

Panel Study on the Impact of Agricultural Policy-based Finance on Farmers' Income in Counties of Zhejiang Province

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Abstract

With the proposal of the rural revitalization and common prosperity strategies, the issues concerning agriculture, rural areas, and farmers have been identified as fundamental problems urgently needing to be addressed in China. Establishing agricultural policy - based financial institutions to provide credit support for agricultural and rural economies is regarded as an effective way to support agricultural development. This paper combines the agricultural credit subsidy theory and the financial technology inclusiveness theory to construct an analytical framework for how agricultural policy - based finance affects farmers' income through multiple paths. It uses a combination of macro - and micro - analysis methods and empirically verifies the research hypotheses. This paper selects a total of 798 panel data from 57 counties (excluding municipal districts) in Zhejiang Province from 2009 to 2022, and adopts a fixed - effects model to analyze the impact of agricultural policy - based finance on farmers' income and its mechanism of action, comprehensively exploring the contribution of policy - based finance to farmers' income increase. The empirical research results show that agricultural policy - based financial credit has a significant promoting effect on farmers' income, and this impact is achieved through both direct and indirect paths. Among them, the scale of agricultural development and the development of rural enterprises are important mediating factors. The former enhances farmers' income level by improving agricultural infrastructure and production efficiency, and the latter further drives farmers' income increase by promoting agricultural industrialization and enterprise development. In addition, the research shows that financial technology plays an important regulatory role in the effectiveness enhancement process of agricultural policy - based finance. By improving credit efficiency, expanding the coverage of financial services, and optimizing resource allocation, it effectively strengthens the income - increasing effect of policy - based finance.

Keywords

Agricultural Policy-based Finance; Farmers' Income; Financial Technology; County-level Panel Data.

1. Background and Significance of Topic Selection

1.1. Background

Agriculture has always been closely linked with national economic and social stability. The 2018 rural revitalization strategy puts forward that China will make "agriculture, rural areas and farmers" a fundamental issue for national governance and social development, highlighting the fundamental position of agriculture in the economic structure and the key significance of rural areas and farmers to social stability. This strategy is regarded as the key path to alleviate the main contradiction and realize the coordinated development of urban and rural areas. The

State Council clearly plans to achieve "strong agriculture, beautiful countryside and rich farmers" by 2050.

Because of the weak nature of agriculture, its development depends on national financial and policy support, financial support for agriculture, the establishment of agricultural policy financial institutions is an effective means. As the only agricultural policy bank in China, Agricultural Development Bank of China plays a key role in agricultural and rural development. The 2024 mid-year work conference showed that the policy-based loans of the ADBC accounted for 94.12% in 2023, up 0.91 percentage points from the beginning of the year. Specifically, policy-directed loans shall guarantee the purchase and storage of grain, cotton and oil and other links, and maintain food security and market stability; policy-directed loans shall focus on the granting of medium and long-term funds, support the construction of large-scale projects and public agricultural infrastructure, improve rural basic conditions, and help rural revitalization. By June 2024, the total amount of loans granted to Zhejiang branches was 434.492 billion yuan, 28.985 billion yuan for short-term working capital loans, 9.108 billion yuan for medium and long-term loans, 396.398 billion yuan for fixed assets loans, 20.303 billion yuan for self-operated loans, 197.360 billion yuan for policy-oriented loans, and 17.336 billion yuan for policy-oriented loans.

In recent years, financial science and technology and policy-based finance go hand in hand. The People's Bank of China ("PBC") shall closely follow the development of financial science and technology, and issue the FinTech Development Plan (2019- 2021) and the Financial Science and Technology Development Plan (2022- 2025) to build a policy and strategic framework for the steady development of financial science and technology. Guide financial institutions to tap the potential of digital technologies and data elements, achieve collaborative drive, empower financial services, help optimize processes, improve efficiency, and lay a solid foundation for high-quality financial development through innovative regulation, pilot and demonstration, and promotion of upgrading projects.

In this context, this paper focuses on the improvement of the agricultural development bank credit business on the agricultural economic development after the integration of financial technology.

