

The Impact Mechanism of Free Competition Among Financial Institutions on the Credit Accessibility of Farmers

-- A Study of Zhejiang Experience

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Abstract: Using data from rural fixed observation points in Zhejiang Province from 2003 to 2022, this study employs a difference-in-differences (DID) model to explore the impact of free competition among financial institutions on the credit accessibility of farmers and its underlying mechanisms. The results show that free competition among financial institutions significantly improves farmers' credit accessibility. The mechanism analysis indicates that such competition leads to an increase in the number of loan officers, promotes the marketization of certain financial functions, and enhances the dissemination of financial knowledge, thereby improving farmers' financial literacy and reducing financing constraints. Specifically, agricultural industrialization and digitalization both indirectly affect the relationship between free competition among financial institutions and farmers' credit accessibility. Based on these developments, financial institutions are able to provide more efficient and convenient financial services, contributing to the formation of a financial ecosystem. Further analysis reveals a noticeable "siphoning effect" of financial competition in Zhejiang Province, where it significantly promotes the growth of rural credit in the region while suppressing the growth of rural credit in neighboring areas. The study's conclusions offer both empirical insights into rural financial market reform from the perspective of policy changes and practical reference from the perspective of regional spillovers for the development of rural finance.

Keywords: Free Competition Among Financial Institutions, Financing Constraints, Difference-in-Differences, Spatial Durbin Model.

1. Introduction

The development of rural finance can promote agricultural growth, increase farmers' income, and revitalize the rural economy by optimizing financial services and resource allocation, thus achieving coordinated urban-rural economic development. After China transitioned to a socialist market economy, rural financial reforms, under the guidance of policy directions, have provided strong financial support for the development of the "Three Rural Issues" (agriculture, rural areas, and farmers). However, the institutional mechanisms of rural financial institutions in China are still incomplete, and credit supply faces multiple barriers. On one hand, there are insufficient rural financial institutions, leading to insufficient competition. In many regions, rural credit cooperatives and rural commercial banks have nearly monopolized the market. Moreover, financial products and services are lacking in diversity, and operational efficiency is low (Chen Xiao-zhi, 2024; Pan Yan-yan, 2019; Wen Tao, 2023). On the other hand, credit interest rates have long been strictly controlled, resulting in interest rates remaining at low levels, which prevents financial institutions from implementing differentiated interest rate policies (Peng Peng, 2022; Wu Ben-jian, 2022). Financial development theory suggests that one of the main indicators of financial liberalization is interest rate marketization. The theory of financial constraints also argues that appropriate market intervention can effectively promote financial development, thus achieving economic growth. However, in the rural financial market, does the government's moderate

intervention to achieve interest rate liberalization and promote free competition among financial institutions follow this pattern?

Existing literature has extensively studied the effects of rural financial market reforms. Most scholars believe that competition among financial institutions reduces the marginal return gap between bank lending to non-agricultural and agricultural sectors, thereby increasing agricultural loans (Qi Hao, 2022). Banking competition helps enhance farmers' financial accessibility (Wang Xiu-hua, 2023), while also deepening the development of inclusive financial services and improving the operational efficiency of rural commercial banks, which in turn increases farmers' access to loans (Wang Xue, 2019; Zhang Da-yong, 2019). Meanwhile, breaking market monopolies and advancing interest rate marketization reforms are key to solving the issue of insufficient rural financial supply (Xu Zhong, 2004). Interest rate marketization incentivizes financial institutions to issue loans, ensuring that farmers' loan costs are reasonably compensated (Zhu Xi et al., 2006). However, the low profitability and high risks in agriculture lead financial institutions to withdraw from the agricultural sector, making it difficult for farmers and small rural enterprises to secure loans (Cao Li-qun, 2001). Studies have shown that rural formal financial loans are not aligned with farmers' needs in terms of scale, duration, etc. (Huo Xue-xi, 2005). Financial institutions have not designed appropriate credit contracts and risk management strategies based on the small-scale operations of farmers (Cheng Yu, 2009). Therefore, promoting the deepening of rural financial market reforms, granting financial institutions more pricing

autonomy, breaking financial market monopolies, and activating the innovative vitality of financial institutions to better introduce market-driven financial products are necessary measures to address the financing difficulties faced by farmers and small rural enterprises.

