

Research on the Influence of Digital Inclusive Finance on New Agricultural Productivity

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Abstract

With the deep integration of digital technology and financial services, digital inclusive finance is constantly showing its unique advantages-inclusiveness and efficiency. This study is devoted to revealing how digital inclusive finance has injected a steady stream of powerful forces into the new agricultural productivity while promoting the development of the new agricultural productivity, and also contributed to the agricultural reform. Based on the panel data of 30 provinces (autonomous regions and municipalities) in China from 2011 to 2022, this paper empirically tests the effect of digital inclusive finance on new agricultural productivity and its internal mechanism through two-way fixed effect model and intermediary effect model. The results show that digital inclusive finance can significantly improve the development of new agricultural productivity, and this conclusion is still valid after a series of robustness tests; The mechanism analysis shows that digital inclusive finance promotes the development level of new agricultural productivity through the high polarization of industrial structure; Heterogeneity analysis shows that the promotion effect of digital inclusive finance on new agricultural productivity is more significant in the southeast area of "Hu Huanyong Line" and high economic development areas; Accordingly, it is suggested to promote the deep integration of digital inclusiveness and agriculture in all directions, further optimize the allocation of rural industrial structure, and fully stimulate the potential energy of digital inclusive finance in rural areas. At the same time, implement the policy of regional differentiation, strengthen the regional balance of digital inclusive finance, and make full use of the "digital dividend" brought by digital inclusive finance to promote the development of new agricultural productivity.

Keywords: digital inclusive finance, new agricultural productivity, advanced rural industries

1. Introduction

In September 2023, General Secretary Xi elaborated on the new quality productive forces at the symposium on promoting the comprehensive revitalization of Northeast China in the new era, pointing out the need to "accelerate the formation of new quality productive forces and enhance new driving forces for development". In January 2024, the Political Bureau of the Central Committee of the Communist Party of China clearly stated during the 11th collective study that "developing new quality productive forces is an inherent requirement and important focus for promoting high-quality development". In March 2024, the second session of the 14th National People's Congress included the development of new quality productivity in the government work report, highlighting the firm determination of the party and the country to promote the development of new quality productivity. New agricultural productivity is the application of new quality productivity in the field of agriculture. Developing new agricultural productivity is not only an inevitable choice to cope with increasingly fierce international agricultural competition, but also conforms to the inherent needs of China's agriculture to self-innovate and pursue high-quality development in the new stage of development. The development of new agricultural productivity cannot be separated from financial support, especially the support of digital inclusive finance, which is indispensable. Digital inclusive finance, with its wide coverage, low financial service costs, and flexible financial product design, can promote the improvement of the innovation ability of high-quality workers, effective integration and optimization of labor resources, enhance the quality and value of labor objects, and thus achieve the generation of new agricultural productivity. Therefore, this article aims to reveal the transformative power of digital inclusive finance in the agricultural sector, showcasing its unique charm as a key driving force for promoting the development of new agricultural productivity, and contributing to agricultural transformation.

2. Journals reviewed

With the deepening implementation of China's digital rural strategy, digital inclusive finance has attracted wide attention. In 2021, the No. 1 central document clearly proposed the strategic deployment of developing rural digital inclusive finance, encouraged the development of diversified credit services, committed to cultivating new agricultural business entities, and actively guided the transformation and upgrading of rural industrial structure to high-end and green directions. Digital inclusive finance, with the Internet, big data, cloud technology and other information technologies as its core driving force, is one of the important paths to promote financial and economic development. Its role is mainly reflected in the following aspects: from a macro perspective, digital inclusive finance adjusts income distribution, narrows the urban-rural income gap [1], stimulates rural entrepreneurship activity, increases employment rates [2], helps rural revitalization, and promotes high-quality development and common prosperity of the Chinese economy [3]. From a meso-level perspective, digital inclusive finance breaks the drawbacks of high transaction costs and information asymmetry in traditional rural financial markets, improves the fairness and convenience of rural financial services, and promotes technological innovation, thereby promoting industrial structure upgrading [4]. At the micro level, the development of digital finance has improved the financing environment for small and medium-sized enterprises, expanded their financing channels, optimized fund allocation, alleviated financing constraints, and promoted the improvement of financial service efficiency [5]. It can be seen that digital inclusive finance has great potential for improving the development of new agricultural productivity.