1.2. Significance of Research

1.2.1. Theoretical Significance

Theoretically, the paper constructs a multi-dimensional analysis framework of the impact of agricultural policy finance on farmers' income and enriches the theory of agricultural economic development.

In the empirical study, it reveals the heterogeneity of policy-based finance in the dimension of region and time, clarifies the intermediary role of agricultural development scale and rural enterprise development, and points out the regulatory role of financial science and technology in enhancing policy-based finance efficiency and optimizing resource allocation, which provides a new perspective for the academic circles.

1.2.2. Practical Significance

From a practical point of view, this study is of great significance to agricultural policy finance and rural revitalization. Agricultural policy-based finance can directly help farmers increase income, but also by rural infrastructure and enterprise development indirectly, for policy direction. Study and put forward to optimize the credit, science and technology to enable, precise policy implementation and other recommendations, conducive to improving the efficiency of funds, rational allocation of resources. The regional heterogeneity and time lag can help to narrow the gap between urban and rural areas and promote regional coordinated development. The penetration of financial technology into agriculture can promote the

transformation of agriculture and the optimization of industrial structure. This study provides policy recommendations for rural revitalization, urban-rural balance and sustainable development of agriculture, and provides practical reference for the construction of agricultural policy finance.

2. Influence Path

2.1. Theoretical Mechanism and Research Hypothesis

This paper focuses on policy directive loan and policy directive loan of agricultural policy finance.

Policy directive loans shall be used to guarantee the credit demand for grain, cotton, oil and other strategic agricultural products, assist in the collection, storage, processing and circulation, maintain the food security and market stability, and have a direct impact on the income of farmers. Medium and long-term loans will be granted under policy guidance to serve large projects and infrastructure, promote the construction of new rural areas and agricultural infrastructure for public welfare, and indirectly affect farmers' income.

Based on this, this paper explores the effect of agricultural policy finance on farmers' income, and puts forward four hypotheses to guide the follow-up empirical research.

2.1.1. Agricultural Credit Subsidy Theory

Before the 1980s, agricultural credit subsidy theory dominated rural finance, and the corresponding strategy was to give priority to the development of credit supply. The theory holds that rural poor groups are short of funds, and the agricultural characteristics lead to the reluctance of commercial banks to get involved.

Therefore, the theory advocates government intervention, allocation of regulatory funds to support agriculture, poverty alleviation, implementation of discount loans to reduce high-interest institutions. Countries implement policies accordingly, the scale of rural financing has increased greatly, promoting agricultural development and alleviating poverty. China established the Agricultural Development Bank of China in the 1990s to boost agriculture with cheap credit.

The main business of the Agricultural Development Bank of China includes purchase, sale and storage of grain, cotton and oil, construction of fixed assets and working capital loans. The following will analyze the development of agricultural credit subsidy theory in its business, sort out the transmission path of agricultural policy finance to farmers' income.

(1) Extension of Agricultural Credit Subsidy Theory in Purchasing, Selling and Storing Grain, Cotton and Oil

Qian Wenwei (2021), chairman of the Agricultural Development Bank of China, pointed out that ADBC loans provided a strong guarantee for the country's food security and made significant contributions to guaranteeing farmers' income. Since 2013, the ADBC has granted cumulative loans of 3.31 trillion yuan for the purchase of grain, cotton and oil, supported enterprises to purchase 3.21 trillion catties of grain and oil and 26.22 million tons of cotton, supported the grain collection and reserves to account for nearly 50% of the social purchase volume and supported the purchase of cotton to account for more than 50% of the total output.[1]

To sum up, we put forward hypothesis 1: Agricultural policy finance loans can promote the growth of farmers' income.

(2) Extension of Agricultural Credit Subsidy Theory to Fixed Assets Construction Loan

The agricultural credit subsidy theory pays attention to the government's support to agricultural infrastructure. Fixed asset construction loans help build modern agricultural facilities for agricultural enterprises and cooperatives.

