

Factors Influencing Crop Insurance Demand in KB Province, Iran: Logit Model Approach

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ABSTRACT: Given the role of insurance in reducing income risk and fluctuations in sustainable agricultural development, in the present paper, factors affecting the demand for the insurance of crop (wheat and rice) products have been studied. In addition, the performance of Agricultural Insurance Fund (AIF) has also been evaluated. In Kohgiluyeh-va-Boyerahmad (KB) province, from two insured and uninsured farmer groups, a sample of 120 individuals was selected and required data were collected using cluster random sampling method through interview and filling questionnaires. The collected data were analyzed using Logit model and factors affecting insurance adaption were determined. The obtained results indicated that variables of age, education, agricultural experience, the rate of insurance awareness, acreage, credit, other agricultural expenses and other incomes have had a significant effect on the demand for the insurance of agricultural products. The findings related to the evaluation of performance of AIF showed that the AIF has had a large distance to independency and the amount of compensation paid to farmers is considerably less than the received premium.

Keywords: Crop Insurance Demand, Kohgiluyeh-Va-Boyerahmad, Logit Model

INTRODUCTION

Agricultural section is known as the most important economic parts and the axis of programs of the national sustainable development. Among the identified factors, the role of insurance in achieving sustainable agricultural development is very important that if such aims are ensured, other agricultural objectives of agricultural department will also be obtained. According to the Food and Agriculture Organization of the United Nations (FAO) reports, out of forty types of natural disasters recorded all over the world, its 31 species occur in Iran and this country is considered among 10 first disastrous countries in the world (FAO, 2009). The insurance of agricultural products is one of the most important ways for reducing agricultural risk that can help the stability of farmers' incomes. Due to various climates, Iran has certain capabilities in producing various types of agricultural products (Pishro et al., 2011). Despite the importance of insurance in sustainable development, insurance has not comprehensively welcomed by farmers and some farmers are refusing to accept insurance. Also, sustainable development is the management and preservation of natural resources and directing agricultural evolutions and structure based on the insurance of agricultural products. One of the fundamental goals of sustainable agricultural development is to create employment in rural areas (Zahedi, 2007). Romun and Yuanyony (2008) stated that the insurance of agricultural products increases the farmers' ability in managing agricultural risk and allows that they can increase the investment rate in the agricultural department. According to the definition of European Organization for Economic Cooperation and Development (OECD), sustainable development is the development which removes the current needs without endangering the ability of the next generations in meeting their needs. Therefore, studying the factors affecting the adaption of insurance by Farmers has been considered by many researchers. In a study, Kohansal (2006) examined the factors affecting the adoption of cotton insurance in North Khorasan province. The obtained results indicate that age, household size, and promoting were effective on the adoption of insurance by cotton farmers and insurance has led to reduce the consumption of manure and increase the consumption of water, labor, herbicide, phosphate and nitrate fertilizers. In a study, Alli (2004) studied the status of insurance on the agricultural development in Nigeria. The study results show that developing the agricultural insurance has effectively helped to reduce the risk of agricultural activities in Nigeria during 1990 and 2000. Mollai and Zamani (2008) investigated the factors affecting the adoption of saffron insurance in South Khorasan in a study. The achieved results demonstrated that no significant relationship has been observed among the connection

variables of saffron farmers and agricultural extension agents, participating in educational workshops and using the mass media, using the support facilities, the unavailability of insurance centers and agriculture bank and farmers' income. In a paper, Torkamani (2009) studied the effects of agricultural products' insurance on the reduction of the risk and inequality of beneficiaries' income in Fars province. Estimating the demand function showed that wheat acreage, the compensation ratio to premium, risk aversion degree, education, experience, the age of farmer and farm ownership has a positive impact on the demand for insurance. Olubiyo et al (2009) has also shown that in the selected products, the development of agricultural insurance has caused to alter the composition of products and affected the agricultural profitability in some productions and improved the agricultural sustainability in China. However, in some studies such as Okwche et al (2012) study, after insuring, the significant increase has not been made in the production and income of most farmers. In general, most previous studies revealed that insurance has played an effective and sensitive role and thereby, as a secure supporter, caused the reliance and self-confidence of farmer and also followed to increase income and reduce farmers' risk although some studies have taken an inverse result. In the present study, the main objective is to evaluate the performance of Agricultural Insurance Fund (AIF) and determine the factors affecting the demand for the insurance of agricultural products for the development of agricultural department in KB province.

