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Contingent Valuations of Indigenous Timber Tree Resources: The Case of Cheha District, Gurage Zone, Ethiopia

Temesgen Yibeltal (MSc.)
Department of Economics, Injibara University, Injibara, Ethiopia

Badasa Wolteji (PhD)
Department of Economics, Jimma University, Jimma, Ethiopia

Tesfaye Etensa (MSc.)*
Department of Economics, Wolkite University, Wolkite, Ethiopia

Mekdes Shewangza (MSc.)
Department of Economics, Wolkite University, Wolkite, Ethiopia

Abstract
Ethiopia has a variety of indigenous trees. Although indigenous timber tree resources have indispensible benefits for environmental balance and economic development, these trees are prone to extinction and degradation by the local peoples for different purposes in Cheha district. The main purpose of this research was to examine the values of commercial and non-commercial uses of indigenous timber tree resources. This study employed contingent valuation methods to elicit the household's willingness to pay for plantation of indigenous trees in Chehadistrict. Mostly primary data was used from a survey of 243 sample households. The study results revealed that mean WTP for the future plantation of indigenous timber tree resources from the double bounded dichotomous format of Seemingly Unrelated Bivariate Probit model was in the range of ETB 41.93827 to ETB 46.24 per person. The study result also revealed that total income of the household, sex of the respondent and training about forest conservation and protection had positive and significant effect on WTP for proposed plantation project. On the other hand, bid amount and distance of households home from the plantation project had negative and significant effects on WTP. Hence, urgent action and involvement of government and local cummunity should be necessary to protect and conserve endangered indigenous timber trees.
Keywords: Economic valuation, Indigenous timber trees, Seemingly Unrelated Bivariate Probit, Cheha, Ethiopia

1. Introduction

Human welfare from environmental improvement is determined by safety environment and economic productivity. Production always depends on extraction of environmental resources. As population growth increases, the demand for livelihood increases. Thus, increase in production through quality and quantities to meet the need of fast growing population. However, increase in production leads to environmental resource depletion, pollution and degradation in the form of deforestation, waste disposal and land degradation (Perman R., 2003). Economic growth is usually related with increasing the demand for environmental resources (EEP, 2015).

Environment provides a variety of services in the form of room for recreation, raw material for production, and other assimilative functions. Values of environmental services of trees are misplaced and trees rise gradually their benefits arise a long time. Open access to forest and forest areas and existence of mismanagement leads to excessive harvesting and over cultivation of forests. Extensive increases in manufacture of many goods could create imbalances and prices below market value. Conservation and protection strategies of forests are need to realize through investigations of commercial and non commercial values of commodities and services of forest resources. Thus, in turn this helps to measure the household's welfare through their willingness to pay. However, all values of commodities and services of forest resources are not incorporated in households' welfare measures due to exclusions of non market values. Therefore, both market and non market values of tree resources are essential for understanding and estimating of household's willingness to pay (Bann, 2008). However, much of their values are not assigned due to extensive market and policy failures. We can assign value for natural environment through benefits they provide in present and future. Valuations of environmental resources that we assign are determinants of decisions and policies that in turn influences natural environment. More substantial and reliable valuations can provide better decisions for environmental resource utilization and conservation policies (Clough, 2013).

Forests and forest management have altered significantly over the previous 25 years. The amount of the world's forest continues to decline as human populations continue to rise and demand for food and land increases, though the rate of net forest loss has been slash by above 50 percent. At this period, the attention paid to sustainable forest management has never been higher: more land is chosen as permanent forest, more measurement, monitoring, reporting, planning and stakeholder participation is happened, and the legal framework for sustaining forest

management is almost common. Larger areas are being designated for conservation of biodiversity at the same time as forests are meeting increasing demand for forest products and services. Thus, significant development has been made towards reversing the general trend of forest area degradation. However, deforestation (including unrestrained conversion of forests to agricultural land), continues at an alarmingly high rate in many countries. Significant efforts are needed to ensure the general trend in scope of forest resources is positive or stable in all regions (FAO, 2015).

Indigenous tree resources have significant social, economic and ecological functions such as nutritional benefits, controlling erosion, shade, traditional medicines, serve as recreational benefit, household income, serve as environmental balance by afford sinks for carbon dioxide and methane at the edge between the decaying fallen leaves and the soil and are a source of biodiversity. However, these indigenous trees are become to extinct by increasing local communities demand for these trees in the form of fuel woods, traditional medicines and other services (Takele Geta, 2014).