Road network construction Rural transportation shall be optimized to facilitate the transportation of agricultural products and reduce costs and losses; water conservancy construction shall ensure stable irrigation water use, precision irrigation with advanced facilities, and increase the output and quality of agricultural products; the construction of agricultural industrial parks shall integrate resources, form a agglomeration effect, and the parks shall be equipped with advanced facilities and technical platforms, and the main entities shall share resource technologies, improve production efficiency, and extend the industrial chain. As a result, farmers can both sell primary produce and obtain higher added value through processing.

Qian Wenhui (2021) indicated that the Agricultural Development Bank of China focuses on mending the weaknesses in rural infrastructure, actively supports the construction of agricultural and rural infrastructure like rural road networks, the renovation of agriculture-related shantytowns, and major water conservancy projects, and plays a crucial role in expanding the scale of agricultural development. In that year, a total of 5.4 trillion yuan in loans was disbursed, including 781.2 billion yuan for water conservancy construction, supporting 81 out of the country's 172 major water conservancy projects[1].

The disbursement of loans has significantly increased farmers' income and ensured the output of agricultural products. A certain sub-branch in Sichuan disbursed 400 million yuan to support the modern irrigation district, irrigating 300,000 mu of cultivated land and benefiting more than 100,000 rural households. Another sub-branch provided loans to support the "Four Good Rural Roads" project, connecting characteristic industrial bases, improving transportation, promoting urban-rural development, and enhancing the environmental quality and income of residents.

Domestic research shows that there is a correlation between the scale of agricultural development and farmers' income. Agricultural policy-based finance issues fixed asset construction loans, which drive rural infrastructure construction, promote the large-scale management of agricultural land, optimize production materials, popularize agricultural science and technology, expand the scale of agricultural development, and thus affect farmers' income.

In summary, Hypothesis 2 is proposed: Agricultural policy-based financial loans affect the scale of agricultural development, thereby influencing farmers' income.

(3) Expansion of the Agricultural Credit Subsidy Theory at the Level of Working Capital Loans

For new types of agricultural business entities, such as family farms and leading enterprises in agricultural industrialization, working capital loans are of particular importance. These business entities can utilize working capital loans to expand their business scale and introduce new technologies.

In 2023, the Agricultural Development Bank of China disbursed a total of 1,574.1 billion yuan in loans to small and micro enterprises, serving 64,516 such enterprises. Successful rural enterprises can play a good exemplary role and stimulate the entrepreneurial enthusiasm of farmers. Wang Yi and others (2022) concluded through empirical research that the return of migrant workers to their hometowns to start businesses can not only increase farmers' income but also narrow the income gap.[8] Li Jing and others (2022) believe that only agricultural enterprises, as the bridge connecting small farmers and modern agriculture, can truly achieve modernization[9].

income. Agricultural policy-based finance disburses working capital loans to help rural enterprises develop smoothly. The development of rural enterprises can provide more job opportunities, stimulate entrepreneurship through the demonstration effect, and transform agricultural products into high-value-added goods. Through these means, it promotes an increase in farmers' income.

In summary, Hypothesis 3 is proposed: Agricultural policy-based financial loans affect the development of rural enterprises, thereby influencing farmers' income.

2.1.2. The Theory of Fintech Inclusiveness

The fintech inclusiveness theory systematically explains how fintech eases financial exclusion and enables inclusive finance via tech innovation, model reform, and resource optimization. Its essence is that fintech overcomes traditional constraints, building a user - need - driven, tech - powered new financial ecosystem. This brings in groups shunned by traditional finance, promoting fair resource distribution and all - around development.

Wen Xuezhou et al. (2022) found empirically that boosting fintech development can notably cut SMEs' loan costs, making credit loans more accessible[2]. Wen et al. (2024), analyzing 510 commercial bank questionnaires, concluded fintech can directly improve small - micro enterprise credit accuracy, aiding precise credit handling[3]. Zhang Zhen et al. (2024) held that fintech, by innovating finance, lowers institutions' costs, benefiting farmers and influencing their income positively[4]. Fan Yunwu (2024) suggested fintech aids policy-based finance in green-agri support, streamlining credit, boosting loan efficiency, and using big data for better farmer - market matching[5]. Su Lanlan et al. (2024) proved that as farmers' digital - economy participation grows, their income rises and the gap shrinks, promoting common prosperity[6]. Considering domestic scholars' research, fintech strongly correlates with financial institutions' development and farmers' income. It impacts farmers' income by broadening financing, enhancing agri - support precision, and increasing bank loan efficiency. Based on this, this paper outlines the fourth path affecting farmers' income.