At present, the academic community has only achieved some preliminary theoretical research results on the overall level of new quality productivity. New agricultural productivity, as a core branch, is still in its initial stage of research and analysis. Currently, research on new agricultural productivity mainly focuses on two aspects: on the one hand, it mainly focuses on discussing the theoretical connotation, mechanism of action, and implementation path of new agricultural productivity. [6] Huang Jikun believes that the development of new agricultural productivity must focus on the optimal allocation of production factors and the optimization of the new quality product system, agricultural product new quality productivity, and factor spatial layout. [7] Luo Biliang believes that new agricultural productivity is driven by agricultural technological innovation, promoting the transformation of agricultural production activities towards digitization and greening. On the other hand, it mainly focuses on empirical analysis around the measurement of indicators and impact effects of new agricultural productivity. [8] Liu Tongshan used the CF method and 3SLS method to study the synergistic effect of moderate scale operation and technological innovation on the development of new agricultural productivity. [9] Li Yongbin pointed out through the construction of a mediation effect model that agricultural insurance can effectively promote the development of new agricultural productivity through agricultural technology innovation and large-scale operation.

In summary, many scholars have conducted research on digital inclusive finance, but there are relatively few research results on how digital inclusive finance can promote the development of new agricultural productivity. Based on this, this article draws on existing research results to explore in depth the empirical impact of digital inclusive finance on new agricultural productivity, enriching research in related fields. The marginal contributions of this study are as follows: (1) Constructing a two-way fixed effects model from an empirical perspective to explore the mechanism and influencing factors of digital inclusive finance on the development of new agricultural productivity, providing scientific basis for the research results; (2) From the perspective of advanced industrial structure, this paper elaborates on the mediating effect of digital inclusive finance on the development of new quality productivity in agriculture, and proposes policy recommendations for promoting the development of new quality productivity in agriculture through digital inclusive finance.

3. Theoretical Analysis and Research Hypotheses

3.1 The Direct Impact of Digital Inclusive Finance Development on New agricultural productivity

New quality productivity is a contemporary advanced productivity generated by technological revolutionary breakthroughs, innovative allocation of factors, and deep industrial transformation and upgrading. Its basic connotation is reflected in the highly optimized combination of laborers, labor materials, labor objects, and their highly optimized combination. Through disruptive and cutting-edge technologies, new formats, new models, and new driving forces are catalyzed, jointly shaping the "new" form of new quality productivity [10].

first of all, knowledge-based, innovative, and skilled workers are the key to accelerating the cultivation and development of new agricultural productivity. Digital inclusive finance can promote the improvement of labor quality and innovation ability. Firstly, the inclusiveness of digital inclusive finance has successfully extended financial services to middle and low skilled workers in rural areas, effectively alleviating the credit constraints faced by these groups, filling the gap in material capital and financial services, and promoting rural workers to

quickly adapt to changes in agricultural technology and market demand [11]. Then, digital inclusive finance can reduce the financing costs and thresholds for small and medium-sized enterprises, provide financial support for their development and innovation and entrepreneurship activities, and release a large number of job opportunities and innovation environments for workers, continuously absorbing and cultivating new farmers [12], and further enhancing the level of agricultural human capital.

Secondly, new quality labor materials are the material basis of new agricultural productivity. Digital inclusive finance can promote the rational allocation and efficient utilization of agricultural data. Digital inclusive finance can break the geographical distance limit of traditional physical outlets, efficiently match financial supply with the demand of the real economy, promote the continuous improvement of Internet technology and network infrastructure, so as to provide more perfect financial services for remote areas and vulnerable groups, and expand the coverage and depth of inclusive finance [13]. In addition, digital inclusive finance can attract capital from urban sectors to go to the countryside, relax the financing constraints of farmers, provide necessary financial support for agricultural production, improve the level of agricultural mechanization, and further promote the integration of urban and rural capital factors [14].