Deforestation is the major severe worldwide environmental problem. Agricultural extension, wood extraction and infrastructure redevelopment are aggravated deforestation in developing countries. Population growth, poverty, and low economic growth have contributed a significant role to forest depletion and environmental degradations (FAO, 2015).

In Africa land degradation is the most crucial problems due to intensive farming and deforestation. Deforestation adds to the greenhouse effect, destroys habitats that sustain biodiversity, affects the hydrological cycle and increases soil erosion, overflow, flooding and landslides (Litman, 2016). It is also a serious problem in Ethiopia. Deforestation with expansion of agriculture into marginal areas aggravated land degradation problem in Ethiopia (Melaku, 2013). Particularly, in South nation nationalities and peoples region (SNNPR), land degradation in the form of soil erosion is driven by deforestation. Thus, effective and sustainable land management should be designed to compact this problem (Genene Tsegaye and Abiy G/Michael, 2014).

Previously, few studies were conducted on valuations of forest resources in Ethiopia ((Alemu and Agbeja, 2011); (Mohamed, 2011); (Dambala and Steven, 2012); (Negewo, 2016). However, there is no study conducted on indigenous trees. Moreover, almost all of the above studies were conducted on valuations of forest resources using either single bounded dichotomous choice or open ended elicitation format. However, this study was conducted using double bounded dichotomous choice followed by open ended elicitation format of Seemingly Unrelated Bivariate Probit model to elicits household's willingness to pay for the indigenous timber tree resources. Therefore, the main objective of the study was to examine the household willingness to pay for commercial and non-commercial uses of indigenous timber tree resources and its determinants by taking Cheha district as case study.

2. Research methodology

2.1. Description of the Study Area

The study was undertaken in Chehadistrict, which is one of the 13 districts in Gurage zone, Southern Nations, Nationalities and Peoples Region (SNNPR), Western part of Central Ethiopia. This district is bordered by Abeshige wereda in the northwest, Oromiya region in the southwest, Ezhadistrict in the north, EnerMuhr district in the south, and Gumerdistrict in the east. It is found 30, 237 and 185 kms far away from Wolkitie, Hawasa and Adis Ababa respectively. This district divided into 41 kebele administrations (39 and 2 kebeles in rural and towns, respectively). The capital of this district is Endeber. The natural topography of this district includes mountainous high lands (40%), flat lands (60%) and forest covered lands (13.56%). It is mainly characterized by Weyna Dega climate (i.e 71% , 7%, 20% and 2% of the area of wereda characterized moist Weyna Dega, Dega, dry Weyna Dega, and Kola respectively).

The area of this district is estimated to be 440.72 km^2. According to Gurage Zone Finance and Economic Development Department (2017), based on 2007, population projection, the total population size of the district is estimated to be 150,805 (9% of total population of Gurage zone). Population distribution of the district is 73,974 (49.1%) male and 76,831 (50.9%) female. 90.9% of the population lives in rural areas and practicing of agricultural way life. Agriculture in this district generally reliant on rain fed and traditional farming system.

According to Gurage Zone Rural and Agricultural Development Office (2017) report, the district is endowed with many indigenous tree species. This study was focused on four indigenous timber trees i.e "Yabesha-Tid (juniperusprocera)", "Girar (acacia Abyssinica)", "Zigba (yellow wood)" and "Wanza (cordial africana)". This District was selected due to indigenous trees are more concentrated within the District and serious problem associated with them.

2.2. Data type, Sources and Methods of Data Collection

This study used primary cross-sectional data for 2017which was collected from rural households of Cheha district in Gurage zone through contingent valuation survey using face-to-face personal interviews, and supported by Focus Group Discussion (FGD) to generate qualitative information on the pre-test. This study also used secondary

data from Agricultural and Natural Resource Bureau, and Finance and Economic Development Department (2017), of Gurage zone.

