Full Length Research Paper

Willingness to pay for rainfall risk insurance by smallholder farmers in Central Rift Valley of Ethiopia: The case of Dugda and Mieso Districts

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Current climate variability is already imposing significant challenge. Therefore, farmers have faced income variability in almost every production season. Problems associated with dependence on rain fed agriculture are common in Ethiopia. Smallholder farmers' vulnerability from such income variability is also common. Over the years, a range of risk management strategies have been used to reduce, or to assist farmers to absorb, some of these risks. Since insurance is potentially an important instrument to transfer part of the risk, the study tries to assess small holder farmer's willingness to pay for the rainfall risk insurance and examine factors that affect farmer's willingness to pay amount. The sample size 161 households using closed ended value elicitation format followed by open ended follow up questions. Logit model was used to estimate the mean willingness to pay in the close ended format in addition with Tobit model to examine factors that affect willingness to pay as well as intensity of payment. Six potential explanatory variables income, ownership of radio, off-farm income, age, number of livestock owning and availability of public and private gifts have negative and/or positive effect on WTP.

Key words: Rainfall risk insurance, contingent valuation method, willingness to pay, smallholder farmers.

INTRODUCTION

Agricultural producers around the world are exposed to a variety of income uncertainties, both market related, such as price variations, as well as non-market related, such as unstable weather patterns. It is well known that such uncertainties induce substantial income risks, and these can be particularly detrimental to poor producers in

developing countries (Sarris, 2002). Due to the scope and diversity of such risks, formal insurance markets are scarce in such settings, and farmers employ relatively sophisticated methods to offset the risks they face (Clarke and Dercon, 2009). Hence, various challenges due to climate variability recognize that adaptation is not

an option but a necessity (Thornton et al., 2006) this is because climate change is expected to have adverse affect on agricultural production. Which remains to be the main source of income for most countries (Bryan et al., 2009), farmers have developed several ways for dealing with the various risks they face. According to Stern (2007), adaptation to climate change and variability will be crucial in reducing vulnerability and is the only way to cope with the impacts that are inevitable over the next few decades.

Over the years, a range of risk management strategies have been used to reduce, or to assist farmers to absorb, some risks. These strategies include on-farm measures such as diversification or selecting less risky production methods, as well as strategies for sharing risk with others. Risk management strategies in which risks have shared with others include, among others, farm financing, share-cropping, price pooling arrangements, forward contracting of farm products, and hedge on future markets.

Hence, insurance is potentially an important instrument to transfer part of the risks (Anderson, 2001) the following two basic reasons can be raised as an advantage of preferring weather-based insurance other than crop insurance. First, weather index insurance contracts require less monitoring to control adverse selection and moral hazard (Hazell, 1999). According to (Stefan et al., 2012), risk-sharing and index insurances are complementary, with increase access to one driving up demand for the other, so that providing index insurance may crowd in informal risk-sharing. Even though, index insurance is an unfamiliar and complex product, providing training to farmers about index insurance has been shown to be important in encouraging take-up (Gine et al., 2012). It has been believed that training has a power to increases awareness as a result demand has also increased.

Similarly Stefan et al. (2012), also supports this idea but type of training provided to leaders of indigenous groups has important implications for demand for insurance, the strengthening mechanisms to manage basis risk makes index insurance more attractive to small-holder farmers. The second reason is weather-based insurance can prevent the problem of adverse selection (that is, since farmers know more about their risks than the insurer, the low-risk farmers may pick out, leaving the insurer with only high-risk customers) and moral hazards (that is, when farmers' behaviors can influence the extent of damage that qualifies for insurance payouts) (Linnerooth-Bayer and Hochrainer-Stigler, 2014).

