

Article

Examining the Impact of Digital Finance on Farmer Consumption Inequality in China

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Abstract: The development of digital finance has significantly changed farmer consumption behavior. This study used data from the China Household Finance Survey of 2015, 2017, and 2019 to examine whether digital finance can eliminate consumption inequality among farmers in China. In doing so, it provides empirical evidence for strategies for balancing social development and ensuring sustainable economic development. This study had three main findings. First, digital finance can significantly alleviate consumption inequality among farmers. Compared to basic consumption, digital finance is more effective at alleviating developmental consumption inequality. Second, digital finance can reduce consumption inequality among farmers by increasing online shopping and reducing income inequality. Third, the effect of digital finance on farmer consumption inequality is more significant in eastern China, among low-income farmers, and among farmers with primary education. These findings indicate that there is a “digital divide” and an “education threshold” in digital finance. Based on these results, this paper suggests measures for alleviating consumption inequality among farmers.

Keywords: income inequality; online shopping; digital divide; educational threshold; intermediary effect



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1. Introduction

China's rural consumption market has great potential [1]. Notably, boosting rural consumption can significantly further sustainable economic growth. However, rural consumption levels are more than 50% lower than half those in urban areas of China (Source: National Bureau of Statistics official website). Additionally, the consumption gap between farmers is large, and there is serious consumption inequality [2]. Farmer consumption inequality not only affects their happiness, but can also hinder relative poverty governance and sustainable economic development. Therefore, consumption inequality among farmers must be addressed to alleviate social contradictions and ensure sustained and stable economic operations.

Digital finance (DF) refers to traditional financial institutions and internet enterprises that use digital technology to achieve financing, payment, investment, and other new financial business models. China's DF includes mobile payment, online finance, and online loans. From 2011 to 2020, China's DF index increased from 33.6 to 334.8 (Source: “Peking University Digital Inclusive Finance Index”), achieving leapfrog development. Today, China is the most extensive user of DF in the world [3]. Relying on digital technology, DF is characterized by low costs, low thresholds, and wide coverage, which alleviate the problems of unbalanced and inadequate development of traditional finance. To date, few studies have been conducted on whether the development of DF can stimulate farmer consumption and narrow the consumption gap.

Theoretically, DF may affect farmer consumption behavior in several ways conducive to reducing their consumption inequality. First, it alters the payment method [4]. Electronic payment circumvents the time and space restrictions of traditional consumption, reduces the cost of payment, highlights consumer experience, weakens the pain of payment, and

releases farmer consumption potential. Second, it eases financing constraints [5]. Online micro-credit services meet the “small and scattered” credit needs of farmers, reduce liquidity constraints, promote farmer entrepreneurship and employment, and encourage farmer consumption. Third, it lowers the access threshold. DF’s characteristics of “low cost”, “wide coverage”, and “sustainability” enable easy access for rural low-income individuals, allowing the “long-tail group” to enjoy its benefits [6].

Based on the above analysis, this study used survey data for the years 2015, 2017, and 2019 from the China Household Finance Survey database (CHFS) by the Southwest University of Finance and Economics to explore the impact of DF on consumption inequality among Chinese farm households. We found that DF can relieve consumption inequality among farmers. These results remained robust after using the instrumental variable method and changing the empirical model. Thus, to solve the problem of consumption inequality among farmers and alleviate rural relative poverty, China should allow DF to develop and encourage more farmers to participate in the DF market.

This study contributes to the field in the following ways. First, it enriches research related to DF and farm household consumption. Most existing studies have concentrated on the impact of DF on household economic behavior [7]. Few scholars have focused on consumption inequality among farm households. Second, it enriches related studies in the field of consumption. Existing consumption studies have mostly explored consumption issues in terms of consumption levels [8], consumption structures, and urban-rural consumption gaps. However, in the context of promoting economic sharing and achieving common prosperity, there is a lack of research on consumption inequality among farm households from the micro perspective. Third, this study is the first to explore the impact of the DF mechanism on farm household consumption inequality from the perspectives of income inequality and online shopping and to analyze regional and household heterogeneity. These contributions help to broaden the scope of existing research and widen the scope of its applications.

2. Literature Review and Research Hypotheses

Chinese and foreign scholars have already conducted rich research on the topic of DF and consumption and summarized the existing literature. We developed the research hypothesis of this study on the basis of such prior research.

2.1. DF and Rural Household Consumption Inequality

China’s DF has become the leading example for the world [3]. Consumption is the endogenous driving force of a country’s economic growth and the final destination of social production. Compared to income, consumption changes can measure the level of family welfare more accurately and steadily, and so consumption inequality can more clearly reflect family economic and welfare inequality [9–11].