The study was used quantitative and qualitative CV survey method to collect data on households' willingness to pay for indigenous timber tree resources in Cheha district. This study employed double bounded elicitation format with an open ended follow up question using a face-to face interview. Data were collected by four trained enumerators. A pre-test of the draft questionnaire was done on 20 households in order to determine sets of bids, and to select appropriate wording and ordering of questions. Respondents were asked whether they are willing to pay particular birr amount and contributions other than money in terms of kind or labor for the proposed plantation project established in the future. The starting bid was set based on the pilot survey of 20, 30 and 50 birr. The starting bids was set 25, 50 and 75 birr.

2.3. Sampling Techniques and size

The study was simple random sampling to avoid selection bias, and climate and population homogeneity of the wereda that enforce to take small sample (nine kebeles). The researcher obtains estimated population number of 31,669 exist in these kebeles of the district. Then, sampled households were selected from these kebeles using simple random sampling method. The following formula was used for sample size determination in case of finite population (Kotari, 2004).

$$n = \frac{z^2 * p * q * N}{e^2 (N-1) + z^2 * p * q}$$

Where: n=Sample Size; Z = abscissa of normal curves that cuts off an area α at the tails; (1- α) always at confidence level of 95% (it is conventional z=1.96 per table); *e* = margin of error that is generally the plus-or-minus figure usually expressed as decimal (±0.05); the estimate should be within 5% of true value (the desired level). The researcher wants to be 95 percent confident that the percentage is estimated to be within ±5% of the true value; N=Population (i.e. 31,669 obtained from Finance and Economic Development Department of Cheha district in 2017; *p* = success for each households to be included in the sample (in proportion to one); *q= 1-p (*failure for each households to be included in the sample); However, *p* value that represents the proportion of defectives in the universe is not given. If it assumed to be p= 0.8, then 1-p=0.2. This was based on the previous study (Mohamed, 2011)

By inserting in the above formula, the desirable sample was 243 which were used for this study and selected using simple random sampling techniques.

2.4 Econometric model specification

The respondents answer separate questions to accept or reject a fixed bid for a specified environmental quality improvement. The single bounded dichotomous choice format method is only associated with one question to one answer (yes or no). It is take-it or leave-it without follow up questions that relates with one round bidding. On the other hand, the double bounded dichotomous choice format had been used by Hanemann (1991) for the first time. It is take-it or leave-it with follow up questions that concerned in two rounds of bidding (first and second bid amount questions). Actually, if a respondent revealed a willingness to pay for the first presented bid, the second threshold is about the original amount. If the respondent is unwilling to pay the first offered bid, the second threshold is reduced to about half the first bid (Cameron and Quiggin, 1994).

Double bounded dichotomous choice format provides statistically more efficient estimates than single bounded dichotomous choice format because the latter requires a larger sample to reach a specified level of accuracy ***(Hanemann, 1991)***.

(Hanemann, 1991) had been proposed various models to estimate welfare functions and measures based on the difference in indirect utility functions. Hanemann was adopted these models for the same purpose, but based on the difference in cost functions. Bivirate normal probability density functions allow for a nonzero correlation unlike usual logistic distribution (Cameron and Quiggin, 1994). In double bounded dichotomous format respondents asked about their WTP to accept or reject a proposed bid for environmental quality improvement. There are four possible outcomes (yes-yes, yes-no, no-yes and no-no) since a respondent is offered two bids.

The model for double bounded dichotomious choice question format is given as follows:

$$\mathrm{WTPij} = \eta_i + \varepsilon_{ij}$$

$$I = 1 \text{ if } \mathrm{y_i} \geq \mathrm{t_i}$$

$$I = 0 \text{ if } \mathrm{y_i} < \mathrm{t_i}$$

Where: WTPij= willingness to pay for jth respondent and i=1, 2 (denotes 1st and 2nd questions)

$\eta i =$ means for responses

ti =the offered threshold, assigned arbitrarily to the i[th] respondent

I=discrete response of a respondent for the WTP question (1=yes, 0=no) and ε_{ij} = error term

Respondents characteristics influence the means is permissible by setting

$$\eta_i = X_{ij}\beta_i$$

Thus, $WTP_{ij} = X_{ij}\beta_i + \varepsilon_{ij}$

Where: Xi = observable attributes of the respondent and $\beta i =$ a coefficient for X; The j[th] contribution to the likelihood function for the discrete choice model is given as follows (Haab and McConnell, 2002).

