

The Impact of Digital Inclusive Finance on Farmers' Income in Jiangsu Province, China

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Abstract

Using Jiangsu Province as a case study, this paper examines whether the expansion of digital inclusive finance is associated with higher farmers' income at the prefecture level. Based on panel data for prefecture-level cities from 2015 to 2024, the study combines descriptive statistics, correlation analysis, and multiple linear regression to evaluate the relationship between per capita disposable income and a set of loan-based indicators representing digital inclusive finance, including overall lending, agricultural loans, loans to small and micro enterprises, and personal consumption loans. The results show that farmers' income in Jiangsu increased steadily during the sample period, while substantial regional heterogeneity remained. Regression estimates suggest that per capita GDP and urbanization are positively associated with income growth, whereas industrial output and fiscal expenditure are negatively associated with the dependent variable in the estimated specification. The coefficients of the core loan-related variables are positive or mixed in direction but do not reach conventional levels of statistical significance after controls are introduced. Taken together, the findings imply that digital inclusive finance may support farmers' income through broader regional development channels, but its direct income effect is not robustly identified in the present model. The paper therefore argues for cautious interpretation, stronger rural digital infrastructure, better-targeted financial products, and further research using richer indicators and identification strategies.

Keywords

Digital Inclusive Finance; Farmers' Income; Rural Revitalization; Jiangsu Province; Regional Development

1. Introduction

Issues concerning agriculture, rural areas, and farmers remain central to China's long-term development agenda. Although Jiangsu Province is one of China's economically advanced regions, important disparities still exist across prefecture-level cities in terms of income levels, urbanization, industrial structure, and access to public resources. Against the background of rural revitalization and digital transformation, digital inclusive finance has received growing attention as a

possible tool for reducing financing constraints, improving financial accessibility, and supporting income growth among rural households.

Compared with traditional finance, digital inclusive finance relies on digital technologies such as mobile payments, online lending, big data, and platform-based service delivery to reduce transaction costs and expand access to financial services. In theory, this can benefit farmers by easing credit constraints, smoothing consumption, lowering information barriers, and broadening access to entrepreneurship and non-farm employment. However, whether these potential benefits translate into measurable income gains at the regional level remains an empirical question.

Existing research has generated broadly positive expectations about the distributive role of inclusive and digital finance, but results differ across regions, levels of analysis, and measurement strategies. Building on the author's original dataset and empirical results, this paper focuses on Jiangsu Province and asks whether prefecture-level differences in digital inclusive finance are associated with farmers' income. The contribution of the paper lies in providing a concise empirical assessment based on relatively recent city-level panel data, while carefully distinguishing between descriptive association and statistically robust causal inference.

2. Literature Review

Recent literature has shifted from broad discussions of financial development to the more specific question of whether digital inclusive finance can raise rural income and reduce structural inequality. Studies using provincial, county-level, and household data generally suggest that digital financial inclusion improves access to financial services, lowers transaction costs, and broadens financing opportunities for rural households, thereby creating conditions that are favorable to income growth and entrepreneurial activity.

A first cluster of recent studies emphasizes income enhancement and rural welfare improvement. Li, Wang, Liao, and Wang (2022) show that digital financial inclusion has significant spatial spillover and threshold effects on farmers' income growth. Lian, Mu, and Zhang (2023) further find that digital inclusive financial services significantly raise rural income in China's major grain-producing regions. At the micro level, Li and Liu (2023) report that digital financial inclusion improves both residents' income levels and income structure, indicating that the benefits of digital finance may operate through multiple channels rather than through credit expansion alone.

A second cluster of studies focuses on inequality, regional heterogeneity, and transmission mechanisms. Zhao, Zheng, and Yang (2022), Shen et al. (2023), and Li, Feng, and Xie (2023) all show that digital financial inclusion is associated with a narrower urban-rural income gap, although the magnitude and pathways vary

across regions. More recent research by Mo, Mu, and Wang (2024) and Wen, Xiao, and Hu (2024) highlights spatial dependence, industrial structure upgrading, and local development conditions as important mediating mechanisms. These findings suggest that the effect of digital finance is context-dependent and may differ according to infrastructure, industrial transformation, and the quality of institutional support.