However, insurances are growing rapidly in the developing world, as part of this growth; innovative new products allow individual smallholder farmers to hedge the risks, for instance, agricultural risks such as drought, disease and commodity price fluctuations (World Bank, 2005). These financial innovations hold significant promise for rural households. According to (Bezabih et al., 2011) crop riskiness at a farm level is highly responsive to rainfall variability and that the choice of high risk-high return crops is hampered by weather uncertainty. Shocks to agricultural income, such as a drought-induced harvest failure, generate movements in consumption for households who are not perfectly insured and at the extreme, may lead to famine or death. Consequently, the variability is imposing significant challenge (Abera and Manfred, 2009) declare that rainfall has emerged as an important factor influencing household food security. Water and energy supply, poverty reduction and sustainable development efforts, as well as by causing natural resource degradation and natural disasters. In response, the national adaptation program of action (NAPA) for Ethiopia has been prepared, basic approach to NAPA preparation was along with the sustainable development goals and objective of the country where it has recognized necessity of addressing environmental issues and natural resource management with the participation of stakeholders (MoWR, 2007). However, an issue that was not yet addressed is whether there is demand as well as willingness to contribute by smallholder farmers for the new rainfall risk insurance. Therefore, the objectives of the study a) assess current risk management strategies practiced by the smallholder farmers b) identify willingness to pay as well as the extent of payment by the smallholder farmers.

MATERIALS AND METHODS

Study area sampling techniques

This method was originally designed to elicit the consumers' willingness to pay for a product that is not yet on the market, is now being widely used even for marketed good that have a substantial impact on the welfare of the society. After designing the draft questionnaire, pre-test was conducted with randomly selected sample households. An openly ended question was used for the elicitation of the respondents' maximum amount they are willing to pay for the insurance service per hectare. Pre-test was used due to make some modifications in the designed questionnaire and to obtain starting bid values. Based on this elicitation some values were selected as the starting bid values for the survey questionnaire (Figure 1).

A multi-stage sampling technique was used to select 161 sample households. In the first step of the sampling, out of the *districts* in the Central Rift Valley that have almost similar climate condition, "*Mieso*" and "*Dugda*" *districts* were purposively selected because these areas are most drought prone areas. In the second stage, out of the 36 Peasant Associations (Pas) in "*Dugda*",4 PAs were selected randomly and of 36 PAs in "*Mieso*" *district,* 3 PAs were selected. In the third stage, the total numbers of households in each PAs were listed and finally a total numbers of 161 sample households were selected based on the proportion of the total number of households in each Pas. Then the bid values were randomly distributed to each questionnaire (161) and interviewed.