RESEARCH METHOD

To select the sample, based on weather conditions, the province is first divided into two tropical and cold regions and cities of Boyerahmad, Dena, Kohgiluyeh and Gachsaran were selected to be studied. Then, among the villages, 10 villages were selected and 70 farmers who insured their wheat and rice products and 50 farmers who didn't insured the above-mentioned products were selected by random sampling and required data was collected through questionnaire and interview. Logit model was used to analyze data. The Logit function that is derived from Logistic function is as the following:

$$Z_i = \alpha + \sum_{i=1}^n \beta_i x_i + U_i$$

$$P_i = f(Z_i) = \frac{1}{1 + e^{-Z_i}} = \frac{1}{1 + e^{-\alpha - \sum_{i=1}^n \beta_i x_i}}$$

And the calculation of possibility of unavailability is also as follows :

$$1 - P_i = \frac{1}{1 + e^{Z_i}} = \frac{1}{1 + e^{\alpha + \sum_{i=1}^n \beta_i x_i}}$$

If the possibility of demand availability is P_i and the possibility of demand unavailability is $1 - P_i$, then, the following relationship is the indicator of the ratio of these two possibilities:

$$\frac{P_i}{1 - P_i} = \frac{1 + e^{Z_i}}{1 + e^{-Z_i}} = e^{Z_i}$$

$$L_i = \ln\left(\frac{P_i}{1 - P_i}\right) = Z_i = \alpha + \sum_{i=1}^n \beta_i x_i$$

P_i : The probability that i^{th} producer accepts the insurance is one and $1 - P_i$ the probability that i^{th} producer does not use services of AIF is zero. L_i is the Logarithm of the function that is linear not only in terms of x_i but also in terms of parameters, here, L_i is known as Logit (Gujarati, 2003). By estimating the mentioned function, in addition to determine the relative effect of each explanatory variables on the tendency probability to the insurance, the final changes of inputs and also the mean of its capacity can be calculated and determined compared to changes of each variables included in the model using the following relation:

$$\frac{\partial P_i}{\partial x_{ij}} = \frac{e^{Z_i}}{(1 + e^{Z_i})^2} \beta_j$$

Where β_j is the j^{th} variable parameter.

By obtaining the partial derivatives from the above relation, capacity (the percentage of changes in the factors affecting insurance in the amount of the demand for insurance), j^{th} explanatory variable is obtained from the following relation:

$$e_i = \left[\frac{e^{Z_i}}{(1 + e^{Z_i})^2} \beta_j \right] \frac{x_i}{P_i}$$

Where capacities are not constant and depend on values of the explanatory variables applied in the model (Sharma, 1997). Variables used in the above-mentioned model indicate the factors affecting the demand

for the products' insurance by wheat and rice farmers and the dependent qualitative variables are defined as the following:

Y = 1: the farmers that are under the insurance.

Y = 0: the farmers that are not under the insurance.

Independent variables include the farmer age (x_1), education rate (x_2), farming experience (x_3), awareness of insurance rate (x_4), training extension courses (x_5), acreage (x_6), receiving credit (x_7), other farming costs (x_8) and other agricultural revenues (x_9). To evaluate the financial performance of AIF, the following formula has been used:

$$Z = (A + I) / P < 1$$

Where, Z is the financial performance, A is the mean of administrative costs, I is the mean of paid compensation and P is the mean of received premium. Economic condition of the performance of the insurance program is that the above ratio is less than one that is the insurance program can compensate the administrative costs and paid compensation by the received premium (Sharma, 1997). To evaluate the performance of the AIF from establishment time to now, the benefit-cost ratio method has been used. In this method, the equivalent of the premium value received in various years has been calculated in the base year and divided into the equivalent of value of the insurance program casts in the same base year. Economic condition of insurance program is that the mentioned ratio is greater than unit. The instrument for data collection is questionnaire and interview. Data was collected through cluster random sampling method (CRS) and the studied model was estimated using Logit model and with the help of EvIEWS software.

