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Research Article

Financial Openness, Bank Systematic Risk, and Macroprudential Supervision

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International experiences have underscored the dual implications of financial openness. Given China's unique circumstances and its escalating level of financial openness, it is crucial to assess potential impacts on the country's bank systemic risk. This paper uses the quarterly data of 37 listed banks in China from 2010 to 2022 to explore the relationship between financial openness and systemic risk of the banking system, the mechanism of action, and the moderating effect of macroprudential policy on the two. The findings indicate an inverted "U"-shaped correlation between financial openness and bank systemic risk. On one side of this shape, financial openness primarily exacerbates funding mismatch, thereby increasing the systemic risk of banks. Conversely, on the other side, it primarily alleviates systemic risk by optimizing capital management. Moreover, with the help of macroprudential supervision, the inverted "U"-shaped relationship between financial openness and bank systemic risk leads to a lower level of systemic risk and, at the same time, promotes the early arrival of the inverted "U"-shaped inflection point between financial openness and bank systemic risk. Notably, the impact of financial openness on the systemic risk of joint-stock commercial banks, urban commercial banks, and rural commercial banks is more significant. The above research results provide a regulatory reference for effectively preventing and resolving systemic risk while achieving high-quality openness to the outside world. In deepening financial openness, the banking industry needs to pay attention to the funding mismatch and the efficiency of capital management and implement differential risk supervision and prevention mechanisms for banks with different ownership, which is conducive to the reduction of bank systematic risk.

1. Introduction

In recent years, China has consistently advanced financial openness through a series of robust measures. These include the facilitation of cross-border securities market interconnections and the comprehensive lifting of foreign share ratio restrictions in banking-securities institutions, funds, and futures, as well as life insurance. The internationalization of the financial industry is presenting a novel scenario. The international prominence of the renminbi (RMB) continues to rise. According to authoritative data, in 2022, the proportion of international payments made using RMB achieved a record high, surpassing the Yen to become the fourth most commonly used payment currency globally (RMB Internationalization Report 2022, released by the People's Bank of China). The proportion of RMB in SDR witnessed an increase from 10.92% in 2016 to 12.28%. There has been a consistent rise in the actual utilization of foreign investment. According to data sourced from the Ministry of Commerce, China's actual use of foreign investment escalated to $173.5 billion in 2021, marking a growth exceeding 55% when compared to 2012. Foreign financial institutions are more active. Data from the China Banking Association showed that by the end of 2021, banks from 51 countries and regions have established institutions in China, with a total of 929 foreign banks operating institutions, and the total assets in China account for 1.31% of the total assets of commercial banks in the country (Foreign Banks in China Development Report 2021 issued by the Foreign Banks Working Committee of the China

Banking Association). The report of the 20th National Congress of the Communist Party of China puts forward higher requirements for expanding financial openness, continuously promoting a higher level of opening in a larger scope, wider field, and deeper level, and enhancing China's strength in global financial resource allocation, which has become the consensus of the current Chinese financial industry.

International experience has demonstrated that financial openness is a double-edged sword. While certain nations have experienced positive outcomes from financial openness, leading to substantial enhancements in their domestic economic efficiency, others have faced significant financial risks during this process. However, commercial banks are usually the main transmission channels and subjects of financial openness risks, and the systematic risks of banks continue to accumulate, eventually leading to a comprehensive financial crisis. For instance, Japan initiated the process of financial liberalization in the 1980s, yielding notable outcomes. The international standing of the yen experienced a significant enhancement, and the asset allocation between domestic and international spheres became more judicious. Nonetheless, this progression was not without associated costs. An overly aggressive approach to financial openness culminated in the accumulation and rupture of asset bubbles, leading to substantial bank nonperforming loans. This resulted in a high number of banks going bankrupt, inflicting a profound setback on Japanese finance. Furthermore, financial openness in emerging economies such as Malaysia, Argentina, Brazil, Mexico, and others has also experienced a similar process, from the accumulation of systemic risk in banking systems to outbreaks and full-blown financial crises.

Combining the actual situation in China, with the financial openness to a higher level, cross-border capital flows are becoming increasingly active. According to data from the State Administration of Foreign Exchange, China's banking foreign financial assets and foreign financial liabilities were $739.2 billion and $948.8 billion in the fourth quarter of 2015, respectively. In the fourth quarter of 2021, the scale of foreign financial assets and foreign financial liabilities in China's banking industry was $1531 billion and $1568.9 billion, respectively, and the growth rate of foreign financial assets and foreign financial liabilities in the banking industry was 107.12% and 65.36%, which meant that the scale of foreign loans and deposits in Chinese banks increased greatly. It is worth noting that RMB belongs to nonfree convertibility currency, cross-border capital inflow will inevitably lead to cross-border capital outflow, and the difference between the two, namely the net amount of cross-border capital flow, will form a certain risk exposure of cross-border capital flow, thus various safety hazards inevitably appear. According to the data from the National Financial Supervision and Administration, the nonperforming loan ratio of commercial banks in China was 1.67% in the fourth quarter of 2015, which rose to 1.73% in the fourth quarter of 2021, an increase of 3.53%. As can be seen from Figure 1, the nonperforming loan ratio of banks in China shows an overall upward trend. Therefore, under the pressure of systemic risk prevention in China's banking system, the relationship between financial openness and bank systemic risk should be examined. What is the relationship between financial openness and bank systemic risk in China? Is there an inflection point value for financial openness that leads to different impacts on bank systemic risk at different levels of financial openness? What are the channels and intrinsic mechanisms through which financial openness acts on bank systemic risk? Are there differences in this impact reflected in different types of banks? Does macroprudential policy regulation play a certain moderating role in the relationship between financial openness and bank systemic risk?

To address the above doubts, this paper uses the quarterly unbalanced panel data of 37 listed commercial banks in China from 2010 to 2022 to examine and explore the relationship and mechanism between financial openness and bank systemic risk as well as the effectiveness of macroprudential supervision. The possible contributions of this paper are as follows: first, to explore the issue of the "degree" of financial openness, that is, whether there is a turning point value in accelerating the process of financial openness that brings different effects on bank systemic risk. Second, this study aims to investigate the mechanism through which financial openness influences bank systemic risk. This is achieved by examining two novel microperspectives: funding mismatch and capital management. Furthermore, it seeks to deeply analyze the specific instances where each of these perspectives plays a predominant role in determining the impact of financial openness on bank systemic risk. Third, macroprudential supervision is further tested in terms of its moderating role in the relationship between financial openness and bank systemic risk. The research significance of this paper is to provide theoretical support for the necessity and sound macroprudential policy framework for effectively preventing bank systemic risk in the process of continuously deepening financial openness, which has important implications for maintaining the stability of the banking system, achieving high-level financial openness, and high-quality economic development.

2. Literature Review and Theoretical Hypothesis

Upon reviewing the existing literature, it is evident that scholars have predominantly focused on financial openness, macroprudential policy, and bank systemic risk in isolation. However, there has been a notable absence of research examining the interrelationships among these three factors. Consequently, this paper aims to provide a comprehensive review from both perspectives.

