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and Regulation in Chinese
Banking: New Evidence**

By *Ying (Veronica) Zhanga, Barry
Quinna, and Lisa Sheenan*

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Ownership dynamics, risk and regulation in Chinese banking: New evidence

Ying (Veronica) Zhang^{a,*}, Barry Quinn^a, Lisa Sheenan^b

^aQueen's University, Belfast, Queen's Business School, Belfast, UK,

^bUniversity College Dublin, UCD College of Business, Dublin, Ireland,

Abstract

This empirical research appraises the impact of Basel III capital regulation on Chinese banks' credit risk-taking, taking into account the interaction between Basel III capital ratio and ownership structure, and using the data on 231 Chinese banks over the period 2010-2019. Our findings affirm that higher regulatory capital levels reduce credit risk, supporting the theory that regulatory buffers mitigate economic shocks and curb excessive risk-taking behaviors. We provide evidence that the impact of Basel III capital regulation on credit risk-taking is influenced by ownership structure. Moreover, the empirical results emphasize how ownership structure affects credit risk, revealing that state-owned banks generally exhibit higher credit risk compared to foreign-owned banks and other ownership types.

Keywords: Basel III, Credit risk, Bank risk, Ownership, Corporate Governance

1. Introduction

The relationship between capital buffers and bank risk-taking has long attracted academic attention (See [Cooper and Ross, 2002](#); [Demirguc-Kunt and Kane, 2002](#); and [Keeley, 1990](#)). Implementing the Basel Accords also led to work focusing on the effects of capital regulation on bank behavior, particularly regarding the impact of capital adequacy requirements on bank risk-taking behavior. The 2007-2009 global financial crisis (GFC) uncovered structural weaknesses in pre-crisis capital regulations. After the crisis, the Basel Committee on Banking Regulation and Supervision (BCBS) developed a consolidated framework (Basel III) for more stringent capital adequacy regulations and liquidity

*Corresponding author

Email addresses: veronica.zhang@qub.ac.uk (Ying (Veronica) Zhang),
b.quinn@qub.ac.uk (Barry Quinn), lisa.sheenan@ucd.ie (Lisa Sheenan)

assessment in recognition of the need for banks to be subject to more stringent capital regulations. Following the goals set by the BCBS, member countries, including China, have established legislation and regulatory frameworks. While regulatory consensus has been reached focusing on capital buffers, there is continued academic debate about the potential effects of capital requirements on bank risk-taking (Chiaramonte and Casu, 2017; Demirguc-Kunt et al., 2013; and Roulet, 2018).

China's banking sector plays an essential role in the country's economic development. It underwent fundamental changes in 1978 as an integral part of China's overall economic reform. Since 2001, China got accession to the World Trade Organization (WTO), the reform of China's banking industry has stepped up its pace, and the entire banking sector has been dramatically reshaped. The reform has transformed Chinese banks into market-oriented enterprises, changed ownership structures, established modern corporate governance mechanisms, and introduced legislation and regulatory framework. Since 2010, improvements and refinements have continued in China's banking sector as part of the advanced stage of the reform. China's financial authority fully accepted the Basel III framework and began its implementation in 2013. A rich body of literature focusing on the previous stages of the reform assesses the relationship between capital requirements and Chinese banks' performance and risk-taking (Lee and Chih, 2013; Pessarossi and Weill, 2015; Tan and Floros, 2013). The objective of this paper is to analyze the impact of capital requirements on Chinese bank risk-taking following the 2007-2009 GFC using the risk-based capital definition of the Basel III framework.

Ownership structures are expected to play a critical role in determining banks' risk-taking behavior. Theoretical and empirical evidence suggests that differences in ownership structure can significantly influence how banks respond to capital regulations. Agency theory posits that ownership concentration and shareholder power shape risk-taking incentives (see Shleifer and Vishny, 1997). For instance, state-owned banks may face competing objectives, such as pursuing social or political goals alongside financial performance, potentially leading to higher risk-taking (see Stiglitz, 1993). Conversely, banks with foreign shareholders might prioritize financial stability and adopt more conservative risk profiles, given their concerns on reputation risk and adherence to stricter regulatory oversight in their home countries (see Demirguc-Kunt and Kane, 2002). These distinctions suggest that the effect of Basel III capital regulation on banks' credit risk-taking may vary across ownership structures, amplifying or mitigating its intended impact depending on the specific ownership type.

In this paper, we extend existing empirical research studying the impact of capital requirements on bank credit risk-taking by incorporating the interaction between capital regulation and ownership structure. Financial theories suggest that capital regulations impact banks' risk-taking due to the effect of the regulation on shareholders' incentives (Allen et al., 2011; Demirguc-Kunt and Kane, 2002) and are supported by empirical studies. Nevertheless, empirical research

finds mixed results including negative association (see [Berger and Bouwman, 2013](#); [Tan and Floros, 2013](#)), positive association (see [Calem and Rob, 1999](#)) and nonlinear relationships (see [Calem and Rob, 1999](#)) between capital regulation and bank risk-taking. Agency theory suggests that corporate risk-taking is influenced by ownership structure depending on the power of shareholder control (see [Shleifer and Vishny, 1997](#)). These theoretical keystones provide the foundation for us to examine the effect of capital regulation on bank risk-taking and how this interacts with ownership structure in determining risk-taking.

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Our key findings are as follows: First, credit risk is generally lower in banks that have higher regulatory capital. This finding is consistent with the theory suggesting that regulatory capital acts as a buffer to resist economic shocks and lower banks' risk-taking incentives (see [Mehran and Thakor, 2011](#)). It also supports the empirical studies of Chinese banks conducted by [Tan and Floros \(2013\)](#) and [Lee and Chih \(2013\)](#).

Second, state-owned banks, in general, have higher credit risk compared to foreign-owned banks and other ownership identities. This finding is consistent with the results of [Zhu and Yang \(2016\)](#) which examine risk-taking of state-owned and foreign banks. This finding also, to some extent, reiterates the empirical results of [Laeven and Levine \(2009\)](#) which finds that banks with large owners who have significant cash flow rights take higher credit risk. During the financial reform, the state shareholder in Chinese banks transformed from a state bureau (e.g., the Finance Ministry) to a state corporation (e.g., Central Huijin Investment Co.) with modern corporate governance mechanisms. The state shareholder has become a shareholder *with highly concentrated control rights and significant cash flow rights*. Due to this, our findings can be considered consistent with the agency theory that concentrated ownership and influential shareholders suggest higher corporate risk-taking ([Saunders et al., 1990](#); [Stulz, 2005](#)). This finding also supports the social view of the theory of state ownership of banks that state-owned banks are willing to undertake credit projects that might not be financially profitable ([Stiglitz, 1993](#)). As [Stiglitz \(1993\)](#) discussed, State-

owned banks often have mandates that go beyond profit maximization. These objectives may include economic development, social welfare and stabilization goals (Providing counter-cyclical financing during economic downturns or crises to stabilize the economy).

Third, the actual impact of Basel III capital regulation on credit risk-taking can be influenced, to some extent, by ownership structure. For example, the results suggest that in government-holding banks, the negative effect of capital regulation on credit risk-taking can be enhanced by its ownership identity when there is no shareholder with significant power to increase risk-taking incentives. The government-holding banks, characterized by the absence of a dominant shareholder with significant power to influence risk-taking incentives, exhibit a stronger alignment with the risk-reducing objectives of Basel III. Their ownership identity may foster a culture of stability and risk aversion, enhancing the negative effect of capital regulation on credit risk-taking.

This paper contributes to the literature in several ways. First, this study assesses the impact of risk-based capital regulation on Chinese bank credit risk-taking following the GFC, using the definition of capital from the Basel III framework. The BCBS first released the Basel III framework in 2010. The Chair of the BCBS stated that evaluating the effects of the regulation is part of the BCBS post-crisis reform in the current macroeconomic environment. In addition, China's banking industry experienced extensive transformation before 2010, and the Chinese case provides uniqueness regarding ownership structure.

Second, our study bridges the research gap by incorporating the interaction between ownership structure and capital regulation while examining the impact of Basel III capital requirements on bank credit risk-taking. Only a few existing studies evaluate the joint effects of ownership structure and bank regulations on bank risk-taking, such as [Laeven and Levine \(2009\)](#). [Pessarossi and Weill \(2015\)](#) test the impact of the interaction between capital regulation and ownership structure on the cost efficiency of Chinese banks. To the best of our knowledge, this is the first study to assess how Basel III regulation and ownership structure jointly shape Chinese bank credit risk-taking following the global financial crisis.

Third, we compile and analyze a bespoke data set of 231 Chinese commercial banks over a period (2010-2019) of the advanced reform stage to study China's banking sector. Previous studies focus on the period before 2010. These 231 banks account for over 80% of China's banking sector in terms of total assets. Apart from employing the data provided by the SNL database, we hand-collected any missing values from individual banks' original annual reports, making our data set extremely comprehensive and novel.

The remainder of this paper is organized as follows: Section II reviews related literature, develops testable predictions, and briefly introduces the evolution of the ownership structure of commercial banks in China. Section III presents the data set and the empirical model, including the variables considered in our analysis. The empirical results are presented in section IV. Section V concludes.

2. Literature

China, as a member of the G20 and the Basel Committee on Banking Supervision, has actively participated in global regulatory reform initiatives following the Global Financial Crisis (GFC) of 2007–2009. A key milestone was the introduction of the Commercial Bank Capital Management Measure (Trial) in June 2012 by the China Banking Regulatory Commission (CBRC),¹ which formalised the adoption of the Basel III framework within China’s banking system.² This reform aimed to align China’s regulatory standards with international practices, particularly concerning credit risk, solvency risk, and systemic stability.

The Basel III framework builds upon the micro-prudential foundations of Basel II, incorporating a broader macro-prudential orientation to address systemic vulnerabilities. [Borio \(2003\)](#) emphasises that macro-prudential regulation subsumes the objectives of micro-prudential approaches, focusing on overall financial stability rather than individual institution resilience. In the Chinese context, the application of Basel III raises critical questions about the interaction between capital regulations, institutional dynamics, and credit risk in a transitional economy.

Recent developments add a new layer of complexity to this regulatory landscape. [Acharya et al. \(2024\)](#) highlight how fiscal stimulus during the GFC inadvertently exacerbated systemic risk in China’s banking sector. State-owned banks, particularly the Bank of China, intensified deposit competition to counter cross-border deposit losses. This competition forced small and medium-sized banks (SMBs) to adopt shadow banking instruments like wealth management products (WMPs), which circumvent regulatory constraints but heightened financial fragility. These findings underscore the dual role of macroeconomic policies and regulatory loopholes in shaping the risk dynamics of China’s banking system.