The popularization and development of DF has led to major changes in the consumption behavior of farmers. The method of paying after purchasing a product and using non-cash payments have reduced the psychological burden of consumers when purchasing and enhanced the consumption experience. The benefits of purchasing pleasure, which increase consumption, are often more pronounced for low-income farmers who are more cash constrained [12–14]. The popularity of DF has promoted the spread of e-commerce platforms in rural areas, broadened consumption channels, and provided families in remote areas with a variety of products to choose from. Thus, DF has increased consumption in remote and developing areas and narrowed the consumption gap [15]. Existing research evidences that the development of DF has a more significant effect on the consumption of low-income farmers, and can effectively narrow the social gap [5,16].

In light of this information, we developed Hypothesis 1.

Hypothesis 1 (H1). *DF can reduce consumption inequality among farmers.*

2.2. Influence of the DF Mechanism on Farmer Consumption Inequality

The popularization of mobile payment has changed the traditional cash payment method, popularized online shopping, eased cash insufficiency restrictions on low-income farmer consumption, broken the time and space constraints of consumption, improved payment efficiency, reduced the time and transportation costs of consumption, and improved the overall life of farmers [4,17]. Furthermore, the use of DF can effectively increase farmer income and reduce consumption inequality by alleviating income inequality. First, the use of DF can effectively optimize the allocation of household assets. Diversified online financial products and lower financial wealth management thresholds have opened the door for low-income farmers to enter the financial market, increased farmers' enthusiasm for participating in the financial market, and increased farmers' property income [18,19]. Second, by alleviating credit constraints, DF solves the problem of insufficient funds for family entrepreneurship, promotes family entrepreneurship, and increases income. Notably, these effects are more significant among low-income farmers who are more constrained by credit [20,21]. Finally, the development of DF can also increase household employment, increase the non-agricultural income of low-income farmers, and promote household consumption [22].

Therefore, we developed Hypothesis 2.

Hypothesis 2 (H2). *DF can reduce the consumption inequality of farmers by increasing online shopping and alleviating income inequality.*

2.3. Heterogeneity in the Impact of DF on Rural Household Consumption Inequality

The impact of DF on rural household consumption inequality differs across regions and household types. Regions with advanced traditional financial development witness faster DF popularization, more complete systems, and more mature conditions, which enable DF to powerfully alleviate consumption inequality [23]. Meanwhile, regarding household type, households with higher levels of financial literacy can more quickly understand and avail themselves of DF services, develop an awareness of the advantages and risks of DF, more easily adapt to DF development trends, and more proficiently use DF. Accordingly, DF more strongly reduces consumption inequality among households with relatively high levels of financial literacy [6,24].

Therefore, we developed Hypothesis 3:

Hypothesis 3 (H3). *The impact of DF on rural household consumption inequality demonstrates heterogeneity across different regional and family characteristics.*

3. Data Sources, Variable Selection, and Model Setting

The previous section hypothesized the impact of DF on farmer consumption inequality by examining existing literature. This section details the empirical analysis we conducted to test our hypotheses.

3.1. Data Sources

The data for this study were collected from the CHFS database by the Southwestern University of Finance and Economics in China. The CHFS takes micro-households as follow-up survey objects and collects household financial information. Since the first round of surveys in 2011, the samples have been tracked every two years, and the sixth round of surveys was launched in 2021. Currently, the data of the first five surveys, conducted in 2011, 2013, 2015, 2017, and 2019, have been publicly released. The sample covers 29 provinces and 1481 communities, includes urban and rural areas, and is nationally representative. The questionnaire used to collect the data includes items related to family member information, family economic activities, and family financial status. In terms of DF, the CHFS questionnaire collects information on the use of household DF and includes items

on topics, such as mobile payment, online operation, online lending, and online financial management based on household DF use. The CHFS also collects detailed statistics on various types of household consumption, including food, clothing, housing, transportation, education and medical care, online communication, shopping, and personal exchanges. Additionally, the CHFS collects basic information on household members, such as age, gender, work, marital status, health, and education level. Given these features, the CHFS database provided good data for this study. Based on the research objectives and index design, we used three-phase data from the 2015–2019 CHFS and removed missing values and samples with household heads younger than 16 years old. To ensure the continuity of the tracking objects, only data from respondents who had participated in each of the three survey periods were retained. Finally, data on 5492 farmers in each period were obtained and merged into balanced panel data.

