Factors that Affect Farmers' Behaviors on Participating in Policy-Oriented Agricultural Insurance in the Pilot Area——A Case of Insurance on Apple in Luochuan County, Shaanxi Province

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Abstract Taking Luochuan County of Shaanxi Province as an example, the factors that affect farmers' behaviors on participating in insurance is analyzed and evaluated according to the questionnaires and by selecting the indexes covering household features, agricultural production risks, the attitudes of rural households towards risks and the transaction cost of participating insurance and by using Logistic regression model. The results show that comparing with insurance company, the government has larger influence on farmers' behaviors on participating insurance; the premium of agricultural insurance does not obstruct farmers' participation in insurance; the bad-handled relations between the government and insurance company have bad effects on the development of local agricultural insurance. In order to promote farmers to participate in agricultural insurance, the relevant countermeasures are put forward: firstly, increasing the investment on rural education and improving cultural level of farmers; secondly, intensifying the promotion on agricultural insurance; thirdly, reasonably planning the duties and rights of the government and the insurance company; fourthly, vigorously encouraging the farmers to conduct scale production of apple and form the scale economy.

Key words Agricultural insurance, Behaviors on participating agricultural insurance; Attitudes towards risks, Transaction costs, China

Agricultural insurance is the insurance against the economic losses caused by natural disasters and unexpected accidents suffered by agricultural producers in the process of crop farming and livestock breeding. Under the background of economic globalization, developing agricultural insurance can not only spare natural risks in agricultural production, stabilize farmers' income, but also stabilize rural financial system and improve agricultural production operation and international competition. In recent years, the central government attaches great importance to the development of agricultural insurance. In the consecutive six years, the No. 1 Document issued by the central government has made great strategies for the development of agricultural insurance. Besides, the pilot works of policy-based agricultural insurance in various areas have been carried out.

At present, the kinds of agricultural insurance are increasing obviously, the business scope is expanding, the coverage of agricultural insurance is widening gradually, the insurance main bodies are multiplying, the functions of agricultural insurance are increasing and the various kinds of pilots are promoting. The pilots of policy-based agricultural insurance have expanded from six provinces in 2007 to sixteen provinces and Xinjiang Production and Construction Corps. At present, there are more than 160 kinds of agricultural insurance and they basically cover the crop faming and livestock breeding. From 2004 to 2008, the total agricultural insurance claims have achieved 11.726 billion yuan. In 2008, the agricultural claims were 7 billion yuan for more than 1.4 million disaster-hit rural households. Among the claims, the insurance claims were 4.6 billion yuan for crop farming and 2.4 billion yuan of claims for livestock breeding. Confronting with the snow and low temperature in the early 2008 and the earthquake hit in Sichuan, China in May 12th, the insurance claims have achieved nearly 0.1 billion yuan concerning the fertile sow insurance, which has greatly undergirded the construction of restoring the disaster-hit areas. Amid displaying the advantages in preventing disasters and risk management, the insurance company has greatly enhanced the capability of agriculture in disaster prevention and control. However, in the process of promoting the pilots, the elements that gravely restrict the development of Chinese agricultural insurance are exposed. For example, the Governmental subsidies are hard to win over; the insurance company does not have high enthusiasm on agricultural insurance; farmers' weak awareness on participating in insurance and so on. Currently, there are many researches on solving the problems of agricultural insurance from the perspective of governments and insurance companies, but few researches on farmers' behaviors on participating insurance. Through questionnaires, the paper analyzed the influencing factors that affect farmers' behaviors and put forward the suggestions, aiming at improving farmers' enthusiasm on participating in insurance and pushing forward the healthy development of agricultural insurance.

