

The Role of Industrial Structure in the Impact of Financial Structure on Systemic Financial Risk: Empirical Evidence from China

Chao LIU

College of Economics and Management, Beijing University of Technology, Beijing 100124, China

E-mail: liuchao@bjut.edu.cn

Xiaopeng SUN*

Hubei Key Laboratory of Digital Finance Innovation, Hubei University of Economics, Wuhan 430205, China

E-mail: sunxpg@foxmail.com

Abstract The debate surrounding the relationship between financial structure and systemic financial risk has been ongoing. This controversy arises from a lack of consideration for national resource endowments, which serve as the foundation for the development of industrial structure. Insufficient research has been conducted on the interplay between financial structure, industrial structure, and systemic financial risk. In light of this, the primary objective of this study is to underscore the crucial role of industrial structure in elucidating the interaction between financial structure and systemic financial risk. The research findings highlight that financial structure indirectly influences systemic financial risk through its impact on industrial structure. There exists significant heterogeneity in the transmission effect of industrial structure, with a more pronounced effect observed in areas characterized by high levels of economic development and belonging to mature clusters. Furthermore, the transmission effect of industrial structure is influenced by efficient market and effective government. The improvement of the efficient market can promote the upgrading of the industrial structure while reducing the level of potential risk. Excessive government intervention will reduce the transmission effect of the industrial structure.

Keywords financial structure; industrial structure; systemic financial risk; efficient market; effective government

1 Introduction

Systemic financial risk has been a topic of significant concern within the academic community^[1–8]. Various factors contribute to systemic financial risk, and among them, financial structure plays a crucial role^[9–11]. Financial structure refers to the composition, correlation,

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*Corresponding author

and quantity ratio of financial elements^[12] and influences the interaction of financial markets, the complexity of the financial system, and the spillover of systemic financial risk^[13].

Different schools of thought hold divergent views on the impact of financial structure on systemic financial risk. Financial structure can be divided into bank-based and market-based financial structure, such as Refs. [14–17]. Bank-based scholars argue that a financial structure dominated by indirect financing possesses advantages in mitigating systemic financial risk, such as reducing information asymmetry in the securities market^[11] and alleviating free-riding and short-sighted investments^[18]. Conversely, proponents of market-based financial structure suggest that it is more conducive to reducing systemic financial risk^[19]. A financial structure dominated by direct financing can lower transaction costs^[20,21], mitigate information asymmetry^[22], and enhance resource allocation efficiency^[23]. As a result, consensus remains elusive regarding the relationship between financial structure and systemic financial risk.

One reason for this lack of consensus is the omission of national resource endowments and their impact on industrial structure development. Geographical location and economic development levels differ among nations, leading to variations in factor endowments. Factor endowments determine the state of industrial structure and its associated risks^[24]. The distribution and utilization of factor endowments, which manifest in the form of industrial structure, are influenced by the flow of financial factors^[25], thereby affecting the stability of financial markets. Additionally, Reference [24] argues that changes in industrial structure should align with the comparative advantage of national resource endowments, maximizing enterprise competitiveness and maintaining financial stability. Therefore, the industrial structure plays a crucial role in the relationship between financial structure and systemic financial risk. However, studies examining this relationship are still in their early stages, necessitating a more detailed investigation. In other words, when discussing the relationship between financial structure and systemic financial risk, differences in factors such as production and labor among countries are not taken into account.

At the same time, the change of industrial structure is closely related to the efficient market and the successful government. The adjustment of industrial structure depends on efficient market and effective government. An efficient market is one in which asset prices fully reflect all relevant information. Investors can enter and exit the market freely. Efficient market can guide enterprises to choose technology and industry according to the comparative advantage of factor resource endowment, and obtain profits through the cost advantage and competitive advantage of products. An effective government is a strategic enabler that fosters sustainable development by providing inclusive institutions, adaptive policies, and market-compatible interventions, while avoiding both laissez-faire passivity and extractive overreach. Its core functions include safeguarding property rights, correcting market failures through time-bound mechanisms, and coordinating resources to unlock private sector potential^[26]. It is important to explore the mechanism through which financial structure influences systemic financial risk by considering the characteristics of industrial structure and financial demands at different stages

of development. In light of this, we aim to provide a plausible answer to the following question: Does financial structure affect systemic financial risk through industrial structure? Can this relationship be influenced by efficient market and effective government?

To address this question, we find it useful to adopt a hypothetico-deductive approach, which will be the focus of the two subsequent sections. The first section presents a theoretical analysis that postulates the relationship between financial structure, industrial structure, and systemic financial risk. The second empirical section is dedicated to testing the effect of industrial structure as a mediator between financial structure and systemic financial risk, and the regulating effect of efficient market and effective government on industrial structure.

The contribution of this article can be summarized as follows:

- The transmission effect of industrial structure between financial structure and systemic financial risk is revealed through the use of intermediary model. This finding enhances our understanding of the complex relationship between financial structure and systemic financial risk.
- Revealing heterogeneity in the transmission mechanism of industrial structure. The study uncovers significant heterogeneity in the transmission mechanism of industrial structure, highlighting that its effect varies across urban agglomerations and economic development.
- The improvement of the efficient market can promote the upgrading of the industrial structure while reducing the level of potential risk. Excessive government intervention will reduce the transmission effect of the industrial structure. This observation underscores the importance of efficient market and effective government in maintaining the effectiveness of industrial structure as a mediating factor in mitigating systemic financial risk.

Furthermore, as China represents a typical developing country, the insights gained from this study could provide valuable implications for other developing countries, offering guidance on navigating the complex relationship between financial structure, industrial structure, and systemic financial risk.

2 Mechanism Analysis

2.1 Financial Structure and Systemic Financial Risk

Reference [27] first constructed a theoretical framework of financial institutions encompassing monetary theory and banking theory. Reference [12] believed that financial structure is a state relationship in nature, form or relative scale between financial institutions and financial instruments. Subsequently, Reference [28] proposed the view that financial structure is dynamically optimized and adjusted, exploring financial structure changes from the perspective of financial deepening theory. Reference [29] further pointed out that the evolution of financial structure is essentially the result of the game between institutional environment and market forces, especially that property rights protection and political institutions determine the adaptive efficiency of the financial system.

Driven by differences in research focuses and economic development contexts, various financial structure models have emerged. Among them, the financial structure models widely accepted and recognized by the academic community are the bank-based financial structure and the market-based financial structure^[18,30], and the two financial structure models have their respective advantages and disadvantages^[31]. Reference [32] institutional path dependence theory explains why some countries are long locked in a specific financial structure model even if the model has shown efficiency defects.

The differences between the two financing structures determine the diversification of channels and methods, and channels and methods show different effects in risk identification, risk pricing, and risk resolution, resulting in different impacts on the real sector^[13,33]. Among them, some scholars believe that the bank-based financial structure can alleviate the drawbacks of the securities market such as information asymmetry, free-riding problems, and myopic investment^[18]; while others believe that the market-based financial structure can reduce transaction costs^[20,21], weaken information asymmetry, improve the efficiency of resource allocation, and help reduce systemic financial risk more than the bank-based financial structure^[19]. Reference [34] hybrid financial system theory points out that in reality, the financial structure of most countries presents the hybrid characteristics of bank and market functions, and its risk transmission mechanism depends on the coupling degree of the two functions.