This study investigates the interplay between regulatory frameworks, ownership structures, and credit risk within the Chinese banking sector. By integrating insights from macro-prudential regulation, fiscal policy, and governance theories, the analysis provides a comprehensive perspective on how global regulatory principles are operationalised in the context of an emerging economy, offering lessons for managing systemic risk and promoting financial stability.

3. Theoretical Literature

3.1. *Bank Capital and Risk*

The relationship between bank capital and risk-taking behaviour is central to financial regulation theory. The Basel framework, particularly Basel III, asserts

¹The CBRC and the China Insurance Regulatory Commission (CIRC) were merged into the China Banking and Insurance Regulatory Commission (CBIRC) in 2018.

²China previously adopted and implemented Basel II and Basel II.5 frameworks.

that robust capital requirements enhance financial stability by mitigating excessive risk-taking and improving resilience. Franchise value theory supports this perspective, positing that stronger capital positions increase a bank's franchise value, incentivising prudent risk management by aligning shareholder and creditor interests (Allen et al., 2011; Mehran et al., 2011; Repullo, 2004). Furthermore, higher capital buffers improve borrower screening, discouraging high-risk lending practices. The moral hazard perspective complements this view, arguing that regulatory capitalisation offsets risk-taking incentives arising from deposit insurance, which protects depositors at the expense of systemic stability (Keeley, 1990; Demirguc-Kunt and Kane, 2002).

Conversely, alternative theoretical perspectives highlight potential unintended consequences of capital regulations. Blum (1999) argues that binding capital requirements may encourage banks to pursue riskier portfolios to maintain returns, while Calem and Rob (1999) identify a U-shaped relationship between capitalisation and risk. In their view, risk-taking decreases with moderate capital increases but rises as capitalisation levels reach regulatory thresholds, reflecting a search for yield in well-capitalised banks. Similarly, Cooper and Ross (2002) and Diamond and Dybvig (1983) suggest that deposit insurance weakens depositor incentives to monitor bank activities, enabling excessive risk-taking.

Acharya et al. (2024) add further nuance to this discussion by illustrating how regulatory arbitrage can exacerbate systemic risks. Their study reveals that fiscal stimulus during the Global Financial Crisis (GFC) intensified deposit competition, forcing small and medium-sized banks (SMBs) to rely on wealth management products (WMPs) to attract funding. These instruments, operating outside traditional balance sheet constraints, allowed banks to circumvent capital requirements. While WMPs temporarily alleviated liquidity pressures, they heightened rollover risks and increased systemic fragility, particularly during periods of interbank stress. This regulatory loophole highlights the dynamic interplay between macroeconomic policy, competition, and regulatory effectiveness.

Agency theory also offers insights into the conflicts that arise under capital regulations. Stricter capital requirements may prompt bank owners to reallocate assets into riskier portfolios to compensate for reduced expected returns (Koehn and Santomero, 1980). Additionally, managers may exploit regulatory loopholes, such as shadow banking, to prioritise short-term gains at the expense of long-term stability. Acharya et al. (2024) illustrate how this behaviour unfolded in the Chinese banking sector, where WMP issuance became a dominant strategy among SMBs facing intense competitive pressures from state-owned banks.

Overall, the theoretical literature underscores the dual nature of capital regulations. While they provide critical safeguards against systemic instability, their effectiveness is contingent on institutional factors, market dynamics, and regulatory enforcement. The interaction between fiscal policies, deposit competition, and shadow banking offers a fertile area for further exploration, particularly in transitional economies like China, where regulatory frameworks and market

conditions are evolving rapidly.

3.2. Ownership Structure and Risk

Ownership structure plays a significant role in shaping bank risk-taking, with agency theory and corporate governance frameworks providing the primary theoretical underpinnings. Concentrated ownership, where large shareholders hold significant control and cash flow rights, is often associated with higher risk-taking. [Shleifer and Vishny \(1986\)](#) and [Laeven and Levine \(2009\)](#) argue that large shareholders have strong incentives to monitor managers, aligning decisions with shareholder objectives and encouraging investments in value-enhancing but riskier projects. Empirical studies, such as [Saunders et al. \(1990\)](#) and [Stulz \(2005\)](#), corroborate this perspective, showing that stockholder-controlled banks exhibit greater risk-taking compared to manager-controlled banks.

However, the dispersed ownership perspective offers a contrasting view. In firms with low ownership concentration, managerial discretion increases, often resulting in conservative investment choices aimed at protecting managerial careers or reputations. [Amihud and Lev \(1981\)](#) and [Hirshleifer and Thakor \(1992\)](#) highlight this tendency, suggesting that managers in such firms may avoid high-risk projects even if they are value-enhancing. Strong investor protection mechanisms, such as legal frameworks for shareholder rights, can counterbalance managerial conservatism, promoting a greater appetite for corporate risk-taking ([John et al., 2008](#)). Conversely, [Burkart et al. \(2003\)](#) argue that dispersed ownership may weaken monitoring, as no single shareholder has sufficient influence to enforce discipline, leading to a more conservative risk posture overall.

[Acharya et al. \(2024\)](#) add to this discussion by illustrating how ownership structure interacts with external pressures, such as deposit competition, to influence bank behaviour. Their findings demonstrate that smaller banks in China, often with less concentrated ownership than state-owned entities, were disproportionately affected by aggressive deposit competition during the GFC. In response, these banks increasingly turned to wealth management products (WMPs) to circumvent balance sheet constraints and attract funding. This behaviour highlights how ownership dynamics, combined with regulatory loopholes, shape risk-taking strategies under competitive pressure.

State ownership introduces additional complexities. State-owned banks are characterised by concentrated control but limited financial stakes, which weakens the incentives for effective monitoring and exacerbates agency problems ([Shleifer and Vishny, 1997](#)). Two competing theories provide insights into the implications of state ownership for risk:

1. The Social View: State ownership serves as a mechanism to address market failures, financing projects with high social value even if they are not commercially profitable ([Stiglitz, 1993](#)). While this can enhance social welfare, it often comes at the expense of profitability and stability, increasing default risk.

2. The Political View: State ownership prioritises political objectives, such as job creation or support for specific industries, over economic efficiency. This misalignment of incentives can lead to inefficiencies and elevated credit risk (Shleifer and Vishny, 1994, 1997).

Acharya et al. (2024) provide empirical evidence supporting the political view, showing that large state-owned banks, such as the Bank of China, intensified deposit competition during the GFC to offset cross-border deposit losses. This behaviour disproportionately pressured smaller banks, pushing them toward riskier, off-balance-sheet funding strategies.

Ownership concentration also interacts with regulatory frameworks. Koehn and Santomero (1980) and Boyd and Hakenes (2008) model how ownership structure moderates regulatory impacts, with large shareholders potentially undermining the effectiveness of capital requirements by prioritising short-term profits. Regulatory arbitrage, as seen in Acharya et al. (2024), further complicates this relationship. The widespread use of WMPs by smaller banks highlights how ownership structures can amplify the inefficacy of regulatory constraints, exacerbating systemic risks.

Overall, the theoretical literature underscores that ownership structure is a critical determinant of bank risk-taking. Concentrated ownership aligns incentives toward higher risk, while dispersed ownership or state ownership introduces additional governance challenges. In transitional economies like China, where ownership structures are diverse and evolving, these dynamics become even more pronounced, interacting with regulatory frameworks and market pressures to shape risk behaviours.

4. Empirical Literature Review

4.1. Bank Capital and Risk

Empirical studies on the relationship between bank capital and risk-taking provide mixed results, reflecting the complexity of this issue. Numerous studies support the stabilising role of capital regulations. Anginer and Demircuc-Kunt (2014) demonstrate that higher levels of regulatory capital act as buffers, absorbing economic shocks and enhancing systemic stability. Similarly, Demircuc-Kunt et al. (2013) find that strong capital positions enable banks to withstand earnings shocks, improving their survival prospects during financial crises. Their findings advocate for including higher-quality capital, such as Tier 1 capital, in regulatory frameworks to enhance resilience. Supporting these conclusions, Tan and Floros (2013) find a significant negative relationship between capital and risk in Chinese banks, while Lee et al. (2015) demonstrate that stronger capital buffers reduce non-performing loans (NPLs), aligning with moral hazard theories.

However, alternative findings challenge this narrative. Blum (1999) argue that binding capital requirements may incentivise banks to take on riskier portfolios

to maintain returns, particularly when regulatory thresholds are narrowly met. [Calem and Rob \(1999\)](#) identify a U-shaped relationship between capitalisation and risk-taking, where risk decreases initially as capital levels rise but increases again at higher capitalisation levels, suggesting a search for yield among well-capitalised banks. [Acharya et al. \(2024\)](#) extend this discussion by illustrating how fiscal stimulus during the Global Financial Crisis (GFC) inadvertently undermined regulatory goals. Their study highlights that intense deposit competition among Chinese banks, driven by fiscal policies, forced smaller banks to rely heavily on shadow banking instruments like wealth management products (WMPs). These off-balance-sheet instruments circumvented regulatory constraints but introduced rollover risks and heightened financial fragility.

These findings suggest that while capital regulations play a critical role in enhancing stability, their effectiveness is heavily influenced by contextual factors such as fiscal policies, market dynamics, and institutional responses. In transitional economies like China, where regulatory frameworks are still maturing, these dynamics are particularly pronounced.

4.2. Ownership Structure and Risk

The empirical literature highlights significant variations in how ownership structure influences bank risk-taking. Studies on concentrated ownership consistently link large shareholder control with higher risk-taking. For example, [Laeven and Levine \(2009\)](#) provide cross-country evidence that banks with concentrated ownership are more likely to engage in riskier activities, as large shareholders prioritise profit maximisation. Similarly, [Saunders et al. \(1990\)](#) demonstrate that stockholder-controlled banks pursue riskier lending strategies compared to manager-controlled banks. In the Chinese context, [Zhu and Yang \(2016\)](#) find that state-owned banks exhibit higher risk levels than foreign banks, a trend attributed to weaker governance and political interference.

Dispersed ownership, on the other hand, tends to dilute monitoring effectiveness, often resulting in managerial conservatism and reduced risk-taking. [Burkart et al. \(2003\)](#) theorise that strong investor protection mechanisms can further weaken ownership concentration, limiting the incentives for active monitoring and aligning decisions with managerial preferences. [Amihud and Lev \(1981\)](#) and [Hirshleifer and Thakor \(1992\)](#) find that in firms with low ownership concentration, managers are more likely to engage in conservative investment strategies to safeguard their personal interests.

[Acharya et al. \(2024\)](#) add new dimensions to this debate by examining how ownership dynamics interact with external pressures like deposit competition. Their findings reveal that smaller banks in China, often with less concentrated ownership than state-owned entities, faced disproportionate competitive pressures during the GFC. To attract funding, these banks increasingly turned to WMPs, a strategy enabled by their governance structures and the absence of large controlling shareholders. This reliance on shadow banking highlights the vulnerabilities associated with dispersed ownership under competitive stress.

