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Article

Analysis on the Income Risk and Income Insurance Ricing of Planting Farmers in North China

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Abstract: The frequent occurrence of extreme weather disasters under global climate change has greatly impacted agricultural production, caused crop yield and price fluctuations, affected the increase of farmers' income, and hindered the development of the rural economy. As a typical mountainous region in North China, Shandong Province is a major peanut-planting province. In recent years, the peanut planting area in Shandong Province has remained relatively stable at around 10 million hectares (approximately 6.67 million hectares), accounting for approximately 14% of the national peanut planting area. Affected by meteorological disaster risks and consequent price risks, peanut farmers in Shandong Province are faced with double threats of output and price. This study is aiming to analyze the income risks faced by peanut planting farmers in the northern regions of China and to develop a comprehensive understanding of the factors influencing their income variability. The study may investigate various aspects especially the market price fluctuations, socioeconomic factors affecting peanut farming and the correlation of the peanut pricing and the local insurance. The current policy-based peanut insurance makes it difficult to fully disperse risks and guarantee stable production with the permission of relevant government department. Therefore, based on the peanut yield and price data of Shandong Province from 1991 to 2017 and following the logical context of "meteorological disaster - yield risk - price risk - income loss - income insurance", this paper uses the Copula method to calculate the premium rate of peanut income insurance and finds that under the guaranteed level of 70%-90%, the pure premium rate is between 1.5%-4.15%. Compared with the current cost insurance with a flat rate of 4% in Shandong Province, the income insurance rate is generally lower than the current rate. Secondly, there are regional differences in income insurance rates. In addition, at a higher level of protection, the income insurance rate is higher.

Keywords: Meteorological Disaster Risk; Planting Income Insurance; Rate Determination; Copula Method

1. Introduction

Peanut is the main oil crop in Shandong Province, and peanut income is an important channel for farmers to increase income in Shandong Province. In the recent 20 years, Shandong peanut planting area and total output and oil crops accounted for more than 96%. However, for a long time, the objective existence and constant aggravation of the risk of natural disasters, as well as the consequent fluctuations in the market price of agricultural products, have become the restricting factors for the stability and further development of peanut production. According to statistics, the disaster area of 575,000 hectares in Shandong Province in 2018 has been expanding in recent years, and the peanut production price index has fluctuated sharply, the peanut production in Shandong Province is facing the double threats of output and price.

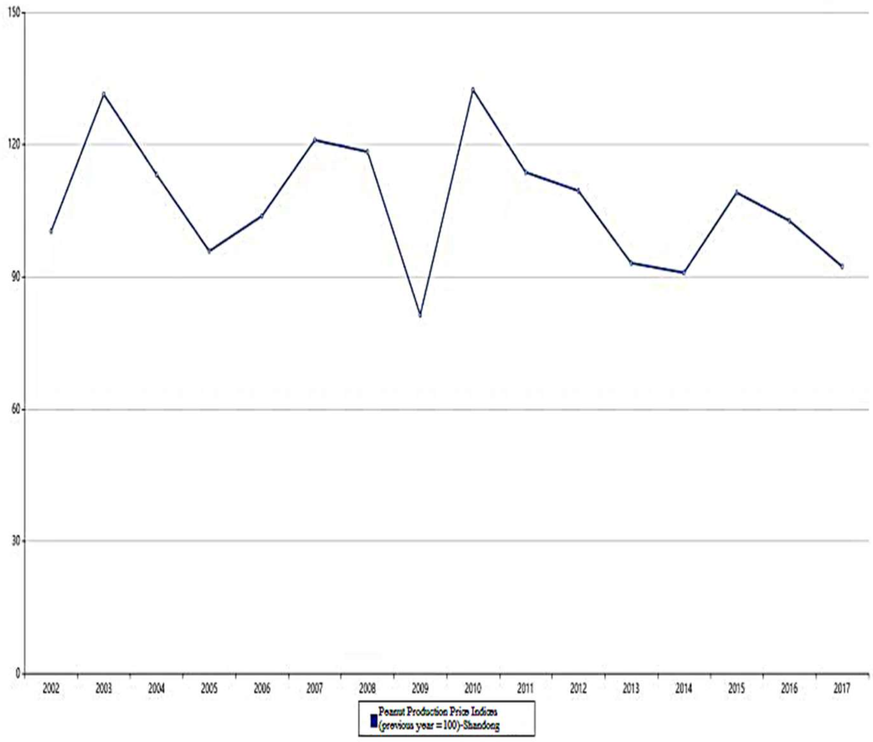

Figure 1. Disaster area of Shandong Province from 1999 to 2018.

