

Synergistic Effect of Agricultural Insurance and Agricultural Credit on Agricultural Economic Development

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Abstract: Agricultural insurance and agricultural credit, as the two major grips of financial support for agriculture, are of great significance in promoting agricultural economic development and realizing the rural revitalization strategy. This paper selects panel data of 31 provinces in China from 2007-2019 and uses Tobit model to explore the intrinsic relationship between agricultural insurance, agricultural credit and agricultural economic development, as well as the impact of the synergistic effect of the two on agricultural economic development, based on theoretical and empirical analysis. The conclusions show that both agricultural insurance and agricultural credit positively contribute to the development of the agricultural economy and that they have positive synergistic effects on agricultural economic development, but with regional differences.

1. Introduction

Agriculture is an important part of China's natural economy and the basis for the development of other industries in China. At present, the main mode of agricultural production in China is still the "Small-Scale Peasant Economy" model, in which farmers produce on a household basis and lack advanced production equipment and management techniques, making it difficult to achieve agricultural scale economies. At the same time, agriculture is weak and agricultural production is exposed to both natural and market risks, while family farmers are weak in resisting risks. In recent years, the frequent occurrence of extreme weather and agricultural market instability and other problems have caused huge losses to farmers and agricultural production, hindering the development of agricultural economy. The development of agricultural economy is inseparable from the support of agricultural finance, agricultural insurance and agricultural credit as two important grasps of financial support for agriculture, on the one hand, farmers can obtain funds to purchase equipment and raw materials at lower interest rates through agricultural credit institutions to promote agricultural production, on the other hand, agricultural insurance can disperse the risks of production and operation of farmers, protect the income of farmers and agricultural reproduction, The coordinated development of both is of great significance to stabilize and promote the development of agricultural economy and realize the strategy of rural revitalization.

With the improvement of China's rural financial policies, the scale of agricultural insurance and

agricultural credit has been expanding and the level of protection has been improving. By the end of 2020, China's agricultural insurance premium income exceeded 80 billion, making it the largest agricultural insurance country in the world ^[1]. In 2021, agricultural insurance has provided risk protection for 178 million farming households to the tune of 4.72 trillion yuan, while the balance of agricultural-related loans in China reached 43.21 trillion yuan, an increase of 11.8% over the previous year. These policies and figures underline the important role of agricultural insurance and agricultural credit in solving the three dimensional rural issues and realizing the rural revitalization strategy in China.

Based on this, this paper uses panel data of 31 provinces in China from 07-19 years to study the relationship between agricultural insurance and agricultural credit and agricultural economic development model, as well as to verify the synergistic effect of the two on agricultural economic development with the help of Tobit. And it compares and analyzes the impact of agricultural insurance and agricultural credit on agricultural economic development in food- and non-food-primarily producing areas. The findings of this paper have theoretical and practical significance for promoting the reform of agricultural financial system and accelerating the high-quality development of agriculture.

2. Research Design

2.1. Theoretical Analysis

Agricultural insurance can disperse and transfer the natural and market risks in agricultural production. On the one hand, agricultural insurance reduces the economic losses in their agricultural production by providing financial compensation to the affected farmers and guarantees the minimum income of the producers, thus ensuring the smooth agricultural reproduction^{[2][3]}; On the other hand, agricultural insurance can stabilize the market of agricultural products, reduce losses caused by price fluctuations of agricultural products, and promote agricultural production and marketing in a market-oriented manner, thus promoting agricultural economic development ^[3]. In the long term, agricultural insurance can influence farmers' income structure in addition to its risk management role. Agricultural insurance promotes the growth of agricultural industry by promoting farmers' income through transfer payments and motivation of farmers' agricultural production and operation ^{[4][5]}. Based on this, the following hypothesis is proposed in this paper.

Hypothesis 1: Agricultural insurance promotes Agricultural economic development.

Agricultural economic development requires a large amount of agricultural technology, agricultural machinery and agricultural infrastructure inputs, and these inputs need to rely on a large amount of capital as support. In addition to government financial subsidies and social investment, agricultural credit can bridge the capital gap and effectively alleviate the shortage of capital in agricultural production, agricultural credit has an important role in promoting the growth of farmers' income ^{[6][7]} and promoting agricultural output ^[8]. With the support of agricultural credit, farmers have ample funds to expand production scale and improve production efficiency, and when farmers feel profitable, they will increase the loan amount, which in turn will promote the development of agricultural credit. This virtuous circle will in turn attract more social investment and talents to the countryside, thus promoting agricultural economic development. Based on this, the following hypothesis is proposed in this paper.

