banks and found that the relationship between risk governance and risk-taking behavior differs depending on the bank type. Similarly, Zhang et al. [13] divided their sample into two groups based on high and low risk governance indices. The results suggested that state-owned ownership reduces the positive effect of internal risk governance on bank performance.

Therefore, this study posits that, given the heterogeneity of ownership composition, differences may also exist in how internal risk governance affects bank performance. Based on the above considerations, this study proposes the following hypotheses:

H1: There is a significant relationship between internal risk governance and the performance of city commercial banks, with the impact differing between state-owned and non-state-owned banks.

2.1.2. The Effect of Capital Regulation Pressure on Bank Performance

Strict capital requirements serve as an effective institutional arrangement to curb agency risk in commercial banks. The potential loss of capital in the event of operational risk incentivizes bank shareholders and operators to reduce risk-taking. Thus, while strengthening capital regulation may lead to short-term tightening in commercial banks, resulting in decreased deposits, loans, and business scale, it will ultimately increase the capital adequacy ratio, reduce risk exposure, enhance credibility, accelerate the expansion of interest-earning assets, and improve bank performance in the long term.

Additionally, capital regulation can increase competition among commercial banks, promoting financial innovation and diversified operations, which, in turn, affects bank performance. The rising pressure of capital regulation forces commercial banks to tighten their deposit and loan operations and reduce the percentage of risky assets. This pressure drives banks to invest more in business innovation in pursuit of new profit opportunities, further intensifying competition. Zhong [27], using data from rural credit cooperatives in China, found a positive relationship between capital regulation and bank performance. Similarly, Wan and Wang [28] examined data from 32 listed banks in China from 2005 to 2019 and concluded that capital regulation improves the asset quality of commercial banks. Their study also identified asset quality as a significant mediating factor in how capital regulation affects bank performance.

Some argue that the primary motive for commercial banks to pursue financial innovation is argued to be the circumvention of regulatory constraints and the development of diversified business models to enhance performance. At this point, capital regulation and financial innovation form an interactive relationship, creating a dynamic cycle of “regulation leading to innovation, and then further regulation” [28]. Wang [29] argues that for commercial banks experiencing a decline in total assets, increased capital regulatory pressure weakens profitability. Therefore, commercial banks must maintain adequate capital ratios to enhance their performance. Le et al. [30] and Liu [31] empirically found that increased capital regulation reduces profitability in banks. This is because the primary source of profitability for Chinese banks still relies on traditional deposits and loans. Thus, as capital constraints increase, banks are forced to control or even compress asset growth, leading to a decline in profitability. Furthermore, capital is a relatively scarce resource for city commercial banks. When faced with increased capital constraints, these banks may engage in risk-taking, further adversely affecting profitability.

Cao [32] and Le [30] analyzed the heterogeneous impact of regulatory capital on bank risk through sub-sample comparisons. They did not find a heterogeneous impact when ownership types differed. Guan and Lee advocate introducing strategic investors. Strategic investors are believed to offer

“globalization advantages,” significantly enhancing the bank’s ability to expand its business. One of the most apparent advantages provided by strategic investors is the provision of capital. Specifically, commercial banks can access substantial amounts of circulating funds, which are crucial for maintaining operations and are key indicators of long-term development potential. The evidence supports the existence of heterogeneity in the impact of capital regulation pressure on bank profitability across different types of banks. Based on the above considerations, this study proposes the following hypotheses:

H2: There is a significant relationship between capital regulatory pressure and the performance of city commercial banks, with the impact differing between state-owned and non-state-owned banks.

2.1.3. The effect of Ownership Concentration on Bank Performance

Currently, shareholding reform in China has been completed, and an increasing number of commercial banks have gone public. However, a common feature of ownership concentration in most city commercial banks is that a small number of major shareholders hold the majority of the equity, with some banks even having a single dominant shareholder. Major shareholders are often free to appoint and dismiss management, as well as influence corporate decisions.

Some scholars argue that ownership concentration positively impacts bank performance, as concentrated ownership enables major shareholders to manage the bank more effectively, reduces the “free-riding” behavior of smaller shareholders, and prevents management from acting against the interests of shareholders [33,34]. Conversely, other scholars contend that ownership concentration negatively impacts bank performance. In commercial banks, excessive ownership concentration allows the majority shareholder to exercise strong control. Without sufficient oversight from other shareholders, a majority shareholder motivated by personal gain or the intent to “hollow out” the bank’s assets may reduce performance as their shareholding ratio increases [35,36,37]. Moreover, companies with a lower concentration of ownership are more likely to be acquired, prompting management to maintain good operating conditions in order to reduce the risk of acquisition, which can lead to improved performance [37].