Finally, the new quality labor object is an important component of new agricultural productivity. Digital inclusive finance can promote the value creation of labor objects. Digital inclusive finance relies on its low cost, high efficiency, and low energy consumption characteristics to catalyze innovation in financial products, guide capital flow towards green economy and technology fields, assist agricultural practitioners in choosing eco-friendly fertilizers and pesticides, significantly improve crop quality and yield, thereby stimulating the potential of green total factor production, promoting a win-win situation between economic and ecological benefits, and promoting the transformation of agriculture towards green development [15]. Based on the above analysis, this article proposes hypothesis 1.

H1: The development of digital inclusive finance can significantly improve the new quality productivity of agriculture.

3.2 The Mechanism of Digital Inclusive Finance on New Agricultural Productivity

Digital inclusive finance is conducive to the upgrading of industrial structure. On the one hand, the "inclusive" characteristics of digital inclusive finance, as well as the reduction of financing thresholds and costs, enable the resolution of funding constraints for agricultural enterprises, small-scale agricultural operators, and new agricultural operators in the process of rural industrial upgrading. Rural leading enterprises, professional cooperatives and other new agricultural management entities play an important role in China's rural industrial structure. However, a survey found that nearly 60% of respondents have financial difficulties in the process of rural industrial transformation and integration [16]. Digital inclusive finance has achieved the full electronic process of loan application, approval, and disbursement by establishing an online service platform, greatly shortening the loan cycle. For new agricultural business entities in urgent need of funds, it is easier to cope with seasonal funding gaps and alleviate the financial constraints of rural industrial transformation and upgrading. Inclusive finance has improved the coverage and depth of financial services in rural areas, accelerated the rational flow of finance between rural industries, and thus promoted the upgrading of industrial structure [17]. On the other hand, digital inclusive finance, through the application of digital technology, can accurately match the various demand ends of the industrial chain. Through the data information generated by transactions, it provides deep fitting digital financial service support for various links in the rural industrial chain, such as supply chain finance and order financing. These financial services significantly enhance the operational efficiency and coordination of the entire industrial chain, and further promote the rational and efficient allocation of financial resources, promoting the optimization and upgrading of rural industries. In addition, the development of digital inclusive finance has accelerated the construction of digital infrastructure in rural areas. The application of cutting-edge technologies such as big data and cloud computing has reconstructed the traditional consumption pattern and nurtured emerging market demand [18]. This series of changes closely connects the two ends of agricultural production and agricultural product sales, deepening the interaction and integration between agriculture, industry, and service industry, stimulating the coordinated development between primary, secondary, and tertiary industries [19], creating broader space and possibilities for rural economic activities, and driving the multi-dimensional and deep level optimization and upgrading of the rural industrial system.

The high polarization of industrial structure is an important way to promote new quality productivity in agriculture. Firstly, the advanced industrial structure has driven the optimization of the employment structure and the overall improvement of labor quality. It emphasizes the cultivation of high-quality agricultural talents, especially specialized agricultural education and skills training, aiming to forge a professional group of farmers who are

proficient in modern agricultural technology and good at market operation, becoming the core driving force for promoting new agricultural productivity [20]. Secondly, with the advanced development of industrial structure and increased investment in agricultural technology, the application of digital technology in various aspects of agricultural production, processing, and sales is becoming increasingly widespread, and a series of new tools integrating green, automatic, and intelligent features are also emerging. The emergence of these new tools greatly enhances operational accuracy, reduces cost consumption, and stimulates high-quality yield and energy increase in multiple dimensions such as genetic breeding and field management. From this, it can be seen that the process of advanced industrial structure has reshaped the material form and organizational mode of agriculture. It has improved traditional labor materials, created new types of labor materials, and collaborated with new agricultural workers to form a set of high-efficiency production models, greatly accelerating the overall efficiency improvement of agriculture. Finally, the advanced industrial structure achieves a harmonious unity of economic benefits and ecological protection. In the process of industrial restructuring, agricultural enterprises continuously innovate their management concepts and business models, form their own brand advantages, and promote the high-quality development of the enterprise economy. At the same time, through industrial structure optimization, agricultural enterprises can reasonably allocate land and labor resources, reduce environmental losses, promote the transformation of agriculture towards a more refined and efficient intensive growth model, and pave the way for sustainable agricultural development. Based on this, this article proposes hypothesis 2.