Hypothesis 2: Agricultural credit promotes Agricultural economic development.

On the one hand, due to the problems of unstable agricultural income and imperfect rural credit guarantee mechanism, agricultural credit institutions have greater concerns in providing credit services to farmers, while agricultural insurance can act as collateral for farmers ^[9], and the protection of agricultural insurance can reduce the default risk of farmers and improve their credit

level, so agricultural credit institutions are often more willing to lend to farmers who have agricultural insurance. On the other hand, since agricultural insurance companies know less about the real information of farmers, farmers may conceal and misreport, while agricultural credit institutions can learn more real information about farmers when they handle loan services, which leads to the fact that agricultural insurance companies often have less comprehensive customer information than agricultural credit institutions. Cooperation between agricultural insurance and agricultural credit can share information, address information asymmetry, and reduce costs ^[10]. As stated before, with the financial support of agricultural credit, farmers are able to expand their production scale and improve their production efficiency, but at the same time, with the expansion of production scale, the production risk and market risk also increase, which in turn promotes the demand of insurance for farmers. With the protection of agricultural insurance and the support of agricultural credit, farmers increase the investment of production capital and reduce the loss of production risk, promoting the development of agricultural economy in a two-pronged way. Based on this, the following hypothesis is proposed in this paper.

Hypothesis 3: There is a synergistic effect between agricultural insurance and agricultural credit to promote agricultural economic development, as shown in Figure 1.

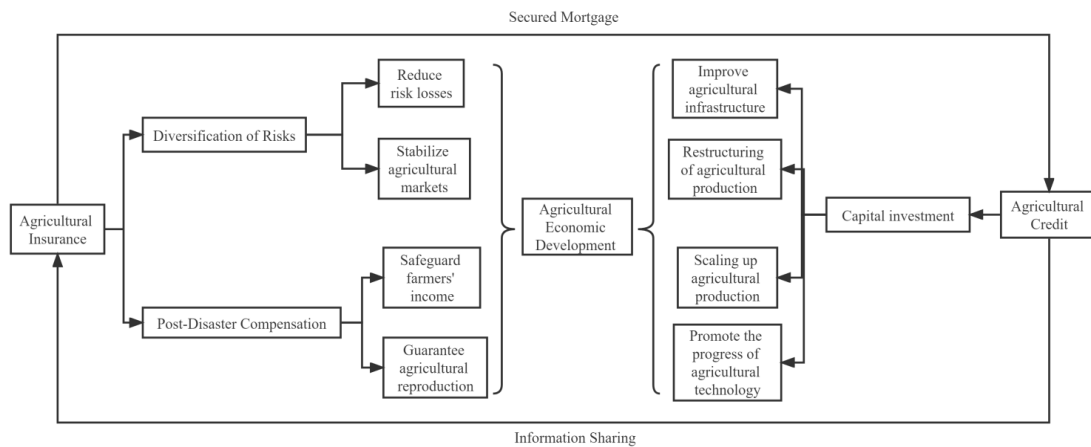


Figure 1: Logic diagram of the synergistic effect.

2.2. Model Selected

In order to study the impact and the synergistic effect of agricultural insurance and agricultural credit on agricultural economic development, the following basic analytical model is constructed in this paper. Where AGDP represents the agricultural economic development level index, Insur represents the agricultural insurance index, Loan represents the agricultural credit index, X represents the control variables affecting agricultural economic development, where $X =$ urbanization rate, industrial structure, electricity level, machinery input, labor input, land input and fertilizer input, and f function represents the relationship between agricultural insurance, agricultural credit, control variables and agricultural economic development.

$$AGDP = f(Insur, Loan, X) \quad (1)$$

In this paper, the following models are developed to analyze the effects of agricultural insurance and agricultural credit on agricultural economic development, and the synergistic effects of the two on agricultural economic development, respectively.

