WEP Warwick Evans Publishing

International Journal of Global Economics and Management

ISSN: 3005-9690 (Print), ISSN: 3005-8090 (Online) | Volume 5, Number 2, Year 2024
DOI: https://doi.org/10.62051/ijgem.v5n2.31
Journal homepage: https://wepub.org/index.php/IJGEM/index

Research on the Mechanism of Digital Inclusive Finance to Promote Rural Industrial Integration

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ABSTRACT

The development of digital inclusive finance is of great significance in easing financial exclusion in China's rural areas and promoting rural revitalization, while an important means of rural revitalization is rural industrial integration. Studying the relationship between digital inclusive finance and rural industrial integration is of great significance in accelerating the construction of agricultural and rural modernization. This paper utilizes the panel data of 30 provinces in China from 2012 to 2022,adopts the entropy value method to calculate the degree of rural industrial integration, and establishes the two-way fixed effect model, the moderating effect model, and the panel threshold model to explore the impact of digital inclusive finance on rural industrial integration and the mechanism of the role of the digital financial inclusion, and the results show that:(1)digital inclusive finance promotes the development of rural industrial integration.(2)The improvement of rural transaction efficiency, the degree of traditional financial competition and agricultural labor productivity enhances the promotion of digital inclusive finance on rural industrial integration. Then corresponding policy advice is given based on the conclusions.

KEYWORDS

Digital inclusive finance; Rural industrial integration; Rural revitalization; Moderating effect

1. INTRODUCTION

In recent years, with the rapid development of the digital economy, digital inclusive finance has become increasingly important in rural areas, and has become an important means of financial services for rural revitalization. Digital inclusive finance not only helps rural small and medium-sized enterprises to integrate into the market, but also reduces the gap between urban and rural areas, and promotes the realization of common wealth [1]. 2024 The Central Government's "Document No.1" stresses the importance of digital inclusive finance in promoting rural industrial integration and enabling rural revitalization. However, rural industrial integration in China is still in its infancy, and the long-term financial inhibition has constrained the development of rural economy [2]. Digital inclusive finance, as a means to effectively alleviate financial inhibition, promotes the integration of rural industries with precise and efficient services [3].

Therefore, through an in-depth study of the mechanism of digital inclusive finance on the integration of rural industries, it helps to further enrich and expand the theoretical framework of inclusive finance and rural economic development, not only providing solid theoretical support and practical reference for the formulation of rural financial policies, but also accelerating the pace of modernization of agriculture and rural areas, and promoting rural revitalization.

2. RESEARCH HYPOTHESES

2.1. Research Hypotheses

(1) Digital Inclusive Finance for Rural Industrial Integration Development

In 2021, the central government's "Document No.1" for the first time proposed the development of "rural digital inclusive finance", compared with traditional finance, digital inclusive finance focuses more on "universal" and "beneficial" aspects. From the perspective of "universal", digital inclusive finance expands the coverage of financial services, expands the scope of service recipients, enables subjects who could not obtain support in the past due to financial exclusion to enjoy effective financial services, and reflects a greater concern for inclusive development. This reflects greater attention to inclusive development [3]. At the same time, digital inclusive finance relies on digital technology with strong positive externalities, which enables market participants in different regions to rapidly access and exchange information [4]. This characteristic reduces the dependence of financial services on geographical location, especially in remote rural areas, and allows financial services to be more widely available, thus further promoting rural industrial integration. Accordingly, this paper proposes Hypothesis 1.

Hypothesis 1: Digital financial inclusion can promote the development of rural industrial integration.

(2) Improved efficiency of rural transactions enhances the role of digital inclusive finance in promoting rural industrial integration

Based on the theory of division of labor and transaction costs, with the advancement of rural industrial integration, the industrial chain is gradually extended,and the agricultural function is constantly broadened, which will inevitably bring about the further refinement of the division of labor, accompanied by a series of increased transaction costs, and trigger the demand for optimization of transaction efficiency. By providing customized and flexible financial services, digital inclusive finance can meet the diversified industrial needs of rural areas, further promote the deep integration of agriculture, tourism, science and technology and other industries, and help optimize the structure of the rural economy and the expansion of the industrial chain. Therefore, this paper proposes hypothesis 2.