In response to the aforementioned issues, this paper conducts an in-depth study of how financial institutions react to interest rate changes and how financing constraints affect farmers' borrowing decisions. This approach further tests the actual policy effects of free competition among financial institutions, revealing the essential characteristics and practical impacts of marketization. It holds significant importance for optimizing rural financial policies and improving rural financial markets. Therefore, this study selects ten villages from fixed observation points in Zhejiang Province as the research subjects. These villages are distributed across ten different county-level regions in the province, representing various development types such as urbanized villages, traditional agricultural villages, and island fishing villages. This diversity effectively represents the rural situation in Zhejiang and provides valuable experience for rural reform and development in other regions.

The marginal contributions of this study are as follows:

First, this paper introduces the perspective of free competition among financial institutions into the rural financial market in Zhejiang, exploring its impact on the rural financial market in Zhejiang. This provides valuable experience for market-oriented reforms in other provinces across the country.

Second, the paper argues that the increase in the number of loan officers intensifies the free competition among financial institutions, which in turn drives the marketization of certain financial functions. This promotes the dissemination of financial knowledge, improves farmers' financial literacy, reduces financial constraints, and fosters social equity, thereby reflecting the significance of a demonstration zone for common prosperity. On this basis, financial institutions provide more efficient and convenient financial services, contributing to the formation of a financial ecosystem.

Third, this study introduces a spatial econometric perspective using a difference-in-differences model to examine the spatial dynamic impact of free competition among financial institutions on the rural financial market. By focusing on the cross-regional competition or cross-regional loan issuance in Zhejiang Province, the study provides strong theoretical and practical support for the empirical findings.

2. Policy Review and Research Hypotheses

2.1. Policy Review

Since the Third Plenary Session of the 14th Central Committee of the Communist Party of China, China has placed significant emphasis on financial market reforms, with interest rate marketization being one of the key steps (Xuan Yang, 2022). The Third Plenary Session of the 18th Central Committee further strengthened the focus on advancing interest rate marketization reforms, while the report of the 19th National Congress raised further requirements for deepening these reforms, reflecting the government's firm determination and efforts in this area (Liang Si, 2022). For instance, regarding loan interest rates, after multiple adjustments by the People's Bank of China, the upper limit of loan interest rates was fully deregulated in October 2004, and

by July 2013, the lower limit was also completely lifted (Liu Xichuan, 2014). However, the establishment of financial institutions and market access have been strictly controlled by government-issued licenses. With the establishment of a market economy, financial regulation gradually loosened, and financial institutions began to move towards marketization, including those in the rural financial market. Local legal-person financial institutions, such as rural credit cooperatives, have long existed, directly leading to a reduced number of rural financial institutions and insufficient competition (Huang Yiping, 2018). To improve issues such as the low coverage of rural bank branches and scarce financial resources, the former China Banking Regulatory Commission (CBRC) issued "Opinions" at the end of 2006 to lower the entry barriers for rural financial institutions, increase market competition, and stimulate the rural financial market. In this competitive environment, price has become a key factor in incentivizing the supply of products and services. At present, rural credit cooperatives still have significant room for interest rate regulation and need to implement differentiated pricing strategies. Only when financial institutions are able to adjust loan interest rates flexibly to cover credit risks and costs can they effectively serve rural clients. Therefore, this study selects 2013 as the point in time when the reform towards free competition among financial institutions was largely completed, and investigates the impact of this competition on farmers' credit accessibility.

2.2. Theoretical Hypotheses

2.2.1. Free Competition Among Financial Institutions and Farmers' Credit Accessibility

Free competition among financial institutions is primarily achieved through the relaxation of interest rate restrictions and the lowering of market entry barriers for financial institutions. China's rural financial system has been largely established, with formal financial institutions forming the core, and effective division of labor and cooperation between formal and informal financial sectors. Among them, formal financial institutions include rural branches of state-owned commercial banks, rural credit cooperatives, and the Agricultural Development Bank. In recent years, the Postal Savings Bank and other new financial institutions have also started to participate. The informal financial sector includes private lending, rural cooperative funds, private money houses, etc. In the context of an underdeveloped capital market, free competition among financial institutions is mainly reflected in the influence of formal credit channels. Specifically, in the rural financial market, the Agricultural Development Bank mainly provides policy-based loans for grain purchasing, while the Postal Savings Bank, before the reform, was limited to deposit collection and did not engage in loan operations. Another key supplier in the rural market is new financial institutions, which, compared to traditional financial institutions, have established more flexible interest rate pricing systems and can more quickly and effectively offer loans to farmers.

