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Economic Valuation Natural Forest: The Case of Sheka Forest, South West Ethiopia

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Abstract
The main objective of this study is to estimate the economic value of Sheka forest, one of the natural forests located in Southern Nations, Nationalities, and Peoples (SNNP) Regional State of Ethiopia. It has a potential to contribute towards the economic development of the region. To estimate conservation value of Sheka forest, contingent valuation method (CVM) were employed by using double-bounded dichotomous choice format. To estimate mean willingness to pay and to identify determinants of household's willingness to pay probit model and seemingly unrelated bivariate probit model were employed. To measure household's maximum willingness to pay for forest conservation Tobit model were used. The result showed that 94.91% of households were willing to pay for the conservation of Sheka forest. As a result, the mean maximum willingness to pay was 47.97 ETB. The households mean willingness to pay for Sheka forest was found to be 39.07ETB from probit model, 39.65 and 58.51ETB from bivariate probit first and second equation respectively.
Keywords: Willingness to Pay, DBDC, SUBPM, Tobit, Probit

1. Background of the Study

Ethiopia has the most biodiversity environment, with ecosystem ranging from damp forest area and widespread marshland to the arid region of the Afar depression. According to the report of FAO, the Ethiopia's forest cover is 12.2 million ha (11%) (FAO, 2010). This indicated that the forest cover shows a decline from 15.11 million ha in 1990 to 12.2 million ha in 2010, during which 2.65% of the forest cover was deforested (Yitebitu et al, 2010). The main causes of deforestation in Ethiopia are clearing of forest for agricultural land, the rate of population growth, cutting for fuel wood, cattle grazing, coupled with improper forest and land tenure policies.

Ethiopia's forest has been governed by the forestry development conservation and utilization proclamation, issued in September 2007 (542/2007), which repealed proclamation 94/1994. The government allocates budget for guards for these forest areas, but effective management plans have not prepared and also not much work has been done on a forest.

Forest has important environmental benefits, such as benefits of regional climate, biodiversity, greenhouse effects, purifying the air and water pollution (Alireza et al, 2013). From recreational activities, food provision, medication purpose humans have obtaining direct and indirect benefits from natural forests. In addition, Forests have a considerable role in protecting soil erosion, reducing global warming by up taking carbon dioxide. Effective management and conservation of natural forests enhances these benefits and facilitates its transfer from current to the future generation.

But, lack of awareness about the total values obtained from the forest, as well as underestimating of the benefits has led to management failures. As a result of this, natural forests are suffering the problem of deforestation, which creates a problem on human well-being, wildlife habitats, and the environment. One of the challenges for the successful management of natural forest is how can we estimate the economic value of this resources. Most of the environmental goods and services have no market price; they are public goods and services. Non-market valuation assesses the contribution of ecosystem services to human well-being by determining the preference of users (Jing, 2013). The preference of the users is obtained by asking the peoples about their willingness to pay for improvement of the existing condition or their willingness to accept for welfare losses.

The establishment of economic value for forest conservation has importance to obtain values of forest to identify a socially optimal decision, to demonstrate the importance of environmental policy. This is because many of the net gains from environmental policy do not show up an immediate monitory gains, for the determination of targets for environmental quality standards, and most of the time peoples give attention for something if it has a value, that means if the policy maker attach monetary value for conservation, peoples began to give concentration and interested in protecting it.

Sheka forest, one of the natural forests located in southern nations, nationalities, and peoples (SNNP) regional state of Ethiopia, covers 238,750 hectares. The forest is rich in a variety of plant and animal species, wild coffee, honey and other non-timber forest products. As a result, it has a potential to contribute towards the economic development of the region. On the other hand, the total area of the forest decline because of clearing of forest for agricultural intention, increases of population growth, and the forest land given to private investors, for instance, the government gives forest land for 'East African Agribusiness' and had begun to clear the forest for tea plantation (MELCA, 2005). The deforestation of Sheka forest is has been increasing at an alarming rate since 1990's because of expansion in the investment of monoculture plantation such as coffee and tea, in this case, the native trees of Sheka replaced by exotic species (MELCA, 2005).

