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Digital Inclusive Finance and Increasing Farmers' Income

-- An Empirical Study based on County Panel Data in the Yangtze River Delta

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Abstract

Thanks to the third technological revolution based on the Internet, China has realized the rapid development of digital economy and digital finance. Digital inclusive finance has brought new growth points to economic development and a significant impact on Farmers' income. Based on the panel data of 151 counties in the Yangtze River Delta from 2014 to 2020, this paper empirically analyzes the impact of digital inclusive finance on Farmers' income by using the digital inclusive finance index compiled by Peking University. The results show that digital inclusive finance significantly promotes the increase of farmers' income. Further analysis shows that digital inclusive finance plays a positive role in increasing farmers' income by promoting the transformation and upgrading of industrial structure. Based on the research conclusions, combined with the empirical figures, inclusive finance and the actual situation of increasing farmers' income, this paper gives policy suggestions.

Keywords

Digital Inclusive Finance; Farmers' Income; Rural Vitalization.

1. Introduction

The key to solving the issues concerning agriculture, countryside and farmers is to increase farmers' income, and the growth of farmers' income is of great significance to promote China's inclusive economic growth and build a socialist harmonious society [1]. Since the reform and opening up, China's per capita disposable income of rural residents has shown explosive growth, from 134 yuan in 1978 to 17131 yuan in 2020, an increase of 127.84 times. Excluding price factors, the actual increase is 18.62 times. At the same time, the income gap between urban and rural residents decreased from 2.56:1 in 1978 to 2.50:1 in 2021. After the eradication of absolute poverty in 2020, the phased goal of poverty alleviation can be achieved, but sustainable income increase and poverty reduction is still the key theme of the country. Digital inclusive finance can break through the limitation of time and space and open up the "last mile" of rural financial services with the help of digital technology [2], so as to develop rural economy and promote rural revitalization. Existing studies usually focus on the impact of Inclusive Finance on income level. Inclusive Finance improves the coverage and depth of financial services for low-income groups by breaking the financial barriers set by formal financial institutions [3], improves financial infrastructure and optimizes the allocation of financial resources, so as to promote income equity and sustainable economic growth [4]. Integrating the concept of Inclusive Finance with digital technology to provide diversified, safe, convenient and affordable financial services through digital means [5], directly increase the financial

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lending opportunities of rural low-income groups and reduce the level of poverty, which is conducive to promoting rural economic development [6]. Based on the development trend of digital Inclusive Finance, Xiaoling Song uses balanced panel estimation to conclude that digital Inclusive Finance significantly promotes the narrowing of urban-rural income gap [7]. Based on the spatial characteristics of digital Inclusive Finance, Haiyan Zhang studies the heterogeneous impact of digital Inclusive Finance on Farmers' income structure. The results show that digital inclusive finance plays a positive role in increasing farmers' income [8]. Further empirical research by Xuetao Sun and others found that the development of digital Inclusive Finance has improved the level of agricultural economic development by promoting agricultural mechanization, which has a significant effect on solving the problem of income inequality in low-income areas [9]. The existing literature has made great progress in the research on the relationship between digital Inclusive Finance and increasing farmers' income, but due to the short development period and lack of data, the literature on the impact of digital Inclusive Finance on increasing farmers' income is still relatively scarce.

In 2021, "No. 1 central document", "the CPC Central Committee and the State Council on comprehensively promoting rural revitalization and speeding up the modernization of agriculture and rural areas" pointed out that during the "14th Five-Year" period, we should develop digital Inclusive Finance in the countryside, promote the development of intelligent agriculture, and let digital technology enter villages and households. Since the G20 summit in Hangzhou in 2016 issued the high principles of G20 digital Inclusive Finance, all sectors of the industry have increasingly recognized the unique role of digital Inclusive Finance (Guo Feng, 2019), especially for residents and enterprises with low material capital or low social capital, so as to promote China's inclusive economic growth [10-11]. In February 2019, the people's Bank of China, the China Banking and Insurance Regulatory Commission, the China Securities Regulatory Commission, the Ministry of finance, the Ministry of agriculture and rural areas and other five national ministries and commissions jointly issued the guiding opinions on financial services for rural revitalization, putting forward the requirements of "effective popularization of digital Inclusive Finance in rural areas". As of December 2021, the number of Internet users in China has reached 1.032 billion, the Internet penetration rate has reached 73.0%, and the proportion of Internet users using mobile phones to surf the Internet has reached 99.7%, which shows that China's digital technology infrastructure construction has achieved remarkable results, the radiation scope of digital inclusive finance has been expanding, and it plays an increasingly important role in the lives of residents in rural areas [12]. China county digital Inclusive Finance Development Index report 2021 shows that the development of county digital Inclusive Finance in China shows a rapid upward trend. Among them, the breadth score of digital credit services has increased by more than 8 times compared with 2017, and the depth of services has increased by 3.8 times compared with 2017, becoming a key area. According to the public data of the e-commerce bank initiated and established by ant group, more than 900 agriculture related county and district governments have reached digital inclusive financial cooperation with it and launched it online. Taking advantage of digital dividends and giving full play to the advantages of digital inclusive finance is of great significance to increase farmers' income and alleviate poverty [13]. It can be seen that digital inclusive finance has gradually become the key driving force for increasing farmers' income.