Interest rate marketization has facilitated the formation of a competitive landscape in the banking sector, shifting the focus of competition from institutional expansion to price competition (Zhang Zong-yi et al., 2012). In terms of credit structure adjustment, intensified competition in the banking sector has driven a shift from a model primarily focused on corporate commercial loans and collateralized loans to strategies that more frequently offer consumer and credit

loans, seeking higher marginal profits (Liu Li-ya et al., 2017). Regarding lending conditions, interest rate marketization has enabled banks to relax asset collateral requirements for small and medium-sized enterprises (SMEs) and improved efficiency in identifying and supervising loan applicants (Wang Dong-jing, 2007). In terms of pricing autonomy, interest rate marketization enhances banks' ability to price credit risk (Zhao Ping and Yao Yao-jun, 2022), and in terms of risk-bearing, promoting interest rate marketization can actively affect the risk-taking behavior of banks by intensifying inter-bank competition and providing more opportunities for risk-bearing (Xiang Hou-jun and Yan Yu, 2017). The marketization of loan interest rates has encouraged rural financial institutions to serve farmers and SMEs more effectively (Qi Hao, 2022).

Based on the above, the first research hypothesis is proposed:

Hypothesis 1: Free competition among financial institutions can improve farmers' credit accessibility.

2.2.2. Free Competition Among Financial Institutions, Loan Officer Quantity, and Financial Knowledge Dissemination

Key factors influencing farmers' access to credit include information asymmetry and high transaction costs (Wang Changyun, 2014). Information asymmetry between farmers and financial institutions, coupled with farmers' inability to provide sufficient collateral, makes it challenging for banks to accurately assess farmers' repayment capabilities, leading to credit rationing. With intensified competition among financial institutions, small and medium-sized banks such as rural commercial banks and township banks have achieved significant growth. Their service networks now extensively cover rural areas, enabling direct service to individual farmers. These banks can enhance their service capabilities by improving credit technologies and soft information development.

Specifically, on the one hand, innovative training methods can improve the credit skills of bank employees. Combining external training with internal mentoring, particularly through a craftsmanship-style internal training approach for new and young employees, can elevate their technical capabilities in serving micro and small clients. On the other hand, improved methods for collecting soft information on micro clients are critical. Collaborating with street committees, village committees, and grassroots governments, banks can gather and integrate data on informal financial activities, community relations, awards, adherence to traffic regulations, and records of public fee payments. This allows for the establishment of agricultural microcredit information databases (Zhu Yanjian, 2022). Such initiatives not only address information asymmetry but also reduce transaction costs, thereby increasing the likelihood of farmers obtaining credit.

In China, agricultural production primarily relies on small-scale farmers who face challenges such as limited operational scale, lower education levels, and restricted access to information—factors that exacerbate the negative impact of information asymmetry. Enhancing financial literacy significantly reduces participants' reliance on informal credit, increasing their likelihood of applying for and obtaining formal credit, thereby alleviating household credit constraints (Song Quanyun et al., 2017; Liu Dan et al., 2019). Households with higher financial knowledge are more familiar with credit products, more adept at accessing financial information, and more rational in their borrowing

behavior. They are also more likely to secure low-interest loans tailored to their circumstances (Chatter, 2013). Conversely, families with lower financial literacy may underestimate borrowing costs and opt for high-cost borrowing, which can exacerbate their debt burden and lead to financial distress (Li Yunfeng et al., 2018).

Improving financial literacy is thus a critical factor in enhancing household credit accessibility. The liberalization of financial institution competition has prompted small and micro banks to organize regular community financial education campaigns and distribute promotional materials to improve farmers' financial literacy.

Based on the above, the second research hypothesis is proposed:

Hypothesis 2: Free competition among financial institutions can enhance farmers' credit accessibility by increasing the number of loan officers and promoting financial knowledge dissemination.

2.2.3. Agricultural Industrialization, Free Competition Among Financial Institutions, and Farmers' Access to Credit

With the transformation of agricultural production models and the industrialization and scale of agriculture, traditional small-scale, short-term loans for individual farmers have increasingly failed to meet the development needs of agricultural industrialization (Zhou Liqun, 2001). In this context, the agricultural supply chain financing model emerged as an innovative financial approach to support agricultural development. This financing method relies on core enterprises within the industrial chain to drive other businesses along the chain. However, when core enterprises lack sufficient leadership within the supply chain, the sustainability of this financing model may be constrained. The success of this financing approach largely depends on the capacity of the core enterprise; if the core enterprise fails to effectively assume its leadership role, the entire financing system may struggle to operate stably and sustainably (Liu Xichuan, 2013).

Driven by rural industrialization, the construction of a financial network is crucial for the long-term prosperity of rural industries. This network not only stabilizes capital flow but also attracts external investment, technology, and talent, thereby enhancing the industrial level and optimizing the allocation of resources between urban and rural areas. Through a solid financial chain, financial services can raise farmers' incomes, promote urban-rural integration, and accelerate the modernization of agriculture and rural areas, thus playing a core role in rural industrial revitalization and generating spillover effects for financial intermediaries (He Guangwen, 2018).