H2: Digital inclusive finance promotes the development of new agricultural productivity through high polarization of industrial structure.

4. Model Design and Variable Description

4.1 Model Settings

To explore the direct effects of digital finance on new agricultural productivity, a benchmark regression model is constructed as follows:

$$nxs_{it} = \alpha + \beta_1 dfi_{it} + \beta_2 Con_{it} + \nu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

In equation (1): i represents the province (district, city); t represents the year; nxs stands for new agricultural productivity, dfi stands for Digital Inclusive Finance, and Con represents a series of control variables; β_1 is the estimated coefficient of the core explanatory variable (i.e. digital inclusive finance); β_2 is the coefficient of the control variable; ν and λ represent fixed effects of time and province; ε_{it} is a random perturbation term.

4.2 Variable Declaration

4.2.1 Explained Variable

The dependent variable is new agricultural productivity (nxs). Based on the basic connotation of new agricultural productivity and drawing on the relevant research results of scholars [21] [22], a measurement index system for the level of new agricultural productivity was constructed by selecting 23 indicators from three dimensions: laborers, labor materials, and labor objects. The specific content is shown in Table 1. On this basis, the entropy weight TOPSIS method is used as the core analysis tool to calculate the weights of each sub index. At first, the index data is dimensionless. Secondly, the entropy weight method is used to calculate the proportion of the index. Finally, the TOPSIS method is used to determine the distance between each index and the positive and negative ideal solutions. Finally, the development results of new agricultural productivity in each province from 2011 to 2022 are obtained.

Table 1. Indicator System for Measuring Agricultural New Quality Productivity

Criterion layer	First level indicator	Econdary indicators	Measurement method	Attribute	Weight
Labor	Productivity of workman	Economic income	Per capita disposable income of rural residents	+	0.0344
		Agricultural output	Total agricultural output value / (Primary industry labor force)	+	0.0564
	Labor quality	Degree of education	Years of education for farmers	+	0.0204
		Education cultivation	Rural residents' expenditure on education, culture, entertainment	+	0.0283

			and consumption		
	Employment philosophy of labors	Employment	1- (Primary industry labor force/Total labor force)	+	0.0005
Means of labor	Material labor materials	Infrastructure	Length of optical cable line	+	0.0576
			Number of agricultural meteorological observation stations	+	0.0250
		Resource output level	Total agricultural output value/cultivated land area	+	0.0542
			Grain yield per unit area	+	0.0154
		Resource utilization level	Total power of agricultural machinery/cultivated land area	+	0.0377
			Total agricultural water consumption/Total output value of the primary industry	+	0.0709
	Intangible labor materials	Technological innovation level	Internal expenditure of R&D funds * (Total output value of agriculture, forestry, animal husbandry and fishery/GDP)	+	0.0765
			Number of agricultural technology patents/Rural population	+	0.0942
		Informatization level	Total volume of postal and Telecommunications services/GDP	+	0.0972
			Rural broadband access users/Internet access users	+	0.0214
subject of labor	New quality industry	Agricultural industry	Number of Farmers' Professional Cooperatives/Employees in the Primary Industry	+	0.0466
			Number of beautiful leisure villages	+	0.0835
		Digital industry	The proportion of rural cable radio and television users to the total number of households	+	0.0446
			Number of mobile phones per 100 households owned by rural residents	+	0.0131
		Environmental pollution	Pesticide usage/Sowing area	-	0.0042
			Usage of agricultural plastic film/Sowing area	-	0.0054
		Green ecology	Forest coverage	+	0.0373
			Number of certified green food products	+	0.0753

4.2.2 Core explanatory variables

Explanatory variable: Digital Inclusive Finance (dfi). Regarding the measurement of digital inclusive finance indicators, many scholars currently commonly use the Digital Inclusive Finance Index compiled by the Digital Inclusive Finance Research Institute of Peking University [23]. Due to the significant difference in magnitude between the Digital Inclusive Finance Index and the New agricultural productivity Evaluation Index, relevant indicators such as the Digital Inclusive Finance Index are divided by 100.