Hypothesis 4: Fintech can further enhance the positive impact of agricultural policy - based finance loan disbursement on farmers' income.

3. An Empirical Analysis of the Impact of Agricultural Policy - based Finance on Farmers' Income

3.1. Data Sources and Processing

One of the core data in this paper, the loan disbursement of Zhejiang's Agricultural Development Bank branches, comes from the internal ACMS system, with city - level data starting in 2009. As not all counties have branches, county - level loan amounts are calculated as the city's total loan volume times the county's loan - balance proportion.

The Digital Inclusive Finance Index is from Peking University's research center report, covering calculations and trends. Lacking 2009 - 2013 county - level data, the Forecast function was used for estimation.

Farmers' income is measured by the per - capita disposable income of Zhejiang's counties (excluding urban districts). Given the Bureau of Statistics' different methods before and after 2013, all income data were adjusted to 2009 prices to rule out price fluctuations.

Other relevant variable data are from the Zhejiang Bureau of Statistics and its "Statistical Yearbook". To avoid spurious regression and heteroscedasticity, all variables were logarithmically transformed to ensure data stability.

3.2. Variable Specification

3.2.1. Dependent Variable

The dependent variable in this paper is farmers' income, representing all earnings of rural residents within a year. It can directly reflect the economic strength and production efficiency of rural households. Due to adjustments in farmers' income survey regulations, the per capita disposable income of farmers is now the statistical standard. The annual per capita disposable

income of rural residents in 57 counties (excluding municipal districts) of Zhejiang Province is selected as the dependent variable, denoted as FI.

3.2.2. Explanatory Variable

The explanatory variable is agricultural policy-based finance. Zhejiang, as the first common prosperity demonstration area in China, makes the study of the Agricultural Development Bank's loan disbursement in its counties representative. When exploring the relationship between farmers' income and the credit services of agricultural policy-based finance, it's found that the bank's credit business significantly affects its development level. Domestic scholars often use the year-end loan balance of the Agricultural Development Bank to evaluate credit levels. Thus, the total year-end loan amount of the Agricultural Development Bank in each county of the province is selected to measure the strength of policy-based financial credit support for agriculture in Zhejiang, denoted as APF.

3.2.3. Moderating Variable

Research by domestic and foreign scholars shows that fintech has a certain impact on policy-based finance, especially in overcoming financial exclusion, with important research value and high credibility. Fintech is denoted as FT.

3.2.4. Control Variables

This study selects urbanization level, economic development level, industrial structure, and human capital as control variables. The urbanization level, denoted as UL, is represented by the ratio of the urban permanent population to the total population. It can provide non-agricultural employment opportunities and improve the social security system, promoting farmers' income growth and stability. The economic development level, measured by the total output value of agriculture, forestry, animal husbandry, and fishery (rural per capita GDP: total output value / rural population), is denoted as EDL, and rural economic development affects farmers' income. The industrial structure, denoted as SS, is measured by the proportion of the total value of non-primary industries in rural areas to the regional GDP. Its optimization can promote urban-rural resource flow, helping farmers gain more opportunities and income from the urban market. Referring to the research of Winters (2009) and others, human capital uses the proportion of students in primary, middle, and secondary vocational education schools to the total population (education popularization rate) as a proxy variable, denoted as HC. Improving human capital can enhance farmers' production skills, increase non-agricultural employment opportunities, and promote income growth. Raising farmers' education level can significantly boost income.