The respondents were asked whether they are willing to pay for a given amount or not, if the respondent says yes or no; finally the single bounded dichotomous choice question is followed up by an
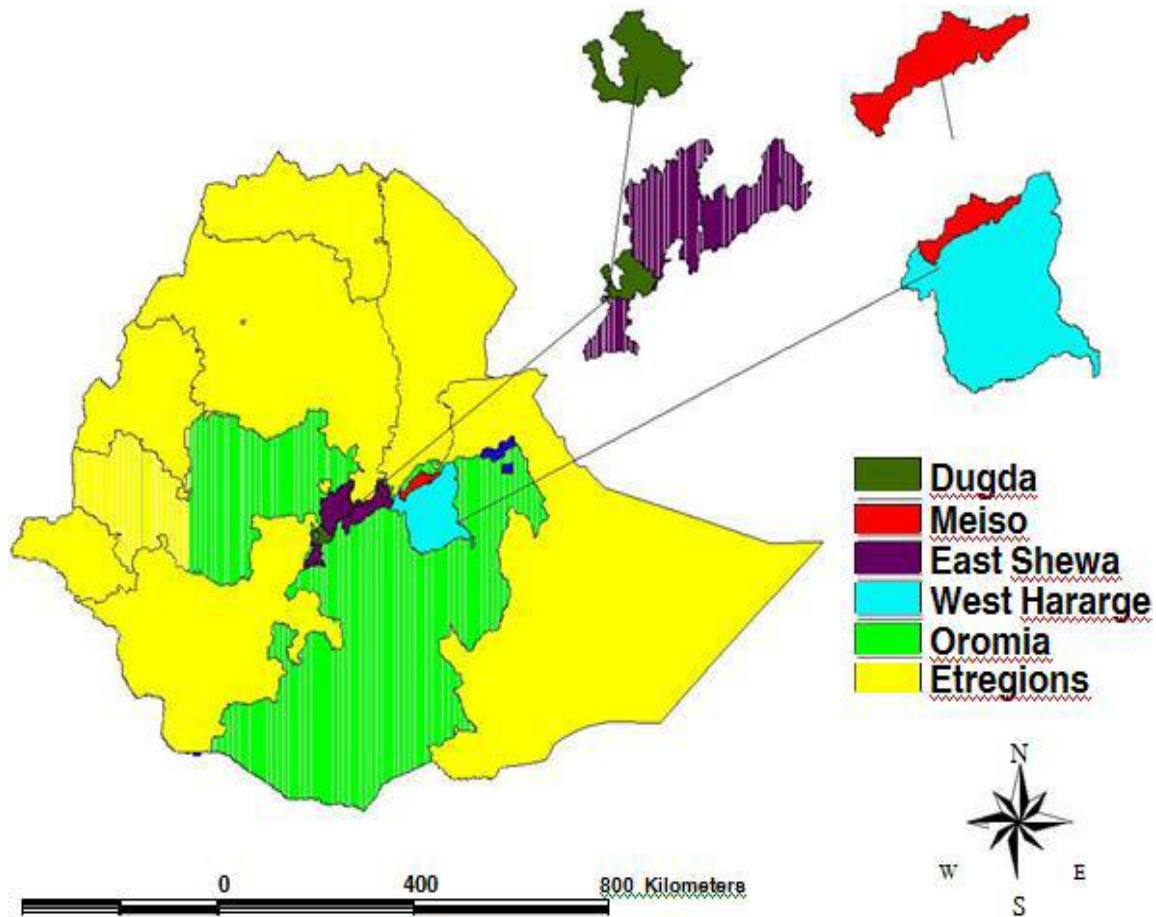
Figure 1. Location of the study area.

open-ended follow-up question. The use of an open-ended questionnaire is justified by its advantage indirectly eliciting the maximum willingness to pay and to avoid biases.

Method of WTP data collection

Willingness to pay is defined as the amount that must be taken away from household's income. The willingness data is collected through contingent valuation method (CVM), this method is also suited to solicit consumers' willingness to pay for a product that is not yet on the market. CVM is now increasingly used in developing countries (Alberini and Cooper, 2000). In this method, the researcher creates a hypothetical market in a non-market or new good. The values which are generated through this hypothetical market are treated as estimates of the value of new good. After designing the draft questionnaire pre test was conducted with 26 randomly selected sample households. An open ended question was used for the elicitation of the respondents' maximum amount they are willing to pay for the insurance service per hectare. This is due to make some modifications in the designed questionnaire of the survey and to obtain starting bid values. Based on this elicitation some values were selected as the starting bid values for the survey questionnaire. The bid values were distributed randomly through 161 sample households and the respondents were asked are you willing to pay this amount if the respondent says yes or no, finally the single bounded dichotomous choice question is followed up by an open-ended follow up question.

Data analysis

The data that had been collected through contingent valuation method has been analyzed using both descriptive statistics and econometric model. Descriptive statistics such as mean, percentage, standard deviation and frequency of appearance was used, whereas, on the econometric approach adopted Probit and Tobit models. The dependent variables are willingness to pay; dummy variable (yes or no) and the maximum amount of money the willing respondent are willing to pay.