2.1. Literature Review

2.1.1. Financial Openness and Bank Systemic Risk. Based on the existing literature, there is no consensus in academia about the specific impact of financial openness on bank systemic risk and its mechanisms. The impact of financial openness on bank systemic risk can be divided into three

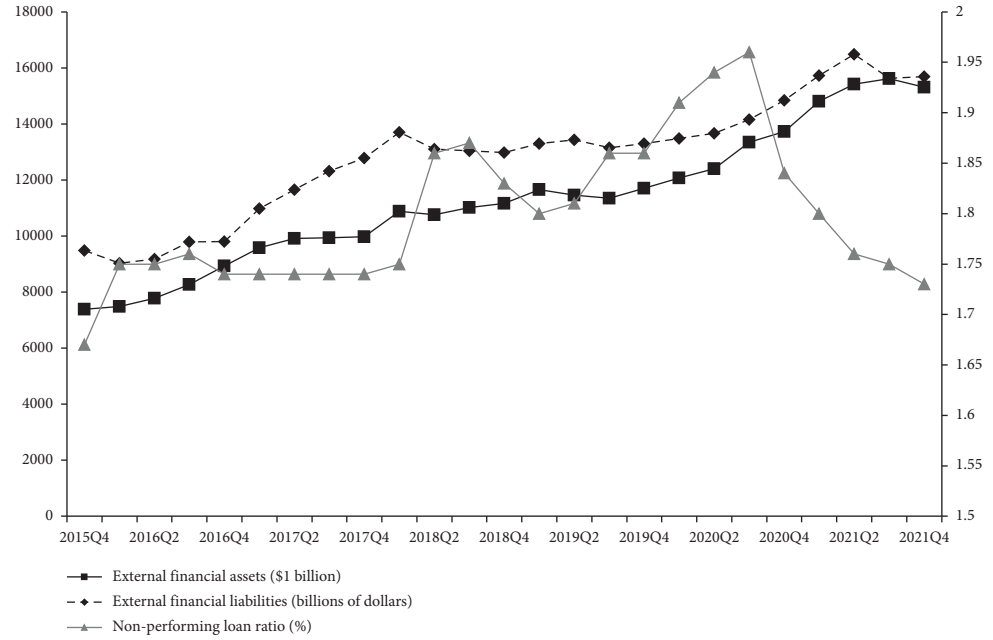

Figure 1: China banking external financial assets, liabilities, and commercial bank nonperforming loan ratio trend chart. Note: the National Foreign Exchange Administration began to publish data on foreign financial assets and liabilities of the Chinese banking industry in the fourth quarter of 2015. The nonperforming loan rate of commercial banks is obtained from the data of major regulatory indicators of the banking industry published by China's State Financial Supervision and Administration Bureau over the years.

categories: positive, negative, and nonlinear. Therefore, we sort out the research results of scholars from these three aspects.

First, financial openness may lead to a reduction in the bank's systemic risk. Dong and Lu employed the logit model to investigate the mechanisms underlying bank crises in relation to varying degrees of financial openness and financial development. Their findings indicate that countries with elevated levels of financial openness exhibit a direct correlation between increased financial development and enhanced prevention of bank risk [1]. In essence, an economy's higher level of financial openness corresponds to a reduced likelihood of its banking systemic risk arising. Joyce discovered that the entry of foreign banks fostered the progression of financial innovation. This development not only improved the operational efficiency of domestic banks but also bolstered regulatory oversight, thereby augmenting financial stability [2]. Van Horen and Claessens found that foreign banks' credit sources are more stable than those of domestic banks through further analysis; thus, foreign entry is beneficial to enhance the stability of the local financial system [3]. Ghosh pointed out that the globalization of the banking sector reduces the possibility of systemic risk occurrence and improves the stability of the local banking system [4]. Also, Zhang et al. mentioned that foreign investment participation weakens the possibility of bank systemic risk occurrence [5]. Faia et al. also agreed that foreign entry has a negative impact on most European bank individual risk and systemic risk indicators [6].

Second, financial openness may lead to a rise in bank systemic risk. Wang and Zhang posited that a relaxation in interest rate control could potentially result in a liquidity shortage within banks, escalate the risk of nonperforming loans, and instigate operational risk and moral hazard. This, in turn, may heighten the likelihood of systemic risk within the banking system [7]. Luo et al. employed cross-country panel data to construct models for testing purposes, concluding that financial openness indirectly augments bank risk by diminishing bank profitability efficiency [8]. Wu et al. conducted an analysis of the correlation between foreign bank entry and bank risk, revealing that such entry increases the risk associated with local banks. This increase is particularly pronounced in less efficient banks [9]. Fang et al. highlighted that financial openness can induce adverse shocks to various market assets, including foreign exchange and stocks, within China's financial market. This phenomenon not only elevates individual bank risk but also contributes to a rise in systemic bank risk due to interindividual correlation networks [10]. Dai et al. empirically demonstrated that financial openness amplifies bank systemic risk through two primary channels: asset prices and competition [11].

Third, the impact of financial openness on the bank's systemic risk is uncertain. Angkinand et al. discovered an inverse "U"-shaped relationship between financial openness and bank systemic risk, contingent on the intensity of capital regulation [12]. Specifically, in an environment with minimal regulatory oversight, the likelihood of banking crises escalates in correlation with the degree of financial openness. Conversely, if macroprudential regulation is amplified, it diminishes the potential for systemic risk emergence. Ayhan Kose et al. posited that financial institutions can reap the dividends of financial openness once they reach a certain maturity, thereby mitigating the potential for financial

openness risk [13]. Similarly, T. D. Bui and H. T. M. Bui highlighted that while the relationship between financial openness and bank risk remains ambiguous, its expansion to a certain degree can bolster bank stability [14]. Li et al. further discovered that the liberalization of the financial industry escalates the likelihood of interest conflicts and moral hazard incidents. Concurrently, it enhances the overall operational efficiency, competitive stature, and innovation proficiency of banks. This leads to risks spreading across markets, regions, and even internationally, thereby complicating efforts to mitigate systemic risk [15]. Chen et al. utilized cross-country data spanning 98 nations from 1999 to 2016 to investigate the relationship between financial openness and the long-term resilience of a banking system. Their findings suggest that while financial openness can substantially bolster the banking system's risk resistance in the long run, it simultaneously escalates bank risk in the short term. Furthermore, they observed that the escalation of single bank risk is not isolated but rather contagious through interbank networks, ultimately leading to an increase in systemic risk within the banking system [16]. Furthermore, Ma and He undertook an empirical examination utilizing microdata from 392 commercial banks in China. Their findings indicated that when the proportion of foreign bank assets surpasses a critical threshold, the influx of foreign banks escalates systemic risk. Conversely, when the proportion of Chinese bank assets overseas exceeds this critical point, offshore investment diminishes systemic risk [17].

2.1.2. Macroprudential Policy and Bank Systemic Risk. Existing research largely concurs that macroprudential policy is inversely related to bank system risk. Furthermore, Lin et al. discovered that the efficacy of macroprudential policy instruments is notably enhanced in countries with a higher degree of financial market openness [18].

In examining the comprehensive impact of macroprudential policy, Gaganis et al. posited that such policies can mitigate excessive procyclicality by curbing the spillover effects stemming from interbank affiliation networks. This, in turn, attenuates the detrimental effects of financial volatility and diminishes risk accumulation within the financial system [19]. Wang et al. provided empirical evidence that macroprudential policies can mitigate the externality input of financial risk by controlling cross-border capital flows, thereby diminishing the contagion intensity of external risks in China [20]. Similarly, An and Dai posited that macroprudential policies can curtail exchange rate volatility induced by cross-border capital flows. This reduction in volatility could weaken the correlation between asset prices, subsequently attenuating the influence of the global financial cycle on open economies [21]. Furthermore, Huang et al. undertook an empirical analysis utilizing the unbalanced panel data from 2268 financial institutions across 32 countries globally. Their findings indicate that macroprudential policy can effectively mitigate systemic financial risk arising from increased capital inflows [22].

Specifically, Wang et al. pointed out that the tight macroprudential policy can effectively inhibit credit expansion, thereby reducing the systemic risk of the banking system [23]. Chen et al. conducted an empirical test by constructing a CoVaR and CCA model, and the results showed that loose macroprudential policy regulation could significantly increase the systemic risk of banks [24]. However, Zhang et al. found that both loose and tight macroprudential instruments can significantly reduce systemic financial risk, and there is no difference in performance between the two. The conclusion still holds after solving the endogeneity problem [25]. It can be seen that the impact of loose macroprudential policy on bank systemic risk is uncertain. Furthermore, Altunbas et al. highlighted that macroprudential policy instruments, including minimum liquidity requirements, loan-to-deposit ratios, foreign exchange position limits, and deposit reserve ratios, mitigate the systemic risk associated with banks arising from liquidity discrepancies and exchange rate volatility [26].

In summary, while researchers have extensively studied the relationship between financial openness, macroprudential policy, and bank systemic risk, there are several limitations to this body of work. First, empirical analysis based on large sample data examining the individual risk contribution (risk spillover) of banks in our country is lacking. Additionally, there is a scarcity of discourse regarding the optimal "degree" of financial openness. Second, most existing literature focuses on two primary aspects: asset prices and competition level, neglecting the role of the two microlevels of funding mismatch and capital management as mechanisms for the effect of financial openness on bank systemic risk. Third, research on financial openness has not yet incorporated the impact of macroprudential policy. Given the close link between financial security and financial supervision, it is imperative to consider the regulatory implications of macroprudential policy in understanding the effects of financial openness on bank systemic risk.