3.3. Modeling

3.3.1. Foundation Modeling.

The panel model constructed in this empirical study is shown in formula (1).

$$\begin{aligned} \text{LnFI}_{it} = & \alpha_0 + \alpha_1 \text{LnAPF}_{it} + \alpha_2 \text{LnFT}_{it} + \alpha_3 \text{LnUL}_{it} + \alpha_4 \text{LnEDL}_{it} \\ & + \alpha_5 \text{LnSS}_{it} + \alpha_6 \text{LnHC}_{it} + \mu_{it} + \varepsilon_{it} \end{aligned} \quad (1)$$

Among them, each prefecture-level city represents its time; the per capita disposable income of farmers is used as an explanatory variable; the ADBC loan volume is used as a core explanatory variable; the PKU Digital Inclusive Finance Index is used as a moderating variable;,, and, respectively, urbanization rate, per capita GDP, proportion of secondary and tertiary industries, education popularization is used as a controlling variable; and the individual fixed effect is a random disturbance item.

3.3.2. Regression Results and Hausmann Test

Different measurement methods were used to estimate the model (2) and the results were shown in Table 1. Through the analysis of the regression results, we know that the regression coefficient of policy finance has reached a significant level of 1% under both random effect and fixed effect. In order to ensure the correctness of the research results, the regression model needs to be validated and screened. Hausmann test is used. See Table 2. The result shows $P = 0.0000$. This shows that the fixed effect regression model is better than the random effect regression model in practical application.

The regression results show that there is a significant positive correlation between the ADB loan and farmers' income, and the correlation is significant at the level of 1%.

The estimates of control variables show that financial technology, economic development level, education penetration rate are all at the level of 1%, and there is a significant positive correlation with farmers' income. Under the 10% level of urbanization and industrial structure, there is a significant positive correlation between urbanization and farmers' income.

Table 1. Benchmark Regression Results

	Ols	Fe	Re
	LnFI	LnFI	LnFI
LnAPF	0.092*** (0.007)	0.172*** (0.010)	0.147*** (0.009)
LnFT	0.906*** (0.024)	0.878*** (0.033)	0.879*** (0.028)
LnUL	0.227*** (0.041)	-0.115* (0.062)	-0.010 (0.054)
LnEDL	0.322*** (0.017)	0.191*** (0.025)	0.252*** (0.022)
LnSS	-0.382*** (0.120)	0.438* (0.231)	-0.095 (0.179)
LnHC	-0.052** (0.021)	-0.235*** (0.055)	-0.144*** (0.039)
Constant Term	1.117*** (0.138)	1.398*** (0.204)	1.181*** (0.171)
Observations	798.000	798.000	798.000
R-squared	0.937	0.956	
Adjusted R-squared	0.936	0.953	

Note: The values in parentheses are standard errors. *, ** and *** indicate that the statistics are significant at the 1%, 5% and 10% significance levels, respectively.

Table 2. Hausman Test

	(b)	(B)	(b-B)	sqrt(diag(V _b -V _B))
	fe	re	Difference	Std. err.
LnAPF	0.172	0.147	0.025	0.044
LnFT	0.878	0.879	0.000	0.017
LnUL	-0.115	-0.010	-0.105	0.030
LnEDL	0.191	0.252	-0.061	0.012
LnSS	0.438	-0.095	0.533	0.146
LnHC	-0.235	-0.144	-0.092	0.039
$\chi^2(6) = (b-B)'[(V_b - V_B)^{-1}](b-B) = 62.577$				
Prob> $\chi^2 = 0.0000$				

4. An Empirical Analysis of the Influence Path of Agricultural Policy-based Finance on Farmers' Income

4.1. Establishment of the Moderating Effect Model

4.1.1. Moderating Effect

To test hypothesis 4: financial technology can further promote the agricultural policy finance loans on the income of farmers. In this paper, we introduce the variable TJ, which is the product of LnAPF and LnFT. To eliminate the effect of collinearity, LnAPF and LnFT are decentralized, as shown in formula (2).

$$\begin{aligned} \text{LnFI}_{it} = & \alpha_0 + \alpha_1 \text{LnAPF}_{it} + \alpha_2 \text{LnFT}_{it} + \alpha_3 \text{LnUL}_{it} + \alpha_4 \text{LnEDL}_{it} \\ & + \alpha_5 \text{LnSS}_{it} + \alpha_6 \text{LnHC}_{it} + \alpha_7 \text{TJ} + \mu_{it} + \varepsilon_{it} \end{aligned} \quad (2)$$

The results show that there is a significant positive correlation between the interaction items and farmers' income at the level of 1%. Hypothesis 4 shows that financial science and technology can further promote the agricultural policy-oriented finance to promote farmers' income.