1 General situation of study area

China is one of the major production bases of apple in the world, with the yield ranking third in the world. The yield of apple accounts for more than 33% of the total output of fruits. Luochuan of Shaanxi Province, locates in the central of Shaanxi Province, is a famous home to apple. The county is regarded as one of the major production bases for the exported apple in China, with annual billions of kilograms of apple export. Luo-

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chuan County is proven as the best place for producing apple by domestic and foreign experts for its wide land, thick soil, rich sunshine, balanced water and feritility, concentrated rainfall and heat, long frost-free period, big temperature difference and zone industrial pollution. Besides, it is also in accordance with the seven climate indexes including sunshine, precipitation, sea level above and so on, so it boasts distinctive natural resources for developing apple industry. It has had more than 60 years' history of planting apple, since the introduction of apple in 1947. In 2009, the Lunchuan County had a big harvest, the total output of apple was 0.65 million ton with the total output value of more than 1.5 billion yuan. At present, the sown acreage of apple in Luochuan County has attainted 0.33 million-hm , 0.21 hm^2 per capita, ranking first in China. The income from apple accounts for 95% above of farmers' per capita net income. Since 2007, the Luochuan apple has been concluded in the scope of policy-based agricultural insurance. The paper takes insurance on apple as an example to study the factors that affect farmers' behaviors on participating in agricultural insurance to put forward suggestions for solving the problems of agricultural insurance.

2 Data source, index selection, model selection

2.1 Data source The data come from the investigation on 200 rural households in Luochuan County of Shaanxi Province in September 2009. The investigation adopted the combination methods of random sampling, stratified sampling and typical survey. There were all together 160 questionnaires returned, after selecting the data according to the needs of research, 142 valid questionnaires were chosen.

From the age structure of the subjects, 67% of them are from 20 to 50 years old, which indicates that middle age and young people are the main labors of the surveyed area, as well as that farmers' willingness on participating in agricultural insurance is near to the willingness of middle age and young people. From the education degree of the subjects surveyed, more than 64% of them have accepted middle school education or above. It can be seen from Table 1 that the insurance covers a wide range, the premium is not so high comparing with local farmers' income and the governmental subsidies are high, but the insurance amount is low. Therefore, the promotion of policy-based agricultural insurance played certain role in abating the losses of farmers caused by natural disasters, but the over low insurance amount restricted farmers' enthusiasm on participating in agricultural insurance.

2.2 Index selection and variable definition

2.2.1 Index selection. The foreign scholars often study agricultural insurance from the perspective of asymmetric information, for example, the moral risk and adverse selection caused by asymmetric information (Rothschild and Stiglitz, 1976)[1], imbalance of agricultural insurance market[2-3], *et al*. The domestic scholars tend to take the agricultural production risks, farmers' attitudes on risks and the transaction costs of insurance as the influencing factors that affect farmers' behaviors on participating in insurance[4-6]. Farmers are the rational economic-man, who aims at seeking the optimized expected profits. According to the existing theory framework of consumers' selection, the expected optimized profits of farmers depend on the expected income at the end of the period(W), fluctuation of income(that is variance δ^2) and appetite for risks . Its utility function can be expressed as follows:

$$U = U(W_1 - \gamma\delta_{w1}^{w}) \quad (1)$$

Table 1 The insurance contracts on apple in Luochuan County, Shaanxi Provicne

Survey area	Subjects insured	Insurance responsibilities	Premium yuan	Insurance amount // yuan/hm^2	Franchise %	Subsidy rate // %
Luochuan County, Shaanxi Province	Apple	Torrential rain, flood	40	15 000	10	50
		Drought, flood, wind	80	30 000		
		Hail , freeze	120	45 000		

Note: Data come from Shaanxi branch of PICC and Shaanxi branch of China United Property Insurance Company.

The agricultural insurance changes people' expected income through changing the fluctuation of income. According to the utility theory on the uncertain condition, under the condition of partly or completely eliminating the fluctuation of income, the expected income utility of risk averter will increase, even though the expected income has not increased. According to the rule of descending absolute risk aversion, the low-income farmers belong to the risk averters. Therefore, theoretically, farmers have strong sense of participating in insurance.

SUN Xiang-yu and ZHONG Fu-ning established an income function after farmers participated in the insurance, that is, agricultural insurance changes people's expected income through changing the fluctuation of income. The per unit area income of farmers after participating in agricultural insurance is CI, and then CI can be expressed as follows:

$$CI = \begin{cases} ml(p,\ y_0 - y_i) - p, & \text{if } y_0 > y_i \\ -p, & \text{if } y_0 \leqslant y_i \end{cases} \quad (2)$$

In the equation, p stands for premium; y_i represents the actual per unit yield; y_0 refers to critical production, that is the maximum yield that achieves the compensation standard; $I(p, y_0 - y_i)$ represents the insurance claim function of actual yield that lower than critical yield. Chinese agricultural insurances are cost insurance and the claims are determined by the losses and premium paid by farmers. m stands for the rate of probability of premium that can be realized, but farmers care about the transaction fee. The probability of critical yield higher than the actual yield determines the final interests of farmers' participation in agricultural insurance. The function is only a approximate expression of expected interests of rural households, who participating in agricultural insurance. It is easy to be found that whether the rural households will attend the insurance or

not is not only determined by production risks, but also by farmers' attitudes on risks and transaction fee.