2.2. Theoretical Hypothesis

2.2.1. Analysis of the Mechanism of Financial Openness Affecting Bank Systemic Risk. Existing studies mainly analyze the mechanism of financial openness on bank systemic risk from two paths: institutional competition and asset prices. In order to enrich the research perspective, this paper selects to further explore the impact mechanism of financial openness on bank systemic risk from two paths around funding mismatch and capital management at the microlevel.

Funding allocation is fundamental to the operation of a bank's business. Financial openness may instigate systemic risk within banks by exacerbating the funding misallocation disparity. First, asset price bubbles and influxes of hot money across international borders, induced by financial openness through the bubble effect, pose significant security risks to commercial banks. A sudden influx or outflow of hot money can cause significant fluctuations in the price and quantity of collateral assets. This, in turn, escalates the degree of term mismatch between deposits and loans, potentially disrupting bank funding chains and exacerbating liquidity issues.

Consequently, this may trigger systemic risk within banks [27]. Furthermore, financial openness increases both the frequency and magnitude of cross-border capital flows. This could potentially lead to a substantial expansion in the scale of bank liabilities, accompanied by a significant increase in debt-to-income ratio pressure. Such circumstances may prompt banks to heighten maturity mismatches to bolster liquidity creation intensity. Consequently, this could stimulate excessive bank liquidity generation, ultimately increasing the likelihood of systemic risk within the banking system. Second, in the context of financial openness, spillover shock effects suggest that cross-border capital flows can influence domestic stock asset prices either directly or indirectly. This is achieved by altering the structure of interbank individual credit or securities investment, thereby intensifying domestic stock market risk. Furthermore, domestic banks' credit funds enter the stock market indirectly via margining and other mechanisms. This interaction results in a mutual contagion and amplification of overall risk levels between the banking and stock markets, facilitated by the "leverage-asset price" double helix mechanism [28].

Capital management serves as a crucial tool for banks to mitigate risks. The promotion of financial openness can encourage banks to enhance their capital management strategies, thereby diminishing the systemic risk associated with the banking system. First, financial openness can significantly enhance the capital adequacy of banks. This openness not only facilitates the influx of foreign capital and bolsters the capital strength of domestic banks, but also promotes the diversification of investment portfolios. This diversification reduces the likelihood of risk occurrence, augments the banks' capacity to mitigate risks and prevent losses, and diminishes their contribution to systemic risks [29]. Specifically, banks will tend to reduce lending and avoid taking unnecessary risks in order to maintain sufficient capital. This approach enhances the stability of the banking system, thereby reducing the likelihood of systemic risks within these institutions. Second, financial openness can facilitate the optimization of capital structures in commercial banks. As per the external supervision effect, foreign investors, acting as the external supervisors of Chinese banks, encourage banking institutions to not only comply with minimum regulatory standards but also consistently enhance their ability to absorb hidden losses and mitigate security risks arising from capital shortages. This, in turn, bolsters the stability of the banking industry in open economies [15]. Furthermore, the knowledge spillover effect suggests that financial openness fosters the domestic input of advanced management knowledge and experience. It also introduces new technologies and products, optimizes organizational structures and talent teams, enhances capital management, improves operational efficiency, refines domestic banks' management systems, and reduces the likelihood of crisis occurrence. Additionally, the inclusion of foreign banks contributes to the elevation of human capital levels among domestic financial practitioners. This enhancement will bolster the long-term risk-resistance capabilities of domestic banks [30]. To sum up, the relationship between financial openness and bank systemic risk may be nonlinear, which may have an impact on bank systemic risk through two paths: amplification of funding mismatch and optimization of capital management.

Based on the above analysis, we propose the following hypothesis:

Hypothesis 1. There is an inverted "U"-shaped link between the bank's systemic risk and financial openness, with an inflection point effect

Hypothesis 2. The funding mismatch mechanism may play a leading role on the left side of the financial openness inflection point, while the capital management mechanism may play a leading role on the right side of the inflection point

2.2.2. Analysis of Macroprudential Policy Adjustment Mechanism. Macroprudential policy, designed to mitigate systemic financial risks, employs prudential instruments to regulate interbank debt and capital levels. This necessitates that banks manage the scale of their interbank operations, decrease the proportion of high-risk assets, and optimize their capital quality. Consequently, this enhances each bank's resilience to risk levels. Following the 2008 international financial crisis, there was a global consensus on the importance of strengthening macroprudential supervision. This approach effectively safeguards against systemic financial risks and maintains financial stability.

In the temporal dimension, macroprudential policy can mitigate the cyclical evolution of systemic risk. This approach effectively curtails the excessive inflation of credit and asset prices, thereby enhancing the efficacy of risk management. Spatially, macroprudential policy serves to diminish the interconnectedness among financial institutions. Consequently, it attenuates the risk of contagion and accumulation that emerge from the interlinked network spanning various financial entities, the financial system, and the real economy. Indeed, the policy of financial openness aimed at bank individuals can mitigate restrictions on cross-border capital flows. This, in turn, accelerates the procyclical response of bank balance sheets to these flows, subsequently leading to more frequent price fluctuations in financial assets. Such changes may amplify the impact of international capital flows [31]. As a macroprudential instrument, the counter-cyclical capital buffer and bank capital requirement serve as effective safeguards against excessive credit growth and the escalation of funding mismatches in the banking sector. When integrated with other macroprudential tools, the capital buffer can be further augmented during economic upturn cycles to mitigate bank risks. In addition, the macroprudential assessment classifies off-balance sheet financing as the scope of broad credit indicators and stipulates the corresponding capital adequacy ratio requirements according to the broad credit scale, which greatly reduces the risk diffusion effect in the financial system. Macroprudential assessment can enable banks with good capital adequacy and asset quality to make timely adjustments, no longer increase the existing reserves of high-risk assets, weaken the speed of

asset expansion, and thus reduce the level of risk taking of banks, which is a policy focus. Researchers have analyzed the quarterly data from 38 economies spanning the years from 1990 to 2018. The empirical evidence suggests that the implementation of macroprudential policy can markedly decrease the likelihood of capital abnormal flow events, particularly significantly mitigating the probability of capital inflow surges and capital flight incidents. Furthermore, as the exchange rate regime becomes increasingly flexible, financial development improves, system quality enhances, and macroprudential policy proves effective in reducing the likelihood of capital inflow surges and capital flight events [32].

Based on the above analysis of the role played by macroprudential policy in preventing and resolving systemic risk in the banking system, the following hypotheses are put forward for further research on whether there is a moderating effect of macroprudential policy on the impact of financial openness on bank systemic risk. Figure 2 well describes the relationship between financial openness, bank systemic risk, and macroprudential supervision, as well as the channels through which financial openness affects bank systemic risk.

Hypothesis 3. The implementation of macroprudential policy can reduce the systemic risk spillover effects of financial openness

3. Research Design

3.1. Sample Selection and Data Explanation. Given the necessity of daily rate of return data from banks to gauge their systemic risk and the inability to measure some listed banks' systemic risk indicators, this study ultimately selects 37 domestically listed banks as samples. These samples form quarterly unbalanced panel data spanning from the fourth quarter of 2010 to the second quarter of 2022. The primary source of bank financial data is the wind database, while the International Monetary Fund's International Balance of Payments statistical database provides the financial openness index data. Additionally, macrolevel control variable data is sourced from the China Economic Network.

