

THE IMPACT OF FINANCIAL AGGLOMERATION ON REGIONAL FINANCIAL RESILIENCE IN CHINA: AN EMPIRICAL TEST BASED ON PROVINCIAL PANEL DATA

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Abstract: Based on panel data of 30 Chinese provinces from 2015 to 2024, this study measures financial agglomeration using the location quotient method and constructs a composite index of regional financial resilience via the entropy method across three dimensions—resistance and recovery, adaptation and adjustment, and innovation and transformation. A two-way fixed effects model is employed to empirically examine the impact of financial agglomeration on regional financial resilience and its regional heterogeneity. The results show that: (1) Financial agglomeration exerts a significantly positive effect on regional financial resilience; a one-unit increase in the agglomeration level is associated with a 0.021-unit increase in resilience. (2) This effect exhibits significant regional heterogeneity: the eastern region experiences the strongest promotional effect (coefficient = 0.051), whereas the central and western regions show negative and insignificant effects. The siphon effect is identified as the core mechanism explaining why the central and western regions fail to benefit from financial agglomeration. (3) The core conclusions remain robust after excluding exceptional years, adding control variables, and employing instrumental variable approaches. Accordingly, policy recommendations are proposed for optimizing the spatial layout of finance, implementing differentiated regional financial policies, and deepening the integration of industry and finance.

Keywords: Financial agglomeration; Regional financial resilience; Provincial panel data; Empirical test

1 INTRODUCTION

Financial agglomeration serves as a core vehicle for the optimal allocation of financial resources and plays a pivotal role in enhancing regional financial resilience and fortifying the financial security shield. Since the proposal of the coordinated regional development strategy, China's regional financial development landscape has evolved continuously; however, the imbalance of financial resource distribution characterized by "high in the east, low in the central and western regions" remains pronounced. Meanwhile, heightened volatility in global financial markets and frequent external shocks continue to test regional financial stability, making financial resilience an essential gauge of a regional financial system's capacity to withstand and recover from shocks. Against this backdrop, how financial agglomeration affects regional financial resilience—and whether such effects exhibit regional heterogeneity—has emerged as a research question of both theoretical value and policy relevance.

Theoretically, financial agglomeration can enhance regional financial resilience through mechanisms such as economies of scale, information spillovers, and risk diversification [1]. The concept of resilience has evolved from Holling's (1973) engineering resilience through Walker et al.'s (2004) multi-dimensional framework to Martin's (2010) regional economic resilience[2-4]. Chinese scholars have further advanced resilience research along two dimensions: measurement indicators and influencing factors[5-6]. However, findings on the relationship between financial agglomeration and financial resilience remain divergent. Wang and Zhao et al. (2025) find an inverted U-shaped relationship between financial agglomeration and urban financial resilience, along with positive spatial spillovers[7]; Gao (2024) reports the strongest effect in the central region[8]; Wu (2025) verifies local promotional and positive spillover effects[9]; and Su (2021) identifies two mediating pathways—industrial structure optimization and financial efficiency improvement[10]. The crux of these discrepancies lies in: Why does financial agglomeration in the central and western regions fail to effectively empower financial resilience? How does the net outflow of resources driven by the siphon effect weaken local financial resilience? Existing research has yet to provide an in-depth examination of these questions.

In light of the above, this study employs the latest provincial panel data from 2015 to 2024, applies instrumental variable methods to address endogeneity, and explains the underlying mechanisms of regional heterogeneity from the perspective of the siphon effect, thereby providing empirical evidence for optimizing the spatial layout of finance and implementing differentiated financial policies.

2 THEORETICAL ANALYSIS AND RESEARCH HYPOTHESES

2.1 Theoretical Mechanisms Through Which Financial Agglomeration Promotes Regional Financial Resilience

Financial agglomeration can enhance regional financial resilience through three pathways: economies of scale, information spillovers, and risk diversification. First, economies of scale: the spatial concentration of financial resources helps reduce transaction costs and improve credit allocation efficiency; regions with dense financial institutions are more

likely to form specialized financial service networks, thereby strengthening the resource allocation capacity of the financial system. Second, information spillovers: financial agglomeration facilitates information sharing and knowledge diffusion among financial institutions, mitigates information asymmetry, and improves risk identification and pricing efficiency, enabling the financial system to adjust more rapidly in response to external shocks. Third, risk diversification: the spatial concentration of financial institutions is conducive to building diversified risk-sharing mechanisms, reducing the systemic impact of individual shocks through portfolio investment and risk hedging. Accordingly, we propose: Hypothesis 1: Financial agglomeration exerts a significantly positive effect on regional financial resilience in China.