$$L_j(\eta_i / t) = \text{pr}(\eta_1 + \varepsilon_{1j} \geq t_1, \eta_2 + \varepsilon_{2j} < t_2)\text{YN}^* \text{pr}(\eta_1 + \varepsilon_{1j} \geq t_1, \eta_2 + \varepsilon_{2j} \geq t_2)\text{YY}^*$$

$$\text{pr}(\eta_1 + \varepsilon_{1j} < t_1, \eta_2 + \varepsilon_{2j} < t_2)\text{NN}^* \text{pr}(\eta_1 + \varepsilon_{1j} < t_1, \eta_2 + \varepsilon_{2j} \geq t_2)\text{NY}^*$$

Where: YY = 1 for yes − yes response, 0 otherwise ; NY = 1 for no − yes response, 0 otherwise ; YN = 1 for yes − no response, 0 otherwise; NN = 1 for no − no response, 0 otherwise ; $t1\ and t2 =$ the first and the second offered thresholds , assigned arbitrarily to the ith respondent.

By assuming normal distributions of $\varepsilon ij \sim (0, \sigma 2)$ and $WTPij \sim (\eta i, \sigma i2)$, the j[th] contribution to the bivariate probit likelihood function is given as follows.

$$Lj(\eta i / t) = \omega\varepsilon 1\varepsilon 2(q1j((t1 - \eta 1/\sigma 1), q2j((t2 - \eta 2/\sigma 2), q1jq2j\rho)$$

Where:

$\omega\varepsilon 1\varepsilon 2 =$ standardized bivariate normal distribution function with zero means

q1j = 2y1j − 1 and q2j = 2y2j − 1

y1j = 1 if the yes response for the 1st question and 0 otherwise

y2j = 1if the yes response for the 2nd question and 0 otherwise

ρ = correlation coefficient and δ1 &δ2

= standard deviation for the errors

By using maximum likelihood the model becomes linear. Stata version 13.00 was employed to analysis the result.

3. Results and discussions

As indicating in table 4.1, from the total sample households of 243, about 70.4% of respondents were willing to pay for the proposed plantation project and 29.6% of respondents were not willing to pay at all. Besides, 49.1% of willing respondents were willing to contribute labor and also willing to pay cash for the proposed project. However, 50.9% of willing respondents were willing to pay cash but not willing to contribute labor. As indicated in table 4.2 below, most sample households were accept low bid. As bid amounts increases from 25 to 75, yes responses of respondents were declined and vice versa.

As shown in table 4.3, About 19.75% of sample households were responded yes-yes for the first and second bid. About 25.51% of sample households were responded yes- no for the first and second bids. The subjects to no-yes joint responses were 25.10% and 29.63% of respondents were responded no-no for both bids (see table 4.3). About 9.5% respondents were not willing to pay at all.

This part of analysis was taken seemingly unrelated bivariate probit model regressions to determine factors that influence WTP and calculating mean and maximum willingness to pay (table 4.4a and 4.4b). According to (Gujarati, 1998)Gujarati (1998) rule of thumb for multicolinearity problem, multicolinearity is a serious problem when the coefficient between two indipendent variable is ≥0.8. The explanatory variables were tested for the existence of serious multicollinearity problem. The genarated correlation coefficients and variance inflation factor (VIF) indicates that there is no serious multicollinearity problem. Therefore, all explanatory variables were included in the model. A likelihood ratio test is conducted to test the independence of restricted and unrestricted probit results and Wald test for 13 degree of freedom is 117.30 for probit. A likelihood ratio is calculated as follows. LR= 2(LogLu- LogLr)= 2(-75.212064-(-167.14648)=183.868832

Using degree of freedom 13 we get LC 22.3621. The calculated LR is greater than critical value. Thus, the

data is fitted to the model. The bivariate probit model with Prob> chi2 = 0.0312 was statistically significance at 5% level. This estimated chi2 is lower than the critical value. Thus, there is no endogeniety problem in the model. Hetroscadesticity is an evident problem in cross section data manipulation. Robust standard error was used to correct this problem.

3.1 Factor affecting WTP for indigenous timber tree resources

A robust seemingly unrelated bivariate probit model was used to analyze the explanatory variables that affect households WTP for the indigenous timber tree resources. Explanatory variables were discused as follows.