In the context of the socialist system with Chinese characteristics, the competitive relationship between financial structure and financial risks exhibits unique dynamic balance characteristics. Based on Reference [35] financial instability hypothesis, the stability of China's financial system essentially relies on the implicit government guarantees for "Ponzi finance". The traditional bank-dominated financial structure maintained stability for a long time under implicit government guarantees and capital controls, but administrative interventions in credit allocation led to capital misallocation and accumulation of zombie enterprises, thereby accumulating systemic risks. This phenomenon confirms the inefficiency of financial resource allocation under Reference [29] "extractive institutions".

With the deepening of market-oriented reforms, the increase in the proportion of direct financing in the capital market has promoted risk diversification and the formation of innovative capital. However, regulatory arbitrage and the expansion of shadow banks during the financial liberalization process have given rise to new risk points, which is consistent with Reference [34] argument that regulatory vacuums in hybrid systems trigger cross-market risk contagion. This contradiction highlights the double-edged effect of financial structure adjustment, which in essence reflects the tension between path dependence and adaptive efficiency during institutional change emphasized by Reference [32].

2.2 Financial Structure and Industrial Structure

Financial structure refers to the composition, correlation, and quantity ratio of financial elements^[12]. Financial structure can be divided into bank-based and market-based financial structures. The bank-based financial structure confirms that it can act as a catalyst for indus-

trialization and be more effective in supporting industries and promoting extensive industrialization compared with financial markets^[36,37]. Simultaneously, the transformation of industrial structure leads to the entry of numerous innovative small and medium-sized enterprises into the market. Since financial intermediaries often have stringent credit requirements, these enterprises typically seek alternative financing channels to meet their capital needs^[38,39], particularly in developing countries. This implies that financial intermediaries can mitigate the risk contagion from the enterprise sector to the financial sector resulting from industrial structure transformation.

2.3 Financial Structure, Industrial Structure and Systemic Financial Risk

Financial intermediation may also increase the level of potential risks associated with industrial structure. On one hand, the adjustment of industrial structure involves eliminating outdated industries, firms, and products^[40], which exposes the financial sector to risky loans from these enterprises. When risks accumulate to a certain extent, a crisis may occur. On the other hand, as the business performance of real enterprises improves, financial intermediaries become more willing to lend to previously reluctant borrowers^[41], thereby increasing their risk-taking propensity and potential risks. Hence, financial intermediation can alter the financing support and risk appetite of enterprises, promote industrial structure transformation, and subsequently contribute to fluctuations in systemic financial risk levels.

The market-based financial structure argues that bank-dominated financial intermediaries are better at mobilizing capital for traditional mature industries. In contrast, financial markets can provide greater support to early-stage emerging enterprises, facilitating industrial structure development through their risk-sharing mechanisms. Developed countries have increased their investments in emerging growth industries while reducing investments in declining industries compared to developing countries. Therefore, the development of financial markets plays a crucial role in improving resource allocation efficiency, optimizing industrial structure^[23,42], and has a greater impact on promoting industrial structure upgrading^[43]. For instance, Reference [44] constructed a large dataset covering 32 developed and emerging countries and found that financial markets are more conducive to the development of externally financed dependent and high-tech intensive industries.

However, providing financial support to high-uncertainty emerging enterprises by market-oriented financial structure can lead to fluctuations in potential risk levels. Therefore, while the support of market-oriented financial structure for high-uncertainty enterprises can facilitate industrial structure upgrading, it can also contribute to changes in the overall level of systemic financial risk.

It is evident that banks and financial markets play distinct roles in the development of industrial structure^[43]. Banks effectively support industries with mature products and technologies, while financial markets offer significant support to emerging industries with high technological intensity and uncertainty. Considering the changes in industrial structure, the support provided by financial structure to industrial structure will also change, thereby impacting the level of risk

to varying degrees.

Next, we constructed a simple model to illustrate the relationship among financial structure, industrial structure and systemic financial risk. We assume that the macroeconomy is divided into traditional sectors and emerging sectors, which consist of two parts - the industrial sector and the financial services sector. K_{a1} and K_{a2} are respectively used to represent the capital stock of the industrial sector and the financial services sector in the traditional sector. K_{b1} and K_{b2} are respectively used to represent the capital stock of the emerging industry sector and the emerging financial services sector within the emerging sectors.

The production function can be expressed as:

$$Y = Y_a + Y_b, \quad (1)$$

$$Y_a = A_a F_a(L_a, K_{a1}, K_{a2}), \quad (2)$$

$$Y_b = A_b F_b(L_b, K_{b1}, K_{b2}), \quad (3)$$

$$\text{s.t. } L = L_a + L_b, K_a = K_{a1} + K_{a2}, K_b = K_{b1} + K_{b2}, K = K_a + K_b. \quad (4)$$

Under the assumption that the traditional sector provides intermediate goods to the emerging sector, its output Y_a influences the production function of the emerging sector:

$$Y_b = F(L_b, K_{b1}, K_{b2}, Y_a) \text{ and } \frac{\partial Y_b}{\partial Y_a} > 0. \quad (5)$$

Industrial linkages can create risk transmission channels. When the output of the traditional sector (Y_a) declines, it not only directly reduces the intermediate input supply to the emerging sector (Y_b), but also deteriorates bank assets ($K_{a2} \downarrow$), triggering a credit crunch that results in a dual shock to both the real economy and financial system^[45]. $\frac{\partial Y_b}{\partial Y_a}$ is the industrial correlation coefficient. When both traditional and emerging industries develop stably, the economy reaches an equilibrium state of development. At this stage, the capital stocks in both industrial and financial sectors achieve their optimal proportions, expressed as:

$$K_a^* = \frac{K_{a2}}{K_{a1}}, K_b^* = \frac{K_{b2}}{K_{b1}}. \quad (6)$$

K_a^* are K_b^* respectively used to represent the desirable proportions of the capital stocks in the industrial and financial sectors of the traditional and emerging sectors.

The upgrading of the consumption structure and the changes in consumption demand have promoted the transformation of production, and the financial support required for the upgrading of the industrial structure has also changed. Combining with Formula (6), it can be understood that during the process of industrial structure upgrading, K_{a1} and K_{a2} will continuously decrease, while K_{b1} and K_{b2} will continuously increase. In terms of the total amount, the investment in K_a gradually decreases while the investment in K_b keeps increasing. According to the “Demand-Following” and “Supply-Following” theories proposed by Reference [46], emerging industries, with their rapid technological iteration and lightweight assets ($A_b \approx 0$), face stronger financing constraints, and their capital intensity is reflected in the demand for venture capital rather than fixed asset investment^[47]. That is to say, to provide financial services for the

development of industries of the same quantity, emerging industries require a higher financial capital stock than traditional industries. The emerging sectors need more capital support than the traditional sectors (that is, K_b^* is greater than K_a^*).