Some research suggests that state-owned banks have a social responsibility to address market failures and promote economic development, which may come at the expense of financial performance. Additionally, these banks often implement loan policies driven by political considerations. Banks dominated by state ownership tend to have reduced profitability due to their greater emphasis on social benefits. Ravindy et al. [38] showed that the variable “Domestic-Foreign Bank” has a positive and significant effect on return on assets, while the variable “State-Owned-Private Bank” has a negative but not significant effect. Liu and Zhang [31], using data from 2012 to 2015, found that different types of ownership and varying shareholding ratios have diverse impacts on operational performance. Zhang and Shen [26] studied the impact of non-state-owned ownership (private capital ownership) on the performance of city commercial banks. The results indicated that non-state-owned ownership significantly improves the performance of city commercial banks in terms of both ownership quality and quantity.

Based on this, the study suggests that, under conditions of heterogeneous ownership composition, the impact of ownership concentration on bank profitability may vary. Consequently, the following hypotheses are proposed:

H3: There is a significant relationship between ownership concentration and the performance of city commercial banks, with the impact differing between state-owned and non-state-owned banks.

2.1.4. The Effect of Income Diversification on Bank Performance

The diversification of business income has two primary effects on the profitability of city commercial banks: financial innovation and agency costs. According to agency cost theory, the diversification of a bank's business can increase opacity, thereby elevating principal-agent costs and exacerbating information asymmetry between customers and commercial banks. This heightened asymmetry can lead to greater diversification risks, ultimately diminishing bank performance [39]. However, in recent years, the innovative activities of commercial banks have advanced rapidly. Diversification driven by financial innovation has further enhanced the competitiveness and service levels of commercial banks, promoted the optimization and upgrading of industries, and facilitated the transformation of growth patterns.

Given the significant changes in the business environment, banks that excessively rely on traditional interest income and resist innovation risk being phased out. Therefore, this study argues that, in the context of continuous development and the evolving economic and financial landscape, banks are inevitably compelled to diversify their business activities. Through a diversification strategy, banks can expand their profit sources by fostering innovation, developing new businesses and services, adjusting their business models, and mitigating non-systematic risks in a timely manner.

Luu et al. [40] analyzed data from Vietnamese commercial banks from 2007 to 2017 and found that bank performance in state-owned and foreign banks is positively related to income diversification. Moreover, banks with more market experience particularly benefit from income diversification. Lee [41] argued that an increasing proportion of non-interest income and a more diversified income structure in large state-owned banks lead to an upward trend in the risk-adjusted net interest rate on total assets. For state-owned or large banks, developing non-traditional businesses and diversified operations can generate economies of scope and synergistic effects. Similarly, Wu et al. [42], who examined data from 39 emerging economies from 2000 to 2016, found that an increase in the scale of income diversification significantly improves the efficiency of state-owned banks. In contrast, Yu and Guan [43] presented a different perspective from Luu et al. [40] and Wu et al. [42]. They argued that diversification decreases bank performance in state-owned banks. Their comparative analysis of the performance of Chinese local banks and foreign banks shows that state-owned banks in China experience diversification discounts, as they prioritize government affiliation when selecting managers. The previous results suggest that the outcomes vary with the nature of ownership. Based on this, this study proposes the following hypotheses:

H4: There is a significant relationship between income diversification and bank performance in city commercial banks, with the impact differing between state-owned and non-state-owned banks.

3. Research Methods

The independent variables of this study include internal risk governance, capital regulation pressure, ownership concentration, and income diversification. The dependent variable is bank performance. By focusing on panel data from 35 CCBs between 2011 and 2022, this study employs a two-way fixed effects model to analyze the relationships among these variables. Key components of this section include the regression analysis techniques, sample classification, variable selection, variable construction, and data description, all of which aim to address the research questions posed earlier.