3.2. Variable Definition

3.2.1. Explained Variable

The explanatory variable in this study is the consumption inequality of farmers. Existing studies mainly use the Gini coefficient or Theil index to describe consumption inequality; however, these studies tend to reflect inequality at the macro rather than the household level. We therefore introduce the concept of “relative deprivation of consumption,” which is based on the theory of relative deprivation and the Kakwani index. The latter is measured by farmer consumption expenditure. We used the Kakwani index to measure farmer consumption inequality [25]. The smaller the Kakwani index, the lower the household’s relative level of consumption. The specific calculation method is derived by assuming that the number of individuals in the sample group, X , is n , and arranging the consumption of farmers in the sample in ascending order. Next, the consumption distribution of the group is $X = (x_1, x_2, \dots, x_n)$, and $x_1 \leq x_2 \leq \dots \leq x_n$. Therefore, the formula for calculating the relative deprivation of consumption by the i th individual, x_i , is derived as:

$$\text{Con}_i = \frac{1}{n\mu_x} \sum_{j=i+1}^n (x_j - x_i) = \gamma_{x_i}^+ \left[(\mu_{x_i}^+ - x_i) / \mu_x \right] \quad (1)$$

where μ_x is the average consumption of the sample, $\mu_{x_i}^+$ is the average calculated according to the individuals in sample X who consume more than x_i , and $\gamma_{x_i}^+$ is the proportion of individuals in sample X who consume more than x_i .

3.2.2. Core Explanatory Variables

The core explanatory variable of this study is DF. Most existing studies on DF use the “Peking University Digital Financial Inclusion Index” (PUDFII), which covers 31 provinces. There are about 2800 counties (districts and county-level cities) in a prefecture-level city; this high number prevents the PUDFII from reflecting the use of DF at the farmer level. Therefore, this study drew on the results of other research [26] and information from the CHFS database to uncover the use of DF among farmers across four categories: mobile payment, online operation, online loan, and online financial management. To reflect the use of DF by farmers, we assigned the core explanatory variable a value of 1 if farmers used any of these types of DF, a value of 2 if they used two types, and so on.

3.2.3. Other Control Variables

Following the research of Wu et al. [18], we chose control variables from the three levels of household head personal characteristics, family demographic characteristics, and family economic characteristics. The personal characteristics of the head of the household include age, gender, marital status, and education level. The family demographic characteristics include family size, the proportion of healthy persons in the family, and the dependency ratio of older adults and children. The family economic characteristics include total family income, family net assets, and whether the household is poor. The variable description statistics are specified in Table 1.

Table 1. Descriptive statistics.

Variable	Variable Definitions	Observations	2015		2017		2019	
			Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Consumption inequality	Calculated from the Kakwani index	16,476	0.462	0.244	0.424	0.242	0.361	0.247
DF	Divided into four categories: mobile payment, online operations, online loans, and online financial management. If any one of these is used, the value is 1; if two are used, the value is 2, and so on.	16,476	0.021	0.155	0.115	0.375	0.426	0.652
Gender	Male = 1, female = 0	16,476	0.889	0.314	0.891	0.312	0.843	0.364
Age	Age of household head	16,476	55.707	12.065	57.002	12.067	58.603	11.700
Education	Education level of household head	16,476	2.487	0.957	2.487	0.974	2.525	1.002
Marital status	Married = 1, other = 0	16,476	0.898	0.302	0.878	0.327	0.867	0.340
Healthy ratio	Proportion of healthy members to number of family members	16,476	0.618	0.308	0.736	0.327	0.740	0.340
Child dependency ratio	Proportion of children to adults	16,476	0.265	0.436	0.250	0.456	0.218	0.418
Older adult dependency ratio	Proportion of older adults to adults	16,476	0.559	0.723	0.705	0.803	0.774	0.824
Family size	Total number of family members	16,476	3.042	1.223	2.665	1.097	2.541	1.076
Income	Family net income logarithm	16,476	9.722	1.437	9.934	1.357	9.902	1.407
Assets	Family net worth	16,476	11.762	1.230	11.702	1.375	11.847	1.344
Poverty	The value is 1 if the family is a poor household, and 0 otherwise.	16,476	0.176	0.381	0.235	0.424	0.301	0.459

3.3. Model Design

3.3.1. Benchmark Regression Model

Based on the research objectives of this study, combined with the data, and according to the results of the Hausman test, we established that a p -value of 0.00 would mean rejecting the original hypothesis that the disturbance term was not related to the explanatory variable. We selected a panel two-way fixed-effects model to conduct an empirical analysis on the impact of DF on rural household consumption inequality. The benchmark regression model was constructed as follows:

$$\text{Con}_{it} = \alpha + \beta_1 DF_{it} + \gamma_1 X_{it} + \epsilon_{it} \quad (2)$$

where Con_{it} represents the consumption inequality of the i th farmer in year t ; DF_{it} represents the use of DF by the i th farmer in year t ; X_{it} represents the relevant control variable of the i th farmer in year t ; and ϵ_{it} is a random error term.

