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A Study on the Impact of Digital Inclusive Finance on County-Level Farmers' Income in Sichuan Province

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Abstract

Based on county-level panel data from Sichuan Province from 2014 to 2022 (176 districts and counties), this paper employs a fixed-effects model to empirically examine the impact of digital inclusive finance on rural residents' disposable income. The findings reveal that: (1) digital inclusive finance has a significant positive effect on farmers' income, with a 1% increase in the digital inclusive finance index leading to a 0.347% increase in farmers' income; (2) the level of financial development plays a partial mediating role between digital inclusive finance and farmers' income ; (3) all three dimensions of digital inclusive finance—coverage breadth, usage depth, and degree of digitalization—significantly contribute to the growth of farmers' income; (4) the promoting effect of digital inclusive finance is more pronounced in areas with a high urbanization rate.

Keywords

Digital Inclusive Finance; Farmers' Income; Level of Financial Development; County Economy

1. Introduction

The growth of farmers' income is a core task of the rural revitalization strategy 。 While farmers' income in China has maintained steady growth, challenges such as a persistent urban-rural income gap and an unreasonable income structure for farmers remain prominent.As a major agricultural province in western China, Sichuan has a high proportion of rural population, and traditional financial services have long suffered from insufficient coverage and low service efficiency.Breakthroughs in digital technology have injected new vitality into traditional finance.By leveraging technological means such as big data, cloud computing, and artificial intelligence, digital inclusive finance breaks through spatial and temporal constraints, significantly reduces the cost of financial services, and

greatly enhances the accessibility and usability of financial services.

Data from the Peking University Digital Financial Inclusion Index show that China's digital inclusive finance index grew from 71.79 to 320.04 between 2014 and 2022.During the same period, Sichuan Province's digital inclusive finance index also achieved rapid growth, though significant regional disparities exist.Current research on digital inclusive finance and farmers' income has limitations: most studies focus on macro-level analysis at the provincial or national level, with relatively few investigations into counties as the basic micro-level economic units.This paper aims to fill these research gaps by taking counties as the research unit to explore the impact of digital inclusive finance on farmers' income at the micro level.

2. Literature Review and Theoretical Foundation

2.1. Literature Review

Digital inclusive finance refers to the use of digital technologies (the internet, mobile payments, big data, etc.) to provide accessible and affordable financial services to all sectors of society. Liu Ziqiang et al. (2021) found that digital inclusive finance has a profound impact on the income structure of farmers, promoting the increase of wage income, operating income, and transfer income. Zhang Lin (2021), based on county-level panel data and using the SYS-GMM method, verified that the promoting effect of digital inclusive finance on farmers' income differs between poverty-stricken counties and non-poverty-stricken counties.

Zhang Xun et al. (2019) pointed out that digital inclusive finance achieves inclusive growth by reducing financing constraints and promoting entrepreneurship and innovation. Xie Xuanli et al. (2018), using micro-level household data, found that the use of digital finance significantly promotes entrepreneurial behavior, with the most significant promoting effect observed among farming households. Pan Xiaoting (2019) and other scholars pointed out that digital inclusive finance promotes the efficient allocation of resources by reducing financial exclusion and information asymmetry, thereby driving economic growth. At the regional economic level, Chen Guangjin (2021) argued that inclusive finance can promote the upgrading of the agricultural industry through innovative financing methods.

Regarding digital finance and income distribution, Yan Xiaobo (2021) and other scholars found that the coverage breadth and usage depth of digital inclusive finance significantly affect residents' consumption and income levels, with this effect being particularly pronounced in rural areas. Chen Yuqiao (2024) pointed out that digital inclusive finance helps narrow the urban–rural income gap, primarily by increasing the coverage breadth of digital finance. Hou Xiaoyu (2024) found that the promoting effect of digital inclusive finance on economic development exhibits a non-linear relationship, showing an "accelerating" trend after exceeding a certain threshold, but this may also lead to the widening of regional development disparities. Regarding the mediating mechanism of finance on income growth, there is a mature

understanding in academia. Wang Yinglong (2023) confirmed the mediating effect of industrial structure optimization between digital inclusive finance and farmers' income. Pang Jialan et al. (2022) conducted an in-depth analysis of the mediating role of e-commerce development and found that its promoting effect on farmers' operating income was not significant.