As agricultural industrialization deepens, rural operating entities have shifted from traditional farmers to larger-scale producers and agricultural enterprises. These new types of business entities are significantly superior to small-scale farmers in terms of management capabilities and risk resilience, while the standardized operations of these enterprises also help mitigate information asymmetry with banks. By integrating the upstream and downstream supply chains of enterprises, banks are better able to assess the operational status of core enterprises, surrounding small businesses, and farmers, providing a basis for risk control. The supply chain financing model based on leading enterprises effectively resolves the issues of information gaps and lack of collateral faced by small-scale farmers (Fan Lifu,

2010). In this model, leading enterprises serve as "information intermediaries" that not only relay information along the production chain but also communicate with financial institutions on behalf of the farmers. Financial institutions, using these "information intermediaries," disburse loans to farmers in the form of production materials, thereby significantly reducing the cost of information collection and process monitoring, and minimizing the possibility of loan fraud. Currently, many traditional financial institutions have partnered with leading enterprises to provide agricultural loans. This model not only closely integrates the flow of funds, information, and the supply chain, but also leverages the complementary advantages between traditional financial institutions and leading enterprises, promoting a mutually beneficial outcome for both (Xu Yuyun, 2020).

Based on the above, the third hypothesis is proposed:

Hypothesis 3: The improvement of agricultural industrialization levels strengthens the impact of free competition among financial institutions on farmers' access to credit.

2.2.4. Agricultural Digitalization, Financial Marketization, and Farmers' Access to Credit

Agricultural digitalization refers to the process of promoting comprehensive economic, social, and cultural development in rural areas through the application of modern information technologies, especially the internet and mobile communication technologies. It encompasses a wide range of fields, including the intelligentization of agricultural production, informatization of rural governance, networking of rural communities, and the e-commerce of agricultural products (Yin Haodong, 2020).

The limitations in natural conditions and resource endowments in rural areas lead to higher production and operating costs, as well as increased risks, which in turn affect the interest of financial investors. This is a major reason for the slow or even stagnated development of rural finance. While the government has implemented several reform measures with some success, the overall accessibility of rural financial services remains low, financing costs remain high, and the efficiency of fund utilization remains poor. Against this backdrop, the development and application of information technologies such as big data, the internet, cloud computing, and artificial intelligence have given rise to digital finance, which has rapidly evolved into a new form of financial service (Huang Yiping, 2018).

Digital finance, through the deep integration of technology and traditional financial services, not only changes the business models of traditional finance but also broadens the scope of financial services. It integrates the multifunctional characteristics of payment, information processing, and resource allocation, improving the flexibility and diversity of financial services. These services not only meet users' needs for wealth preservation and value appreciation but also provide effective financial support to marginalized groups (Xu Yuyun, 2020).

The development of digital finance, with more convenient, lower-cost, and more sustainable services, has successfully connected the "last mile" of financial services, providing multi-level and broad-field financial support for the integrated development of rural industries, optimizing the allocation of financial resources, and significantly promoting the comprehensive development of rural economies and societies (Tang Wenhao, 2022). Among these, digital agriculture as a new business model is gradually gaining

recognition. It not only helps farmers increase their incomes but also lowers the lending threshold in rural areas, improves the efficiency of fund utilization, and alleviates the current financing difficulties faced by the "three rural issues" in China (Huang Yiping, 2018).

Traditionally, credit is verified through the use of existing assets as collateral. However, with the application of digital technology, information from agricultural production can also be used to generate credit. Financial institutions can invest in digital development and launch more convenient and faster financial products. At the same time, loan officers can help farmers learn to use these digital products, thereby improving farmers' access to credit.

Based on the above, the fourth hypothesis is proposed:

Hypothesis 4: The improvement of agricultural digitalization enhances the impact of free competition among financial institutions on farmers' access to credit.