2.2 Regional Heterogeneity in the Resilience Effect of Financial Agglomeration

Significant differences exist across China's eastern, central, and western regions in terms of economic development, financial market maturity, and industrial foundations, such that the impact of financial agglomeration on financial resilience exhibits regional heterogeneity. The eastern region, with its robust economic foundation and well-developed financial system, can fully release the positive effects of financial agglomeration through channels such as economies of scale, information spillovers, and risk diversification, thereby significantly enhancing regional financial resilience. In contrast, the central and western regions, with relatively weak financial foundations, may experience a siphon effect from financial agglomeration—financial resources concentrate toward core cities in the east, resulting in a net outflow of financial resources from the central and western regions. The absorptive capacity of local financial institutions is insufficient to translate agglomeration effects into resilience improvements; in some cases, resource outflows may even weaken local financial resilience. Accordingly, we propose:

Hypothesis 2: The impact of financial agglomeration on regional financial resilience in China exhibits significant regional heterogeneity, with the strongest positive effect in the eastern region and weaker or insignificant effects in the central and western regions.

3 RESEARCH DESIGN

3.1 Variable Selection

- (1) Dependent variable: Regional financial resilience (Resil).
- (2) Core independent variable: Financial agglomeration level (Fagg).
- (3) Control variables: Drawing on existing research in the field of financial resilience, three control variables are selected to account for factors other than financial agglomeration that may affect regional financial resilience, as detailed below (Table 1):

Table 1 Variable Definitions

Type	Variable Name	Symbol	Definition
Dependent variable	Regional financial resilience	Resil	Composite index calculated using the entropy method
Independent variable	Financial agglomeration level	Fagg	Measured by the location quotient index
Control variable	Gross domestic product	GDP	Gross domestic product
Investment level	Inv	Total fixed asset investment / GDP	
Government intervention	Gov	Fiscal expenditure / GDP	

Note: t-statistics in parentheses; ***p < 0.01, **p < 0.05, *p < 0.10.

3.2 Data Sources

This study employs panel data from 30 Chinese provinces (excluding Xizang due to severe data deficiencies) over the period 2015–2024, yielding 300 observations. Data are sourced from provincial statistical yearbooks, the National Bureau of Statistics, and the official website of the People's Bank of China.

3.3 Model Specification

Based on the results of the F-test and the Hausman test, a two-way fixed effects model is selected as the baseline regression model to examine the impact of financial agglomeration on regional financial resilience. The model is specified as follows:

$$Resil_{it} = \alpha_0 + \alpha_1 Fagg_{it} + \alpha_2 \ln gdp_{it} + \alpha_3 inv_{it} + \alpha_4 gov_{it} + \lambda_i + \mu_t + \varepsilon_{it} \quad (1)$$

where $Resil_{it}$ denotes the regional financial resilience level of province i in period t ; $Fagg_{it}$ is the core independent variable; $\ln gdp_{it}$, inv_{it} , and gov_{it} represent the gross domestic product (in logarithm), investment level, and government intervention of province i in period t respectively; subscripts i and t index the province and year, respectively; α_0 is the constant term; α_1 through α_6 are the corresponding parameters; λ_i and μ_t denote individual fixed effects and time fixed effects respectively; and ε_{it} is the random error term.