4.2.3 Intermediary Variable

Intermediate variable: Advanced industrial structure (ari). Drawing on the methods of Wang Wei et al. to measure it [24], the specific disclosure is as follows:

$$ari = \sum_{i=1}^3 K_i \times i = K_1 \times 1 + K_2 \times 2 + K_3 \times 3 \quad (2)$$

In equation (2), the ratio of the output value of the i -th industry to the total output value is represented by K_i ;

4.2.4 Control Variable

To ensure the accuracy of the results, this article refers to relevant literature [25] [26] and selects urbanization rate (urb), logistics development level (lnhfv), fiscal support for agriculture (fsa), and financial development level (fin) as control variables. The urbanization rate is expressed as the ratio of urban population to total population; The level of logistics development is measured by the natural logarithm of road freight volume; The financial support for agriculture is expressed as the proportion of expenditure on agriculture, forestry, water affairs, and environmental protection to GDP; The level of financial development is measured by the ratio of the balance of deposits and loans of financial institutions to GDP.

4.3 Data Sources

Due to the lack of some data in Xizang, this study selects panel data from 30 provinces (cities and autonomous regions) in China from 2011 to 2022. The data on digital inclusive finance comes from "The Digital Inclusive Finance Index of Peking University", and the rest of the data comes from "China Statistical Yearbook", "China Rural Statistical Yearbook", "China Population and Employment Statistical Yearbook", "China Science and Technology Statistical Yearbook" and "local statistical yearbooks". Partial missing values were supplemented using linear interpolation, and the descriptive statistical analysis of each major variable is detailed in Table 2.

Table 2. Descriptive statistics of variables

Attribute	Variable	Sample size	Mean value	Variance	Minimum value	Maximum value
Explained Variable	nxs	360	0.2490	0.0886	0.1027	0.4857
Explanatory variable	dfi	360	2.4393	1.0764	0.1833	4.6069
Intermediary variable	ari	360	2.5662	0.3052	2.0736	3.9922
Control variable	urb	360	0.6012	0.1206	0.3504	0.8958
	lnhfv	360	11.3495	0.8674	8.8203	12.6610
	fsa	360	0.0395	0.0253	0.0086	0.1451
	fin	360	3.4323	1.0948	1.6776	7.6223

5. Empirical Result Analysis

5.1 Benchmark Regression Analysis

Table 3 shows the baseline regression results, where columns (1) and (2) respectively indicate the regression results of digital inclusive finance on the development of new agricultural productivity with and without control variables. The comparative results show that regardless of whether control variables are added to the regression model, digital inclusive finance has a significant positive promoting effect on new agricultural productivity at the 1% level. That is, for every 1 unit increase in digital inclusive finance, the average increase in new agricultural productivity is 0.0947 and 0.1122 units, respectively. The possible reason is that the complexity of new agricultural productivity is constrained by multidimensional factors, such as climate and terrain, soil conditions, policy orientation, and regional agricultural structure, which may limit the full potential of digital inclusive finance. However, digital inclusive finance has the characteristic of wide coverage, which can precisely overcome such limitations. By providing a wider range of financial services, optimizing information exchange mechanisms, and accelerating the popularization of technological knowledge, it has a universal positive effect on new agricultural productivity. Therefore, although there is not much difference in new agricultural productivity among provinces, the promotion and application of digital inclusive finance can still promote new agricultural productivity at various levels and regions.

Table 3. Benchmark Regression Results

	(1)	(2)
dfi	0.0947*** (0.0000)	0.1122*** (0.0000)
Control variable	No	Yes
Fixed province	Yes	Yes
Fixed year	Yes	Yes
N	360	360
adj. R ²	0.9359	0.9389

Note: the values in parentheses are Z, and^{***}、^{**}、^{*} indicate significance at the 1%, 5%, and 10% statistical levels.

5.2 Robust Test

5.2.1 Sample Data Screening

The original data was truncated by 1% and 5%, and the results after re regression are shown in columns (1) - (2) of Table 4. The results show that after removing the influence of outliers, digital inclusive finance still has a significant positive effect on new agricultural productivity at the 1% level.