Under the assumption that all industries continue to provide the same categories of products and services during industrial structure upgrading, with the total capital stock remaining constant, the optimal capital allocation ratios between traditional and emerging sectors remain unchanged in equilibrium. However, the internal relative proportions undergo dynamic adjustment. According to industrial evolution theory, this process manifests as capital reallocation from traditional to emerging industries, characterized by the following conditions:

$$(K_{a2} - \Delta K_{a2})/(K_{a1} - \Delta K_{a1}) = K_a^*, (K_{b2} + \Delta K_{b2})/(K_{b1} + \Delta K_{b1}) = K_b^*. \quad (7)$$

Assuming that economic development is subject to fixed budget constraints within a certain period of time, cross-sectoral investment cannot change indefinitely. Capital flows are constrained by conditions $\Delta K_a + \Delta K_b = 0$.

During the period of industrial structure transformation, available resources will flow from traditional sectors to emerging sectors:

$$\Delta K = \Delta K_a = \Delta K_b, \Delta K_a = \Delta K_{a1} + \Delta K_{a2} = \Delta K_b = \Delta K_{b1} + \Delta K_{b2}. \quad (8)$$

According to Formulas (6) and (7), it can be obtained:

$$\Delta K_{a2} = \Delta K_{a1} K_a^*, \Delta K_{b2} = \Delta K_{b1} K_b^*. \quad (9)$$

Combined with Formula (8), it can be obtained:

$$\Delta K = \Delta K_{a1}(K_a^* + 1), \Delta K = \Delta K_{b1}(K_b^* + 1). \quad (10)$$

Considering $K_b^* > K_a^*$, it can be deduced:

$$\Delta K_{b1} < \Delta K_{a1}, \Delta K_{b2} > \Delta K_{a2}. \quad (11)$$

On the premise that the total amount of capital remains unchanged, the capital ΔK_{a1} flowing out of the traditional industrial sector is greater than the capital ΔK_{b1} flowing into the emerging industrial sector, and the capital increment ΔK_{b2} in the emerging financial sector is greater than the capital decrease ΔK_{a2} in the traditional financial sector. This indicates that the stock of financial capital required per unit output after the upgrading of the industrial structure is higher than the capital needed under the original industrial structure.

After considering the collateral constraints of enterprises, the capital flow equation is revised to:

$$\Delta K_{a1} = \theta_a A_a - \gamma K_{a1}, \Delta K_{b1} = \theta_b A_b + \eta K_f - \delta K_{b1}. \quad (12)$$

Among them, θ is the mortgage discount rate. $\theta_i A_i$ is the maximum financing amount under the constraint of collateral ($A_a \ll A_b$ leads to financing difficulties in emerging sectors). η is

market financing efficiency. K_f stands for the financing volume in the financial market. γ and δ respectively represent the capital exit rate of traditional sectors and the capital loss rate of emerging sectors.

Financial structure (FS) is represented by the ratio of financial markets (K_f) to financial intermediaries (K_b). After considering the industrial correlation ($\lambda = \frac{\partial Y_b}{\partial Y_a}$), the financial structure can be expressed as:

$$FS' = \frac{K_f + \lambda \Delta Y_b}{K_b - \lambda \Delta Y_a}. \quad (13)$$

When traditional sectors decline ($\Delta Y_a < 0$), the risks of financial intermediaries (K_b) rise, promoting the adjustment of the financial structure towards market dominance ($FS' \uparrow$).

Systemic financial risk is influenced by three aspects, namely financial intermediary risk, financial market risk and risk triggered by industrial correlations. The formula is as follows:

$$\text{Risk} = \alpha \left| \frac{K_{a2}}{Y_a} \right| + \beta \left| \frac{K_f}{Y_b} \right| + \lambda \left| \frac{Y_a}{Y_b} \right|. \quad (14)$$

Market-driven financial structure support high-tech emerging industries through risk-sharing ($K_{b1} \uparrow$)^[42,43]. Excessive financing may lead to asset bubbles. The bank-led financial structure can stabilize employment and output in traditional sectors (K_{a1}) and avoid short-term collapse, but it is facing the delayed escalation of credit mismatch (renewal of loans by “zombie enterprises”)^[44]. Once traditional sectors withdraw ($\gamma \uparrow$), non-performing loans of banks ($K_{a2} \downarrow$) will push up systemic financial risk ($\alpha \uparrow$). The expansion of emerging sectors ($\Delta K_{b1} > 0$), if relying on market financing ($K_f \uparrow$), may trigger a chain of sell-offs due to stock price ($\beta \uparrow$) fluctuations. Thus, the following hypothesis is proposed:

H1 Financial structure can influence systemic financial risk through industrial structure.

2.4 The Role of Efficient Market and Effective Government

An effective government strategically intervenes to correct market failures and promote structural transformation while maintaining synergy with markets^[49]. It identifies latent comparative advantages through targeted interventions^[50], avoids rent-seeking^[51], and phases out support as industries mature. This market-facilitating approach balances institutional credibility and policy adaptability^[52], fostering state-market cooperation for sustainable growth.

Lin’s new structural economics (NSE) posits that the interaction between government intervention and market efficiency should be grounded in the dynamic synergy of an “efficient market” and a “facilitating state”. The theory contends that economic development is fundamentally a process of continuous industrial upgrading, wherein the market plays a decisive role in resource allocation, while the government must provide strategic guidance at different stages of industrial transformation to address market failures. The core rationale for government intervention lies in identifying and nurturing industries aligned with an economy’s latent comparative advantages. By coordinating investments in infrastructure, disseminating critical information, and incentivizing first-movers, the state reduces transaction costs and risks for firms entering

new industries, thereby accelerating the realization of market efficiency. Crucially, such interventions must avoid substituting market mechanisms or protecting industries misaligned with comparative advantages, instead focusing on enhancing—rather than distorting—market functionality. NSE asserts that the boundary between government and market roles should evolve dynamically with development stages: Proactive state involvement is essential in early capital-scarce phases, while interventions should gradually recede as market institutions mature. This framework reconciles the complementary—rather than antagonistic—relationship between state and market by positioning government as a “market-enabling” actor, affirming the centrality of markets in long-term efficiency while justifying targeted interventions to overcome structural bottlenecks. The theoretical contribution of NSE thus lies in its systematic integration of state action and market forces within a unified developmental logic.

An efficient market and an effective government play significant roles in the transmission effects of industrial structure. An efficient market can enhance resource allocation efficiency and swiftly reflect changes in market supply and demand. Simultaneously, adjustments in industrial structure can quickly transmit through market mechanisms to the financial structure, impacting systemic financial risk. However, as the degree of government intervention increases, the government’s role in the economy becomes more prominent. Government intervention measures aim to correct market failures or promote economic development but may lead to distorted market signals and influence the behavior of market participants, thereby affecting the transmission effects of changes in industrial structure.

Thus, the following hypothesis is proposed:

H2 The transmission effect of industrial structure between financial structure and systemic financial risk is influenced by an efficient market and a competent effective government.

In summary, previous studies have examined the influence of financial structure on systemic financial risk and industrial structure separately. However, the relationship between financial structure, industrial structure, and systemic financial risk remains unclear. What role does industrial structure play in the interaction between financial structure and systemic financial risk? How does financial structure impact systemic financial risk with the changing industrial structure? These gaps in the literature motivate our research. To address these questions, we first employ a mediation effect model to investigate the relationship between financial structure, industrial structure, and systemic financial risk using Chinese provincial panel data from 2006 to 2022. In addition, the impact of efficient market and effective government on the relationship of financial structure, industrial structure and systemic financial risk is also considered.