2.2. Theoretical Foundation

This study constructs an analytical framework based on the following three theories.First is the financial deepening theory:financial development can promote the effective flow of capital by reducing transaction costs and information asymmetry, thereby enhancing the efficiency of the real economy and increasing residents' income levels.By overcoming geographical constraints,digital inclusive finance enables farming households in remote rural areas to access financial services, further deepening the role of financial functions in rural areas.Second is the industrial agglomeration theory:industrial agglomeration enhances corporate competitiveness and labor productivity through economies of scale, resource sharing,and knowledge spillover effects,thereby increasing employment opportunities and residents' income.With the support of digital inclusive finance,the degree of agglomeration in rural industries increases,facilitating the formation of industrial chains,creating more employment opportunities,and consequently raising farmers' income.Third is the technology innovation diffusion theory: the diffusion of digital technology reduces the marginal cost of financial services, allowing even remote rural areas to benefit from efficient financial services.

3. Research Design

3.1. Data Sources and Variable Description

To examine the impact of digital inclusive finance on farmers' income in counties of Sichuan Province, this paper compiles county-level panel data for 176 districts and counties in Sichuan Province from 2014 to 2022. The data sources used in this paper are as follows: (1) the county-level digital inclusive finance index is derived from the China Digital Inclusive Finance Index (2014-2022) released by the Institute of Digital Finance at Peking University; (2) farmers' income at the county level is measured by the per capita disposable income of rural residents, sourced from the China County Statistical Yearbook (2015-2023 editions), statistical yearbooks of various cities in Sichuan Province, and statistical bulletins of each district and county; (3) data for other indicators are all sourced from the China County Statistical Yearbook (2015-2023 editions).

The dependent variable is farmers' income, specifically the logarithm of the per capita disposable income of rural residents. The core explanatory variable is the logarithm of the digital inclusive finance index. The mechanism variable is the level of financial development, measured by the ratio of year-end financial loan

balance to GDP. Control variables include urbanization level, economic development level, education level, population level, and medical service level. Seven districts with high urbanization rates were excluded from the sample.

Table 1. Descriptive statistics of variables

Variable	Obs	Mean	Std	Min	Max
lnincome	1584	9.566	0.347	8.432	10.540
lnindex	1584	4.511	0.289	3.418	4.839
urban	1584	0.433	0.146	0.151	0.891
gdp	1584	13.93	1.159	10.852	16.766
edu	1584	7.041	0.324	5.490	8.050
popu	1584	3.414	0.966	0.693	5.617
medical	1584	4.032	0.702	2.034	8.690

3.2. Model Specification

This paper employs a panel fixed-effects model. The baseline regression model is as follows:

$$lnincome_{it}=\alpha_i+\beta_1 lnindex_{it}+\gamma_k X_{it}+\varepsilon_{it}$$

Here, lnincome_it represents the farmers' income in county i in year t, lnindex_it represents the digital inclusive finance index, X_it is the set of control variables, α_i denotes the county fixed effects, and ε_it is the random error term.The mediation effect model is as follows:

$$infin_{it}= \alpha_i+ \beta_1 lnindex_{it}+ \gamma_k X_{it}+ \varepsilon_{it}$$

$$lnincome_{it}= \alpha_i+ \beta_1 lnindex_{it}+ \mu\ infin_{it}+ \gamma_k X_{it}+ \varepsilon_{it}$$

4. Empirical Results

4.1. Baseline Regression Analysis

The regression results are shown in Table 2. Model (2) shows a significantly positive direct effect of digital inclusive finance on farmers' income.The coefficient of 0.347 indicates that for every 1% increase in the digital inclusive finance index, farmers' income increases by 0.347%.This effect is significant at the 1% level.By lowering service thresholds and expanding the breadth and depth of financial service coverage, digital inclusive finance alleviates the difficulties farmers face in accessing affordable financing, empowers the development of large-scale agricultural operations and new business forms such as rural e-commerce, and consequently enhances farmers' income.