Table 3. Moderating Effect

	(3.1)	(4.1)
	LnFI	LnFI
LnAPF	0.172*** (0.010)	0.144*** (0.010)
LnFT	0.878*** (0.033)	0.871*** (0.032)
LnUL	-0.115* (0.062)	-0.055 (0.061)
LnEDL	0.191*** (0.025)	0.277*** (0.028)
LnSS	0.438* (0.231)	-0.011 (0.235)
LnHC	-0.235*** (0.055)	-0.261*** (0.054)
TJ		0.086*** (0.013)
Constant Term	1.398*** (0.204)	0.696*** (0.226)
Observations	798.000	798.000
R-squared	0.956	0.959
Adjusted R-squared	0.953	0.955

Note: The values in parentheses are standard errors. *, and * indicate that the statistics are significant at the 1%, 5% and 10% significance levels, respectively.

4.1.2. Lag Effect

In this paper, variables with a one-period lag, two-period lag, and three-period lag, namely L1.LnAPF, L2.LnAPF, and L3.LnAPF, are respectively introduced to conduct a lag analysis of the model. As shown in equations (3), (4), and (5).

$$\begin{aligned} \text{LnFI}_{it} = & \alpha_0 + \alpha_1 \text{LnAPF}_{it} + \alpha_2 \text{LnFT}_{it} + \alpha_3 \text{LnUL}_{it} + \alpha_4 \text{LnEDL}_{it} \\ & + \alpha_5 \text{LnSS}_{it} + \alpha_6 \text{LnHC}_{it} + \alpha_7 \text{TJ} + \alpha_8 \text{L1.LnAPF}_{it} + \mu_{it} + \varepsilon_{it} \end{aligned} \quad (3)$$

$$\text{LnFI}_{it} = \alpha_0 + \alpha_1 \text{LnAPF}_{it} + \alpha_2 \text{LnFT}_{it} + \alpha_3 \text{LnUL}_{it} + \alpha_4 \text{LnEDL}_{it}$$

$$+\alpha_5 \text{LnSS}_{it} + \alpha_6 \text{LnHC}_{it} + \alpha_7 \text{TJ} + \alpha_8 L_2 \cdot \text{LnAPF}_{it} + \mu_{it} + \varepsilon_{it} \quad (4)$$

$$\begin{aligned} \text{LnFI}_{it} = & \alpha_0 + \alpha_1 \text{LnAPF}_{it} + \alpha_2 \text{LnFT}_{it} + \alpha_3 \text{LnUL}_{it} + \alpha_4 \text{LnEDL}_{it} \\ & + \alpha_5 \text{LnSS}_{it} + \alpha_6 \text{LnHC}_{it} + \alpha_7 \text{TJ} + \alpha_8 L_3 \cdot \text{LnAPF}_{it} + \mu_{it} + \varepsilon_{it} \end{aligned} \quad (5)$$

Substitute the above three lagged variables into the fixed-effects model. The results are shown in Table 4. The one-period lag, two-period lag, and three-period lag of policy-based finance all have a significant positive correlation with farmers' income at the 1% significance level. In addition, as the number of lag periods increases, the moderating effect gradually weakens.