Model 1: The role model of agricultural insurance on agricultural economic development:

$$AGDP_{it} = \beta_1 + \beta_2 Insur_{it} + \sum_{j=1}^n \alpha_j X_{j,it} + \varepsilon_{it} \quad (2)$$

Model 2: The role model of agricultural credit on agricultural economic development:

$$AGDP_{it} = \beta_1 + \beta_2 Loan_{it} + \sum_{j=1}^n \alpha_j X_{j,it} + \varepsilon_{it} \quad (3)$$

Model 3: The synergistic effect model of agricultural insurance and agricultural credit on agricultural economic development:

$$AGDP_{it} = \beta_1 + \beta_2 Insur_{it} + \beta_3 Loan_{it} + \beta_4 Insur_{it} \times Loan_{it} + \sum_{j=1}^n \alpha_j X_{j,it} + \varepsilon_{it} \quad (4)$$

In these models, AGDP_{it} is the explanatory variable indicating the level of agricultural economic development in province i in year t, and Insur_{it} and Loan_{it} are the explanatory variables indicating the level of agricultural insurance development and agricultural credit development in province i in year t, respectively. In order to observe the synergistic effect of agricultural insurance and agricultural credit on agricultural economic development, the cross multiplication term Insur_{it}×Loan_{it} of agricultural insurance and agricultural credit is introduced in the model, and ε_{it} denotes the random disturbance term.

2.3. Variable Selected

2.3.1 Explained Variables

Agricultural economic development level (AGDP): Referring to relevant literature^[11], this paper selects the gross output value of agriculture, forestry, animal husbandry and fishery in each province to indicate the local agricultural economic development level. The higher the total output value, the higher the level of agricultural economic development.

2.3.2 Explanatory Variables

(1) Agricultural insurance (Insur): Agricultural premium income in each province can most intuitively reflect the current status of local agricultural insurance development, so this paper chooses agricultural insurance premium income as an indicator to measure the level of agricultural insurance development.

(2) Agricultural credit (Loan): In this paper, the loan amount of agriculture, forestry, animal husbandry and fishery in each province is selected to measure the local level of agricultural credit. The higher the loan amount, the more money farmers put into agricultural production, and the more likely it is to promote agricultural economic development.

(3) Agricultural insurance multiplied with agricultural credit (Insur×Loan): The cross-multiplier indicates the synergistic effect of agricultural insurance and agricultural credit on agricultural economic development, and the coefficient indicates the degree of their synergy on agricultural economic development; a positive coefficient means that it promotes agricultural economic development, and the opposite means that it inhibits agricultural economic development.

2.3.3 Control Variables

(1) Urbanization rate (city): In this paper, the proportion of urban population to the total

population in each province is chosen to represent the urbanization rate. An increase in the urbanization rate not only expands the market for agricultural products, but also provides more high-income jobs for farmers, and capital returns to the countryside through farmers, thus driving agricultural economic development.

(2) Industrial structure (indus): In this paper, the proportion of the value added of the primary industry to the total GDP of each province is selected to indicate the industrial structure. The smaller the ratio indicates that the industrial structure is more reasonable and the secondary and tertiary industries are well developed, so that it can promote the flow of population and capital and feed more resources to the primary industry.

(3) Electricity level (elect): In this paper, rural electricity consumption in each province is selected to measure the local electricity level, which can reflect the degree of development of local agricultural technology and infrastructure.

(4) Machinery input (power): In this paper, the total power of agricultural machinery in each province is selected to measure the degree of local machinery input, which can reflect the mechanization level of a region, and the improvement of agricultural mechanization level can promote the improvement of local agricultural production capacity.

(5) Labor input (labor): In this paper, the number of employees in the primary industry in each province is chosen to measure the local labor input. Human capital is one of the important factors to promote the development of agricultural economy, so theoretically, the more the number of employees in the primary industry, the more it can promote the development of agricultural economy.

(6) Land input (land): In this paper, the crop sown area in each province is selected to measure the degree of local land input. An increase in crop sown area will improve crop yield and thus increase agricultural income.

(7) Fertilizer input (fert): In this paper, the amount of agricultural fertilizer applied in each province is selected to measure the degree of local fertilizer input. A reasonable amount of fertilizer application can promote agricultural output, while excessive fertilizer use will inhibit agricultural output, cause soil pollution, and be detrimental to agricultural economic development.