Model specification

Tobit model was commonly known as censored normal regression model (Greene, 2003). It assumes that many variables have a lower or upper limit that was known as a threshold value and take on this limiting value for a large number of respondents. For the remaining sample respondents, the variable takes on a wide range of values above the limit. The explanatory variables in the model may influence both the probability of limit responses and the size of non-limit. The two parts correspond to the classical regression for the non limit (continuous) observations and the relevant probabilities for the limit (zero) observations, respectively (Table 1). Based on the above behavior of the model, Tobit analysis is appropriate for this study and the formula for the Tobit model is described as follows; following Long (1997), the structural equation of Tobit model

Table 1. Variables and their measurement included in the mode.

Variable	Code	Type of variable	Definition and Measurement
Age of the household	AGE	Continuous	Age of household head in years
Sex of the household	SEHH	Dummy	Sex of household head 1, if male 0, otherwise
Marital status	MRST	Discrete	Marital status 1, married 2, single 3, divorced
Location of the study area	NAWO	Dummy	Location of the study area 1, if in Dugda 0, in mieso
Family size	FSIZE	Continuous	Number of family members
Income from crop	FINC	Continuous	Total annual income of the households from crops in Birr
Education of the household	EDUC	Dummy	Education status of HHH, 1 if literate 0, otherwise
Off-farm income	OFINC	Continuous	Total off-farm income measured in Birr
Initial Bid value	BID	Discrete	Initial bid value offered in Birr per hectare
Maximum willingness to pay	MWTP	Continuous	Maximum WTP in Birr per hectare
Credit constraint	CREDIT	Dummy	1 if the household is highly credit constrained 0, otherwise
Extension service	EXTENTION	Dummy	1 service user 0, otherwise
Livestock holding	TLU	Continuous	Measured in tropical unit
Dependency ratio	DEPR	Continuous	Measured in Birr
House type	HOUSE	Dummy	1 if iron roofed 0, otherwise
Owning radio	RADIO	Dummy	1 if owning radio 0, otherwise
Availability of public and private aids	PAPA	Dummy	1 if household head has aid 0, otherwise

censored from below can be expressed as:

$$y_i^* = x_i\,\beta_i + \varepsilon_i \tag{1}$$

Where, Y_i = the observed dependent variable, in this case the maximum willingness to pay the respondent is willing to pay in Ethiopian Birr; YI^*= the latent variable which is not observable; X_i = vector of factor affecting willingness to pay.

The model parameters can be estimated by maximizing the Tobit likelihood function of the following form (Maddala, 1997):

$$L = \prod_{Y_i^* > 0} \frac{1}{\sigma} f\left(\frac{Y_i - \beta_i X_i}{\sigma}\right) \prod_{Y_i^* \leq 0} F\left(\frac{-\beta_i X_i}{\sigma}\right) \tag{2}$$

Where f and F are respectively, the density functions and

cumulative distribution function of > 0 means the product over those *I* for which > 0, and < 0 means the product over those *I* for which < 0.

Maddala (1997), proposed the following techniques to decompose the effects of explanatory variables into the decision to pay and intensity effects. Thus, a change in X (explanatory variables) has two effects. It affects the conditional mean of Y_i^* in the positive part of the distribution, and it affects the probability that the observation will fall in that part of the distribution. Similar approach will be used in this study:

i. The marginal effect of an explanatory variable on the expected value of the dependent variable is:

$$\partial E\,(Y_i)/\,\partial X_i = F_{(z)}\beta_i \tag{3}$$

Where, $\beta_i X_i/\delta$ is denoted by z, and F is a cumulative distribution.

ii. The change in the probability of willingness to pay as independent variable Xi changes is:

$$\partial F(Z)/\partial X_i = f(z)\,\beta/\delta \tag{4}$$

iii. The changes in the amount of money respondent are WTP with respect to a unit change in an explanatory variable among those who are willingness to pay are:

$$\frac{\partial E\left(\frac{Y_i}{Y_i}>0\right)}{\partial X_i} = \beta_i\left[1 - Z\frac{f(z)}{F(z)} - \left(\frac{f(z)}{F(z)}\right)\right] \tag{5}$$

Where: F (z) = is the cumulative normal distribution of z; f (z) = is the value of the derivative of the normal curve at a given point (unit normal density); z = is the z-score for the area under normal curve; β = is a vector of Tobit Maximum Likelihood estimates and σ = is the standard error of the error term.