On the experiences of former literatures and interviews, the research adopts the income of rural households' insured crops, non-agricultural income, planting scale *et al.* to measure the production risks; the family features and use of money saved to weigh farmers' attitudes toward risks; rural households' trust degree on government and insurance company to estimate the transaction costs.

2.2.2 The definition of variables. The explained variables are farmers' willingness on participating in agricultural insurance; the explaining variables include the features of rural households, agricultural production risks, farmers' attitudes on risks, transaction costs. The features of rural households gender, age and education degree. Factors that affect agricultural production risk include the income of rural households' insured crops, non-agricultural income and planting scale. Factors that affect farmers' attitudes toward risks include the use of money saved and the number of insurances the households have participated. The variables that affect the transaction costs include the promotion of insurance company, the credit of insurance in farmers' mind and the promotion on insurance conducted by the government. The value of the variables can be seen on Table 2.

Table 2 Definition of variables

Types	Name of variable	Definition of variable
Explained variable	Payment willingness	Not participating in =0 participating in =1
Explaining variable	Features of family	
	Gender	Female =0 male =1
	Age	≤20 years old =0,21 -30 =1,31 - 40 =2,41 - 50 =3,50 -60 =4,61 -70 =5, ≥70 years old =6
	Education degree	≤ primary school education =0, middle school education =1,high school/secondary technical school =2,junior college/university =3, ≥ postgraduate education =4
	Agricultural production risks	
	Sown acreage//hm^2	0.13 -1.00
	Income of per unit area//yuan/hm^2	≤45 000 yuan =0,45 001 -59 985 =1,59 986 -74 985 =2,74 986 -89 985 =3, 89 986 -104 985 =4,104 986 -119 985 =5,119 986 -134 985 =6,134 986 -149 985 =7,149 986 -164 985 =8,164 986 -179 985 =9,179 986 -194 985 =10, 194 986 -209 985 =11,209 986 -224 985 =12, ≥224 986 =13
	Non-agricultural income	0 yuan =0,0 -4 999 =1,5 000 -9 999 =2,10 000 -14 999 =3,15 000 -19 999 =4,20 000 -24 999 =5,25 000 -29 999 =6,30 000 -34 999 =7,35 000 -399 99 =8,40 000 -44 999 =9,45 000 -49 999 =10, ≥50 000 =11
	Attitude toward risks	
	Use of money saved	No =0,saving or supporting the education of their suns and daughters =1, enlarging production =2,investment =3
	Number of insurances participated	No =0,one =1,two =2,three or above =3
	Transaction costs	
	Promotion degree of the insurance company	No =0,small =1,general =2,great =3
	Credit of insurance company	Bad =0,general =1,good =2
	Promotion of the government	No =o, small =1, general =2, great =3

2.3 Model selection In order to analyze the significance of various factors that affect rural households' willingness on participating in insurance, the paper choose the Logistic regression model and its expression is as follows.

In the expression, α_0 is constant term; $x_1, x_2 \cdots x_p$ are explaining variables and their specific connotations can be seen on Table 2. β_1, β_2, ----, β_p are all estimating coefficient, μ stands for distribution term.

$$\text{logit}(p) = -\alpha_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_i x_i + \mu \quad (3)$$

3 Results and analysis

The logistic regression processing is conducted by using SPSS17.0 statistical software on the cross section data of samples. In the process of processing the data, backward screening method is adopted, that is to introduce all the variables into regression equation, and then test the significance of all the variables. In one or many insignificant variables, the variables with the minimum *t* test value should be eliminated until the *t* test value of all variables is significant. The estimated results can be seen on Table 3.

