Study on the Impact of Policy Agricultural Insurance Business Development on Rural Economic Development – By using Regression Model

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Abstract—Yunnan Province is located in the southwest of China. Due to the late start of agricultural insurance and weak development, Yunnan agricultural insurance has obvious complexity and particularity. The implementation of policy-based agricultural insurance can ensure agricultural production in Yunnan Province and play a certain role in the rural economy. In order to further determine the factors that affect the high-quality development of policy-based agricultural insurance in Yunnan Province, this article obtains relevant data through the China Statistical Yearbook, Yunnan Statistical Yearbook, Yunnan Ministry of Agriculture and Rural Affairs, the official website of PICC, China Climate Disaster Yearbook, etc. OLS is used to obtain unbiased estimates for the time-series data to establish a regression model. Pearson correlation coefficients are used as Pearson correlation coefficient was used as an indicator to verify the relevance of the data. At the same time, to ensure that the estimation of the OLS model is valid, a cointegration test between the explanatory variables and the control variables is done in the paper using VIF. Finally, this paper uses regression models to analyze the impact of agricultural insurance on the rural economy. To strengthen the construction of the agricultural insurance market system in Yunnan Province, it puts forward suggestions to promote the development of high-quality policy-based agricultural insurance in Yunnan Province.

Keywords-policy agricultural insurance; regression model; rural economic; Yunnan Province

1 INTRODUCTION

1.1 Background

Insurance is an essential form of economic compensation in modern society. Policy-based agricultural insurance is a method adopted by most countries and regions to prevent and avoid agrarian production risks, which is very suitable for China to protect agricultural producers from huge agricultural disasters. The so-called policy-based agricultural insurance means that the state provides policy support and financial support on the basis of agricultural insurance to achieve the purpose of protecting and developing agriculture.

So far, the agricultural insurance market in Yunnan Province is characterized by imperfect laws and regulations, insufficient government support, few types of agricultural insurance, few insurance institutions, low quality of agricultural personnel, and backward agricultural claims technology, which make farmers lack understanding of agricultural insurance. However, the potential demand of farmers for agricultural insurance is enormous. Yunnan Province is a large

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agricultural province, and agricultural production activities are easily affected by natural disasters, and the livelihood of the farming population is difficult to guarantee. As it is located in the western plateau and the natural environment is relatively poor, the cultivated land is generally found in the mountainous area. The soil in the mountainous countryside is loose, and soil erosion is serious. At the same time, due to the influence of some external factors such as weather and climate, agricultural production technology is relatively backward, the ability to withstand agricultural, natural disasters is relatively weak, the agricultural foundation burden is heavy, the ability to withstand natural disasters is poor, and the total agricultural production capacity is not strong. Adapt to the increasing impact of population growth, improvement of life, and economic development on farm products. (The picture below shows the affected area of rural land in Yunnan Province from 2008 to 2018). The overall effect of agricultural insurance is still in a weak state, affecting the sustainable and healthy development of agriculture and negatively impacting future rural economic development. Due to these factors, the rural economic development of Yunnan Province is subject to certain restrictions. Whether the implementation of policy-based agricultural insurance can effectively reduce the financial risks of agriculture, better avoid agricultural risks, and protect the livelihood of the agrarian population has become an urgent problem for governments at all levels in Yunnan Province.

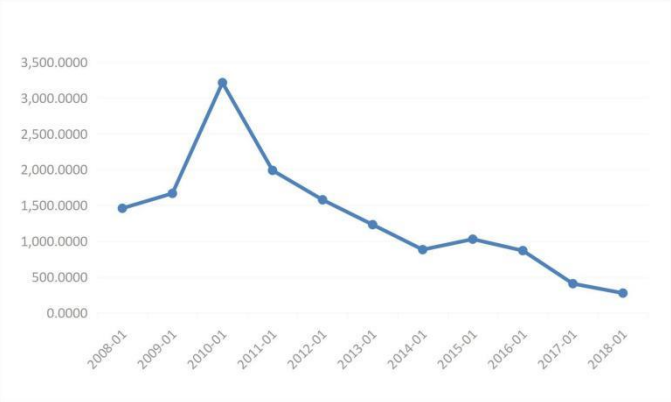

Figure1. The affected area of crops in Yunnan Province

Previous studies have shown that the development of policy-based agricultural insurance will help Yunnan Province better avoid and reduce agricultural disasters. Promoting the healthy and sustainable development of agricultural insurance plays an irreplaceable role in ensuring rural stability and maintaining agrarian production safety. However, due to a late start, the farm insurance market has not yet been perfected. At the same time, restricted by business models, diverse climates, complex geographic environments, and epidemic conditions, some problems have gradually emerged, such as the unreasonable structure of premium subsidies and the lack of a catastrophe risk dispersion system in agricultural insurance.