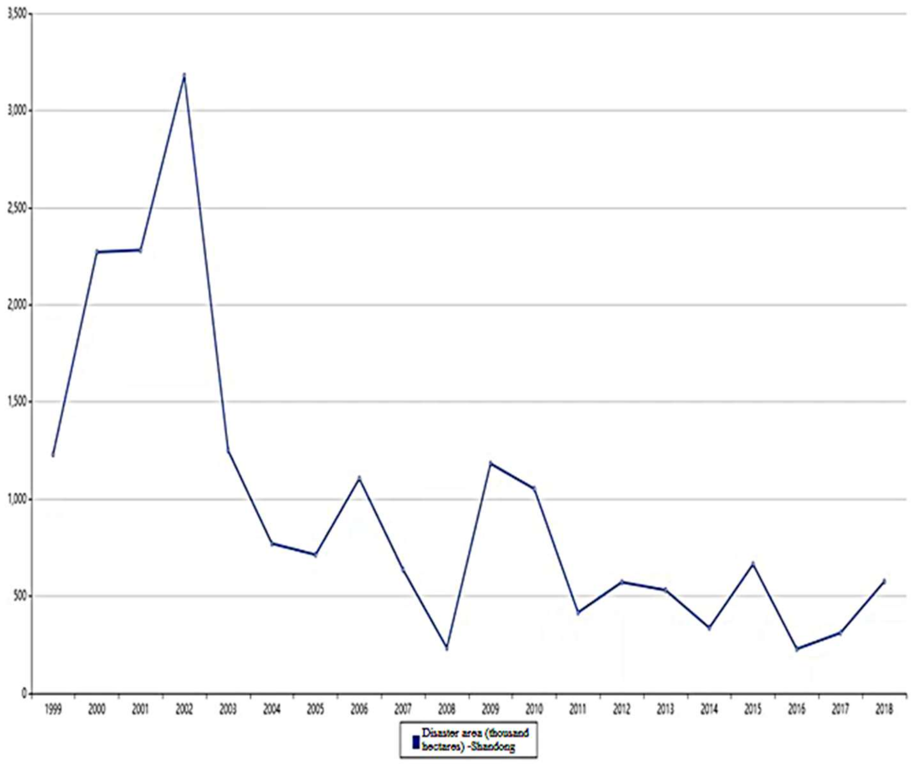

Figure 2. Peanut production price index in Shandong Province from 2002 to 2018.

Agricultural insurance is an important means to spread planting risk and stabilize agricultural production. However, peanut insurance developed relatively late in Shandong Province, and its risk protection function also has some limitations objectively. In 2006, Shandong Province began to carry out a policy-based agricultural insurance pilot. In 2014, Shandong Province's peanut insurance was listed as one of the crop varieties that enjoy subsidies from the central government. At present, the peanut insurance in Shandong Province is still dominated by price insurance, which can only guarantee a certain proportion of the physical and chemical cost of peanut planting and cannot fully meet the diversified risk security needs of farmers. In 2018, Shandong Province revised its peanut planting insurance clauses and implemented them across the province. Compared with the revision before, the average amount of peanut insurance per hectares has been increased from 400 yuan to 600 yuan, and the premium per mu has also been increased from 16 yuan to 24 yuan (Su & Pu, 2021) [1]. With the increase of peanut insurance amount, the protection effect of peanut insurance can be enhanced, but the promotion effect is very limited under the influence of increasing materialization cost and human cost as well as expanding natural disaster risk. In addition, the peanut insurance in Shandong Province has always been subject to a uniform premium rate of 4%, so the long-term and unchanged inelastic premium rate is difficult to effectively connect with the peanut industry development and rural economic development, and the regional differences of peanut production cannot be effectively reflected. While the natural and social conditions of peanut production are constantly changing, it is particularly necessary to explore and innovate agricultural insurance that can provide more comprehensive risk protection.