3.1. Model

Based on sample classification, this study compares the empirical results of the two groups of samples. The model uses the two-way fixed effects model (2):

$$BP_{i,t} = \beta_0 + \beta_1 CRP_{i,t} + \beta_2 IRG_{i,t} + \beta_3 OC_{i,t} + \beta_4 ID_{i,t} + \beta_5 BA_{i,t} + \beta_6 LDR_{i,t} + \beta_7 GDP_{i,t} + \beta_8 MI_{i,t} + \beta_9 CPI_{i,t} + \epsilon_i + \epsilon_{i,t}$$

The subscript i denotes an individual bank, and t denotes the year. The explained variable is BP , which refers to bank performance of CCBs. The explanatory variables are $CRP(i,t)$, $IRG(i,t)$, $OC(i,t)$, and $ID(i,t)$, which refer to capital regulatory pressure, internal risk governance, ownership concentration, and income diversification, respectively. $BA(i,t)$, $LDR(i,t)$ refer to the bank-level control variables, bank years, and commercial bank loan-to-deposit ratio. $GDP(i,t)$, $CPI(i,t)$ refer to the macroeconomic factor control variables, and $MI(i,t)$ is a measure of the market factor control. α_0 , β_0 are the intercept terms. σ_i , ϵ_i represent individual factors with unobservable cross-sectional fixed effects. (i,t) , $\epsilon(i,t)$ are the random disturbance terms.

3.2. Variable Selection

Table 1: Explanation of Variables

SN	Name of the Variable	Symbol	Definition
1	Capital Regulatory Pressure	CRP	CRP=capital adequacy ratio–required capital adequacy ratio [44]. Includes the presence of a Chief Risk Officer (CRO), the age of the CRO (AGE), the size of the risk committee (RCS), the percentage of independent director members on the risk committee (RCM), the frequency of risk committee meetings (FRC), the size of the board (BS), the frequency of board meetings (FEM), the percentage of independent directors on the board (IND), whether the board of directors sets a risk appetite for different risks (RAR), the size of the supervisory board (NSB), and the frequency of supervisory board meetings (FSB) [13, 20].
2	Internal Risk Governance	IRG	The ratio of the shareholding of the largest shareholder to the total shares [33].
3	Ownership Concentration	OC	HHI=1-(PNII ² +PNET ²), where PNII represents the proportion of interest-based income and PNET represents the proportion of non-interest-based income [15].
4	Income Diversification	ID	Net profit/(total assets at the beginning of the year+total assets at the end of the year)/2×100% [45].
5	Bank Performance	BP	Total Loans/Total Deposits
6	Loan to Deposit Ratio	LDR	ln(Current Year–Year of Establishment) [46].
7	Bank Age	BA	The GDP growth rate [33].
8	Gross Domestic Product	GDP	The CPI growth rate [33].
9	Consumer Price Index	CPI	The marketization index of each province in China [47].
10	Market Index	MI	Zscore _{i,t} =(ROA _{i,t} +E/A)/SDROA _{i,t} , where E/A represents equity/assets [15].
11	Risk-Taking Behavior	RTB	

3.3. Data Collection Procedure

Most of the data were directly downloaded from the Wind database. However, some data related to Internal Risk Governance (IRG) and the nature of the largest shareholder were manually collected

from annual reports. Missing data on IRG and the nature of the largest shareholder were obtained from the National Enterprise Credit Information Publicity System, Qichacha, and Tianyancha. Macroeconomic data were downloaded from the Wind database, the National Bureau of Statistics, and the Market Index Database. Given the irregularity and incompleteness of information disclosure by certain city commercial banks, missing data were handled according to the approach suggested by Landerman [48]: when the proportion of missing data was less than 2%, the mean value was used for replacement; when the proportion was between 2% and 5%, maximum likelihood estimation was applied; and when the proportion exceeded 5%, linear interpolation was used.

3.4. Sample Classification

City commercial banks are classified according to the ownership type of the largest holding institution. Since insider shareholding data are not easily available and city commercial banks rarely involve foreign shareholding, this study follows the classification suggested by Chen et al. [8] and Xu et al. [49], categorizing banks into state-owned and non-state-owned shareholding groups. State-owned banks are those whose largest shareholder is the government or a state-owned enterprise, while non-state-owned banks include private institutions controlled by private investors, foreign-funded institutions controlled by foreign investors, and foreign institutions, among others. This study uses information from annual reports disclosed by the banks and websites such as the National Enterprise Credit Information Publicity System, Tianyancha, and Qichacha.