The likelihood ratio chi-square value of the overall test of regression equation is 55.263, the value of *P* equals to 0.000 ≤ 0.05,indicating that the model is reasonable and it is of the statistical significance. At the same time, through the estimation on the accuracy, the overall evaluation accuracy of overall evaluation has achieved 82.3%, that is the factors chosen can explain more than 80% of farmer's willingness on participating in agricultural insurance. The research conducts specific analyses from six aspects covering family features, farmers' attitude towards risks, transaction costs, rural households who have not participated in agricultural insurance and rural households who have participated in agricultural insurance.

3.1 Features of family The *P* value of education degree is 0.003,which is extreme significant. According to the investigation, rural households, who have accepted middle school education or above, account for 64% of the surveyed population. Among them, 71% of them have chosen to participate in agricultural insurance. It indicates that the higher the education de-

gree, the stronger the farmers' willingness on participating in agricultural insurance.

As for gender and age in the survey, rural households at the age ranging from 20 years old to 50 years old, account for 67% of the total rural households surveyed; rural households at the age ranging from 30 years old to 50 years old account for 53% of the total rural households surveyed, which implies that many farmers surveyed are middle age and young people. The significance of the two factors is not so significant, which may relate to the traditions that the production is determined by the masters of rural households.

Table 3 Evaluation results of farmers' willingness on participating in insurance

Item	Evaluation on parameters							
Participating in agricultural insurance	B	Standard difference	Wald	df	Significance level	Exp(B)	Confidence interval of Exp(B) 95%	
							Down bound	Up bound
Interception	6.995	1.494	21.910	1	0.000			
Gender	−0.231	0.563	0.169	1	0.681	0.793	0.263	2.392
Age	0.072	0.212	0.114	1	0.736	1.074	0.708	1.629
Education degree	−0.966	0.330	8.547	1	0.003	0.381	0.199	0.727
Apple plantation	0.005	0.069	0.005	1	0.943	1.005	0.878	1.150
Income of per unit area	0.084	0.085	0.979	1	0.322	1.088	0.921	1.285
Non-agricultural income	−0.109	0.105	1.070	1	0.301	0.897	0.729	1.103
Surplus	−0.610	0.341	3.200	1	0.074	0.543	0.279	1.060
Participated in agricultural insurance	−1.547	0.459	11.370	1	0.001	0.213	0.087	0.523
Insurance company	−0.106	0.102	1.095	1	0.295	0.899	0.737	1.097
Reputation	−0.436	0.396	1.212	1	0.271	0.647	0.298	1.405
Government	−1.057	0.378	7.826	1	0.005	0.347	0.166	0.729

3.2 Agricutural production risk From the perspective of the statistical results, the elements used to weigh the production risk of insured crops including sown acreage, income level of per unit area, non-agricultural income *et al.*, all do not have obvious significance. Two reasons can explain it. For one thing, the sown acreage of the surveyed rural households is not so big. Generally, the area is limited in 1.07 hm^2 and 44% of them is contracted currently, so it does not produce profits in short term. For another thing, the non-agricultural income of rural households in the surveyed area is limited and the insurance of this part of income is not so flexible.

3.3 Farmers' attitude towards risk The *P* value of the use of money saved is 0.74, which is significant at the significance level of 10%. The wider the use of money saved explains rural households, the stronger sense of investment. The *P* value of 0.74 is significant at the level of 10% significance, indicating that farmers has high enthusiasm on participating in agricultural insurance.

The *P* value of the number of insurance participated is 0.001, which shows that the more the insurance participated by rural insurance, the more rural households want to participate in agricultural insurance. The more the rural households understand the agricultural insurance, the lower the degree of evading risks and the more willing to accept new kinds of insurance.

3.4 Transaction costs The promotion and reputation of insurance company exerts small influence on farmers' willingness on participating in agricultural insurance. But the value of the promotion on agricultural insurance conducted by the government is 0.005, which is significant. It illustrates that farmers' attitude toward risk and their decision-making activities are greatly affected by the government. So the government should fully display its function in popularizing agricultural insurance. The insufficient understanding of farmers on insurance businesses may be accountable for the fail of insurance companies in promoting its insurance products. The better the work done by the government in popularizing insurance knowledge and fulfilling insurance subsidies is, the more effective the activities of insurance companies.

