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Willingness to Pay for Crop Insurance Premium- A Study of Maize Growing Farmers in Karnataka

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Abstract

Agricultural activity is subject to a wide range of risks due to the variable economic and biophysical environment in which farming operates. Agriculture risks arise due to uncertainty over factors determining returns to agricultural production. Crop insurance is one of the risk mitigating strategies for farmers. The objective of the study was to estimate WTP by the rainfed maize farmers to crop insurance premium and also factors influencing their WTP. Double Bounded Dichotomous Choice (DBDC) method of Contingent Valuation (CV), Tobit and Logit models were used to address the objective. On an average farmers were willing to pay 0.34 per cent more premium than the prevailing rate to insure their crop. The average probability of WTP of farmers for crop insurance premium was 0.53 and average probability of non WTP was 0.48. Age was the important factor influencing their WTP. It was observed that farmers' awareness about the products and procedures of crop insurance was poor. Hence, efforts should be made to increase the awareness and help farmers to take advantage of crop insurance.

Key words: Risk, Crop insurance, Premium, Willingness to pay Willingness to Pay for Crop Insurance Premium- A Case of Maize Growing Farmers in Karnataka

INTRODUCTION

Agricultural activity is subject to a wide range of risks due to the variable economic and biophysical environment in which farming operates. Agriculture risks arise due to uncertainty over factors determining returns to agricultural production. Uncertainty in agriculture reflects the nature of most farm production systems, which is influenced by ever-changing economic and biophysical conditions. The natural lag between when production decisions are made and when returns to farming can be realised exposes agricultural enterprises to the variability, in the intervening period, of a range of factors that determine the value of production. These include weather, animal and plant health, changes in agricultural markets and a range of macroeconomic factors. Variability in these factors results in uncertainty over key determinants of farm income like output price, yield, and input costs - with implications for farmers' economic welfare and effects on the economic (allocative) and technical efficiency of farm production.

Maize *(Zea mays* L.*)* is one of the important staple food crops of the world and ranks next only to wheat and rice. It is third most important cereal crop in India occupying about 8.26 million hectare of area, producing 16.72 million tonnes with an average productivity of 2024 kg per hectare during 2009-10. The major area under maize is rainfed and there is no substitute for this crop during rainy season. Maize is considered as crop with minimal level of risk, but its spread over large areas in recent years has increased its risk level. Since it is mostly grown under rainfed situation in Karnataka, rainfall is one among the major limiting factors. Maize is gaining more importance in recent year and area under its cultivation is increasing. In recent past, incidences of pest and diseases have also increased and started making serious impact on maize output. Thus, crop insurance is very much required and necessary to share the risk of farmers and help them to a greater extent.

Insurance is the transfer of risk between the insured and the insurer at a cost which reduces the intensity of loss that would have otherwise been suffered by the insured. Insurance not only reduces the uncertainty faced by the insured, but it evens out the burden of a loss especially if the loss is of large scale one.

Ray (1960) defines insurance as a "social device which aims at reducing the uncertainties of loss through combination of a large number of similar uncertainties and through the use of

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accumulated funds, distributing the burden at loss, should there be any over space and time".

Insurance of crops is regarded as an essential part of well rounded agricultural programme designed to provide protection to farmers against physical failure of crops due to weather and other unavoidable natural hazards. Crop insurance advances the process of stabilizing the agricultural industry to a stage of production, making such a process more comprehensive, effective and useful.

Knight (1971) brought out the difference between risk and uncertainties. He indicated that in case of risk the distribution of outcome in a group of instance is known while in case of uncertainty this is not true. Ray (1960) in his paper reviewed the need and importance of crop insurance in minimizing risk and also examined the countries operating crop insurance programmes. Crawford (1979) excerpts some of the problems faced by the developing countries in the operation of crop insurance programme which seriously limit the probability of success and decreases the level of benefits realized.