Although a large number of documents have discussed the influencing factors of increasing farmers' income from various aspects, this paper believes that at least three aspects are worth supplementing, expanding and improving. The specific analysis is as follows: first, whether based on the research perspective of digital inclusive finance or digital economy, most of the existing studies are carried out at the provincial or prefecture level city level, and the county level has not been carefully considered; Second, from the perspective of research content, there is little literature to investigate in detail the impact of county digital Inclusive Finance on

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Farmers' income, and empirically test the magnitude of its impact; Third, most of the existing studies discuss the impact of digital inclusive finance on the primary industry, and there is less analysis on the impact of non-agricultural industries in rural areas.

The marginal contribution of this paper mainly includes the following three aspects: first, in terms of theoretical contribution, this paper systematically investigates the relationship between county digital Inclusive Finance and increasing farmers' income for the first time, which provides a new perspective for explaining the motivation of increasing farmers' income. Second, in terms of empirical content, this paper finds that the development of digital Inclusive Finance has a significant impact on Farmers' income. Third, in terms of policy meaning, the research conclusions of this paper not only provide theoretical reference for the government on how to better promote the increase of farmers' income, but also help the government to supplement and improve the relevant policies to solve the issues and promote rural revitalization.

2. Theoretical Analysis and Research Hypothesis

2.1. Direct Action Mechanism of Digital Inclusive Finance on Increasing Farmers' Income

The direct action mechanism of digital Inclusive Finance on increasing farmers' income is mainly reflected in the following two aspects. First, significantly narrow the "digital divide" between urban and rural areas [14]. First of all, digital inclusive finance can narrow the information production gap, which is conducive to the effective application of information tools to agricultural appliances and production technology, which will further improve the productivity of rural areas and improve the income level of farmers. Secondly, digital Inclusive Finance reduces the information access gap, which is conducive to farmers receiving and sharing information more quickly, conveniently and through multiple channels, reducing information asymmetry, reducing search costs and increasing income [15]. At the same time, information access provides farmers with learning opportunities to help farmers distribute production factors more reasonably and improve productivity [16]. Finally, digital inclusive finance can narrow the information gap, especially the popularization of applications with high skill requirements, which can increase farmers' income channels. For example, the digital inclusive financial system can better serve rural low-income groups, reduce farmers' financing costs, break through the threshold restrictions of financial services, and achieve the effect of increasing income and reducing poverty. Second, the development of digital Inclusive Finance makes rural areas reap "digital dividends". This is reflected in two aspects. First, there have been many new industries, such as the rise of e-commerce platforms such as Taobao, Pinduoduo and Alibaba, which has widened the sales channels of agricultural products and opened the market of agricultural products. Farmers can get more benefits by increasing the sales of agricultural products. Tiktok and Kwai live broadcast are new ways of marketing, so that farmers can directly face consumers and reduce the intermediate links and save costs [17]. At the same time, new business forms have also spawned new jobs. The development of digital Inclusive Finance not only provides more opportunities for farmers' employment, but also improves farmers' entrepreneurial willingness. For example, rural e-commerce represented by "Taobao village" promotes farmers' income through the intermediary mechanism of promoting farmers' return to their hometown for employment [18]. Second, the application of digital governance. Digital governance includes digital public services, which is not only conducive to the implementation of targeted poverty alleviation, but also better handle labor relations and optimize the income distribution system [19]. Therefore, this paper puts forward hypothesis 1.

Hypothesis 1: Digital inclusive finance plays a positive role in increasing farmers' income.