Table 2. The result from Logit model to calculate the mean WTP.

Variables	Coefficient	St. d	t-value	p-value
CONSTANT	3.993626	0.6619955	6.03	0.0000
BID	-0.021873	0.0042091	-5.20	0.0000

In the logit model of single bounded dichotomous format, are given initial bid value in which they may accept or reject. In the logit model the dependent variable is dummy variable. The purpose of the Logit model is to estimate the mean WTP. Following Gujarati (1999), the Logit model is expressed as follows:

$$\text{Logit}\left(P(X)\right) = \beta_\circ + \beta_i x_i + \varepsilon_i \qquad (6)$$

Where: $P(X)$ = probability that a given household is willingness to pay; $\beta_\circ$ = Constant term; β_i = regression coefficient to be estimated or Logit parameter; X_i = initial bid value; ε_i = error term of the Logit regression.

One of the main objectives of estimating an empirical WTP model based on the CV survey responses is to drive a central value or mean of the WTP distribution Hanemann et al. (1991). According to Gujarati (1999) both Probit and Logit models provide similar results thus, for comparative computational simplicity Logit model was used for the estimation. And the mean willingness is formulated as:

$$E(\text{WTP}) = \frac{\ln\left(1+\exp\left(\beta_\circ\right)\right)}{\beta_1} \qquad (7)$$

Where: β_1 = bid coefficient; $\beta_\circ$ = Constant term.

RESULTS AND DISCUSSION

Descriptive statistics results

Descriptive statistics such as mean, minimum and maximum values, range and standard deviations were used to describe the major factors explaining farmers' willingness to pay for rainfall risk insurance. In addition, mean difference for continuous variables and frequency of discrete variables were tested using t-test and chi-square test respectively by using (SPSS V-16).

Perception of risk

Households in the study area perceive that they are exposed to a variety of substantial risks from different sources. Therefore, based on the results obtained from formal survey questionnaire, households define risk in three ways: year when rainfall delays, year when rainfall is inadequate, year when rainfall is high.

Risk management strategies

In order to cope with sources of risks, rural households have developed various risk management strategies which only differ from place to place, and among the farmers. Therefore, sale of livestock in case of emergency is a major risk coping strategy practiced by farmers others, diversification use of improved technology, delay in a sale of crop products and intercropping were also strategies used by farmers which are listed according to their importance.

Willingness to pay analysis

The total sample households were randomly distributed to the four initial bid values (50, 100, 150, 200), each value contains 41, 47, 36 and 37 respondents respectively. Out of the total sample respondents 17(27.2%) responded "no" to the initial bid value. The main reason farmers have refused to accept the service includes they could not afford it, and they did not trust the service very well. But the rest 144(72.8%) show their interest to contribute and gave a "yes" or "no" response to the initial bid value then follow-up values.

Estimation of the mean WTP

The initial bid value was regressed with the dependent dummy variable, the result of the coefficients were showed in Table 2, and willingness to pay for the single bounded dichotomous format is as follows:

$$E(\text{WTP}) = \frac{\ln\left(1+\exp(\beta_\circ)\right)}{\beta_1}$$

Where:

$\beta_1 = 0.021873$

$\beta_\circ = 3.993626$

$= \frac{\ln\left(1+\exp(3.993626)\right)}{0.021873} = 183.41$

Thus, the mean willingness to pay calculated from the single bounded dichotomous format is 183.41 Ethiopian birr per hectare. However, the mean WTP is 129.93 Ethiopian birr per hectare from responses to the open-ended CV survey questions, which is lower than the mean value obtained from the closed-ended Logit model estimates. Thus, the result showed that the respondents were willingness to pay between the ranges of 129.93 to 183.41 Ethiopian Birr per hectare for the proposed rainfall

Table 3. Total willingness to pay and total revenue in Eth (Birr).