4 EMPIRICAL RESULTS

4.1 Descriptive Statistics

As shown in Table 2, the financial agglomeration level (*fagg*) has a mean of 0.996, a standard deviation of 0.420, a minimum of 0.480, and a maximum of 2.510, indicating substantial variation across regions—the location quotients of financial centers such as Beijing and Shanghai consistently exceed 2.0, whereas provinces like Hunan and Henan fall below 0.6, reflecting a pronounced "high in the east, low in the central and western regions" pattern. The regional financial resilience (*resil*) has a mean of 0.369, a minimum of 0.105, and a maximum of 1.000, likewise exhibiting notable inter-provincial variation. In terms of economic significance, the standard deviation of *fagg* is 0.420, implying that a one-standard-deviation change in financial agglomeration corresponds to a resilience change of approximately 0.009 units, representing about 2.4% of the *resil* mean (0.369). This suggests that financial agglomeration makes a stable yet moderate marginal contribution to resilience.

The correlation between *fagg* and *resil* is significantly positive at the 1% level ($r = 0.748$), providing preliminary support for the positive effect. *lngdp* exhibits the highest correlation with *resil* ($r = 0.934$), indicating that economic scale constitutes an important foundation for financial resilience. Notably, *inv* and *gov* are highly positively correlated ($r = 0.844$), suggesting that regions with higher fixed asset investment also tend to have larger government expenditures, potentially driven by common policy factors. The variance inflation factor (VIF) test shows that all variables have VIF values below 10 (Mean VIF = 2.866), ruling out severe multicollinearity and laying the groundwork for subsequent regression analyses.

Table 2 Descriptive Statistics and Correlation Matrix

Variable	Mean	SD	Min	Max	(1)	(2)	(3)	(4)	(5)
(1) <i>resil</i>	0.369	0.185	0.105	1.000	1.000				
(2) <i>fagg</i>	0.996	0.420	0.480	2.510	0.748***	1.000			
(3) <i>lngdp</i>	11.104	0.431	10.199	12.338	0.934***	0.588***	1.000		
(4) <i>inv</i>	0.365	0.243	0.042	1.042	-0.236***	-0.493***	-0.242***	1.000	
(5) <i>gov</i>	0.098	0.045	0.022	0.199	-0.275***	-0.442***	-0.348***	0.844***	1.000

Note: *** denotes significance at the 1% level.

4.2 Baseline Regression

Table 3 reports the baseline regression results. After progressively adding control variables, the coefficient on the core independent variable *fagg* remains consistently significant. In the two-way fixed effects model (Column 3), the regression coefficient of *fagg* is 0.021, significant at the 1% level ($t = 4.577$), indicating that a one-unit increase in financial agglomeration is associated with a 0.021-unit increase in regional financial resilience, thus supporting Hypothesis H1.

In terms of economic significance, although the *fagg* coefficient of 0.021 may appear modest, it must be interpreted in the context of the variable scale: raising the location quotient from 0.6 (typical of central and western provinces) to 1.5 (approaching the eastern average) would increase resilience by approximately 0.019 units, which represents 5.1% of the *resil* mean—an effect of practical significance in provincial panel data. Comparing the individual fixed effects model (*fagg* coefficient = 0.042) reveals that part of the positive effect is attributable to time trends; however, the net effect remains significantly positive (0.021) after controlling for time effects, indicating that the promotional effect of financial agglomeration on financial resilience is not solely driven by macroeconomic upturns but reflects an independent marginal contribution. The model achieves a high overall goodness of fit (Adj. $R^2 = 0.985$), indicating that the two-way fixed effects model adequately explains the variation in the data.

The investment level (*inv*) is significantly positive (0.026, at the 5% level) after controlling for time effects, consistent with the logic that fixed asset investment stimulates economic circulation and strengthens the financial system's shock-absorbing capacity. The government intervention variable (*gov*) is insignificant (0.065, $t = 0.733$), suggesting that fiscal expenditure has limited direct impact on financial resilience, possibly because government spending is primarily directed toward infrastructure and social welfare, with indirect and lagged effects on the financial system's functional capacity. Economic scale (*lngdp*) is significantly positive at the 1% level (0.050), indicating that regions with larger economies possess a more robust foundation for financial resilience.

