Farmers' Willingness-to-pay for Weather Based Crop Insurance Scheme in Guntur District of Andhra Pradesh

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ABSTRACT

This article has explored the farmers' willingness-to-pay (WTP) for weather based crop insurance scheme (WBCIS) for paddy in Guntur district of Andhra Pradesh. Double bounded dichotomous contingent valuation method was employed to elicit the farmers' WTP. Responses of farmers were used to fit the log-likelihood model using 'STATA' statistical data analysis software package. Seven factors were tested for their influence on farmers' average WTP for WBCIS. The results of analysis shown that farmer age is negatively influencing farmers' average WTP for WBCIS. Whereas farm size, farmer education, annual income and awareness about crop insurance scheme is positively influencing the farmers' average WTP for WBCIS. The access to institutional credit and farming experience have insignificant influence on average WTP. The farmers' average WTP for WBCIS for paddy crop in Guntur district of Andhra Pradesh is Rs. 1,421.77 per hectare which is 4.73% of the maximum possible compensation offered of Rs. 30,000/-.

Key words : Contingent Valuation, Willingness to pay, WBCIS.

The agriculture production is subjected to vagaries of adverse weather events which in turn influence and brings volatility in farm income. Agricultural Insurance Corporation is planning to introduce improved insurance product called weather based crop insurance scheme based on weather data which overcomes several drawbacks of traditional crop insurance schemes based on crop loss estimation. The present study was conducted to analyse the following two objectives.

1. To know the willingness-to-pay of paddy farmers for weather based crop insurance scheme in Guntur district.

2. To analyse the major factors affecting paddy farmers' willingness-to-pay for weather based crop insurance scheme.

MATERIAL AND METHODS

To elicit farmers' willingness-to-pay for weather based crop insurance, the double bounded dichotomous model of contingent valuation (CV) method was employed as it is the most popular method used during present days for estimation of WTP (Haripriya, 2003) and it also yields more efficient and narrow range estimates of parameter than single bound dichotomous CV method (Hanemann *et al.*, 1991). The weather based crop insurance policy was explained in detail to all farmers, before they were asked whether they would be willing to pay for weather based crop insurance policy at certain price level. The exact wording of question posed to farmers was "Suppose if new weather based crop insurance introduced into the market, which is effective in compensating farmer losses based on the cost of cultivation, the phase of the crop (Phase I: Planting to panicle initiation, Phase II: Panicle initiation to Flowering and Phase III: Flowering to harvest) and deviation of pre-fixed weather parameter from its normal level in your locality then, there will not be any yield loss estimation survey or crop cutting experiments for assessing yield loss. In this case, would you like to take the premium? If 'Yes', would you pay Rs_____ per hectare for insurance policy which would provide you a compensation of Rs____, if insured event occurs?" Depending on the response to first bid, the second bid was given: for "yes" respondents, the second bid was higher and for "no" respondents, it was lower than the first bid.

Bid design:

To obtain a preliminary guess about the WTP distribution, we conducted a pilot study with open-ended questions that asked the individual farmers the maximum amount they are willing to pay for the weather based crop insurance scheme for the paddy crop and depending upon distribution of farmers' response, following bidding amounts were decided as shown in Table 1.

Log-likelihood function for WTP:

The all responses were categorised into four types of response groups i.e. Yes followed by Yes; Yes followed by No; No followed by Yes and No followed by No. The probabilities for observing each group can be specified as follow:

Prob(Yes/Yes) = Prob($WTP \geq P^H$)

Prob(Yes/No) = Prob($WTP \geq P^H$) – Prob($WTP \geq P^*$)

Prob(No/Yes) = Prob($WTP \geq P^H$) – Prob($WTP \geq P^L$)

Prob(No/No) = Prob($WTP \geq P^L$)

The standard assumption for the DB-DCV format is that the respondent's true valuation is not altered by the size of the bids presented (McLeod and Bergland, 1999). Assuming a normal distribution, the log-likelihood function for WTP model is

$$\ln L = \sum_{i=1}^{n} I^{YY} \ln\left[1 - \phi\left(\frac{P^H - \beta\chi}{\sigma}\right)\right] + I^{YN} \ln\left[\phi\left(\frac{P^H - \beta\chi}{\sigma}\right) - \phi\left(\frac{P^* - \beta\chi}{\sigma}\right)\right]$$

$$+ I^{NY} \ln\left[\phi\left(\frac{P^* - \beta\chi}{\sigma}\right) - \phi\left(\frac{P^L - \beta\chi}{\sigma}\right)\right] + I^{NN} \ln\left[\phi\left(\frac{P^L - \beta\chi}{\sigma}\right)\right]$$

Where, the 'I' symbol denote binary indicator variables for the four response groups. χ is a vector of variables considered in function. ϕ is some statistical distribution function. Parameter σ is the standard error of the regression that captures the randomness of the bid function. The function was estimated using 'STATA' statistical data analysis software package.

RESULTS AND DISCUSSION

The results of log-likelihow function are presented in Table 2. The variables considered for analysis are farmer age in years, education in years, farm size in acres, farming experience in years, annual income rupees, awareness about crop insurance as dummy variable and institutional credit access as dummy variable. All variables except institutional credit access and farming experience were found significantly affecting WTP in the analysis.