3.2. Description of Variables

3.2.1. Explained Variable: Bank Systemic Risk. This paper employs the methodology proposed by Adrian and Brunnermeier utilizing ΔCoVaR as a proxy indicator of bank systemic risk [33]. In this approach, banks are viewed as instigators of risk within the financial system. The value-added risk of the entire financial system, with respect to the bank, is measured, and the contribution of individual banks to systemic risk is calculated. This method has evolved into a well-established index for comparative analysis among scholars. There are three prevalent methods for measuring ΔCoVaR: the DCC-GARCH model method, the copula method, and the quantile regression method. Wang et al. empirically demonstrated that the first two methods provide a more accurate measure of the spillover effect between the banking industry and the financial system [34]. The copula function encompasses numerous function families and offers high model flexibility. Consequently, this paper adopts the copula-GARCH-CoVaR model to assess the risk spillover from commercial banks to the banking system.

$$\Delta\mathrm{CoVaR}_{q,t}^{\mathrm{system}|i} = \Phi^{-1}(q\%)\rho_i^t\delta_t^{\mathrm{system}}, \tag{1}$$

where $\Delta\mathrm{CoVaR}_{q,t}^{\mathrm{system}|i}$ refers to the systemic risk of individual bank i at time t; ρ_i^t refers to the correlation coefficient of return rate between individual bank i and the banking system at time t; $\delta_t^{\mathrm{system}}$ refers to the return volatility of the banking system at time t; $\Phi^{-1}(q\%)$ refers to the quantile of $q\%$ under normal distribution, where $q\%$ is -5%. In this study, the Copula-GARCH-CoVaR model's parameters are derived using a two-step process, and the daily CoVaR is then obtained by inserting each of them into equation (1), as appropriate. The related quarterly CoVaR is then computed as an average. It is important to note that the absolute value is used in this study for the convenience of further research because the derived CoVaR is frequently negative. The greater the value, the greater the bank's systematic risk.

3.2.2. Core Explanatory Variable: Financial Openness. In fact, financial openness can be directly manifested as cross-border capital flows, so the scale of cross-border capital flows is the most commonly used quantitative indicator of financial openness by many scholars in empirical tests. Chen and Pang point out that the existing literature mainly measures the flow and stock [35], which are represented by Karry, Lane, and Milesi-Ferretti, respectively. Among them, Kose et al. measured the level of financial openness by the ratio of total capital inflow and outflow to GDP [36]. Lane and Milesi-Ferretti measured a country's level of financial openness by comparing the total stock of cross-border assets and liabilities to GDP [37, 38]. Both approaches have benefits and drawbacks. In the stock index, the measurement of cross-border assets and liabilities stock is relatively complicated and has relatively large measurement errors. But it is relatively simple and easy to use the flow index to measure the level of financial openness. Many domestic scholars use this method for measurement. However, there are many problems in measuring the level of financial openness through flow indicators. First, the dividends and risks of financial openness are actually related to the stock of capital, not the flow of capital. Second, the increase in capital flow does not necessarily mean the improvement of the level of financial openness; for example, the retrogression of the level of financial openness will be accompanied by a large amount of capital inflow. According to the above analysis, it is more scientific and reasonable to use the stock index to measure the level of financial openness.

Therefore, this paper adopted the financial openness stock index for research, draws on the method used by Pan et al.'s technique from 2022 [39], and adopts the financial integration index to comprehensively measure the degree of financial openness. The specific measurement formula is as follows:

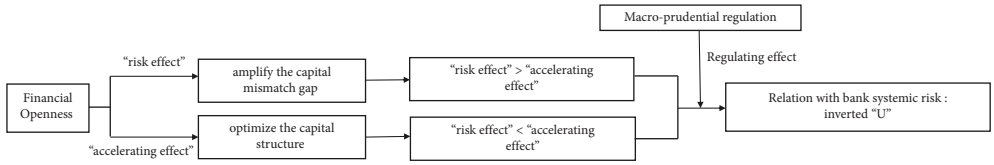

Figure 2: Framework chart on the relationship between financial openness, bank systemic risk, and macroprudential supervision.

$$\text{Open}_{i,t} = \frac{\text{Peqa}_t + \text{Peql}_t + \text{Pdia}_t + \text{Pdil}_t}{\text{Gd}p_t}, \tag{2}$$

where $\text{Open}_{i,t}$ represents the factual financial openness of China at time t; Peqa_t and Peql_t represents the stock of assets and liabilities of the equity portfolio, respectively; Pdia_t and Pdil_t represents the stock of assets and liabilities of direct investment, respectively.

3.2.3. Mediating Variables. The funding mismatch and capital management are the intermediary channels that are suggested in this study. In accordance with Chen and Li's research from 2022 [40], this paper employs the bank loan-to-deposit ratio (Ltd) as a stand-in for the funding mismatch proxy variable. It is easy for the sudden influx of foreign money to create liquidity accumulation on the liability side of banks in the developing environment of China's financial market system. At this time, if the bank cannot convert deposits in time, it will affect the profitability of the bank and eventually form a safety hazard. As a result, the loan-to-deposit ratio of banks is an inverted indication, and the higher the funding mismatch, the smaller the value. The proxy variable chosen by capital management is the capital adequacy ratio (Car), which is represented as net capital/risk-weighted assets. High capital adequacy ratios will put commercial banks under more operating stress and decrease their liquidity. Contrarily, from the viewpoint of the financial system, a larger capital adequacy ratio can raise the likelihood of systemic risk. Undercapitalized banks may be encouraged to control risks by having higher capital adequacy ratios, but this process would ultimately shift the bank's individual risk to systemic risk and cause systemic risk spillover [41]. As a result, the capital adequacy ratio of a bank is an inverted indicator, and a lower value denotes optimal capital management.

3.2.4. Adjusting Variables. The macroprudential policy data used in this study were downloaded from the IMF's iMaPP database. The database includes all macroprudential policy tools used by the IMF and categorizes them into 17 different categories with more thorough and reliable information. In order to reflect the employment of these 17 macroprudential policy tools, the iMaPP database adopted dummy variable values. A given tool is +1 if it is used or tightened, −1 if it is unavailable or loose, and 0 if it remains unchanged. By combining each of the dummy variables at once, the total macroprudential index (MAPP) is calculated. This study adds the monthly data from each year to the monthly data from the iMaPP database to produce the quarterly macroprudential policy index. Additionally, this article splits macroprudential policies into two categories: tightening and easing, in order to investigate the variations in the direction and function of various policy adjustments. Among them, MAPP_L stands for lax macroprudential policy, while MAPP_T stands for strict policy.

3.2.5. Control Variables. The systemic risk of bank is caused by micro- and macrofactors. In order to adequately present the influence of these factors, this paper introduces two control variables by referring to the research of Dai et al. [11]. The first is a set of microlevel variables, such as (1) bank size, which is equal to the natural logarithm of total asset size, (2) return on assets (Roe), expressed by weighted return on equity, (3) noninterest income as a percentage of nii, which is equal to the ratio of noninterest income to total operating income, (4) nonperforming loan ratio Npl, which is equal to the ratio of nonperforming loans over total loan balance, and (5) cost-to-income ratio Bcr, which is equal to operating expenses over net operating income. The other is macrolevel data, such as (1) the money supply growth rate M2_gr, which is the M2 quarterly year-on-year growth rate, and (2) the macroeconomic growth rate gdp_gr, which is represented by the real GDP's annual growth rate.

3.3. Model Setting. The analysis above suggests that financial openness and bank systemic risk may have an inverted "U"-shaped relationship. Therefore, the financial open proxy index and its square term are unified into the empirical study, and the following panel regression model is constructed:

$$\text{Risk}_{i,t} = \alpha_0 + \alpha_1 \text{Open}_{i,t} + \alpha_2 \text{Open}_{i,t}^2 + \varphi \text{Control} + \varepsilon_{i,t}, \tag{3}$$

where $\text{Risk}_{i,t}$ represents bank systemic risk; $\text{Open}_{i,t}$ represents financial openness; $\text{Open}_{i,t}^2$ is the square term of financial openness; Control refers to the group of control variables; and $\varepsilon_{i,t}$ refers to the random error term. According to the above analysis conclusion, if the empirical results show that the estimated coefficient α_2 of the square term of financial openness is significantly negative, then the inverse "U"-shaped relationship hypothesis is valid.