4.3. State Ownership and Regulation

State ownership has been widely studied in the context of its interaction with regulatory frameworks. While state ownership is often associated with inefficiencies, some studies highlight its potential to address market failures. [Andrianova et al. \(2012\)](#) find that state ownership of banks contributes to long-term economic growth, supporting the social view. Conversely, [La Porta et al. \(2002\)](#) report a negative association between state ownership and economic growth, consistent with the political view. [Beck et al. \(2004\)](#) argue that state ownership increases market concentration and reduces competition, adversely affecting bank performance.

At the individual bank level, state-owned banks are generally found to underperform private banks in terms of profitability and efficiency. [Berger et al. \(2009\)](#) and [Fungáčová et al. \(2013\)](#) document that state-owned banks in China are less efficient than joint-stock and foreign banks. [Iannotta et al. \(2007\)](#) extend this analysis, showing that state-owned banks exhibit lower profitability and weaker long-term performance compared to their private counterparts. These findings emphasise the governance and operational challenges posed by state ownership, particularly in transitional economies.

4.4. Ownership Structure and Regulation

The interaction between ownership structure and regulatory frameworks has received increasing attention in the empirical literature. [Pessarossi and Weill \(2015\)](#) analyse Chinese banks and find that the effects of capital requirements vary by ownership type, with state-owned banks responding differently from private banks. Similarly, [Laeven and Levine \(2009\)](#) provide evidence that concentrated ownership can dampen the effectiveness of regulatory stringency, as large shareholders often prioritise short-term gains over regulatory compliance.

[Acharya et al. \(2024\)](#) add to this discussion by examining how shadow banking emerged as a response to regulatory constraints. Their findings reveal that WMPs allowed banks to bypass loan-to-deposit ratio (LDR) regulations, exposing regulatory weaknesses in moderating risk-taking. These instruments became particularly prevalent among smaller banks with dispersed ownership, highlighting how governance structures mediate the effectiveness of regulatory policies.

4.5. Cross-Linkages, Synthesis, and Hypothesis Development

The theoretical and empirical literature on bank capital, ownership structure, and risk-taking reveals a complex interplay of regulatory, governance, and market dynamics. This study integrates these strands to highlight key cross-linkages and synthesises insights to develop hypotheses that reflect the unique contributions of this study.

The stabilising role of capital regulation is well-supported by franchise value and moral hazard theories, as well as empirical evidence from both global and Chinese banking contexts. Higher regulatory capital mitigates excessive risk-taking, enhances borrower screening, and increases resilience against economic

shocks (Allen et al., 2011; Keeley, 1990; Anginer and Demircu-Kunt, 2014). However, alternative perspectives emphasise the context-dependent nature of these effects. Blum (1999) and Calm and Rob (1999) demonstrate that binding capital requirements can incentivise riskier portfolio allocations, particularly among well-capitalised banks seeking to maintain returns. Acharya et al. (2024) extend these findings, showing that fiscal stimulus-induced deposit competition led to regulatory arbitrage in China, with smaller banks relying on shadow banking instruments like wealth management products (WMPs). This evidence highlights the limitations of capital regulations when macroeconomic policies and market pressures undermine compliance.

Ownership structure further complicates the effectiveness of regulatory frameworks. Concentrated ownership aligns managerial incentives with shareholder interests, often promoting risk-taking to maximise returns (Shleifer and Vishny, 1986; Laeven and Levine, 2009). However, state ownership introduces governance challenges, such as prioritising political goals over economic efficiency, resulting in higher credit risk (Shleifer and Vishny, 1997; Zhu and Yang, 2016). Acharya et al. (2024) provide additional insights, showing how state-owned banks, such as the Bank of China, intensified deposit competition during the Global Financial Crisis (GFC), exacerbating systemic risk and destabilising smaller banks.

Dispersed ownership and weak monitoring mechanisms further dilute the impact of regulatory stringency. Studies such as Burkart et al. (2003) and Amihud and Lev (1981) reveal that managerial conservatism and risk aversion are more likely under dispersed ownership structures. In China, smaller banks with dispersed ownership were disproportionately affected by competitive pressures, as they lacked the concentrated oversight that could mitigate risky behaviour. These banks increasingly adopted shadow banking practices to circumvent regulatory constraints, a phenomenon documented extensively in Acharya et al. (2024).

The interaction of ownership structure and regulation offers further insights into bank risk-taking. Koehn and Santomero (1980) and Boyd and Hakenes (2008) model how ownership moderates regulatory impacts, with concentrated ownership amplifying risk-shifting behaviours under strict regulatory regimes. Acharya et al. (2024) build on these models by illustrating how regulatory arbitrage through WMPs weakened the intended effects of capital and liquidity regulations in China, underscoring the importance of aligning regulatory frameworks with ownership and market dynamics.

This study advances the literature by proposing the following hypotheses, which integrate insights from theoretical models, empirical findings, and recent developments in China’s banking sector:

1. Capital Regulation and Credit Risk Regulatory capital is widely theorised to reduce credit risk by promoting stability and mitigating excessive risk-taking. However, this study hypothesises that the effectiveness of capital

regulations varies by institutional context, particularly bank size and market competition.

- *Hypothesis 1: Regulatory capital is negatively associated with credit risk, with the strength of this relationship moderated by bank size.*
2. State Ownership and Credit Risk State-owned banks face unique governance challenges, including weaker monitoring and political interference, which may elevate credit risk. However, regulatory stringency could partially mitigate these risks by enforcing compliance and reducing inefficiencies.
- *Hypothesis 2: State-owned banks exhibit higher credit risk than private banks, but this relationship is moderated by the stringency of regulatory frameworks.*
3. Interaction of Ownership and Regulation Ownership concentration influences how banks respond to regulatory policies. This study hypothesises that concentrated ownership enhances regulatory effectiveness in private banks but diminishes it in state-owned banks, where political goals may override compliance incentives.
- *Hypothesis 3: The impact of capital regulation on credit risk is moderated by ownership structure, with distinct effects in private and state-owned banks.*

This study distinguishes itself by integrating capital regulation and ownership structure into a unified analytical framework. While prior research often examines these factors independently, this study addresses their interaction, offering new insights into how governance and regulation jointly influence credit risk. By focusing on China—a transitional economy with diverse ownership structures and a dynamic regulatory environment—this study contributes to understanding the contextual factors shaping banking risk. It also draws on recent findings, such as those of [Acharya et al. \(2024\)](#), to explore how fiscal policies and deposit competition amplify the limitations of regulatory frameworks, adding practical relevance to the analysis.

5. Data and forensic accounting analysis

This study analyses annual data for 231 commercial banks in China, for the period 2010-2019, providing a total of 2,310 observations. The categories of sample financial institutions of the banking sector and their ownership structure are listed in [Table 1](#).

The main data source used is SNL Financial (a service provided by S&P Global Inc.). However, this source provides only incomplete data. Therefore, in cases where the SNL database does not provide enough information or has doubtful values, we double-check and hand collect data from other official sources including the annual issues of China’s Statistical Yearbook, the press release and the

Table 1: Cross tabulation of Ownership and Type

Ownership/Type	Big Six	City bank	Foreign bank subsidiary	National bank	Rural commercial	Total
Foreign-owned	0 (0.0%)	0 (0.0%)	33 (100.0%)	0 (0.0%)	0 (0.0%)	33 (14.3%)
Foreign Joint-stock	0 (0.0%)	12 (11.0%)	0 (0.0%)	1 (8.3%)	0 (0.0%)	13 (5.6%)
Joint-stock	0 (0.0%)	48 (44.0%)	0 (0.0%)	5 (41.7%)	66 (93.0%)	119 (51.5%)
Local government-holding	0 (0.0%)	45 (41.3%)	0 (0.0%)	2 (16.7%)	5 (7.0%)	52 (22.5%)
State-owned	6 (100.0%)	4 (3.7%)	0 (0.0%)	4 (33.3%)	0 (0.0%)	14 (6.1%)
Total	6 (100.0%)	109 (100.0%)	33 (100.0%)	12 (100.0%)	71 (100.0%)	231 (100.0%)

*Ownership Structure:*¹ Foreign-owned: Foreign bank operating in China;² Foreign Joint-stock: Joint-stock Banks having foreign strategic investors (usually shareholding over 15%);³ Joint-stock: Banks' share held by mixed-ownership insitutions and individuals; if shareholding involves indirect local government holding, the stake is less than 10%;⁴ Local government-holding: Banks'share either held by local Treasury Bureau (no matter how much of the stake), or indirectly held by local government over 10%;⁵ State-owned: Bank directly controlled by Central Huijin, Finance Ministry or state-owned enterprises.*Bank Types:*^a Big Six: The biggest six banks, all state-owned;^b City bank: Branches usually cover a city and the near cities within the province where the bank headquarter is located;^c Foreign bank subsidiary: Foreign bank branches and subsidiaries;^d National bank: Branches cover the whole country and based on the CBIRC's categorization;^e Rural commercial: Branches usually cover local communities and rural area within a province where the bank headquarter is located.

annual reports of the China Banking and Insurance Regulatory Commission (CBIRC), and the annual reports of individual banks. Macroeconomic data is collected from the official channels of the World Bank, IMF, FSB, BCBS, the national regulatory authorities such as CBIRC, and China's Statistical Yearbook.

Our initial dataset included some abnormal data points. To address this issue, we consulted the above alternative data sources to verify or correct these anomalies. We manually excluded data points that could not be justified or corrected. Specifically, the excluded data pertain to foreign-owned banks' Basel III Tier 1 Capital Ratios and Total Regulatory Capital Ratios exceeding 100%. These values are neither logical nor economically plausible, warranting their removal from the sample.