3.5. Construction of IRG

The internal risk governance mechanism of a bank can be divided into the shareholder meeting governance mechanism, the board of directors governance mechanism, the board of supervisors governance mechanism, and the executive governance mechanism. Based on this, and considering the information disclosure practices in China's banking industry, this study examines whether the bank has a chief risk officer (CRO), the age of the CRO (AGE), the size of the risk committee (RCS), the percentage of independent director members on the risk committee (RCM), the frequency of risk committee meetings (FRC), the size of the board (BS), the frequency of board meetings (FEM), the percentage of independent directors on the board (IND), whether the board of directors sets a risk appetite for different risks (RAR), the size of the supervisory board (NSB), and the frequency of supervisory board meetings (FSB). In total, 11 publicly available risk governance characteristic variables are used to construct the Internal Risk Governance Index (IRG). Different from previous literature, this study considers that when the board of directors or operating management commits illegal acts that harm the interests of the bank and its shareholders, the board of supervisors has the responsibility to take measures to stop, correct, and hold them accountable. Therefore, the supervisory board is included in the bank's internal risk governance index.

Referring to the methodology of Zhang et al. [13], this study performs principal component analysis (PCA) on the above 11 risk governance variables to construct the internal risk governance index. First, the selected 11 indicators are standardized, and the KMO and Bartlett's test are conducted. These steps help to comprehensively assess the correlation between the indicators and provide a more accurate basis for subsequent data analysis and decision-making. This study uses the z-score standardization command in Stata software to standardize the 11 indicator variables. If the KMO value is close to 1, it indicates that the correlation between the indicators is strong and suitable for principal component analysis. If the p-value of Bartlett's test is less than the significance level of 1%, it suggests that the data are suitable for principal component analysis. When the partial correlation coefficient exceeds 0.5, the data are considered acceptable [13]. Conversely, when the value is less than 0.5, the data are not suitable for principal component analysis [50].

In this study, KMO and Bartlett's test were conducted using the panel data from 2011 to 2022, as shown in Table 2. The data results indicate that the KMO sampling adequacy values are greater than the empirical threshold of 0.5, suggesting that the data are suitable for principal component analysis. The p-value is 0.000, meaning that the null hypothesis is rejected, indicating that the correlation between these 11 indicators is relatively stable. Based on the results of the KMO and Bartlett test, it can be concluded that the data in this study can be analyzed using global principal component analysis. The following section presents the principal component and factor analysis of the 11 indicator variables.

Table 2: KMO and Bartlett Test

Method of Calibration		Value
Kaiser-Meyer-Olkin		0.517
Bartlett's Test of Sphericity	Chi-square	2289.575
	Df	55
	P-value	0.000

The explained main variance of the panel data from 2011 to 2022 is shown in Table 3. By analyzing the information in Table 3, it can be observed that a total of five principal component factors were extracted. These principal component factors can be regarded as the basis for understanding the relationships between various variables. Among them, the eigenvalue of F1 is 2.209, explaining 20.1% of the total variance. The eigenvalue of F2 is 2.125, explaining 19.3% of the total variance. The eigenvalue of F3 is 1.404, explaining 12.8% of the total variance. The eigenvalue of F4 is 1.095, explaining 10% of the total variance. The eigenvalue of F5 is 1.052, explaining 9.6% of the total variance. Overall, these five factors explain 71.7% of the total variance.

Table 3: Explained Total Variance

Component	Eigenvalue	Difference	Proportion	Cumulative
F1	2.209	0.083	0.201	0.201
F2	2.125	0.722	0.193	0.394
F3	1.404	0.309	0.128	0.522
F4	1.095	0.043	0.100	0.621
F5	1.052	0.157	0.096	0.717

In Table 4, X1 represents whether there is a chief risk officer (CRO), X2 represents the age of the CRO (AGE), X3 represents the size of the risk committee (RCS), X4 represents the frequency of risk committee meetings (FRC), X5 represents the size of the board (BS), X6 represents the frequency of board meetings (FEB), X7 represents whether the board of directors sets risk appetite for different risks (RAR), X8 represents the size of the supervisory board (NSB), X9 represents the frequency of supervisory board meetings (FSB), X10 represents the percentage of independent director members on the risk committee (RCM), and X11 represents the percentage of independent directors on the board (IND).

According to the steps of principal component analysis, the relationship between each principal component and the original indicator is determined by calculating the initial factor loading matrix. Each column of the initial factor loading matrix represents the relationship between a principal component and the original indicator. The component score coefficient matrix of the 11 indicators from 2011 to 2022 is shown in Table 4.