More recent work also extends the discussion from income to broader development capabilities. Wu and Zhang (2024) and Zhou, Cheng, and Li (2024) argue that digital inclusive finance can strengthen rural and agricultural resilience, while Xia and Xu (2025) provide updated evidence that digital financial inclusion is conducive to the sustainable growth of farmers' income at the provincial level. Taken together, the recent literature provides strong motivation for re-examining Jiangsu Province. Although Jiangsu has relatively advanced digital infrastructure, intra-provincial disparities remain substantial; accordingly, it is necessary to test whether the positive relationships identified in broader Chinese samples are also observed in this comparatively developed but regionally diverse setting.

3. Data, Variables, and Research Design

This study uses prefecture-level panel data for Jiangsu Province from 2015 to 2024. The dependent variable is the natural logarithm of per capita disposable income ($\ln\text{income}$). The core explanatory variables are loan-related indicators that proxy the local development of digital inclusive finance, including the year-end balance of loans of financial institutions (difi), agricultural loans (difi1), loans to small and micro enterprises (difi2), and personal consumption loans (difi3). Control variables include industrial output (ind), urbanization rate (city), per capita GDP (pgdp), government expenditure (gov), and fixed-asset investment (fi).

Specifically, $\ln\text{income}$ measures the income level of residents in Jiangsu's prefecture-level cities; difi captures the overall scale of formal lending; difi1 , difi2 , and difi3 describe sector-specific credit allocation; and ind , city , pgdp , gov , and fi are included to control for industrial development, urbanization, macroeconomic conditions, fiscal support, and investment intensity. The empirical strategy follows the original draft and combines descriptive statistics, regression analysis, and correlation analysis. Because the preserved empirical output is based on a multiple linear regression framework, the present paper retains that specification while interpreting the results cautiously and in line with standard academic practice.

4. Empirical Results

4.1. Descriptive Statistics

Table 1 reports the descriptive statistics of the main variables. The mean of $\ln\text{income}$ is 9.79, with a standard deviation of 0.335, indicating moderate dispersion in income levels across Jiangsu cities during the sample period. The loan-related

variables also display substantial variation, suggesting pronounced differences in financial scale and structure across regions. Control variables such as urbanization and per capita GDP likewise reveal sizeable inter-city heterogeneity, which justifies their inclusion in the empirical specification.

Table 1. Descriptive statistics of variables

Variable	Mean	Std. Dev.	Min	Max	Median
lnincome	9.79	0.335	8.99	10.53	9.88
difi	204.56	97.78	57.42	316.84	208.81
difi1	210.44	99.23	64.13	316.84	215.81
difi2	208.67	98.54	65.31	307.89	208.81
difi3	212.34	100.12	9.49	325.92	215.81
ind	45.34	6.23	37.60	62.00	45.70
city	67.45	6.54	52.00	86.80	67.10
pgdp	11.34	0.45	10.23	12.10	11.37
gov	6.87	1.23	3.65	13.47	6.75
fi	1.12	0.34	0.53	2.52	1.04

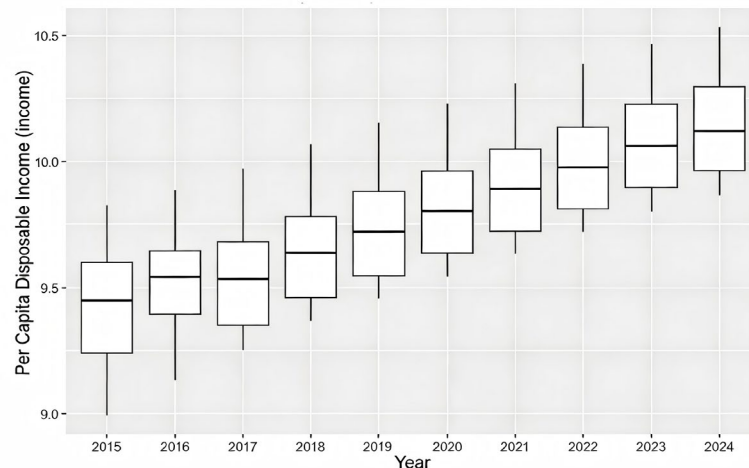


Figure 1. Annual boxplot of per capita disposable

Figure 1 shows a generally upward movement in the distribution of per capita disposable income over time. Both the median and the interquartile range gradually shift upward, indicating sustained income growth. At the same time, the spread across observations suggests that regional differences persist rather than disappear completely during the sample period.