This article will take Yunnan Province as an example. Using the payment expenditure of agricultural insurance in Yunnan Province from 2008 to 2018 and the disposable income of rural farmers, a regression model was established to analyze the impact of agricultural insurance on the rural economy. This will help to further understand the actual effect of agricultural insurance

on the rural economy and provide some reference for the analysis of the relationship between policy-based agricultural insurance and rural economic development.

2 LITERATURE REVIEW

The word agriculture insurance can be summed up from three perspectives: one is from the perspective of the country; Second is from the perspective of the market; third is from the perspective of scope. Zhang & Yang (2010) [1] pointed out that agricultural insurance is the country's support through fiscal, taxation, and other aspects. The two plantings and raising industries suffered a natural disaster in the production process. He (2019) [2] measured the burden rate of provincial financial subsidies and the subsidy intensity of the central finance to each province. He found that there exists the problem of unfair subsidy intensity of the central finance to each province. Tuo & Zhang (2018) [3] conducted a comparative study on the development practices of agricultural insurance in various countries. They pointed out that many countries adopted combining government and market due to the extensive impact of farming risks. Mârza (2015) [4] studied the legal system, market conditions, and government role in agricultural insurance in Peru, Uruguay, and other Latin American countries. Raju (2008) [5] studied the current situation of agricultural insurance in India and believed that the government should provide more excellent fiscal policies and financial services for farm insurance and increase agricultural insurance coverage.

On the impact of agricultural insurance on the rural economy, a large number of scholars have carried out a lot of useful research. Arrow (2001)[6] proposed many methods in agricultural risk management, and farmers can realize effective management of yield risk by purchasing crop insurance. Goodwin (2001) [7] showed that farmers benefited from agricultural insurance income after the disaster, accounting for about 70% of their annual income, which effectively proved the critical role of agricultural insurance in stabilizing income. Wen (2016) [8] analyzed the impact of agricultural insurance on economic growth from theoretical and empirical perspectives, and the results showed that agrarian insurance could affect rural economic growth. Cheng (2016) [9] selected four provinces in Central China to construct a panel model between the development of agricultural insurance and rural economic growth and empirically tested how agricultural insurance affects rural economic growth.

3 RESEARCH METHODOLOGY

3.1 Data sources

Regarding the retrieval of materials, the authors read newspapers and books through the library, use the library's electronic query system to learn about library-related materials through bibliographic queries, and find relevant literature on agricultural insurance research at home and abroad. They were checking statistics and data from relevant departments such as the China Statistical Yearbook

(http://www.stats.gov.cn/tjsj/ndsj/), Yunnan Statistical Yearbook (http: / stats. yn.gov.cn/tjsj/ tjnj/), Yunnan Ministry of Agriculture and Rural Affairs (https:// www.nync.yn.gov.cn/), the official website of PICC (https://www.picc.com/), China Climate Disaster Yearbook, etc. to

obtain relevant data. The data relating to policy agricultural insurance and rural residents' income in Yunnan Province from 2008-2018 were obtained through the resources mentioned above, which constituted a time series data.

3.2 Model setting and empirical method

In this paper, we first test the stationarity of the time series data found. After testing, we have reason to believe that the data used in this paper is stable. Considering the stability of stationary time series data and the stability of the economic environment in our province, we have reason to believe that unbiased estimation can also be obtained by using OLS to estimate time-series data. Therefore, this paper constructs a minimalist measurement model as follows:

$$\begin{aligned}&\text{Disposable income of rural residents} = \text{cons} + \\ &\beta 1 \text{Premium income from agricultural insurance} + \\ &\beta 2 \text{premium expenditure on agricultural insurance} + \beta 3 * \text{Contral variables} + \\ &\text{interference term} \end{aligned} \quad (1)$$

In the above formula, the explained variable is the per capita disposable income of rural residents in Yunnan Province in each period. Policy agricultural insurance is the primary explanatory variable in measuring the development index of agricultural policy insurance. According to Ma (2013), this paper selects two indexes: agricultural insurance premium income and agricultural insurance indemnity. Considering the difference between economic development level and rural economic development in Yunnan Province, this paper selects other factors that affect economic development as control variables, namely, GDP, consumption level of residents in Yunnan Province. In the above formula as a control variable into the model for control. At the same time, according to the previous research results, this paper puts forward the research hypothesis:

H: the cost of agricultural insurance will affect the change of disposable income of rural residents

H1: the premium income of agricultural insurance will affect the disposable income of rural residents

H2: agricultural insurance compensation will affect the disposable income of rural residents

3.3 Description of the Selection of Variables

Specifically, on the variable selection of policy agricultural insurance, according to the choice of indicators in previous literature and the availability of index data, the premium income and compensation scale of agricultural policy insurance is selected, including agrarian insurance premium income and agricultural insurance compensation expenditure, two measurement indicators.