Total incomes of the household (tinch): The total income of the household was affect positively and significantly the willingness to pay of the respondents for the first and the second bids at 1% significance levels. the result of marginal effect indicated that a one birr increase in the annual total incomes of the household, increases the probability of willingness to pay of the respondent for the proposed plantation project in both bids by 0.1% keeping other factors constant. This implies that the households who have more income are willing to pay more. This result is in line with the Adugna (2013) though heused the income from agricultural activities instead of total income.

Sex of Respondents (sexr): It was affect posetively and significantly the willingness to pay of respondents for the first and the second bids at 1% significance levels. This may be indigenous timber trees are mainly used for fuel; construction and making of goods that male respondents take part more in conservation of these trees. The results of marginal effect showed that being male respondents will increase the probability of willingness to pay of the household for both the first and second bids by 15.4%, keeping other factors constant.

Distance from the household's home to proposed plantation site (disth): It was affect the willingness to pay of respondents for both bids negatively and significantlyat 1% significance levels.Since the distance of the household is far away from plantation site, the accessibility of benefits from the site expected to decrease. So households live at a long distance from proposed plantation site were less willing topay for the proposed plantation site development.This result is in line with (Solomon, 2004) The marginal effect results indicated that the distance of respondents house far away from the proposed plantation project by one kilo meter decreases the probability of accepting the first bid values by 6.8%,keeping other factors constan

Training on conservation and protection forest resource (train): It was affect the willingness to pay of respondents for both bids posetively and significantly at 5% level of significant.This may due to households who have got training will have awareness on forest resource conservation and they were willing to pay more for proposed plantation project.This result is in line with (Solomon, 2004) and (Adugna, 2013). The marginal effectresult showed that training on the forest resource conservation and protection willincrease the probability of WTP of respondents by 12.5%.

Bid amount (bid): It was affect the willingness to pay of respondents for both bids negatively and significantly at 1% of significance level. It is obvious that the proposed threshold price increases, the respondents would be less willing toaccept the bid amount. The result of marginal effect showed that increases the bid amount by one birr, decreases the probability of willingness to pay for plantation project by 0.6%, keeping other factors constant.

3.2. Mean/ maximum WTP for indigenous timber tree resources

The mean WTP was estimated for all models using (Krinsky and Robby, 1986) mean willingness to pay estimation method using 'STATA13.0' wtpcikr.

As indicated in table 4.5, the mean WTP for open ended was (ETB 41.93827) per personwhich is less than but nearer to the WTP founded usingthe close ended format (ETB46.24). Therefore, the mean WTP for the future plantations of indigenous timber tree resources is in the range of ETB41.93827 – ETB 46.24 per person.Therefore, the annual aggeragate mean WTP for plantation of indigenous timber trees are founded to be in the range of ETB1,328,143.1-ETB1,464,374.56.

4. Conclusion and Policy Implication

Indigenous timber trees are important to meet countries sustainable development in terms of their many benefits. The study concluded that these trees are important to environmental balance; ensure food security problems, construction and building, aesthetic beauty and fresh air. All most all of the respondents agreed the usefulness of indigenous timber trees for environmental balance. However, degradation of these trees is rising time to time and prone to danger of extinct. Therefore, active participation of households for conservation and protection of indigenous timber trees is important. Soil erosion and deforestation were the prior and serious environmental problem in the study area. More than 50% respondents were taken deforestation as the prior environmental problem. More than 42% of sample households were concerned about the environment.

Cross-sectional data obtained from contingent valuation face-to-face survey interveiw of 243 sample households were used in this study. These respondents were selected from nine kebeles of Cheha District using

random sampling method. This study used double bounded dichotomous choice elicitation format to elicit the households WTP. Seemingly unrelated bivariate probit were applied for analysis of data.

Contingent valuation WTP survey results showed that from the total sample households of 243, about 70.4% of respondents are willing to pay for the proposed plantation project and 29.6% of respondents are not willing to pay at all. Besides, 49.1% of willing respondents are willing to contribute labor and also willing to pay cash for the proposed project. However, 50.9% of willing respondents are willing to pay cash but not willing to contribute labor. The study revealed low family budget was the most important reason for non willing respondents at all. The most influencing factor for these repondents was distance of project from the respondents house.