3. Empirical Research Design

3.1. Research Design

This paper examines the impact of the degree of competition among financial institutions on farmers' access to credit and its influencing factors. Given that this experiment is a dynamic process, a difference-in-differences (DID) model is used to explore the differences in farmers' loan accessibility under varying levels of competition among financial institutions before and after the basic completion of interest rate liberalization. When conducting policy experiments with the generalized DID model, individuals are typically divided into an experimental group and a control group, and cross-period differences between the experimental and control groups before and after the policy implementation are analyzed. The policy implementation point is the same for all members of the experimental group. Since there is no theoretical control group in this study, the generalized DID model is employed. In the model, Y represents the dependent variable, and $HHI_i \times Post_t$ represents the DID dummy variable. $Control_{it}$ are the control variables, μ_i represents the individual fixed effects, σ_t represents the year fixed effects, and ε_{it} represents the random error term.

$$DK_{it} = \beta_0 + \beta_1 HHI_i \times Post_t + \beta_2 \sum Control_{it} + \mu_i + \sigma_t + \varepsilon_{it}$$

Moderating Effect Model, In the moderating effect model, M_{it} represents the moderating variables, specifically the level of agricultural industrialization and the level of agricultural digitalization.

$$DK_{it} = \beta_0 + \beta_1 M_{it} \times HHI_i \times Post_t + \beta_2 HHI_i \times Post_t + \beta_3 M_{it} + \beta_4 \sum Control_{it} + \mu_i + \sigma_t + \varepsilon_{it}$$

3.2. Variable Selection

Dependent Variable: Farmers' Loan Accessibility DK .

Due to data limitations, the balance of farmers' borrowed funds at the end of the year is used as the indicator for measuring loan accessibility. A value of 1 is assigned if there is a balance of borrowed funds, and 0 otherwise.

Independent Variable: **Difference-in-Differences Interaction Term**.

HHI_i represents the degree of financial institution competition. Following the methodology of Qi Hao (2022), the Herfindahl-Hirschman Index (HHI_i) is used to measure financial institution competition. The calculation aggregates

the squared market share of various bank branches within a given county:

$$HHI_i = \sum_{j=1}^{N_i} (\text{branch}_{ij} / \sum_{j=1}^{N_i} \text{branch}_{ij})^2$$

Where \backslash (*branch*) is the number of branches of bank in county, and N_i is the total number of bank branches in county. The index ranges from 0 to 1, with lower values indicating higher competition. *Post* is a time grouping variable, assigned a value of 0 before 2013 and 1 after 2013.

Mechanism Variables: The number of township credit officers is used as the proxy for mechanism analysis. The annual subscription to newspapers and magazines serves as a proxy for the dissemination of financial knowledge. **Agricultural Industrialization Level (*chanye*):** Measured as the ratio of households participating in industrialized operations to the total number of households in the township. **Agricultural Digitalization Level (*inter*):** Measured as the average number of mobile phones per household in the township, calculated as the total number of mobile phones owned divided by the total number of households.

Control Variables: The study includes household characteristics, household head characteristics, and regional characteristics as control variables:

Household Characteristics:** Number of permanent residents (*People*), number of laborers (*Labor*), cultivated land area at the beginning of the year (*Land*), and the value of productive fixed assets at the end of the year (*fix*).

Household Head Characteristics: Gender of the household head (*sex*), age of the household head (*age*), and educational attainment of the household head (*eduyears*).

3.3. Data Sources and Processing

This study is based on data from the National Rural Fixed Observation Points, a major data source for agricultural and rural research in China. The survey system covers over 20,000 households and more than 300 administrative villages across all 31 provinces of China, excluding Hong Kong, Macau, and Taiwan, ensuring both broad coverage and representativeness. The survey encompasses a wide range of topics, including population structure, employment, income and expenditures (including agricultural subsidies), agricultural production, consumption, and more, providing a comprehensive reflection of the rural economy and social development. Since its establishment, the survey system has conducted continuous follow-up investigations for over 30 years, except for 1992 and 1994, ensuring data continuity and consistency. This long-term dataset offers valuable insights into the dynamic changes in rural areas and serves as an authoritative and reliable foundation for academic research and policy formulation.

For this study, data from ten villages in Zhejiang Province are selected. These villages are located in ten different cities and counties across the province, representing diverse types of rural areas, including urbanized villages, traditional agricultural villages, and island fishing villages. This selection provides a representative sample of Zhejiang's rural conditions. Since the national tracking observations began in 1986, Zhejiang has consistently maintained the continuity of the observation process, ensuring the data's continuity and unbiased nature. The study period spans from 2003 to 2022, aligning with the implementation of key policies such as the State Council's "Deepening the Reform Pilot Program for Rural Credit Cooperatives" and Zhejiang's "Eight-Eight

Strategy."

Data Processing: The National Rural Fixed Observation Points data is filtered to select household data from Zhejiang Province for the years 2003 to 2022. Samples with significant missing data are excluded, and missing values are supplemented using interpolation methods, with additional information drawn from the "Zhejiang Province Financial Operation Report." The final dataset consists of an unbalanced panel with 4,927 observations.