This study, therefore, focused on local communities' willingness to pay for conservation of forest, because community based conservation practice will be effective for protection and management of forest. Hence it estimates the economic value of Sheka forest area by using contingent valuation method.

2. Methodology of the Study

The study was conducted in Sheka forest district, which is found under Shekacho zone in South Nation Nationality and People's Regional State of Ethiopia. This zone is located at distances of 674 km from the capital, Addis Ababa and the area is one of the few areas with high tropical rainforest cover in Ethiopia. This area receives the rain fall throughout the year, with monthly minimum 70mm and maximum about220mm. It covers 238,750 hectors of the forest. There are over 300 higher plants, 50 mammals, 200 birds, 20 amphibian species, 55 and 10 endemic plant and birds respectively (Tadesse et al, 2011).

The primary data were collected through questionnaire, face to face interview and direct observation techniques. The data were collected from the surrounding sampled household heads that live around Sheka forest area. To gain qualitative information the researcher undertakes focus group discussion by using 40 randomly selected households from selected kebeles. As a result of focus group discussion, there were three most frequently stated values; those were 15, 30, and 40 ETB selected as a starting value. According to Cameron and Quiggin (1994), the initial determined amount of bid value for double-bounded dichotomous choice format will be doubled if the first response for initial bid is "Yes" and it become half if the response is "No". Based on this idea the sets of bids are (15, 7.5, 30), (30, 15, 60) and (40, 20, 80) ETB per year. To supplement the primary data, secondary data were collected from the administrative office of Masha, Yeki and Andercha woredas and the randomly selected kebeles.

To get adequate, representative and appropriates sample size and sampling methods, the peoples around Sheka forest area were taken to be the sampling population. The researcher used a stratified sampling technique to select sampled population. Sheka has three sub city (woreda) namely Yeki, Masha and Andercha from those woredas 4 kebeles those are bordering the forest from each woreda were purposively selected. Using simple random sampling sampled 300 respondents were selected from all kebeles. These 300 sampled respondents were selected based on proportional allocation to the sample size of the households in this selected Kebeles.

The study applied both descriptive and econometrics model in order to analyze the data properly. The descriptive part explained by using table, percentage, and mean of the result. To measure willingness to pay and determinants of the respondent's willingness to pay, probit and bivariate probit models were used. To determine the determinants of household's maximum willingness to pay Tobit model was used.

The study used contingent valuation method (CVM) to estimate the economic value of Sheka forest area, because it incorporates both use and non-use values. Contingent valuation method uses survey questions to elicit from a sample of consumers their willingness to pay (WTP) and willing to accept (WTA) for a change in the level of environmental goods and services, in a carefully structured hypothetical market, by doing this it allows for a more detailed investigation of human preference.

For determining the determinants of household's willingness to pay for Sheka forest conservation probit model were employed. The basic model for analyzing dichotomous CV responses is the random utility model (Haab and McConnell, 2002). In this model there are two choices that present for respondent I, which can be written as:

$$Uji= Uj(Yi, Si, \varepsilon i)$$

Where, j=1 is the final state when the CV program is implemented, j=0 for the status quo, Y_i income of respondent i, S_i is socio-economic characteristics and ε_{ij} is random variables with mean zero, distributed identically and independently. In this model there is a change of something from status quo, to the final state, that represent by q, so for status quo there would be $U_{0i}= U (Y_i, S_i, q^0, \varepsilon_{0i})$ and utility in the final state would be $U_{1i}= U (Y_i, S_i, q^1, \varepsilon_{1i})$.