6. Methodology

Our empirical design follows [Tan and Floros \(2013\)](#) and [Bitar et al. \(2018\)](#). [Bitar et al. \(2018\)](#) examine the impact of risk-based and non-risk-based capital ratios on bank risk, performance and profitability, using a sample of banks from OECD countries. [Tan and Floros \(2013\)](#) analyse data on Chinese banks from 2003 to 2009 to examine the relationship between bank capital, risk and efficiency. Both studies use OLS regression models and provide enlightening results regarding the relationship between capital and risk. [Bitar et al. \(2018\)](#) focus on the impact of different measures of capital ratios on bank risk. [Tan and Floros \(2013\)](#) attempt to disentangle the inter relationship between capital, efficiency and risk. The banking data they employ covers the third stage of China's financial reforms. Both studies provide plausible benchmarks for our research. This paper tests the impact of regulatory capital requirements of CBIRC (based on the Basel III framework) on bank credit risk, incorporating the interaction between bank regulation and ownership structure of Chinese banks. This study employs the annual panel data of 231 commercial banks over

the period 2010-2019 (the fourth stage of the financial reform). We begin by examining the impact of regulatory capital on credit risk. Then, we explore the relationship between ownership structure and bank credit risk. Finally, we extend the analysis by testing whether the relation between regulatory capital and credit risk varies with different ownership structure. The baseline OLS regression model specification is outlined as follows:

$$\begin{aligned}
 Risk_{i,t} = & \beta_0 + \beta_1 * Capital_{i,t} + \beta_2 * Capital_{i,t}^2 + \beta_3 * BankControl_{i,t} + \\
 & \beta_4 * Ownership_i + \beta_5 * Capital_i * Ownership_i + \quad (1) \\
 & \beta_6 * IndustrySepcific_{i,t} + \beta_7 * Macro_{i,t} + \epsilon_{i,t}
 \end{aligned}$$

In 1, the subscripts i and t denote the individual bank and year respectively. The variable $Risk_{i,t}$ refers to bank i 's credit risk indicators which are represented by financial ratios of asset quality in the CAMEL rating system. The variables $Capital_{i,t}$ and $BankControl_{i,t}$ are different dimensions of capital adequacy requirements and control variables. The variable $Ownership_i$ is a firm specific dummy variable. The variables are defined in the appendix Table 9.

The inclusion of the quadratic term $Capital_{i,t}^2$ in the OLS regression model is motivated by the hypothesis of a potential non-linear relationship between regulatory capital ratios and bank credit risk. While regulatory capital levels (such as TC_to_RWA) are expected to mitigate credit risk by providing a buffer against unexpected losses, there is evidence in the literature and theoretical reasoning suggesting that the impact of capital adequacy on credit risk may not be strictly linear. Previous studies have observed similar non-linear relationships in the context of bank risk and regulatory capital (e.g. (Bitar et al., 2018), (Altunbas et al., 2007)).

These studies suggest that capital ratios do not uniformly affect risk across all levels, necessitating a quadratic term to capture the complexity of this relationship.

Preliminary plots (not shown here for brevity) indicated a potential non-linear pattern between TC_to_RWA and the dependent variables (NPL and LLR). The plots will be presented in the robustness check.

6.1. Bank Credit Risk

We use the non-performing loan (NPL) ratio (i.e., Non-Performing Loans/Total Gross Loans) to represent banks' credit risk, with higher values indicative of increased credit risk (Bitar et al., 2018). However, NPL ratios only reflect the size of the problem not the quality of the loan book, which reflects the future expectation of loans write-offs. In order to ensure the robustness of our results, Loan Loss Reserve/Gross Loans (LLR) ratio is also employed, representing the proportion of the loan book a bank expects to be

written-off. Taken together, these ratios capture banks’ potential credit default risk (NPL) and loan book quality (LLR).³

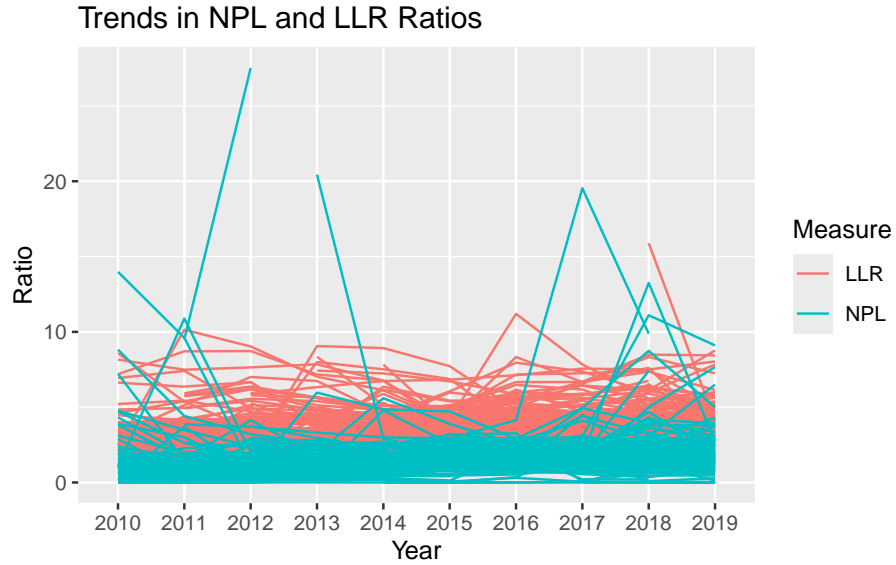


Figure 1

Figure 1 illustrates the dynamics of Non-Performing Loan (NPL) ratios and Loan Loss Reserve (LLR) ratios across Chinese banks from 2010 to 2019. The NPL ratios for most banks appear to remain relatively low and stable across the years, with some spikes observed in certain years (e.g., 2011, 2017). LLR are generally higher than NPL ratios, indicating that banks often reserve more than the actual non-performing loans to cover potential future losses. NPL ratios exhibit more volatility than LLR, with certain banks experiencing sudden and dramatic increases, which may highlight uneven credit risk exposures or sector-specific challenges.

6.2. Capital Adequacy Requirements

The impact of capital adequacy regulation on credit risk has been widely debated yet remains an empirical challenge (Keeley, 1990; Blum, 1999; Cooper and Ross, 2002; Demirguc-Kunt and Kane, 2002; Demirguc-Kunt et al., 2013; Repullo, 2004; Allen et al., 2011; Lee and Chih, 2013; Anginer and Demirguc-Kunt, 2014; Lee et al., 2015). Hogan (2015) suggests that capital requirements are negatively related to bank risk-taking. Hellmann et al. (2000) argue that

³Similar to Bitar et al. (2018), we focus on bank credit default which is one of the components of Pillar I of Basel III. Because our sample banks include listed and un-listed banks in China, we will not consider market risk and operational risk.

capital regulation induces banks to take excessive risk. [Calem and Rob \(1999\)](#) find a U-shaped association between capital buffer and bank risk-taking which is also found in the Chinese banks by [Jiang et al. \(2020\)](#). In terms of the measurement of bank capital, studies such as [Tan and Floros \(2013\)](#) and [Lee and Hsieh \(2013\)](#) both use Equity/Total Assets to measure individual banks' capital adequacy. [Demirguc-Kunt et al. \(2013\)](#) find stronger association between bank capital and stock return when the leverage ratio is used to measure bank capital instead of risk-based capital ratios. [Berger and Bouwman \(2013\)](#) find broadly similar empirical results using risk-based and non-risk-based capital ratios. The Basel III framework, as the core of the Basel Committee's post-crisis reforms, aims at strengthening banks' risk capture and the resilience of the whole banking system. Risk-based capital ratios are commonly employed to examine the relationship between regulation and bank risk-taking ([Laeven and Levine, 2009](#); [Bitar et al., 2018](#); [Roulet, 2018](#)).⁴

Risk-based capital adequacy requirements are deemed as the core of the Basel III framework and CBIRC capital management regulation. The Tier 1 capital ratio, is defined as the ratio of Tier 1 capital to the total risk-weighted assets (RWA). The total regulatory capital ratio is measured as Tier 1 and Tier 2 capital to RWA. These two ratios have the same numerator, focusing on different aspects of the bank capital buffer. To examine the impact of Basel III on the individual banks' credit risk, we choose the total regulatory capital ratio as our variable of interest (*TC_to_RWA*), taking into account of the higher accessibility of the data.

6.3. Bank-level Predictors

The vector $BankControl_{i,t}$ includes a set of variables which account for banks' particular characteristics. The following bank-level control variables are employed:

NL_to_GL: we use the ratio of the Total Net Loans/Total Assets as a proxy for asset quality. The existing literature shows that banks with traditional loan portfolios may be exposed to lower risk than those investing in derivatives ([Bitar et al., 2018](#)). [Tan and Floros \(2013\)](#) use the loan to total assets ratio as an indicator of liquidity.

ROE: we employ the ratio of return on equity to measure profitability of banks. This predictor exhibits the ability of a bank to employ its own resource, i.e., equity, to generate profits.

Income_Div: a measure of banks' income diversity. The ratio is calculated as $1 - ((NetInterestIncome - OtherOperatingIncome) / TotalOperatingIncome)$ ([Laeven and Levine, 2007](#)). Literature has a mix of views on banks' risk and return. For example, [Diamond \(1984\)](#) states that diversification of financial

⁴[Laeven and Levine \(2009\)](#) use the regulatory capital ratio (TC/RWA) as the variable of capital requirements

intermediaries may improve market valuation under delegated monitoring. [Laeven and Levine \(2007\)](#) argue that diversified financial conglomerates may have a lower market value compare to those who concentrate on lending activities. [Demirgüç-Kunt and Huizinga \(2010\)](#) report that both bank risk and return increase with the increase of non-interest income share in the total operation income.

LnAssets: we employ the natural logarithm of total assets to control for bank size. Bank size is considered as one of the important influences of risk given a bank's economies of scale. A higher value of total assets may decrease individual banks' risk ([Pasiouras, 2008](#); [Tan and Floros, 2013](#)); and a larger bank may have higher probability to survive during the financial crisis ([Berger and Bouwman, 2013](#)). Thus, a negative relationship would be expected between bank size and credit risk.

6.4. Industry and Macroeconomic variables

In addition to bank-specific variables, industry and macroeconomic conditions are taken into account when assessing the relationship between bank credit risk and regulation.

Concentration: we use the ratio of total assets of the largest six banks (Big Six) to the total assets of all Chinese commercial banks to measure the level of industry competition. We employ this ratio by following [Tan and Floros \(2013\)](#) as a measure of competition in China's banking sector. [Tan and Floros \(2013\)](#) take the total assets of the largest three banks, matching their data period 2003-2009. We take four systemic important banks plus Bank of Communications and the Postal Savings Bank. These six banks individually are considered as much larger than the rest of commercial banks in terms of total assets. A high concentration ratio may reflect low competition. [Boyd and De Nicoló \(2005\)](#) argue that more concentrated financial markets may lead to more bank risks.

Macroeconomic conditions may influence bank activities. [Dagher et al. \(2016\)](#) argue that there may be a procyclical relationship between economic development and bank lending. [Demirguc-Kunt and Detragiache \(1997\)](#) find that countries are more prone to financial crisis when economic growth is low and inflation is high. We take the annual GDP growth rate (*GDP_Growth*) and the consumer price index (*Inflation_CPI*) as measures of macroeconomic conditions. Both variable definitions are presented in [Table 9](#).