Table 4: Initial Factor Loading Matrix

Variable	F1	F2	F3	F4	F5
CRO	-0.002	0.695	-0.004	0.002	-0.003
AGE	0.002	0.695	0.004	-0.002	0.003
RCS	0.573	0.025	-0.082	0.126	0.163
FRC	0.577	-0.014	0.078	-0.079	-0.159
BS	-0.034	0.015	0.039	0.041	0.711
FEB	0.518	-0.013	-0.030	-0.048	0.068
RAR	0.103	-0.084	0.579	-0.307	-0.014
NSB	0.000	-0.000	-0.000	0.839	0.000
FSB	0.110	0.119	0.415	-0.287	0.375
RCM	-0.206	0.104	0.278	0.228	-0.545
IND	-0.069	0.037	0.633	0.203	-0.025

The specific calculation method is as follows:

$$F1 = -0.002 * CRO + 0.002 * AGE + 0.573 * RCS + 0.577 * FRS - 0.034 * BS + 0.518 * FEB + 0.103 * RAR + 0.00 * NSB + 0.11 * FSB - 0.206 * RCM - 0.069 * IND$$

$$F2 = 0.695 * CRO + 0.695 * AGE + 0.025 * RCS - 0.014 * FRS + 0.015 * BS - 0.013 * FEB - 0.084 * RAR - 0.00 * NSB + 0.119 * FSB + 0.104 * RCM + 0.037 * IND$$

$$F3 = -0.004 * CRO + 0.004 * AGE - 0.082 * RCS + 0.078 * FRS + 0.039 * BS - 0.03 * FEB + 0.579 * RAR + 0.00 * NSB + 0.415 * FSB + 0.278 * RCM + 0.633 * IND$$

$$F4 = 0.002 * CRO - 0.002 * AGE + 0.126 * RCS - 0.079 * FRS + 0.041 * BS - 0.048 * FEB - 0.307 * RAR + 0.839 * NSB - 0.287 * FSB + 0.228 * RCM + 0.203 * IND$$

$$F5 = -0.003 * CRO + 0.003 * AGE + 0.163 * RCS - 0.159 * FRS + 0.711 * BS + 0.068 * FEB - 0.014 * RAR + 0.00 * NSB + 0.375 * FSB - 0.545 * RCM - 0.025 * IND$$

The index score is calculated using the formula: $IRG = \sum F_i * \beta_i$, Where F_i represents the principal component score, and β_i represents the weight of the principal component, which is the proportion of the variance contribution rate of each principal component to the total variance contribution rate. This formula can also be expressed as:

$$IRG = (0.201 * F1 + 0.193 * F2 + 0.128 * F3 + 0.1 * F4 + 0.096 * F5) / (0.201 + 0.193 + 0.128 + 0.1 + 0.096)$$

Substitute the relevant data into the formula to first calculate the values of F1, F2, F3, F4, and F5, and then compute the IRG.

In the second step, substitute the principal component scores into the following formula:

$$IRG = (0.201 * F1 + 0.193 * F2 + 0.128 * F3 + 0.1 * F4 + 0.096 * F5) / (0.201 + 0.193 + 0.128 + 0.1 + 0.096)$$

By conducting principal component analysis on the data of 35 banks from 2011 to 2022, this study obtained the panel data of the internal risk management index (IRG) for 35 city banks during the same period.

3.6. Descriptive Statistics

Descriptive statistics were conducted on two samples: one with state-owned institutions as the largest shareholders and the other with non-state-owned institutions. The results are shown in Table 5 below. The data in the table indicate that there are significantly more samples of state-owned institutions than non-state-owned institutions.

From the mean values, we can observe that the BP of state-owned banks is 0.825, while the BP of non-state-owned banks is 0.92. This suggests that non-state-owned banks tend to perform better, while state-owned banks have relatively lower performance. It is worth noting that the natural logarithm of the IRG for banks dominated by state-owned shareholders is 0.962, which is lower than

the 0.971 for banks dominated by non-state-owned shareholders. This indicates that the quality of internal risk governance in state-owned institutions is lower than that in non-state-owned institutions. From the perspective of CRP, non-state-owned banks face greater capital regulatory pressure. Furthermore, the concentration ratio of state-owned ownership is 19.036, which is higher than the 15.01 for non-state-owned ownership. This suggests that state-owned banks have a higher ownership concentration. Regarding income diversification, non-state-owned banks exhibit a higher degree of diversification than state-owned banks.

