The impact of Digital Inclusive Finance on China’s agricultural trade

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Abstract. In October 2022, the Party's 20 National Congress report clearly proposed to promote rural revitalization in an all-round way. It will need to speed up digital transformation so that digital inclusive finance can serve the high-quality development of China's agriculture. Based on this, this paper uses the panel data of 31 provinces from 2011 to 2020 to investigate the impact of digital financial inclusion on the scale of agricultural trade. The results show that digital inclusive finance can promote the trade of agricultural products, and the level of economic development is a favorable factor to promote the trade of agricultural products, while foreign investment level, traditional financial level, government intervention level and urbanization level hinder the development of agricultural products trade to a certain extent. Accordingly, relevant policy suggestions are given. First, local government needs to combine the current development of agricultural products and vigorously develop digital inclusive finance. Second, use the financial advantage of digital inclusive finance to improve the scientific and technological content of agricultural products. Third, the government needs to control the degree of intervention in agricultural trade. Fourth, increase investment in new rural infrastructure to boost trade in agricultural products.

Keywords: Digital inclusive finance, Agricultural trade, The scale of trade, international trade.

1. Introduction

Since the reform and opening up, with the strengthening of the world economic connection, China's international trade status is improving day by day. As a world - class agricultural power, China's agricultural import and export trade plays a pivotal role in the whole international trade. In 2022, the Report to the Party's 20th National Congress made a series of important decisions and plans for the work of agriculture, rural areas and farmers in the new era, including "comprehensively promoting rural revitalization", and further pointed out the overall requirements and direction for the work. Although China's imports and exports of agricultural products increased year by year from 2011 to 2020, China's trade deficit of agricultural products is too large, and the export scale is small. There are significant problems such as poor quality of agricultural products, low technology content and farmers' financing difficulties. Therefore, if China want to promote the sustainable development of agricultural trade, it is supposed to first solve the problem of financial support in agricultural trade.

In recent years, with the development and application of digital technology, digital inclusive finance, as a brand new form of financial business, has developed rapidly and solved many pain points in the development process of traditional finance. In a low-cost and convenient way, digital inclusive finance enables small and micro enterprises and farmers who have been easy to be neglected for a long time to access to finance. To some extent, it solves financing difficulties and other problems, so as to relieve their operating pressure and enjoy high-quality financial services. The "No. 1 Document" issued by the Central Committee in 2021 clearly calls for the "development of rural digital inclusive finance", sounding the clarinet for the development of rural digital inclusive finance. Promoting digital inclusive finance can effectively overcome the long-standing problems of high transaction costs, information asymmetry and financing difficulties in agricultural and rural investment and financing systems, which is of great significance to boosting rural revitalization. Rural digital inclusive finance will certainly play an important role in solving the financing difficulties in the fields of agriculture, rural areas and farmers in China.

However, there are still some difficulties and problems in the process of promoting rural digital inclusive finance, such as weak and lagging infrastructure, poor digital finance development ecology, not rich digital application scenarios, and difficult construction of big data credit system. The influence of digital inclusive finance on the development of agricultural import and export trade has become a problem worth discussing. Therefore, based on the reality of China's economic development, this paper uses the panel data of 31 provinces and cities from 2011 to 2020 to investigate the influence mechanism of digital inclusion finance on agricultural trade, and adopts five factors as control variables: economic development level, foreign investment level, traditional financial development level, government intervention level and urbanization level. It is of great practical significance to provide experience and reference for the application and development of digital inclusive finance in agricultural trade.

2. Literature review

As inclusive finance continues to empower industries, research on inclusive finance is emerging in a variety of fields and directions. After the report of the 19th National Congress proposed that "to implement the rural revitalization strategy, it is of great importance to make solving the problems of 'agriculture, rural areas and farmers' a top priority in the work of the whole Party", a large number of literatures have conducted research on the impact of inclusive finance on the problems of "agriculture, rural areas and farmers" in China. Among them, most studies have examined its effect on urban-rural income gap, poverty alleviation, rural finance and other aspects.