On the choice of income variables of rural residents, according to the current statistical index system in China, the rural residents' per capita disposable income can be used to measure the variables of rural residents' income.

According to the previous literature analysis, we summarize the other factors that may affect residents' income. The three variables of GDP, consumption level and fixed assets of rural households were selected as control variables into the regression model.

The above variable data are collected on the official websites of China Statistical Yearbook (http: /www. stats. gov.cn/tjsj/ ndsj/), Yunnan Statistical Yearbook (http ://www.stats.yn.gov.cn/ tjsj/tjnj/), Yunnan Ministry of Agriculture and Rural Affairs(https://www.nync.yn.gov.cn/), PICC (https://www.picc.com/).

4 DATA DESCRIPTION

Descriptive statistics is an essential but often overlooked statistical tool. Descriptive statistics are not just a table of data analysis. In doing empirical work, descriptive statistics can find anomalies in the data, such as negative numbers that should be positive, more than 1%, etc. In this paper, the relevant data of Yunnan Province needed from 2008 to 2018 are sorted out. The data are described, the mean value, the maximum value, and the minimum value are explained and summarized, and the general trend of various variables in this period is grasped.

Table 1 Description Statistics of Variables

Name of variable	***Sample capacity***	***Mean value***	***Standard error***	***Minimum***	***Maximum***
Per capita disposable income of rural residents	11	6603.11	2681.82	3102.60	10767.91
Area affected by crops	11	1327.37	816.14	274.80	3215.00
Insurance premium income	11	821.83	397.41	199.22	1195.08
Insurance payments	11	557.48	305.05	172.61	1109.60
Agricultural sown area	11	6765.60	366.87	6056.19	7194.43
GDP in the primary sector	11	1750.52	536.72	974.00	2388.55
Consumption of rural residents	11	6107.13	2394.64	2547.00	9123.00
Investment in fixed assets in rural areas	11	336.67	116.30	171.50	465.37

According to the above table, the data of Yunnan Province for 11 years are included in the study, and the variables involved are: the per capita disposable income of rural residents; the explanatory variables are insurance company premium income, insurance company compensation expenditure; the control variables are crop area affected, area sown in agriculture, GDP of the primary sector, the consumption level of rural residents, and the amount of investment in rural fixed assets. The range of per capita disposable income of rural residents in the explained variables is between [3102.6/10767.91], and the per capita disposable income of rural residents in Yunnan Province has increased by about quadruple in 11 years. In the explanatory variables, the range of insurance company premium income is between [199.22/1195.08], and the increased rate of insurance company premium is much faster than that of rural residents' disposable income.

Insurance company compensation expenditure also increased from 172.61 in 2008 to 1109.6 in 2018. In addition, compared with the slow growth of per capita disposable income of rural residents, the growth rate of the consumption level of rural residents also exceeds the growth rate of their income.

5 DATA ANALYSIS

5.1 Correlation Analysis of Variables

Table 2 shows the Pearson correlation coefficient matrix between the variables involved in this study. Considering that the variables involved in this study are continuous numerical variables, the Pearson correlation coefficient was used as the indicator for the relevant inquiry. By interpreting the data in Table 2, we find a significant correlation between the explanatory variable rural disposable income per capita and the explanatory variables insurance premium income and insurance company payout expenditure, and the significance reaches the 1% level. Specifically, the correlation between the explanatory variable disposable income per rural resident and insurance premium income is 0.941, a strong correlation (Pearson's correlation coefficient is more significant than 0.8), and this correlation is positive. The correlation between rural disposable income per capita and insurance company payout is 0.960, which is a strong correlation (Pearson's correlation coefficient is greater than 0.8), and this correlation is positive. The correlation between disposable income per rural resident and the main explanatory variables is not only significant but also significant with the control variables crop area, agricultural sown area, GDP of the primary industry, the consumption level of rural residents, and investment in rural fixed assets. The correlation between them also reaches a 1% significance level, except for the correlation with crop area, which is All the correlations were positive, except for the correlation with the area of crop damage, which was negative. Through the initial exploration of the correlations, we have reason to believe that the inclusion of the above variables in the model to form an OLS regression model has good predictive strength.