Agricultural income insurance is a kind of agricultural insurance that has been well developed in the United States. Considering the two major risks in the production and sales of agricultural products, it provides economic compensation in the years of crop failure and prevents the fluctuation of market prices of agricultural products, to ensure the basic stability of farmers' income. The United States is the country that develops peanut income insurance earlier. According to the Revenue Income Protection report issued by the United States Department of Agriculture, a relatively complete peanut insurance system has been largely established, designed to provide farmers with comprehensive coverage for general risks including extreme weather, pests and diseases, fires, price changes including market risks, and earthquake and hurricane catastrophe risks, which also fall under the category of safety (Knisley, 2016) [2]. Therefore, under the trend of increasingly serious natural and social risks of peanuts in Shandong Province, the analysis of peanut income risk and income insurance pricing mechanism is conducive to resolving agricultural production and operation risks, stabilizing the enthusiasm of agricultural production and agricultural investor confidence, and ensuring the safety of oil supply. Secondly, it is conducive to promoting the effective governance of agriculture, rural areas and farmers by the government, alleviating poverty caused by disasters and returning to poverty due to disasters and facilitating the formation of effective mechanisms for poverty alleviation and targeted poverty alleviation (Sun et al., 2017) [3]. Finally, it is conducive to curbing the risk of market fragmentation between urban and rural areas, promoting the integrated development of urban and rural areas, and realizing rural revitalization, agricultural modernization and economic and social development.

2. Materials and Methods

2.1. Research on the Development of Income Insurance

The Crop Revenue Coverage (CRC) of the US is the earliest form of income insurance. Foreign research on the development and effect of income insurance is also abundant. Bruce (1997) [4] compared the income insurance plan with the agricultural insurance plan in 1990 and found that the income insurance had higher redistribution efficiency and could provide farmers with basically the same level of income at a lower cost. Xu and Pu (2014) [5] introduces the insurance mechanism into the basic economic growth model and found that income insurance and premium subsidies had a significant positive effect on promoting crop output and agricultural economic growth.

However, domestic income insurance has not yet entered the stage of the pilot. Through the comprehensive comparison of five agricultural insurance models, Zhou and Yu (2005) [6] put forward the appropriate gradual development of agricultural insurance strategy, by firstly piloting economic crop income insurance, then gradually spreading to food crops income insurance, and eventually establishing a complete system of agricultural insurance. Xiao and Wang (2013) [7] pointed out that the implementation of agricultural income insurance has important practical significance and demonstrated the feasibility of carrying out income insurance in China from the three successful elements of income insurance. Carrying out agricultural income insurance is conducive to making up for the limitation of insufficient risk compensation capacity of existing insurance in the market, providing sufficient insurance guarantee for agricultural production, accelerating the innovation of agricultural insurance strategy, and ultimately boosting agricultural supply-side structural reform (Ren, 2016) [8]. Citing market risk characteristics, Tuo and Zhu (2016) [9] point out the limitations of price index insurance and stated that the development of income insurance plays an important role in the reform of the price formation mechanism of China's agricultural products, in combination with the development of agricultural income insurance in the United States. The economic benefits of agricultural income insurance increase with the increase in the level of security. The implementation of income insurance can not only reduce the premium rate, but also improve the insurance demand, premium income, insurance depth and insurance density to different degrees (Wang, Sun, & Jiang, 2017) [3]. Lin and Li (2020) [10] conclude from the analysis of empirical data at the county level of Jiangsu Province that, risk factors and operating characteristics had a significant impact on the willingness of farmers to participate in income insurance. With the increase in the number of disasters and the decline of agricultural product prices, the willingness of farmers to participate in income insurance became more and more strong.

2.2. Research on Income Insurance Pricing: The Copula Method

The core of income insurance pricing is the marginal and joint distribution fitting of both yield and price. The mainstream methods of rate calculation are consistent at home and abroad.

The parametric method and non-parametric method are the two main methods for the distribution fitting of yield per unit area and price. The parameter method is simple to operate, and the commonly used distributions for fitting yield data include Beta distribution (Grant, 1989) [11], log-normal distribution (Goodwin, 2000) [12], Weibull distribution. Common distributions of fitting price data include Burr distribution (Tejeda, 2008) [13], log-logistic distribution (Ghosh, 2011) [14], log-normal distribution (Goodwin, 2000) [12]. However, due to the prior distribution of parameter method, it has certain randomness and subjectivity, and there may be deviations in risk measurement. The non-parametric method can well make up for the above deficiencies. By introducing kernel function, the optimal distribution can be determined by selecting the appropriate window width, to improve the accuracy of tracking the output and price risk (Fu at al., 2017) [15].

