Impact of Digital Financial Inclusion Development on Rural Income Levels

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Abstract. In recent years, the continuous development of digital technology and inclusive finance has provided a strong impetus for rural revitalization. With the advantages of wide coverage, low cost and wide range of service targets, digital inclusive financial services have become a key support for solving the "three rural" problem and promoting rural revitalization. Based on this, this paper selects the county-level data of 12 counties and districts in Nanning City from 2016 to 2021 and uses regression analysis and fixed effect model to test the impact of the development of digital financial inclusion on the level of rural income in Nanning City. The results show that digital inclusive finance has a significant positive effect on the level of rural income, and with the deeper development of digital inclusive finance, the stronger the effect on farmers' income increase. Therefore, in order to give full play to the role of digital financial inclusion in increasing farmers' income and create a new model of digital financial inclusion in "smart countryside", the popularization of digital financial inclusion in rural areas should be promoted.

Keywords: Digital Financial Inclusion; Rural Income Level; Multiple Regression Modeling.

1 Introduction

Economic growth by digital technology draws significant attention to academic discourse in business and economic research[1-2]. The report of the 20th Party Congress in 2022 put forward specific measures to promote rural revitalization, including giving priority to the development of agriculture and rural areas, adhering to the integrated development of urban and rural areas, promoting the revitalization of rural industries, talents, culture, ecology and organizations, and strengthening financial services for the "three rural areas" and remote areas. Therefore, the issue of the "three rural areas" is an urgent problem that needs to be solved at present.

In the domestic literature, Liu Ziqiang and Nan Shuangxiang (2021, 2022)[3-4] and others concluded that the development of digital inclusive finance can reduce the financial threshold, promote the balanced distribution of financial resources, and have a positive effect on improving the income level of rural residents through the empirical

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analysis of China's provincial panel data. On the other hand, Zhang Zihan (2021)[5] Geng Xudong (2022)[6] and others empirically analyze the impact of digital inclusive finance on rural residents' entrepreneurship based on CHFS data, and find that the development of digital inclusive finance is conducive to stimulating the entrepreneurial willingness of rural residents, increasing the income of rural households, and enhancing the sense of well-being of rural residents. In addition, Tian Jingyi et al. (2022)[7] argued that the expansion of digital inclusive finance has a significant positive impact on increasing the income level of rural residents, and that this positive effect increases with the increasing level of digital inclusive finance development. In foreign literature research, Jie Li (2020)[8] studies the impact of digital inclusive finance on economic aspects such as consumption and income, and finds that digital inclusive finance has a significant positive effect on increasing residents' consumption and income.WenwuXie (2020) and Huang Bo (2021)[9-10] analyze from the perspective of rural residents' entrepreneurship that digital inclusive financial development of rural residents' entrepreneurship has a significant promotion effect. Digital financial services are held out as keymoney-related answers for enhancing monetary consideration[11-13].The other important aspect provided by digital finance is devices which are used by customers which can either be digital devices like mobile phones that can transmit information or instruments like payment cards that can be used to connect with digital devices like point of sale terminals[14-15].

In literature studies at home and abroad, it is found that the development of digital inclusive finance can reduce the financial threshold and promote the balanced distribution of financial resources, especially for low-income people in small towns and rural areas, the effect is particularly significant. However, most of the current scholars' studies on digital financial inclusion are concentrated at the national level, provincial level and municipal level, and have not yet studied the impact of digital financial inclusion on the rural income level at the county level. This paper is of great significance through the empirical research to effectively measure the support of digital financial inclusion to the rural economy and to provide a better theoretical basis for the revitalization of rural areas by China's digital financial inclusion services.

2 Empirical Analysis

2.1 Data Source and Variable Selection

2.1.1. Explained Variables.

Rural income level (NC). Per capita disposable income of rural residents is an important indicator of rural economic development. Therefore, this paper uses the logarithmic value of per capita disposable income of rural residents from 2016 to 2021 published in Nanning Statistical Yearbook to measure the explanatory variables.

2.1.2. Core explanatory variables.

Digital Inclusive Financial Development Level (DIFI). This paper uses the logarithmic value of the Digital Inclusive Finance Composite Index (DIFI) publicly re-

leased by the Digital Finance Research Center of Peking University (DFRC) in Nanning City during the period of 2016-2021 as the core explanatory variable.

2.1.3. Control variables.

(1) Urbanization level (CITY): In this paper, the proportion of urban resident population in 12 counties (districts) of Nanning City to the total local resident population is chosen to represent the urbanization level. (2) Level of financial support for agriculture (GSA): This paper uses the proportion of expenditure on agriculture, forestry and water affairs in the 12 counties (districts) of Nanning City in the government's general public budget expenditure to represent the level of financial support for agriculture.(3) Industrial Structure Level (IS): The proportion of the added value of the secondary industry to the regional GDP of the 12 counties (districts) in Nanning City is chosen to represent the level of industrial structure. (4) Economic Development Level (GDC): The logarithmic value of the Gross Domestic Product (GDP) of the 12 counties (districts) in Nanning City is chosen to represent the level of economic development. Table 1 shows all the variables used in this study.