Table 4. Lag Test

	(4.1)	(4.2)	(4.3)	(4.4)
	LnFI	LnFI	LnFI	LnFI
LnAPF	0.144*** (0.010)	0.104*** (0.016)	0.108*** (0.014)	0.123*** (0.014)
LnFT	0.871*** (0.032)	0.863*** (0.034)	0.814*** (0.037)	0.749*** (0.041)
LnUL	-0.055 (0.061)	-0.021 (0.067)	-0.019 (0.075)	0.032 (0.086)
LnEDL	0.277*** (0.028)	0.208*** (0.030)	0.159*** (0.031)	0.179*** (0.033)
LnSS	-0.011 (0.235)	0.334 (0.274)	0.634** (0.301)	0.518 (0.327)
LnHC	0.261*** (0.054)	0.214*** (0.060)	-0.171** (0.066)	-0.107 (0.074)
TJ	0.086*** (0.013)	0.060*** (0.016)	0.040** (0.019)	0.059** (0.024)
L ₁ .LnAPF		0.070*** (0.016)		
L ₂ .LnAPF			0.100*** (0.014)	
L ₃ .LnAPF				0.088*** (0.014)
Constant Term	0.696*** (0.226)	1.314*** (0.260)	1.849*** (0.279)	2.062*** (0.302)
Observations	798.000	741.000	684.000	627.000
R-squared	0.959	0.952	0.943	0.926
Adjusted R-squared	0.955	0.948	0.937	0.918

Note: The values in parentheses are standard errors. *, and * indicate that the statistics are significant at the 1%, 5% and 10% significance levels, respectively.

4.2. Establishment of Intermediary Effect Model for Agricultural Development Scale

In order to verify whether policy-based finance can promote the growth of farmers' income by promoting the scale of agricultural development, the mediation effect model is established as shown in Equation (6) below.

$$\begin{aligned} \text{LnSAD}_{it} = & \alpha_0 + \alpha_1 \text{LnAPF}_{it} + \alpha_2 \text{LnFT}_{it} + \alpha_3 \text{LnUL}_{it} + \alpha_4 \text{LnEDL}_{it} \\ & + \alpha_5 \text{LnSS}_{it} + \alpha_6 \text{LnHC}_{it} + \mu_{it} + \varepsilon_{it} \end{aligned} \quad (6)$$

From the regression results in Table 5, it can be seen that when the scale of agricultural development is taken as the dependent variable, policy-based finance has an obvious promoting effect on the scale of agricultural development, which verifies Hypothesis 2.

Table 5. Mediation Effect Analysis

	(3.1)	(4.5)
	LnFI	LnSAD
LnAPF	0.172***	0.039***
	(0.010)	(0.011)
LnFT	0.878***	0.281***
	(0.033)	(0.035)
LnUL	-0.115*	-0.157**
	(0.062)	(0.067)
LnEDL	0.191***	0.204***
	(0.025)	(0.027)
LnSS	0.438*	-0.983***
	(0.231)	(0.251)
LnHC	-0.235***	-0.391***
	(0.055)	(0.060)
Constant Term	1.398***	6.838***
	(0.204)	(0.223)
Observations	798.000	798.000
R-squared	0.956	0.744
Adjusted R-squared	0.953	0.723

Note: The values in parentheses are standard errors. *, ** and *** indicate that the statistics are significant at the 1%, 5% and 10% significance levels, respectively.

4.3. Establishment of the Mediation Effect Model for the Development of Rural Enterprises

The proxy variable for the development of rural enterprises is selected as the main business income of agricultural product processing enterprises above the designated size. Since the relevant county-level data of this indicator cannot be collected, the relevant data of 11 prefecture-level cities are used for each item of the mediation effect in this part. The proxy variable of human capital is adjusted from the education popularization rate in the previous text to the average years of education per capita, and the selection of other variables remains unchanged.

In order to verify whether policy-based finance can promote the growth of farmers' income by promoting the development of rural enterprises, the mediation effect model is established as shown in Equation (7) below:

$$\begin{aligned} \text{LnAID}_{it} = & \alpha_0 + \alpha_1 \text{LnAPF}_{it} + \alpha_2 \text{LnFT}_{it} + \alpha_3 \text{LnUL}_{it} + \alpha_4 \text{LnEDL}_{it} \\ & + \alpha_5 \text{LnSS}_{it} + \alpha_6 \text{LnHC}_{it} + \mu_{it} + \varepsilon_{it} \end{aligned} \quad (7)$$

From the regression results in Table 6, it can be seen that when the development of rural enterprises is taken as the dependent variable, policy-based finance has an obvious promoting effect on the development of rural enterprises, which verifies Hypothesis 3.