3 Econometric Modelling and Variables

3.1 Variables and Data

In this study, a total of 31 provinces in China were selected for research, excluding three provinces due to inconsistent statistical coverage (Taiwan, Macao, and Hong Kong Province). The annual data primarily came from the Wind financial database. To ensure data reliability,

missing and abnormal data were eliminated, resulting in a comprehensive survey using panel data from Chinese provinces spanning the period 2006 to 2022.

The main dependent variable in this study is systemic financial risk (fr). Most scholars construct a financial stress index by selecting relevant indicators from banks, securities, insurance, and foreign exchange^[53,54]. However, systemic financial risk is a cumulative process influenced by the financial system structure and external shocks. Thus, the fluctuation of any single economic variable or multiple market variables alone is insufficient to represent systemic financial risk. Following relevant literature^[15,54,55], this paper constructs a financial stress index based on four aspects: financial sector, enterprise sector, government sector, and household sector. The selected indicators and their definitions are presented in Table 1.

The positive indicator indicates that the relationship between the indicator and systemic financial risk is positive. The negative indicator indicates that the indicator has a negative relationship with systemic financial risk. The moderate index indicates that the more deviated from the optimal value of the index, the higher the level of systemic financial risk.

Financial sector indicators reflect the accumulation of risks caused by the operation of financial institutions and markets, including four dimensions: banking, securities, insurance and real estate. Among them, the non-performing loan ratio reflects the risk caused by the accumulation of bad debts; The credit inflation rate represents the hidden risk of rapid credit growth. The loan-to-deposit ratio reflects the ability of financial institutions to resist risks. The development degree of the stock market represents the potential risks caused by overestimating or underestimating the stock market, and the growth rate of the stock transaction volume measures the development scale of the stock market. Premium depth and insurance density represent the development degree of insurance industry. The ratio of house price to income and the proportion of the size of the real estate market represent the risks contained in the rapid growth of house price, and the fluctuation of house price will cause the instability of the financial system through the impact on residential investment, consumption and credit.

The enterprise sector indicators reflect the systemic financial risk accumulated by the operation of enterprises. With the promotion of China's supply-side structural reform, the risks accumulated during the elimination of backward production capacity and the transformation and upgrading of enterprises cannot be ignored. Once a risk event occurs in an enterprise, it will also have an impact on the financial institutions associated with it. In this study, the asset-liability ratio and the degree of enterprise loss are selected as the solvency of the enterprise sector and the degree of risk faced by the loss.

Government sector indicators reflect local financial risk, fiscal gap is used to measure the government's income and expenditure gap in the allocation of social resources and its solvency, and local government debt and urban investment bonds are used to measure its debt pressure. Household sector indicators reflect the accumulation of household risks, the growth rate of per capita income of households reflects the income status of households, and the unemployment rate represents the idle labor capacity in labor capacity that has not been transformed into

Table 1 Indicator system of systemic financial risk

Type	Variable declaration	Explanation	Character of indicators
Financial sector	Bank: Non-performing loan ratio	Ratio of non-performing loans to total loans	Negative
	Bank: Rate of credit inflation	Bank lending growth rate as a percentage of GDP growth rate	Positive
	Bank: Loan-to-deposit ratio	The ratio of bank loans to total deposits and loans	Positive
	Security: Stock market value	The ratio of the total market value of stocks to GDP	Positive
	Security: Growth rate of securities turnover	The growth rate of the volume of securities traded	Positive
	Insurance: Insurance penetration	Premium income as a percentage of GDP	Negative
	Insurance: Insurance density	The ratio of the premium to the population	Positive
	Real estate: Housing-price-to-income ratio	The ratio of the price of a house to the income of residents	Moderate
Business enterprise sector	Real estate: Real estate market scale	Ratio of real estate output value to GDP	Positive
	Debt-to-assets ratio	The ratio of total liabilities to total assets	Moderate
	Degree of loss	Losses of loss-making enterprises as a percentage of GDP	Positive
Government sector	Financing gap	Fiscal expenditure minus fiscal revenue as a percentage of GDP	Negative
	Urban investment bond	Ratio of urban investment debt to GDP	Positive
	Government debt	Ratio of local government debt to GDP	Positive
Household sector	Household income	Growth rate of per capita household income	Negative
	Unemployment rate	Urban unemployment rate	Negative

Note: This table shows the composition of indicators of systemic financial risk, including the economic significance of each indicator, its calculation method and its relationship with systemic financial risk.

household wealth.

Based on the relationship between the indicators and systemic financial risk, they are categorized as positive, negative, or moderate indicators. The weight of each index is determined using the entropy weight method, ultimately providing a fitting value for the systemic financial risk level.

Referring to the research results of References [56–59], the steps for calculating systemic

financial risk indicators using the entropy weight method are as follows.

The first step is to process the original data to eliminate the differential influence of different dimensions on the calculated index.

Positive indicator:

$$x'_{ij} = \frac{x_{ij} - \min\{x_{1j}, \dots, x_{nj}\}}{\max\{x_{1j}, \dots, x_{nj}\} - \min\{x_{1j}, \dots, x_{nj}\}}. \quad (15)$$

Negative indicator:

$$x'_{ij} = \frac{\max\{x_{1j}, \dots, x_{nj}\} - x_{ij}}{\max\{x_{1j}, \dots, x_{nj}\} - \min\{x_{1j}, \dots, x_{nj}\}}. \quad (16)$$

Moderate indicator:

$$x'_{ij} = \frac{|x_{ij} - \overline{x_{ij}}|}{\max\{x_{1j}, \dots, x_{nj}\} - \min\{x_{1j}, \dots, x_{nj}\}}. \quad (17)$$

Among them, x_{ij} represents the j -th indicator data ($j = 1, \dots, 13$) of the i -th province ($i = 1, \dots, 31$).

The second step is to calculate information entropy (e_j).

$$p_{ij} = \frac{x'_{ij}}{\sum_{i=1}^n x'_{ij}}, \quad (18)$$

$$e_j = -k \sum_{i=1}^n p_{ij} \ln p_{ij}, \quad k = \frac{1}{\ln n}. \quad (19)$$

Among them, when $p_{ij} = 0$, it is stipulated that $p_{ij} \ln p_{ij} = 0$.

The third step is to calculate the coefficient of difference (d_j).

$$d_j = 1 - e_j. \quad (20)$$

The fourth step is to calculate the index weight (w_j).

$$w_j = \frac{d_j}{\sum_{j=1}^n d_j}. \quad (21)$$

Based on the nature of each indicator of systemic financial risk, the weights of each indicator for 31 provinces in each historical year were calculated. Finally, the systemic financial risk index of previous years is synthesized.

The independent variable in this study is financial structure (fs). To measure financial structure, we adopt a composite measure of the comparative roles of banks and markets, following References [60, 61]. As suggested by References [62–64], the level of financial structure is calculated using the entropy weight method from three dimensions: relative scale, relative vitality, and relative efficiency.

The relative scale of financial structure originated from Reference [12] theory of financial deepening and Reference [65] hypothesis of financial structure-growth. The relative size of financial structure measures the proportion of the stock market to the banking system. We

measure the relative size of financial structure as the ratio of stock market capitalization to GDP divided by private credit (bank loans) to GDP.