Table 1. Definition of Main Variables

Variable Nature	Variable Name	Variable Symbol	Variable Description
Explained Variables	Rural Income Level	lnNC	Rural disposable income per capita in logarithmic terms
Core Explanatory Variables	Level of digital financial inclusion development	lnDIFI	Logarithmic Digital Financial Inclusion Composite Index
Control Variables	Urbanization Level	CITY	Urban resident population/total local resident population
	Level of financial support for agriculture	GSA	Expenditure on Agriculture, Forestry and Water Affairs/Local Financial Expenditure
	Industrial Structure	IS	Value Added of Secondary Industry/GDP
	Economic Development Level	lnGDC	Logarithmic value of GDP

2.2 Model setting

According to the indicator setting, this paper takes the income level of rural residents (NC) as an explanatory variable, and the Digital Inclusive Finance Composite Index (DIFI) as an explanatory variable. Meanwhile, the level of urbanization (CITY), the level of financial support for agriculture (GSA), the level of industrial structure (IS),

and the level of economic development (GDC) are used as the control variables of the model. In order to improve the robustness of the results, this paper takes the logarithmic treatment of the three variables of disposable income per capita of rural residents, digital financial inclusion composite index and gross regional product. To eliminate the heteroskedasticity of the data, some of the data are logarithmically processed in this paper, and the main model as shown in equations (1):

$$\ln NC_{i,t}=\beta_0+\beta_1 \ln DIFI_{i,t}+\beta_2 CITY_{i,t}+\beta_3 GSA_{i,t}+\beta_4 IS_{i,t}+\beta_5 \ln GDC_{i,t}+\varepsilon_{i,t} \quad (1)$$

Also lagging the DIFI by one and two periods to create regression models as shown in equations (2) and (3):

$$\ln NC_{i,t}=\beta_0+\beta_1 \ln DIFI_{i,t-1}+\beta_2 CITY_{i,t}+\beta_3 GSA_{i,t}+\beta_4 IS_{i,t}+\beta_5 \ln GDC_{i,t}+\varepsilon_{i,t} \quad (2)$$

$$\ln NC_{i,t}=\beta_0+\beta_1 \ln DIFI_{i,t-2}+\beta_2 CITY_{i,t}+\beta_3 GSA_{i,t}+\beta_4 IS_{i,t}+\beta_5 \ln GDC_{i,t}+\varepsilon_{i,t} \quad (3)$$

Where: i denotes the region, t denotes the year, lnNC denotes the per capita disposable income of rural residents, lnDIFI denotes the financial inclusion index, CITY denotes the level of urbanization, GSA denotes the level of financial support for agriculture, IS denotes the level of industrial structure, lnGDC denotes the level of economic development, β denotes the coefficients of the respective variables, and ε denotes the random interference term.

2.3 Model testing

Table 2. Descriptive Statistics of Variables

Variable	Sample Size	Mean	Standard Deviation	Minimum	Maximum
lnNC	72	9.604	0.299	9.102	11.37
lnDIFI	72	4.713	0.116	4.432	4.912
CITY	72	0.585	0.245	0.259	0.941
GSA	72	0.157	0.0870	0.0470	0.358
IS	72	0.319	0.373	0.0710	3.250
lnGPC	72	14.72	0.894	13.18	16.40

From the results of the descriptive analysis in Table 2, it can be seen that the level of urbanization (CITY) and the level of industrial structure (GSA) in the region there is a large gap between the level of urbanization (CITY) the maximum value of 0.941, the minimum value of 0.259, the level of industrial structure (GSA) the maximum value of 3.25, the minimum value of 0.0711, indicating that the level of urbanization and industrial development in some areas of Nanning City is low, which to a certain extent is not conducive to the development of the rural economy

The level of urbanization (CITY), the level of financial support for agriculture (GSA) and the level of economic development (GDC) among the control variables all have a significant positive effect on the increase of rural income level at the 1% significant level.

Table 3. Variance Inflation Factor Analysis

Variable	VIF	1/VIF
CITY	5.300	0.189
lnGPC	4.620	0.216
GSA	3.610	0.277
lnDIFI	2.090	0.479
IS	1.470	0.682
Mean	VIF	3.420

To diagnose multicollinearity, the variance inflation factor (VIF) test is performed in this paper. Normally, 10 is the judgment boundary of VIF: when VIF is less than 10, it is considered that there is no multicollinearity between variables; when 10<=VIF<100, it is considered that there is a strong multicollinearity between variables; and when VIF is greater than or equal to 100, the model has serious multicollinearity. In Table 3, the largest value of VIF is 5.3, the smallest value is 1.47, and the average value is 3.42, and all three values are less than 10, which indicates that there is no multicollinearity between the variables.