Based on this model the respondent wants to pay Ai if the utility with final state greater than the utility of the status quo.

$$U_1(Y_i - A_j, S_i, \varepsilon_{1i}) > U_0(Y_i, S_i, \varepsilon_{0i})$$

The likelihood function for N sample size,

$$L(\alpha, \beta / Y, S, A) = \prod_{i=1}^{N} [\phi(\alpha Si / \delta - \beta Ai / \delta)]^{Ii} [1 - \phi(\alpha Si / \delta - \beta Ai / \delta)]^{1-I}$$

Generally, probit model was used to gain the main determinants of household's willingness to pay for conservation of Sheka forest by using the formulation of Haab and McConnel (2002).

$$WTP_i^* = \beta 1 Si + \varepsilon i$$

where WTP^*_i = is unobservable latent variable of households' willingness to pay the observed dummy variable WTP_i is defined as,

WTP_i=1 if WTP^*_i > BID1 and
WTP_i=0 if WTP^*_i < BID1

$$WTP_i = \beta_0 + \beta_1 BID_1 + \beta_2 EDUC + \beta_3 HHINC + \beta_4 HHSIZE + \beta_5 HHSEX + \beta_6 ENVOPI + \beta_7 FORBEN + \varepsilon_i$$

Where, WTP_i is willingness to pay of the respondent, BID is amount of bid offered to the respondent, EDUC is education level of the respondent, HHINC is income of the respondent, HHSIZE is number of household size, HHSEX is sex of the respondent, ENVOPI is environmental opinion of the respondent and FORBEN is benefits of forest.

To analysis the double-bounded questions, the bivariate probit model were used. The bivariate is a general parametric model which used for the two-response survey. In this model there are four possible answers for the given bid values, such as yes-yes, no-yes, yes-no and no-no responses. Let A_1 and A_2 are the first and the second bid prices respectively, so the bounds on WTP are:

i. $A_1 \leq WTP < A_2$ .... for the yes-no responses
ii. $A_1 > WTP \geq A_2$....... for the no-yes responses
iii. $WTP \geq A_2$.............. for the yes-yes responses
iv. $WTP < A_2$.............. for the no-no responses

According to Haab and McConnell (2002), the most general econometric model for the double-bounded data comes from the formulation that:

$$WTP_{ji} = \mu_j + \varepsilon_{ji}$$

where WTP_{ji} = represents the i[th] respondent's willingness to pay
j = 1,2 represents the first and the second answers
μ_1 and μ_2 = are the means for the first and the second responses

The overall conservation value of Sheka forest is calculated by using annual average willingness to pay per household's times by the number of households in the area.

To estimate the maximum willingness to pay of the household and its determinants we use Tobit model. The general formulation for Tobit model will be:

$$MWTP_i^* = x_i \beta + \varepsilon_i \qquad MWTP_i = 0 \; if \; MWTP_i^* \leq 0$$

$$MWTP_i = MWTP_i^* \; if \; MWTP_i^* > 0$$

$$MWTP_i = \alpha_0 + \alpha_1 EDUC + \alpha_2 HHINC + \alpha_3 HHSIZE + \alpha_4 HHSEX + \alpha_5 ENVOPI + \alpha_6 FORBEN + \alpha_7 BID_1 u_i$$

These variables selected because of most of the time the household's decision regarding willingness to pay affected by those variables.

3. Data Analysis and Discussion

3.1. Socio-Economic and Demographic characteristics of households

From the total of sampled households, the average family size of the households is 3.87 with a minimum of 1 and maximum of 9 members within a single household with a monthly household's income of 2,818.008 ETB per month, which ranging from a minimum income of 700 ETB to the maximum income of 5,000 ETB. Out of the total sample households 225 (86.21%) were willing to pay the randomly offered initial bid and the remaining 36 (13.79) of the households were not willing to pay the randomly offered initial bid. Out of 225 willing households, male headed households contribute 89.78%, while female headed households contribute 10.22%. On the other hand, from 36 unwilling households 41.69% were female headed households, while the remaining 58.33% were male headed households. The result of the survey shows that there is strong relationship between sex of household head and willingness to pay of the randomly offered initial bid.