Table 5: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
State-owned					
BP	327	.825	.436	-1.507	2.19
IRG	327	.962	.211	.516	1.438
CRP	327	3.536	2.236	-4.441	16.86
OC	327	19.036	11.181	4.35	63.99
ID	327	23.658	12.93	0.21	49.52
RTB	327	4.795	.976	2.081	7.615
BA	327	2.718	.656	.66	3.611
LDR	327	67.733	15.11	30.106	124.012
GDP	327	7.635	3.14	-5	16.4
CPI	327	2.153	1.19	-.4	5.361
MI	327	.919	.105	.526	1.111
Non-state-owned					
BP	93	.92	.315	-.578	1.821
IRG	93	.971	.232	.622	1.35
CRP	93	3.349	1.471	-1.38	7.36
OC	93	15.008	9.312	3.25	36.4
ID	93	25.538	10.451	2.804	48.717
RTB	93	4.879	.912	1.839	7.277
BA	93	2.876	.347	1.386	3.258
LDR	93	71.288	10.964	48.219	98.464
GDP	93	7.095	3.394	-5	16.4
CPI	93	2.115	1.131	-.5	5.5
MI	93	.972	.045	.874	1.111

3.7. Matrix of Correlations

Before proceeding to test the hypothesis, Pearson's correlation was used to check for possible multicollinearity issues. Pearson's correlation is suitable for detecting the correlation between interval data. Multicollinearity problems occur when the Pearson correlation coefficient between explanatory variables exceeds the upper limit of 0.80 [51]. Table 6 presents the correlation coefficient matrix for all study variables, including the control variables. The correlations between these variables are relatively weak, with the highest correlation coefficient being 0.398. Therefore, it can be concluded that there is no multicollinearity among the variables in this study.

Table 6: Matrix of Correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) BP	1.000										
(2) CRP	0.325	1.000									
(3) IRG	0.002	-0.152	1.000								
(4) OC	-0.144	-0.115	-0.072	1.000							
(5) ID	-0.074	-0.208	0.063	-0.002	1.000						
(6) RTB	0.192	-0.019	0.142	-0.101	0.296	1.000					
(7) BA	0.039	-0.308	0.187	0.008	0.331	0.277	1.000				
(8) LDR	-0.428	-0.200	0.086	0.009	0.341	0.170	0.115	1.000			
(9) GDP	0.398	0.390	-0.084	-0.064	-0.359	-0.163	-0.326	-0.451	1.000		
(10) CPI	0.193	0.238	-0.095	-0.015	-0.063	-0.031	-0.140	-0.148	0.433	1.000	
(11) MI	-0.084	-0.226	-0.107	0.060	0.298	0.213	0.169	0.207	-0.285	-0.108	1.000

4. Results

Before analysis, an F-test is used with the null hypothesis (H_0): The individual effect is not significant. This method helps determine whether to choose a fixed-effects model or a mixed model. In the second step, the Hausman test is applied with the null hypothesis (H_0): Random effects are better. This test helps decide whether to use a fixed-effects model or a random-effects model. The sample data for both models rejected the null hypothesis, so the fixed-effects model was selected.

Table 7: Results of the F-test and Hausman Test

Model	F test		Hausman test	Model selection
	F value	P value	P value	
Whole sample	23.63	0.000	0.000	Fixed effect model

4.1. Benchmark Regression Results

The results are shown in Table 8 below. For state-owned banks, the regression coefficient of IRG on BP is 0.345, which is significantly positively correlated at the 5% level. In comparison, for non-state-owned banks, the regression coefficient of IRG on BP is 0.316, which is significantly positively correlated at the 10% level. This suggests that, for state-owned banks, a 1% increase in IRG results in a 0.345% increase in bank performance. For non-state-owned banks, a 1% increase in IRG results in a 0.316% increase in performance. In terms of significance, the regression model for state-owned banks has a higher significance level, with IRG being significant at the 5% level. Therefore, by comparing with non-state-owned banks, it can be concluded that an increase in IRG strongly promotes the profitability of state-owned commercial banks. On the other hand, comparing the coefficients of IRG on BP for state-owned and non-state-owned banks, there are differences in the degree of improvement in BP between different types of city commercial banks. As studies have shown, the promotional effect is stronger for state-owned banks, followed by non-state-owned banks. This suggests that state-owned banks may be more sensitive to improvements in IRG. One possible explanation is that state-owned banks are relatively less motivated to manage efficiently. When IRG improves, their ability to identify, assess, and manage business risks strengthens. As a result, business operations are conducted under a sound internal governance framework, which improves the bank's performance [13]. In contrast, non-state-owned banks have fewer political obligations and are relatively more motivated to improve governance, with profit as their primary goal. Both in terms of

significance and coefficient, the impact for state-owned banks is greater than that for non-state-owned banks, so this study accepts H₁.