With this background, this study is an attempt to estimate farmers' willingness to pay additional premium for crop insurance. In economics, the willingness to pay (WTP) is the maximum amount a person would be willing to pay, sacrifice or exchange in order to receive a good or to avoid something undesired. In the present study, it refers to farmers WTP to pay for crop insurance premium to receive benefit from it. Beside study also makes an attempt to identify factors that influence the farmers' WTP for crop insurance.

Methodology

Purposive sampling technique was adopted for the selection of study area and random sampling technique was adopted in the selection of sample respondents for collection of data required for the study.

Karnataka state was selected purposively for the study as it is a major maize growing state in India. To address the objective of the study, primary data from rainfed maize growers were considered. Primary data was collected randomly from 300 farmers cultivating maize under rainfed situation. The study was conducted in rainfed maize growing areas of Chikmagalur district of Karnataka. A structured schedule was prepared, and it was pre-tested before taking up the task of data collection. Primary data was collected through personal interviews from rainfed maize growers on various aspects of maize production and their willingness to pay towards crop insurance premium. The data pertain to the agriculture production year 2024-25.

Analytical tools and techniques employed

Double Bounded Dichotomous Choice (DBDC) method of Contingent Valuation (CV)

The most frequently used question formats for estimating willingness to pay (WTP) are single bound and double-bound dichotomous choice formats. Single bounded dichotomous choice CV method was pioneered by Bishop and Heberlein (1979) and only one dichotomous question is asked with a threshold amount and the respondent is expected to answer either 'yes' or 'no' to that amount. In this format, each respondent is asked once whether he/she would be willing to pay a specified bid amount, and in the double-bound format, after the single-bound question, he/she is asked once again whether he/she would be willing to pay another bid amount. The basic idea of dichotomous choice contingent valuation is given by Hanemann (1984). The single-bound format is incentive and compatible theoretically and has the advantage of making the responses easy since it is similar to our real purchase actions. Although the double-bound format has not such advantages, it is more efficient in estimating willingness to pay (WTP) since it makes the respondent's WTP more restrictive.

Haab and McConnell (2002) stated that there are three ways why DBDC is more efficient than single bounded. First, the yes-no and no-yes provides a clear bound of WTP, second the 'no-no' and 'yes-yes' estimate efficiency gains, and third the number of responses is substantially increased, especially for larger sample sizes. To avoid initial bid biases, the initial bids were randomly assigned to respondents.

The first question is a simple yes or no question "Are you willing to pay an amount X?" If the answer is yes (or no), another question followed to elicit a maximum (or minimum) value. Hence, the respondents identified two amounts that limited their maximum WTP. (Bateman *et al.* 2001).

Contingent Valuation Approach

To examine the factors affecting farmers' additional willingness to pay for crop insurance premium, Double Bounded Dichotomous Choice (DBDC) method of CV was employed. For this, a hypothetical situation of insurance market (subsidies given to small and marginal farmers was not considered) in which the farmers have to pay a definite amount of money to purchase products (insurance) in respective markets and their willingness to pay (WTP) was elicited. Here, the initial bid was proposed to the consumers and depending upon the answer to the first bid, a second bid was proposed, which was higher than the first bid for a "yes" response and lower for a "no" response for the initial bid. We denoted the first bid with P*, and the second bid with PH if it was higher, and with PL, if it was lower than P*. Accordingly, there were four possible response groups: (G1) respondents who said "yes" to both the bids, so that WTP $\geq$ PH; (G2) those who said "yes" to the first bid, but "no" to the second bid so that P* $\leq$ WTP < PH; (G3) those who said "no" to the first, but "yes" to the second bid, so that PL $\leq$ WTP < P*; and (G4) those who said "no" to both bids, so that WTP < PL. The bids were distributed randomly in the survey schedules to get the desired variation.

Double Bounded Logit

A double bounded Logit was used to analyze the data. For double bound model, we observe two dichotomous variables, i. e. the answers to the first question and its follow-up. There are four possible outcomes i. e. 'YES YES' (YY), 'YES NO' (YN), 'NO YES' (NY), and 'NO NO' (NN).

Following Hanemann *et al* (1991), the following response probabilities were obtained for the Logit model.

