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Research on the Impact of Digital Inclusive Finance on Rural Residents' Income

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Abstract: *Since 2016, China's digital financial inclusion efforts have significantly expanded access to rural financial services, demonstrating remarkable results in both coverage and depth. Leveraging the convenience and efficiency of digital financial inclusion platforms, rural residents now have access to a diverse range of financial services, including payments, deposits, and loans, effectively enhancing financial inclusivity and supporting income growth among rural residents. In remote rural areas where traditional financial services are less accessible, the development of digital financial inclusion shows immense potential and is anticipated to become a key driver of economic development for rural communities. This study adopts an empirical research approach, collecting and analyzing extensive panel data from prefecture-level cities in Heilongjiang, China, from 2011 to 2021. Using fixed-effects and random-effects models, we examine the impact of digital financial inclusion on rural income and find that its development significantly contributes to income growth among rural residents.*

Keywords: *Digital Financial Inclusion, Income of Rural Residents, Fixed Effect Model*

1. Introduction

As an extension and deepening of inclusive finance, digital inclusive finance leverages digital technology to make financial services more accessible, thereby significantly enhancing the availability of financial products and services for farmers. In rural areas where traditional financial systems are difficult to reach, the widespread adoption of digital finance holds tremendous potential and is expected to serve as a key driver for rural economic development. Heilongjiang Province in China, with its unique natural resources and vast agricultural potential, presents an ideal setting for studying the role of digital inclusive finance in poverty alleviation and income growth. This research aims to enrich and expand the theoretical framework of digital inclusive finance by focusing on the income of rural residents in Heilongjiang. Specifically, it examines how digital inclusive finance influences income growth in the region. The significance of this study lies in its potential to deepen rural residents' understanding of digital inclusive finance, encouraging them to use digital financial services more effectively and scientifically, which in turn could enhance their income levels. Furthermore, the findings could offer practical insights to policymakers, helping them craft more targeted policies to support agriculture, optimize the allocation of financial resources, and narrow the urban-rural income gap.

2. Literature Review

For many years, scholars have been dedicated to exploring the deep interconnections between finance and the real economy. In March 2005, the World Bank Poverty Alleviation Consultation Organization held a meeting to discuss the establishment of an inclusive financial system and the development of inclusive finance. Later that year, in October, the United Nations incorporated inclusive finance into the Millennium Development Goals. Since the concept of inclusive finance was first defined in 2005, it has emphasized the development of financial services in rural areas as a means of improving the production and living standards of rural residents. Various countries have conducted research on digital inclusive finance, with studies in South Asian countries highlighting its significant association with economic development and its positive impact on poverty reduction. Li et al. (2023) utilized panel data and multiple statistical methods to demonstrate that digital inclusive finance not only promotes economic growth but also contributes to alleviating energy poverty, showing that financial inclusion is crucial for driving economic development and achieving energy transition in South Asia [1].

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Similarly, Ong et al. (2023) studied the impact of digital finance on financial inclusion in ASEAN's low-income economies, applying innovation diffusion theory to reveal that digital inclusive finance plays a key role in promoting economic growth in these regions. The study found that digital technologies significantly affect access to bank credit for private enterprises, and have the potential to enhance the level of digital financial inclusion [2].

In OECD countries, Hashemizadeh et al. (2023) examined the relationship between digital inclusive finance, information communication technology, and economic growth. Their study found positive correlations between these factors, as well as with population growth and non-financial investment, providing valuable insights for policymakers seeking to leverage digital technology to promote inclusive financial growth [3]. In emerging markets such as Vietnam, Nguyen et al. (2023) constructed a financial inclusion index at the household level, identifying key factors influencing financial inclusion, including total income, relative income, and the proximity of households to the nearest bank branch, offering guidance for promoting financial inclusion in specific regions [4]. Al Khub et al. (2024), using a non-linear probability unit regression model, analyzed data from 260 participants to determine key factors affecting financial service availability. The study found that prioritizing marginalized groups—such as women, the elderly, and low-income populations—can effectively reduce poverty and foster economic progress in emerging markets [5].