Class bound. For WTP amount	Class mark for WTP amount	Sample District of HHs		Total no of HHs	Total WTP in Ethiopian (Birr)	Sample HHs WTP at least that amount		Total HHs WTP at least that amount	Total Revenue
		N	%			N	%		
0-50	25	39	24.223	12,103.3	302,582	161	100	49,966	1,249,150
51-100	76	54	33.54	16,759.6	1,273,729	122	75.5	37,864	2,877,664
101-150	126	11	6.832	3,414.18	430,186	68	42.24	21,105	2,659,230
151-200	176	37	22.981	11,482.7	2,020,953	57	35.40	17,688	3,113,088
201-250	226	7	4.347	2,172.02	490,877	13	8.07	4032	911,232
251-300	276	7	4.347	2,172.02	599,478	11	6.83	3413	941,988
301-350	326	5	3.105	1551.44	505,771	6	3.73	1864	607,664
351-400	376	1	0.621	310.29	116,669	1	0.62	310	116,560
Total		161	100	49,966	5,740,244				

risk insurance service.

Estimating total willingness to pay and total revenue

The total willingness to pay and total revenue at different prices that households in the seven PAs of the two districts ("*Dugda*" and "*Mieso*") were willing to pay as computed. The sampled seven PAs namely, *(B/Gusaa, Odd Bokota, Jawe Bofo, S/wakalee, Huse mandhera, Chobi, Burimulu)* have a total of 3281 households with a total population of 49,966 households with a total population of 275,307 and the average family size of 5.86. Based on this information and the distribution of WTP by the respondents, it would be possible to estimate the expected total willingness to pay and total revenue for the study area. Table 3 provides the procedure and results of the analysis.

The first column shows the maximum willingness to pay interval, and the second is class for willingness to pay (the mid willingness to pay) of the first column. The third and the fourth columns show the number and the percentage of sample households whose willingness to pay amount falls within a given interval. The total number of households in two districts of the study area has multiplied by the proportion of sample households falling under each category to obtain the total number of households whose willingness to pay lies in each boundary (column fifth). And total willingness to pay (column sixth) has been obtained by multiplying the mid willingness to pay by total number of households willingness to pay. The total household of 49,966 in two districts of the study area was expected to pay ET birr 5,740,244 / year if every household insures one hectare of his/her land.

Therefore, the result shows that the average insurance premium payment was ET birr 114.88 / hectare/ household if the proposed insurance service has implemented. This result is almost similar with an average willingness to pay ET 129.93 / hectare/ household. A column seven and eight represents the number and the percentage of sample household willingness to pay at least the amount in each interval. Similarly, column nine shows total number of households willing to pay at least the amount in each interval and it falls when the mid willingness to pay rises (column ten). Total revenue has been obtained by multiplying the mid willingness to pay amount (column two) by the corresponding total number of households' willingness to pay at least that amount, (column nine).