RESULTS AND DISCUSSION

In this section, first, results of evaluating the performance of Agricultural Insurance Fund (AIF) of agricultural products and then various factors affecting the demand for the insurance of products are described focusing on agricultural sustainability. Since Z value is equal to 13.05 and is greater than unit, it reveals that the performance of AIF has been non-economic in the studied years. Therefore, in the total, the AIF couldn't encompass payment compensations and administrative costs using received premium. Using the method of project analysis, results of economic evaluation have been calculated to calculate the benefit-cost ratio (B/C), the value of costs (administrative costs and payment compensations) and the value of interest (the total of received premium) to the base year. Since the benefit-cost ratio is less than unit i.e. about 0.31, then we conclude that the performance of AIF has not economically justified during the studied period. Table (1) shows the performance of AIF in relation to the wheat and rice crops in KB province in the crop years of 2006 to 2010. The mentioned table shows that the number of insured individuals has been decreased about 25.2% in years 2006 to 2007 and increased equivalent to 48% in years 2008 to 2009 and increased at a rate equivalent to 14.7% in years 2009 to 20010. In 2006 and 2007, the insured level has been decreased equivalent to 49% but increased in 2007 to 2008. During 2009 to 2010, the insured level has significantly been in the rate of 64.28% due to farmer awareness to the adaption of products' insurance. In 2006 to 2007, the damage level has been increased equal to 33.97% (Anonymous, 2010). In 2007 to 2008, the damage level has significantly been increased in rate equivalent to 165.5% so that has been faced with the growth of 247.5% during 2008 to 2009. Comprising the ratio of the paid compensation to the received premiums has been equivalent to 1.6% during 2006. The ratio has been equivalent to 3% in 2007. Also, in 2008, the amount of the compensation paid to the received premiums has been equivalent to 18.2% and finally during 2009 to 2010, it has been equivalent to 15.3%. In 2006 to 2010, due to the awareness of farmers, the insured population has been increased equivalent to 58%, consequently the insured level of individuals is increased. The premium received from farmers has dramatically been grown by AIF; also, the compensation paid by AIF has been equal to 4242%, then the rate of the compensation paid by AIF is more than the rate of insurance received by farmers. The available evidence shows that the performance of AIF has grown in all areas.

Table 1. The performance of Insurance Fund of agricultural products in relation to the Insurance of crope products in KB province in 2006-2010

Index	Year					Annual Growth (%)
	2006	2007	2008	2009	2010	
The number of insured individual	3898	2913	8972	13284	15236	58
Insured area (Hectare)	4235.2	2123.6	5957.5	7261.23	11928.60	36
Damaged area (Hectare)	3445	4615	12247	41925	60145.88	329
Received premium (Million Rials)	5431	4548	42642	13424	12638	445
The number of eligible compensation	2498	1190	7421	9425	10246	62
Paid compensation (Million Rials)	9115	14057	779861	1323282	1942622	4242

Source: Kohgiluyeh-va-Boyerahmad Agricultural Insurance Fund

Using the maximum likelihood method, to determine the factors affecting the adoption of insurance and the insurance capacity of products, results of Logit model have been presented in the model in Table (2)

through changes in each independent variable. Capacities indicate the change percentage in the probability of product's insurance by farmers through a percentage change in the related variables. The likelihood test is equivalent to 91.8. The statistic value shows that variables in the model explain the change in the dependent variables at a high level. In other words, 91.8% of changing in the dependent variable is explained by the explanatory variables in the model (Salami and Ahmadabadi, 2001). The coefficient of determination (R^2) used as the criterion for the goodness of fitting in the ordinary regression is calculated entitled as Mc Fadden R^2 in Logit models. The more Mc Fadden R^2 is less than 1, the more the model is explainable at a high level (Gujarati, 2003). According to Table (2), there is a statistically negative and significant relationship between the age of farmers and the insurance of products that is the more the age of farmers, the lower the possibility of product's insurance will be by farmers. In other words, due to the risk aversion, older farmers have tendency to various innovations such as the insurance of products and use traditional ways for confronting the risk in agriculture activities.