2.4. Data Sources

Table 1: Results of descriptive statistics of variables.

Variable	Symbol	Obs	Mean	Std.Dev.	Min	Max
Agricultural economic development	lnagdp	403	7.531	1.107	4.382	9.164
Agricultural insurance	lninsur	403	6.164	1.449	0.438	9.197
Agricultural credit	lnloan	403	6.421	1.125	1.033	8.204
Insurance multiplied with credit	lninsur*lnloan	403	40.621	13.773	0.802	69.575
Urbanization rate	city	403	0.543	0.141	0.226	0.896
Industrial structure	indus	403	10.422	5.432	0.3	31.1
Electricity level	lnelect	403	4.870	1.028	0.6	5.899
Machinery input	lnpower	403	7.578	1.106	4.543	9.499
Labor input	lnlabor	403	6.314	1.101	3.592	7.979
Land input	lnland	403	8.107	1.189	4.484	9.601
Fertilizer input	lnfert	403	4.717	1.226	1.526	6.574

This paper selects panel data from 31 provinces in China from 2007-2019 as the study sample, with 403 sample values. The raw data were obtained from the China Agricultural Statistical

Yearbook, China Rural Statistical Yearbook, China Insurance Yearbook and China Rural Financial Services Report. We used Excel and stata16.0 to process the raw data. In the process of processing, some indicators were logarithmically processed in this paper in order to eliminate the differences in data magnitudes, and linear interpolation was used to fill in the individual missing data. The descriptive results of each variable are shown in Table 1.

3. Conclusions

3.1. Results

In this paper, Tobit regressions were conducted using panel data of 31 provinces for 07-19 years, firstly for the national sample, and then regression analysis was conducted by region for the main grain-producing regions and non-main grain-producing regions, and the regression results are shown in Tables 2 and 3.

3.1.1 Analysis of full-sample regression results

In order to explore the impact of agricultural insurance and agricultural credit on agricultural economic development, as well as the impact of their synergistic effects on agricultural economic development, Tobit regressions were conducted on the panel data in this paper, and Table 2 shows the regression results for the full sample. Columns (1), (3) and (5) show the regression results without control variables, while columns (2), (4) and (6) show the regression results with the inclusion of control variables.

From the first four columns of regression results, it can be seen that both agricultural insurance and agricultural credit have a significant positive effect on agricultural economic development at the 1% level, which shows that the development of both agricultural insurance and agricultural credit significantly promotes the development of agricultural economy, and the promotion effect of agricultural credit is stronger. The government's financial subsidies for agricultural insurance have been increasing in recent years, reducing the financial pressure on farmers to purchase agricultural insurance, increasing the participation rate of farmers, and the subsequent development and improvement of agricultural insurance, which not only reduces the production risk of farmers, but also helps the reproduction of agriculture, and ultimately the increase in productivity brings economic growth. As the level of agricultural credit increases, farmers have broader sources of financing and greater ability to raise capital. Credit institutions provide farmers with capital so that they have sufficient funds to purchase new equipment and technology to put into agricultural production, thus contributing to the development of the agricultural economy.

From columns (5) and (6), it can be seen that the coefficients of the interaction terms of agricultural insurance and agricultural credit are 0.0135 and 0.0115, and they are significant at the 1% and 5% levels, respectively, indicating that agricultural insurance and agricultural credit have synergistic effects on the development of agricultural economy, i.e., the combination of agricultural insurance and agricultural credit can play the role of $1+1>2$, and the coordinated development of the two has a greater promotion effect on agricultural economy. The development of agricultural insurance contributes to the positive effect of agricultural credit on the agricultural economy, and likewise the improvement of the level of agricultural credit promotes the positive effect of agricultural insurance on the agricultural economy. Among the control variables, the effects of electricity level, fertilizer input and labor input on agricultural economic development were positive and passed the significance test, which indicates that the increase in rural electricity consumption, fertilizer usage and the number of people employed in agriculture has a certain contribution to agricultural economic growth.