In terms of the relationship between output and price, CRC assumes that they are independent of each other (Xie et al., 2011) [16]. But in fact, the output and price are not independent, and according to specific situations, the correlation of output and price is either positive, or negative, correlation degree also has a certain difference. Therefore, the Copula method is often used to characterize the correlation between the two in subsequent relevant studies (Ghosh, 2011) [14]. The Copula method is also mostly used in the pricing research of income insurance in China. The differences were mainly in crop species, data selection, marginal distribution, and Copula function forms. Xie et al. (2011) [16], taking Fuyang City, Anhui Province as the research object, selected three representative crops, namely corn, wheat and soybean, and were the first to use Copula method to study income insurance pricing. Tian et al. (2019) [17] also took grain crops as examples to determine the income insurance rate based on Copula method. Xu and Pu (2014) [5] uses Copula method to conduct pricing research on Shanxi apple income insurance. Specifically, Bao (2019) [18] and Jiang (2019) [18] used Copula method to study the pricing of peanut income insurance in Henan Province. Based on the former, the latter considers regional differences within the province and designs weather index income insurance for specific regions, and the rates calculated by the two are also quite different. But there is still some lack of attention to the pricing of peanut income insurance in China. As a result, the Copula method can provide a more accurate, flexible and reliable modeling framework for calculating peanut income insurance, which brings important method innovation and benefit improvement to the agricultural insurance field.

3. Results

3.1. Statistical Description of Peanuts Planting Risk

Shandong Province is in the temperate monsoon climate zone. During the same period of rain and heat, there is more precipitation, and the terrain is plainer and hillier. Therefore, the natural geographical environment is suitable for peanuts growth. Shandong Province is a major peanuts Province in China. In the past 10 years, Shandong Province has been in a leading position in the planting area and total output of peanuts, second only to Henan Province, and its output per unit area is only lower than Anhui Province and Henan Province. In 2017, the sown area and total output of peanuts in Shandong accounted for 15% and 18% of the national total, respectively, and the output per unit area of peanuts exceeded the national average by 20%. The risk management process of this study is conducting the ISO 31000. By adopting an ISO 31000 approach, peanuts farmers can systematically identify, assess, and manage these risks to better protect crop yields and incomes. This standard emphasizes continuous monitoring and continuous improvement, so that farmers can respond to new risk factors in a timely manner and improve the stability and sustainability of agricultural operations. Hence, risk management based on ISO 31000 can help peanut farmers to better understand the risks, develop more effective coping strategies, and improve the reliability of production and the sustainability of the agricultural economy.

Figure 3 shows the planting area and yield data of peanuts in Shandong Province from 1988 to 2017. As is shown in the figure, the planting area and total output of peanuts keep synchronous change, which can be roughly divided into two stages. From 1988 to 2003, due to the improvement of production conditions and government policy support, except for the two major droughts in 1989 and 1997, which resulted in low peanut yield, the peanut planting area and total output fluctuated but rose. In particular, in 1993, Shandong Province fully liberalized the purchase and sale of oil, which greatly promoted the planting enthusiasm for farmers. From 2003 to 2017, due to the sluggish peanut market at home and abroad as well as the government's grain support policies and other factors, the planting area and total output of peanuts generally declined.