4. Empirical Analysis

4.1. Baseline Regression

Table 1 reports the estimation results, with columns (1) to (3) showing the regression results for household credit availability, with (1) excluding control variables, (2) including household characteristics, and (3) including household head characteristics. The results indicate that the coefficient of the interaction term is significantly negative at the 1% level, and the absolute value increases as more control variables are added. This suggests that the financial institution competition reform has improved the accessibility of credit for rural households, alleviating their financing difficulties to some extent. After the financial institution competition reform, the rural financial market, previously dominated by a single system, was diversified, providing a foundation for the development of various financing models.

Table 1. The Impact of Financial Institution Competition on Household Credit Accessibility

	(1)	(2)	(3)
VARIABLES	y	y	y
HHI*Post	-2.284*** (-5.29)	-2.457*** (-5.67)	-2.442*** (-5.61)
people		-0.008 (-1.48)	-0.008 (-1.48)
labor		0.019*** (3.26)	0.018*** (3.19)
land		-0.004 (-1.17)	-0.005 (-1.18)
fix		0.006*** (3.53)	0.006*** (3.51)
sex			0.035 (1.10)
age			0.000 (0.53)
eduyears			0.007* (1.92)
Constant	0.227*** (17.09)	0.207*** (8.73)	0.106 (1.62)
Observations	4,927	4,927	4,927
R-squared	0.450	0.453	0.453
id FE	YES	YES	YES
Year FE	YES	YES	YES

4.2. Robustness Test

4.2.1. Parallel Trend Test

A key assumption for the unbiased estimation using the difference-in-differences (DID) method is the parallel trends assumption, which asserts that the treated group and the control group would have followed the same trend in the absence of the policy intervention. Specifically, prior to the completion of interest rate marketization, the two groups

should exhibit similar trends, ensuring that any differences observed post-intervention are due to the policy rather than other time-varying factors. In practice, it is not possible to directly verify whether the treatment group would have followed the same trend as the control group had the policy not been implemented, as this is a counterfactual scenario. Therefore, the parallel trends test can only be conducted for the period before the policy implementation. From the figure, we observe that between 2003 and 2011, the estimated difference in the credit accessibility between the treatment group and the control group (based on regions with different levels of banking competition) is close to zero. This indicates that, compared to 2012 (the baseline year), there were no significant differences between the two groups during this period. This finding supports the validity of the parallel trends assumption prior to the policy intervention.

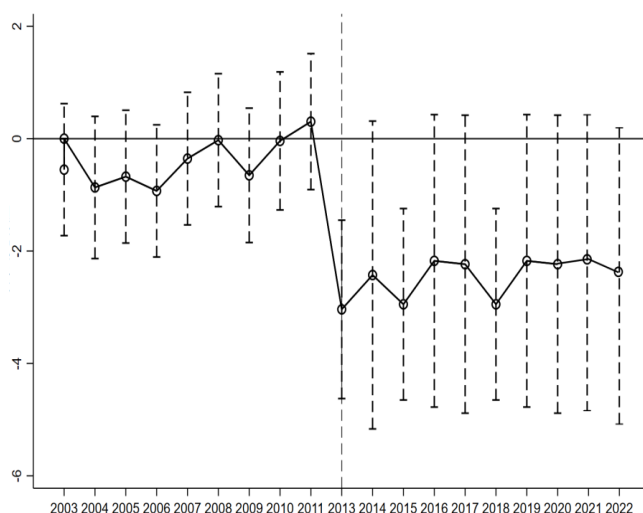


Figure 1. Parallel Trend Test

4.2.2. Variable Substitution Test

To examine the robustness of the regression results, one common approach is to substitute variables. In the original analysis, the dependent variable, loan accessibility, was a binary variable distinguishing between farmers who had loans and those who did not. In this robustness test, we replace the original dependent variable with the scale of the loan (Y2), using the logarithm of the end-of-year loan balance as the new dependent variable for regression analysis.

For the explanatory variables, we replace the Herfindahl-Hirschman Index (HHI) with the market share ratios of the top banks in the city. Specifically, we use the proportion of bank branches of the top three banks (CR3), the top four banks (CR4), and the top five banks (CR5) in the local market to assess the robustness of the results.

The results are presented in Table 2. Column (1) shows the regression results with the substituted dependent variable, loan scale, and columns (2) to (4) show the regression results with the substituted explanatory variables. All regressions include the control variables. The results remain consistent with the earlier findings, indicating that the conclusions are robust.