3.3.2. Two-Stage Least Squares Method

As noted above, we used a panel two-way fixed-effects model for a benchmark regression, which alleviates the estimation bias caused by omitted variables. However, consumption inequality among farmers may adversely affect farmers' use of DF. Therefore, there may be reverse causality in the benchmark model. Accordingly, it was necessary

to use the instrumental variable method [27] to correct the benchmark model. Drawing on relevant research, we adopted the PUDFII [26] and used the product of the first lag period of DF and the first-order difference of DF as instrument variables [28] to conduct an endogeneity analysis.

3.3.3. The Mediation Effect Model

While a benchmark regression can test the relationship between DF and rural household consumption inequality, it does not reveal the internal impact mechanism. Therefore, on the basis of the benchmark regression, we employed a mediation effect model to explore the internal mechanism of DF's impact on farmer consumption inequality [29,30]. Specifically, we set the mediation effect model as follows:

$$C_{it} = \alpha + \beta_1 DF_{it} + \gamma_1 X_{it} + \epsilon_{it} \quad (3)$$

$$IN_{it} = \alpha + \beta_1^1 DF_{it} + \gamma_1 X_{it} + \epsilon_{it} \quad (4)$$

$$C_{it} = \alpha + \beta_1^2 DF_{it} + \beta_2 IN_{it} + \gamma_1 X_{it} + \epsilon_{it} \quad (5)$$

First, we regressed Model (3) to test the impact of DF on farmer consumption inequality. The meaning of each variable was consistent with the benchmark regression. Second, we regressed Model (4) to test the impact of DF on the intermediary variables and established that a significant DF coefficient would indicate that DF significantly impacts the intermediary variables. Third, we regressed Model (5) and established that a significant intermediary variable coefficient would indicate that the intermediary variable is effective and that DF development can affect farmer consumption inequality through the intermediary variable.

4. Empirical Results

This section reports the results of our empirical analysis based on the above model setting and data to verify our hypotheses.

4.1. Benchmark Regression

Table 2 reports the results of the benchmark regression of DF on rural household consumption inequality. Column (1) of Table 2 lists the two-way fixed effects of the control year and household. The regression coefficient was -0.062 and was significant at the 1% level. Each additional unit of DF reduced farmer consumption inequality by 6.2%. Columns (2)–(4) of Table 2 list the control variables that were gradually included in the basic regression; all results remained significant at the 1% level. The findings show that more intense farmer use of DF correlated with lower farmer consumption inequality.

From the perspective of the control variables, at the household head level, households with male heads had a lower degree of consumption inequality; however, this impact was not significant. Meanwhile, the regression coefficient of the age of household head was significantly positive, which means that the older the household head, and the lower their education level, the smaller the consumption demand and desire and therefore the more serious the consumption inequality of the farmer. Unmarried farmers had a deeper level of consumption inequality. However, after adding the family economic variable, this was no longer significant. This shows that the impact of the household head's marital status on consumption inequality is also affected by other family economic variables. At the family population level, families with a high proportion of healthy and underage members and large families had lower economic burdens and lower levels of consumption inequality. Further, families with a high child support ratio had high household consumption expenditures and low consumption inequality. The older adult dependency ratio was positively, but not significantly, correlated with farmer consumption inequality. At the household economic level, household total incomes and net assets were high, indicating that farmers had sufficient consumption capacity. Notably, increases

in income and assets can significantly alleviate the consumption inequality of farmers. Meanwhile, poverty did not significantly impact consumption inequality.

Table 2. Benchmark regression results.

	(1)	(2)	(3)	(4)
DF	−0.062 *** (0.004)	−0.056 *** (0.004)	−0.043 *** (0.004)	−0.035 *** (0.004)
Gender		−0.014 (0.008)	−0.005 (0.007)	−0.003 (0.007)
Age		0.002 *** (0.000)	0.001 *** (0.000)	0.001 *** (0.000)
Education		−0.014 *** (0.004)	−0.014 *** (0.003)	−0.012 *** (0.003)
Marital status		−0.038 *** (0.010)	−0.022 * (0.010)	−0.017 (0.009)
Healthy ratio			−0.029 *** (0.007)	−0.015 * (0.007)
Child dependency ratio			−0.030 *** (0.006)	−0.029 *** (0.006)
Older adult dependency ratio			0.006 (0.005)	0.002 (0.005)
Family size			−0.050 *** (0.003)	−0.041 *** (0.003)
Income				−0.020 *** (0.002)
Assets				−0.026 *** (0.002)
Poverty				0.000 (0.006)
Constant term	0.463 *** (0.002)	0.420 *** (0.023)	0.626 *** (0.024)	1.100 *** (0.036)
Time fixed effects	yes	yes	yes	yes
Household fixed effects	yes	yes	yes	yes
N	16,476	16,476	16,476	16,476
R ²	0.091	0.105	0.153	0.186
p	0.000	0.000	0.000	0.000

Note: The cluster robust standard errors are in brackets; ***, **, * represent significance levels of 1%, 5%, and 10%, respectively. The following are the same.