Hypothesis 2: Increased efficiency of rural transactions enhances the role of digital inclusive finance in promoting rural industrial integration.

(3) Increased competition in traditional finance enhances the role of digital inclusive finance in promoting rural industrial integration

In recent years, digital inclusive finance has developed very rapidly in China, relying on the Internet and big data platforms to sink financial services, which will have a certain impact on the traditional banking and financial industry, leading to the diversion of deposits and loans in the banking industry, indirectly promoting the process of interest rate marketization, and then intensifying the degree of competition in the banking industry [5]. In addition, Xue Wuxi's research found that the increase in the degree of competition of banks in the county is conducive to lowering the loan interest rate and increasing the pass rate of loan applications from farmers, thus improving financial inclusion [6]. Therefore, this paper proposes hypothesis 3.

Hypothesis 3: The increased level of competition in traditional finance enhances the role of digital inclusive finance in promoting rural industrial integration.

(4) Increased agricultural labor productivity enhances the role of digital inclusive finance in promoting rural industrial integration

With the emergence of Taobao villages, Internet wisdom platforms and e-commerce, it has gradually become a model for the integrated development of rural industries. According to Huang Zhuo, while

rural e-commerce is entering, digital technology is also developing towards the countryside, promoting the circulation of urban and rural commodities, and under the impetus of e-commerce to the countryside, the digital transformation of circulation and the development of digital agriculture have become an inevitable trend [7]. Therefore, this paper proposes hypothesis 4.

Hypothesis 4: Increased agricultural labor productivity enhances the role of digital inclusive finance in promoting rural industrial integration.

3. EMPIRICAL RESEARCH DESIGN

3.1. Selection of Variables

(1) Explained variables and explanatory

The explanatory variable of this paper is the degree of rural industrial integration (RID) in each province of the country, and we refer to the studies of Yu Tao [8], Li Xiaolong [9], and Bai Enlai [54], etc., to construct the system of the degree of integration of rural industries, and use the entropy value method to measure the index of rural industrial integration. The explanatory variable of this paper is the development level of digital financial inclusion (DigFin). This paper adopts the Digital Financial Inclusion Index, which is derived from the provincial-level data provided in the "Peking University Digital Financial Inclusion Index (2012-2022)" jointly compiled by the Digital Finance Research Center of Peking University and the Ant Group Research Institute.See Guo Feng et al. [9] for specific index compilation.

(2) Control variables

Referring to the studies of Zhang Lin [10], Yuan Xiaohui [11], and Li Lin [12]), this paper selects nine control variables, such as the level of urbanization, regional gross domestic product per capita, the degree of government intervention, the strength of the government's support for agriculture, the progress of agricultural technology, the degree of advanced industrial structure, the investment in fixed assets in the countryside, the use of electricity in the countryside, the balance of loans related to agriculture, and so on.

(3) Moderating variables

Based on the research hypotheses in 2.4, this paper selects rural transaction efficiency, the degree of traditional financial competition and agricultural labor productivity as the moderating variables.

Rural Transaction Efficiency (Z1): Drawing on the research of Qi Qunquan and Zhao Yu, Chen Zhongwen et al. and Li Yinghui and Li Jing et al. [13], this paper constructs an indicator system from the level of rural infrastructure and transportation, the strength of rural financial support for rural areas, the level of rural human capital, the level of rural communication and electricity use, and the level of rural consumption expenditure to comprehensively reflect the efficiency of rural transactions.