With the advancement of technology, digital inclusive finance has proven effective in helping farmers achieve poverty alleviation and economic prosperity, addressing the limitations of traditional financial systems in serving agriculture and farmers. Liu et al. (2021) conducted a study based on the China Family Database (CFD) and found that the widespread adoption of digital inclusive finance reduces rural households' dependence on agricultural production. This shift has led to a negative impact on agricultural output, as it exacerbates the gap between non-agricultural economic activities and agricultural production efficiency [6]. Li et al. (2022), using the spatial Durbin model and panel threshold model, found that digital inclusive finance has a positive spatial spillover effect on farmers' income growth, with a dual threshold effect influencing this growth [7]. Guo et al. (2023) further confirmed that digital inclusive finance can improve the income of farmers, particularly benefiting low-income farmers [8]. Das and Chatterjee (2023) compared the impact of different financial channels and communication technologies on poverty and income inequality, revealing that digital inclusive finance plays a key role in reducing financial poverty and promoting poverty alleviation in both urban and rural areas [9]. Ding et al. (2023), using data from the China Household Finance Survey (CHFS), examined how the development of digital inclusive finance can mitigate asset poverty and promote income growth, with heterogeneous analyses revealing regional and group-specific impacts [10].

Although research on financial inclusion, including the establishment of index systems and research methodologies, has become well-established, studies on digital financial inclusion remain relatively underdeveloped. Heilongjiang Province, a major agricultural hub in northeastern China, holds a significant share of the national agricultural economy. However, there is a lack of focused research on digital inclusive finance in this region. As a key component of financial technology (fintech), digital inclusive finance has shown great potential in improving rural financial services and promoting rural economic development. Building on existing literature, this study uses panel data from 12 prefecture-level cities in Heilongjiang Province (2016–2021) to conduct empirical research. The goal is to accelerate the development of digital inclusive finance in the province and provide a scientific basis for increasing farmers' income.

3. Empirical Analysis

3.1. Model Select and Data Source

This paper draws on the variables selected by Xue Long in the study Digital Inclusive Finance and Enterprise Surplus Management and adopts the income level of rural residents in 12 prefecture-level cities in Heilongjiang Province as the dependent variable [11]. The core explanatory variable is the digital financial inclusion index, as released by the Digital Financial Research Center of Peking University, which is used to assess the impact of digital inclusive finance on the income growth of rural residents in Heilongjiang Province. Additionally, control variables include the urban-rural income gap, urbanization level, financial support, and educational support in Heilongjiang Province, as outlined in Table 1.

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Table 1: Variables and their meaning interpretation

Variable	Name	Meaning
Y	GDP	The disposable income of farmers in Heilongjiang Province (take the natural log)
X1	GOV	Peking University Digital Financial Inclusive General Index
X2	TR	Urban-rural income gap (Thiel index)
X3	URR	Urbanization level
X4	PGDP	Economic development level
X5	OPE	Open to the outside world level

3.1.1. Explained Variable

In this study, the income level of rural residents in Heilongjiang Province is represented by the per capita disposable income data from the Heilongjiang Statistical Yearbook, covering the period from 2011 to 2021. To reduce data fluctuation and address heteroscedasticity, the natural logarithm of per capita disposable income is used as a proxy for the income level of rural residents. This transformation helps stabilize the variance and improve the reliability of the analysis.

3.1.2. Explanatory Variable

The degree of digital financial inclusion is represented by the Digital Financial Inclusion Index, which is selected from the Report on Digital Financial Inclusion Index released by the Digital Finance Research Center of Peking University. This index serves as a proxy to reflect the level of development of digital inclusive finance in Heilongjiang Province.

3.1.3. Controlled Variables

Urban-rural income gap. This paper used the Thier index as the reference data for the urban-rural income gap. The formula of Thiel index refers to the study[12], which expresses the Tyer index with TR.

$$TR = C1 \times \ln(C1/C2) + R1 \times \ln(R1/R2)$$

Where C1= urban resident income / total income, C2= urban population / total population, R1= rural resident income / total income, R2= rural population / total population.

Urbanization level. The urbanization rate from 2011 to 2021 was selected as the measure of urbanization level in the reference data of Heilongjiang Provincial Statistical Yearbook.

Economic development level. The natural log of the per capita GDP of Heilongjiang province was selected as the reference data to measure the level of economic development.

Open to the outside world level. Select the data of regional GDP and actual use of foreign capital in the Statistical Yearbook of Heilongjiang Province, and the level of opening to the outside world = actual use of foreign investment / GDP.