The relative vitality of the financial structure reflects the dynamic adaptability of financial innovation and serving the real economy, based on Reference [66] view of financial functions and Reference [43] theory of system competition. The relative vitality of financial structure measures the vitality of the stock market relative to the banking system. We measure the relative vitality of financial structure as the ratio of stock market trading volume to private credit (bank loans).

The relative efficiency of financial structure measures the liquidity strength of financial markets and financial intermediaries, which is derived from Reference [61] efficiency hypothesis and Reference [67] information cost model. The relative efficiency of financial structure measures the efficiency of the stock market relative to the banking system.

According to Reference [68], we measure financial institution efficiency by the loans-to-deposits ratio, while market efficiency is proxied by stock market turnover. The relative efficiency of financial structure is then defined as the ratio of market efficiency to financial institution efficiency.

The mediating variable in this study is the industrial structure (industrials). Following References [39, 69], we utilize the ratio of the output value of the tertiary industry to the secondary industry. This ratio can clearly reflect the relative importance and development stage of different industries within an economy. In the early stages of economic development, the secondary sector often dominates because industrialization and infrastructure construction are the main drivers of economic growth. However, as the economy develops and technology advances, the tertiary sector gradually rises, increasing its share in the national economy. This shift not only signifies the optimization and upgrading of the economic structure but also reflects the transition of the labor force from traditional manufacturing to modern services, and the shift in economic growth models from reliance on material production to reliance on knowledge and services.

To enhance the empirical results, additional variables such as city size (cs), education level (el), residents' consumption level (rcl), urban-rural income gap (urig), aging degree (ad), and location advantage (la) are included, based on the studies by References [70–72].

3.2 Econometric Modelling

The mediating effect model is constructed to examine whether financial structure influences systemic financial risk through the mediating role of industrial structure. The mediating effect model is specified as follows:

$$fr_{it} = \alpha_0 + \alpha_1 fs_{it} + \sum_{m=1}^6 \chi_m controls_{it} + \sum area + \sum year + \varepsilon_t, \quad (22)$$

$$industrials_{it} = \beta_0 + \beta_1 fs_{it} + \sum_{m=1}^6 \delta_m controls_{it} + \sum area + \sum year + \varepsilon_t, \quad (23)$$

$$fr_{it} = \eta_0 + \eta_1 fs_{it} + \eta_2 industrials_{it} + \sum_m \theta_m controls_{it} + \sum area + \sum year + \varepsilon_t, \quad (24)$$

where i represents the index of the province; t represents the year. fr_{it} and fs_{it} denote the explanatory variable (systemic financial risk) and explained variable (financial structure) respectively. And $industrials_{it}$ is the mediator. It can be calculated by the ratio of the output value of the tertiary industry to the secondary industry. $controls_{it}$ are a set of control variables, which have a significant impact on systemic financial risk, i.e., city size, education level, residents' consumption level, urban-rural income gap, aging degree, and location advantage. α_0 , β_0 and η_0 are constant term. α_1 , β_1 , η_1 and η_2 are the corresponding coefficient. $\sum year$ denotes the year fixed effect. $\sum area$ denotes the individual effect; ε_t represents a random interference term.

4 Empirical Results and Discussion

Taken industrial structure as mediator variable, we use data from 2006 to 2022 of 31 provinces of China to investigate the impact of financial structure on systemic financial risk.

4.1 Analysis of the Transmission Effect of Industrial Structure

The empirical test of the transmission mechanism between financial structure, industrial structure, and systemic financial risk is conducted based on the mediating effect test method proposed by Reference [73]. The specific test results are presented in Table 2.

For comparison purposes, we also provide measurements based on three dimensions of financial structure. In columns (1)–(3), we examine the mediating role of industrial structure without considering control variables. The results presented in Table 2 indicate that columns (1)–(3) pass the significance test. In columns (1), financial structure demonstrates significance at the 10% level, suggesting a positive correlation between financial structure and systemic financial risk. This finding indicates that industrial structure acts as a mediator between financial structure and systemic financial risk. Furthermore, the significance of the mediating effect of industrial structure is assessed using the Sobel test. The Z-values obtained from the Sobel test pass the significance test at the 1% level, indicating that the mediating effect of industrial structure is statistically significant.

The regression results in columns (4)–(6) with the addition of control variables on the basis of columns (1)–(3). The Sobel test also passes the significance test at the 1% level, which shows that the intermediation effect of industrial structure still exists between financial structure and systemic financial risk.

Next, the KHB method is used to test the effect of industrial structure. The specific results are shown in Table 3. The total correction of financial structure to systemic financial risk is 0.1487. The direct effect is 0.0942. The indirect effect of industrial structure is 0.0544, accounting for 36.6% of the total effect.

These results highlight the crucial mediating role of industrial structure between financial structure and systemic financial risk, revealing the transmission mechanism of financial struc-

Table 2 The transmission effect of industrial structure

Variables	(1)	(2)	(3)	(4)	(5)	(6)
fs	0.0674*	0.8836***	0.0622**	0.0997**	-0.0269	0.1005***
	(3.02)	(7.17)	(2.64)	(3.80)	(-0.21)	(3.85)
industrials			0.0059			0.0267***
			(0.71)			(2.79)
cs				-0.0286	-0.3272*	-0.0199
				(-0.69)	(-1.65)	(-0.48)
el				5.3344***	-40.1603***	6.4061***
				(4.37)	(-6.89)	(5.04)
rcl				-0.0602*	0.1723	-0.0648**
				(-1.82)	(1.09)	(-1.97)
urig				0.0500**	0.1099	0.0471***
				(2.83)	(1.30)	(2.68)
ad				0.0000	0.0000	0.0000
				(0.57)	(0.02)	(0.57)
la				14.4775*	-203.0082***	19.8947**
				(3.46)	(-10.16)	(4.34)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Area	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.1038*	0.9044***	0.0985**	0.5953	2.7534	0.5218
	(15.23)	(24.06)	(9.72)	(1.47)	(1.42)	(1.30)
Observations	527	527	527	527	527	527
Adj. R^2	0.757	0.570	0.756	0.768	0.693	0.772
Sobel Z		0.1608***			0.0554***	

Note: This table shows the test results of the transmission effect of industrial structure with and without control variables. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. The T statistics are in parentheses.

Table 3 Test results of the KHB method

	Coefficient	Std. err.	z	$P > z$	[95% conf. interval]
Total	0.1487	0.0131	11.34	0.000	[0.1230, 0.1744]
Direct	0.0942	0.0197	4.77	0.000	[0.0555, 0.1329]
Indirect	0.0544	0.0149	3.65	0.000	[0.0252, 0.0837]

Note: This table shows the transmission effect test of industrial structure by KHB method. Direct refers to the direct impact of financial structure on systemic financial risk, excluding industrial structure. Indirect refers to the indirect influence of financial structure on systemic financial risk through industrial structure.

ture $\rightarrow$ industrial structure $\rightarrow$ systemic financial risk. Specifically, as the market share of the capital market increases, the level of industrial structure upgrading may significantly increase. The adjustment of financial structure and industrial structure has increased the potential threat

of systemic financial risk. This supports the hypothesis (H1) suggesting that a market-based financial structure, which aligns with financial needs, is more beneficial for industrial development in China compared to a bank-based financial structure. Additionally, this finding suggests that an increase in the market share of the financial sector does not contribute to the stable development of the financial system, and banks, rather than financial markets, are more effective in maintaining financial stability in China.