As it is observed, there is a positive and significant relationship between education and the record of agriculture on the adoption of insurance. Salami and Ahmadabadi (2001) reported a positive relationship between the experience of planting sugar beet and the insurance of this product in their study that the issue conform the result of the present study. Also, it shows a positive relationship between the farmer awareness of the rate of premium and the adoption of insurance. The positive and significant effect on the farmers' awareness of the insurance rate is the indicator of the fact that farmers with the awareness of the premium rate select the product desired to them. Calculated capacity shows that by 1% increase in the awareness of farmers compared to the insurance rate, the adoption probability of insurance is increased 0.03% by farmers. According to the Table, there is a positive relationship between the training and promoting courses and the tendency of farmers to the adoption of products insurance. However, the obtained coefficient is not statistically significant. Based on the results, there is a positive and significant relationship between the rate of product's acreage and the adoption probability of insurance by farmers.

In other words, the probability of adoption of the insurance will be increased by increasing the acreage of products. As the below table shows, by 1% increase in the rate of acreage, the adoption probability of insurance by farmers increases 0.12%. The received credit is the factor that has a positive and significant effect on the tendency of farmers to product's insurance. According to the results obtained in their study, Nikoei and Torkmani (2000) stated that obtaining credit has a positive and significant effect on the insurance adoption of sugar beet.

Smith and Baquet (1996) cited a positive and significant relationship between obtaining credit and the insurance for wheat product in their study that confirms the result of the study. The variable of other agricultural costs also has a positive and significant effect on the probability of the adoption of insurance by farmers. Calculated capacity shows that by 1% increase in other agricultural costs, the adoption probability of insurance by farmers will increase to 0.06%. The variable of other incomes has a negative and significant effect on the demand for the insurance of products. In other words, farmers having other income sources except for the income resulted from products of wheat and rice have been less vulnerable in the face of climate risks. So, we conclude that socio-economic factors such as the level of education, age of farmers, acreage level, obtaining credit, awareness of the insurance rate, other incomes and other costs have significant roles in the adoption of product's insurance. It is obvious that recognizing this issue plays a vital role in promoting aims of the sustainable agricultural development.

Table 2. Results of estimating Logit model using maximum likelihood method

Variables	Estimated Coefficient	Wald Test	Level of Significance	Change in Possibility (Elasticity)
Constant	-0.635	-1.743	0.342	-
Age (x_1)	-0.026	-1.741	0.086***	0.242
Education (x_2)	0.055	1.348	0.124	0.028
Agricultural record (x_3)	0.012	1.875	0.061***	0.03
Awareness of the insurance rate (x_4)	0.0508	2.524	0.002*	0.03
Extensive training course (x_5)	0.0600	1.054	0.298	0.32
Acreage level (x_6)	1.879	2.247	0.000*	0.121
Obtaining credit (x_7)	0.625	1.332	0.027**	0.028
Other agricultural costs (x_8)	0.030	2.113	0.020**	0.060
Other revenues(x_9)	-0.555	-2.247	0.087***	-0.032
LR statistic	91.8			
MC Fadden R^2	0.31			

(***), (**), (*) Respectively indicate significance levels at 1%, 5% and 10% is

Source: Research findings

CONCLUSIONS AND RECOMMENDATIONS

Therefore, to increase the role of the insurance of agricultural products in sustaining agricultural activities, offering the following suggestions is required. Generally, the insurance can provide a bright future for producers to sustainably develop the agriculture and help to provide conditions for the sustainable agricultural development. Comparing the amount of the paid compensation by Agricultural Insurance Fund (AIF) with the received premium shows that in the province, the AIF was away from independency in the studied years and has increasingly been dependent on the government assistance so that it could help sustainable agricultural development. Considering the effect of level of education on the adoption of insurance, it is suggested that more investment be done in the formal education in village. In addition, it is suggested that in holding the extensive training classes, possibly the training methods that require less literacy be used. According to the low history of such studies in the country, it is suggested that the similar functional studies be done in other provinces so that policy-makers and planners plan and make policy with more confidence and certainty to the obtained results. To develop the insurance services, it is suggested that more variety be applied in insurance program so that farmers continue their activity more confidently that the issue in turn leads to employment and sustainable agricultural development. Given that there is one insurance program for all products, for sustainable agriculture, variety of insurance plans that include different tariffs and insurance coverage from 50 to 90 percent is suggested.

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