To further analyze the impact of DF on farmer consumption inequality, we divided farmer consumption into two categories, basic consumption and development-oriented consumption [4], and explored the impact of DF on these categories. The results are shown in Table 3. Basic consumption includes consumption related to food, clothing, and housing. Developmental consumption includes consumption related to medical care, education and entertainment, household equipment services, transportation and communication, and other forms of consumption. In terms of regression results, the impact of DF on farmer basic consumption inequality and development consumption inequality was significant at the 5% level. Notably, DF more strongly alleviated developmental consumption inequality; the regression coefficient was 0.035. This may be because the consumption elasticity of basic consumer goods is small, and DF has a limited impact on it. Another explanation may be that DF presents farmers with more consumption channels. The popularization of DF broadens consumer visions and increases their willingness to consume more development-oriented goods, especially in areas with severe consumption inequality.

Table 3. Consumption sub-item regression results.

	(1)	(2)
	Basic Consumption Inequality	Developmental Consumption Inequality
DF	−0.018 ** (0.006)	−0.035 ** (0.011)
Control variable	control	Control
Constant term	0.897 *** (0.070)	1.400 *** (0.180)
Time fixed effect	yes	yes
Household fixed effect	yes	yes
N	16,476	16,476
p	0.000	0.000

4.2. Endogeneity Analysis

Although the two-way fixed-effects model used in the previous benchmark regression can solve the deviation caused by missing variables, it cannot solve the interference of reverse causality in the estimation results. Therefore, we used instrumental variables to alleviate the endogeneity estimation bias, namely the PUDFII, the product of the first lag period of DF, and the first-order difference of DF. First, the PUDFII can reflect the development level of DF in a region. The larger the index, the higher the level of DF development in the region, and the greater the possibility of farmers using DF, which meets the correlation requirements of the instrumental variables. Second, because the PUDFII is a macro index, it is difficult for it to directly affect the consumption inequality of micro farmers and meet the requirements of exogenous instrumental variables.

The instrumental variable estimation results are shown in Table 4. Column (1) of Table 4 reports the estimation results of the first stage. The results reveal that both instrumental variables are significantly positively correlated with DF, indicating that in areas with a high DF index, farmers are more likely to use DF. The F value of the one-stage estimate is 177.40, which is significantly larger than 10, excluding the weak instrumental variable problem. The KP-rk-LM statistic was 147.06 and the *p*-value was 0.000; accordingly, we rejected the unidentifiable null hypothesis and reasoned that there was a correlation between the instrumental and endogenous variables. Columns (2)–(4) report the second-stage estimation results of the instrumental variables. The *p*-values of Hansen’s exogeneity test are all greater than 0.10, which means that we could not reject the hypothesis that the instrumental variables meet the exogeneity requirements. Therefore, the two instrumental variables selected in this study were valid. As Table 4 shows, after alleviating the endogeneity problems, the role of DF in reducing farmer consumption inequality remained significant at the 1% level, the impact on basic and developmental consumption inequality was significant at the 5% level, and the mitigation effect was stronger for developmental consumption inequality, in step with the benchmark regression results above.

Table 4. Endogeneity test.

	(1)	(2)	(3)	(4)
	DF	Consumption Inequality among Farmers	Basic Consumption Inequality	Developmental Consumption Inequality
DF		−0.028 *** (0.009)	−0.022 ** (0.009)	−0.031 ** (0.012)
DF lags one period × DF first-order difference	0.605 *** (0.033)			
DF Index	0.259 *** (0.093)			
Control variable	control	control	control	control
Time fixed effect	yes	yes	yes	yes
Household fixed effect	yes	yes	yes	yes
N	10,984	10,984	10,984	10,984
One-stage F statistic	177.40	177.40	177.40	177.40
KP-LM	147.06	147.06	147.06	147.06
p	0.000	0.000	0.000	0.000
Hansen’s test p-value	—	0.670	0.832	0.323

4.3. Robustness Test

To ensure the robustness of the estimation results, we replaced the model for the robustness test [31]. According to the calculated peasant household consumption inequality index, peasant households with a consumption inequality index greater than or equal to 0.5 experience consumption inequality; we assigned such households a value of 1. Meanwhile, peasant households with a consumption inequality index less than 0.5 do not experience consumption inequality; we assigned such households a value of 0. The panel logit model was used for the robustness estimation, and the estimation results are shown in Table 5. After changing the model, the impact remained significant, indicating that the regression results were robust.