As a developing country, China's financial system is predominantly bank-oriented, with banks playing a more prominent role in financing than financial markets. Simultaneously, the development of banks facilitates access to credit for the private sector. The expansion of private sector credit directly contributes to the growth of industrial structure and promotes its upgrading, thereby fostering stable financial development. Moreover, when comparing to the United States with a typical market-based financial structure, the empirical results suggest that a bank-based financial structure is more suitable for the development of China's financial system. The United States has a thriving tertiary industry, while China's economy is primarily driven by agriculture. Although China has made progress in its tertiary industry, the current industrial structure remains dominated by the primary sector. Consequently, the financial needs associated with the primary industry are more effectively met through financial intermediation.

Several reasons may account for the relationship between financial structure and systemic financial risk. Firstly, China's capital market is still in its early stages and lags behind developed countries. The absence of robust institutional systems and relevant laws contributes to high financial market risks. Banks, with well-established supervisory systems, become a preferred choice for enterprises seeking financing channels. Secondly, capital market financing exposes enterprises directly to market risks, leading to a relatively higher probability of systemic financial risk. In contrast, banks mitigate risks associated with information asymmetry and business risks by leveraging their understanding of the fundamental aspects of enterprises. This conclusion is also supported by Reference [50].

4.2 Testing of Endogeneity and Robustness

In this section, we explore the endogeneity of the main results and assess their robustness.

Firstly, there exists a complex interactive relationship between financial structure and systemic financial risk. It is possible that there is a bidirectional causal relationship between them. Moreover, financial structure is an endogenous variable in the transformation of industrial structure. And there might be a correlation between financial structure and industrial structure.

To address the endogeneity issue, we select other countries and regions that are in the same legal source group as China and calculate their financial structure indices. On this basis, construct the instrumental variables of the financial structure. This approach refers to the research results of Reference [74]. The legal sources of a country usually stem from early historical reasons and cannot have a direct impact on the choice of foreign capital entry methods in that country, and thus are exogenous. The specific calculation formula is:

$$\text{fstr}_{kt}^{\text{IV}} = \sum_{\text{OT} \neq \text{CHN}} (\text{fstr}_{st}^{\text{OT}} \times \text{SI}_t^{\text{CHN-OT}}) \times w_{\text{CHN}kt}, \quad (25)$$

where $\text{fstr}_{kt}^{\text{IV}}$ represents the financial structure index of other countries (France, Germany, Italy, and Spain) that belong to the German source group in the civil law system along with China. The data is sourced from the Global Financial Development database of the World Bank. $\text{SI}_t^{\text{CHN-OT}}$ represents the similarity of per capita GDP between China and other countries in the group. Among them, $\text{SI}_t^{\text{CHN-OT}} = 1 - \left(\frac{\text{PCG}_t^{\text{CHN}}}{\text{PCG}_t^{\text{CHN}} + \text{PCG}_t^{\text{OT}}} \right)^2 - \left(\frac{\text{PCG}_t^{\text{OT}}}{\text{PCG}_t^{\text{CHN}} + \text{PCG}_t^{\text{OT}}} \right)^2$ and the data is derived from the World Development Indicators database of the World Bank. The reason for choosing the similarity of per capita GDP between China and other countries as the weight is that the more similar the economic development level of a country is to that of China, the more likely it is to have a similar financial structure to China. $w_{\text{CHN}kt}$ is the adjusted weight coefficient matrix. The proportion of the number of head offices of banks in various provinces and cities in China to the national total in 1936 is selected for measurement. The data is sourced from the “National Bank Yearbook (1936)”. And then, we perform regression analysis using the two-stage GMM instrumental variable method to conduct endogeneity tests.

The regression results, present in column (1) of Table 4, indicate that the transmission effect of industrial structure remains significant, suggesting that its influence is not affected by endogeneity issues. These findings provide robustness to our research conclusions. The F-statistic of the weak instrumental variable test (21.35) is greater than that of empirical rule (10), indicating that there is no problem of weak instrumental variables. To sum up, after considering the potential endogeneity problem, the benchmark regression results of this paper still hold.

Secondly, for robustness testing, different from the entropy weight method mentioned earlier, we calculate the average values of the relative size, relative vitality, and relative efficiency of the financial structure. The results are reported in column (2) of Table 4.

Thirdly, replacing the explained variable to conduct a robustness test. On the one hand the CRITIC weighting method is used to measure the financial structure index again. On the other hand, considering the impact of shadow banking on the financial market, the scale of shadow banking should be increased within the existing financial risk system. Drawing on the research of Reference [75], the scale of shadow banking in a province is the sum of entrusted loans, trust loans, and undiscounted bank acceptance bills in the province’s social financing scale. The results are reported in column (3) and (4) of Table 4. It can be observed that the impact of industrial structure on systemic financial risk remains significant, reinforcing the robustness of our research results.

Fourthly, in terms of upgrading the industrial sector, the development of tertiary industries reflects the advanced industrial form. Thus, according to Reference [76], the extent of industrial structural is assessed by the contribution of the tertiary industry to the economy. The results are shown in column (5) of Table 4. It can be known that the transmission effect of the industrial structure still exists significantly.

Fifthly, to mitigate the potential influence of data outliers, we conduct regression analysis

Table 4 The result of endogenetic processing and robustness testing

Vari- ables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
fs	0.1631* (1.50)			0.1070*** (3.89)	0.1021*** (3.85)	0.0921*** (3.64)	0.0876** (2.35)	0.2565** (2.39)	0.1005*** (3.85)
fs1		0.0082*** (5.86)							
fs2			0.0158*** (4.91)						
indus- trials	0.0623*** (5.19)	0.0269*** (2.87)	0.0305*** (3.21)	0.3237*** (3.21)		0.0199** (2.11)	0.0427*** (2.96)	0.1922 (1.62)	0.0267*** (2.79)
indus- trials1					0.0459 (0.64)				
crisis							0.1414*** (3.20)		
zgxg									0.1414*** (3.20)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Area	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Con- stant		0.3627 (0.92)	0.3712 (0.93)	0.5250 (1.24)	0.5866 (1.45)	0.2402 (0.63)	0.3282 (0.50)	-7.3172* (-1.67)	0.5218 (1.30)
Obser- vation	527	527	527	527	527	527	372	527	527
R^2	0.6373	0.8031	0.7990	0.7911	0.7920	0.8036	0.7332		0.772
First- stage	21.35								
Sobel		0.0048***	0.0103***	0.5321***	0.0340***	0.0448***	0.0541***		0.554***

Note: Column (1) of Table 4 shows the endogenous processing results. Columns (2)–(9) are the regression results of the robustness test. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. The T statistics are in parentheses.

on all continuous variables after applying a 1% truncation process. The regression results are reported in column (6) of Table 4. It can be observed that the transmission effect of industrial structure has been examined and supports our previous conclusion.

Sixthly, the influence of exogenous shocks is controlled. The sample intervals of this article include crisis periods such as the international financial crisis and the COVID-19 pandemic. To avoid interference from the crisis event on our research conclusions, this paper constructs the dummy variable (crisis) representing the crisis period. For the years 2007–2009 and 2020–2022, the value of crisis is 1, while for other years it is 0. The regression results are displayed in column (7) of Table 4. It can be observed that after controlling for the potential impact during

the crisis period, the transmission effect of industrial structure persists, which is consistent with the previous findings.