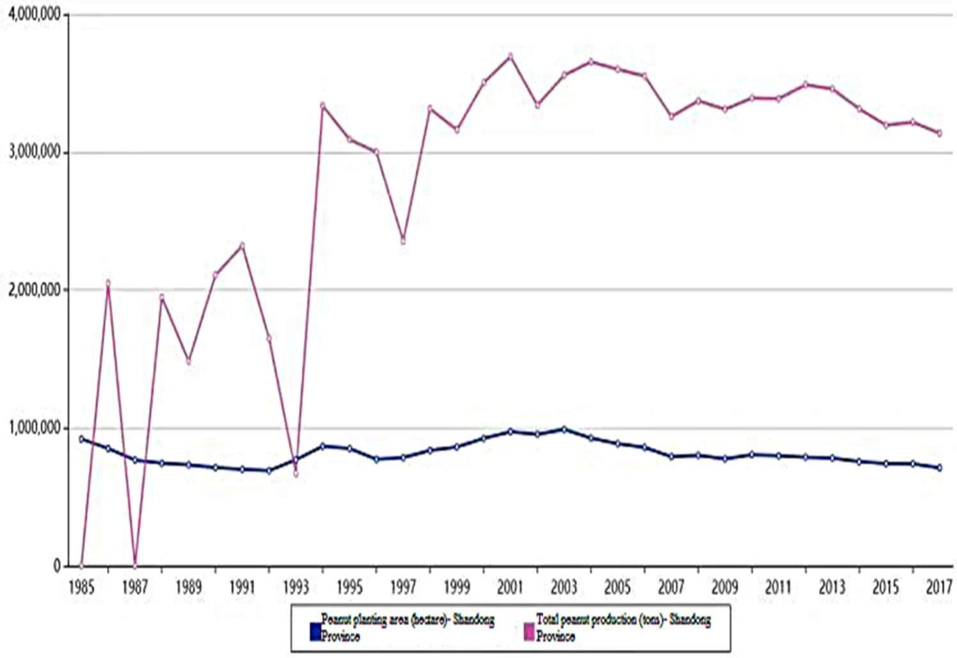

Figure 3. Sown area and total output of peanuts in Shandong Province from 1988 to 2017.

3.2. Analysis of Influencing Factors of Peanut Yield Per Unit Area

The peanut production in Shandong Province is greatly affected by meteorological disasters, especially drought. Although peanut is a drought-tolerant crop, it has a relatively strong demand for water during the germination and flowering period (generally from May to June). However, 60% to 80% of the precipitation in Shandong Province is concentrated in summer, and the precipitation at the turn of spring and summer is relatively insufficient, which makes it difficult to meet the necessary water conditions for peanut germination and flowering. Figure 4 shows that there is an obvious negative correlation between peanut yield per unit area and drought-affected area in Shandong Province, while there is no obvious correlation between peanut yield per unit area and drought-affected area.

In addition, as the smallest unit of labor production, farmers obtain the output through input of labor, capital, technology, and other factors in the peanut planting process. The relationship between peanut input and output can be expressed as the following Cobb-Douglas production function:

$$Q_t = A(K_1 + K_2)^{\alpha} L^{\beta} \tag{1}$$

Wherein: set the technology input A and labor input L; Capital input K can be divided into premium K_1 (including property loss insurance, namely production loss insurance and personnel health accident insurance) and other capital input K_2 except premium input. This suggests that insurance is involved in the peanut planting process in the form of premium expenditure and has an impact on peanut production.

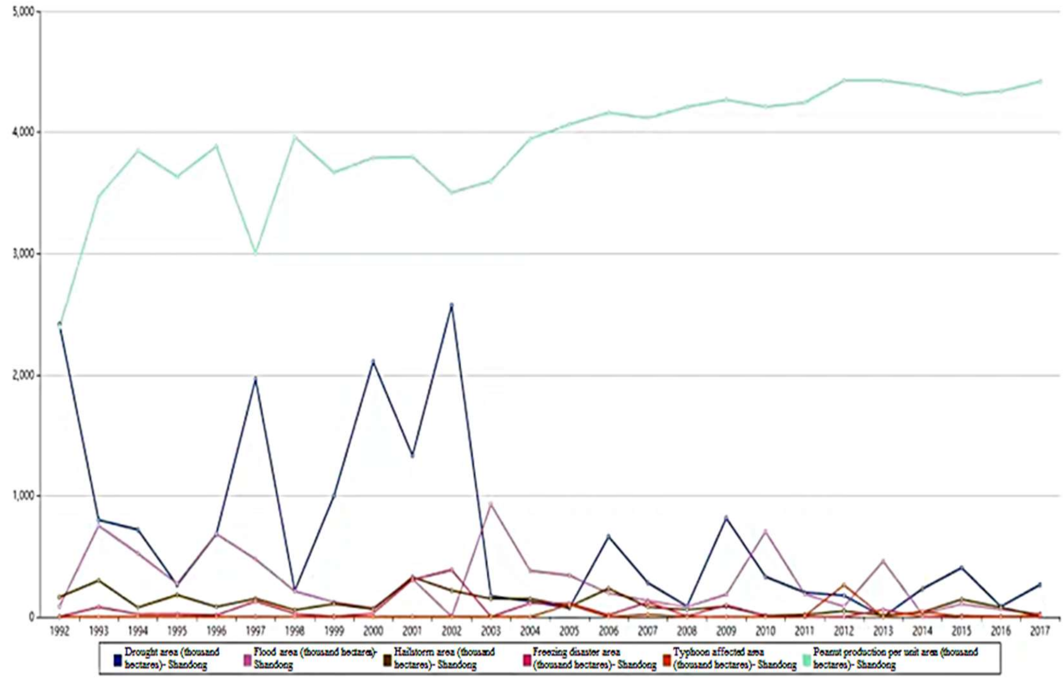

Figure 4. Peanut yield per unit area and disaster area of meteorological disasters in Shandong Province from 1992 to 2017.