5.2.2 Excluding the Impact of the Epidemic and Municipalities Directly Under the Central Government

Considering the impact of the epidemic and municipalities directly under the central government on the relationship between digital inclusive finance and new quality productivity, this article excludes data from 2020-2022 and four municipalities directly under the central government in China, namely Beijing, Tianjin, Shanghai, and Chongqing, and conducts regression analysis. The results of columns (3) and (4) in Table 4 show that in all the tests mentioned above, the regression coefficients of digital inclusive finance are significantly positive, consistent with the benchmark regression results, indicating that hypothesis H1 is valid in this study.

5.2.3 Increase Control Variables

Adding control variables can further fully consider the potential influencing factors of the relationship between digital inclusive finance and new agricultural productivity, and avoid estimation bias. Therefore, based on the control variables mentioned earlier, infrastructure level (road), social development level (sum), and technology market development level (tech) are selected as new control variables. Among them, the infrastructure level is processed by taking the logarithm of the road mileage; The level of social development is expressed as the ratio of total retail sales of consumer goods to GDP; The development level of the technology market is represented by the ratio of technology market transaction volume to GDP. Re expand the regression with the newly added control variables, and the results are shown in columns (5) - (7) of Table 4. The regression results indicate that after sequentially adding new control variables, the regression coefficient of digital inclusive finance on new agricultural productivity remains significantly positive, confirming the high robustness of the regression results.

Table 4. Results of Robustness Test

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
dfi	0.1083 ^{***} (0.0000)	0.0580 ^{***} (0.0015)	0.0357 [*] (0.0768)	0.1505 ^{***} (0.0000)	0.1122 ^{***} (0.0000)	0.1065 ^{***} (0.0000)	0.0983 ^{***} (0.0000)
road					0.0024 [*] (0.0769)		
sum						0.0734 ^{**} (0.0258)	
tech							0.4922 ^{***} (0.0044)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed province	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	360	360	270	312	360	360	360
adj. R ²	0.9390	0.9276	0.9425	0.9418	0.9395	0.9394	0.9405

Note: the values in parentheses are Z, and^{***}、^{**}、^{*} indicate significance at the 1%, 5%, and 10% statistical levels.

5.2.4 Endogeneity Test

Although benchmark regression models use fixed years and provinces, and consider a range of control variables to avoid potential omitted variable bias, they still face endogeneity issues caused by mutual causality. To ensure the reliability of the research results, this study used a two-stage least squares method for endogeneity testing, with instrumental variables selected as lagged by one period and lagged by two periods of the digital inclusive finance index (Table 5). The reason is as follows: the development of digital inclusive finance in the previous year may have a direct impact on the development of digital inclusive finance in the current year, but the level of development of new agricultural productivity in the current year cannot have a reverse effect on the digital

inclusive finance situation in the previous year or two, effectively eliminating the possibility of causality and meeting the requirements for selecting instrumental variables. The regression results of the lagged first and second periods of the Digital Inclusive Finance Index are shown in columns (1) - (2) and (3) - (4) of Table 5, respectively. From the first stage regression results, it can be seen that both instrumental variables are significantly positive at the 1% level, and the F-statistic value is greater than the critical value at the 10% level of the Stock-Yogo weak identification test (16.38), indicating the absence of weak instrumental variables; The LM statistic significantly rejects the null hypothesis of insufficient identification of instrumental variables, indicating that the selection of instrumental variables is reasonable; This indicates that from the second stage regression results, the digital inclusive finance index is significantly positive at the 1% level, which means that after considering endogeneity issues, the promoting effect of digital inclusive finance on new agricultural productivity still holds true.

Table 5. Results of endogeneity test

Variable	(1) Phase 1	(2) phase 2	(1) Phase 1	(2) phase 2
dfi		0.144*** (0.0240)		0.255*** (0.0444)
Instrumental variable	0.773*** (0.0390)		0.509*** (0.0583)	
Control variable	Yes	Yes	Yes	Yes
Fixed province	Yes	Yes	Yes	Yes
Fixed year	Yes	Yes	Yes	Yes
LM statistic	100.880***		46.717***	
F statistic	419.878		87.298	
Weak recognition test	16.38	16.38	16.38	16.38
Critical value at the 10% level				
N	330	330	300	300

Note: the values in parentheses are Z, and ***, **, * indicate significance at the 1%, 5%, and 10% statistical levels.