Table 2: Regression results (national samples)

Variable	Agricultural economic development					
	(1)	(2)	(3)	(4)	(5)	(6)
Agricultural insurance	0.1778*** (0.0343)	0.1584*** (0.0352)	–	–	0.0141 (0.0431)	0.0263 (0.0431)
Agricultural credit	–	–	0.3357*** (0.0481)	0.2959*** (0.0521)	0.2331*** (0.0518)	0.1951*** (0.0556)
Insurance multiplied with credit	–	–	–	–	0.0135*** (0.0037)	0.0115** (0.0038)
Urbanization rate	–	1.0319* (0.5219)	–	1.3132** (0.5833)	–	0.7179 (0.5195)
Industrial structure	–	0.0010 (0.0012)	–	0.0022* (0.0013)	–	0.0003 (0.0012)
Electricity level	–	0.0667 (0.0506)	–	0.0448 (0.0532)	–	0.0668* (0.0491)
Machinery input	–	0.0431 (0.0502)	–	-0.0637 (0.0505)	–	-0.0113 (0.0491)
Labor input	–	0.1623** (0.0544)	–	0.1771** (0.0657)	–	0.1813** (0.0541)
Land input	–	0.0326 (0.0446)	–	-0.0085 (0.0453)	–	0.0250 (0.0432)
Fertilizer input	–	0.3807*** (0.0679)	–	0.1492* (0.0842)	–	0.2577*** (0.0705)
Constant	6.3171*** (0.2848)	2.1229** (0.6803)	5.2753*** (0.3485)	3.1685** (0.9128)	4.7522*** (0.3567)	1.9006** (0.6648)
Observations	403	403	403	403	403	403

Note: ***, **, and * represent significant at the 1%, 5%, and 10% levels, respectively, and the values in parentheses are standard deviations.

3.1.2 Analysis of the regression results by region

Due to the different economic levels, agricultural resources and policies in different regions of China, the agricultural economic development situation is also different. In order to investigate the impact of agricultural insurance and agricultural credit on agricultural economic development in different regions, this paper divides the country into main grain-producing regions and non-main grain-producing regions for discussion, where the main grain-producing regions include 13 provinces of Heilongjiang, Liaoning, Jilin, Inner Mongolia, Hebei, Henan, Hubei, Hunan, Jiangxi, Sichuan, Jiangsu, Shandong and Anhui, and the non-main grain-producing regions are the remaining 18 provinces. Table 3 shows the regression results by region.

As shown in column (1) of Table 3, agricultural insurance is negatively but insignificantly related to the agricultural economy in main grain-producing regions, while in non-main grain-producing regions, agricultural insurance is positively related to the agricultural economy and significant at the 1% level. It indicates that agricultural insurance inhibits the development of agricultural economy in the main grain-producing regions, but promotes the development of agricultural economy in the non-main grain-producing regions. The reason for this may be the imperfect agricultural insurance policy in the main grain-producing regions. As the key regions to ensure national food security, the ratio of agricultural insurance financial subsidies in each major agricultural province is relatively high, but some of the major agricultural provinces have limited

financial strength and adjusted the level of agricultural insurance coverage downward in order to alleviate the economic pressure on agricultural insurance financial subsidies, coupled with the fact that most of the major grain-producing provinces are located along the Yangtze and Yellow Rivers, which are subject to climate change and natural disasters, and farmers can only receive compensation when serious natural disasters occur^[12]. Although agricultural premium income is high, the low level of coverage inhibits the development of the agricultural economy in the main grain-producing regions. This is consistent with the findings of Yuan Hui et al^[13], who found that agricultural insurance in Hubei Province did not promote an increase in agricultural output, but rather had a negative effect on agricultural output. As shown in column (2) of Table 3, agricultural credit is positively correlated with the agricultural economy in both main grain-producing and non-main grain-producing regions, which is consistent with the results of the national sample, but this positive correlation is not significant in main grain-producing regions, while in non-main grain-producing regions, agricultural credit has a significant positive contribution to agricultural economic development.