Table 2 Pearson Correlation coefficient matrix

	Per capita disposable income of rural residents	***Agricultural crops affected***	***Insurance premium income***	***Insurance payments***	***Agricultural sown area***	***GDP of primary industries***	***Consumption of rural residents***	***Investment in fixed assets in rural areas***
Per capita disposable income of rural residents	1							
Agricultural crops affected	-0.799***	1						
Insurance premium income	0.941***	-0.759***	1					
Insurance payments	0.960***	-0.792***	0.909***	1				

Agricultural sown area	0.658**	-0.468	0.849***	0.676**	1			
GDP of primary industries	0.982***	-0.804***	0.981***	0.940***	0.759***	1		
Consumption of rural residents	0.987***	-0.774***	0.962***	0.932***	0.718**	0.992***	1	
Investment in fixed assets in rural areas	0.975***	-0.772***	0.978***	0.945***	0.747***	0.985***	0.983***	1

*0.1, **0.05,0.001***

5.2 Co-linearity Test of the Regression Model

As can be seen from Table 3, to ensure that the estimates of the OLS model are valid, we first did a Co-linearity test between the explanatory variables and the control variables. Another criterion is that when the value of 1/VIF (tolerance) is less than 0.1 and infinitely close to the value range of 0, we also consider serious co-linearity between the variables, and the regression model is biased at this point. As can be seen from Table 3, the values of VIF for this model are all less than 10, and the tolerances are all greater than 0.1; hence, we believe that there is no collinearity between the explanatory variables and the control variables of the model, and it is effective to use the OLS model to estimate.

Table 3 Cointegration test for regression models

Variable	***VIF***	***1/VIF***
GDP of primary industries	2.67	0.374531
Insurance premium income	2.44	0.409836
Consumption of rural residents	2.71	0.476190
Investment in fixed assets in rural areas	2.36	0.423728
Insurance payments	2.14	0.467289
Agricultural sown area	2.32	0.431034
Agricultural crops affected	2.99	0.334448

5.3 Regression Model Results

Firstly, according to Model (1), we can learn that there is no significant causal relationship between any of the control variables and the explanatory variable, rural disposable income per capita.

Further interpreting Model (2), which incorporates the key explanatory variable agricultural insurance premium income, we can find that the effect of agricultural insurance premium income on the income of rural residents is not significant. In addition, a separate regression of agricultural insurance premium income and rural residents' income reveals ($t=9.41$, $p<0.001$) that is, agricultural insurance premium income has a significant positive effect on rural residents' income. However, when the regression was run with the inclusion of the control variables gross provincial product and level of consumption, the relationship between agricultural insurance premiums and rural incomes was not found to be statistically significant. This suggests that there are many

factors that influence the income of rural residents and that the effect of agricultural insurance premium income may only be one of them, and the effect size is weak.

To further discuss the effects of agricultural insurance on the income of rural residents, based on the previous analysis of the impact of premium income on the income of rural residents, we also discussed the impact of the variable of agricultural insurance payout on the income of rural residents. The relevant results are presented in Model (3).

Based on the regression results of Model (3), we find that the control variable agricultural sown area also has a negative effect on rural residents' disposable income per capita, and this relationship is verified at the 5% significance level. The critical explanatory variable insurance company payout also significantly affects the growth of the explained variable disposable income per rural inhabitant, and this significance is verified at the 5% level. This effect is positive. This is demonstrated by the fact that when the insurance company payout expenditure rises by one unit, the per capita disposable income of rural residents increases by 4.07 units. The positive sign of agricultural insurance payout expenditure and the regression coefficient of 4.07 indicates that a change in agricultural insurance payout expenditure can cause a difference in the income of rural residents in the same direction. The increase in payout expenditure contributes to the rise in income of rural residents. The main reason for rural residents to participate in agricultural insurance is its role in securing future farm income. In the event of agricultural risk, the more rural residents payout on agricultural insurance, the more it helps to increase farm income, thus increasing the income level of the residents.

Finally, we explore the integrity of fit of the model. The goodness of fit of the three Models (1), (2), and (3) are 0.986, 0.986, and 0.997, respectively, taking into account that the values retain the last three decimal places, so the value of the goodness of fit of Model (2) is more significant than that of Model (1), which indicates that the gradual inclusion of key explanatory variables has continuously improved the goodness of fit of the regression model This means that the explanatory power of the model has been significantly improved. The goodness of fit implies the explanatory power of the model. The worth of fit value of Model (3) is 0.997, meaning that the model is able to explain 99.7% of the variation in rural disposable income per capita using this model, which has good explanatory power.