Seventhly, the system GMM model is used for regression to alleviate the bias caused by omitted variables. The regression results are shown in column (8) of Table 4. It can be found that the transmission mechanism of the industrial structure still exists significantly, and the regression results in the previous text are robust.

Finally, the Guiding Opinions on Regulating the Asset Management Business of Financial Institutions were jointly issued by the People's Bank of China, the China Banking and Insurance Regulatory Commission, the China Securities Regulatory Commission and the State Administration of Foreign Exchange on April 27, 2018. On the one hand, its implementation directly compresses the off-balance sheet business of banks, alters the asset allocation behavior of financial institutions, and leads to significant changes in the financial structure. On the other hand, its implementation may trigger liquidity risks in the short term, but reduce the risks of shadow banking in the long term. At the same time, its introduction has a strong exogenous nature, is a national regulatory policy shock, and has nothing to do with the risks of individual financial institutions, making it suitable to be used as a control variable. Therefore, referring to Reference [77], we generate a time dummy variable with 2018 as the dividing point, setting the values from 2006 to 2017 as 0 and from 2018 to 2022 as 1. The empirical analysis results are in column (9) of Table 4. The conclusion remains consistent with the previous text.

4.3 Heterogeneity Analysis

This section mainly analyzes the heterogeneity of the transmission effect of industrial structure from the perspectives of industrial structure transformation, urban agglomerations and economic development level. The aforementioned key findings generally hold after splitting the whole panel into the two sub-panels.

Construct indicators for the industrial structure rationalization and upgrading, and analyze the heterogeneous impact of the financial structure on system financial risk through different transmission paths. The industrial structure rationalization uses the Theil index (industrials1). The proportion of the tertiary industry to primary industry plus secondary industry is used for the industrial structure upgrading (industrials2). The results are shown in columns (1) and (2) of Table 5. It can be found that the Sobel test for the industrial structure rationalization is not significant, while the Sobel test for the industrial structure upgrading is significant. Rationalization emphasizes the coordinated development among industries, while high-end development focuses on the upgrading and high-endization of industries. Because they reflect different characteristics of the industrial structure, the paths and degrees of influence on the dependent variable are also different, thereby leading to differences in the transmission effect. Furthermore, this also indicates that the impact of the financial structure on systemic financial risk is more focused on the trend of industries developing towards high-end and technology-intensive directions. This means that the allocation effect of financial resources in supporting the industrial structure has a more crucial impact on systemic financial risk.

Table 5 Results of heterogeneity analysis

Variables	(1)	(2)	(3)	(4)	(5)	(6)
fs	0.0998*** (3.81)	0.0959*** (3.67)	0.1114*** (2.60)	0.0859*** (2.71)	0.0876*** (2.67)	0.0605*** (3.38)
industrials			0.0261* (1.83)	0.0302** (2.18)	0.0213 (1.71)	0.0680 (1.35)
industrials1	0.0500* (1.67)					
industrials2		0.0359*** (2.74)				
cs	-0.0339 (-0.82)	-0.0319 (-0.77)	-0.0240 (-0.38)	-0.0338 (-0.57)	-0.0156 (-0.32)	0.0869 (0.60)
el	5.1604*** (4.22)	6.7245*** (5.12)	5.9324*** (2.71)	8.1090*** (4.98)	5.5963*** (3.37)	14.2000*** (5.09)
rcl	-0.0764** (-2.22)	-0.0583 (-1.77)	-0.0578 (-1.16)	-0.0684 (-1.35)	-0.0613 (-1.61)	0.0140 (0.19)
urig	0.0598*** (3.21)	0.0458*** (2.60)	0.0447* (1.88)	0.0600** (2.11)	0.0513*** (2.65)	0.1340* (1.67)
ad	0.0000 (0.61)	0.0000 (0.50)	0.0000 (0.39)	0.0000 (1.17)	0.0000 (0.21)	0.0001 (1.57)
la	15.8131** (3.72)	19.0720** (4.26)	20.2378** (3.18)	-6.3482 (-0.37)	17.6107*** (3.33)	-248.9850** (-1.81)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Area	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.7616 (1.83)	0.5637 (1.40)	0.6051 (1.08)	0.8399 (1.13)	0.5971 (1.25)	-1.1791 (-0.79)
Observations	527	527	323	204	425	102
R ²	0.7930	0.7951	0.7493	0.8967	0.7835	0.9022
Sobel test	-0.0016	0.1190***	-0.0209**	0.1246***	-0.0257***	0.1759***
Chow test			3.84***		5.28***	

Note: Column (1) of Table 5 is the result of the industrial structure rationalization. Column (2) is the result of the industrial structure upgrading. Column (3) is the result of the conduction effect of non-urban agglomeration industrial structure, while column (4) is the result of urban agglomeration. Column (5) is the result of the transmission effect of industrial structure in cities with lower economic development level, while column (6) is the result of cities with higher economic development level. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. The T statistics are in parentheses.

The sample is divided into urban and non-urban agglomerations for regression analysis. The urban agglomerations include Beijing-Tianjin-Hebei, Yangtze River Delta, Chengdu-Chongqing, Pearl River Delta, and the middle reaches of the Yangtze River, involving Beijing, Tianjin, Hebei, Shanghai, Jiangsu, Zhejiang, Sichuan, Chongqing, Guangdong, Hunan, Hubei and Jiangxi

provinces. The remaining 19 provinces are non-urban agglomerations. The same classification is adopted by References [78, 79] during their research process. The Chow test yields a significant result at the 1% level, and the specific outcomes are presented in columns (3) and (4) of Table 5. Compared with non-urban agglomerations, it is evident that the transmission effect of industrial structure is significant in urban agglomerations. This implies that the role of industrial structure in the process of financial structure impacting systemic financial risk exhibits notable differences. One possible explanation for this disparity is that the unique economic agglomeration characteristics and financial deepening mechanism of urban agglomerations. Urban agglomerations form a close economic network through industrial synergy and efficient allocation of factors, making the development of industrial structure more sensitive to the financial structure and thereby amplifying its transmission effect on system financial risk. The policy synergy advantages of urban agglomerations will enhance the linkage effect between industrial policies and financial supervision, making the intermediary path of industrial structure for system financial risk clearer. In contrast, the industrial layout of non-urban agglomeration provinces is relatively scattered, and financial resources rely more on traditional bank credit. The feedback mechanism of industrial structure on financial structure is relatively weak, resulting in financial risk being less affected by local industrial transformation. As a result, the transmission effect of industrial structure is more pronounced in urban agglomerations.