Table 3 Baseline Regression Results

Variable	(1)	(2)	(3) Two-way FE	(4) Individual FE
<i>fagg</i>	0.023*** (4.814)	0.021*** (4.577)	0.021*** (6.609)	0.042*** (6.609)
<i>lngdp</i>	0.049*** (3.683)	0.047*** (3.609)	0.050*** (60.401)	0.267*** (60.401)
<i>inv</i>	0.028** (2.386)	0.026** (2.182)	-0.009 (-0.479)	
<i>gov</i>	0.065 (0.733)	0.218* (1.762)		
<i>cons</i>	-0.266* (-1.840)	-0.261* (-1.825)	-0.293* (-45.278)	-2.653*** (-45.278)

N	300	300	300	300
Adj. R ²	0.985	0.985	0.985	0.962
Province FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	No

Note: t-statistics in parentheses; ***p < 0.01, **p < 0.05, *p < 0.10.

4.3 Heterogeneity Test

To further uncover regional differences in the resilience effect of financial agglomeration, the sample is partitioned into eastern, central, and western regions for subgroup regressions, with results reported in Table 4. The fagg coefficient for the eastern region is 0.051, significant at the 1% level ($t = 5.414$), representing the strongest promotional effect—more than double the national estimate (0.021)—indicating that the positive mechanisms of economies of scale, information spillovers, and risk diversification are fully operative in the eastern region. The central region yields a coefficient of -0.009 ($t = -1.539$), and the western region -0.001 ($t = -0.305$), both insignificant. Hypothesis H2 is thus supported.

Why is the promotional effect of financial agglomeration in the east more than twice the national average? The core reason lies in the self-reinforcing cycle of financial agglomeration that has taken hold in the eastern region: dense financial institutions → abundant information spillovers → efficient credit allocation → accessible corporate financing → enhanced economic vitality → further attraction of financial institutions. Financial agglomeration in cities such as Beijing and Shanghai has surpassed threshold effects, exhibiting increasing marginal returns to agglomeration. By contrast, the central and western regions, with their relatively weak financial foundations, not only fail to generate effective economies of scale and information spillovers through agglomeration but also suffer from the siphon effect, whereby financial resources flow net toward the east. The absorptive and innovative conversion capacity of local financial institutions in the central and western regions is insufficient to translate agglomeration effects into resilience improvements; resource outflows may even weaken local resilience—a conjecture consistent with the negative direction of the fagg coefficient in the central region (-0.009), which, although not statistically significant, suggests that the siphon effect may be eroding financial resilience in the central region.

The regional differentiation of control variables warrants further interpretation. First, lngdp is significantly positive in the eastern (0.186*) and central (0.034) regions but significantly negative in the western region (-0.056^*), implying structural impediments to the conversion of economic growth into financial resilience in the west—total economic output expansion has not effectively translated into the financial system's shock-absorbing capacity, likely because the western economy is dominated by resource-based industries and the financial system remains underdeveloped, making it difficult for economic increments to feed into financial functional improvements. Second, inv is significantly positive in the central and western regions (0.055* and 0.051*) but insignificant in the east (0.012), indicating that capital formation remains an important pillar for resilience improvement in the central and western regions, whereas the eastern region's financial resilience depends more on financial agglomeration per se rather than fixed asset investment. Third, gov is significantly negative in the western region (-0.287^*), suggesting that excessively large government expenditure may crowd out market-based financial resource allocation, exerting a suppressive effect on financial resilience.

Table 4 Heterogeneity Test Results

Variable	Baseline	Eastern	Central	Western
fagg	0.021*** (4.577)	0.051*** (5.414)	-0.009 (-1.539)	-0.001 (-0.305)
lngdp	0.050*** (3.677)	0.186*** (4.628)	0.034** (2.298)	-0.056^* (-3.601)
inv	0.026** (2.182)	0.012 (0.421)	0.055*** (4.434)	0.051*** (3.344)
gov	0.065 (0.733)	-0.014 (-0.085)	-0.252 (-1.381)	-0.287^* (-3.398)
cons	-0.293^* (-1.957)	-1.694^* (-3.813)	-0.141 (-0.829)	0.781*** (4.718)
N	300	110	80	110
Adj. R ²	0.985	0.986	0.996	0.996

Note: t-statistics in parentheses; ***p < 0.01, **p < 0.05, *p < 0.10.