3.1.4. Descriptive Statistics

In our study, we selected 12 prefecture-level cities in Heilongjiang Province as the sample and constructed a panel dataset with multiple variables for subsequent model development. The results of the descriptive statistical analysis are presented in Table 2. As shown, the average natural logarithm of the income level of rural residents is 9.504, with a maximum value of 10.079 and a minimum value of 8.945, indicating a significant regional disparity in economic development. The average value of the Digital Financial Inclusion Index, the core explanatory variable, is 171.434, with a maximum of 289.007 and a minimum of 26.74, reflecting an unbalanced development of digital inclusive finance across the region. The urban-rural income gap ranges from a maximum of 0.107 to a minimum of 0.002, with an average of 0.035, showing varying degrees of income inequality, where higher values signify a greater gap. In terms of urbanization, the average annual urbanization rate is 59.1%, with a substantial difference across cities, ranging from 87.7% to 25%. Regarding economic development, the natural logarithm of economic development shows an average of 10.445, with a maximum of 11.903 and a minimum of 9.656. Lastly, the level of openness varies, with a mean of 0.013, a maximum of 0.088, and a minimum of 0.000018, indicating differing levels of policy input and regional development. These data highlight the diverse economic conditions and development trajectories across Heilongjiang's prefecture-level cities.

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Table 2: Descriptive statistics of the data

Variable	Observations	Mean	Median	Maximum	Minimum	Standard deviation
GDP	132	9.504	9.502	10.079	8.945	0.274
GOV	132	171.434	185.749	289.007	26.740	66.624
TR	132	0.035	0.034	0.107	0.002	0.022
URR	132	0.588	0.588	0.877	0.250	0.159
PGDP	132	10.445	10.366	11.903	9.656	0.460
OPE	132	0.013	0.009	0.088	0.000	0.014

3.1.5. Correlation Analysis

As shown in Table 3, the P-value is less than 0.05, indicating a statistically significant positive correlation between the two variables. Specifically, per capita disposable income in rural areas is positively correlated with the development of digital inclusive finance, suggesting that the advancement of digital inclusive finance contributes to an increase in the per capita disposable income of rural residents.

Table 3: Correlation analysis of the data

	LNGDP	GOV	TR	URR	PGDP	OPE
LNGDP	1(0.000***)	0.939(0.000***)	-0.254(0.003***)	0.345(0.000***)	0.287(0.001***)	0.169(0.052*)
GOV	0.939(0.000***)	1(0.000***)	-0.134(0.126)	0.304(0.000***)	0.297(0.001***)	0.103(0.240)
TR	-0.254(0.003***)	-0.134(0.126)	1(0.000***)	-0.582(0.000***)	0.598(0.000***)	0.185(0.034**)
URR	0.345(0.000***)	0.304(0.000***)	-0.582(0.000***)	1(0.000***)	0.072(0.410)	-0.089(0.309)
PGDP	0.287(0.001***)	0.297(0.001***)	0.598(0.000***)	0.072(0.410)	1(0.000***)	0.182(0.037**)
OPE	0.169(0.052*)	0.103(0.240)	0.185(0.034**)	-0.089(0.309)	0.182(0.037**)	1(0.000***)

Note: * * *, * * and * represent the significance levels of 1%, 5% and 10%, respectively

3.1.6. F-Test

As shown in Table 4, the F-test statistic is 15.243, with a P-value less than 0.05, indicating statistical significance at the 1% level. Therefore, we reject the null hypothesis and conclude that the fixed effect model is appropriate for this analysis.

Table 4: F-Test

	Statistics	Prob.
F-Test	15.243	0.000***

Note: * * *, * * and * represent the significance levels of 1%, 5% and 10%, respectively

3.2. Empirical Results

3.2.1. Benchmark Regression Results

In this paper, panel data regression analysis was conducted using SPSS, and the regression results are presented in Table 5. The variables GOV, URR, PGDP, and GDP show a positive correlation with Y, meaning that as GOV, URR, PGDP, and GDP increase, rural residents' income also increases. On the other hand, TR and OPE are negatively correlated with Y, indicating that as the urban-rural gap widens, the income of rural residents decreases. Specifically, the R-squared value is 0.972, which is very close to 1, indicating a good model fit. This suggests that the selected explanatory variables can effectively explain the variation in Y, with high predictive accuracy and explanatory power.