Degree of traditional financial competition (Z2): Since banks still dominate China's financial system, referring to Jiang Fuxiu et al. [14], the Herfindahl Index (HHI). The HHI index is constructed as shown in equation(1):

$$HHI_{i,t} = \sum_{j=1}^{J} \left(\frac{Branch_{jit}}{\sum_{j=1}^{n} Branch_{jit}} \right)^2 \quad (1)$$

Agricultural labor productivity (Z3): Agricultural labor productivity refers to the number of agricultural products or output value produced by each agricultural worker on average per unit of time. In this paper, we refer to Zhang Fu and Han Dongqing [15] and use the ratio of the gross product

of agriculture, forestry, animal husbandry and fishery to the number of people employed in the primary industry to measure the size of agricultural labor productivity.

3.2. Model Building

(1) Research on the impact of digital inclusive finance on rural industrial integration

In order to test the impact of digital inclusive finance on the integrated development of rural industry, this paper constructs the following model for benchmark regression test:

$$RID_{i,t} = \alpha_0 + \alpha_1 DigFinance_{i,t} + \sum Controls + \sum Year + \sum province + \varepsilon_{i,t} \quad (2)$$

(2) Analysis of the mechanism of digital inclusive finance to promote rural industrial integration

According to the theoretical analysis above, with the improvement of rural transaction efficiency, the degree of traditional financial competition and agricultural labor productivity, the promotion effect of digital inclusive finance on rural industrial integration becomes more significant, in order to verify hypotheses 2, 3 and 4, this paper constructs the following moderating effect model according to the testing process proposed by Wen Zhonglin [16]:

$$RID_{i,t} = \theta_1 + \beta_1 \cdot DigFinance_{i,t} + \beta_2 \cdot DigFinance \cdot Z_1 + \beta_3 \cdot Z_1 + \sum Controls + \sum Year + \sum province + \varepsilon_{i,t} \quad (3)$$

$$RID_{i,t} = \theta_1 + \beta_1 \cdot DigFinance_{i,t} + \beta_2 \cdot DigFinance \cdot Z_2 + \beta_3 \cdot Z_2 + \sum Controls + \sum Year + \sum province + \varepsilon_{i,t} \quad (4)$$

$$RID_{i,t} = \theta_1 + \beta_1 \cdot DigFinance_{i,t} + \beta_2 \cdot DigFinance \cdot Z_3 + \beta_3 \cdot Z_3 + \sum Controls + \sum Year + \sum province + \varepsilon_{i,t} \quad (5)$$

Z1 in equation (3) is the regulating variable of rural transaction efficiency, construct the interaction term between digital inclusive finance (DigFin) and rural transaction efficiency DigFin×Z1, and use model (3) to test the regulating role played by rural transaction efficiency in the process of digital inclusive finance influencing the integrated development of rural industries. Similarly, Z2 and Z3 in equations (4) and (5) are the traditional financial competition degree and agricultural labor productivity adjustment variables, respectively, and the same interaction term is constructed to test the moderating role played by digital inclusive finance in the process of influencing rural industrial integration.

3.3. Data Description and Sources

This paper selects 2012-2022 as the research time interval, and the research object includes 30 provinces (except Tibet) in China. The data on the business income of leisure agriculture and rural tourism come from the China Leisure Agriculture Yearbook, the number of Taobao villages come from the statistical survey of the Ali Research Institute, the data on facility agriculture come from the national greenhouse data, the balance of agriculture-related loans come from the China Rural Finance Report and the People's Bank of China's annual report, the data on financial institutions for calculating the degree of competition of traditional finance come from the financial licensing information of the State Supervision and Regulation Administration (SSRA), and the data on investment in fixed assets come from the China Statistical Yearbook of Fixed Asset Investment and the National Bureau of Statistics.

4. EMPIRICAL ANALYSIS

4.1. Baseline Regression Analysis

Table 4-2 shows the regression results of verifying digital financial inclusion on rural industrial integration development. Column (1) shows the impact of digital inclusive finance on rural industrial integration without controlling for region and time levels, and the regression coefficient of the explanatory variables is 0.191 and passes the 1% significance level test; column (2) controls for the fixed effect of region, and the regression coefficient of the explanatory variables is 0.200 and passes the 1% significance level test; column (3) controls for the fixed effect of time, and the regression coefficient of the explanatory variables is 0.217, which passes the significance level test; column (4) fixes for both region and time, with an explanatory variable coefficient of 0.139, which passes the 1% significance level test. This indicates that digital inclusive finance can promote the development of rural industrial integration and the results are relatively robust. Hypothesis 1 is verified.