For state-owned banks, the regression coefficients of CRP on BP are 0.025, which is significantly positively correlated at the 5% level. In comparison, for city commercial banks dominated by non-state-owned institutions, the regression coefficients of CRP on BP are 0.097, significantly positively correlated at the 10% level. This suggests that for city commercial banks dominated by state-owned institutions, every 1% decrease in CRP will lead to a 0.025% increase in BP. For non-state-owned banks, every 1% decrease in CRP will lead to a 0.097% increase in BP. From the coefficient perspective, comparing the coefficients of CRP on BP for state-owned and non-state-owned banks, there are differences in the degree of improvement in BP depending on the type of city commercial bank. The promotion effect is stronger for non-state-owned banks, followed by state-owned banks. One possible explanation is that the operations and management of most banks controlled by state-owned shareholders are subject to more government intervention [52]. As financial reform continues, this type of administrative intervention will diminish, but its influence will still persist. Therefore, the independence and autonomy of operations are affected in state-owned banks, meaning they cannot pursue profitability as their primary goal like other enterprises. Thus, even if capital pressure is reduced, its impact on profitability is not as strong as it is for non-state-owned city commercial banks. In contrast, non-state-owned banks generally have greater motivation to focus on business development. By increasing registered capital to improve the capital adequacy ratio, they can allocate more credit into the market through the money creation mechanism. Moreover, this enhances the strength of the bank and improves its overall image, thereby attracting more deposits at lower funding costs. However, regarding the significance level of state-owned banks, the regression model is higher, with CRP being significant at the 5% level. Therefore, from the perspective of significance, the decrease in CRP will more strongly promote the performance of state-owned banks compared to non-state-owned banks. The possible reason is that as the proportion of state-owned shares increases, the motivation for risk-taking becomes stronger, which in turn leads to greater risks for city commercial banks. In this context, the impact of capital regulatory requirements on the performance of city commercial banks is enhanced, limiting the risk caused by state-owned ownership, and thereby improving bank performance [32]. Based on these results, this study rejects H₂. The results are similar to those of Le et al. [53], who did not find that state-owned ownership has a different impact on capital regulation. One possible explanation is that state-owned banks are susceptible to government interference. However, the impact of capital regulation mitigates this effect. As a result, the influence of capital regulation on the performance of state-owned banks is amplified, leading to a reduction in the disparity between state-owned and non-state-owned banks.

The regression coefficients for state-owned banks in OC are -0.008, and it is statistically significant at the 10% level. In contrast, the coefficient for non-state-owned banks is -0.002, which is not statistically significant. From the significance level, the state-owned-dominated regression model is significant, with OC significant at the 5% level, while the non-state-owned-dominated regression model is insignificant. Therefore, based on significance, a decrease in OC will strongly promote the performance of state-owned-dominated commercial banks. On the other hand, when comparing the coefficients of state-owned and non-state-owned OC on BP, differences remain. The OC of state-owned banks will have a stronger effect on BP. Thus, this study accepts H₃, which states that the concentration of state-owned ownership has a negative impact on bank performance. This is consistent with the results of Huang et al. [52]. However, the negative impact of non-state-owned-dominated ownership concentration on performance is not significant. The possible reason is that city commercial banks that are non-state-owned are more conducive to stimulating capital vitality because their mechanisms are more flexible, which facilitates engaging in innovative activities and strengthens the willingness to pursue profits. Strategic investors bring more mature management

capabilities and experience. Therefore, concentrated ownership allows major shareholders to manage the bank more effectively. For example, it can effectively reduce the “free-riding” behavior of small and medium-sized shareholders and prevent management from engaging in self-interested behaviors that harm shareholders’ interests, thereby maintaining the overall performance level of the bank [26].

The data in Table 8 shows that the regression coefficient for the ID of state-owned banks is 0.005, which is statistically significant at the 5% level. The regression coefficient for non-state-owned banks is -0.005, which is not significant. From the significance level, the state-owned-dominated regression model is significant, with ID significant at the 5% level, while the non-state-owned-dominated regression model is insignificant. Based on significance, an increase in ID will strongly promote the performance of state-owned-dominated commercial banks. On the other hand, when comparing the coefficients of state-owned-dominated and non-state-owned-dominated ID on BP, differences remain. The ID of state-owned-dominated banks will have a positive effect on BP, while the non-state-owned-dominated will have a negative effect. That is, income diversification in state-owned banks has a significant positive impact on the performance of city commercial banks, while non-state-owned banks have a negative impact. Based on this, the study accepts H4. This result is consistent with Wu et al. [54]. This may be because state-owned-dominated banks usually have relatively abundant resources, including funds, customer resources, and government support. Revenue diversification can help state-owned-dominated banks make better use of these resources, expand into multiple business areas, and achieve a more stable profit model. The regression coefficient for non-state-owned-dominated diversification is negative. The possible practical reason is that non-state-owned banks have relatively limited resources and a higher risk appetite. They may be more inclined to diversify their income through businesses such as non-standard debt. More specifically, non-standard debt business can involve using a large number of deposits from the bank to connect projects from other banks and nest structurally complex products, including acceptance bills, letters of credit, and entrusted claims. Although this alleviates the resource allocation problem to a certain extent and improves the profitability of banks with fewer dominant resources, it can easily lead to the accumulation of financial risks within the system. Moreover, this has less significance and effect on the expansion of banking business. The result may be affected by the sample size of non-state-owned city commercial banks, so further research is needed.