3.3. Spider Theory Model Analysis of Peanut Price

Peanut is the main oil crop in Shandong Province. There is a time lag between peanut production supply and demand. The output of peanut farmers is affected by the price of the previous period, while the demand of peanut processing enterprises is affected by the price of the current period. Obviously, the supply and demand decisions of peanuts conform to the assumptions of the Cobweb model. In this paper, the output and average selling price of peanuts in Shandong Province from 1991 to 2017 were respectively selected to establish a cobweb theoretical model:

$$\begin{cases} Q_d = 3044 + 216.72P_t \\ Q_s = 3035.5 + 226.96P_{t-1} \\ Q_d = Q_s \end{cases} \tag{2}$$

226.96/216.72=1.0472>1, which is a divergent cobweb model, that is, as time goes by, the actual price of peanuts will fluctuate around the equilibrium price with an increasing range, and finally deviate from the equilibrium price infinitely. The fluctuation of peanut price will have a serious impact on the income of farmers and the production stability of related enterprises.

Farmers are the direct bearers of peanut price risk. Peanut price risk first affects the stability of their family income, and then affects the improvement of their consumption utility level and life quality. Secondly, due to the short-sightedness and blindness of farmers' production, the irregular and violent fluctuation of prices is not conducive to guiding farmers to form a reasonable planting expectation, leading to a large increase and decrease of peanut planting scale and further aggravating the instability of prices.

Enterprise is the indirect undertaker of peanut price risk; the price risk is reflected in the fluctuation of production cost of peanut processing enterprises. Under the condition that the peanut processing product market is relatively stable, enterprises passively bear all the risks caused by changes in the cost, and the increased uncertainty of business revenue and profit, which may cause the attendant risks such as operation and management.

3.4. Income Gap and Rate Calculation

The mean of income over the years is the expected income in the risk-free state, which is $\hat{y}$; y_t is the income over the years, and $\Delta y_t = y_t - y$ is the income gap in the risk state.

When the income gap is negative, the compensation mechanism of income insurance is triggered, and the farmers get compensation. The insurance amount is the difference between the expected income and the actual income of the year. Accordingly, the amount of compensation payable to the farmer shall be:

$$Pension(y) = \begin{cases} \hat{y} - y_t, \Delta y_t < 0 \\ 0, \Delta y_t > 0 \end{cases} \tag{3}$$

Set α as the level of insurance protection, generally, $\alpha \in [0.7, 0.9]$. The net premium rate of insurance is calculated according to the following formula:

$$ExpectedLoss(y) = prob(y < \alpha \hat{y})[\alpha \hat{y} - E(y \mid y < \alpha \hat{y})] \tag{4}$$

$$r = ExpectedLoss / \alpha \hat{y} \tag{5}$$

4. Discussion

4.1. Data Selection and Processing

Table 1. Unit root test and detrending.

Production and Price		Before processing		After processing	
		p-value	The inspection results	p-value	The inspection results
Production	Shandong	0.0012	Smooth	0.0000	Smooth
	Qingdao	0.0056	Smooth	0.0000	Smooth
	Yantai	0.1113	Not smooth	0.0189	Smooth
	Linyi	0.0473	Smooth	0.0000	Smooth
	Heze	0.0871	Not smooth	0.0101	Smooth
Price		0.1619	Not smooth	0.0251	Smooth

Firstly, the annual yield and price data of peanuts in Shandong Province from 1991 to 2017 are selected to measure the income insurance rate. Considering the regional difference in peanut production, the annual peanut production and price data of Qingdao City, Yantai City, Linyi City and Heze City are selected to determine the premium rate respectively. The yield per unit area was selected from the “Shandong Statistical Yearbook" over the years. The index of average selling price per 50kg of main products is selected. The data source is from “National Agricultural Product Cost and Income Data Collection".

The time series data have trend characteristics, which may affect the distribution fitting and the reliability of the results, so the unit root test is carried out on the data. Table 1 shows that the unit area yield and price series of Yantai and Heze are not stable. To obtain stationary time series, H-P filtering method is used to detrend the data. The significance level was set as 0.05, and the per unit area yield and price series of peanuts were stable after treatment. To eliminate the influence of dimension on results, the data is standardized.