In order to further discuss the mechanism by which financial openness affects bank systemic risk, an intermediary effects model is constructed as follows:

$$\begin{aligned} M_{i,t} &= \beta_0 + \beta_1 \text{Open}_{i,t} + \varphi \text{Control} + \varepsilon_{i,t}, \\ \text{Risk}_{i,t} &= \gamma_0 + \gamma_1 \text{Open}_{i,t} + \gamma_2 \text{Open}_{i,t}^2 \\ &\quad + \gamma_3 M_{i,t} + \varphi \text{Control} + \varepsilon_{i,t}. \end{aligned} \tag{4}$$

The intermediary variable $M_{i,t}$ refers to the specific channel through which financial openness affects the bank's systemic risk. γ_1 (or γ_2) and γ_3, respectively, measure the direct effect and intermediary effect of financial opening on banks' systemic risk. If γ_1 (or γ_2) is significant but γ_3 is not significant, it indicates that financial openness will directly affect the systemic risk of banks. If neither γ_1 nor γ_2 is significant but γ_3 is significant, it indicates that there is a complete intermediation effect, and financial openness has an impact on banks' systemic risk entirely through intermediary variables. If γ_1 (or γ_2) and both γ_3 are significant at the same time, it indicates that financial openness can not only have a direct impact on bank systemic risk but also through intermediary variables.

The moderating effect model is built as follows in order to further discuss the moderating impact of macroprudential regulation on the link between financial openness and bank systemic risk.

$$\begin{aligned}\text{Risk}_{i,t} = {} & \delta_0 + \delta_1 \text{Open}_{i,t} + \delta_2 \text{Open}_{i,t}^2 + \delta_3 \text{MPI}_{i,t} \\ & + \delta_4 \text{Open}_{i,t} \times \text{MPI}_{i,t} + \delta_5 \text{Open}_{i,t}^2 \times \text{MPI}_{i,t} \\ & + \varphi \text{Control} + \varepsilon_{i,t},\end{aligned} \tag{5}$$

where $\text{MPI}_{i,t}$ is the adjustment variable, representing the macroprudential policy index is substituted into the three macroprudential policy indicators, MAPP, MAPP_T, and MAPP_L, respectively. The definitions of the remaining variables are consistent with the previous ones.

4. Empirical Research

4.1. Descriptive Statistics. Table 1 presents the descriptive statistics for each variable. Initially, an examination of bank systemic risk indicators reveals that the minimum ΔCoVaR value is 0.389 (as observed in Suzhou Bank during the third quarter of 2017), while the maximum value stands at 6.309 (as noted in Bank of Communications during the same quarter in 2015). Subsequently, an analysis of financial openness indicators indicates a standard deviation of Open at 0.644. This suggests a significant shift in China's financial openness levels in recent years, attributable to fluctuations in international capital flows into and out of the country.

4.2. Fundamental Regression Analysis. The correlation between financial openness and bank systemic risk is delineated in Table 2. Specifically, column (1) presents the regression results from a mixed OLS effect model. The quadratic term associated with the financial openness level indicator exhibits a significant negative relationship at the 10% threshold. This suggests an inverted "U"-shaped association between financial openness and bank systemic risk. Column (2) further reveals that, when accounting for individual banks and time levels, the estimated coefficient for the quadratic term of the financial openness indicator is both negative and significant at the 1% threshold. The corresponding coefficient stands at −3.737, signifying that the influence of financial openness on bank systemic risk initially increases before subsequently decreasing. This observation aligns with the theoretical analysis presented in this paper, confirming the existence of an inverted "U"-shaped nonlinear relationship between financial openness and bank systemic risk.

The inverted U-shaped relationship implies an inflection point effect between financial openness and bank systemic risk. The value of this inflection point for the degree of financial openness can be determined by the results presented in Table 2, which is 1.2663. When compared to the original data, it becomes evident that China's level of financial openness at the end of June 2022 (1.09) falls below this inflection point value. However, its maximum value in historical data surpasses this inflection point value. This suggests that while the current level of financial openness lies on the left side of the inverted U-shaped inflection point, it progressively approaches this point. Notably, there has been a period where it has even been on the right side of the inflection point. Despite this, there is a minimal range of benefits associated with increasing the level of financial openness. Therefore, consistently improving the level of financial openness aids in reducing bank systemic risk. Consequently, the regression results in Table 2 support Hypothesis 1.

4.3. Endogeneity and Robustness Test. In order to further ensure the authenticity of the above results, this paper uses four methods to achieve endogeneity and robustness tests.

4.3.1. Replace Explanatory Variables. Many domestic scholars adopt foreign direct investment (FDI) to measure the level of financial openness in our country, so the following formula is used to measure the actual level of financial openness:

$$\text{Open} = \frac{\text{CAPFLOW}}{\text{GDP}}, \tag{6}$$

where CAPFLOW represents the sum of foreign direct investment, equity investment capital, bond investment capital, and other investment capital, and GDP is the gross domestic product. Column (1) of Table 3 shows the regressions after replacing the explanatory variables. It can be seen from the results that the relationship between financial openness and bank systemic risk presents an inverted "U"-shape, which is consistent with the previous analysis.

4.3.2. Systematic GMM Estimation. Given the potential for bias in regression coefficients due to the selection of a particular regression method, it is imperative to consider this factor. In this paper, the system generalized method of moments (GMM) is used to replace the fixed effects model (FE) for the endogeneity test. Specifically, by using multilayered retardation elements to explain variable levels or differences as tool variables, the intrinsic problems caused by the possible existence of unobserved omission variable deviations and measurement errors can also be addressed. In addition, AR (2) statistics are larger than 0.1, and the Hansen statistics are not significant, which both demonstrate the rationality of the selection of tool variables, indicating that

Table 1: Descriptive statistics of variables.

Variables	Sample size	Mean	Median	Standard deviation	Minimum	Maximum
Risk	1100	2.081	1.906	0.887	0.389	6.309
Open	1100	1.069	0.802	0.644	0.384	2.417
$Open^2$	1100	1.557	0.643	1.778	0.148	5.841
Size	1100	10.04	10.18	1.553	6.716	12.87
Roe	1100	9.666	8.860	5.227	1.770	26.65
Nii	1100	25.24	25.05	9.494	2.622	57.17
Npl	1100	1.278	1.310	0.397	0.340	2.470
Ltd	1100	0.764	0.742	0.129	0.388	1.175
Bcr	1100	27.83	27.09	5.692	15.14	59.01
M2_gr	1100	2.677	2.202	1.261	0.930	6.524
Gdp_gr	1100	1.463	1.600	2.934	−10.10	11.60

Table 2: Analysis of the impact of financial openness on bank systemic risk.

Variables	(1) OLS risk	(2) FE risk
Open	0.966** (0.376)	9.464*** (2.289)
$Open^2$	−0.228* (0.118)	−3.737*** (0.896)
Size	−0.101*** (0.0206)	−0.0125 (0.145)
Roe	0.0597*** (0.0114)	−0.00449 (0.00914)
Nii	0.0108*** (0.00341)	0.00474 (0.00290)
Npl	−0.282*** (0.0796)	−0.677*** (0.0740)
Bcr	0.00668 (0.00498)	0.00931 (0.00571)
M2_gr	0.0790*** (0.0288)	0.494*** (0.113)
Gdp_gr	−0.0189* (0.00989)	0.561*** (0.148)
Constant	1.557*** (0.410)	−3.898 (2.695)
Individual fixation effect	No	Yes
Time fixation effect	No	Yes
Observed values	1100	1100
R-squared	0.114	0.742
Number of banks	37	37

Note. Values within () are clustering standard errors of coefficients and ***, **, and *significant at 1%, 5%, and 10% levels, respectively. The following table is the same.

the system GMM model used in this paper is valid and there is no model misconstruction problem. Regression results show that the coefficient of the quadratic component of the financial openness indicator is still considerably negative at the level of 1%, showing that the choice of regression methods had no impact on the findings of this article.

4.3.3. Reverse Causality Processing. As can be seen from the aforementioned analysis, there may be a reverse causal relationship between the level of financial openness and the bank's systemic risk. The higher the bank's systemic risk, the more likely it is that the country will weaken its level of financial openness. Because of this, the financial openness indicator is regressed once more in this study with a one-period lag. The results are shown in column (3) of Table 3, where it is clear that the coefficient of the quadratic term of the financial openness indicator is still significantly negative at the 1% level. The empirical findings are thus consistent with the preceding assumptions, even when the effect of reverse causality is excluded.