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2.2. Indirect Mechanism of Digital Inclusive Finance Affecting Farmers' Income

The indirect mechanism of digital inclusive finance on increasing farmers' income is mainly reflected in that the development of digital inclusive finance is conducive to optimizing resource allocation channels, promoting technological innovation, and then promoting the transformation and upgrading of industrial structure [20]. In the process of the development of digital Inclusive Finance, financial institutions carrying out relevant businesses complete the formation and initial accumulation of capital by absorbing deposits, and adjust the input of factors for the best capital required by enterprises for production, so as to strengthen the allocation function of resources and promote the upgrading of industrial structure [21]. Small and micro enterprises are the new force of innovation and entrepreneurship. Digital inclusive finance can indirectly promote the upgrading of industrial structure by promoting innovation and entrepreneurship [22]. At the same time, the transformation and upgrading of industrial structure has a significant impact on Farmers' income [23]. The adjustment and change of non-agricultural industrial structure is an important factor affecting residents' income [24], and the increase of its share will increase farmers' income and narrow the income gap between urban and rural residents [25]. The continuous upgrading of industrial structure and the rising proportion of secondary and tertiary industries can provide non-agricultural employment opportunities for the transferred rural labor force, and then promote the income growth of rural residents [26]. In addition, industrial upgrading in rural areas has a great impact on Farmers' income. With the continuous integration and development of rural industries, industrial upgrading can not only improve the income of different types of farmers in rural areas, but also better narrow the income gap between urban and rural residents [27]. Therefore, this paper puts forward hypothesis 2.

Hypothesis 2: Digital inclusive finance plays a positive role in increasing farmers' income by promoting the transformation and upgrading of industrial structure.

3. Model Construction and Variable Selection

3.1. Data Sources

Previous studies on digital Inclusive Finance and farmers' income either took prefecture level cities across the country as the research object, or individual provinces or cities as the research object, which not only ignored the impact of the differences in economic development between cities on rural areas, but also did not take into account that cities and rural areas in some areas have been connected. Different from previous studies, this paper selects Jiangsu, Zhejiang and Anhui provinces as the research objectives. This is because the Yangtze River Delta has nearly half of China's top 100 counties, their counties and prefecture level cities have coordinated economic development, and the counties and rural areas are relatively independent and representative.

The receipt used in this paper includes two parts, one is the county statistical data, the other is the digital inclusive financial data. The county statistical data comes from the China county statistical yearbook and the statistical yearbooks of provinces and cities from 2014 to 2020 (calendar years). The relevant indicators of digital Inclusive Finance come from the digital inclusive finance database of Peking University calculated by Guo Feng et al. [3]. Taking the county domain name as the logo, this paper matches the digital inclusive financial data with the county statistical data in the China county statistical yearbook, so as to form the panel data of 151 counties in the Yangtze River Delta from 2014 to 2020.

3.2. Variable Selection

(1) The explained variable is the income of rural residents. This paper measures the income of rural residents by using the per capita disposable income of rural residents in the urban-rural

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integrated household income and expenditure and living conditions survey carried out by the National Bureau of statistics since 2013.

(2) The explanatory variable is digital Inclusive Finance. This paper uses the digital inclusive finance index of the digital finance research center of Peking University to measure the development level of digital Inclusive Finance. The index is based on the massive data of ant financial, which measures the digital Inclusive Finance formed by the services provided by Internet companies.

(3) Control variables. ① Proportion of output value of non-agricultural industries. In this paper, the proportion of the output value of non-agricultural industries is expressed by the proportion of the output value of the secondary and tertiary industries in the GDP of each county in the Yangtze River Delta. Compared with the primary industry, the secondary and tertiary industries are more developed, the construction of rural digital inclusive financial infrastructure is relatively more in line with the city, and rural residents are more vulnerable to the impact of digital inclusive financial products. ② Agricultural mechanization level. This paper uses the total power of agricultural machinery to measure the level of agricultural mechanization. The level of agricultural mechanization drives the development of large-scale, intensive and industrialized agricultural production, and effectively promotes the growth of farmers' income by changing farmers' income structure. ③ the development level of agriculture, forestry, animal husbandry and fishery services. This paper uses the ratio of the output value of agriculture, forestry, animal husbandry and fishery service industry to the total output value of agriculture, forestry, animal husbandry and fishery to measure the development level of agriculture, forestry, animal husbandry and fishery service industry. The development level of agriculture, forestry, animal husbandry and fishery service industry is of great significance to improve agricultural production efficiency and overall agricultural benefits. ④ Urbanization rate. This paper measures the urbanization rate by the proportion of urban population in the total population. The development of urbanization provides farmers with a large number of employment opportunities, and the transfer of rural labor force brings about an increase in wage income.