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$P_i^{yy} = 1/ (1 + e^{-(\alpha + \beta \text{ HIGH BID})})$ ……..…(1)

$P_i^{NN} = 1 - 1/ (1 + e^{-(\alpha + \beta \text{ LOW BID})})$ …….. (2)

$P_i^{YN} = 1/ (1 + e^{-(\alpha + \beta \text{ HIGH BID})}) - 1/ (1 + e^{-(\alpha + \beta \text{ FIRST BID})})$ …….. (3)

$P_i^{NY} = 1/ (1 + e^{-(\alpha + \beta \text{ FIRST BID})}) - 1/ (1 + e^{-(\alpha + \beta \text{ LOW BID})})$ …….. (4)

Where

FIRST BID – Starting bid value

LOW BID – Follow-up Low bid value

HIGHER BID – Follow-up High bid value

The double bound log-likelihood function is

$L^{DB} = \Sigma I_i^{YY} \log P_i^{YY} + \Sigma I_i^{YN} \log P_i^{YN} + \Sigma I_i^{NY} \log P_i^{NY} + \Sigma I_i^{NN} \log P_i^{NN}$ …… (5)

i = 1 ……n

Where, I_i indicates the response category of each respondent i.

Tobit Model

To estimate mean additional willingness to pay for insurance premium, Tobit regression model was used. This model is suggested by James Tobin, the Nobel laureate (Gujarati, 1995). Tobit model uses maximum likelihood method to estimate coefficients.

Mathematically the Tobit model is expressed as

$Yi = \beta_0 + \beta_i X_i + _i$; if RHS > 0

= 0 otherwise.

Where, $Yi = WTP_i$

The model employed in the study for crop insurance premium was

WTP_i = willingness to pay (Tick or Cross) of i^{th} respondent

$Y_i=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\mu$ ……..... (6)

Where,

X_1 – Age in years.

X_2 – Area under maize cultivation in acres.

X_3 – Household average annual income in rupees.

X_4 – Sum amount insured as crop insurance in rupees.

μ – Error term

Results and Discussion

As discussed earlier, a hypothetical market was taken for crop insurance and prevailing premium rate was considered for all farmers irrespective of subsidies or any others facilities from the government. On an average farmers were willing to pay 0.34 per cent more premium than the prevailing rate to insuring their crop. In general 2.5 and 2 per cent of sum insured is collected as premium in kharif and rabi, respectively (Table 2).

Table 1: Tobit model result for the willingness to pay (WTP) more premium for crop insurance

Parameters	Co-efficient	Standard error	t value
Age (Yrs)	-0.0711 *	0.040	-1.77
Area under maize (ac)	0.0572	0.059	0.97
Income (Rs)	-0.0003	0.004	-0.71
Sum insured (Rs)	0.0007**	0.003	1.96
Constant	-0.4678	1.947	-0.24
Log likelihood = -397.377			
Pseudo R2 = 0.0102			

Note: **, * denotes significant at 5 and 10 per cent respectively Additional willingness to pay for crop insurance is 0.34 per cent

Age and sum insured were the two variables found to be statistically significant at ten and five per cent level, respectively (Table 1). One year increase in the age of farmer above mean level leads to decrease his/her WTP insurance premium by 0.0711 per cent. Sum insured by farmers has positive impact on the WTP insurance premium. An addition of Rs.1000 insured by the farmer, his/her WTP premium increases by 0.7 per cent.

Table 2: Summary of willingness to pay (WTP) for crop insurance premium

Season	Prevailing premium rate	Farmers WTP	Difference
Kharif	2.5	2.84	0.34
Rabi	2.0	2.34	0.34

Table 3: Distribution of maize farmers by WTP more premium for crop insurance

Sl. No.	Premium (%)	Number of farmers	Percent	Cumulative Per cent
1	up to 25	35	11.67	11.67
2	25-50	23	07.67	19.33
3	50-75	13	04.33	23.67
4	75-100	4	01.33	25.00
5	>100	48	16.00	41.00
	Sub total	123	41.00	41.00
6	Unwilling	177	59.00	59.00

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	to pay			
	Total	**300**	**100.00**	**100.00**

A significant number of respondents (41 %) were willing to pay more premium for crop insurance. In a similar trend of study, Griffith and Nesheim (2008) found that 80 per cent of households were willing to pay at least some positive amount to organic food. Majority of the farmers (16 %) indicated that their WTP for insurance premium was more than 100 per cent (Table 3). Farmers not willing to pay were 59 per cent. The findings of the study is in line with that of the results obtained by Dipeolu *et al.* (2009), Piyasiri and Ariyawardana (2002) and Griffith and Nesheim (2008).