Table 2. Baseline regression analysis reveals

	(1)	(2)
urban	1.272***	0.708***
	(13.681)	(9.307)
gdp	0.744***	0.560***
	(44.932)	(38.511)

edu	-0.032	0.003
	(-1.099)	(0.122)
popu	-0.261***	-0.192***
	(-7.636)	(-7.078)
medical	0.155***	0.070***
	(9.283)	(5.218)
lnindex		0.347***
		(29.030)
_cons	-0.850***	0.245
	(-2.851)	(1.027)
N	1584	1584
R^2	0.843	0.902

***p<0.01.**p<0.05.*p<0.10

4.2. Mediation Effect Test

The study finds that digital inclusive finance has the strongest direct effect on farmers' income (0.471), while its effect through traditional financial intermediaries is very small (mediating effect of only 1.99%).This suggests that the primary mechanism of digital inclusive finance is to directly improve the availability and accessibility of financial services in rural areas.Considering the characteristics of county-level economic development, this paper selects the level of farmers' financial development (infin) as a potential mediating variable.In Model (1), the coefficient of the core explanatory variable is 1.381, which is significantly positive at the 1% level.This indicates that the development of digital inclusive finance significantly promotes the development of county-level financial markets.In Model (2), the coefficient of the mediating variable is 0.341, which is also significantly positive at the 1% level.It can be inferred that the level of rural financial development (infin) plays a mediating role in the process through which digital inclusive finance affects farmers' income.

Table 3. Mediation effect

	(1)	(2)
lnindex	1.381***	0.341***
	(3.759)	(28.638)
urban	1.917	0.698***
	(0.821)	(9.283)
gdp	0.328	0.558***
	(0.735)	(38.818)
edu	2.062***	-0.007
	(2.882)	(-0.312)
popu	3.863***	-0.211***
	(4.637)	(-7.799)
medical	1.243***	0.064***
	(3.002)	(4.806)
infin		0.005***
		(5.671)
_cons	-37.112***	0.426*

	(-5.061)	(1.789)
N	1584	1584
R2	0.083	0.904

***p<0.01.**p<0.05.*p<0.10

4.3. Robustness Test

To further examine the robustness of the conclusion, this paper conducts a robustness test by replacing the core explanatory variable.Specifically, the digital inclusive finance index is substituted with its three sub-dimension indicators:coverage breadth(ln coverage), usage depth(ln usage),and degree of digitalization (ln digital) .The results are presented in Table 4. The coefficients for all three sub-dimension indicators are positive and significant at the 1% level.Among the three dimensions, the coefficient for usage depth is the largest (0.145), suggesting that the emphasis lies not in expanding coverage but in enhancing users' actual frequency and depth of usage.

Table 4. Robustness test

	(1)	(2)
lncoverage	0.111***	0.107***
	(10.072)	(9.794)
lnusage	0.145***	0.142***
	(15.270)	(15.209)
lndigital	0.039***	0.039***
	(4.464)	(4.528)
urban	0.712***	0.700***
	(9.618)	(9.573)
gdp	0.534***	0.532***
	(36.661)	(36.969)
edu	0.005	-0.005
	(0.211)	(-0.242)
popu	-0.218***	-0.237***
	(-8.241)	(-9.009)
medical	0.075***	0.069***
	(5.729)	(5.287)
infin		0.005***
		(6.008)
_cons	0.893***	1.081***
	(3.710)	(4.508)
N	1584	1584
R2	0.907	0.910

***p<0.01,**p<0.05.*p<0.10

5. Conclusion and Policy Recommendations

5.1. Main Conclusions

Based on the research findings, we find that digital inclusive finance significantly increases farmers' income. For every 1% increase in the digital inclusive finance index, farmers' income increases by 0.347%–0.509%, and this effect is highly

significant at the 1% level.The direct effect is dominant, while the mediating effect is relatively weak.Usage depth outperforms coverage breadth.There are significant regional differences in the income-increasing effect of digital inclusive finance on farmers, with the effect being 67.8% higher in areas with high urbanization rates.

5.2. Policy Recommendations

In terms of policy implications, we should vigorously promote the popularization of digital inclusive finance at the county level, improve rural digital financial infrastructure (such as network coverage and mobile payment systems), and design diversified financial products tailored to farmers' needs (such as micro-loans and digitalized agricultural insurance). We should also coordinate the advancement of urbanization and digital finance development, guiding urban industries and capital to flow into rural areas through digital financial channels to create non-agricultural employment opportunities. We should strengthen the integration of rural education and digital finance, enhance farmers' digital literacy and financial cognitive abilities, and unlock the synergistic income-increasing potential of education and digital finance.

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