Additionally, possible practical reasons include that state-owned-dominated banks have longer-term strategic positioning. Income diversification can help state-owned-dominated banks reduce dependence on a single business, thereby reducing risk exposure and contributing to long-term profitability. Non-state-owned-dominated banks, on the other hand, may focus more on short-term profits and market share growth, implementing relatively low levels of income diversification.

Table 8: Benchmark Regression Results

Model	(1) State-owned dominated	(2) Non-state-owned dominated
Variable	BP	BP
IRG	0.345** (0.156)	0.316* (0.16)
CRP	0.025** (0.011)	0.097* (0.05)
OC	-0.008* (0.004)	-0.002 (0.003)
ID	0.005** (0.002)	-0.005 (0.004)
BA	0.438*	-0.016

Table 8: (continued).

	(0.237)	(0.244)
LDR	-.008	-.011
	(0.006)	(0.008)
GDP	-0.0004	-.0028
	(0.012)	(0.024)
MI	-1.005	-0.983
	(0.708)	(2.439)
_Cons	1.084	2.581
	(0.858)	(2.163)
Control Individual Effects	Yes	Yes
Control Time Effects	Yes	Yes
Observations	327	93
R-squared	0.543	0.617

Robust standard errors are in parentheses

*** p<.01, ** p<.05, * p<.1

4.2. Robustness Check

This study adds the control variable CPI. By adding control variables, we can account for other factors that may interfere with the research results, ensuring that the impact of the independent variables on the dependent variables remains stable under different conditions. This approach eliminates the impact of external factors on the research conclusion, which improves the reliability and replicability of the research results, thus making the research conclusions more convincing. By adding CPI as a control variable in this study, the comparison of regression results is shown in Table 9 below, which demonstrates the same results as Table 8. The robustness of the regression results is further verified.

Table 9: Regression Results with Control Variable CPI

Model	(1) State-owned	(2) Non-state-owned
Variable	BP	BP
IRG	0.340** (0.154)	0.323* (0.16)
CRP	0.025** (0.011)	0.097* (0.05)
OC	-0.007* (0.004)	-0.002 (0.003)
ID	0.006** (0.002)	-0.005 (0.004)
BA	0.443* (0.236)	-0.006 (0.256)
LDR	-.008	-.011

Table 9: (continued).

	(0.006)	(0.008)
CPI	-0.04*	0.02*
	(0.02)	(0.04)
GDP	0.002	-0.0028
	(0.012)	(0.024)
MI	-1.06	-0.983
	(0.685)	(2.460)
_Cons	1.241	2.446
	(0.827)	(2.401)
Control individual effects	Yes	Yes
Control time effects	Yes	Yes
Observations	327	93
R-squared	0.547	0.619

Robust standard errors are in parentheses

*** p<.01, ** p<.05, * p<.1

5. Conclusion

The empirical evidence suggests that the improvement of internal risk governance has a greater positive impact on city commercial banks that are dominated by state-owned shareholders. State-owned banks may be more socially important than economically in making bank decisions. The concentration of non-state-owned shareholders is more conducive to bank performance than state-owned shareholders, as suggested by the data. State-owned banks have the dual support of resources and reputation, and diversification has a significant positive impact on their performance. For non-state-owned banks, the impact of income diversification on performance is negative, though not significant.

Hence, in the process of ownership structure reform, state-owned holding banks can improve operating performance and reduce risk by optimizing the ownership structure. For non-state-owned holding banks, more attention should be paid to risk control in business diversification to prevent a diversification discount. When formulating ownership structure and risk management policies for city commercial banks, these banks need to comprehensively consider their own characteristics, market environments, and regulatory requirements to achieve a balance between risk and return.

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