Derivation of aggregate demand

The aggregate demand has been derived from the above willingness to pay scenario (Table 3). Any point on the curve shows all the respondents that prefer the insurance service, but do not bid more than the corresponding value on the mid willingness axis. The demand curve is negatively sloped, indicating the fall of the demand for the insurance service as an insurance premium increases, like most other non-market goods other things remaining constant. The area under demand curve represents the gross value of
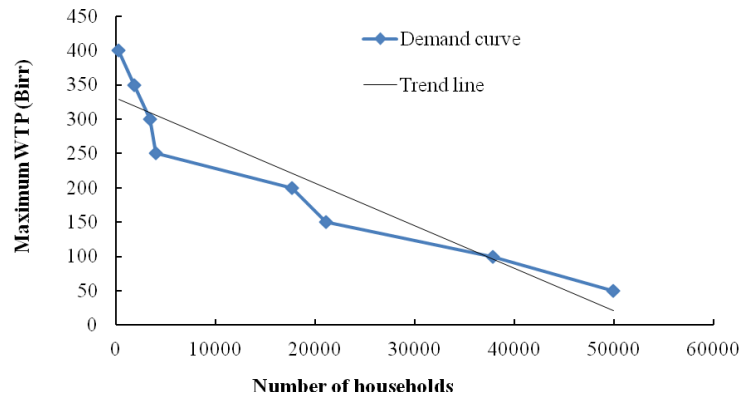
Figure 2. Estimated demand curve for rainfall risk insurance service.

Table 4. Maximum Likelihood estimates of the Tobit model.

Variables	Estimated coefficient	Standard error	t-ratio
Constant	3.70112	103.639	0.0357
NAWO	-2.77379	18.8725	-0.14697
SEHH	105.47	62.4742	1.68821
AGE	-1.72656	0.71336	-2.42032**
EDUC	7.89432	15.9354	0.49539
MRST	22.2316	22.1423	1.00403
FINC	0.00556	0.00155	3.59743***
OFINC	-0.01032	0.00487	-2.12119**
DEPR	-0.66475	8.84637	-0.07514
FSIZE	5.18168	3.7561	1.37954
TLU	-5.01802	1.64755	-3.04575***
CREDIT	-9.49309	15.8865	-0.59756
EXTENTION	24.4899	22.8428	1.0721
PAPA	-49.3245	16.0296	-3.0771***
BID	0.05866	0.12318	0.47623
RADIO	33.4783	20.6775	1.61906**
HOUSE	0.68939	14.8145	0.04653

Number of observation = 161
Log likelihood = -854.3120
Threshold value for the model: Lower = 0.0000 Upper = + infinity
δ = 83.4523
Z = 1.48 ф (z) = 0.2859 Φ(z) = 0.9307

***, **, * indicate significance at 1, 5, and 10% levels, respectively. Source: Model result, 2010.

consumers' surplus if the service is available for free or zero (Figure 2).

Econometric model result

Econometric software called Limited dependant (Limdep 7) was employed to estimate the Tobit and Probit models. Out of the 16 hypothesized explanatory variables, six were found to be statistically significant, four of them were continuous and the rest two were dummy variables.

The variables were age of the household head (AGE), total income from farm (FINC), total off-farm income (OFINC), livestock holding (TLU), owning radio (RADIO), and availability of public and private donations (PAPA). Moreover, the sign of the estimated coefficients were consistent with the expected signs (Tables 4 and 5).

Conclusion

Age of the household head (AGE) is an important factor

Table 5. Marginal effects of the explanatory variable on the dependent variable.

Variables	Change in probability $\dfrac{\partial F(z)}{\partial X_i}$	Change among willing $\dfrac{\Delta E\left(\frac{y_i}{y_i^*}\right) > 0}{\partial X_i}$	Total change $\dfrac{\partial E(y_i)}{\partial X_i}$
NAWO	-1.66800	-2.63030	-2.58250
SEHH	63.4230	100.0140	98.1955
AGE	-0.00548	-1.51590	-1.4900
EDUC	0.04564	12.6173	12.4022
MRST	13.3687	21.0861	20.6982
FINC	0.00002	0.0055	0.0054
OFINC	-0.00003	-0.0098	-0.0096
DEPR	0.01727	-4.7743	-4.6929
FSIZE	0.01691	4.6763	4.5966
TLU	-0.01618	-4.4728	-4.3966
CREDIT	0.02439	-6.7416	-6.6269
EXTENTION	0.09502	26.2641	25.8164
PAPA	-0.16233	-44.8686	-46.723
BID	0.00085	0.0235	0.0231
RADIO	0.15218	42.0637	41.4367
HOUSE	0.01919	5.3063	5.2159

Source: based on model output.

influences the respondent's willingness to pay negatively, Earlier studies by Patrick (1988), Gine et al. (2007) the age of the household has negative effect on the demand for insurance. Young farmers are more likely to purchase insurance than elders, as the age of household head increases, the willingness to pay amount decreases significantly.