4.4 Robustness Checks

To ensure the reliability of the baseline regression conclusions, three robustness checks are conducted (results reported in Table 5).

First, the exceptional years of the COVID-19 pandemic (2020–2022) are excluded. Abnormal economic fluctuations during the pandemic may have introduced confounding effects on the relationship between financial agglomeration and financial resilience. After exclusion, the fagg coefficient is 0.020*** ($t = 3.362$), consistent with the baseline model, confirming that the core finding is not driven by extreme periods.

Second, the logarithm of the number of industrial enterprises above designated size (lnequ) is added as a control variable. The scale of microeconomic agents in a region simultaneously affects financial agglomeration and regional financial resilience; regions with more large-scale enterprises are not only more prone to financial resource agglomeration but also

possess more shock-resistant economic structures. After inclusion, the fagg coefficient becomes 0.024*** ($t = 4.990$), a slight increase suggesting mild downward bias in the baseline estimate when enterprise scale is not controlled for, although the direction and significance remain unchanged.

Third, the logarithm of income level (lnwag) is added as a control variable. Resident income levels affect consumption market vitality and enterprise efficiency wage effects, which in turn influence regional financial resilience. After inclusion, the fagg coefficient is 0.021*** ($t = 4.581$), confirming the robustness of the conclusion.

All three checks demonstrate that the positive effect of financial agglomeration on regional financial resilience does not change substantively with variations in the sample period and control variable selection, supporting the robustness of the baseline regression conclusions.

Table 5 Robustness Checks

Variable	Baseline	Excl. 2020–2022	Adding lnequ	Adding lnwag
fagg	0.021*** (4.577)	0.020*** (4.990)	0.024*** (4.581)	0.021***
lngdp	0.050*** (3.677)	0.046** (2.582)	0.038*** (2.615)	0.038*** (2.830)
inv	0.026** (2.182)	0.028* (1.860)	0.020 (1.609)	0.022* (1.874)
gov	0.065 (0.733)	−0.029 (−0.243)	0.039 (0.442)	−0.010 (−0.111)
lnequ	0.009** (2.393)			
lnwag	0.058*** (3.628)			
_cons	−0.293* (−1.957)	−0.241 (−1.227)	−0.237 (−1.576)	−0.801*** (−3.955)
N	300	210	300	300
Adj. R ²	0.985	0.985	0.985	0.988
Province FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Note: t-statistics in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

4.5 Endogeneity Test

The baseline regression may be subject to endogeneity concerns arising from reverse causality and measurement error: financial agglomeration promotes financial resilience, but regions with stronger financial resilience may also attract greater financial resource agglomeration, creating bidirectional causality. To address this issue, the one-period lag of financial agglomeration (L.fagg) is employed as an instrumental variable, and two-stage least squares (2SLS) estimation is conducted.

The first-stage regression shows that the coefficient on L.fagg is 0.584* ($t = 8.590$), with an F-statistic of 220.27, far exceeding the empirical threshold of 10 for weak instruments, thereby satisfying the relevance condition of the instrument. In the second-stage regression, the fagg coefficient is 0.019* ($t = 2.582$), indicating that after controlling for endogeneity, financial agglomeration still exerts a significant causal promotional effect on regional financial resilience. Compared with the baseline coefficient (0.021), the 2SLS estimate is slightly lower (by approximately 9.5%), suggesting mild upward bias in the baseline OLS estimate—regions with stronger resilience do attract more financial resource agglomeration, inflating the OLS estimate—but the bias is limited in magnitude, and the direction and significance of the core conclusion remain unchanged. This result strengthens the credibility of the causal positive effect of financial agglomeration on regional financial resilience.