Out of 261 sampled respondents, 215 (82.38%) households have a positive environmental opinion about the conservation of the environment, the remaining 46 (17.62%) have no idea about forest conservation. From the total of 215 respondents, who have positive environmental opinion and concerned about the environment, 198 (92.09%) were willing and 17(7.91%) were not willing to pay for forest conservation. Out of 46 respondents, 41.30% were not willing and 58.70% were willing to pay the randomly offered initial bid. As indicated on table 1, there is a positive relation between environmental opinion and willingness to pay for conservation, because households who have a positive opinion about the environment want to protect and transfer good environmental condition for future generations.

From the total sample of 261, 207 which are 79.31% of the sampled respondents were beneficiary from the forest, whereas the remaining 54(20.69%) respondents' state that they do not gain any benefits from the forest. In addition, out of 207 respondents, 191(84.89%) were willing and 16(44.44%) were not willing to pay the initial bid. Besides, 15.11% of households who stated that they do not gain any benefits from the forest were willing to pay and the remaining 55.56% were not willing to pay the initial bid. As indicate on table 4, there is strong positive relationship between forest benefit and willingness to pay. This is because households who benefits from the forest want to increase his/her benefits by conserving the forest.

The education data showed that from the sampled respondents 213(81.61%) attended their formal education, the remaining 48(18.39%) were neither read nor write (illiterate). The majority of the respondents were within primary education. The mean of years that the household head spent in school is about 0.898 for willing households and 0.3 for no willing households head. Education level of the household head is statistically significant at 5% level of significance. The result indicates that level of education have strong impact on households' willingness to pay.

The average income per household is about 2818.008 ETB per month, ranging from a minimum income of 700ETB to the maximum income of 5000ETB. The main sources of income are crop and spice production, selling of coffee and honey, and off farm activities. The mean income for willing households was estimated to be 2958.222 ETB, whereas for non willing households the mean income was 1941. As shown the data there is statistically significant difference between willing and non willing households. The household who have higher income is more willing to pay for conservation of forest.

Table 1: Descriptive statistic of explanatory variables

Variable	Mean	Std.Err	Min	Max
HHSIZE	3.873563	0.1323587	1	9
EDUC	0.816092	0.0240261	0	1
WTPBID1	0.862069	0.0213853	0	1
WTPBID2	0.7662835	0.0262454	0	1
MWTP	47.24138	1.460068	10	90
HHINC	2818.008	80.63677	700	5000

Source: Own Survey, 2017

3.2. Households Opinion about the Problems and Conservation Activities of Sheka Forest

Based on the questionnaires respondents asked to state their opinion about the problems of Sheka forest. According to their response, the most severe problem of Sheka forest is related to the government program that is an expansion of investment on monoculture plantation, in this, the government gives forest land for private investors for tea and coffee plantation so the native trees of Sheka replace by exotic species. This problem followed by an increase of population growth, cutting trees for fuel wood and agricultural expansion.

Concerning the present forest management and preservation exercises of the area 101 (38.697%) respondents said that the present forest protection and preservation is not sufficiently strict, 70 (26.82%) respondents replied that there is proper forest protection and conservation, the remaining 90 (34.48%) were not aware of any forest protection activities.

3.3. Analysis of Household's Opinion for Improvement of Sheka Forest Conservation

Households were asked to state their opinion for better improvement of Sheka forest. According to their responses, 69.73% of the respondents were suggested that the government and the communities must work cooperatively and by selecting representatives of each Kebeles community there should be meeting and reports of works that done on each Kebeles. Out of sampled respondents, 76.63% replied that the government does not give the forest land for private investments, because those investors have no contribution to forest protection and they want to become profitable on their investment, they do not care about the communities and for the forest area.