Table 2. Variable Substitution Test

	(1)	(2)	(3)	(4)
VARIABLES	Y2	Y1	Y1	Y1
HHI*Post	- 27.403*** (-5.96)			
CR3*Post		- 35.253* ** (-5.86)		
CR4*Post			- 22.451*** (-6.16)	
CR5*Post				- 15.010 *** (-6.20)
Observations	4,927	4,927	4,927	4,927
R-squared	0.462	0.454	0.454	0.454
id FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

4.3. Mechanism Analysis

4.3.1. Promotion of Village Credit Officer Numbers

This study uses a two-step mediation model to examine the impact of financial institution competition on the number of village credit officers, testing whether the increase in competition within financial institutions leads to an increase in the number of credit officers. The regression results are presented in Table 3, Column (1).

The results show that the coefficient for the financial institution competition variable is significantly negative at the 1% level. The regression results suggest that the reform in financial institution competition has facilitated the increase in the number of credit officers, which in turn enhanced the localization of services, reduced the difficulty in collecting soft information from farmers, and addressed the issue of information asymmetry. This reduction in transaction costs has consequently improved the accessibility of credit for farmers.

The increase in credit officers intensified the competition among financial institutions, promoted the marketization of some financial functions, alleviated financial constraints, and fostered social equity. This reflects the significance of the demonstration zone for common prosperity. As frontline staff, credit officers collect soft information from clients, meet the financing needs within the agricultural supply chain, and help build a supply chain finance ecosystem, thereby promoting cooperation and mutual benefits between farmers and enterprises.

4.3.2. Promotion of Financial Knowledge Dissemination

Using a two-step mediation model, this study examines the impact of financial institution competition on the dissemination of financial knowledge, testing whether the reform of financial institution competition can promote the spread of financial knowledge. The regression results are presented in Table 3, Column (2).

The results show that the coefficient for the financial institution competition variable is significantly negative at the 1% level. After the reform of financial institution competition, financial knowledge was disseminated to farmers, improving their financial literacy. The regression results indicate that the reform of financial institution competition strengthened the promotion of financial knowledge, enhancing the financial

literacy of farmers, and thus improving their access to credit.

In particular, in the agricultural sector, financial institutions provide financial consultation to farmers through formal credit information platforms and modern information technologies, addressing credit knowledge biases and misperceptions. This initiative also improved the recognition of financial products and the application of information technology by participants in the agricultural supply chain, promoting the establishment of a financial ecosystem, increasing the transparency of financial services, and driving the healthy development of the agricultural supply chain.

Table 3. Mechanism Analysis

VARIABLES	(1)	(2)
HHI*Post	-2.100***	-9.253***
	(-6.79)	(-7.52)
people	-0.008**	0.022
	(-2.13)	(1.45)
labor	-0.017***	-0.045***
	(-4.13)	(-2.74)
land	0.003	0.021*
	(1.26)	(1.95)
fix	-0.004***	0.005
	(-3.00)	(1.06)
sex	-0.004	0.046
	(-0.19)	(0.50)
age	-0.000	0.004**
	(-0.70)	(1.98)
eduyears	-0.003	0.018
	(-1.10)	(1.54)
Constant	0.285***	4.182***
	(5.92)	(21.86)
Observations	4,927	4,927
R-squared	0.643	0.680
id FE	YES	YES
Year FE	YES	YES

4.3.3. Moderating Effect of Agricultural Industrialization Level

Table 4 reports the estimated results, with Column (1) showing the moderating effect of agricultural industrialization. The results reveal that the coefficient for the interaction term is significantly negative at the 1% level, indicating that as agricultural industrialization develops, it strengthens the effect of financial institution competition on improving farmers' access to credit. Agricultural industrialization adopts market-oriented, economically efficient strategies, focusing on leading industries and products, and optimizing the combination of production factors to create effective industry organization models. The core of this approach lies in improving the organizational structure of agriculture and enhancing its development level, making agriculture more aligned with market demand and economic growth requirements.

After the financial institution competition reform, more financial institutions are willing to invest in large-scale, branded, industrialized, and specialized agricultural industries. At the same time, agricultural industrialization promotes the development of new business entities and leading enterprises, providing a foundation for the formation of supply chains. The agricultural supply chain connects various stages from the farm to the table, ensuring effective coordination of agricultural production, processing, supply,

and sales, forming a closely-knit system. On this basis, financial institutions provide more efficient and convenient financial services, contributing to the formation of a financial ecosystem.

4.3.4. Moderating Effect of Agricultural Digitalization Level

Table 4 also reports the estimated results for the moderating effect of agricultural digitalization, with Column (2) showing the results. The coefficient for the interaction term is significantly negative at the 1% level, indicating that as digitalization advances, it enhances the effect of financial institution competition on improving farmers' access to credit. Credit officers can go into villages to promote farmers' use of digital tools, enabling them to access financial information and utilize internet financial products offered by financial institutions.