In terms of urban-rural income gap, Zhou (2020) uses the MM decomposition method of quantile regression to judge whether digital inclusive finance brings "digital dividend" or "digital divide" [1]. Zhang et al. (2021) pay special attention to the narrowing of the "digital divide" [2]. Based on the China Household Tracking Survey (CFPS), they find that digital finance helps to restrain the widening of the digital divide and its negative effects. In terms of poverty alleviation, Zhu and Wang (2017) for the first time changed the research perspective from provincial to county level, adopted the two-stage least square method, and concluded that the effect of inclusive finance on poverty reduction and income increase of rural residents in poor counties was significantly less than that in non-poor counties [3]. On this basis, Liu and Liu (2020), starting from the perspective of innovative Internet, concluded that the goal should be to directly increase the financial availability of poor farmers, so as to break the disadvantages of the dual structure of urban and rural finance [4]. In terms of rural financial construction, some scholars identified problems such as the difficulty in determining ownership of rural assets and the high cost of financial operation in the process of inclusive financial services (Wang 2018) [5], the heterogeneity of different types of rural formal financial demands (Fu et al. 2018) [6], the contradiction between financial inclusion and the profitability of rural commercial banks (Dong et al. 2021) [7], etc. And they put forward a series of feasible paths and strategies.

In addition, some literatures use relevant data to study the impact of digital financial inclusion on export trade (trade scale, trade structure).

From the perspective of trade scale, most studies take the enterprise level as the entry point. For example, Chen and Qiu (2021) selected the export data of enterprises from 2011 to 2013 to study and discuss the role channels of digital finance in promoting the export of enterprises [8]. Zhang et al. (2022), based on the relevant data of domestic small and medium-sized enterprises and the digital inclusive finance index, found that digital inclusive finance significantly promoted the export of small and micro enterprises by improving the working capital use efficiency of small and medium-sized enterprises [9]. In addition, some scholars went beyond the enterprise level and tested from the regional level that digital inclusive finance is conducive to promoting the development of export trade in the eastern and central regions, while its impact on the development of export trade in the western region is not significant (Zhao et al. 2021) [10]. In addition, they also investigated the impact of inclusive finance gap between China and other countries on China's foreign trade exports from the level of country differences. The results show that the larger the gap, the more adverse it will be to China's export (Li 2021) [11]; From the perspective of trade structure, Fan and Zhang (2016) used the data of 15 manufacturing industries in 10 provinces from 2004 to 2013 and found that the impact of inclusive finance on exports was significantly heterogeneous in terms of industry, and the impact on industries with high dependence on external financing was more significant [12]. Wang (2017) verified the effect of inclusive finance development on the optimization of China's export trade structure based on the three dimensions of financial scale, financial structure and financial efficiency [13]. Combined with the above findings, these studies have provided a research basis for promoting the sustainable development and multi-application of inclusive finance.

After sorting out the existing research, it is found that the existing research focuses on the impact of inclusive finance on "agriculture, rural areas and farmers", while the related research on agricultural products is relatively lacking. In addition, the research direction of inclusive finance is too macro, and the small category of inclusive finance is ignored. For example, the academic circle ignores the small category of "agriculture, rural areas and farmers" -- planting industry (food and agricultural products, etc.). This is not only the focus of targeted poverty alleviation and the implementation of the rural revitalization strategy, but also the focus of inclusive finance, which has important research value.

Therefore, in order to enrich the in-depth study of inclusive finance and make up for the limitations of previous literatures, this paper selects the inter-provincial panel data of agricultural trade from 2010 to 2020 as the basis and constructs an econometric model to investigate the impact mechanism of digital inclusive finance on the import and export trade of agricultural products. In addition, five control variables including economic development level, foreign investment level, financial development level, government intervention level and urbanization level were added, in order to improve relevant research in this field and provide experience reference for the development of agricultural trade.

3. Research Design

Data sources. In this paper, 31 provinces and cities (excluding Hong Kong, Macao and Taiwan with missing data) were selected as research objects. Panel data from 2011 to 2020 were used to analyze the impact of digital financial inclusion on the import and export trade of agricultural products. The main variable data came from China Statistical Yearbook and the website of the National Bureau of Statistics, etc., and some missing data were filled by interpolation method.