5.3 Mechanism Analysis

This article refers to the research of Wen Zhonglin et al. [27] and constructs a mediation effect model to explore the transmission mechanism of the impact of digital inclusive finance on new agricultural productivity. The specific disclosure is as follows:

$$ari_{it} = \alpha_0 + \beta_1 dfi_{it} + \beta_2 Con_{it} + \nu_i + \lambda_t + \varepsilon_{it} \quad (3)$$

$$nxs_{it} = \alpha_0 + \beta_1 dfi_{it} + \beta_2 ari_{it} + \beta_3 Con_{it} + \nu_i + \lambda_t + \varepsilon_{it} \quad (4)$$

In equations (3) to (4), ari_{it} represents the upgrading of industrial structure, and the other variables are the same as above.

The regression results of the impact of the development of digital inclusive finance on new agricultural productivity through the upgrading of industrial structure are shown in Table 5. The coefficient of column (1) in Table 5 for digital inclusive finance is 1.4978, which is significant at the 1% level, indicating that digital inclusive finance is positively promoting the development of a highly polarized industrial structure. The coefficients of column (2) for both digital inclusive finance and highly polarized industrial structure are significantly positive, indicating that highly polarized industrial structure plays a mediating role in the process of digital inclusive finance promoting the development of new agricultural productivity. Hypothesis H2 in this paper is verified.

Table 5. Results of mediation effect test

	(2) ari	(3) nxs
dfi	1.4978*** (0.0000)	0.0784*** (0.0008)
ari		0.0226***

		(0.0015)
Control variable	Yes	Yes
Fixed province	Yes	Yes
Fixed year	Yes	Yes
<i>N</i>	360	360
adj. <i>R</i> ²	0.7206	0.9404

Note: the values in parentheses are Z, and ***, **, * indicate significance at the 1%, 5%, and 10% statistical levels.

5.4 Heterogeneity Analysis

On the one hand, there are regional differences. As an important national geographic line in China, the "Hu Huanyong Line" is an important reference for examining the regional development gap in China [31]. The sample is divided into the southeast and northwest regions of the "Hu Huanyong Line" and subjected to regression grouping. See columns (1) and (2) in Table 6 for details. The impact coefficients of digital inclusive finance on the new agricultural productivity in the southeast and northwest regions of the "Hu Huanyong Line" are 0.0732 and 0.1798, respectively, and have passed the significant levels of 1% and 5%, indicating that digital inclusive finance has a significant impact on the development of new agricultural productivity in all provinces, and has a higher impact coefficient on the new agricultural productivity in the southeast region of the "Hu Huanyong Line".

On the other hand, there are differences in the level of economic development. The differences in economic development levels between regions may lead to differences in the development of digital inclusive finance. Therefore, the level of economic development is represented by the per capita GDP of the province where it is located, and the research sample is divided into high economic development areas and low economic development areas based on the median of this index. The specific results are shown in columns (3) and (4) of Table 6. Digital inclusive finance is significant at the 1% and 5% levels in high and low economic development areas, respectively. The reason for this result may be that the economic development level and relatively complete infrastructure of high economic development areas have more resources and funds invested in the field of digital innovation, thereby promoting technological research and innovation, providing strong support for digital finance, and making the region have strong digital innovation capabilities. Therefore, the role of digital inclusive finance in promoting new agricultural productivity in this region is stronger. However, low economic development areas have lower levels of economic development, relatively backward infrastructure, and limited digital innovation capabilities. Therefore, compared to high economic development areas, the role of digital inclusive finance in driving new agricultural productivity in local economic areas is smaller.

Table 6. Heterogeneity Test Results

Variable	(1) The "Hu Huanyong Line" southeast region	(2) The "Hu Huanyong Line" northwest region	(3) High economic development areas	(4) Low economic development areas
dfi	0.0732*** (0.0000)	0.1798** (0.0356)	0.0618*** (0.0017)	0.0910** (0.0107)
Control variable	Yes	Yes	Yes	Yes
Fixed province	Yes	Yes	Yes	Yes
Fixed year	Yes	Yes	Yes	Yes
<i>N</i>	300	60	180	180
adj. <i>R</i> ²	0.9676	0.8679	0.9750	0.9189

Note: the values in parentheses are Z, and ***, **, * indicate significance at the 1%, 5%, and 10% statistical levels.