About 54.79% of the respondents believed that the government should begin afforestation and spread of varies seeds of forest in each woreda. 53.64% of the households replied that the government should be facilitating training activities on the conservation of Sheka forest. About 64.75% of households expressed their view that the government should be employed workers by salary to protect the forest. Out of the sample respondents, 68.97% recommended that NGOs should be participating in the conservation of the forest by teaching and giving training, financial and material support to conservation of the forest.

3.4. Households Willingness to Pay for Forest Conservation

Based on the hypothetical market of Sheka forest, households were asked to state whether they are willing to pay or not for conservation of Sheka forest. The result shows that out of 275 respondents 261 (94.91%) were willing to pay the given bid amount, while the rest 14 (5.09%) were not willing to pay the given bid amount for forest conservation. The reasons of unwilling households were their economic condition and also they assume that it is government obligation to conserve the forest.

In line with this, in this study there were three initial bid values (15, 30, and 40), among this values the respondents were asked to state their willingness to pay by giving the randomly offered initial bids in equal proportion. In this case, if the respondents accept the randomly offered initial bid, the follow up bid was doubled and if they were not accept the initial bid the follow up bid became halved.

Table 3: Households Willingness to Pay for the First and Follow up Bid Value

	$WTPBID_1$		$WTPBID_2$	
WTP	Number	Percentage	Number	Percentage
Yes	225	86.21	200	76.63
No	36	13.79	61	23.37
Total	261	100	261	100

Source: Own Survey, 2017

As a result, 225(86.21%) of the households accept the randomly offered initial bid and the remaining 36(13.79%) were not willing to pay the initial bid. In addition, 200(76.63) of the households willing to pay the follow up bid value, the remaining 61(23.37%) were not willing to pay the follow up bid value for conservation of forest.

In open-ended questions, households were also asked to state their maximum willingness to pay for forest conservation.

The mean maximum willingness to pay for forest conservation:

$$MeanMWTP = \frac{\sum MWTP}{n}$$

MeanMWTP= 12330/261= 47.24 ETB

Where, Mean MWTP is mean maximum willingness to pay, $\sum MWTP$ is summation of maximum willingness to pay of the sampled respondent and n is number of sampled respondents. The mean willingness to pay for the sampled respondents is 47.24 ETB per household per year, which ranges from a minimum of 10 to a maximum of 95ETB from open-ended question.

3.5. Econometric Analysis

Probit Model

In addition to the descriptive analysis, the econometric analysis used to identify the major determinants of households' willingness to pay and to estimate the coefficient of socio-economic variables that affect households' willingness to pay for forest conservation. Before we estimate willingness to pay, we must test the problem of multicollinearity. Multicollinearty means the existence of a perfect linear relationship between some or all of explanatory variables of the model (Guiarati, 2004). Multicollineartiy becomes a serious problem if the correlation coefficient is 0.8 or above. Based on this there is no problem of multicollinearity on our data. To avoid the problem of heteroscedasticity we use robust estimation.

The estimation results of the probit model used only to recognize the variables are statistically significance and to show the direction of the consequence of explanatory variables on the willingness to pay (Green, 1993). The marginal effects show the probability of respondents accepting or rejecting the offered bid amount due to a unit change in continuous explanatory variables and a change of dummy variables from 0 to 1 for discrete variables (Tamirat, 2014).

Before estimating the coefficient of the variables, multicollinearity test was presented to test if there were a problem of multicollinearity between explanatory variables. The result of continuous variables showed that there were no multicollinearity problems between the variables and the result of VIF were less than 10. To test the problem of multicollinearity between dummy variables we show the contingency coefficient. The result showed that the contingency coefficient of dummy variables were less than 0.8. According to the result, there was no multicollinearty problem on our model.