6.5. Ownership Structure

A key focus of our analysis is the influence of ownership structure on the responsiveness of Chinese banks to capital regulation changes. Institutional structure is an essential part of corporate governance, attracting much academic attention. Ownership structure and business model dynamics are a distinct characteristic of risk and profitability profiles in European banking ([Ayadi et al., 2020](#)). [Laeven and Levine \(2009\)](#) argue that ownership structure should be

taken into account when assessing individual banks' risk-taking behaviour. Existing literature tests bank risk-taking, regulation and ownership structure and finds the risk preference of managers depends on the importance of private benefit and the level of shareholder rights (John et al., 2008), yet typically does not integrate the ownership structure into the risk-regulation studies (Laeven and Levine, 2009). Banking theory suggests that bank regulation influences the incentives of bank risk-taking (Blum, 1999; Cooper and Ross, 2002; Demirguc-Kunt and Kane, 2002; Allen et al., 2011; Demirguc-Kunt et al., 2013; Tan and Floros, 2013; Lee et al., 2015). Agency theory suggests that ownership structure determines shareholder power and affects corporate risk-taking (Jensen and Meckling, 1976; Shleifer and Vishny, 1997; La Porta et al., 1999; Stulz, 2005; John et al., 2008). Based on the above discussion, ownership structure should be incorporated into the analysis of the risk-regulation relationship, because ownership structure influences the incentive of bank risk-taking in response to bank regulation (Boyd and Hakenes, 2008). Thus, we examine the impact of Basel III regulation on banks' credit risk, taking into account the interaction between ownership structure and regulation requirements.

Using a hand-crafted data-set, gathered by hand from translations of annual reports, we employ ownership structure as a categorical variable, and classify commercial banks in China into five categories: state-owned, local government-holding, joint-stock, foreign-joint stock, and foreign-owned. We learn from the above classification that two kinds of banks are involved with government shareholding: state-owned banks and local government-holding banks. The state-owned banks and local government-holding banks both have state or local government as their direct or indirect shareholders. We differentiate these two types of banks on the grounds that:

1. concerning the government involved, the state-owned banks only have the state government as their direct or ultimate shareholder, for example, Finance Ministry and Central Huijin Investment Ltd.; while the local government-holding banks only have local Bureau of Finance as their government shareholder.
2. In terms of power of government shareholders, the state-ownership has much greater control rights in the state-owned banks, compared to local Bureau of Finance in local government-holding banks where the local government has less than 20% shareholding.
3. With regard to size, the state-owned banks are the largest ones in terms of total assets, and most of them are national banks; while local government-holding banks usually are medium sized banks and provide financial services in cities and nearby areas.

From these perspectives, these two categories of banks may have distinctive reactions to risk-taking and bank regulation. Therefore, we separate these two types of government-ownership.

Associated with the theorem of welfare economics and the property rights theory, there are two alternative views of government participation in financial

markets: the social view and the political view. The social view suggests that state ownership is a form of government intervention which addresses to market failures and improves market functions and economic performance (Atkinson and Stiglitz, 1980; Stiglitz, 1993). According to this view, state-owned banks may finance those projects which might not be profitable but might have high value of social welfare. Therefore, state-owned banks may have poorer performance in profitability along with higher default risk compared to their counterparts in the private sector. In contrast, the political view claims that state ownership acts as an conduit for politicians to fulfill the political benefits rather than improve social welfare. For example, excessive employment of state firms only benefits those who support government politically (Shleifer and Vishny, 1994). According to the political view, state-owned firms are inefficient because the state shareholders, with highly concentrated control rights and no cash flow rights, only maximize their political goals which may jeopardize social welfare (Shleifer and Vishny, 1997).

Empirical literature reports mixed results regarding the impact of state ownership on macroeconomic development (La Porta et al., 2002; Andrianova et al., 2012). At the individual bank level, most studies report that state-owned banks have poorer performance and higher risk-taking, compared to other types of ownership. For example, Sapienza (2004) finds state-owned banks favor large firms and charge them lower interest rates than private-owned banks in Italy. Berger et al. (2005) report that state-owned banks in Argentina have poor long-term performance. Iannotta et al. (2007) argue that government owned banks have lower loan quality and higher insolvency risk than other bank types in Europe. As part of the results of the financial reform in China, the evolved ownership structure of banks in China has attracted academic attention after China’s accession to the WTO in 2001. Studies focusing on the third stage of China’s financial reform (2001-2010) report that state-owned banks do not perform as well as their peers regarding bank risk and performance (Berger et al., 2009; Pessarossi and Weill, 2015).

7. Main Results

Table 2: Descriptive Statistics

	N	Mean	Median	SD	Min	Max
NPL	1818	1.503	1.353	1.387	0.000	27.515
LLR	2072	3.228	3.009	1.361	0.082	15.883
Tier1_Ratio	2098	12.750	11.258	5.407	0.820	48.439
TC_to_RWA	2100	14.716	13.411	5.142	0.948	49.635
LnAssets	2128	16.585	16.448	1.646	12.065	22.188
NL_to_TA	2118	43.929	45.126	10.860	0.000	74.219
ROE	1972	12.870	12.757	6.699	-11.947	46.606
Income_Div	2091	0.447	0.346	0.400	-3.566	2.976

Concentration	2310	41.569	40.740	4.134	36.670	48.700
GDP_Growth	2310	7.678	7.234	1.336	5.950	10.636
Inflation_CPI	2310	2.590	2.347	1.123	1.437	5.554

Table 2 presents the descriptive statistics for the sample variables, offering an overview of the financial characteristics of Chinese commercial banks during the sample period. The mean of the Non-performing Loans (NPL) to Gross Loans ratio is 1.503%, a figure that aligns closely with broader trends observed in the literature. It is slightly lower than the 1.8% reported in Jiang et al. (2020), who analyze Chinese banks during 2004–2017, but higher than the 0.92% reported in Tan and Floros (2013) for the earlier period of 2003–2009. This trend of a rising NPL ratio over time reflects the evolving challenges faced by Chinese banks as they transition to market-driven credit expansion. The relatively low average NPL ratio in Chinese banks during this period can be attributed to the establishment of four Asset Management Companies (AMCs), which offloaded substantial amounts of NPLs from state-owned banks (Tan and Floros, 2013). However, the increase in NPL ratios in recent years suggests a potential deterioration in asset quality amidst rapid credit growth and economic restructuring.

Our adjustment regarding some anomalous observations of foreign-owned banks reduced the mean values of Tier1_Ratio and TC_to_RWA compared to the original dataset but resulted in more logical and representative statistics. The adjustments enhance the reliability of our analysis, ensuring the reported statistics align with economic reality and the regulatory framework.

The refined mean of Tier1_Ratio is 12.75%, while the mean of TC_to_RWA is 14.72%. These values are consistent with expectations for Chinese commercial banks, illustrating compliance with Basel III standards, which have been fully enforced in China since 2013 under the Commercial Bank Capital Management Measures. The mean Tier 1 Capital Ratio of 12.75% is significantly above the Basel III requirement of 6%, demonstrating sound capital adequacy in the Chinese banking sector. However, the lower averages compared to the averages observed in international studies such as Bitar et al. (2018) highlight potential challenges, for example, differences in risk-weighted asset composition.

The mean of ROE is 12.86 which is slightly lower than what is reported in Lee et al. (2015) (13.86). They examine the relationship between bank capital and profitability and risk, using the data of Chinese commercial banks from 1997-2011. This period is a transitional time for China’s banking industry since it witnessed the three main stages of the financial reform in China’s banking industry. By 2011, key regimes of the financial reform had finished and essential mechanisms regarding corporate governance, legislation, among others had been established. The current sample reflects a more stable but competitive environment, where profitability may be constrained by stricter regulatory oversight and corporate governance reforms.

The Net Loans to Total Assets (NL_to_TA) ratio has a mean of 43.93%, indicating a strong reliance on traditional lending activities within the Chinese banking system. This figure aligns with the role of commercial banks as primary credit intermediaries in China’s financial sector.

The market concentration rate, with a mean of 41.57, indicates a moderately concentrated sector, dominated by large state-owned banks but also increasingly featuring smaller banks including joint-stock banks and rural commercial banks.

Figure 2 reports the Pearson correlation matrix between the predictor variables. It shows a very strong positive correlation between TC_to_RWA and Tier1_Ratio (0.95), which is expected as Tier 1 Capital is a major component of Total Capital under the Basel III framework. Additionally, TC_to_RWA exhibits moderate negative correlations with NPL (-0.27) and LLR (-0.27), indicating that banks with stronger capital adequacy tend to have lower non-performing loans and loan loss reserves. This supports the notion that well-capitalized banks are generally better equipped to manage credit risk.

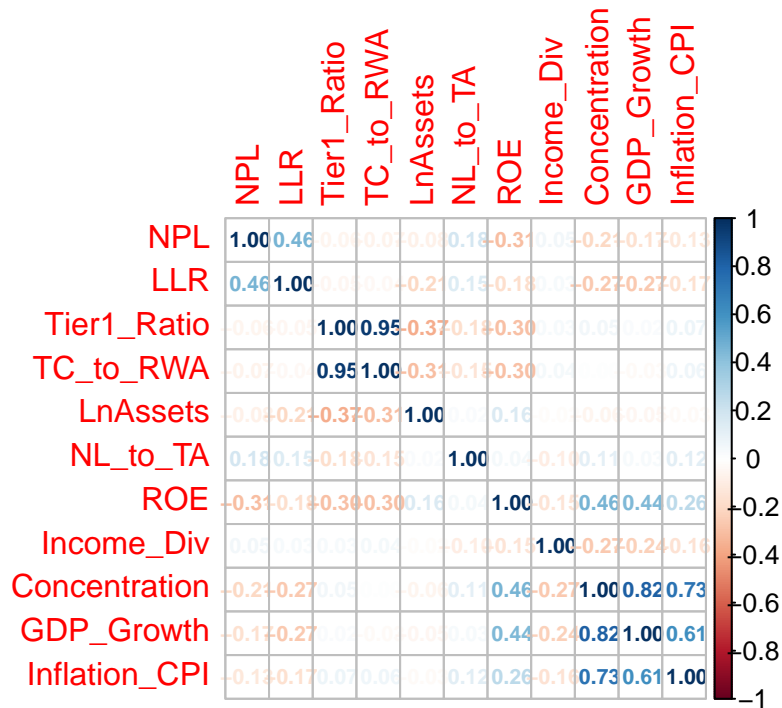


Figure 2: Linear Correlation Matrix

7.1. Impact on bank credit risk – Risk-based total capital ratio

Table 3: OLS Baseline Regression

Predictors	NPL		LLR	
	Estimates	CI(95%)	Estimates	CI(95%)
(Intercept)	6.325 ***	4.964 – 7.685	12.805 ***	11.584 – 14.026
TC_to_RWA	-0.176 ***	-0.233 – -0.120	-0.129 ***	-0.174 – -0.083
(TC_to_RWA) ²	0.003 ***	0.001 – 0.004	0.002 ***	0.001 – 0.003
LnAssets	-0.079 ***	-0.117 – -0.041	-0.212 ***	-0.248 – -0.177
NL_to_TA	0.024 ***	0.018 – 0.030	0.019 ***	0.014 – 0.024
ROE	-0.065 ***	-0.076 – -0.054	0.016 **	0.006 – 0.026
Income diversity	-0.020	-0.172 – 0.132	-0.208 **	-0.345 – -0.071
Concentration	-0.060 ***	-0.093 – -0.027	-0.115 ***	-0.145 – -0.086
GDP growth	0.086	-0.006 – 0.178	-0.158 ***	-0.243 – -0.073
CPI	0.024	-0.059 – 0.106	0.117 **	0.042 – 0.192
Observations	1696		1927	
R ² / R ² adjusted	0.179 / 0.174		0.189 / 0.185	
		* p<0.05	** p<0.01	*** p<0.001

Table 3 reports a statistically significant negative relationship between the risk-based total capital ratio (TC_to_RWA) and both measures of bank credit risk (NPL and LLR). Specifically, for NPL, the coefficient of TC_to_RWA is -0.176, while for LLR, it is -0.129, both significant at the 1% level. These findings support the hypothesis that higher regulatory capital levels are associated with lower credit risk, reinforcing the stabilizing effect of Basel III’s capital requirements on the banking system.