In conclusion, the regression results show that the impact of agricultural insurance premium income on the disposable income of rural residents has not reached statistical indicators. Still, the farm insurance indemnity expenditure significantly positively affects the disposable income of rural residents. Specifically, the higher the agricultural insurance compensation expenditure, the higher the disposable income of rural residents.

Table 4 Results of regression model

	(1) ***Per capita disposable income of rural residents***	(2) ***Per capita disposable income of rural residents***	(3) ***Per capita disposable income of rural residents***
Area of agricultural sowing	-1.291 (-1.91)	-0.797 (-0.49)	-2.602* (-2.47)

Area affected by crops	0.025 (0.08)	0.020 (0.06)	0.155 (0.68)
Investment in rural fixed assets	4.533 (0.70)	8.095 (0.79)	-15.916 (-1.99)
Consumption of rural residents	0.426 (0.73)	0.287 (0.51)	1.144 (2.18)
GDP of primary industries	2.751 (1.10)	3.872 (1.19)	-2.518 (-0.72)
Insurance company premium income		-2.105 (-0.40)	7.051 (1.76)
Payment by the insurance company			4.070** (4.55)
_cons	6363.358* (2.11)	2440.081 (0.23)	18716.261* (2.50)
N	11	11	11
R Square value	0.986	0.986	0.997
Value of F	255.396***	126.232***	685.564***

6 CONCLUSION

6.1 Conclusions of the Study

- In the separate regressions of agricultural insurance premium income on rural residents' disposable income, rural insurance premium income significantly and positively influenced rural residents' disposable income. However, the effect of agricultural insurance premium income on the disposable income of rural residents was not significant after the inclusion of control variables.

- Agricultural insurance payout expenditure significantly and positively influenced rural residents' disposable income; Specifically, the higher the agricultural insurance payout expenditure, the higher the disposable income of rural residents.

- Based on the results of the empirical study, we further proposed suggestions and initiatives to improve the per capita disposable income of rural residents in Yunnan Province, which is conducive to the improvement of people's living standards in Yunnan Province.

6.2 Suggestions

6.2.1 Changing the consumption attitudes of Yunnan's rural residents

According to the results of the analysis of the agricultural insurance affect residents' income level, as mentioned above, the possible reasons is that Yunnan Province is located in the northwest, residents' consumption concepts backwards, conservative, is unwilling to lower-income to pay insurance. Therefore, the government should actively promote the consumption idea of Yunnan local people, make its reasonable consumption, and will be used to pay the insurance part of consumption.

6.2.2 Increasing investment in policy-based agricultural insurance in Yunnan Province

In order to give full play to the influence of policy-based agrarian insurance on the income of rural residents, the government should increase the investment in policy-based agricultural insurance in the central and western regions. In addition to policy support and financial subsidies for the West and central areas, insurance companies should be given more preferential policies, such as tax exemption or low tax rates for the agricultural insurance business, to encourage them to carry out this business.

6.2.3 Establishing a specialized agricultural insurance agency and promoting legislation in an orderly manner

By establishing a unique agricultural insurance mechanism, the interests of various parties can be taken into account to ensure the steady promotion and sustainable development of policy-based farm insurance. Based on the agricultural insurance mechanism, the state should also promulgate relevant statutes, specifically in the form of laws stipulating the status and role of the state's support and protection system for agriculture, as well as the rights and responsibilities of the relevant subjects of interest, including the role and responsibilities of the government in its work, to reduce illegalities in agrarian insurance transactions. The government of Yunnan Provincial should also actively promote the construction of laws and regulations on agricultural insurance while giving each local government greater autonomy and allowing local departments to formulate local regulations and documents under the premise of acting by the law.

6.2.4 Improving farmers' knowledge and culture of agricultural insurance in Yunnan Province

First, strengthen education and training, strive to solve the problem of information asymmetry from the supply and demand sides, curb the adverse selection and moral hazard that may occur in agricultural insurance, and reduce transaction costs and management costs. Second, schools should develop related school-based courses to popularize the knowledge of policy-based agricultural insurance.

6.2.5 Strengthening the cultivation of talents for agricultural insurance in Yunnan Province

The reserve and cultivation of talents are the keys to the sustainable operation of a company. To establish the talent team of agricultural insurance in Yunnan Province, we must solve the root problem of the lack of agricultural insurance talent in Yunnan Province. First, we should appropriately improve the treatment of agricultural insurance employees and strive to reach the

average level of employees in national insurance enterprises. Secondly, we should strengthen the ideological education of agricultural insurance practitioners to cultivate their spirit of basing themselves on their duties and being brave in dedication. Finally, the government should increase investment in this area and provide certain material subsidies to the rural insurance personnel working at the grassroots level for a long time.

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