Table 5. Robustness test.

	(1)	(2)	(3)
	Consumption Inequality among Farmers	Basic Consumption Inequality	Developmental Consumption Inequality
DF	−0.528 *** (0.092)	−0.432 ** (0.154)	−0.532 * (0.266)
Control variable	control	control	control
Time fixed effect	yes	yes	yes
Household fixed effect	yes	yes	yes
N	8091	7740	9054
p	0.000	0.000	0.000

5. Mechanism Analysis

The above benchmark regression results showed that DF has significantly reduced consumption inequality among Chinese farmers. However, exactly how does DF affect consumption inequality among farmers? This section reports our study of the impact mechanism based on the aspects of farmers' income inequality [32] and online shopping [16].

5.1. Income Inequality

DF can help low-income farmers access financial services more easily, enabling "long-tail groups" to share the benefits of financial development; help farmers increase their incomes, and reduce farmer income inequality by facilitating self-employment and online financial management. Therefore, we selected income inequality as an intermediary variable to explore the role of DF on farmer consumption inequality. The Kakwani index was used to measure farmer income inequality using the measurement method mentioned above. The regression results using income inequality as a mediating variable are shown in Table 6. Columns (1) and (2) report the regression results of DF on farmers' income and consumption inequality, respectively. The regression coefficients were both significant at the 1% level, indicating that DF can increase income and consumption among low-income groups, narrow the income and consumption gap among farmers, and significantly reduce farmer income and consumption inequality. The regression results in Column (3) show that the DF coefficient is negative and the household income inequality coefficient is positive at the 1% significance level. These findings indicate that DF can affect household consumption and alleviate household consumption inequality by reducing household income inequality.

Table 6. Income inequality and consumption inequality of farmers.

	(1)	(2)	(3)
	Consumption Inequality	Income Inequality	Consumption Inequality
DF	−0.034 *** (0.004)	−0.012 *** (0.002)	−0.032 *** (0.004)
Income inequality			0.169 *** (0.020)
Control variable	control	control	control
Time fixed effect	yes	yes	yes
Household fixed effect	yes	yes	yes
Constant term	1.093 *** (0.034)	2.558 *** (0.018)	0.660 *** (0.061)
<i>N</i>	16,476	16,476	16,476
<i>p</i>	0.000	0.000	0.000

5.2. Payment Convenience

The dynamic development of DF has brought about changes in consumption payment methods. Online shopping platforms have broadened the consumption channels of farmers, and mobile payment has provided convenient modes of payment for online shopping. Farmers whose offline consumption was historically constrained by time, space, and cash in the past can switch to online shopping, which can save time and transportation costs. Further, farmers can also use online lending to realize consumption. Additionally, the post-payment process supports farmer consumption demand. Therefore, online shopping was selected as an intermediary variable, and whether the respondents had online shopping experience was selected as a proxy variable to explore the effect of DF on farmer consumption inequality. The results of the regression with online shopping as a mediating variable are shown in Table 7. Columns (1) and (2) report the regression results of DF on online shopping and rural household consumption inequality, respectively. The regression coefficients were all significant at the 1% level, indicating that DF significantly impacted online shopping and rural household consumption. Column (3) shows that the DF and online shopping coefficients are negative and significant at the 1% level, indicating that DF can provide farmers with more opportunities to access online shopping apps, promote farmer consumption, and alleviate farmer consumption inequality.

Table 7. Payment convenience and consumption inequality of farmers.

	(1)	(2)	(3)
	Consumption Inequality	Online Shopping	Consumption Inequality
DF	−0.034 *** (0.004)	0.914 *** (0.097)	−0.026 ** (0.004)
Online shopping			−0.038 *** (0.005)
Control variable	control	control	control
Time fixed effect	yes	yes	yes
Household fixed effect	yes	yes	yes
Constant term	1.093 *** (0.034)	0.054 (0.054)	1.118 *** (0.034)
<i>N</i>	16,476	16,476	16,476
<i>p</i>	0.000	0.000	0.000

6. Heterogeneity Analysis

Different regions have different levels of DF development, and different groups have different levels of access to and capacities for the use of digital financial solutions. This

section explores the heterogeneity in the impact of DF on farmer consumption inequality through regional differences and group differences.