Table 4. Moderating Effect of Agricultural

VARIABLES	(1)	(2)
M*HHI*Post	-7.059**	-0.572***
	(-2.45)	(-4.26)
HHI*Post	-1.544***	-1.296***
	(-2.61)	(-2.61)
M	1.021***	0.031**
	(3.10)	(2.22)
people	-0.006	-0.005
	(-1.17)	(-1.09)
labor	0.018***	0.015***
	(3.15)	(2.90)
land	-0.003	-0.006**
	(-0.67)	(-2.10)
fix	0.007***	0.011***
	(3.70)	(7.43)
sex	0.027	0.022
	(0.83)	(0.88)
age	0.000	0.000
	(0.35)	(0.16)
eduyears	0.005	0.004
	(1.17)	(1.14)
Constant	0.086	0.002
	(1.23)	(0.04)
Observations	4,927	4,927
R-squared	0.461	0.439
id FE	YES	YES
Year FE	YES	YES

Financial institutions have heavily invested in digitalization, building information collection platforms and introducing a wider range of financial products. Overall, digitalization improves the quality of financial services provided by institutions and enhances the creditworthiness of borrowers, thereby increasing loan availability. Simultaneously, with the rapid development of information technologies, internet and IoT applications have been widely implemented in the "agriculture, rural areas, and farmers" sector, leading the technological-driven transformation and upgrading of agricultural supply chains. The widespread use of these technologies has contributed to the development of smart agricultural supply chains, which is set to become the mainstream trend in the future. This technology-driven supply chain upgrade not only improves the efficiency and effectiveness of agricultural production but also aids in the

formation of a financial ecosystem, offering more opportunities and possibilities for agricultural and rural finance.

5. Conclusion and Recommendations

This study, based on data from the National Rural Fixed Observation Points for the period 2003–2022, specifically focusing on Zhejiang Province, explores the impact of financial institution competition on farmers' access to credit, its transmission mechanisms, and spatial spillover effects. The key conclusions of the study are as follows:

(1) Impact of Financial Institution Competition on Farmers' Access to Credit: Financial institution competition significantly enhances farmers' access to credit, especially in rural areas.

(2) Transmission Mechanism: The study finds that financial institution competition promotes the increase in the number of credit officers, which in turn improves local financial services, enhances the collection of soft information from farmers, addresses information asymmetry, and reduces transaction costs. These factors collectively improve farmers' access to credit. Furthermore, the competition reform has intensified the promotion of financial literacy, thereby improving farmers' financial knowledge and, in turn, their access to credit. Additionally, both agricultural industrialization and digitalization have indirect effects on the relationship between financial institution competition and farmers' access to credit.

Policy Implications: This study offers the following policy recommendations:

(1) Further Deepening Interest Rate Liberalization Reform: The results of this study suggest that advancing interest rate liberalization can help alleviate the credit constraints faced by small farmers, solving issues like financing difficulties. Small farmers, under traditional farming models, often struggle to meet the loan requirements of rural financial institutions. By advancing interest rate liberalization, fostering healthy competition among financial institutions, and improving access to financial services, we can better support local development.

(2) Promoting the Construction of a Rural Financial Ecosystem: Small and medium-sized commercial banks should focus strategically on building a strong financial ecosystem. They need to develop a robust strategic support system, coordinate and manage the various elements of the financial ecosystem to optimize the financial environment. These banks should carefully select suitable operational models and industry opportunities, establish efficient organizational structures and management teams, and create incentive and constraint mechanisms. Moreover, improvements in retail customer resources and offline branch operations should be considered, seeking unique resources to improve their platforms.

(3) Transforming the "Siphon Effect" into the "Spillover Effect": Regions with abundant financial resources should help promote the economic development of surrounding areas. When formulating regional development strategies, it is crucial to consider the distribution of interests among different regions, strengthen transportation and information networks, and build a shared bridge for technological innovation. This will foster the flow of knowledge and technology across different administrative regions and enhance cooperation between regional financial institutions. Furthermore, it will maximize the spatial spillover effects of

policies that improve regional innovation capabilities. This approach can also provide a potential solution to the issue of regional development imbalance, which directly impacts the implementation of the national strategy for common prosperity.

By implementing these policies, we can foster a more equitable and efficient financial ecosystem that supports the development of rural areas and addresses the challenges of regional disparities, ultimately contributing to the broader goals of national economic and social progress.

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