4.2. Regression Analysis

Table 2 presents the baseline regression results. The overall fit of the model is high, with an R-squared of 0.9561, indicating that the included variables jointly explain a large share of the variation in $\ln\text{income}$. Among the control variables, urbanization (city) and per capita GDP (pgdp) are positively and significantly associated with income, which is broadly consistent with the expectation that more developed and

more urbanized regions tend to generate stronger income performance. By contrast, industrial output (ind) and public fiscal expenditure (gov) are negative and statistically significant in the estimated specification, suggesting that the relationship between structural transformation, fiscal allocation, and household income may be more complex than a simple linear growth narrative would imply.

The coefficients of difi, difi1, difi2, and difi3 do not reach conventional levels of statistical significance after controls are introduced. This pattern does not necessarily imply that digital inclusive finance is irrelevant to farmers' income. Instead, it may reflect at least three possibilities. First, the direct effect of digital financial services may be indirect, lagged, or mediated through employment, entrepreneurship, or household financial behavior rather than captured contemporaneously in city-level income data. Second, the loan-related indicators are highly correlated with one another, which raises the likelihood of multicollinearity and inflates standard errors. Third, loan balances can measure financial scale without fully measuring the accessibility, quality, affordability, or actual use of digital inclusive financial services by rural households.

Table 2. Regression results

Variable	Estimate	Std. Error	t value	p value
(Intercept)	5.446	0.461	11.815	0.000***
difi	-3.054	2.482	-1.230	0.221
difi1	1.651	1.339	1.233	0.220
difi2	0.906	0.737	1.230	0.221
difi3	0.499	0.406	1.229	0.221
ind	-0.011	0.004	-2.546	0.012*
city	0.012	0.004	3.012	0.003**
pgdp	0.329	0.053	6.162	0.000***
gov	-0.014	0.005	-2.865	0.005**
fi	-0.021	0.039	-0.539	0.591
Dependent variable	lnincome			
R-squared	0.9561			
Adjusted R-squared	0.9528			
F-statistic	290.2			
Prob > F	<0.000			

a. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

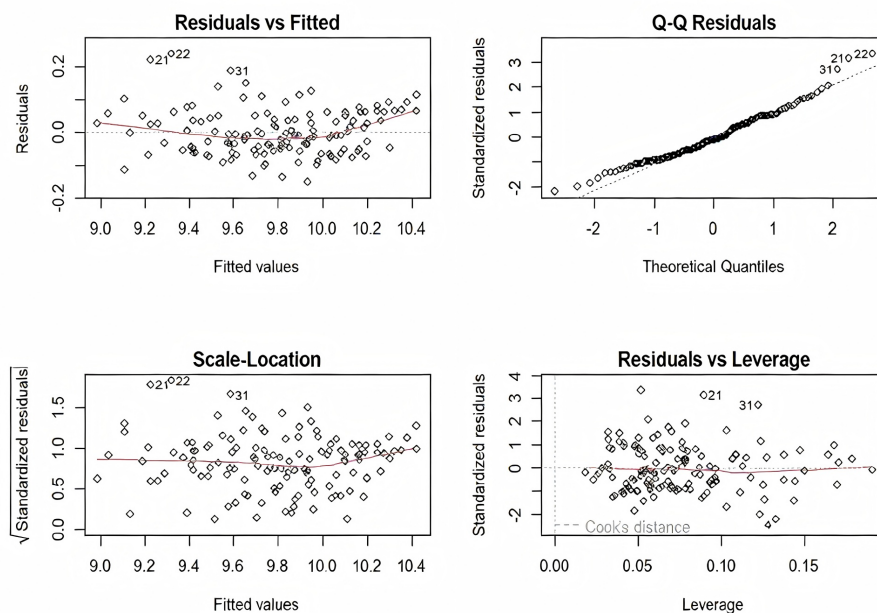


Figure 2. Diagnostic plots for the linear regression

The diagnostic plots in Figure 2 do not indicate an obvious breakdown of the linear specification, but they also point to several influential observations and mild departures from ideal residual behavior. This supports a cautious reading of the coefficient estimates and reinforces the need for robustness checks in future research.