Interestingly, the squared term of TC_to_RWA is positive and significant in both models, suggesting a non-linear relationship. While higher capital ratios reduce credit risk initially, the marginal effect diminishes at higher levels of capitalization. This non-linear dynamic could imply that beyond a certain threshold, additional capital buffers provide diminishing returns in mitigating credit risk, potentially reflecting inefficiencies in capital allocation or over-capitalization.

The finding can be explained by the fact that those Chinese banks with higher level of regulatory capital have higher capability to reduce the impact of Non-Performing Loans, and thus lower Loan Loss Reserve. The findings align with prior studies. For instance, [Tan and Floros \(2013\)](#) find a negative but insignificant relationship between bank risk and capitalization when Loan Loss Reserve to Gross Loans is employed as the proxy of risk. [Lee et al. \(2015\)](#) report a significant negative relationship between bank capital and credit risk (proxied by NPL ratio). Our study provides evidence supporting the risk-mitigating role of capital adequacy in the Chinese banking sector. These results underscore the importance of Basel III in equipping Chinese commercial banks with sufficient capital buffers to absorb shocks and maintain financial stability.

Among bank-specific and macroeconomic control variables, several control vari-

ables exhibit significant effects on bank credit risk. We find that bank size, asset quality, and profitability are the most significant variables. Bank size has a significant and negative impact on Chinese banks' credit risk (NPL (-0.079) and LLR (-0.212)). This result is consistent with findings from some studies regarding the impact of capital ratios on bank credit risk (see [Tan and Floros, 2013](#), [Bitar et al. \(2018\)](#)). This finding suggests that large banks are more competent in dealing with risky loans and or they can spread the risk across a larger more diverse loan risk profile, emphasizing the advantages of size in diversifying risk, leveraging reputation, and accessing financial markets.

The ratio of net loans to total assets is positively associated with credit risk in both models, with coefficients of 0.024 (NPL) and 0.019 (LLR). This suggests that a higher concentration of loans relative to total assets increases exposure to credit risk. Profitability (ROE) shows divergent effects. It is negatively associated with NPL (-0.065, significant at the 1% level), indicating that more profitable banks are better at managing non-performing loans. However, the positive coefficient for LLR (0.016) suggests that higher profitability might also correlate with conservative provisioning policies.

There is a significant and negative relationship between banking industry concentration and individual banks' credit risk. This result reflects the dominant position of large state-owned banks, which are systemically important and subject to stricter oversight. The total assets of the largest six commercial banks account for 41.87% averagely during 2010-2019, although the industry concentration shows roughly a year-by-year decrease in the past decade. The first four out of these six banks are listed as global systemically important banks (G-SIBs) by Financial Stability Board (FSB) in 2020. In the context of China's banking industry, these six banks have a better ability to reduce the pressure in their credit activities, compared with other medium and smaller-sized banks.

7.2. Impact on bank credit risk – Ownership structure

Table 4: OLS Regression-Ownership Structure

Predictors (Intercept)	NPL		LLR	
	Estimates	CI(95%)	Estimates	CI(95%)
	6.026 ***	4.533 – 7.519	10.953 ***	9.681 – 12.225
TC to RWA	-0.142 ***	-0.201 – -0.084	0.004	-0.042 – 0.050
TC to RWA *	0.002 ***	0.001 – 0.004	0.000	-0.000 – 0.001
TC to RWA LnAssets	-0.087 ***	-0.134 – -0.039	-0.213 ***	-0.254 – -0.172
NL to TA	0.020 ***	0.014 – 0.026	0.012 ***	0.007 – 0.017
ROE	-0.074 ***	-0.086 – -0.063	-0.016 **	-0.026 – -0.006

Table 4: OLS Regression-Ownership Structure

Income Div	0.016	-0.137 – 0.169	-0.078	-0.208 – 0.053
Concentration	-0.052 **	-0.084 – -	-0.090 ***	-0.118 – -
		0.019		0.062
GDP Growth	0.088	-0.004 – 0.180	-0.119 **	-0.199 – -
				0.038
Inflation CPI	0.015	-0.067 – 0.098	0.072 *	0.001 – 0.143
Ownership	-0.704 ***	-1.007 – -	-1.728 ***	-1.940 – -
[Foreign-owned]		0.401		1.517
Ownership	-0.086	-0.327 – 0.154	-0.031	-0.249 – 0.187
[Foreign				
Joint-stock]				
Ownership	-0.022	-0.164 – 0.121	-0.070	-0.197 – 0.057
[Local				
government-				
holding]				
Ownership	0.066	-0.205 – 0.337	0.022	-0.224 – 0.267
[State-owned]				
Observations	1696		1927	
R ² / R ²	0.189 / 0.183		0.287 / 0.282	
adjusted				
			* p<0.05	** p<0.01
				*** p<0.001

Table 4 reports the results of the impact on bank credit risk by adding banks' ownership structure as a specific control variable, using joint-stock banks as the reference category. We find that the inclusion of ownership structure as a control variable does not alter the significant and negative impacts of bank size, equity returns, and industry concentration on credit risk. However, the relationship between regulatory capital and Loan Loss Reserve (LLR) becomes statistically insignificant.

The findings reveal nuanced effects of ownership structure on bank credit risk. Specifically, foreign-owned banks exhibit significantly lower levels of non-performing loans (NPL) and Loan Loss Reserves (LLR) compared to joint-stock banks. This aligns with existing literature, such as [Berger et al. \(2009\)](#), which highlights the efficiency gains associated with foreign ownership in Chinese banks. By contrast, local government-owned banks and state-owned banks do not display statistically significant differences from joint-stock banks regarding NPL or LLR, except for a marginally positive coefficient for state-owned banks in the NPL regression. This result requires careful interpretation, as it underscores the complexity of ownership effects and their interaction with governance structures and historical roles.

The results are consistent with prior studies such as [Laeven and Levine \(2009\)](#)

which document the influence of large investors on bank risk-taking behavior. These findings support the view that ownership concentration, whether through state holdings or foreign investment, can shape the risk profile of banks.

As discussed earlier, the ownership structure of Chinese banks has been a focal point in research due to its unique historical and institutional context. For example, [Zhang et al. \(2016\)](#) emphasize the disparities in risk-taking behavior across ownership types, and [Pessarossi and Weill \(2015\)](#) explore the interplay between capital adequacy and ownership structure. The reason that the ownership structure becomes one of the main interest factors in Chinese banking research could stem from the unique growth path of China's banking industry and suspicion in Western democracies of latent state manipulation. The past four decades witnessed dramatic changes and development in China's banking sector. The three stages of the reform in China's banking industry achieved the advancement of the legal and financial infrastructure, as well as the more diversified ownership structure. By 2010 the four G-SIBs and other 12 commercial banks all completed IPOs. Private shareholding accounted for 77.7% in rural commercial banks. The period after 2010 could be considered not only as a stage of the financial reform for further progressing and improving, but also a time to evaluate the effectiveness of the substantial bank ownership changes. In recent times, as China seeks to decouple its reserve banking system from the US, there may be important implications for continued regulatory cooperation in international banking⁵.

The results reveal that the coefficients of state-owned banks in the regression analysis do not indicate statistically significant differences from joint-stock banks in terms of credit risk. This result requires careful interpretation, as state ownership remains associated with complex governance dynamics. This finding, to some extent, supports the viewpoint that state-owned banks would be involved in policy-guided credit activities instead of profit-centered ones (see [Pessarossi and Weill, 2015](#)). The social lending theory of state ownership (see [Atkinson and Stiglitz, 1980](#)) suggests that state-owned enterprises contribute to "correcting the 'failure' of market economy" due to imperfect competition, inefficiency and public good. According to this view, government-owned enterprises may help improve overall performance of economy (see [Stiglitz, 1993](#)). In China's banking context, the biggest four commercial banks were founded and conducted a large amount of government lending in the early 1990's, before national banks and city banks were established. Within a relatively long period, the state-owned banks (including local government-holding banks founded later in the end of 1990's) played a role of 'government agencies' to pursue the broader social welfare objectives rather than profit maximizing; for example, the projects of the nationwide High-speed Rail network. Since the state-owned banks target multiple welfare objectives which might not be measurable, the managers in the state-owned banks have low powered incentives (see [Tirole, 1994](#)). However,

⁵<https://rhg.com/research/us-china-decoupling>

this resulted in the significant non-performing loan levels of ‘Big Four’ banks before China’s WTO accession in 2001.

Since 2001, the ownership structure has been dramatically transformed, due to China’s overall industrial reforms and the commitments to the WTO agreement. The large part of shares directly held by local government were gradually replaced by mixed ownership enterprises, foreign investments, and private investors. In terms of the state-owned banks, direct state intervention was replaced by Central Huijin (a company representing the state government) along with the establishment of modern corporate governance system. However, state ownership still closely engaged in policy-lending. This can be explained by two reasons: (1) although the direct government shareholding structure changed, business connection with state-owned enterprises remains due to the long-lasting business relationship and contracts such as those nationwide infrastructure projects lasting for decades; (2) the development of modern corporate governance mechanisms in China’s banking industry could transform government ownership into concentrated ownership, the ownership similar to the one of large investors with significant control rights and cash flow rights (see [Shleifer and Vishny, 1997](#)). From this perspective, concentrated ownership puts pressure on management decision ([Shleifer and Vishny, 1997](#)) and bank risk taking incentives ([Boyd and Hakenes, 2008](#)) Almost all state-owned banks are listed banks. With their significant control rights and cash flow rights, the state (large) shareholder in these state-owned, listed banks may take excessive risk by favouring particular clientele such as large conglomerates in projects with potential of social-benefits rather than those with target of profit-maximizing. [Sapienza \(2004\)](#) finds that state-owned banks favour large firms and charge lower interest rates than other types of banks in Italy.