4.3.4. Shrinkage Processing. This research introduced tail indentation processing for the 1% and 99% quantiles of the sample data since the presence of aberrant values in the sample could alter the outcomes of the regression analysis. Financial openness is highly associated with bank systemic risk in an inverted "U"-shape, according to the regression findings, which are displayed in column (4) of Table 3, supporting the validity of the previous conclusion.

4.4. Heterogeneity Analysis. This study conducts a heterogeneity analysis using several types of banks as examples, taking into account that the relationship between financial openness and bank systemic risk may be affected by the individual features of banks and behave differently. To investigate whether there is heterogeneity in the link between financial openness and bank systemic risk, the sample banks are separated into state-owned commercial banks, joint-stock commercial banks, urban commercial banks, and rural commercial banks in the sections that follow.

The findings are shown in columns (1) through (4) of Table 4, where it is discovered that, aside from state-owned commercial banks, the regression coefficients of the quadratic term of the financial openness indicator of joint-stock commercial banks, urban commercial banks, and rural commercial banks are significantly negative at the level of 1%, indicating that the inverse relationship between financial openness and systemic risk of state-owned commercial banks is not significant. The risk spillover of state-owned commercial banks is less strong, and there is insufficient significance in the inverted "U"-

Table 3: Endogeneity and robustness test.

Variables	Change the core explanatory variables (1) risk	Systematic GMM estimation (2) risk	Reverse causality processing (3) risk	Shrinkage processing (4) risk
Open	3.149** (1.354)	14.11*** (5.476)		9.539*** (2.255)
$Open^2$	−1.357* (0.720)	−3.943*** (1.522)		−3.769*** (0.883)
L. Open			2.546*** (1.017)	
L. $Open^2$			−0.872*** (0.335)	
Constant	1.626 (2.145)	−1.356 (6.067)	−0.0976 (2.824)	−4.152 (2.641)
Controlling variables	Yes	Yes	Yes	Yes
Individual fixation effect	Yes	Yes	Yes	Yes
Time fixation effect	Yes	Yes	Yes	Yes
Observed values	1084	989	1063	1100
R-squared	0.745		0.755	0.740
AR (1)		0.012		
AR (2)		0.275		
Hansen test		0.214		
Number of banks	37	37	37	37

Table 4: Heterogeneity analysis.

Variables	State-owned bank (1) risk	Joint-stock bank (2) risk	City commercial bank (3) risk	Rural commercial bank (4) risk
Open	8.121 (5.343)	18.32*** (4.649)	21.57*** (4.275)	68.95*** (19.62)
$Open^2$	−3.497 (2.189)	−7.295*** (1.834)	−8.774*** (1.747)	−29.31*** (8.369)
Constant	−6.722 (14.01)	−22.73*** (6.304)	−19.60*** (5.937)	−54.68*** (18.10)
Controlling variables	Yes	Yes	Yes	Yes
Individual fixation effect	Yes	Yes	Yes	Yes
Time fixation effect	Yes	Yes	Yes	Yes
Observed values	245	386	321	148
R-squared	0.930	0.829	0.772	0.852
Number of banks	6	9	14	8

shaped link between financial openness and the systemic risk of state-owned commercial banks. This might be due to the fact that state-owned commercial banks have a larger scale, more stringent rules and regulations, and more advantages in capital allocation and capital management than banks with other types of ownership. They can also more calmly handle the challenges posed by the continued expansion of financial openness.

5. Further Analysis

5.1. Impact Mechanism Analysis. In accordance with the configurations of models (4) and (5), empirical models for financial openness, funding mismatch, and capital management are, respectively, established. The correlation between financial openness and these two mechanism variables is initially analyzed. Given the potential lagging effect of financial openness on bank funding mismatch and capital management optimization, a regression analysis considering a lag period of one is conducted. The results of this regression can be found in Table 5.

The regression results, as presented in column (1) of Table 5, reveal a significant negative correlation between the loan-to-deposit ratio and financial openness. Furthermore, a smaller loan-to-deposit ratio corresponds to a larger gap in capital misallocation. This suggests that an increase in the level of financial openness significantly exacerbates the disparity in bank capital misallocation. Similarly, column (2) of Table 5 indicates a significant negative relationship between the capital adequacy ratio and financial openness. As the level of financial openness improves, the capital adequacy ratio decreases. This implies that enhanced financial openness optimizes capital management. To elucidate the influence of financial openness and its intermediary variables on systemic risk within banks, the regression results are detailed in Table 6.

The results in Table 6 indicate that the nonlinear effects of financial openness on bank systemic risk remain significant after adding the mediating variables. Specifically, the narrowing of the funding mismatch gap can significantly inhibit bank systemic risk, and it can be seen that financial openness not only has a direct impact on bank systemic risk but also affects bank systemic risk through the channel of the funding mismatch gap. Also, the regression coefficient of the capital adequacy rate is significantly positive at the level of 1%, indicating that financial openness can affect bank systemic risk through optimizing capital management channels, and both channels play a partial mediating effect, which verifies Hypothesis 2.

Specifically, at the onset of a rise in financial openness levels, commercial bank monetary mismatches will exhibit greater abundance and diversity. This leads to an enhancement in capital flow control, making it challenging to manage bank

Table 5: Analysis of the mechanisms of financial openness affecting banks' systemic risk I.

Variables	(1) Ltd	(2) Car
L. Open	−1.556*** (0.144)	−33.56*** (2.655)
Constant	4.217*** (0.371)	96.00*** (6.895)
Controlling variables	Yes	Yes
Individual fixation effect	Yes	Yes
Time fixation effect	Yes	Yes
Observed values	1063	1063
R-squared	0.748	0.534
Number of banks	37	37

Table 6: Analysis of the mechanisms of financial openness affecting banks' systemic risk II.

Variables	(1) Risk	(2) Risk
L. Open	3.504*** (1.080)	3.491*** (1.051)
L. Open^2	−0.805** (0.352)	−0.675*** (0.339)
Ltd	−0.760*** (0.283)	
Car		0.0497*** (0.0150)
Constant	−4.020 (3.047)	−4.314 (3.084)
Controlling variables	Yes	Yes
Individual fixation effect	Yes	Yes
Time fixation effect	Yes	Yes
Observed values	1063	1063
R-squared	0.733	0.757
Number of banks	37	37

monetary mismatch risk. Sudden influxes or outflows of "hot money" can result in a decrease in both the price and quantity of collateral assets. Consequently, this increases the degree of loan-to-deposit mismatches and escalates bank bad debts. Even if commercial banks acquire advanced operational management knowledge and experience, as well as new technology and products from abroad, they may not be able to translate these into tangible benefits in a short period of time. The "risk effect" of financial openness is significantly more pronounced than the "promotion effect," leading to an increase in systemic risk within the banking system. As financial openness progresses to a certain extent, it necessitates adjustments in the domestic banking system. This adjustment simultaneously enhances its competitiveness, enabling it to adeptly navigate the challenges and opportunities presented by financial openness. Consequently, this facilitates high-level financial opening and promotes high-quality economic development. Currently, the allocation of bank funds and capital management in China effectively reflects the external supervision effect and knowledge spillover effect. This optimization of the organizational structure of banks further elevates the level of financial innovation, deepening its impact. The "promotion effect" of financial openness surpasses the "risk effect," thereby diminishing the likelihood of crisis occurrence and reducing the systemic risk associated with China's banking system.

5.2. Adjustment Effect Analysis. This study delves deeper into the moderating influence of macroprudential policy on the interplay between financial openness and bank systemic risk. It is important to highlight that the relationship between these two variables exhibits an inverted "U"-shaped pattern. To elucidate this, the paper constructs an interaction term between financial openness and the macroprudential policy index. Subsequently, it investigates the impact of macroprudential policy on this inverted "U"-shaped relationship by examining the association between the interaction term and bank systemic risk. Specifically, the regression results in column (1) of Table 7 demonstrate that financial openness under macroprudential supervision exhibits an inverted "U"-shaped relationship with bank systemic risk. The interaction term's coefficient between the quadratic term of financial openness and the macroprudential policy index is −6.062, which is significantly negative at the 1% level. This suggests that macroprudential supervision can effectively mitigate the systemic risk spillover effect of financial openness. The calculated inflection point value of financial openness under macroprudential supervision is 1.0405, as derived from the results presented in Table 6. This value is notably lower than the original inflection point value of 1.2663. Furthermore, at this inflection point, the level of bank systemic risk diminishes from 5.9919 to 2.0181. These findings suggest that prior to the transition point of the inverted "U" relationship, macroprudential supervision mitigates the adverse effects of financial openness on bank systemic risk. The findings presented in columns (2) and (3) of Table 7 suggest that both stringent and lenient macroprudential policies can markedly mitigate the adverse effects of financial openness on bank systemic risk. Furthermore, these policies can expedite the onset of an inverted "U"-shaped turning point between financial openness and bank systemic risk.