4.2. Marginal Distribution Fitting of Yield and Price

Common distribution forms including Burr, Gamma, Normal, Logistic, log-logistic, log-normal, and Weibull are selected. Python 2.7 is used to fit the yield and price data per unit area in Shandong Province, Qingdao, Yantai, Linyi, and Heze respectively, the AIC and BIC values are calculated, and the optimal distribution is selected according to the principle of minimum sum of squares error. The specific results of unit yield and price distribution fitting are shown in Table 2.

Table 2. Fitting results of marginal distribution of yield and price.

Production and Price		Distribution	Parameter
Production	**Shandong**	Logistic	μ = 0.1126 Sigma = 0.6468
	Qingdao	Logistic	μ = 0.1053 Sigma = 0.7353
	Yantai	Logistic	μ = 0.112 Sigma = 0.6373
	Linyi	Logistic	μ = 0.1253 Sigma = 0.7652
	Heze	Logistic	μ = 0.1077 Sigma = 0.6309
Price		Normal	μ = 0.4841 Sigma = 0.2780

4.3. Joint Distribution Fitting of Yield and Price

Table 3. Fitting results of joint distribution of yield and price.

Region	The Kendall coefficient	Copula function	Parameter
Shandong	0.0631	Clayton	0.11
Qingdao	0.0742	Gumbel	1.17
Yantai	0.1198	Frank	1.01
Linyi	0.1655	Gumbel	1.29
Heze	0.0285	Gumbel	1.11

The Common Copula functions Gaussian, t, Clayton, Frank, and Gumbel Copula are selected, and R Studio is used to carry out joint distribution fitting of yield and price data of Shandong Province, Qingdao, Yantai, Linyi, and Heze respectively. Firstly, the Kendall rank correlation coefficient is used to measure the correlation between yield per unit area and price series. Secondly, the optimal Copula function is selected by the AIC or BIC criterion, and the corresponding parameter estimation is carried out by maximum pseudo-likelihood estimation method. The correlation between yield per unit area and price and the specific results of joint distribution fitting are shown in Table 3.

4.4. Monte Carlo Simulation and Rate Calculation

Based on the acquired marginal and joint distribution of both yield and price, 10,000 random sequences of yield per unit area and price are generated by the Monte Carlo method. On this basis, reverse standardization is carried out and the trend items of unit area yield and price data are added back to obtain the sample yield and price data, and the sample income data is obtained by multiplying the two. The net premium rate of income insurance at the level of 70-90% is calculated as follows.

Table 4. Results of income insurance premium rating and comparison with current cost insurance.

Region Security level	70%	75%	80%	85%	90%
Shandong	1.5%	2.22%	2.93%	3.69%	4.15%
Qingdao	0.85%	1.67%	2.21%	2.95%	3.47%
Yantai	1.91%	2.29%	3.32%	3.85%	4.33%
Linyi	2.01%	2.78%	3.59%	3.98%	4.54%
Heze	0.98%	1.88%	2.71%	3.21%	3.86%
Current cost insurance	4%	4%	4%	4%	4%

5. Conclusions and Suggestions

5.1. Relevant Conclusions

Firstly, through the analysis of the peanut income risk in Shandong Province by the Cobb-Douglas production function and Cobweb Theory Model, it was found that the peanut yield in Shandong Province was negatively correlated with the drought, and the divergent Cobweb Model showed that the peanut price had a serious fluctuation. The existence of peanut income risk directly affects the income stability of planting farmers and the production enthusiasm of related enterprises. Obviously, the development of peanut income insurance has its necessity and practical significance.

Secondly, through the unit area production and price data of Shandong Province and four cities from 1991 to 2017, using the H-P filtering method, Copula method, Monte Carlo method and other methods to calculate the pure premium rate of income insurance, it was found that under the guaranteed level of 70-90%, the pure premium rate was between 1.5% and 4.15%. Comparatively speaking, the rate level of Qingdao and Heze City is lower overall, while that of Yantai and Linyi City is higher overall. This is possibly because the Kendall rank correlation coefficient of the first two groups is negative, which indicates that there is a weak negative correlation between unit yield and price, and there is a certain hedging effect between yield risk and price risk, so the rate level is lower. At the same time, compared with the current cost insurance with a flat rate of 4% in Shandong Province, the overall rate of income insurance is lower than the current rate, which can provide a more comprehensive protection at a lower cost under the same level of protection. Therefore, the development of peanut income insurance has its feasibility.

However, at a higher level of protection, the premium rate of income insurance is still relatively high, especially when the hedging effect between unit yield and price is not significant, the premium rate of income insurance is higher than the current cost insurance. Currently, farmers' insurance income insurance brings high protection but also accompanies high-cost expenditure.