Therefore, younger household heads are more likely to be willing to pay for rainfall risk insurance compared to older household heads. Thus, it might be explained by the fact that younger household heads have less long life experience on predicting weather conditions, and they are also sensitive to the new technologies than elders. The result shows that for each additional year in age of the respondent, the probability of the willingness to pay for rainfall risk insurance decreases by 0.548%. It also shows that as the age of a respondent increase by one year, the amount of cash he/she is willing to pay for rainfall based insurance decreases by 1.5159 Birr.

Household income from crop (FINC)

This variable is found to have a positive impact on the probability of willingness to pay as hypothesized and the effect is statistically significant at 1% probability level. Those household heads that generate high income from crop production would be more willing to pay for rainfall risk insurance. When the income increases by one birr, the probability of the willingness to pay for the service also increases by 0.002% hence, the income level of the

household increase by one Birr. As a result the amount of cash the household could pay increases by 0.0055 Birr, other factors held constant. This is based on economic theory, which states that individual's demand for most commodities or services depend on income (Mbata, 2006). Vince and Joyce (1994) have found that income of the household has positive impact on the demand for rainfall based insurance.

Ownership of radio by the household (RADIO) is another important factor which affect maximum willingness to pay positively. Information from radio enhances the ability of farmers' access to improved technologies and risk management strategies. Farmers that own radio may get different information on extension service, credit service, improved seed variety, input prices and output prices than those farmers who do not have radio. This variable also shows that farmers that own radio have 15.218% of possibility to paying for rainfall risk insurance than those farmers who do not possess. Thus, farmers that own radio would pay Birr 42.0637 more than those farmers that do not have radio.

As expected the availability of off-farm income (OFINC) is negatively related to maximum willingness to pay. Households occupied in different off-farm activities reduce the probability of willingness to pay for rainfall risk insurance by 0.003%. Therefore, this expected to have negative influence on farm activity. A study conducted by Sakurai and Reardon (1997) showed that respondents who received high amount of income from other non-farm activities are not interested in participating in drought insurance. The marginal effect of this variable also shows

when off-farm income increases by one Ethiopian birr the amount of money households would be willing to pay for rainfall risk insurance decreases by 0.0098 Birr, other factors held constantly.

Public and private aid (PAPA)

PAPA is an important factor that affects the dependent variable negatively. Availability of public and private donations decreases the willingness to pay by 16.233%. Sukurai and Reandon (1997) have also found a negative effect on the dependent variable when farmers have found more donations from governmental or other non-governmental organizations, either in kind or cash therefore this might be explained by the fact that as households become more dependent and less active, and their willingness to pay tends to be less. The marginal effect of the variable shows that those household depend on public and private gifts decrease willingness to pay by 44.8686 Birr than those who don't have the gift, other variables held constant.

Livestock holding (TLU)

Number of livestock ownership is found to have a negative effect. Each additional unit of livestock (TLU) decreases the willingness to pay by 1.618%. The negative effect implies that income from livestock may encourage farmers to depend more on livestock than farming and results in less effort being give to the crop production. The marginal effect shows that for each additional TLU that possess the willingness to pay amount decreases by 4.4728 Birr, other variables held constant.

It was then concluded that if rainfall risk insurance premium is within affordable range (with this range affected by the above mentioned factors) and households have enough information about it, farm households are willing to pay for the service. However, policy makers need to be aware that socio-economic and institution characteristics that are linked with farm households influence the willingness to pay for rainfall risk insurance.

Conflict of Interest

The authors declared that they have no conflict of interest.

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