Willingness-To-Pay

Based on coefficients shown in Table 2, the willingness-to-pay for WBCIS is Rs. 1,421.77 per hectare of paddy crop with lower limit of Rs. 210.12 and upper limit of Rs. 3,542.40 at 95% level of confidence (or 5% level of significance). The farmers' willingness-to-pay for weather based crop insurance scheme is 4.73% of the maximum possible compensation offered of Rs. 30,000/- per hectare. It was much lower than the mean WTP value estimated by Krishna and Qaim (2007) for Bt eggplant in Andhra Pradesh.

Factors affecting mean willingness-to-pay for WBCIS

Farmer age is found to be negatively significant with the WTP. As the farmer age increases, farmer's WTP for WBCIS decreases. Also in our study, increase in the farmers' age reduces their WTP by Rs. -24.48 which is significant at 1% level. It is in contrast to the results obtained by Seyed *et al.* (2010), who stated that farmer age is positively related to adoption of crop insurance by farmers. This may be due to differences in socio-economic features of farmers of India and Khuzestan province of Iran. Farmer education is found to be positively significant with the WTP. As the farmer educational level goes increasing, farmer's WTP for WBCIS is also increasing by Rs. 39.35 which is significant at 1% level of significance. This result is in compliance with result obtained by Seyed *et al.* (2010) who stated that farmer literacy level is positively related to his adoption of crop insurances. Farm size is found to be positively significant with the WTP. As the farm size increases, farmer's WTP for WBCIS also increases. The marginal effect of farmer size on farmer's WTP is Rs. 38.78 which is significant at 5% level of significance. Farming experience is found to be positively non-significant with the WTP because farmers are still having reservation about this WBCIS. Annual income is found to be positively significant with the WTP. As the annual income is increasing, farmer's WTP for WBCIS also goes on increasing but very little. The marginal effect of annual income on farmer's WTP is Rs. 0.0013 which is significant at 5% level of significance. Awareness about crop insurance is found to be positively significant with the WTP. As the farmer is made aware about crop insurance, farmer's WTP for WBCIS increases heavily. The marginal effect of awareness about crop insurance on farmer's WTP is Rs. 77.97 which is significant at 5% level of significance. Institutional credit access to farmer is found to be insignificant factor influencing the WTP. Institutional credit access to farmer does not have any significant effect on farmer's WTP pay for WBCIS. The intercept value for estimated log-likelihood function is Rs. 716.48 which is significant at 5% level of significant.

Table 1. Bid amounts decided based WTP for WBCIS.

Sl. No.	Initial bid		Follow-Up bids			
	P*		P^L		P^H	
	Bid amount	Compensation	Bid amount	Compensation	Bid amount	Compensation
1	450	4,500	250	3,000	600	6,000
2	1,325	13,250	500	8,500	1,550	15,500
3	2,250	22,500	750	15,000	3,000	30,000

Table 2. Analysis of major factors affecting farmers WTP for WBCIS.

Sl. No.	Variables	Coefficient (Std. Error)	Z value	P >| z|	95% confidence interval	
					Min.	Max.
1	Farmer age	-24.48** (8.15)	-2.64	0.008	-37.46	-5.51
2	Farmer education	39.35** (15.12)	2.60	0.009	9.70	68.99
3	Farm size	38.78* (17.21)	2.25	0.024	5.04	72.52
4	Farming experience	11.28 NS (8.35)	1.85	0.052	-0.09	32.65
5	Annual income	0.0013* (0.0005)	2.23	0.026	0.0001	0.0024
6	Awareness about crop insurance	77.97* (31.7)	2.46	0.014	15.83	140.12
7	Institutional credit access	2.77 NS (132.62)	0.02	0.98	-257.18	262.71
8	Constant	716.48* (293.12)	2.44	0.015	141.96	1291.00
9	ln σ	6.27 (0.11)	56.92	0.00	6.05	6.48
10	σ	528.15 (58.17)	-	-	425.60	655.41
11	Log-likelihood	-202.30	-	-	-	-
12	Chi-square (χ^2)	53.99	-	-	-	-
13	WTP(Rs.ha^{-1})	1421.77	-	-	210.12	3542.40

*significant at 5% level of significance

**significant at 1% level of significance

NS: Non-Significant

    Note: The estimated coefficients can directly be interpreted as variables marginal effect on WTP

Conclusions:

Farmers are willing to pay for WBCIS up to 4.73% of total sum insured for paddy crop in Guntur district of Andhra Pradesh. So government should subsidise premium amount above the 4.73% of sum insured to ensure more farmers' participation in WBCIS. Among major factors affecting farmers' WTP, the farmer age is negatively influencing farmers' mean WTP while all other variables affect WTP positively.

Suggestion:

The major factor which will increase the farmers' willingness-to-pay for WBCIS is to conduct large scale awareness programme because awareness about WBCIS is the only factor which can be easily altered by implementing agency and found to be significantly influencing the farmers' WTP. Therefore AIC should launch awareness campaign for farmers through different programmes like Rachabanda and Polambadi or displaying pictorial flexies showing benefits of WBCIS, at Grampanchayat offices, farmers meeting places, village libraries and temples. AIC officials should come to villages for creating in-depth awareness about WBCIS. Bankers can quote numerical facts about similar scheme, if any, which is being implemented in any other region. AIC can take help from local agriculture extension officers for arranging awareness programmes.

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