Indeed, macroprudential policy can effectively oversee indicators such as the capital adequacy ratio. This approach serves to safeguard against credit inflation within the banking industry, lowers the likelihood of term mismatch and liquidity risk, and aids in reducing leverage while

Table 7: Results of the moderating effects analysis.

Variables	(1) Risk	(2) Risk	(3) Risk
L. Open	3.879*** (0.492)	3.192*** (0.580)	3.979*** (0.497)
L. Open^2	−1.864*** (0.176)	1.426* (0.852)	−2.345*** (0.215)
MAPP	−5.099*** (0.471)		
$MAPP_T$		−48.32*** (16.52)	
$MAPP_L$			−7.504*** (1.001)
Open ∗ MAPP	13.39*** (1.159)		
Open^2 ∗ MAPP	−6.062*** (0.522)		
Open ∗ $MAPP_T$		47.32*** (17.83)	
Open^2 ∗ $MAPP_T$		−10.25** (4.594)	
Open ∗ $MAPP_L$			14.72*** (1.987)
Open^2 ∗ $MAPP_L$			−4.084*** (0.606)
Constant	4.711** (1.995)	9.810*** (2.397)	3.966* (2.051)
Controlling variables	Yes	Yes	Yes
Individual fixation effect	Yes	Yes	Yes
Time fixation effect	Yes	Yes	Yes
Observed values	842	842	842
R-squared	0.802	0.802	0.802
Number of banks	36	36	36

precisely managing commercial bank risks. In summary, with the aid of macroprudential supervision, the inflection point of the inverted "U" relationship between financial openness and bank systemic risk has reached a lower level of systemic risk. This not only promotes the early arrival of the inverted "U" turning point of financial openness and bank systemic risk but also narrows the negative interval of these two factors. Therefore, it is posited that Hypothesis 3 is supported by verification.

6. Conclusions and Policy Recommendations

6.1. Conclusion. This paper uses the quarterly data of 37 listed banks in China from 2010 to 2022 and empirically analyzes the impact and mechanism of financial openness on bank systemic risk. The results show that (1) financial openness has an inverted "U"-shaped relationship with bank systemic risk. (2) The inverted "U" relationship is primarily shaped by two key mechanisms: funding mismatch and capital management within banks. On the left side of this relationship, financial openness predominantly amplifies bank systemic risk through the amplification of funding mismatch. Conversely, on the right side of the inverted "U", it primarily mitigates bank systemic risk through the optimization of capital management. (3) Macroprudential policy can mitigate the systemic risk spillover effect of financial openness to a certain degree. Specifically, it facilitates the attainment of a lower level of systemic risk at the inflection point of the inverted "U"-shaped relationship between financial openness and bank systemic risk. This is achieved through macroprudential supervision while simultaneously promoting the early arrival of the inverted "U"-shaped inflection point. This process effectively narrows the negative interval between financial openness and bank systemic risk. It should be emphasized that both stringent and lenient macroprudential policies can significantly attenuate the adverse impact of financial openness on bank systemic risk. Furthermore, they promote the early arrival of the inverted "U"-shaped inflection point between financial openness and bank systemic risk. (4) In comparison to state-owned commercial banks, financial openness has a more pronounced inverted "U"-shaped impact on the systemic risk of joint-stock commercial banks, urban commercial banks, and rural commercial banks. These findings offer valuable regulatory insights for effectively mitigating systemic financial risks while ensuring high-quality economic openness. As financial opening deepens, it is imperative for the banking sector to focus on funding mismatch and enhancing capital management efficiency. Distinct risk supervision and prevention strategies should be adopted for different categories of banks: state-owned commercial banks, joint-stock commercial banks, urban commercial banks, and rural commercial banks. Such differentiation is instrumental in diminishing the systemic risk associated with the banking system.

6.2. Policy Recommendations. Based on the aforementioned research findings, this paper makes the following policy proposals for successfully preventing banks' systemic risks while slowly advancing financial openness against the backdrop of creating a new development pattern.

First and foremost, we must steadfastly advocate for a high degree of financial openness and work to reach the "inflection point" as quickly as feasible. According to the previous analysis, China's financial openness level is below the inflection point value at the end of June 2022 and is steadily moving toward this inflection point, which is on the left side of the inverted "U"-shaped inflection point. In order to reduce the bank's systemic risk, we must maintain a high level of financial openness, gradually cross the "inflection point," secure the security of opening up, and maximize the benefits of financial openness. China's financial institutions should continue to make it easier for foreign investors to enter the domestic market, continuously improve the business environment in line with international standards, genuinely permit foreign investment to benefit from

preferential national treatment prior to establishment and negative list management in accordance with the law, broaden the types of investable industries and assets, and make investing more convenient. In order to accomplish both development and security, it is required to steadily increase the institutional opening up of rules and regulations and consistently improve the effectiveness of financial management and risk prevention capacity under open conditions.

Second, as a prerequisite for opening up, commercial banks must continually strengthen their capacity for risk management. To prevent significant market shocks during centralized debt repayment, commercial banks should abide by laws and regulations that control the proportion of local currency and foreign debt, establish a currency mismatch risk supervision system, and promptly stop the fund mismatch gap from widening. Commercial banks should simultaneously aggressively learn and assimilate new management approaches, product systems, and risk control technologies to maximize the effectiveness of capital management and strengthen China's financial sector's capacity to support the real economy. Commercial banks should also be ready to handle the positive side of the financial openness inflection point and employ differentiated competition measures based on their unique advantages to contend with overseas competition.

Additionally, macroprudential tools' direction needs to be continually improved. On the one hand, systemic financial concerns, such as the expansion of bank risk exposure brought on by the impact of the epidemic, are avoided by the employment of macroprudential measures. In order to improve the financial system's capacity to prevent risk contagion in the face of procyclical oscillations, macroprudential instruments are primarily intended to propose new standard requirements on the basis of the microprudential supervisory requirements already in place. On the other hand, a variety of macroprudential policy tools must be used, and a varied structure must be developed, along with a constant improvement of the "dual-pillar" regulatory framework and monetary policy. Macroprudential supervision can be appropriately improved for joint-stock commercial banks, urban commercial banks, and rural commercial banks, among others.

Finally, distinct risk surveillance and prevention strategies need to be implemented. Since China's financial openness level is still on the left side of the inflection point at this point, we must give top priority to the negative effects that could result from further increasing financial openness on the systemic risk of banks and continually enhancing the system for preventing and monitoring financial risk. Aside from strengthening compliance management and prudential supervision of short-term capital flows, the regulatory authorities should pay close attention to the outward direct investment and overseas assets of joint-stock commercial banks, urban commercial banks, and rural commercial banks, establish a timely and efficient monitoring and regulation mechanism for short-term capital flows, and prevent and address individual and systemic financial risks of banks.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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References

[1] Q. M. Dong and M. S. Lu, "Empirical analysis of the impact of financial openness and development degree differences on the generating mechanism of the banking crisis," *Research in International Finance*, vol. 6, pp. 79–85, 2010.

[2] J. P. Joyce, "Financial globalization and banking crises in emerging markets," *Open Economies Review*, vol. 22, no. 5, pp. 875–895, 2011.

[3] N. Van Horen and S. Claessens, *Foreign Banks: Trends, Impact and Financial Stability*, International Monetary Fund, Washington, DC, USA, 2012.

[4] A. Ghosh, "How does banking sector globalization affect banking crisis?" *Journal of Financial Stability*, vol. 25, pp. 70–82, 2016.