Table 5: Fixed Effect

Variable	Coefficient	Standard Error	t	p	R^2	F
Con_	8.004	0.318	25.262	0.000***	Within=0.972	F=787.222
OPE	-0.441	0.436	-1.01	0.315	Between=0.283	P=0.000***
GOV	0.003	0	39.174	0.000***	Overall=0.887	
TR	-3.638	0.565	-6.444	0.000***		
URR	0.13	0.068	1.913	0.058*		
PGDP	0.09	0.033	2.704	0.008*		
Dependent variable: Y (natural log of rural disposable income of rural residents)						

Note: * * *, * * and * represent the significance levels of 1%, 5% and 10%, respectively

3.2.2. The Impact Analysis of Digital Financial Inclusion

The regression coefficient for the effect of digital inclusive finance on the income of rural residents in Heilongjiang Province is 0.003, which is statistically significant at the 1% level. This highlights the

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positive impact of digital inclusive finance on improving farmers' income. Many financial institutions have prioritized rural areas as key targets for promoting inclusive finance. The rise of digital inclusive finance has effectively lowered the entry barriers to financial services, benefiting more rural residents and small and micro enterprises. This shift not only encourages farmers to engage in digital financial inclusion but also motivates them to increase their income through diversified investments. Additionally, the promotion of digital inclusive finance indirectly optimizes local industrial structures, stimulates economic development, and further improves farmers' income levels.

3.2.3. The impact Analysis of Other Factors

Other factors also have varying effects on the income of rural residents. The regression coefficients for the urban-rural income gap, urbanization level, economic development level, and openness to the outside world are -3.638, 0.13, 0.09, and -4.41, respectively. Among these, the coefficient for the urban-rural income gap (TR) is negative, and the P-value is significant at the 1% level, indicating that the urban-rural gap adversely affects farmers' poverty alleviation and income growth. The coefficient for openness to the outside world (OPE) is negative, but with a P-value greater than 0.05, indicating no significant effect. The urbanization rate (URR) is significant at the 10% level, suggesting that with the acceleration of urbanization, some rural industries are hollowing out, and the rural population is declining, which impedes the growth of rural residents' income. The coefficient for per capita GDP (PGDP) is positive and significant at the 1% level, indicating that greater economic development allows rural residents to escape poverty and increase their income.

3.3. Robustness test

3.3.1. Replacement Variable Method Benchmark Regression Results

To verify the impact of digital inclusive finance on rural residents' income, we reduced the sample time, using data from 2017 to 2021 instead of 2011 to 2021. The regression results, shown in Table 6, are consistent with the benchmark regression analysis, confirming the robustness of the initial results. As seen in Table 6, the digital financial inclusion index remains highly significant at the 1% level, confirming its significant impact on the per capita disposable income of rural residents. Other variables, with the exception of PGDP, also show statistical significance.

Table 6: Robustness test: To reduce the sample time

Variable	Coefficient	Standard Error	t	p	R^2	F
Con_	8.004	0.318	25.262	0.000***	Within=0.957	F=190.806
OPE	-0.756	0.407	-1.858	0.070*	Between=0.035	P=0.000***
GOV	0.004	0.001	8.364	0.000***	Overall=0.432	
TR	-9.37	1.621	-5.785	0.000***		
URR	-0.281	0.084	-3.369	0.002***		
PGDP	0.026	0.043	0.612	0.5544		Steady

Note: * * *, * * and * represent the significance levels of 1%, 5% and 10%, respectively

3.3.2. The Tobit Model Test

Table 7: Robustness test: The Tobit model

Variable	Coefficient	Standard Error	t	p	Coefficient with a 95% confidence interval	
					upper limit	inferior limit
Con_	7.406	0.199	37.161	0.000***	7.797	7.016
GOV	0.003	0	33.354	0.000***	0.004	0.003
TR	-5.505	0.565	-9.738	0.000***	-4.397	-6.613
URR	-0.309	0.06	-5.14	0.000***	-0.191	-0.427
PGDP	0.178	0.023	7.731	0.000***	0.223	0.133
OPE	1.922	0.452	4.255	0.000***	2.807	1.037

Note: * * *, * * and * represent the significance levels of 1%, 5% and 10%, respectively

Because the variables were continuous variables and the samples were limited, the regression analysis was performed using the Tobit model, as shown in Table 7, and the regression results were consistent with the benchmark regression analysis, demonstrating that the regression results were robust. Table 7 shows that the digital inclusive is significant at the 1% level, the null hypothesis was rejected and the term coefficient was significant. At the same time, the index also rejected the null hypothesis, showing that the coefficient of the Thil index term is significant. Similarly, the significance of the urbanization

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level is also very obvious, and the original hypothesis is also rejected, so the coefficient of the urbanization level term is also significant. In addition, the level of economic development and the level of opening-up are both significant.