To test the overall significance of the model the chi-square distribution was used in this study. The result shows that the probability of the chi-square (χ^2) distributions was 126.48 with 2 degree of freedom less than the tabulated counterfactual is 0.0000. This means the variables explaining the willingness to pay for conservation of the forest fits the probit model at 5% probability level. The data fits the model in a good way.

Household's income has a positive relation with the willingness to pay and statistically significant at 5% level of significance. Other things remain constant the marginal effect shows that a one-birr increase in income will increase the probability of accepting the proposed initial bid by 0.0034%. This indicates that households with higher average income have more willingness to pay. The result is consistent with the work done by (Belay, 2015) and (Yibeltal, 2011).

The result of probit model shows that the initial bid level affects household's willingness to pay at 5% level of significance, with a negative sigh which indicates that the increase of initial bid reduces the probability that households are accepting the proposed bid price. Other things remain constant; a one-birr increase in the bid amount will decrease the probability of accepting the proposed bid price by 0.80%. Environmental opinion is the other determinants of household's willingness to pay. It is statistically significant at 5% level of significance. Household's who have a positive environmental opinion are more willing to pay. For households who has positive environmental opinion the probability of willingness to pay for accepting the proposed bid level increases by 14.60 %, citrus paribus.

The other determinant factor was education level. The variable education has a positive relation with the willingness to pay and statistically significant at 5% level of significance. Households who have attained their formal education were found to have high willingness to pay for conservation of forest. This happened because of education increase the environmental awareness of the individual. Other things remain constant; the marginal effect shows that the level of education increase by one will increase the probability of accepting the proposed initial bid by 15.9%.

Table 3: Estimated Coefficients and Marginal Effects of the Probit Model

Number of obs. = 26147 Prob > chi^2 = 0.0000
Wald chi2(7) = 54.47 Pseudo R2 = 0.5697

Variables	Coefficient	Robust std.Err	P>|z|	dy/dx
BID_1	-0.1347641	0.0405518	0.001	-0.0080349
EDUC	1.23568	0.3864624	0.001	0.158526
HHINC	0.0005728	0.0002385	0.016	0.0000342
HHSIZE	-0.0296214	0.065897	0.653	-0.0017661
HHSEX	0.5222744	0.3945811	0.186	0.0449586
ENVOPI	1.168145	0.5121616	0.023	0.1461427
FORBEN	1.127989	0.2914424	0.000	0.1311647
-CONSTANT	0.4536271	0.5185001	0.382	

Log pseudoliklihood = -45.057882 LR chi2(2) = 126.48 Prob > chi2 = 0.0000
dy/dx= is for discrete change of dummy variable from 0 to 1

Source: Own Survey, 2017

Forest benefit and willingness to pay has positive relation and statistically significance at 5% level of significance. The household who benefits from the forest has positive willingness to pay for forest conservation because they want to increase their benefits by conserving the forest area. Other things remain constant, the result of marginal effect shows that the increase of forest benefits increase the probability of willingness to pay for forest conservation by 13.12%.

Bivariate Probit Model and Discussion

A robust seemingly unrelated bivariate probit model was used to analyze the explanatory variables which affect household's willingness to pay for the conservation of Sheka forest. To employ this model first we check if there a correlation between error terms. The result of rho showed that the correlation coefficient is different from zero and statistically significant at 5% level of significance, so we can employ seemingly unrelated bivariate probit model.

Forest Benefit: is one of the variables that affect household's willingness to pay. This variable had a positive relation with households' willingness to pay and statistically significant at 5% level of significance in both equations. This might be because household heads who are beneficiary by the forest may be willing to pay forest conservation to increase his/her benefits. The marginal effect result shows that households who benefits from the forest about conservation of forest would increase the probability of willingness to pay by 0.68%.

Households Income: is the other variable which had a positive relation to households' willingness to pay in both equations and statistically significant at 5% level of significance. The result is related with the basic economic theory, which states that households demand for goods or services positively related with income level. Other things remaining constant, the result of marginal effect shows that an increase of household's income by one birr increases the probability of household's willingness to pay for conservation of forest by 0.02%.