Table 4-1. Impact of digital financial inclusion on rural industrial integration

	(1)	(2)	(3)	(4)
variant	RID	RID	RID	RID
DigFin	0.191***	0.200***	0.217***	0.139***
	(6.59)	(6.64)	(4.58)	(2.88)
Urb	0.002	-0.000	0.006	0.003
	(0.24)	(-0.03)	(0.98)	(0.44)
GDP	0.017***	0.015***	0.015***	0.006***
	(11.71)	(8.55)	(10.42)	(3.52)
Govint. a	0.123***	0.115***	0.019	-0.003
	(3.62)	(3.05)	(0.53)	(-0.07)
Govint. b	-0.436***	-0.227	-0.466***	-0.205
	(-3.34)	(-1.43)	(-3.80)	(-1.52)
Tec	-0.188***	-0.207***	-0.350***	-0.436***
	(-7.40)	(-7.59)	(-11.11)	(-13.35)
Indu	0.033***	0.038***	0.005	-0.003
	(2.61)	(2.79)	(0.38)	(-0.22)
Fi	-0.011***	-0.013***	-0.015***	-0.003
	(-2.92)	(-2.61)	(-4.26)	(-0.64)
Ele	-0.008**	0.003	-0.006	0.009
	(-1.98)	(0.35)	(-1.37)	(1.14)
Loan	0.000***	0.000***	0.000***	0.000***
	(12.26)	(10.53)	(11.95)	(12.06)
Constant	-0.015	-0.107	0.653***	1.296***
	(-0.31)	(-1.61)	(4.33)	(7.04)
area fixed effect	uncontrolled	Controlled	uncontrolled	Controlled
time fixed effect	uncontrolled	uncontrolled	Controlled	Controlled
Observations	330	330	330	330
Number of id	30	30	30	30
F test	0	0	0	0

4.2. Robustness Check

(1) Replacement of explanatory variables

In order to test the robustness of the core findings, this paper refers to the practice of Chen Jiang scholars [17] and utilizes the method of explanatory variable substitution by replacing the explanatory variable with the degree of digitization and conducting a benchmark regression, the results of which are shown in Table 4-2:

Table 4-2. Robustness Tests

	(1)	(2)
variant	RID	RID
DigFin	0.139***	
	(2.88)	
Level of digitization		0.054*
		(1.81)
Urb	0.003	0.004
	(0.44)	(0.66)
GDP	0.006***	0.006***
	(3.52)	(3.34)
Govint. a	-0.003	0.006
	(-0.07)	(0.17)
Govint. b	-0.205	-0.119
	(-1.52)	(-0.87)
Tec	-0.436***	-0.369***
	(-13.35)	(-13.39)
Indu	-0.003	-0.006
	(-0.22)	(-0.40)
Fi	-0.003	-0.001
	(-0.64)	(-0.18)
Ele	0.009	0.008
	(1.14)	(1.00)
Loan	0.000***	0.000***
	(12.06)	(11.51)
Constant	1.296***	1.376***
	(7.04)	(6.45)
Observations	330	330
Number of id	30	30
F test	0	0

As can be seen from Table 4-3, column (2) shows the impact of changing the explanatory variable to the degree of digitization on the integrated development of rural industries, with a regression coefficient of 0.054 and passing the 10% significance level test. The direction of the regression coefficients of the explanatory variables is the same as in column (1). This indicates that the findings of this paper are robust.