4. Conclusions

This study first systematically reviews the relevant theoretical mechanisms and constructs an analytical framework for empirical research. Based on this framework, data from various prefecture-level cities in Heilongjiang Province were selected to explore the specific impact of digital inclusive finance on the income of local farmers. Using panel data from 2011 to 2021 and employing a fixed effects model for regression analysis, the results reveal that promoting the development of digital inclusive finance in Heilongjiang Province can significantly improve the income levels of rural residents.

To achieve this goal, it is crucial to strengthen the infrastructure for internet and mobile communication networks, continuously improving network coverage and signal quality. This will ensure that digital inclusive financial services can operate smoothly in a stable and efficient network environment. Additionally, cooperation between financial institutions and technology companies should be actively promoted to jointly develop digital financial products tailored to the unique needs of Heilongjiang Province. This will help meet the diverse financial needs of all social groups.

Simultaneously, regulatory measures should be enhanced to standardize the operational behavior of financial institutions, ensuring the stability and fairness of the financial market and protecting consumers' interests. Financial institutions should also be encouraged to strengthen self-regulation and develop self-discipline mechanisms to promote the sustained and healthy development of digital inclusive finance.

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References

[1] Li Z, Hasan M M, Lu Z. Studying financial inclusion, energy poverty, and economic development of South Asian countries[J]. Environmental Science and Pollution Research, 2023, 30(11): 30644-30655.
[2] Ong H B, Wasiuzzaman S, Chong L L, et al. Digitalisation and financial inclusion of lower middle-income ASEAN. [EB/OL].Heliyon, 2023, 9 (2), e13347.
[3] Hashemizadeh A, Ashraf R U, Khan I, et al. Digital financial inclusion, environmental quality, and economic development: the contributions of financial development and investments in OECD countries[J]. Environmental Science and Pollution Research, 2023, 30(54): 116336-116347.
[4] Nguyen H S, Ho C M, Vo A T, et al. The determinants of financial inclusion from the households' perspectives in Vietnam[J]. Plos one, 2023, 18(9): e0291020.
[5] Al Khub A, Saeudy M, Gerged A M. Digital financial inclusion in emerging economies: evidence from Jordan[J]. Journal of Risk and Financial Management, 2024, 17(2): 66.
[6] Liu Y, Liu C, Zhou M. Does digital inclusive finance promote agricultural production for rural households in China? Research based on the Chinese family database (CFD)[J]. China Agricultural Economic Review, 2021, 13(2): 475-494.
[7] Li Y, Wang M, Liao G, et al. Spatial spillover effect and threshold effect of digital financial inclusion on farmers' income growth—Based on provincial data of China[J]. Sustainability, 2022, 14(3): 1838.
[8] Guo X, Wang L, Meng X, et al. The impact of digital inclusive finance on farmers' income level: evidence from China's major grain production regions[J]. Finance Research Letters, 2023, 58: 104531.
[9] Das S, Chatterjee A. Impacts of ICT and digital finance on poverty and income inequality: A sub-national study from India[J]. Information Technology for Development, 2023, 29(2-3): 378-405.
[10] Ding T, Li Y, Zhu W. Can Digital Financial Inclusion (DFI) effectively alleviate residents' poverty by increasing household entrepreneurship?–an empirical study based on the China Household Finance Survey(CHFS)[J]. Applied economics, 2023, 55(59): 6965-6977.
[11] Xue L, Liu J N, Huang Q. Digital inclusive finance and corporate earnings management[J]. Friends of Accounting, 2022, (23): 46-55.
[12] Wang S P, Ouyang Z G. Threshold effect of urban-rural income gap on real economic growth in China[J]. Social Sciences in China, 2008, (02): 54-66+205.