7.2.1. Ownership structure - group level comparison

In the above regression results, the coefficients of state-owned banks and local government-holding banks do not indicate statistically significant differences from the reference group joint-stock banks in terms of credit risk. We consider to take a paired t-test or an ANOVA model to examine the difference between different ownership structure. However, because our data are categorized into mutually exclusive ownership groups. Therefore, we choose to perform ownership group comparison on NPL performance using ANOVA model.

Table 5 reports that foreign-owned banks consistently show lower NPL compared to joint-stock banks, aligning with existing literature on efficiency gains in foreign ownership ([Berger et al., 2009](#)) and corresponding to the regression results. State-owned and local government-holding banks also show significantly lower NPL than joint-stock banks, though the effect sizes are smaller. However, comparisons among the other groups, such as state-owned vs foreign-owned, do not show significant differences.

7.3. Impact on bank credit risk – Interaction between regulation and ownership structure

Table 5: ANOVA_HSD results for Ownership Structure

Comparison	Difference	Lower_CI	Upper_CI	Adjusted_p_value
Foreign-owned vs Joint-stock	-0.526	-0.880	-0.172	-0.880
Foreign Joint-stock vs Joint-stock	-0.328	-0.688	0.033	-0.688
Local government-holding vs Joint-stock	-0.219	-0.430	-0.007	-0.430
State-owned vs Joint-stock	-0.373	-0.718	-0.028	-0.718
Foreign Joint-stock vs Foreign-owned	0.198	-0.277	0.674	-0.277
Local government-holding vs Foreign-owned	0.308	-0.068	0.683	-0.068
State-owned vs Foreign-owned	0.153	-0.311	0.616	-0.311
Local government-holding vs Foreign Joint-stock	0.109	-0.272	0.490	-0.272
State-owned vs Foreign Joint-stock	-0.046	-0.514	0.423	-0.514
State-owned vs Local government-holding	-0.155	-0.521	0.212	-0.521

Table 6: Regression with Interaction between Ownership and Capital Regulation

Predictors	NPL		LLR	
	Estimates	CI(95%)	Estimates	CI(95%)
(Intercept)	5.471 ***	4.071 – 6.871	10.776 ***	9.572 – 11.980
TC to RWA	-0.089 ***	-0.121 – -0.058	0.023	-0.005 – 0.052
LnAssets	-0.079 **	-0.127 – -0.032	-0.213 ***	-0.254 – -0.171
NL to TA	0.021 ***	0.015 – 0.027	0.012 ***	0.007 – 0.017
ROE	-0.076 ***	-0.087 – -0.064	-0.017 ***	-0.027 – -0.007
Income Div	0.016	-0.137 – 0.169	-0.062	-0.192 – 0.069
Concentration	-0.050 **	-0.082 – -0.017	-0.091 ***	-0.119 – -0.063
GDP Growth	0.097 *	0.006 – 0.189	-0.116 **	-0.195 – -0.036
Inflation CPI	0.012	-0.070 – 0.094	0.070	-0.001 – 0.140
Ownership [Foreign-owned]	-2.644 ***	-3.395 – -1.892	-1.961 ***	-2.497 – -1.424
Ownership [Foreign Joint-stock]	-0.956	-2.783 – 0.871	1.302 **	0.479 – 2.125
Ownership [Local government-holding]	-0.145	-0.987 – 0.697	-0.364	-1.117 – 0.390
Ownership [State-owned]	0.151	-1.320 – 1.622	0.469	-0.886 – 1.824

Table 6: Regression with Interaction between Ownership and Capital Regulation

TC to RWA × Ownership [Foreign- owned]	0.107 ***	0.067 – 0.148	0.010	-0.022 – 0.042
TC to RWA × Ownership [Foreign Joint-stock]	0.066	-0.075 – 0.206	-0.100 **	-0.160 – - 0.040
TC to RWA × Ownership [Local government- holding]	0.009	-0.054 – 0.072	0.023	-0.033 – 0.079
TC to RWA × Ownership [State-owned]	-0.010	-0.122 – 0.103	-0.034	-0.138 – 0.070
Observations	1696		1927	
R ² / R ² adjusted	0.197 / 0.189		0.293 / 0.287	
			* p<0.05	** p<0.01
				*** p<0.001

Table 6 presents results examining the interactive effects of ownership structure and regulatory capital on bank credit risk, with Joint-stock banks serving as the reference category. The findings reveal how different ownership types interact with capital adequacy requirements to influence credit risk. This aligns with prior research. For example, some studies suggest that the relationship between risk and ownership structure is closely associated with national regulation because regulation influences both bank owners' and bank managers' incentives of risk-taking and risk-shifting (John et al., 2000, 2008). Laeven and Levine (2009) examine the interactions between ownership structure and national regulatory requirements and stringency, and find the relationship between risk and regulation stringency depends on ownership structure. Berger and Bouwman (2013) state that capital requirements have different impact on bank performance based on different bank size. Here we include the interaction term of the capital adequacy variable with different ownership structure variables.

The inclusion of interaction terms between the regulatory capital ratio (TC to RWA) and ownership structure captures the heterogeneity in risk behavior across ownership types. Notably, the standalone regulatory capital variable (TC to RWA) becomes statistically insignificant in LLR regressions after including the interaction terms. This indicates that the risk-reducing effects of regulatory capital may depend on the ownership structure of the bank.

Foreign-owned banks demonstrate significant negative coefficients in both the

NPL and LLR regressions, indicating significantly lower credit risk compared to joint-stock banks. However, the positive and significant interaction term (TC to RWA \times Ownership [Foreign-owned]) in the NPL regression indicates that stringent capital requirements may induce a compensatory increase in risk-taking behavior among foreign-owned banks. This finding is consistent with theories, such as [Koehn and Santomero \(1980\)](#) and [Buser et al. \(1981\)](#), which suggest that bank owners may adjust portfolios to offset utility losses under stricter regulations.

Local government-holding banks show limited responsiveness to capital adequacy requirements. Both the standalone ownership variable and the interaction term (TC to RWA \times Ownership [Local government-holding]) are statistically insignificant in both regressions. This suggests that local government-holding banks operate in a manner similar to joint-stock banks, with no significant deviations in risk-taking behavior. This muted response may be due to the mixed ownership structures of these banks, which lack dominant government shareholders and align more closely with market-driven governance.

State-owned banks do not show statistically significant differences in risk-taking behavior relative to joint-stock banks, as reflected in the insignificant coefficients for both NPL and LLR regressions. Similarly, the interaction term (TC to RWA \times Ownership [State-owned]) is insignificant in both regressions, indicating that regulatory capital does not significantly alter risk-taking incentives for state-owned banks. Different from the interaction term of local government-holding banks, the interaction term of state-owned banks are negative to the reference group. This may reflect the broader socio-economic objectives of state-owned banks, which prioritize long-term development goals over short-term risk management. Their less responsive behavior aligns with the idea that concentrated ownership, particularly by the state, reduces sensitivity to market-driven regulatory frameworks (see [Laeven and Levine, 2009](#)).

8. Robustness of the OLS baseline regression model

To ensure the validity and robustness of our findings, we conduct additional analyses addressing potential limitations of the OLS estimation, particularly concerning the bounded nature of the dependent variable (NPL and LLR). The following tools will be applied: (1) fitted value check; (2) alternative Estimation - two-Sided Tobit Model; and (3) clustered Standard Errors.

8.1. Fitted Value Check

The robustness check based on fitted values (Figure 3) provides insight into the behavior of the dependent variables (NPL and LLR) across different levels of the risk-based total capital ratio (TC_to_RWA). Both predicted values of NPL and LLR plots show a non-linear relationship, consistent with the quadratic term in the baseline regression model. A similar pattern is observed for both dependent variables: the predicted values decline sharply as TC_to_RWA increases initially, stabilizing around the middle range and rising slightly for higher

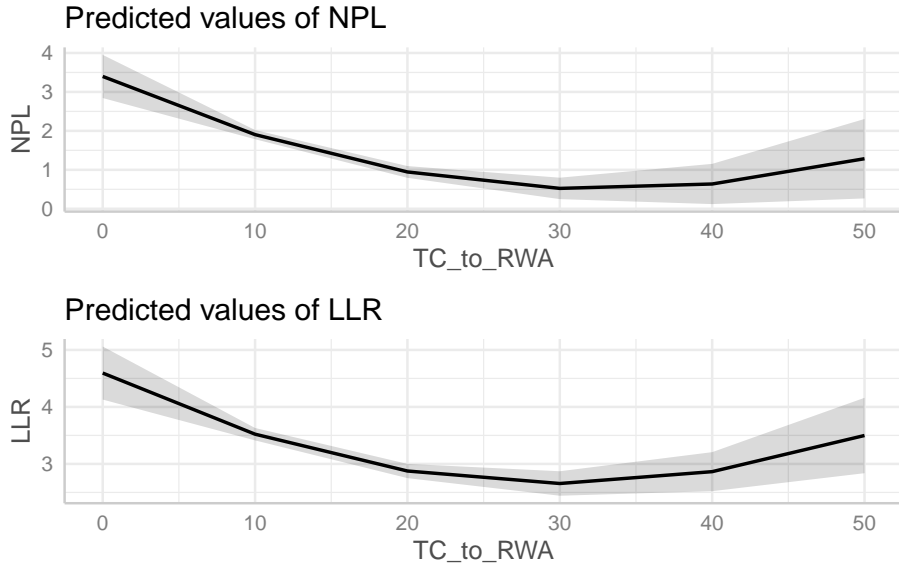


Figure 3: Fitted values of dependent variables

levels of `TC_to_RWA`. Due to the fact that we manually excluded the extreme/abnormal data of the regulatory capital ratio, the fitted values remain well within the logical bounds of the dependent variable, indicating that OLS behaves well. This supports the validity of the baseline OLS estimation for modeling the above dependent variables.

The increasing fitted values at higher levels of `TC_to_RWA` suggest diminishing returns of higher regulatory capital on credit risk reduction. This aligns with the baseline regression results showing a negative coefficient for `TC_to_RWA` and a positive coefficient for its squared term, reinforcing the hypothesis of non-linearity in the relationship.