The average and maximum willingness to pay for the plantation project wereETB41.9 and ETB300, respectively. The Seemingly unrelated bivariate probit results revealed that mean WTP for the future plantations of indigenous timber tree resources was in the range of ETB 41.93827 – ETB 46.24 per month per person. Therefore, the annual aggeragate mean WTP for plantation of indigenous timber trees are founded to be in the range of ETB 1,328,143.1- ETB 1,464,374.56.

The study results also revealed that total income of households, sex of respondents and training about forest conservation and protections had positive and significant effect on WTP for proposed plantation projects while bid amount and distance of households home from the plantation project had negative and significant effects on WTP. Generally, the involvement of government and local people participation is crucial for conservation and protection of indigenous timber trees. This study focused on the conservational values of indigenous timber trees. Therefore, special focuses are required through further studies on environmental protection and quality improvement of all tree species.

The following policy implication were presented based on the study results.

- The study results indicated that most of sample households are concerned and willing to contribute for plantations of indigenous timber trees. Therfore, any program considered to conservation of indigenous trees should be based on the joint participation of local peoples and government. This is important for sustainable and efficient utilization of forest resources.
- As the study result indicated sex of respondent were influenced WTP posetively and significant strongly. Thus, indicated that males were more concerned about plantation of indigenous trees. As a result, Government should give a special focuses for females in terms of participation in conservation and protections of forest resources.
- The study result revealed income affected WTP of the households posetively and significantly. Thus, the wealthy households were contribute more in terms of cash. However, every body should be contribute for the conservation of endangered timber tree resources.
- The study result revealed households training participation affected WTP of the households posetively and significantly. Government should be give a special attentionand facilitate trainning opportunities for local peoples about environmental resource conservation and protection.
- The study result revealed that distance of respondents house from plantation site was affect WTP negatively and significantly. Thus, government should be promote and facilitate plantation site around each kebeles through expandingcredit access to local peoples for forest resource protection and conservation.

References

Adugna. (2013). Determinants of Willingness to Pay for Conservation and Rehabilation of Bamboo forest: the case of Bambasi District, Benshangul Gumuz, Ethiopia. *Masterthesis of Haramaya University, Ethiopia* .

Alemu and Agbeja. (2011). deforestation and endangered indigenous tree species in South-West Nigeria . . *University of Ibadan, Nigeria.*

Bann. (2008). *The economic valuation of tropical forest.* Southeast Asia.

Cameron and Quiggin. (1994). estimation using contingent valuation data from a dichotomous choice with follow-up questionnaire. *journal of environmental economics and management* , 218-234.

Clough, H. a. (2013). *Valuing natural assets.* Wellington: New Zealand.

Dambala and Steven. (2012). contingent valuations of community forestry program in Ethiopia: observing preference anomalies in double bounded contingent valuation method. *University of Pretoria, South Africa* .

EEP. (2015). *Valuing forests.* London, United Kingdom.

FAO. (2015). *Country report.* Rome, Italy.

Genene Tsegaye and Abiy G/Michael. (2014). Review on overall status of soil and water conservation system and its constraints in different agro-ecology of southern Ethiopia. *Journal of natural science research* , vol.4, No.7.

Gujarati. (1998). Basic Econometrics (second ed.). *New York: MacGraw Hill international* .

Haab and McConnell. (2002). *valuing environmental and natural resources: econometrics of non market valuation.* Northhampton: Edward Elgar publishing.

Hanemann, L. a. (1991). Statistical efficiency of double bounded dichotomous choice contingent valuation. *American journal of agricaltural economics* , 1255-1263.

Krinsky and Robby. (1986). Krinsky, I. and Robb, A. (1986). On approximating to the estimation of welfare measures in discrete responsevaluation studies. *The Review of economics and statistics, 68(4):* , 715-719.

Litman. (2016). *Considering the impacts, benefits and costs of different land use development patterns.* Victoria.

Melaku. (2013). Sustainable land managment program in Ethiopia. *power point presentation prepared by national program coordinator of sustainable land managment program.* Hawasa, Ethiopia.

Mohamed. (2011). Peceptions of local community towards deforestation . . *Master thesis at Addis Ababa University* .

Negewo. (2016). economic valuation of forest conserved by local community for carbon sequestration: the case of Humbo community assisted natural regeneration afforestation/ reforestation carbon sequetration project. *Hawasa university, Ethiopia.*

Perman R., M. Y. (2003). *Natural resource and environmental economics.* Edinburgh: Longman, 2nd edition.