Table 4: Bivariate Probit Model Estimation

Seemingly unrelated bivariate probit			Number of obs = 261	
Log pseudolikelihood = -123.90163		Wald chi2(14) = 158.43	Prob > chi2 = 0.0000	
Variable	WTP initial bid		WTP second bid	
	Coefficient	Robust std.Err	Coefficient	Robust std.Err
BID_1 / BID_2	-0.1204422	0.0409761	-0.0819722	0.0187795
EDUC	1.037485	0.4152328	-0.0819722	0.0187795
HHINC	0.0006026	0.0002794	0.0007789	0.0002757
HHSIZE	-0.0271147	0.059128	-0.0100291	0.0587586
HHSEX	0.5220489	0.3232006	-0.6706273	0.3773287
ENVOPI	1.012692	0.503089	-0.3528335	0.3944734
FORBEN	0.9560912	0.2966824	-0.7781933	0.3971269
CONSTANT	0.2974999	0.5225756	2.318363	0.6164265
rho	-1	7.66e-13		

Source: Own Survey, 2017

BID_1 / BID_2 = BID_1 is for first equation whereas BID_2 is for second equation

Household Sex: is the other variable which has a negative relation with household's willingness to pay for the second equation and statistically significant at 5% level of significance, but the variable was statistically insignificant for first equation.

BID: the amount of the initial and the follow-up bids as expected has a negative relation with households' willingness to pay and statistically significant at 5% level of significance. The negative sigh showed that as the amount of bids value increase by one birr, the probability of households' willingness to pay for the given bid amount decrease. The result is inconformity with the studies done by Adugna (2013) and Mekdes (2014).

Education: respondents' education level and willingness to pay for forest conservation had a positive relation and statistically significant at 95% level of significance. This might be because education increase peoples' awareness about conservation and protection of forest. Other things remain constant; the result of marginal effect shows that as education level increase, the probability of household's willingness to pay increase by 81.96%.

Environmental Opinion: has a positive relation with households' willingness to pay and statistically significant at 5% level of significance for the first equations, but it is statistically insignificant in equation two.

Tobit Model and Discussion

This model is used to estimate mean maximum willingness to pay for open-ended question. As shown on table 5 the p-value is equal to 0.0000; this implies the model is overall significance. In this model initial bid, education level, household's income and sex of household were statistically significant, the remaining 3 variables environmental opinion, forest benefits, and the number of a family were statistically insignificant.

As the results of Tobit model household's average income and maximum willingness to pay has a positive relation and statistically significant at 95% level of significance. Other things remain constant if the households' average monthly income increase by one birr, maximum willingness to pay increased by 1.18%. This is theoretically valid and acceptance.

The other factor which affects maximum willingness to pay is sex of household head. This is a dummy variable that takes 1 if the household head is male, and 0 otherwise, it has a positive and significant relation with maximum willingness to pay and significant at 5% level of significance. Other things remain constant; male household head has high maximum willingness to pay than female household head. Education level of the household heads is one of the major determinants of household's maximum willingness to pay for forest conservation. The amount of initial bid has a positive relation with maximum willingness to pay for forest conservation.

Table 5: Estimated Result of Tobit model

Number of obs = 261		Prob > F = 0.0000	
F(7, 254) = 383.22		Pseudo R2 = 0.2642	
Variables	coefficient	robust Std.Error	P>|t|
BID1	0.5868823	0.1464746	0.000
EDUC	14.74705	2.155088	0.000
HHINC	0.0118157	0.0013136	0.000
HHSIZE	0.2844168	0.31671	0.370
HHSEX	3.508468	1.586379	0.028
ENVOPI	-2.026791	1.672825	0.227
FORBEN	1.389288	1.712766	0.418
CONSTANT	-16.63784	2.787511	0.000

Source: Own Survey, 2017

Validity Test of Contingent Valuation Results

Construct validity test: also referred as theoretical validity test. According to the result of the study, household income and willingness to pay has a positive relation as prior expectations. This is related to the theory of demand, which states that other things remain constant there is a positive relationship between income and price. As prior expectation, randomly offered initial bids and willingness to pay has negative relation

Protest rate: to minimize the problem of protest bids all actions made throughout the design of survey questions, so the response rate is high. Out of 275 sample respondents only 14 were not willing to pay for forest conservation.