6. Conclusions and Recommendations

Currently, the development of digital inclusive finance has become a key force driving China's agricultural productivity from quantitative to qualitative and from large to strong. By deepening the application of digital inclusive finance in the agricultural sector, it can fully leverage its amplification, superposition, and multiplier effects, promoting a qualitative leap in agricultural productivity. This study theoretically elucidates the intrinsic mechanism of the relationship between digital inclusive finance and new agricultural productivity. The entropy

weight TOPIS method is used to systematically measure the development level of new agricultural productivity in 30 provinces (regions, cities) in China from 2011 to 2022. The impact and mechanism of digital inclusive finance on new agricultural productivity are empirically analyzed. The main research conclusions are as follows: Firstly, the development of digital inclusive finance is conducive to improving the new quality productivity of agriculture. This conclusion still holds after reducing the tail 1% and tail 5%, increasing control variables, excluding special years, and municipalities directly under the central government. Secondly, although digital inclusive finance has significantly promoted the development of new quality productivity in agriculture as a whole, there are heterogeneity differences in different geographical locations and economic development regions. Specifically, digital inclusive finance has a stronger empowering effect on the new quality productivity of agriculture in the southeast and high economic development areas of the Hu Huanyong Line. Thirdly, digital inclusive finance can promote the development of new agricultural productivity by upgrading the industrial structure.

Based on the main research conclusions, this study proposes the following suggestions:

To begin with, comprehensively promote the deep integration of digital inclusive finance in the agricultural sector, laying the foundation for improving the level of new quality productivity in agriculture. On the one hand, we need to strengthen financial education for farmers, especially in the application of technologies such as electronic payments, blockchain, and big data analysis, to enable them to proficiently master digital financial tools and lay a solid software foundation for agricultural transformation and upgrading. On the other hand, financial institutions are encouraged to increase investment in the agricultural field and accelerate the construction and improvement of infrastructure such as the internet and mobile communication in rural areas. By improving network coverage and stability, a solid hardware foundation is provided for the application of digital inclusive finance. In addition, utilizing digital technology to transform traditional financial service models, such as online account opening, remote signing, etc., significantly reduces transaction costs, simplifies approval procedures, and improves service efficiency.

Secondly, a reasonable adjustment of rural industrial structure can improve the productivity of new agricultural products. Above all, financial institutions should timely launch financial products and loan services based on the characteristics of agriculture and the transformation and upgrading of rural industries, in order to flexibly solve the funding bottleneck problems of farmers and agricultural enterprises in the process of rural industrial structure adjustment and optimization. Then, through the integration of upstream and downstream resources in the industrial chain, a cluster effect can be formed to share advanced information, technology, and market resources, which can greatly improve agricultural output efficiency while reducing unnecessary resource consumption. This linkage mechanism helps to build a more efficient and sustainable agricultural ecological chain and promote the development of new agricultural productivity. Finally, the government should actively promote the cultivation and development of emerging industries, such as leisure agriculture, rural tourism, e-commerce platforms, etc. These new formats not only broaden farmers' income channels, but also, with the continuous development of new formats, the agricultural structure is becoming increasingly diversified, and the level of new agricultural productivity has been greatly improved.

Thirdly, considering the differences in the development level of new agricultural productivity and the degree of application of digital inclusive finance in different regions, the government should formulate differentiated support policies to promote balanced development between regions. Starting from dimensions such as coverage breadth, usage depth, and digitalization level, formulate financial inclusive policies that meet the needs of regional agricultural development to ensure the regional adaptability and maximization of policy benefits. For example, based on one's own resource endowment, agricultural development level, etc., it is necessary to enhance the scientific connection between traditional agricultural industries, strategic emerging industries, and future industries according to local conditions; At the same time, attention should be paid to the construction of digital inclusive finance infrastructure, with a special focus on the coverage of rural areas. By establishing a digital finance network covering all parts of the country, it is possible to effectively avoid the financial repression that digital inclusive finance may cause in areas with lower economic development levels, and narrow the digital divide.

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