6.1. Regional Heterogeneity

Differences in the levels of DF and economic development in the regions in which farmers are located suggest that the impact of DF on farmer consumption inequality may differ across regions. Therefore, we divided the samples into three types based on region, i.e., eastern region, central region, and western region, and conducted a heterogeneity analysis [27]. The results are shown in Table 8. The regression results evidence that the impact of DF on farmer consumption inequality is significant at the 1% level across all three regions. In terms of specific regression coefficients, the effect of DF on rural household consumption inequality is greatest in the eastern region, second greatest in the central region, and weakest in the western region. This may be due to a “digital divide”: DF is most developed in the eastern region, where farmers enjoy broader coverage and higher levels of financial literacy, factors which may cause DF to more easily impact farmer consumption behavior. Therefore, it is necessary to promote the transformation and upgrading of traditional finance in the central and western regions to DF, and to give play to the role of DF in narrowing the social gap to alleviate the development imbalance caused by the uneven distribution of financial capital across regions and achieve common prosperity.

Table 8. DF and rural household consumption inequality: Regional differences.

	(1)	(2)	(3)
	Eastern Region	Central Region	Western Region
DF	−0.039 *** (0.006)	−0.036 *** (0.007)	−0.030 *** (0.007)
Control variable	control	control	control
Time fixed effect	yes	yes	yes
Household fixed effect	yes	yes	yes
Constant term	1.046 *** (0.059)	1.111 *** (0.062)	1.119 *** (0.054)
N	5469	5061	5946
p	0.000	0.000	0.000

6.2. Household Income Heterogeneity

In addition to regional heterogeneity, the impact of DF on rural household consumption inequality may also vary according to household characteristics. Therefore, we divided the sample into three household income categories: low, medium, and high [5]. The regression results are shown in Table 9. Specifically, the results revealed that DF has a significant alleviating effect on the consumption inequality of farmers in different income classes. Meanwhile, the coefficients of the low, middle, and high-income groups were 0.063, 0.034, and 0.026, respectively. Therefore, DF had the greatest impact on the consumption inequality of low-income farmers, followed by middle-income farmers, and, finally, high-income farmers. This may be because low-income farmers are more constrained by traditional financial methods and are more sensitive to the use of DF, which has liberated their consumption potential. It can be seen that the financial exclusion and credit constraints of low-income groups are still relatively serious. DF can alleviate this dilemma, free low-income farmers from financial exclusion and credit constraints, and reduce consumption inequality among farmers.

Table 9. DF and rural household consumption inequality: Household income differences.

	(1)	(2)	(3)
	Low-Income Farmers	Middle-Income Farmers	High-Income Farmers
DF	−0.063 *** (0.012)	−0.034 ** (0.011)	−0.026 *** (0.006)
Control variable	control	control	control
Time fixed effect	yes	yes	yes
Household fixed effect	yes	yes	yes
Constant term	0.886 *** (0.078)	1.258 *** (0.142)	1.304 *** (0.133)
<i>N</i>	5492	5492	5492
<i>p</i>	0.000	0.000	0.000

6.3. Educational Heterogeneity

Due to its financial professionalism, DF has educational thresholds that hinder its popularization. For example, DF customers are required to have basic literacy and knowledge of smart phone usage. Therefore, we classified the samples according to household head education level [33], to examine differences in the effect of DF across educated groups. The regression results are shown in Table 10. Specifically, the results reveal that DF has a significant effect on alleviating consumption inequality among differently educated groups. The effect on groups with primary school and junior high school education is significant at the 1% level, and the effect on groups without primary and high school education is significant at the 10% level. This may be because DF excludes groups who have not attended school. Such people are limited by their own educational level, and it is difficult for them to enter the DF customer group. Meanwhile, groups with education above the high school level may not be so financially excluded, and the popularity of DF may have little impact on their lives. While groups with primary and junior high school education are severely excluded from traditional finance, they are able to use DF. Therefore, because DF has liberated the consumption potential of this group, these people may be more easily attracted to the digital financial market and more sensitive to the use of DF. It can be seen that the financial exclusion of groups with low education is still relatively serious. DF can alleviate this dilemma, free these groups from financial exclusion, and reduce consumption inequality among farmers. However, the “digital divide” still exists, and many people who have not gone to school are still restricted from accessing digital financial solutions. Therefore, while promoting DF development and popularization, DF training courses should be held to free more people from financial exclusion and increase their spending power.

Table 10. DF and rural household consumption inequality: Educational differences.

	(1)	(2)	(3)	(4)
	No Schooling	Primary School	Junior High School	High School and above
DF	−0.048 * (0.021)	−0.035 *** (0.008)	−0.026 *** (0.006)	−0.017 * (0.009)
Control variable	control	control	control	control
Time fixed effect	yes	yes	yes	yes
Household fixed effect	yes	yes	yes	yes
Constant term	1.067 *** (0.112)	1.163 *** (0.060)	0.927 *** (0.071)	1.379 *** (0.126)
<i>N</i>	2160	6590	5760	1966
<i>p</i>	0.000	0.000	0.000	0.000s

7. Discussion

The empirical analysis results show that DF can reduce the consumption inequality of farmers and that online shopping and income inequality play intermediary roles. Moreover, the impact effect of DF displays regional, income, and education heterogeneity, which verifies the three research hypotheses put forward above.