3.6. Estimation of Mean Willingness to Pay

The main objective of double bounded dichotomous choice format was to estimate total willingness to pay of respondents for the conservation of forest. We compute mean and/or median willingness to pay by using stata application based on Krinsky and Robb procedure.

Table 6: Estimation result of mean WTP from Probit and bivariate model: Krinsky and Robb (95%)

Measure	WTP	LB	UB	ASL*	CI/MEAN
Mean/Median(Probit)	39.07	34.41	57.14	0.0004	0.58
Mean/Median(BID1)	39.65	34.11	66.78	0.0020	0.82
Mean/Median(BID2)	58.51	54.80	67.21	0.0000	0.21

*: Achieved Significance Level for testing H0: WTP<=0 vs. H1: WTP>0LB: Lower bound; UB: Upper boundLB: Lower bound; UB: Upper bound

Source: Own Survey, 2017

The aggregate WTP from probit model is 2,501,842.91ETB, 2,538,983.14ETB and 3,746,681.05ETB from bivariate probit model, and 3,025,007.91ETB from open ended response. Over 70% of the respondents want to pay this amount as voluntary denotation.

4. Conclusion and Policy Recommendation

Sheka forest is one of the few areas with high tropical rainforest cover in Ethiopia. The major aim of the study was to estimate households' willingness to pay (WTP) for the conservation of Sheka forest and to find the main determinants of households' willingness to pay. To achieve the objective of the study, contingent valuation method (CVM) was used by using double bound dichotomous questions followed by open-ended questions. The respondents stated that the current forest protection and conservation are not strict enough, 70 (26.82%) and 90 (34.48%) respondents replied that there is proper protection and they were not aware of any forest protection respectively.

The result shows that out of 275 respondents 261 (94.91%) were willing to pay the given bid amount, while the rest 14 (5.09%) were not willing to pay the given bid amount for forest. The Probit shows that four variables such as, education level, households income, environmental opinion, and forest benefit, were statistically significant at 5% level of significance and had a positive effects on the probability of households accepting the randomly offered initial bid, and the amount of bids were statistically significant at 5% level of significance and had negative effect on respondent's willingness to pay, and household size and sex of household were statistically insignificant.

According to the result of robust seemingly unrelated bivariate probit model forest benefit, households' income, and education level had a positive relation to households' willingness to pay in both equations and statistically significant. The amount of the initial and the follow-up bids has a negative relation with households' willingness to pay and statistically significant at 5% level of significance. Household sex is the other variable which has a negative relation with household's willingness to pay for the second equation and statistically significant at 5% level of significance, but the variable was statistically insignificant for first equation. To identify the major factors affecting households' maximum willingness to pay the Tobit model was used. In this model initial bid, education level, household's income and sex of household were statistically significant, the remaining three variables environmental opinion, forest benefits, and the number of a family were statistically insignificant.

The mean WTP for conservation of Sheka forest from probit model is 39.07 ETB and bivariate probit model is 39.65 ETB for first equation and 58.51 ETB per households per year for second equation. The aggregate WTP from probit model is 2,501,842.91 ETB, 2,538,983.14 ETB and 3,746,681.05 ETB from bivariate probit model, and 3,025,007.91 ETB from open ended response. Over 70% of the respondents want to pay this amount as voluntary denotation.

The study finally recommends that incorporating the local community into land use planning and forest management will be effective and attractive.

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