8.2. Alternative Estimation - Two-Sided Tobit Model

In Figure 4, the histogram of NPL shows a distribution that is right-skewed, with most observations clustered near 0, making it a suitable candidate for a two-sided Tobit model. NPL has a natural lower limit at 0, where observations may be censored. The histogram of LLR exhibits a more symmetric and continuous distribution, with no observations at exactly 0 or 100. This indicates that LLR does not experience the same boundary-related issues as NPL, making a two-sided Tobit model inappropriate for this variable. A standard linear regression (OLS) is more suitable for modeling LLR.

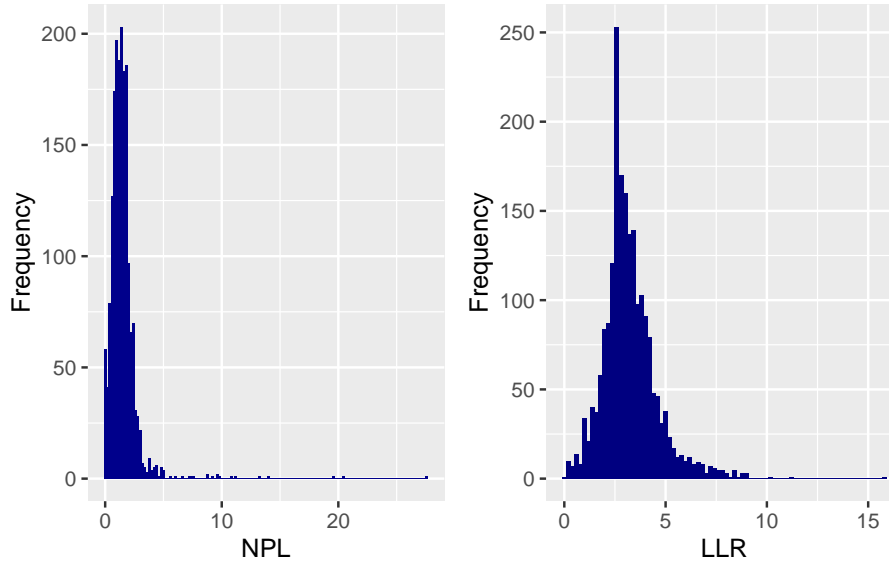


Figure 4: Frequency plots of dependent variables

Table 7: Tow-sided Tobit Regression Table

	NPL	
Predictors	Estimates	CI
(Intercept)	3.093 ***	1.322 – 4.864
TC_to_RWA	-0.051 ***	-0.071 – -0.031
LnAssets	-0.004	-0.074 – 0.065
NL_to_TA	0.029 ***	0.022 – 0.037
ROE	-0.075 ***	-0.087 – -0.062
Income_Div	0.046	-0.132 – 0.224
Concentration	-0.052 ***	-0.082 – -0.021
GDP_Growth	0.137 **	0.052 – 0.222
Inflation_CPI	-0.012	-0.088 – 0.063
logSigmaMu	-0.347 ***	-0.503 – -0.190
logSigmaNu	0.067 ***	0.030 – 0.105
Observations	1696	
	* p<0.05	** p<0.01 *** p<0.001

Table 7 reports that the coefficient for the total regulatory capital ratio (TC_to_RWA) is negative and statistically significant. This result is consistent with the baseline regression findings, supporting the conclusion that higher regulatory capital ratios are associated with lower credit risk. However, the magnitude of the effect is smaller in the Tobit model compared to the

OLS (-0.176 in OLS), likely reflecting the censored nature of the dependent variable in Tobit estimation. The coefficient of bank size (LnAssets) is not statistically significant in the Tobit regression. This contrasts with the OLS results, where bank size showed a significant and negative association with NPL. This difference might indicate that the effect of bank size on NPL is less pronounced when accounting for censored observations. Other coefficients are in line with the baseline regression results. A significant negative coefficient for logSigmaMu (-0.347) indicates that the standard deviation of the latent error term is relatively small, meaning there is less dispersion or variability in the unobserved factors influencing the censored NPL observations.

8.3. Clustered Standard Errors

Table 8: Estimation - Clustered Standard Errors

Predictors	NPL			LLR		
	Estimates	std. Error	CI(95%)	Estimates	std. Error	CI(95%)
(Intercept)	5.014 ***	0.628	3.782 – 6.246	11.607 ***	0.569	10.491 – 12.724
TC_to_RWA	-0.057 ***	0.009	-0.073 – -0.040	-0.025 ***	0.006	-0.037 – -0.012
LnAssets	-0.071 ***	0.019	-0.109 – -0.033	-0.203 ***	0.018	-0.239 – -0.168
NL_to_TA	0.023 ***	0.003	0.018 – 0.029	0.019 ***	0.003	0.014 – 0.024
ROE	-0.066 ***	0.006	-0.077 – -0.055	0.018 ***	0.005	0.008 – 0.027
Income diversity	-0.009	0.078	-0.161 – 0.144	-0.210 **	0.070	-0.348 – -0.073
Concentration	-0.060 ***	0.017	-0.093 – -0.027	-0.117 ***	0.015	-0.147 – -0.087
GDP growth	0.103 *	0.047	0.010 – 0.195	-0.145 ***	0.044	-0.231 – -0.060
CPI	0.012	0.042	-0.071 – 0.095	0.100 **	0.038	0.025 – 0.175
Observations	1696			1927		
R ² / R ² adjusted	0.169 / 0.166			0.180 / 0.177		
				* p<0.05	** p<0.01	*** p<0.001

To address potential heteroskedasticity or within-cluster correlation in the residuals, we re-estimated the OLS model using clustered standard errors. Both coefficients of total regulatory capital ratio (TC_to_RWA) for NPL and LLR remain statistically significant with a slightly reduced magnitude compared to the baseline regression estimate. The confidence interval is narrower, suggesting robust evidence for the negative relationship between capital adequacy and credit risk. A similar pattern is found regarding the coefficients of other variables including the bank size (LnAssets) and profitability (ROE). The clustering adjustment reinforces the conclusion that larger banks are better equipped to mitigate credit risk, likely due to diversified portfolios, economies of scale, or reputational advantages. Bank profitability reduces non-performing loans through better risk management. The use of clustered standard errors confirms the robustness of the baseline OLS results, with minor adjustments to coefficient magnitudes and confidence intervals.

9. Conclusion

This paper aims to analyze the impact of capital regulation on Chinese banks' credit risk-taking following the 2007-2009 GFC and to assess the impact of capital regulation on credit risk-taking by incorporating the interaction between capital regulation and ownership structure. We focus on risk-based capital regulation from the Basel III framework that affects Chinese commercial banks over the period 2010-2019. This period coincides with the fourth stage of China's financial reform and the implementation of Basel III framework in China. Financial theories, supported by empirical studies, suggest that the impact of bank regulation on bank risk-taking varies due to different ownership structure (Laeven and Levine, 2009). The results provide robust evidence of the stabilizing effects of regulatory capital, nuanced by the ownership structure of Chinese banks. These findings offer significant contributions to the understanding of credit risk management in China's banking sector under Basel III regulations.

We find that Basel III risk-based capital regulation has a negative impact on bank credit risk-taking. These findings reaffirm the critical role of higher regulatory capital in enhancing financial stability. However, the significant positive coefficient of the squared term of TC to RWA reveals a non-linear relationship, suggesting diminishing marginal returns to higher capital buffers. This dynamic likely reflects inefficiencies in capital allocation or the challenges of over-capitalization. The results align with the broader literature, including Lee et al. (2015) and Tan and Floros (2013), which highlight the risk-mitigating role of capitalization. In the Chinese context, the results demonstrate that well-capitalized banks are better equipped to absorb credit losses, thereby reducing both NPL and LLR levels. Nonetheless, the observed non-linear effects emphasize the importance of optimizing capital levels to balance risk reduction and efficiency.

When ownership structure is incorporated into the analysis, using joint-stock banks as the reference category, significant differences emerge across ownership types. Foreign-Owned Banks consistently exhibit lower credit risk compared to joint-stock banks. State-owned banks do not display statistically significant differences from joint-stock banks in terms of credit risk. This finding may support the social view of the state ownership theory, as their socio-economic mandates often dilute the impact of regulatory incentives on risk behavior and take risks due to the transformation of ownership structure during China's financial reform.

We compare the credit risk-taking level of different ownership structure in China's commercial banks and find that state-owned banks have higher credit risk-taking than any other ownership structure in China's banking industry. This finding is consistent with the social view of the state ownership theory, as well as the theory predicting that powerful shareholders have stronger incentives to take risks due to the transformation of ownership structure during China's financial reform.

Furthermore, we find that the impact of capital regulation on credit risk-taking is influenced by ownership structure. The same bank regulations have different effects on credit risk-taking because of the interaction between bank regulation and ownership structure. The findings align with and extend prior research, such as [Laeven and Levine \(2009\)](#) and [Berger and Bouwman \(2013\)](#), by demonstrating the nuanced interactions between ownership structure, regulatory capital, and credit risk in the context of China's banking sector. This study provides empirical support for Basel III's risk-mitigating objectives while highlighting the heterogeneity in regulatory effectiveness across ownership types.

10. Appendix - Table of Variables

Table 9: Variable Definitions

Variable	Definition	Source
NPL	Non-Performing Loans/Gross Loans; Non- Performing Loans as a percentage of loans before reserves	SNL Database and bank annual reports
LLR	Loan Loss Reserves/Gross Loans; Reserves for loan losses as a percent of loans before reserves	SNL Database and bank annual reports
Tier1_Ratio	Tier 1 capital ratio as defined by the latest regulatory and supervisory guidelines	SNL Database and bank annual reports
TC_to_RWA	Total Regulatory Capital/Risk Weighted Assets; Total capital ratio as defined by the latest regulatory and supervisory guidelines.	SNL Database and bank annual reports
NL_to_TA	Total Net Loans/Total Assets; loans and finance leases, net of loan-loss reserves, as a percent of total assets	SNL Database and bank annual reports
ROE	Return on average equity; net income as a percent of average equity	SNL Database and bank annual reports
Total_Assets	Total Assets; all assets owned by the company as of the date indicated, as carried on the balance sheet and defined under the indicated accounting principles	SNL Database and bank annual reports
LnAssets	Natural Logarithm of Total_Assets; as an indicator of the size of a bank	Manually computation based on the data of Total_Assets
Income_Div	Income diversity; 1-(Net Interest Income – Other Operating Income)/Total Operating Income	Manually computation based on SNL Database and bank annual reports
Concentration	The total assets of the largest five (the largest six in 2019) commercial banks (in terms of assets), as percentage of the total assets of the whole banking sector	CBIRC statistics release
GDP	GDP Growth rate (%); annual percentage growth rate of GDP at market prices based on constant local currency.	World Bank Database
Inflation_CPI	Inflation as measured by the consumer price index (CPI) reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.	World Bank Database

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