5. ANALYSIS OF MECHANISMS

5.1. Regression Analysis of the Moderating Role of Rural Transaction Efficiency: Augmentation of the Original Effect

With the development of rural industrial integration, the industrial chain has been extended and the value chain has been upgraded, and inevitably, a series of transaction costs will be generated in the process of extending the industrial chain, and transaction efficiency is negatively correlated with transaction costs. Therefore, this section starts from the perspective of rural transaction efficiency and refers to Wen Zhonglin's approach to regression test the model (3-3) above to explore whether the effect of digital inclusive finance for rural industrial integration will be strengthened with the improvement of rural transaction efficiency. The test results are shown in Table 5-1.

Table 5-1. Analysis of regulatory mechanisms: efficiency of rural transactions

	(1)	(2)
variant	RID	RID
DigFin	0.139***	0.156***
	(2.88)	(3.20)
DigFin×Z_1		0.101*
		(1.92)
Z_1		-0.568
		(-1.62)
Urb	0.003	0.003
	(0.44)	(0.44)
GDP	0.006***	0.006***
	(3.52)	(3.27)
Govint. a	-0.003	-0.016
	(-0.07)	(-0.43)
Govint. b	-0.205	-0.149
	(-1.52)	(-1.08)
Tec	-0.436***	-0.422***
	(-13.35)	(-12.69)
Indu	-0.003	-0.003
	(-0.22)	(-0.22)
Fi	-0.003	-0.003
	(-0.64)	(-0.77)
Ele	0.009	0.006
	(1.14)	(0.74)
Loan	0.000***	0.000***
	(12.06)	(8.11)
Constant	1.296***	1.209***
	(7.04)	(6.43)
Observations	330	330
Number of id	30	30
F test	0	0

From column (2) of the regression results in Table 5-1, the coefficient of the interaction term (DigFin×Z1) between digital inclusive finance and rural transaction efficiency is significantly positive, the coefficient of the interaction term is 0.101*, and the main effect coefficients in column

(1) are in the same direction. This indicates that the improvement of rural transaction efficiency enhances the promotion of digital inclusive finance on rural industrial integration and plays a positive moderating role. Hypothesis 2 is verified.

5.2. Regression Analysis of the Moderating Role of the Degree of Traditional Financial Competition: Augmenting the Original Effect

China is still a traditional financial system dominated by banks, and rural financing mainly comes from traditional credit from banks, thus banks are in the context of the booming development of digital finance. Therefore, starting from the degree of traditional financial competition, the above models (3-4) are regressed to explore the moderating role they play in digital inclusive finance for rural industrial integration, and the test results are shown in Table 5-2.

Table 5-2. Regulatory Mechanism Analysis: Degree of Competition in Traditional Finance

	(1)	(2)	(3)
variant	RID	RID	RID
DigFin	0.139***	0.135***	0.117**
	(2.88)	(2.82)	(2.23)
DigFin×Z_2		0.046*	0.060
		(1.87)	(1.31)
Z_2		0.018	-0.267
		(0.07)	(-0.82)
Urb	0.003	0.003	0.003
	(0.44)	(0.56)	(0.44)
GDP	0.006***	0.006***	0.006***
	(3.52)	(3.28)	(3.30)
Govint.a	-0.003	-0.007	-0.004
	(-0.07)	(-0.19)	(-0.10)
Govint.b	-0.205	-0.242*	-0.233*
	(-1.52)	(-1.78)	(-1.67)
Tec	-0.436***	-0.450***	-0.445***
	(-13.35)	(-13.59)	(-13.34)
Indu	-0.003	-0.014	-0.009
	(-0.22)	(-0.95)	(-0.60)
Fi	-0.003	-0.003	-0.003
	(-0.64)	(-0.67)	(-0.72)
Ele	0.009	0.002	0.005
	(1.14)	(0.31)	(0.70)
Loan	0.000***	0.000***	0.000***
	(12.06)	(11.83)	(11.99)
Constant	1.296***	1.399***	1.477***
	(7.04)	(7.16)	(6.07)
Observations	330	330	330
Number of id	30	30	30
F test	0	0	0

The regression results in column (2) of Table 5-2 show that the coefficient of the interaction term between the digital financial inclusion index and the degree of traditional financial competition (DigFin×Z2) is significant at 0.046, passing the 10% significance level test, and has the same sign as

the main effect coefficient in column (1), which suggests that: the increase in the degree of traditional financial competition enhances the role of digital financial inclusion in the promotion of the integration of the rural industry, and exerts a positive moderating effect. Therefore, hypothesis 3 is verified.