7.1. DF Alleviates Farmer Consumption Inequality

On the whole, DF has significantly reduced farmer consumption inequality [34]. With its inclusive nature, DF helps more low-income farmers to enjoy high-quality financial services. The World Bank has put forward the concept of “inclusive finance” to promote financial services that benefit more people and can help narrow the gap between the rich and the poor in society through financial means. However, because the promotion cost and threshold of inclusive finance is high and the sustainability of such methods is insufficient, their effect is limited. DF’s wide coverage and low threshold solve this problem.

While DF has already spread to numerous households [35], it remains necessary to accelerate its development and popularize it across central and western China and low-income earners. As part of this work, financial institutions should enrich financial products to meet the needs of farmers of different strata. Furthermore, infrastructure should be constructed and financial knowledge should be taught in developing areas to facilitate access to DF.

7.2. The Heterogeneous Impact of DF on Farmer Consumption Inequality

This study found that DF heterogeneously impacts farmer consumption inequality across different regions, incomes, and education levels [36]. DF most strongly alleviated farmer consumption inequality in eastern China and among farmers with a low education and income levels. These findings indicate that there is a “digital divide” and a “digital dividend” in DF. Developed areas in eastern China have more complete infrastructures and, relatedly, more mature conditions for the use of DF. Meanwhile, low-income earners and people with low levels of education have been excluded by traditional finance for a long time. It is notable that DF has a greater marginal impact on these groups [37]. As above, these findings suggest that DF development should be quickened, especially across central and western China, and that DF access should be ensured for low-income earners.

7.3. Impact of DF on Farmers’ Online Shopping and Income Inequality

DF can alleviate farmer consumption inequality by reducing farmer income inequality and increasing their rates of online shopping; specifically, DF can do so by increasing farmers’ income and making transactions more convenient [38]. The mobile payment function has promoted the rapid popularization of e-commerce online shopping, reduced the consumption cost of farmers, and widened their consumption channels. The online lending and financial services of DF can promote farmer entrepreneurship, employment, and income growth and enhance the consumption capacity of low-income farmers.

The development of DF has improved the convenience of consumption payments, and the convenient payment method has brought changes to the operation and consumption methods of farmers. Therefore, we should pay attention to the welfare brought about by e-commerce platforms to farmers, further promote the popularization and development of e-commerce in rural areas, and improve the consumption level and quality of farmers. In addition, we should continue to focus on enhancing the role played by online financial management and online loans in helping farmers, easing their credit constraints, enriching their income channels, and enhancing their consumption capacity.

8. Conclusions and Future Research

Based on the context of the digital economy and the digital village, this study focused on the impact of DF on farmer consumption inequality. Research hypotheses were proposed after examining the existing literature and empirical tests were carried out using the micro

panel data of the CHFS for 2015, 2017, and 2019 to test the hypotheses. Below, we present the conclusions and limitations of the study and directions for further research.

8.1. Conclusions

First, DF has significantly reduced consumption inequality between basic and developmental farmers. By using the instrumental variable method to alleviate the estimation bias caused by endogeneity, we found that these results remained significant and robust. Second, using a mechanism analysis, we found that DF can alleviate farmer consumption inequality by reducing farmer income inequality and increasing payment convenience. Third, our heterogeneity analysis found that DF involves a “digital divide”. Specifically, it most intensely alleviates rural household consumption inequality in eastern China and has a relatively weak impact on groups that have not gone to school.

8.2. Limitations and Prospects

The research in this study provides theoretical and empirical support for further extending the role of DF in alleviating farmer consumption inequality and achieving common prosperity. In doing so, it helps to alleviate the main contradiction of unbalanced social development in China and offers insights useful for other developing countries seeking to alleviate development imbalances.

However, this study had a few limitations. First, because there is no unified authoritative index standard for DF at the micro level, we could only study mobile payments, online finance, and online lending, which were available in the CHFS database. Second, this study only focused on the positive impact of the development of DF on the lives of farmers, based on data availability, and did not take up the risks of DF.

Therefore, future research on the role of DF in reducing farmer consumption inequality should also pay attention to the risks accompanying the rapid development of DF, such as excessive consumption and informal lending, which may lead to a farmers’ credit crisis and affect credit reporting. Therefore, in the process of promoting the development of DF, we also need to establish and improve the financial market supervision system to prevent financial risks.

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