[5] B. Zhang, C. Song, and J. S. Liu, "Foreign equity Participation, ownership structure, and risk taking of Chinese banks: an empirical analysis based on 61 commercial banks," *Macroeconomic Research*, vol. 6, pp. 31–42, 2018.

[6] E. Faia, S. Laffitte, and G. Ottaviano, "Foreign expansion, competition and bank risk," *Journal of International Economics*, vol. 118, pp. 179–199, 2019.

[7] C. Wang and T. Q. Zhang, "Comparative study of financial crisis shocks in the process of economic openness," *Financial Research*, vol. 3, pp. 97–110, 2011.

[8] Y. Luo, S. Tanna, and G. De Vita, "Financial openness, risk and bank efficiency: cross- country evidence," *Journal of Financial Stability*, vol. 24, no. 6, pp. 132–148, 2016.

[9] J. Wu, M. H. Chen, B. N. Jeon, and R. Wang, "Does foreign bank penetration affect the risk of domestic banks? Evidence from emerging economies," *Journal of Financial Stability*, vol. 31, pp. 45–61, 2017.

[10] Y. Fang, R. Y. Yan, and Z. W. Zheng, "Research on the impact mechanism of capital account opening on bank risk," *International Finance Research*, vol. 11, pp. 33–43, 2017.

[11] S. G. Dai, B. Z. Lin, and B. Yu, "Financial opening, bank correlation and bank systemic risk in China," *Social Science Journal of Jilin University*, vol. 62, no. 5, pp. 101–117+237, 2022.

[12] A. P. Angkinand, W. Sawangngoenyuang, and C. Wihlborg, "Financial liberalization and banking crises: a cross-country analysis," *International Review of Finance*, vol. 10, no. 2, pp. 263–292, 2010.

[13] M. Ayhan Kose, E. S. Prasad, and A. D. Taylor, "Thresholds in the process of international financial integration," *Journal of International Money and Finance*, vol. 30, no. 1, pp. 147–179, 2010.

[14] T. D. Bui and H. T. M. Bui, "Threshold effect of economic openness on bank risk-taking: evidence from emerging markets," *Economic Modelling*, vol. 91, pp. 790–803, 2020.
[15] Z. Li, K. Song, and J. W. Yang, "Banking openness, foreign ownership, and bank risk taking," *Finance and Trade Economics*, vol. 41, no. 10, pp. 96–110, 2020.
[16] W. Chen, J. W. Huang, and L. Wang, "A study of financial openness and the heterogeneity of systemic risk-taking by banks," *Research in International Finance*, vol. 393, no. 1, pp. 33–43, 2020.
[17] L. Ma, Y. He, and M. H. Niu, "Has opening up led to higher risks in the banking sector?-- An empirical test based on the proportion of foreign ownership and the proportion of overseas assets," *Financial Research*, vol. 4, pp. 91–111, 2020.
[18] X. Lin, Z. P. Li, and Q. H. Song, "Banking system risk and macroprudential policy effectiveness: evidence from 72 countries," *Journal of World Economic Research*, vol. 2023, no. 4, pp. 47-58+118–135, 2023.
[19] C. Gaganis, A. Lozano-Vivas, P. Papadimitri, and F. Pasiouras, "Macroprudential policies, corporate governance and bank risk: cross-country evidence," *Journal of Economic Behavior and Organization*, vol. 169, pp. 126–142, 2020.
[20] Y. X. Wang, Y. F. Wang, and H. F. Yang, "Research on the mechanism of cross-border capital flow macro-prudential policy to prevent imported financial risks," *Economist*, vol. 9, pp. 88–97, 2022.
[21] L. An, J. P. Dai, and W. Xu, "The effectiveness of macroprudential policies in responding to external financial shocks," *Research in International Finance*, vol. 2023, no. 3, pp. 13–25, 2023.
[22] X. F. Huang, S. N. Lian, and R. S. Cai, "Surge of capital inflow and systemic financial risk: based on? An empirical analysis of the CoVaR method," *International Finance Research*, vol. 2023, no. 3, pp. 37–49, 2023.
[23] D. P. Wang, Y. Zhang, and W. X. Guo, "Macroprudential policy, credit expansion, and systemic banking crises: international empirical evidence from 124 economies," *Research in International Finance*, vol. 8, pp. 44–54, 2022.
[24] G. J. Chen, X. Y. Jiang, and X. Q. Zhao, "Monetary policy, macroprudential supervision, and banks' systemic risk taking," *Systems Engineering Theory and Practice*, vol. 40, no. 6, pp. 1419–1438, 2020.
[25] X. F. Zhang, X. L. Zhang, and L. B. Xu, "Research on macroprudential tools and systemic financial risk," *Journal of International Finance Research*, vol. 2023, no. 2, pp. 38–47, 2023.
[26] Y. Altunbas, M. Binici, and L. Gambacorta, "Macroprudential policy and bank risk," *Journal of International Money and Finance*, vol. 81, pp. 203–220, 2018.
[27] X. J. Xie and X. F. Wang, "The impact of cross-border capital flow on bank risk: based on the perspective of risk accumulation effect and risk contagion effect," *Reforma*, vol. 2, pp. 127–143, 2022.
[28] L. F. Song, H. Y. Niu, and Z. L. Liu, "House price volatility, implied warranties, and banking systemic risk," *Economic Theory and Economic Management*, vol. 3, pp. 16–26, 2018.
[29] X. Q. Cheng and L. L. Ge, "Analysis on the effectiveness of banks' systemic risk and macro-prudential evaluation system," *Statistics and Decisions*, vol. 36, no. 19, pp. 146–151, 2020.
[30] Z. H. Fan and Y. J. Wen, "Research on the risk of Chinese commercial banks under the internationalization of finance," *Comparison of Economic and Social Systems*, vol. 6, pp. 129–132, 2006.
[31] B. Zhang, C. H. Yu, and C. H. Liu, "Financial opening, procyclical response of banks, and cross-sector transmission of capital flows," *Shanghai Economic Research*, vol. 2023, no. 4, pp. 84–103, 2023.
[32] Z. F. Chen, S. Q. Liu, and K. X. Li, "Have macroprudential policies reduced abnormal capital flows?-- Based on transnational experience," *International Finance Research*, vol. 1, pp. 39–49, 2022.
[33] T. Adrian and M. K. Brunnermeier, "CoVaR," *The American Economic Review*, vol. 106, no. 7, p. 1705, 2016.
[34] Z. W. Wang, S. C. Lv, and X. C. Mao, "Effectiveness comparison and application of the CoVaR calculation method based on the risk spillover correlation feature," *Economic Review*, vol. 4, pp. 148–160, 2014.
[35] L. N. Chen and S. M. Pang, "Measurement of financial openness in China," *Economist*, vol. 6, pp. 35–44, 2012.
[36] M. A. Kose, E. Prasad, K. Rogoff, and S. J. Wei, "Financial globalization: a reappraisal," *IMF Staff Papers*, vol. 56, no. 1, pp. 8–62, 2009.
[37] P. R. Lane and G. M. Milesi-Ferretti, "The external wealth of nations: measures of foreign assets and liabilities for industrial and developing countries," *Journal of International Economics*, vol. 55, no. 2, pp. 263–294, 2001.
[38] P. R. Lane and G. M. Milesi-Ferretti, "The external wealth of nations mark II: revised and extended estimates of foreign assets and liabilities, 1970–2004," *Journal of International Economics*, vol. 73, no. 2, pp. 223–250, 2007.
[39] J. Pan, Y. C. Yang, and L. B. Liu, "The impact of financial opening on export technology complexity: an examination based on transnational panel data," *Research on International Economy and Trade*, vol. 202, no. 7, pp. 86–103, 2022.
[40] R. Chen and J. Y. Li, "Short-term cross-border capital flows, exchange rate fluctuations, and bank risk taking: intermediation effects based on asset price and liquidity mismatch," *Financial Regulation Research*, vol. 1, pp. 58–78, 2022.
[41] F. Su, J. Y. Yu, and J. Xiong, "Can higher capital adequacy requirements effectively prevent financial risks?-- Retesting based on the differences-in-differences method," *Research in International Finance*, vol. 9, pp. 76–86, 2019.