Farmers WTP were influenced by different factors. To have a clear view on the factors which influence the WTP of the farmers, a double bounded logit model was estimated. The average probability of WTP (Table 4) of farmers for crop insurance premium was 0.53 and average probability of non WTP was 0.47. Bid value, age and sum insured were the variables having significant influence of farmers WTP for insurance premium.

Table 4: Double bounded logit regression result of WTP more for crop insurance premium

Parameters	Estimates	Slope (Probability)	Standard Error	Probability
Bid value (Premium rate)	-1.8639***	0.190	0.0962	0.000
Age (Yrs)	-0.01838*	0.004	0.0102	0.072
Area under maize (ac)	0.0070	0.017	0.0152	0.647
Income (Rs)	-0.0003	0.001	0.0001	0.713
Sum insured (Rs)	0.0001*	0.000003	0.0009	0.096
Constant	0.6533***		0.5391	0.000

Note*:* ***, * denotes significant at 1 and 10 per cent respectively Average probability of WTP for crop insurance: **0.525322 (P)**

The analysis showed that, of the five variables considered, bid value, age of farmer and sum insured by farmer were significant at a probability level of 0.01 and 0.10. For example, unit increase in the bid value leads to decrease in probability of WTP by 0.19.

Results also revealed that, in line with the theory of demand, the bid values had a significant (at 1 % level) negative effect on the WTP for insurance premium. This clearly indicated that the farmers were sensitive to cost aspects while paying for the crop insurance. Age of the farmers and sum insured had significant influence on the WTP and were significant at 10 per cent. Higher the age of the farmers, lower the additional WTP for insurance premium. A unit increase in the age of the farmer leads to decrease in the probability of WTP by 0.004. Increase in sum insured of Rs. 1000 leads to increase in the probability of WTP by 0.003. Area under maize and income of the farmers did not have a significant impact on the WTP for insurance premium.

Distribution of farmers based on their response to first and second bid is presented in table 5. Among the sample farmers 41 per cent gave positive response to WTP bids and 16 per cent farmers said yes for both bids. Farmers who said yes for first bid and changed their decision when bid value was increased formed 14.67 per cent, while the opposite behavior was seen among 10.33 per cent of farmers.

Table 5: Distribution of maize farmers by response to WTP more for crop insurance premium

Sl. No.	Response	Numbers	Per cent
1	YY	48	16.00
2	YN	44	14.67
3	NY	31	10.33
4	NN	177	59.00
	Total	**300**	**100.00**

Conclusion

Agriculture is subjected to wider range of risks and crop insurance play a key role in minimizing them to a greater extent. Crop insurance is regarded as an essential part of well rounded agricultural programme designed to provide protection to farmers against physical failure of crops due to weather and other unavoidable natural hazards. Crop insurance advances the process of stabilizing the agricultural industry to a stage of production, making such a process more comprehensive, effective and useful. One of the major findings of the study was the impact of farmers' age on their WTP, as age increases farmers additional WTP for crop insurance premium decreases. During the study it was observed that farmers' awareness about the insurance and procedures of crop insurance was poor. Hence, efforts should be made to increase the awareness and help farmers to take better benefit out of it, as they are willing to pay for increased premium. Though crop insurance is known as one of the risk coping strategies among farmers, some of them have not adopted and some have come out of this programme. Therefore, there is a need to design suitable police to make crop insurance mandatory for all rainfed farmers, considering the area coverage under the crop in a particular area.

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