Table 3: Regression results (regional samples)

Variable	main grain-producing regions			non-main grain-producing regions		
	(1)	(2)	(3)	(1)	(2)	(3)
Agricultural insurance	-0.0369 (0.1133)	–	-0.1171 (0.1047)	0.1634*** (0.0123)	–	0.0636*** (0.0137)
Agricultural credit	–	0.0804 (0.0932)	0.1183 (0.0978)	–	0.3221*** (0.0289)	-0.0163 (0.0399)
Insurance multiplied with credit	–	–	0.0058 (0.0069)	–	–	0.0178*** (0.0025)
Urbanization rate	-0.6481 (1.1401)	-1.5118 (1.7355)	-0.9210 (1.8782)	0.4549** (0.1869)	0.7928*** (0.1968)	0.0257 (0.1596)
Industrial structure	0.0031 (0.0013)	0.0008 (0.0024)	-0.0001 (0.0025)	-0.0007 (0.0005)	-0.0002 (0.0006)	-0.0006 (0.0004)
Electricity level	0.0701 (0.0047)	-0.1004 (0.1408)	-0.0875 (0.1415)	0.0115 (0.0170)	0.0189 (0.0183)	0.0219 (0.0136)
Machinery input	-0.0190 (0.0835)	-0.0036 (0.0796)	-0.0052 (0.0794)	0.0563* (0.0303)	-0.1015** (0.0376)	-0.0659** (0.0279)
Labor input	0.0112 (0.2646)	0.0621 (0.1034)	0.0611 (0.1029)	-0.1373 (0.0385)	-0.0325 (0.0442)	-0.0530 (0.0327)
Land input	-0.0724 (0.1735)	-0.0479 (0.0717)	-0.0611 (0.0725)	-0.1549*** (0.0292)	-0.0957** (0.0325)	-0.0879*** (0.0241)
Fertilizer input	0.5947 (0.4466)	-0.046 (0.0717)	-0.0654 (0.1192)	2.1872*** (0.0835)	1.8972*** (0.0990)	1.8952*** (0.0726)
Constant	5.9741** (1.8821)	9.0209*** (1.9147)	9.0108*** (1.9367)	-1.5827** (0.5328)	-1.6270** (0.5518)	-1.045* (0.4563)
Observations	169	169	169	234	234	234

Note: ***, **, and * represent significant at the 1%, 5%, and 10% levels, respectively, and the values in parentheses are standard deviations.

As can be seen from column (3) of Table 3, the cross multipliers of agricultural insurance and agricultural credit are positively correlated with the agricultural economy, which is consistent with the results of the national sample, but this positive correlation is not significant in main grain-producing regions, while in non-main grain-producing regions, the cross multipliers of agricultural insurance and agricultural credit are significant at the 1% level, which indicates that the synergistic

effect is stronger in non-main grain-producing regions. The reason for this may be that government agricultural support policies for food-producing regions are more numerous and diversified, in addition to the fact that more agricultural technology, capital and manpower have been invested in main grain-producing regions than in non-main grain-producing regions, and agricultural insurance and agricultural credit are only part of the reasons for promoting their agricultural economic growth. Therefore, the synergistic effect of agricultural insurance and agricultural credit in food-producing areas is not obvious.

3.1.3 Robustness Test

The direction and significance of the effects of agricultural insurance and agricultural credit and the synergistic effect of the two on agricultural economic development are relatively consistent in both cases with and without control variables, fully reflecting the robustness of the study results. In order to further ensure the reliability of the regression results, two methods of replacing the explanatory variables and replacing the regression model are used to conduct robustness tests in this paper. Table 4 shows the regression results of the robustness test.

Table 4: Robustness test results

Variable	(1) lnavv	(2) re	(3) fe
Agricultural insurance	0.0321 (0.0402)	0.0296 (0.0438)	0.0118 (0.0450)
Agricultural credit	0.1928*** (0.0515)	0.1814*** (0.0558)	0.2186*** (0.0577)
Insurance multiplied with credit	0.0102** (0.0035)	0.0117** (0.0038)	0.0102** (0.0039)
Urbanization rate	0.5168 (0.4931)	0.7528 (0.5064)	0.6747 (0.6195)
Industrial structure	0.0009 (0.0012)	0.0003 (0.0012)	0.0012 (0.0014)
Electricity level	0.0549 (0.0458)	0.0718 (0.0492)	0.0522 (0.0529)
Machinery input	-0.0113 (0.0456)	-0.0089 (0.0477)	-0.0715 (0.0501)
Labor input	0.1857*** (0.0511)	0.1784*** (0.0539)	0.1465** (0.0657)
Land input	0.0245 (0.0402)	0.0278 (0.0441)	0.0065 (0.0452)
Fertilizer input	0.2517*** (0.0669)	0.2796*** (0.0693)	0.1651** (0.0841)
Constant	1.5144**	1.6857**	3.2191***
Observations	403	403	403

Note: ***, **, and * represent significant at the 1%, 5%, and 10% levels, respectively, and the values in parentheses are standard deviations.