Table. 1 Descriptive statistics of variables

Variables	Obs	Min	Max	Mean	Std. Dev.
exim	310	0.140	427.0	63.47	86.49
ifi	310	16.22	431.9	216.2	97.03
gdp	310	16165	164889	53357	26990
fdi	310	0.000107	0.121	0.0199	0.0187
fin	310	1.528	8.131	3.304	1.206
gov	310	0.119	1.354	0.297	0.210
urb	310	0.228	0.938	0.579	0.132

Model setup. Based on literature review, the following panel model is set in this paper to investigate the influencing factors of agricultural import and export trade, as shown in (1) :

$$exim_{it} = \alpha_0 + \alpha_1 ifi_{it} + \alpha_2 gdp_{it} + \alpha_3 fdi_{it} + \alpha_4 fin_{it} + \alpha_5 gov_{it} + \alpha_6 urb_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

Among them, $exim_{it}$ is the total import and export volume of agricultural products, which is an official indicator used to represent the total import and export volume of agricultural products in a year. The total volume of imports and exports of agricultural products is a powerful indicator of the scale of trade in agricultural products [14]. ifi_{it} is the overall digital financial inclusion index, reflecting the comprehensive level of regional digital financial inclusion development, namely, coverage breadth, depth of use, degree of digitalization and etc. Digital financial inclusion has expanded the scope of financial services, enabled more people to enjoy financial support and convenience [15], and provided a new development opportunity for the import and export trade of agricultural products in a region. For gross regional product, gdp_{it} is often considered as an influential factor in trade studies [16,17]. It reflects the final results of production activities of all resident units in a certain period of time, and is an important indicator to measure the degree of development of a region's national economy. The larger the value, the better the economic development of the region. fdi_{it} is the level of foreign investment, foreign direct investment builds strength for agricultural internationalization through promoting the adjustment of regional industrial structure and the transformation of economic development mode [18]. In addition, the technology spillover of foreign direct investment promotes the export trade of agricultural products, optimizes the brand image of foreign trade agricultural products, and pushes agricultural products to break through non-tariff barriers, so as to help agricultural products open up new markets [19]. fin_{it} is the development level of traditional finance, regional financial development plays a certain role in the steady growth of agricultural exports. A resilient financial system can expand capital channels, significantly reduce capital borrowing risks, provide financial endorsement guarantees for agricultural import and export trade, and reduce transaction costs [20]. gov_{it} is the extent of government intervention, appropriate government intervention provides a benign policy environment for the import and export trade of agricultural products, standardizes and guides market behavior, and protects the interests of market participants. Excessive intervention will disturb the market order, affect the normal operation of the market, and is not conducive to enhance the ability of agricultural import and export traders to resist risks [21]. urb_{it} is the urbanization level, expressed by the proportion of urban population in the total population. The larger the proportion, the higher the urbanization level of the region. Urbanization accelerates the establishment of a modern agricultural industrial system, improves the quality and added value of agricultural products, and promotes the transformation and upgrading of agricultural trade [22]. μ_i represents regional effect, λ_t represents time effect, ε_{it} represents random disturbance term.

Variable selection. In this paper, the total import and export volume of agricultural products was taken as the explained variable, the general index of inclusive finance IFI was taken as the core explanatory variable, and gross regional product (gdp), level of foreign investment (fdi), level of financial development (fin), level of government intervention (gov) and level of urbanization (urb) were selected as the control variables.

Explained variables. The explained variable of this paper is the total amount of imports and exports of agricultural products.

Explanatory variable. The explanatory variable of this paper is the total index of Digital inclusive finance constructed by the Digital Economy Research Center of Peking University. The index is based on six principles, that is, both breadth and depth, horizontal and vertical comparability, reflecting the balance of inclusive finance, multi-level and diversity, convenience of Internet technology and continuity and integrity of data. The index system of digital inclusive finance is constructed from three aspects: coverage breadth, depth of use and degree of digital support, and is constructed by logarithmic function. At present, the index includes three dimensions: provincial level, prefecture-level city and county, with a time span from 2011 to 2020.