3.3. Model Construction

In order to specifically analyze the impact of digital Inclusive Finance on Farmers' income, this paper constructs the following linear regression model:

$$\text{lnincome}_{it} = \alpha + \beta_1 \text{lndig}_{it} + \beta_2 X_{it} + \text{year}_{it} + \mu_{it} \quad (1)$$

Table 1. Descriptive statistics of each variable

Variable	Sample size	Mean value	Standard deviation	Minimum value	Maximum value
lnincome	1036	9.7457	0.3831	8.8957	10.6248
lndig	1036	4.6038	0.2547	3.5077	4.9152
rat	1036	0.8787	0.0740	0.5093	0.9928
lnagrmac	1036	7.4253	4.8279	1.7527	14.8552
lnagrserv	1036	0.0493	0.0431	0.0004	0.2563
lnurban	1036	-1.4036	0.3627	-2.4241	-0,4000

In formula (1), subscript i represents county or county-level city (i = 1, 2, ... , 151); t represents the year (t = 2014, 2015, ..., 2020). income is the explanatory variable of this paper, and dig is the explanatory variable of this paper (digital inclusive finance), X represents a series of control variables that have an impact on farmers' income, and year represents the time trend item, α represents a constant, β represents the elastic coefficient of each variable, μ is a random

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disturbance term. In order to reduce the influence of heteroscedasticity on the regression results, this paper takes logarithm for farmers' income, digital inclusive finance, agricultural mechanization level, development level of agriculture, forestry, animal husbandry and fishery service industry and urbanization rate, and "ln" before the variable indicates logarithm.

The results of descriptive statistical analysis of each variable are shown in Table 1.

4. Analysis of Empirical Results

Using the fixed effect model, this paper discusses the impact of the development of digital inclusive finance, the level of urbanization, the total power of agricultural machinery, the proportion of non-agricultural output value and the level of agricultural producer services on Farmers' income. The results of regression analysis are shown in Table 2.

Table 2. Results of fixed effect regression

Variable	(1)	(2)	(3)	(4)	(5)
lndig	0.0322*** (0.0055)	0.0322*** (0.0055)	0.0333*** (0.0057)	0.0242*** (0.0061)	0.0248*** (0.0060)
lnurban		0.0093 (0.0484)	0.0069 (0.0492)	0.0106 (0.0492)	0.0091 (0.0488)
lnagrmac			-0.0074 (0.0056)	-0.0050 (0.0053)	-0.0090 (0.0057)
rat				0.1531*** (0.0273)	0.1710*** (0.0300)
lnagrserv					-0.0752** (0.0292)
year	0.0819*** (0.0007)	0.0818*** (0.0007)	0.0817*** (0.0008)	0.0816*** (0.0007)	0.0815*** (0.0007)
cons	-155.5042*** (1.4215)	-155.4608*** (1.4366)	-155.0805*** (1.5033)	-154.9697*** (1.4734)	-154.7447*** (1.4527)
obs	1036	1036	1036	1036	1036

Note: The data in brackets is standard error; * * *, * ** is significant at the level of 1%, 5% and 10% respectively. The same below.

Table 2 reports the fixed effect regression results of model (1). Column (1) of Table 2 only estimates the explanatory variables in model (1), and adds control variables to model (1) one by one from columns (2) to (5). With the addition of control variables one by one in the econometric model (1), the significance of the model has not changed significantly, indicating that the estimation result is relatively robust. The estimation results in column (5) show that the development of digital Inclusive Finance will significantly promote the increase of farmers' income. For each unit of digital inclusive finance index, farmers' income will increase by 2.48%. This result is relatively intuitive. Due to the integrated development of digital technology and the concept of Inclusive Finance in recent years, the access threshold of financial institutions has been reduced, which directly increases the financial lending opportunities of rural low-income groups, so as to increase the non-agricultural income of rural residents and increase the income of farmers. The development of non-agricultural industries will significantly promote the increase of farmers' income. For each unit of increase in the output value of non-agricultural industries, farmers' income will increase by 17.1%. This result is relatively reasonable. The development of non-agricultural industry will provide non-agricultural jobs for rural labor force and increase the non-agricultural income of rural residents. Hypothesis 2

of this paper is verified. The rise of the level of agricultural producer services will significantly reduce farmers' income. For every unit of agricultural producer services, farmers' income will be reduced by 7.52%. This result needs attention. The trusteeship service of agricultural production or the service of machinery instead of manpower did not directly improve the income of rural residents.

5. Robustness Test

When discussing the impact of the development of digital Inclusive Finance on increasing farmers' income, the potential endogeneity of the development of digital inclusive finance needs special attention. The potential endogeneity of the development of digital inclusive finance means that digital inclusive finance increases farmers' income through relevant factors. At the same time, the increase of farmers' income will also promote the development of digital Inclusive Finance. In order to solve the problem of endogeneity, this paper takes the lag first order of digital inclusive financial index as an instrumental variable.