3.5 Rural households who have not participated in agricultural insurance In the survey, it is spotted that only 3% rural households did not participate in agricultural insurance out of bad economic condition; 10% of the rural households did not participate in agricultural insurance on account of the high premium, but 59% of rural households do not participate in the insurance out of insufficient understanding on it. It can be seen that the premium of agricultural insurance does not hinder farmers to participate in agricultural insurance, but the high transaction costs caused by the insufficient understanding on agricultural insurance.

During the investigation, It is spotted that many rural households did not participate in the agricultural insurance or some participated in the past year, but this year they do not participate in it. The reason was that the insurance company compensated less on disasters or even did not compensate. The major reason was that the local government kept a large part of the premium and the insurance company could not get the relevant premium, so it was hard for them to compensate farmers timely.

Rural households' expectation on future agricultural production losses and probability will directly affect their demands on agricultural insurance. The survey shows that if in one year, the natural disaster decreases, the coverage and premium of agricultural insurance will drop dramatically; but after the year, in which the natural disasters happened, rural households' willingness on participating agricultural insurance will increase obviously.

3.6 Rural households who have participate in agricultural insurance Many rural households have two years or above experiences on participating in agricultural insurance, according to some rural households, participating in agricultural insurance does not exert great influences on its production, but as an ef-

fective way to evade risks, they are willing to participate in the insurance. In the rural households who have participated in agricultural insurance, 47% of them think that although the agricultural subsidies are low, they are willing to accept it as long as they can get compensation in disaster-hit years; 50% of them think that the current premium is reasonable, so it does not need to adjust it; and 3% of them think the subsidies are relatively low.

4 Suggestions on encouraging rural households to participate in agricultural insurance

4.1 Accelerating the development of rural education and improving farmers' educational degree Farmers, who have accepted good education, are more willing to accept new things, less affected by traditional thoughts; have high investment awareness, so they are more willing to participate in agricultural insurance. At the same time, the government should intensify education on rural households' investment awareness and set good examples for them to improve their acceptability to agricultural insurance and basically improve farmers' enthusiasm on participating in agricultural insurance.

4.2 The government should fully display its influences and intensify the promotion on agricultural insurance In the survey, the insufficient understanding on agricultural insurance, rather than the premium, that hinders farmers' willingness on participating in agricultural insurance, so at the current stage, the government should improve popularity of agricultural insurance. Currently, Chinese farmers have high trust on the government, so the government plays crucial role in promoting agricultural insurance. The government can build the platform for the insurance company and help it to set up its business network until the mutual trust between rural households and the insurance company has been established. The government can encourage rural households with high education degree to participate in the insurance first and provide them with the information on preventing and controlling disasters, to let other rural households know the benefits of agricultural insurance and participate in it voluntarily.

4.3 The responsibilities and duties between the government and the insurance company should rationally clarified The local government should handle the relations with the insurance company well and rationally clarify the responsibilities and duties between them. The government should fulfill the preferential policies to insurance company and strictly realize the subsidies on premium. Some local government regards agricultural insurance as "extra burden" and the premium as "exorbitant charges". Besides, due to the unclear supporting policies of our central government, the local government is wary of the disaster-hitting year. Some local governments even want to get some profits from premium subsidies rather than subsidizing the fund to farmers. So the development of agricultural insurance is seriously hindered. Besides, the existing framework of "policy-based insurance + commercial operation" does not have clear boundary between policy-based insurance and commercial insurance. When subsidizing, the governments can not tell whether the losses come from the policy-based business or the commercial business, so it is hard for them to determine the amount of subsidies and scientifically adjust the performance of commercial insurance companies and policy-based insurance companies. In the end, the launch of policy-based agricultural insurance will be badly affected. Therefore, it is imperative to solve the technical problems and rationalize the relations between the government and insurance companies.

4.4 The government should vigorously encourage farmers to conduct scale operation of apple and form scale economy Scale economy is conducive in evading risks, increasing farmers' income and improving rural households' enthusiasm on participating in agricultural insurance. With the rise of farmers' income, the surplus money will increase as well , and then farmers will have wide range to use their money and farmers' insurance rate will rise. The measure can root out the problem of small volume of insurance participated in by farmers.

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