2.4 Regression results and robustness tests

Table 4. Regression Model Analysis

	Fixed effects mode		Random effects model	
Variable	(1)	(2)	(1)	(2)
lnDIFI	0.325***	0.308***	0.305***	0.282***
	(2.400)	(2.320)	(2.020)	(2.306)
CITY		2.837*		-0.038
		(1.584)		(0.364)
GSA		2.192*		-0.096
		(1.225)		(0.807)
IS		0.056		0.086
		(0.215)		(0.114)
lnGPC		0.046		0.121
		(0.245)		(0.092)
_cons	6.304***	8.410***	6.304***	6.304***
	(2.080)	(3.421)	(2.080)	(2.080)
N	72.000	72.000	72.000	72.000
R^2	0.915	0.926	0.813	0.852

[Note] ***, **, * indicate significant at the 1%, 5%, and 10% levels, respectively.

According to Tables 4, the level of digital financial inclusion (DIFI) in Nanning City has a significant positive impact on the level of rural income, both in the fixed-effects model and the random-effects model. With the control variables included in the model, the core explanatory variable DIFI is significant at the 1% level, with a coefficient of 0.308, and with other control variables held constant, for every unit increase in the level

of digital financial inclusion development, farmers' incomes increase by 0.308%. In the fixed effects model, the control variables urbanization level (CITY) and financial support for agriculture (GSA) have a 10% significance level effect on the level of rural income in Nanning City, indicating that with each unit increase in the level of urbanization (CITY) and the level of financial support for agriculture (GSA), the per capita disposable income of the rural population increases by 2.857% and 2.192%, while other control variables have less impact on the level of rural income in Nanning City.

Table 5. F-test, LM-test and Hausman test

Type of test	Statistic value	P-value	Final choice of model
F test	2.63	0.0276	
LM test	2.96	0.0000	Fixed effects mode
Hausman test	12.24	0.0317	

According to Tables 5, the F test is used to test the individual effect, resulting in a P value of 0.0276, which is less than 0.05, indicating that the fixed effect is better than the mixed effect, so the original hypothesis is rejected, and the fixed effect model is selected. Secondly, the LM test was conducted to test the time effect, which yielded a p-value of 0.0000, which rejected the original hypothesis at 1% level of significance, thus choosing the random effect model out of the mixed effect model and the random effect model. Finally, the Hausman test was conducted which yielded a p-value of 0.0317 which is less than 0.05 and hence the original hypothesis was rejected and the final choice was the fixed effect model.

Table 6. Lag effect test

	Lag Phase I	Lag Phase II
lnDIFI	2.152***	1.543**
	(0.274)	(0.922)
CITY	0.019	-0.133
	(0.277)	(0.450)
GSA	0.354*	0.110
	(0.200)	(0.335)
IS	-0.034	0.023
	(0.038)	(0.076)
lnGDC	-0.026	0.037
	(0.045)	(0.090)
L.lnDIFI	0.483***	
	(0.107)	
L2.lnDIFI		0.474
		(0.328)
_cons	-2.547**	-0.408
	(0.988)	(2.701)
N	60.000	48.000
R^2	0.945	0.880

[Note] ***, **, * indicate significant at the 1%, 5%, and 10% levels, respectively.

Considering that digital financial inclusion has continuity, lag one and lag two tests were conducted on the core explanatory variable Digital Inclusive Financial Development Level (DIFI). As shown in Table 6 the lagged one period coefficient of DIFI is 0.483, which is positively correlated at 1% significance level. In addition, the lag two coefficient of DIFI is 0.474, which indicates that digital financial inclusion has a significant impact on farmers' income over a sustained period in the fixed effect model test. Therefore, digital financial inclusion can utilize digital technology to continuously promote the penetration of financial services into rural areas, which in turn helps to increase the income level of farmers.

In addition, at the 10% significance level, the level of financial support for agriculture is significantly and positively correlated with the level of farmers' income, and as the level of financial support for agriculture increases by one unit, the level of farmers' income increases by 0.354%. In addition, the increase of fiscal expenditure to support the development of rural agriculture also contributes to the increase of farmers' income level.

3 Conclusion

First, the development of digital financial inclusion has a significant positive effect on the level of rural income in Nanning City, and the results of the empirical analysis are consistent with the theoretical analysis; second, through the lag test of the core explanatory variables of the DIFI, the test results are still significant, and with the deeper development of digital financial inclusion, it will have a significant effect on the level of rural income in Nanning City, which is consistent with the theoretical analysis. The deeper the development of digital financial inclusion, the more obvious the effect of increasing income on the level of rural income in Nanning City and increasing financial expenditure on rural agriculture is also conducive to improving the level of rural income in Nanning City.

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