4.3. Correlation Analysis

The correlation matrix reported in Table 3 confirms that *lnincome* is positively correlated with most explanatory variables, especially *pgdp* (0.935), *city* (0.832), *difi1* (0.839), and *difi* (0.806). The strongest correlations are observed among the loan-related indicators themselves, such as *difi* and *difi1* (0.993), *difi* and *difi2* (0.986), and *difi* and *difi3* (0.976). These values provide further evidence of potential multicollinearity. Meanwhile, the correlation between *lnincome* and *gov* is slightly negative (-0.072), suggesting that fiscal expenditure alone does not automatically translate into higher disposable income under the observed regional conditions.

Table 3.Correlation matrix

Variable	lnincome	difi	difi1	difi2	difi3	ind	city	pgdp	gov	fi
lnincome	1	0.806	0.839	0.782	0.706	0.732	0.832	0.935	-0.072	0.557
difi	0.806	1	0.993	0.986	0.976	0.691	0.549	0.663	0.152	0.359

difi1	0.839	0.993	1	0.966	0.953	0.727	0.603	0.700	0.158	0.415
difi2	0.782	0.986	0.966	1	0.955	0.657	0.522	0.648	0.124	0.332
difi3	0.706	0.976	0.953	0.955	1	0.603	0.418	0.547	0.163	0.235
ind	0.732	0.691	0.727	0.657	0.603	1	0.873	0.741	0.444	0.795
city	0.832	0.549	0.603	0.522	0.418	0.873	1	0.903	0.155	0.833
pgdp	0.935	0.663	0.700	0.648	0.547	0.741	0.903	1	-0.070	0.621
gov	-0.072	0.152	0.158	0.124	0.163	0.444	0.155	-0.070	1	0.382
fi	0.557	0.359	0.415	0.332	0.235	0.795	0.833	0.621	0.382	1

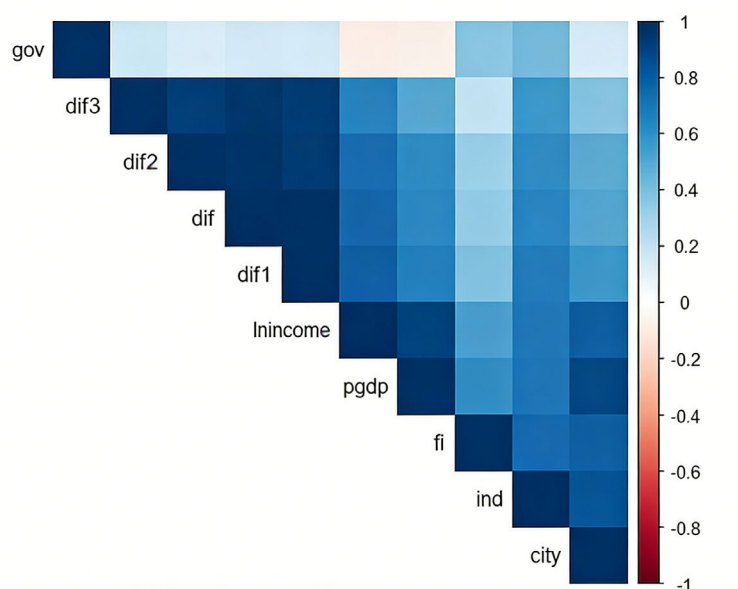


Figure 3. Correlation heatmap

The heatmap visually reinforces the results of Table 3 by showing dense positive clustering among the core financial indicators and development-related variables. Such clustering is useful descriptively, but it also highlights why coefficient interpretation in a multivariable regression should remain conservative.