Table 6 Endogeneity Test (2SLS)

Variable	First Stage (fagg)	Second Stage (resil)
L.fagg	0.584*** (8.590)	
fagg	0.019*** (2.582)	
lngdp	−0.594*** (−3.346)	0.032* (1.875)
inv	−0.012 (−0.054)	0.008 (0.717)
gov	0.434 (0.418)	0.080 (1.014)
_cons	7.979*** (3.676)	0.431** (1.991)
N	270	270
F	220.272	11770.473

Note: t-statistics in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

5 CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1 Research Conclusions

Based on panel data of 30 Chinese provinces from 2015 to 2024, this study empirically examines the impact of financial agglomeration on regional financial resilience and its regional heterogeneity, yielding the following main conclusions: First, financial agglomeration significantly promotes regional financial resilience, supporting Hypothesis H1. The baseline regression shows that a one-unit increase in financial agglomeration raises regional financial resilience by 0.021 units ($t = 4.577$, $p < 0.01$). This conclusion remains robust after excluding COVID-19 pandemic years, adding control variables, and using instrumental variables to address endogeneity. Financial agglomeration indeed enhances the comprehensive capacity of regional financial systems to withstand shocks and recover, through mechanisms of economies of scale, information spillovers, and resource allocation optimization. The 2SLS estimate indicates approximately 9.5% upward bias in the baseline regression, yet the direction of the causal effect remains unchanged, reinforcing the credibility of the finding.

Second, the resilience-enhancing effect of financial agglomeration exhibits significant regional heterogeneity, supporting Hypothesis H2. The promotional effect is strongest in the eastern region (coefficient = 0.051*, $t = 5.414$), 2.4 times the national average, indicating that a self-reinforcing cycle of financial agglomeration has formed in the east with increasing marginal returns. The effects in the central and western regions are negative and insignificant (central: -0.009 , $t = -1.539$; western: -0.001 , $t = -0.305$). The siphon effect is the core mechanism: financial resources concentrate toward core eastern cities, resulting in net financial resource outflows from the central and western regions, where the absorptive and innovative conversion capacity of local financial systems is insufficient to translate agglomeration effects into resilience improvements. The regional differentiation of control variables further corroborates this judgment: the $\ln gdp$ coefficient in the western region is negative (-0.056^*), indicating that economic output expansion has failed to translate into financial resilience; inv is significantly positive in the central and western regions, confirming that capital formation remains the primary pillar of resilience improvement; and gov is significantly negative in the western region (-0.287^{***}), suggesting that government expenditure may crowd out market-based financial resource allocation.

5.2 Policy Recommendations

First, optimize the spatial layout of finance and facilitate the transition from "siphoning" to "radiation." Leverage the radiating and driving functions of international financial centers such as Beijing and Shanghai, and guide the rational diffusion of financial resources toward the central and western regions through mechanisms including cross-regional industrial investment funds, financial enclave cooperation, and branch network expansion. Cultivate regional financial growth poles in the central and western regions (e.g., Chengdu, Wuhan, Xi'an) to form a multi-tiered financial network and mitigate the siphon pressure of resource concentration toward the eastern pole.

Second, implement differentiated regional financial policies tailored to development stages. The eastern region should prioritize financial innovation and cross-border cooperation, strengthen risk spillover management, and facilitate orderly capital flows toward the central and western regions. The central region should enhance its capacity for financial cooperation and absorption, improve the efficiency of converting financial resources into resilience, and prioritize credit allocation to advanced manufacturing and green industries. The western region should focus on addressing financial infrastructure deficiencies, expanding digital financial coverage, lowering barriers to financial service access, and reversing the net outflow of financial resources.

Third, deepen the integration of industry and finance to unblock the transmission channel from financial agglomeration to financial resilience. Allocate financial resources precisely to industrial restructuring and technological innovation to strengthen regional economic recovery and transformation capacity; encourage financial institutions to develop diversified risk hedging products, improve regional risk-sharing mechanisms, and reduce the contagion risk from shocks to individual industries or enterprises; and establish a tiered, region-specific financial risk prevention and control system with inter-regional coordination to achieve synergistic enhancement of financial resilience.

The limitations of this study include: the exclusion of Xizang due to data constraints and the absence of extreme shock periods such as the 2008 Global Financial Crisis; the financial resilience index, constrained by data availability, does not incorporate dimensions such as digital financial penetration and financial institution interconnectedness; and the exploration of mediating mechanisms remains to be deepened—future research could introduce mediating effect models to test specific pathways such as industrial structure optimization and financial efficiency improvement and extend the analysis to the city or county level.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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