Table 6. Mediation Effect

	(4.1)	(5.6)
	LnFI	LnAID
LnAPF	0.115*** (0.025)	0.036** (0.016)
LnFT	0.339*** (0.044)	0.046* (0.027)
LnUL	0.025 (0.224)	-0.116 (0.139)
LnEDL	0.162** (0.074)	-0.051 (0.046)
LnSS	7.483*** (1.391)	2.427*** (0.866)
LnHC	0.283*** (0.098)	0.533*** (0.061)
Constant Term	7.562*** (0.204)	7.392*** (0.127)
Observations	154.000	154.000
R-squared	0.966	0.856
Adjusted R-squared	0.962	0.839

Note: The values in parentheses are standard errors. *, and * indicate that the statistics are significant at the 1%, 5% and 10% significance levels, respectively.

4.4. Robustness Test

To ensure that the results of the baseline regression possess the characteristics of robustness and reliability, this study employs the following methods to conduct robustness tests.

(1) In order to reduce errors and accurately determine the sample size data, this study respectively removes the economic samples of Hangzhou, which has the largest economic volume, and Lishui, which has the smallest economic volume, among all the prefecture-level cities. The regression results after this treatment are presented in the second column of Table 7. The results show that after removing the samples from extreme regions, agricultural policy-based finance still has a significant positive impact on farmers' income. Compared with the baseline regression, the coefficient regression value and significance level of the explanatory variable (agricultural policy-based finance) have not changed significantly. This further verifies the reliability and robustness of the regression results, and strongly supports the validity and credibility of the research conclusions of this study.

(2) The winsorization technique is used to perform a 1% level of winsorization on the key variables in the regression model. The corresponding regression results are shown in the third column of Table 7. After the 1% winsorization treatment, it is found that agricultural policy-based finance still has a significant and positive promoting effect on farmers' income. The results show that after conducting winsorization on the data to eliminate the possible interference of outliers, the relationship between the core variables remains stable and significant, further strengthening the robustness and reliability of the research results of this study.

(3) In order to effectively mitigate the problem of simultaneity bias, this study selects the data of the next period of the dependent variable, that is, farmers' income, to carry out regression analysis. The regression results are presented in the fourth column of Table 7. The analysis results show that at the 1% significance level, policy-based finance has a positive promoting effect on farmers' income. This result is highly consistent with the baseline regression result,

further confirming the stability and reliability of the research results of this study. It strongly illustrates the consistency and significance of the impact of policy-based finance on farmers' income under different time series settings, providing a more comprehensive and in-depth empirical support for the research conclusions.

Table 7. Robustness Test

	Exclude Hangzhou and Lishui	1% winsorization treatment	The next period of the dependent variable
	LnFI	LnFI	F ₁ _LnFI
LnAPF	0.137*** (0.010)	0.127*** (0.010)	0.116*** (0.010)
LnFT	0.838*** (0.029)	0.882*** (0.030)	0.847*** (0.029)
LnUL	0.080 (0.064)	0.086 (0.067)	0.072 (0.068)
LnEDL	0.292*** (0.025)	0.292*** (0.025)	0.268*** (0.024)
LnSS	-0.612*** (0.199)	-0.574*** (0.207)	-0.429** (0.210)
LnHC	-0.060 (0.041)	-0.036 (0.042)	-0.070 (0.043)
TJ	0.125*** (0.014)	0.122*** (0.014)	0.077*** (0.014)
Constant Term	1.167*** (0.197)	1.137*** (0.198)	1.737*** (0.197)
Observations	616.000	616.000	572.000
R-squared			
Adjusted R-squared			

Note: The values in parentheses are standard errors. *, and * indicate that the statistics are significant at the 1%, 5% and 10% significance levels, respectively.

5. Conclusion

Through the empirical results, agricultural policy-based finance has a strong promoting effect on farmers' income, and affects farmers' income through two intermediaries: the scale of agricultural development and the development of rural enterprises. In addition, financial technology plays an obvious positive regulatory role in the impact of agricultural policy-based finance on farmers' income.

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