5. Discussion

The findings suggest that digital inclusive finance is positively associated with farmers' income in Jiangsu Province, but the relationship is more nuanced than a simple credit-expansion story. Descriptive and correlation results indicate that areas with stronger digital financial development tend to display higher rural income levels, which is broadly in line with recent studies arguing that digital finance can improve household access to payments, savings, insurance, and basic

financial services. However, once multiple controls are introduced in the regression model, the explanatory power of the core loan-related indicators becomes statistically weak. This means that the direction of the relationship remains broadly consistent with the literature, but the retained empirical evidence in this paper is not sufficient to support a strong causal claim that digital finance alone directly increases farmers' income in Jiangsu.

A more plausible interpretation is that digital inclusive finance affects rural income through indirect and complementary channels. In relatively developed regions such as Jiangsu, income growth may depend less on the simple availability of rural credit and more on whether digital finance is embedded in local industrial upgrading, e-commerce participation, agricultural marketing, entrepreneurship, and public service accessibility. In other words, digital financial tools may work mainly as an enabling infrastructure that reduces transaction costs, expands market access, and improves financial convenience, while the final income effect is jointly shaped by education, urbanization, fiscal support, transportation conditions, and the local economic base. This interpretation also helps explain why the correlation results are positive whereas the controlled regression coefficients are not statistically strong.

These results also point to an important issue of regional heterogeneity. Jiangsu is one of China's more economically advanced provinces, with relatively mature digital infrastructure and substantial variation across southern, central, and northern areas. Under such conditions, the marginal contribution of digital finance may differ markedly by locality. For areas that already have high financial penetration, additional digital financial services may generate only limited incremental gains. By contrast, for counties with weaker market access or lower service coverage, improvements in digital payment systems, information access, and inclusive financial availability may still matter considerably. Therefore, the empirical pattern observed here should be read as evidence of differentiated effects rather than as proof that digital inclusive finance is ineffective.

At the same time, the discussion should remain cautious because the present analysis is based on the author's original variable system and retained model outputs. The proxy variables mainly capture financial-scale characteristics, but they may not fully reflect usage quality, service depth, digital literacy, platform participation, or household-level behavioral responses. In addition, the sample size and prefecture-level aggregation may limit the ability to identify micro-level mechanisms. Future research could strengthen the analysis by incorporating richer indicators of digital finance usage, testing threshold or spatial spillover effects, and combining macro panel evidence with household or county-level data.

6. Conclusion and Policy Implications

Using prefecture-level panel data for Jiangsu Province from 2015 to 2024, this paper examines the relationship between digital inclusive finance and farmers' income.

The overall evidence suggests a positive developmental linkage between the two, but the strength and significance of that linkage vary across empirical specifications. The descriptive statistics and correlation analysis indicate that rural income tends to be higher in contexts with stronger digital financial development, while the baseline regression shows that the independent contribution of the retained loan-based indicators is not statistically robust after controls are included. Accordingly, the main conclusion of this paper is not that digital inclusive finance automatically raises farmers' income, but that it provides a supportive institutional and technological environment whose income effects depend on broader structural conditions.

Policy implications should therefore focus on improving the quality and inclusiveness of rural digital financial development rather than merely expanding the scale of credit. First, local governments should continue to strengthen rural digital infrastructure, especially in less-developed areas, so that farmers can access stable internet services, mobile payment systems, and convenient digital financial platforms. Second, policy design should combine digital finance with rural industrial development, e-commerce, agricultural supply chains, and entrepreneurship support, thereby transforming financial accessibility into sustainable income-generating capacity. Third, financial institutions should optimize product design for farmers and small rural operators by improving service affordability, usability, and risk-control arrangements rather than relying on uniform credit expansion alone.

In addition, greater attention should be paid to farmers' digital literacy and the inclusiveness of actual service use. Training in digital skills, financial knowledge, and platform-based market participation can help rural households convert access to digital finance into effective economic opportunities. At the research level, future studies should further examine regional heterogeneity, mechanism channels, and long-term effects using richer micro data and more rigorous identification strategies. Such efforts would help clarify under what conditions digital inclusive finance can make a stable and measurable contribution to rural income growth.

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