Control variables. There are many researches on the influencing factors of the scale of agricultural import and export trade. Most literatures empirically test the influence path of economic development level, foreign direct investment, financial development level, government intervention level, urbanization level and other factors involving economic, social, cultural and other aspects on the import and export trade of agricultural products. Based on the availability of data, based on the studies of scholars such as Yang Yuanyuan [23] and Dong Yunfei [17], this paper selects the following factors for analysis:

Economic development level (gdp) : gross regional product.

Foreign Direct Investment (fdi) : the ratio of the amount of foreign direct investment measured in RMB to the GDP.

The level of financial development (fin) : the ratio of outstanding loans of financial institutions to GDP at the end of the year.

Government intervention degree (gov) : the ratio of general public budget expenditure of the government to the GDP.

Urbanization level (urb): ratio of urban population to total population.

The descriptive statistics of the main variables are shown in Table 1.

4. Empirical test

Results of baseline regression. In this paper, Stata software is used to regression the fixed and random effects of the model. In order to eliminate the possible multicollinearity between variables, the method of adding explanatory variables one by one was adopted for regression. Hausmann test accepted the null hypothesis, that is, the regression results of fixed effects model were considered to be more ideal. The results are shown in Table 2. It can be concluded as follows:

First, the development of digital inclusive finance plays a significant role in promoting the scale of China's agricultural trade. It affects the import and export trade of agricultural products by covering breadth, using depth and digitization degree. Firstly, digital inclusive finance expands coverage, breaks through geographical restrictions, provides financial services needed by agricultural trade enterprises, improves the accessibility and universality of financial services, and alleviates their financing constraints to a certain extent. Secondly, digital inclusive finance sinks to rural and backward areas to provide rich and precise financial services for small and micro enterprises and farmers. Various participants in the agricultural trade industry are faced with problems such as insufficient investment capital and poor capital turnover during the development period. Digital inclusive finance can not only improve trade financing methods and enrich rural capital supply through credit business, credit business, insurance business and other services, but also promote traditional rural financial institutions to lower customer threshold and innovate financial products through "catfish effect" and "technology spillover effect", so as to provide diversified financing channels for agricultural trade and promote the growth of agricultural trade scale [24]; In addition, the enhancement of digitalization is conducive to enhancing the payment convenience of agricultural import and export enterprises. As a new form of finance, it relies on artificial intelligence, big data, blockchain and other technologies to provide a digital payment platform. Digital payment provides payment convenience for agricultural import and export enterprises in procurement, foreign trade settlement and other aspects, helps reduce the opportunity cost of cash held by agricultural import and export enterprises and the transaction cost of payment and settlement, accelerates capital turnover, solves the problem of information asymmetry and so on, so as to promote the sustainable development of agricultural import and export trade. It can be seen that digital inclusive financial services provide new opportunities for the development of China's agricultural trade.

Secondly, the level of regional economic development is an important cornerstone of agricultural import and export trade. The increase of regional GDP stimulates the potential demand and purchasing power of the region in which it is located, thus increasing the total volume of agricultural imports and exports and promoting the development of China's agricultural trade [18]. To promote the development of agricultural import and export trade, it must rely on economic development. Economic development can support the construction of infrastructure such as farmland water conservancy, improve the production conditions of agricultural products, increase the added value of agricultural products, so as to promote the sustainable development of agricultural trade.

Thirdly, the level of foreign direct investment has a certain inhibitory effect on the development of agricultural trade. Compared with developed countries, China's foreign trade of agricultural products still has many problems: poor quality of agricultural products, low technical content, difficult to meet the international market demand [17]; Agricultural products in some areas lack independent intellectual property varieties and technologies, facing intellectual property barriers; In addition, agriculture itself is affected by natural factors, there is a strong uncertainty, but at present, China's agricultural technology in yield stability and risk resistance and other aspects still need to be broken through. Foreign enterprises are more inclined to invest in the second and third industries with high returns, such as manufacturing and high-tech industries, for the consideration of risk and return. Therefore, the government should guide foreign enterprises to invest in agricultural science and technology, biotechnology and other related industries that help realize mechanization and large-scale production of agriculture, and urge them to break through non-tariff barriers, so as to promote the import and export trade of agricultural products.