First, drawing on Quartey and Lin Qinying^{[14][15]}, the explanatory variable total output value of agriculture, forestry, animal husbandry and fishery (AGDP) was replaced with the value-added of the primary industry (aav) and treated logarithmically. The results are shown in column (1) of Table 4. The direction and significance of the regression coefficients of the interaction term of the

explanatory variables agricultural insurance and agricultural credit are basically consistent with the regression results of the national samples, and the synergistic effect of agricultural insurance and agricultural credit on agricultural economic development is equally significant.

Second, the Tobit model is replaced with a mixed regression fixed-effects and random-effects model, and the results are shown in columns (2) and (3) of Table 4. The direction and significance of the regression coefficients of the interaction terms of the explanatory variables agricultural insurance and agricultural credit are basically consistent with the regression results of the national samples, as well as with the regression results after replacing the explanatory variables, and the synergistic effects of agricultural insurance and agricultural credit on agricultural economic development are equally significant, indicating that the model has good robustness.

3.2. Discussion

At present, China has entered a new stage of rural development, and the rural revitalization strategy is the general banner for solving the three dimensional rural issues in the new era. The importance of financial support for rural revitalization strategy is self-evident, and agricultural insurance and agricultural credit, as two important grasps of financial support for rural areas, have been the hot spots of scholars' research. Unlike most studies, this paper puts agricultural insurance, agricultural credit and agricultural economic development in one analytical framework, and selects panel data from 31 provinces for 07-19 years, using Tobit model to analyze the impact of agricultural insurance, agricultural credit and the synergistic effect of the two on agricultural economic development from national and regional samples. The results of the study were obtained as follows: (1) Agricultural insurance positively contributes to the development of the agricultural economy, but with regional differences, where agricultural insurance inhibits the development of the agricultural economy in main grain-producing regions and significantly contributes to the development of the agricultural economy in non-main grain-producing regions. (2) Agricultural credit positively contributes to the development of the agricultural economy, and this contribution is stronger than that of agricultural insurance, and more significant in non-main grain-producing regions than in main grain-producing regions. (3) Agricultural insurance and agricultural credit have positive synergistic effects on agricultural economic development, and the synergistic effects are more significant in non-main grain-producing regions than in main grain-producing regions.

Based on the above conclusions, this paper proposes the following policy recommendations:

First, improve the agricultural insurance policy and increase the level of protection of agricultural insurance. As the protection level of agricultural insurance is also inconsistent in different regions, the protection level is high in provinces with strong financial strength and low in provinces with weak financial strength. The government should establish a unified minimum level of coverage to avoid some provinces with insufficient financial strength from lowering the level of coverage in order to reduce financial pressure, and increase the agricultural insurance premium subsidies for these provinces. In particular, the government should increase premium subsidies for the main grain-producing regions to maintain farmers' motivation to grow grain and ensure national food security.

Second, develop diversified special insurance + credit products. For different groups, such as small-scale farmers and new agricultural operators, the market should provide insurance+credit products suitable for different groups; for different regions, such as major grain-producing regions and non-major grain-producing regions, the market should provide credit+insurance products suitable for different regions and with regional characteristics, so that they can better meet diversified needs and promote the synergistic development of agricultural insurance and agricultural credit.

Third, strengthen the government's role in promoting the insurance+credit cooperation model. It is proved that the joint development of agricultural insurance and agricultural credit not only reduces the default risk of farmers and solves the problem of "difficult financing" of farmers, but also improves the level of agricultural insurance development, and the joint development of the two effectively promotes the development of agricultural economy. However, at present, China's agricultural insurance and agricultural credit are still in the primary cooperation stage, and the enthusiasm of cooperation between them is not high. It is still necessary for the government to take the lead in promoting the cooperation between insurance companies and credit institutions, increase the publicity of the cooperation model of agricultural insurance and agricultural credit, and propose corresponding supporting policies to improve the enthusiasm of farmers to participate in insurance and loans.

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