5.2. Policy Suggestions

First, it is suggested and innovated the premium subsidy mechanism for agricultural insurance in this study especially for the peanut planting and peanuts production. The national financial support is a strong backing source for the income insurance pilot and its subsequent development, and the multi-subject and multi-channel premium allocation mode of “peasant household - professional cooperative - relevant enterprise - commercial insurance company - government" has been established and improved. Agricultural insurance in China adopts a policy-based business model, in which governments at all levels provide various types of insurance and non-insurance subsidies to farmers. It is suggested that the trials expansion of policy-based agricultural insurance reform, according to the government work report for 2019. According to the Opinions of the Central Committee of the Chinese Communist Party and the State Council on “Doing a Good Job in the Key Work of Comprehensively Promoting Rural Revitalization in 2022,” (2022) [19], the local superior agricultural products to pilot, flexible premium and other incentives to replace the unified premium subsidies. In addition, the government is suggested to carry out differentiated subsidies according to the corresponding rates at different levels of security (Table. 4). The proportion of government subsidies will be reduced to a certain proportion for farmers who are insured with a higher level of protection, taking the 70% stipulated by the "green box Policy" of the WTO as the baseline level of protection (WTO, nd.) [20]. Through the innovation of insurance types and subsidy mechanisms, we promote the improvement of the supply side of insurance companies and the government, accelerating the matching of the supply and demand of agricultural insurance, which can illustrate the positive interaction between the structural reform of agricultural supply side and the development of agricultural insurance.

Additionally, we will establish a perfect agricultural information database through the analysis of this study. Rate determination is an important part of crop income insurance and requires high accuracy of relevant data. At present, relatively unified agricultural information database has not been fully established in China (Ren, 2018) [21]. Firstly, the content of relevant agricultural statistical data channels has a high degree of homogeneity, and there is a serious crossover. Secondly, the period of some agricultural statistics is short, and there are some deficiencies in data integrity and consistency. Third, agricultural statistics mainly focus on the national and provincial level, while the micro level, especially the county level and below, is relatively lacking, which brings great difficulty to the accuracy and difference determination of the income insurance rate. Therefore, the establishment and improvement of agricultural information database will provide complete data support for the research on the determination of agricultural income insurance rate.

Furthermore, it is important to improve agricultural insurance varieties and related systems. First, the financial supervisory authorities and relevant departments should further liberate their thinking and guide insurance institutions to research and develop insurance varieties specifically tailored for peanut planting, shifting the focus from cost coverage to price and income protection for farmers. Second, insurance underwriters should optimize the standards for survey and loss assessment, regulate specific issues such as assessment methods, claims thresholds, assessment procedures, and compensation processing, and effectively safeguard the legitimate rights and interests of insured farmers. Third, insurance institutions should enhance innovation in agricultural insurance products and services, formulate reasonable insurance plans, improve underwriting work, and meet the growing demand for agricultural insurance in the rural areas. Fourth, we suggest strengthening the publicity while disclosure to ensure that farmers are aware of premium subsidy policies, insurance clauses, and progress in claims settlement. Fifth, strengthen risk management and adopt a preventative approach combining risk prevention and claims handling, and effectively diversify risks through methods such as reinsurance.

Finally, the study suggests accelerating the development of agricultural futures. Expand the pilot program of "insurance plus futures", according to the guideline. Optimizing innovative financial means such as "insurance plus futures" can create a synergy between futures and insurance, providing sustainable protection for agricultural farmers. In traditional agricultural insurance, insurance underwriters bear substantial claims risks, following the ISO3000 scheme. However, "insurance plus futures" disperses and transfers some of the risks through the futures market, effectively adding a form of "reinsurance" for insurance underwriters. For a long time, the prices of agricultural products in China deviate from the market level to some extent which has been lasted for a long period. Meanwhile, the prices of the three main grain markets are greatly affected by the government's minimum purchase price policy. Although peanut has a high degree of marketization, the non-synchronization and unpredictability of peanut price make it still unable to fully reflect market risks. The futures market has a good function of price discovery and can timely and accurately reflect the price changes of the target agricultural products market through an open and orderly market-oriented operation. Promoting the development of peanut futures and further enhancing the marketization of peanut price, will not only effectively hedge the price risk of peanut in the trading period, but also provide more accurate and reasonable price data for the research on determining the premium rate of peanut income.

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