Table 3. Results of instrumental variable regression analysis

Variable	(6)	(7)
lndig	0.0568*** (0.0149)	0.0335** (0.0162)
lnurban		0.0438 (0.0561)
lnagrmac		-0.0072 (0.0058)
rat		0.2292*** (0.0429)
lnagrserv		-0.0985*** (0.0232)
year	0.0798*** (0.0010)	0.0799*** (0.0011)
Under identification test Kleibergen-Paap rk LM statistic	59.001	55.131
Chi-sq(1) P-val	0.0000	0.0000
Weak identification test Kleibergen-Paap rk LM statistic	207.954	167.230
10% maximal IV size	16.38	16.38
obs	888	888

Whether the selection of instrumental variables is effective depends on the following two aspects: one is whether the instrumental variables are exogenous, and the other is whether the instrumental variables and endogenous variables have significant correlation. In this paper, 2SLS model is used for subsequent estimation, and the test results of instrumental variables are shown in Table 3. The results show that the kleibergen-paap rk LM Test in columns (6) and (7) significantly rejects the original hypothesis of "insufficient identification of instrumental variables" at the level of 1%, indicating that there is no problem of insufficient identification in the model. The F value of Kleibergen-Paaprk Wald F statistical test in column (6) and (7) is greater than the threshold under the 10% error level of Kleibergen-Paaprk weak tool variable, and the T value of tool variable is significant at the 1% level. It can be seen that the selection of each tool variable is appropriate, and there is no problem of weak tool variable. The results of

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Hansen J statistics also show that the selection of instrumental variables of the model is appropriate.

Table 3 reports the regression results of instrumental variables of model (1) estimated by 2SLS method. The regression results in column (7) show that after considering the endogenous problem, although the conclusion that the development of digital Inclusive Finance significantly promotes the increase of farmers' income is still tenable, the coefficient of digital Inclusive Finance in the second stage regression result is significantly increased to 0.0335 compared with the benchmark regression result, which shows that ignoring the endogenous problem will lead to a serious underestimate of the estimation coefficient. Overall, the regression results of instrumental variables confirm the research hypothesis 1 of this paper, that is, the development of digital Inclusive Finance has a significant positive role in increasing farmers' income.

6. Conclusions and Suggestions

This paper empirically studies the impact of the development of digital Inclusive Finance on Farmers' income by constructing the panel data model between digital Inclusive Finance and farmers' income increase, using the county-level index data from 2014 to 2020 and the instrumental variable method. The results show that: first, digital inclusive finance plays a positive role in increasing farmers' income. Second, digital inclusive finance increases farmers' income by promoting the transformation and upgrading of industrial structure. Third, the improvement of the level of agricultural producer services will reduce farmers' income, but it does not affect the significant role of digital Inclusive Finance in increasing farmers' income.

Based on the above research conclusions, combined with the actual situation of empirical figures, Inclusive Finance and increasing farmers' income, this paper gives the following policy suggestions:

First, strengthen the construction of digital inclusive financial infrastructure. The development of digital Inclusive Finance in the Yangtze River Delta has made a significant contribution to increasing farmers' income, but there is still a large room for rise. In order to continue to emphasize the role of digital Inclusive Finance in increasing farmers' income, we should strengthen the construction of information infrastructure and improve the Internet penetration rate, which requires the development of "new infrastructure" such as 5g and big data center platform. In addition, we should also promote the development of rural e-commerce, such as the construction of e-commerce sites in rural areas and a special rural logistics system, so as to give better play to the role of "digital dividend", effectively overcome the "digital divide", promote high-quality economic development in rural areas and increase farmers' income.

Second, enhance rural residents' awareness of digital Inclusive Finance. Nowadays, digital inclusive financial products are rapidly popularized in rural areas, but farmers still lack financial awareness and do not understand the essence and risks of digital finance, which may lead to new problems. Farmers' awareness of digital inclusive finance can be cultivated through the combination of online and offline. Online courses can be learned spontaneously, and offline relevant knowledge can be popularized through digital finance enterprise publicity or government organization training, so as to strengthen the depth of rural residents' understanding and contact with digital inclusive financial products.

Third, give play to the positive incentive role of Finance and taxation. The government should encourage financial institutions to appropriately lower the access threshold and guide insurance institutions to provide small life insurance and commercial supplementary medical insurance for underdeveloped areas and low-income groups. At the same time, provide more economic opportunities for low-income rural residents, enhance their employment and entrepreneurial ability, and escort them out of poverty. In the long run, the development of

digital Inclusive Finance in China should be integrated with industrial assistance, employment assistance and other assistance measures to expand the "hematopoietic" assistance function.

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