Fourth, the development level of traditional finance has not played its role in promoting agricultural trade. There is a long-term equilibrium relationship between the scale of agricultural trade and the level of rural financial development. First of all, rural financial institutions generally lack innovative financial products, lack of service power, and still agricultural financing difficulties, so farmers' financing needs are difficult to meet [23]. In addition, due to the weak nature of agriculture and the profit-driven nature of capital, the purpose of serving "agriculture and agriculture" of Chinese rural traditional financial institutions has been deviated, and it is difficult to provide financial services to small micro enterprises and rural areas such as backward economic development [19]. Therefore, the level of traditional financial development has a certain degree of inhibition effect on agricultural products.

Fifth, too much government intervention is not conducive to the long-term construction of agricultural trade system. On the one hand, excessive government intervention will affect the leading role of the market and destroy and interfere with the law of market operation [15]. In addition, the degree of government intervention is not well controlled, which is easy to increase the cost of social operation and reduce the efficiency of social operation. This kind of government intervention which "does not cure the root cause" cannot solve the problem of agricultural trade from the root cause, and is unfavorable to the long-term development of agricultural import and export trade.

Sixth, the level of urbanization has a significant inhibitory effect. With the accelerated pace of urbanization, the rural population is gradually transferred to the city, a large number of farmers left to cultivate the land, and the problem of abandoning farmland is becoming more and more significant. The change of urban and rural population brought by the development of new urbanization will have a certain negative impact on the production, management and sales of agricultural products, thus affecting the supply of agricultural products available for export and the demand for agricultural products in foreign markets [25]. Local urbanization and rural revitalization need to be balanced. The government needs to be vigilant about county towns siphoning rural resources to prevent the neglect of urban-rural coordinated development and the decline of the primary industry.

Table 2 Step-to-step regression results of the random effects model

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	exim	exim	exim	exim	exim	exim
ifi	0.086 * * *	0.007	0.003	0.012	0.011	0.183 * * *
	(8.3562)	(0.4888)	(0.1786)	(0.5723)	(0.5563)	(7.3195)
gdp		0.346 * * *	0.348 * * *	0.338 * * *	0.339 * * *	0.315 * * *
		(7.0045)	(7.0456)	(6.5474)	(6.5381)	(7.0264)
fdi			0.031	0.035	0.033	0.026
			(1.2292)	(1.3522)	(1.2299)	(1.0941)
fin				0.031	0.028	0.007
				(0.6562)	(0.5523)	(0.1685)
gov					0.026	0.210 *
					(0.2034)	(1.9012)
urb						0.722 * * *
						(9.6905)
Constant	0.107 * * *	0.071 * * *	0.078 * * *	0.085 * * *	0.087 * * *	0.374 * * *
	(19.6975)	(9.8948)	(8.6061)	(6.1633)	(4.6914)	(11.1065)
Regional effect	YES	YES	YES	YES	YES	YES
Time effect	YES	YES	YES	YES	YES	YES
Observations	310	310	310	310	310	310
R-squared	0.201	0.321	0.325	0.326	0.326	0.498
Number of id	31	31	31	31	31	31

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Robustness test. In order to verify the robustness of the benchmark regression results, the explained variables were replaced in this paper, that is, the popularization and development degree of digital inclusive finance was deeply understood from the two aspects of coverage breadth and use depth, and the two regression factors were respectively carried out. The results are shown in Table 3. The coefficients of all influencing factors do not change significantly in direction and value, indicating that the baseline regression results are relatively robust.

Table. 3 Robustness test results

	(1)	(2)
VARIABLES	exim	exim
cov	0.192 * * *	
	(7.2660)	
gdp	0.320 * * *	0.437 * * *
	(7.1891)	(10.1989)
fdi	0.026	0.009
	(1.0789)	(0.3427)
fin	0.002 (0.0495)	0.097 * * (2.2334)
gov	0.169	0.252 * *
	(1.5327)	(2.0904)
urb	0.797 * * *	0.438 * * *
	(9.6630)	(7.0293)
dig		0.054 * * * (3.7654)
Constant	0.399 * * *	0.247 * * *
	(10.9590)	(8.7323)
Regional effect	YES	YES
Time effect	YES	YES
R square	0.002	0.164
Observations	310	310
Number of id	31	31