5.3. Regression Analysis of the Moderating Role of Agricultural Labor Productivity: Augmenting the Original Effect

According to the theoretical analysis above, the improvement of agricultural labor productivity can better consolidate the development of primary industry and promote the integrated development of rural industry. Therefore, this paper starts from the perspective of agricultural labor productivity and carries out regulation effect regression on the above model (3-5) to explore its regulation effect, and the results are shown in Table 5-3:

Table 5-3. Regulatory Mechanism Test: Agricultural Labor Productivity

	(1)	(2)
variant	RID	RID
DigFin	0.139***	0.143***
	(2.88)	(2.95)
DigFin×Z_3		0.019**
		(2.11)
Z_3		-0.096*
		(-1.90)
Urb	0.003	0.003
	(0.44)	(0.47)
GDP	0.006***	0.006***
	(3.52)	(3.50)
Govint. a	-0.003	0.004
	(-0.07)	(0.11)
Govint. b	-0.205	-0.216
	(-1.52)	(-1.61)
Tec	-0.436***	-0.422***
	(-13.35)	(-12.30)
Indu	-0.003	-0.012
	(-0.22)	(-0.81)
Fi	-0.003	-0.002
	(-0.64)	(-0.46)
Ele	0.009	0.008
	(1.14)	(1.10)
Loan	0.000***	0.000***
	(12.06)	(11.43)
Constant	1.296***	1.219***
	(7.04)	(6.17)
Observations	330	330
Number of id	30	30
F test	0	0

From column (2) of Table 5-3, we can see that the coefficient of the interaction term (DigFin×Z3) between digital financial inclusion language and agricultural labor productivity is 0.019, which passes

the 5% significance level test and is in the same direction as the main effect coefficient in column (1). This indicates that: the increase of agricultural labor productivity enhances the promotion of digital inclusive finance on rural industrial integration and plays a positive moderating role. Therefore, hypothesis 3 is verified.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1. Conclusions of the Study

Digital inclusive finance promotes the integrated development of rural industries. With the help of digital technology, digital inclusive finance improves the availability of finance in rural areas, eases financial exclusion, alleviates the financing constraints of various rural subjects, and thus promotes the integrated development of rural industries. Digital inclusive finance contributes to the integration of rural industries, mainly from the "universal" and "benefit" aspects: on the one hand, with the help of cloud computing, Internet of Things and other technologies, optimize the allocation of funds and resources, expand the service object, not only for the local leading enterprises, but also for the local farmers. On the one hand, with the help of cloud computing and other technologies such as Internet of Things, we can optimize the allocation of capital and resources, expand the service targets, serve not only local leading enterprises but also local farmers, alleviate the financing constraints, and promote the development of primary, secondary and tertiary industries as well as their integration. On the other hand, it gives full play to the role of "benefit" by improving the efficiency of traditional financial institutions in utilizing capital resources, saving human capital costs, operating costs and information costs, and more accurately grasping the pain points and needs of enterprises and farmers in rural areas, so as to promote the integrated development of rural industries.

6.2. Policy Recommendations

Rural industrial integration is a necessary way to realize rural revitalization and achieve agricultural modernization; and digital inclusive finance is also a general trend of development, so this paper puts forward the following suggestions:

The development strategy of promoting digital inclusive finance should be persistently promoted, giving full play to its positive role in rural areas and helping the integration and development of rural industries. Against the background of the continuous development of digital technology and the increasing degree of informatization today, digital inclusive finance has gradually become a trend of financial development with its inclusive and universal characteristics, which requires grasping the development law of the digital economy era as well as the various advantages, and making use of the inclusiveness as well as the various benefits brought about by digital inclusive finance, so as to enable more social subjects to receive the dividends of the digital economy era.

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