Solomon. (2004). Contingent valuation of multi-purpose trees. Msc thesis, AAU, Ethiopia. *Master thesis at Addis Ababa University, Ethiopia* .

Takele Geta, L. N. (2014). Ecological and socio-economic importance of indigenous multi-purpose fodder trees. *Jigjiga university, Jigjiga, Ethiopia.*

Table 4.1: Distribution of willing and non-willing respondents

Means of payment	**cash in birr**	**%**	**labor in man day**	**%**
No of willing respondents	171	70.4	108	44.4
No of non-willing respondents	72	29.6	135	55.6
Total	243	100	243	100

Source: Computed from survey data (2017)

Table 4.2: Frequency of WTP bids

Bids	**Freq.**	**Percent (%)**	**Yes**	**No**
25	81	33.33	55 (67.9%)	26 (32.1%)
50	81	33.33	40 (49.4%)	41 (50.6%)
75	81	33.33	13 (16.1%)	68 (83.9%)

Source: Own survey (2017)

Table 4.3: Joint frequency of discrete response for cash

Joint responses	**Frequency**	**%**
Yes-Yes	48	19.75
Yes-No	62	25.51
No-Yes	61	25.1
No-No	72	29.63

Source: Own survey (2017)

Table 4.4a: Result of Seemingly unrelated bivariate probit and marginal effects

Number of obs = 243
Wald chi2(26) = 118.41
Log likelihood = -192.18006 Prob > chi2 = 0.0000

	wtp1			wtp2		
	Coef.	Robust Std. Err.	P>|z|	Coef.	Robust Std. Err.	P>|z|
ibid /bid2	-.0359414	.0064718	0.000	-.0153709	.006558	0.019
tinch	.0032692	.0009125	0.000	.0023422	.0007481	0.002
ager	-.0283725	.0174053	0.103	-.0041771	.0133231	0.754
sexr	1.402682	.2837718	0.000	-.3286202	.2290391	0.151
edr	.0147093	.0360045	0.683	.0435897	.0280194	0.120
famsr	-.0833954	.082567	0.312	.0274328	.0618173	0.657
dpr	-.0868379	.1501417	0.563	.0905333	.1203134	0.452
disth	-.3293081	.1292188	0.011	-.0934706	.0918442	0.309
lives	.0272189	.1087588	0.802	.0554423	.0796835	0.487
noind	-.0756298	.0607759	0.213	-.1152861	.0467668	0.014
train	.5065912	.2395164	0.034	.2677751	.1995467	0.180
tlo	-.2396385	.2330229	0.304	.427905	.1840876	0.020
acc	.2471564	.2598364	0.342	-.0057277	.2019518	-0.03
_cons	4.809364	1.806518	0.008	.1151856	1.271543	0.09
athrho	-.646642	.3109461	0.038			
rho	-.5694051	.2101305				

Source: Own computation (2017)

Table 4.4b: Marginal effects after seemingly unrelated bivariate probit results

y = Pr(wtp1=1,wtp2=1) (predict)
= .10900358

variable	marginal effects	Std. Err.
ibid	-.0058128	.00137
tinch	.0009042	.00028
ager	-.0052583	.00342
sexr	.1541533	.05306
edr	.0093669	.00681
famsr	-.0090897	.01507
dpr	.0004694	.02787
disth	-.0682435	.02506
lives	.0132902	.01964
noind	-.0307134	.01209
train	.1246584	.04758
tlo	.0298419	.04443
acc	.0379347	.04423
bid2	-.0024641	.00124

Source: Own computation (2017)

Table 4.5: Mean/maximum WTP for the first and second bid Krinsky and Robb (95 %) Confidence Interval for WTP measures (Nb of reps: 5000 and Equation: WTP1)

	Obs	Mean	Std. Dev.	Min	Max
Maximum WTP	243	41.93827	42.89484	0	300

MEASURE	WTP	LB	UB	ASL* CI/MEAN
MEAN/MEDIAN for WTP1	46.24	37.95	53.46	0.0000 0.34
MEAN/MEDIAN for WTP2	44.26	9.19	58.97	0.0170 1.12

Source: Own survey, 2017