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

5. Conclusions and Suggestions.

Based on the analysis of the influence of digital inclusive finance on the trade of agricultural products, this paper adds five control variables, including the level of economic development, the level of foreign investment, the level of financial development, the level of government intervention and the level of urbanization, and deeply explores the deficiencies and pain points of the trade of agricultural products in China. Based on this, this paper uses panel data of 31 provinces and cities to empirically test the influence mechanism of digital financial inclusion and other five control variables on agricultural trade. The research findings are as follows: First, digital inclusive finance is developing steadily under the guidance of the central government and governments at all levels in China. However, it is still at a low level, and the role of traditional finance in the popularization of digital inclusive finance remains to be played. Secondly, the implementation and development of digital inclusive finance is conducive to the increase of the scale of agricultural trade to a certain extent. The coverage breadth and digitalization degree of the indicators in the financial inclusion index IFI can promote the development of agricultural trade. Third, the level of economic development is significantly positively correlated with the scale of agricultural trade, while the traditional financial development level and foreign direct investment have not played their role in promoting agricultural trade, and excessive government intervention and the improvement of urbanization level have worsened the foreign trade of agricultural products.

Based on this, this paper puts forward the following policy recommendations for the development of our agricultural trade:

Firstly, it is supposed that China should do it best to develop digital inclusive finance based on the current situation of agricultural trade. At present, agricultural trade is confronted with the challenges of low digitalization level and lack of informationization and data. The development of agricultural trade urgently needs the support of digital inclusive finance. Digital inclusive finance should be used to adjust the management layout of agriculture, accelerate the transformation of agriculture to industrialization, and scale, standardize and modernize the smallholder economy. Meanwhile, the country should increase the coverage of digital inclusive finance, encourage rural financial institutions to constantly innovate agricultural financial products, provide convenient financial services for more agriculture-related enterprises and farmers, and strive to realize the modernization of digital countryside and agriculture and rural areas.

Moreover, make full use of the financial advantages of digital financial inclusion, encourage investment in agricultural science and technology, biotechnology and other industries, improve the scientific and technological content of agricultural products, and enhance the competitiveness of agricultural products trade. Digital financial inclusion can reduce the cost of financial services, improve the efficiency and level of financial services, and provide more convenient financial support for agricultural products enterprises. Relying on the abundant capital supply of digital inclusive finance, the government should encourage the import and export enterprises of agricultural products to invest in agricultural science and technology, biotechnology and other directions, and vigorously develop and promote agricultural science and technology. Therefore, the scientific and technological content of agricultural products will be increased, the production cost will be reduced, and the quality and price competitiveness of China's agricultural trade will be greatly enhanced, and the development of China's foreign trade of agricultural products will be promoted.

Furthermore, Chinese government should grasp the limits of intervention in the import and export trade of agricultural products. The government should introduce policies to encourage digital inclusive finance in the import and export trade of agricultural products. Capital is profit-driven, and without government support, it is difficult to incline financial resources to small and micro enterprises and rural households. However, when the government intervenes in the agricultural trade market, it must proceed from the long-term planning of local economic construction and agricultural trade development, introduce a supporting policy system tailored to local conditions, strengthen the reform of rural supply side, and enhance the development vitality of rural economy. At the same time, when supporting the application of digital inclusive finance in the trade of agricultural products, attention should be paid to the new risks and hazards it brings, strengthen the supervision of service providers such as financial institutions and wealth management companies on the investment of farmers, and also pay attention to the control of the government over the trade of agricultural products to prevent excessive intervention and other problems.

Fourth, increase new infrastructure investment in rural areas to facilitate the development of agricultural trade. China's economy is still characterized by a dual structure, and there is still a gap between urban and rural areas and between different regions. The government should give consideration to urbanization development and rural revitalization, increase investment in new rural infrastructure, and pay attention to the coordinated development of urban and rural areas. It should continue to support optical fiber construction and Internet coverage in remote rural areas, and push forward the construction of 5G networks as soon as possible. At the same time, preferential policies and subsidies for rural financial institutions should be strengthened, "digital travel to rural areas" should be promoted, and the use of terminal equipment by rural households should be enhanced in scope and depth, so as to ensure that all rural residents can enjoy affordable and high-quality digital financial services.

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