Per capita GDP reflects the economic development achievements of a region and the degree of prosperity of its residents. Provinces with high per capita GDP tend to have an excellent industrial structure, with a high proportion of service industries and high-tech industries. Provinces with low per capita GDP are mostly dominated by traditional industries, with relatively low technological levels and labor productivity, and the input-output efficiency of factors is not high. According to the per capita GDP of 31 provinces, the sample is divided into two groups based on the level of economic development: low-level and high-level by K-means clustering method. The high economic development group includes Beijing, Shanghai, Tianjin, Fujian, Jiangsu and Zhejiang. The remaining 25 provinces are in the low economic development level group. The regression results can be found in columns (5) and (6) of Table 5. Furthermore, a Chow test is conducted to examine the differences between the grouped regression results. The test yielded a significant result (Chow test value of 5.28, significant at the 1% level), indicating that the coefficients between the groups can be compared. It is evident that the transmission effect of industrial structure is significantly present in the high-level economic development group. This implies that the role of industrial structure in the process of financial structure influencing systemic financial risk exhibits notable differences across different levels of economic development. It is possible that the high-level economic regions possess stronger economic strength and a more developed financial system compared to the low-level economic regions. The upgrading of industrial structure in these areas can receive support in terms of talent, funding, and favorable conditions. Therefore, the transmission effect of industrial structure is more pronounced in regions with a higher level of economic development.

4.4 Analysis Considering Efficient Market and Effective Government

This section aims to investigate whether the transmission role of industrial structure in the impact of financial structure on systemic financial risk is influenced by efficient market and effective government. According to References [80, 81], we use the proportion of market-allocated economic resources from China's marketization index to measure efficient markets (em). Referring to Reference [82], effective government (eg) is quantified by the ratio of fiscal expenditure to GDP.

What is the joint regulatory effect of efficient market and effective government on the transmission effect of industrial structure? The model 72 of Hayes' PROCESS macro for SPSS^[83] is used for analysis. With one standard deviation above or below the average, the efficient market and effective government are divided into three levels respectively, for further analysis. The transmission effects under different levels of efficient market and effective government are presented in Table 6. It is found that the combined effect of the efficient market and effective government has a significant impact on the transmission effect of industrial structure. Specifically, on the one hand, when the degree of effective government is certain, the transmission effect of the industrial structure will increase with the growth of efficient market. This indicates that the improvement of the efficient market can promote the upgrading of the industrial structure while reducing the level of potential risk. On the other hand, when the level of efficient market remains unchanged, excessive government intervention will reduce the transmission effect of the industrial structure. When the government's intervention in the market is too high, the transmission effect of the industrial structure fails to pass the statistical test.

Table 6 The result of the transmission effect of efficient market and effective government on industrial structure

	Efficient market	Effective government	Effect	BootSE	BootLLCI	BootULCI
		M-1SD	0.036	0.0106	0.0152	0.0568
Financial	M-1SD	M	0.025	0.0086	0.0082	0.0418
structure →		M+1SD	0.0065	0.0089	-0.0111	0.0241
industrial		M-1SD	0.0419	0.0081	0.026	0.0578
structure →	M	M	0.0288	0.0065	0.016	0.0416
systemic		M+1SD	0.0067	0.009	-0.011	0.0245
financial		M-1SD	0.0446	0.0086	0.0278	0.0615
risk	M+1SD	M	0.0305	0.0071	0.0166	0.0445
		M+1SD	0.0068	0.0099	-0.0127	0.0263

Note: M-1SD indicates low levels. M stands for medium level. M+1SD indicates a high level.

It is worth noting that when effective government is at a high level, the impact of the industrial structure transmission effect is not significant regardless of efficient market. This phenomenon can be explained by several reasons. Firstly, excessive government intervention may lead to unreasonable allocation of market resources. Resources flow to industries that do

not have competitive advantages, rather than to efficient and competitive industries selected by the market. The misallocation of resources may cause a disconnect between the financial system and the real economy, thus reducing the impact of the financial structure on the industrial structure. Secondly, excessive government intervention in the market may cause market distortion. Enterprises may take excessive risks with government support, which may lead to risk management loopholes in enterprises and financial institutions, and exacerbate the accumulation of systemic financial risk. At this point, financial markets are not fully reflecting the risks and conditions in the real economy. The impact of financial structure changes on industrial structure will be restricted. Thirdly, excessive intervention in the market may lead to a loss of confidence among market participants. In this case, the government will take some measures to adjust the industrial structure or the financial structure. However, market participants may have doubts about the long-term sustainability and effectiveness of policies, thus diminishing their impact on markets.

5 Conclusion and Policy Implications

In summary, this study utilized a sample of 31 provinces in China from 2006 to 2022 to examine the relationship between financial structure, industrial structure and systemic financial risk. The main findings are as follows. Firstly, the impact of financial structure on systemic financial risk operates indirectly through the mediating effect of industrial structure, following the mechanism of “financial structure $\rightarrow$ industrial structure $\rightarrow$ systemic financial risk”. Secondly, there is significant heterogeneity in the transmission effect of industrial structure, with a more pronounced effect observed in areas characterized by high levels of economic development and belonging to mature clusters. Lastly, the transmission effect of industrial structure is influenced by efficient market and effective government. The improvement of efficient market can promote the upgrading of industrial structure and increase the level of potential risks. Excessive government intervention will reduce the transmission effect of industrial structure.

Based on the research results, the following policy suggestions are put forward.

Firstly, guide policy-based financial institutions to increase support through national development plans. At the same time, combine tax and fee cuts with the innovation-driven development strategy to provide targeted subsidies for strategic emerging industries, promoting industrial structure upgrading and the elimination of inefficient production capacity. In addition, attention should be paid to the adaptability of financial structure adjustment to supply-side structural reform to ensure that the allocation of financial resources is in line with the orientation of national industrial policies.

Secondly, in response to the regional development differences under the new urbanization strategy, classified guidance should be implemented:

Relying on the advantages of industrial synergy and financial agglomeration, urban agglomerations, under the framework of the financial regulatory sandbox, explore diversified financing tools such as technology finance and green bonds to support the upgrading of high-tech indus-

tries. At the same time, a cross-regional financial risk prevention and control mechanism led by the central bank and local financial regulatory authorities should be established.

For non-urban agglomeration areas, the focus should be placed on enhancing the credit efficiency of traditional banks. Through special loans from policy banks increase support for infrastructure and traditional industry transformation, and avoid simply copying the high-risk financing model of urban agglomerations. During this process, it is necessary to pay attention to aligning with the rural revitalization strategy and the regional coordinated development strategy, and ensure that the downward flow of financial services is in line with the local industrial foundation.

Lastly, grasp the reasonable boundaries of government intervention in policy-making. On the one hand, the negative list system is adopted to reduce excessive intervention in the market and ensure the autonomous regulatory function of the market mechanism. On the other hand, it is necessary to enhance data analysis and evidence support for policy implementation to ensure that government supervision not only conforms to the new development concepts but also follows the policy transmission path of “top-level design - local pilot - national promotion”. This can prevent the distortion of market signal transmission and achieve the organic unity of efficient market and effective government.

This study provides important insights into the relationship between financial structure, industrial structure, and systemic financial risk, but several limitations should be acknowledged. Firstly, the sample coverage is limited to China’s provincial-level data, which may not fully capture cross-country variations in financial systems and economic structure. Secondly, while we have controlled for major economic shocks, the rapid emergence of digital finance and its disruptive impact on traditional financial structure warrants further investigation. Future research should expand in two directions: 1) conducting cross-country comparative studies to test the generalizability of our findings, particularly in economies with different financial architectures; and 2) incorporating digital financial indicators to examine how fintech innovations modify the risk transmission mechanisms. These extensions would significantly enhance our understanding of the structural determinants of financial stability in the evolving global financial landscape.

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