CONTINGENT VALUATION OF COMMUNITY PLANTATIONS IN ETHIOPIA: A LOOK INTO VALUE ELICITATION FORMATS AND INTRA-HOUSEHOLD RESOURCE ALLOCATION DECISION

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Abstract

This paper is an application of the contingent valuation method on community plantations in the highlands of Ethiopia. A discrete-continuous elicitation format was applied. It was found that there is a problem in applying a closed ended elicitation format in this context with a community resource since a community resource typically implies a community based scenario and such a scenario invites to yea-saying. The well-known problem of compliance bias is also difficult to avoid in such settings. Application of a closed-ended format under such circumstances would exaggerate the WTP for the good in question.

The study asked both spouses in a household for their willingness to pay for a new plantation. The analysis of the bid function shows that the factors affecting their bids differ. The common preference model was thus rejected in this application.

The analysis of the bid function showed that landless, and in particular non-heads without land, have a significantly higher WTP for a new plantation. Afforestation activities might therefore have positive equity implications. The analysis also indicates that it might be a good idea to concentrate plantation efforts since there seem to be specialization going on in collection behaviour. The negative and significant relationship between livestock and WTP reminds us of the need to carefully consider the opportunity costs of such interventions. Land is scarce in the Ethiopian highlands and if a new use of the land is introduced, then there will always be losers.

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1. INTRODUCTION

Ethiopia is experiencing deforestation combined with a high rate of land degradation and expectations of continuing heavy dependence on woody biomass for fuel and construction. A major strategy to satisfy the increasing demand for woody biomass is therefore to increase its supply through tree planting. This is also reflected in numerous project proposals for afforestation or reforestation in the country (e.g. World Bank 1984; ENEC 1986; EFAP 1993a). One such scheme is the introduction and expansion of community plantations, also called woodlots.[4]

Community woodlots are not new to many Ethiopian peasants. Their history goes back to the second half of the 1970s when they were introduced largely as food-for-work projects in the drought affected areas of Ethiopia. It emerged as a product of the environmental activism and awareness that developed immediately after one of the major famines in modern Ethiopian history. It also came after the seizure of power by the now defunct military-socialist government in 1974 that, among others, nationalized land in 1975 and created peasant associations (PAs) as the lowest administrative units in rural Ethiopia. This new land tenure system and administrative structure implied, at least in theory, that the PAs would have some area of land under their jurisdiction part of which is allocated for individual use by peasants and part of it for communal use by members of the PA, such as communal grazing and browsing land. In practice, however, such projects as hill side plantations and construction of soil conservation structures particularly on common lands have been initiated and implemented using the top-down approach with little consultation, if any, with the local communities. The plantations practically belonged to the government and the labour contribution of the local communities in the establishment of the plantations and soil conservation structures was mainly in exchange for wages paid in kind (food-for-work) largely financed by the United Nations/World Food Program (UN-WFP). With a value of food committed by WFP that was estimated to be slightly over half a billion USD for the period 1975-1990, it was the largest food-for-work project in Africa in terms of the resources committed (Yeraswork 1995: 5; Berhanu et al. 2003).

[4] It should be emphasized, however, that this is not the only option available to satisfy increasing demand for woody biomass. Other potential alternatives or complementary options include energy substitution (such as electricity, kerosene, biogas and liquefied petroleum gas (LPG)), substitutes for construction such as bricks and energy efficiency improving measures such as improved stoves and cooking pots. While the relevance and feasibility of each of these options has to be examined in detail, these may be in general remote possibilities in the near future particularly for rural areas given the supply constraints, cultural and educational constraints and high investment requirements for infrastructure and equipment.

The full management and use of some of the plantations that survived until the change of government in 1991 was transferred to the local communities (PAs). However, a number of them have been destroyed either in the transition between the two governments or immediately after the transfer to the local communities due to lack of proper rules and regulations on their management and use (Yeraswork 1995).

In an evaluation of the soil conservation and afforestation programs, Hoben (1995) observes, “in retrospect, it is clear that much of this effort was wasted or counterproductive”, and argues that a neo-Malthusian environmental policy narrative “was used by government and donors alike to justify the rapid, massive and widespread use of standardized environmental management ‘packages’ without research on their environmental impact or their economic costs and benefits”.

Does such an experience mean that there is no need and no future for community woodlots in Ethiopia? Probably not, since community woodlots could, among other things, minimize time spent to collect fuel and increase woody biomass availability for fuel and construction particularly for the landless and those in short supply of labor for fuel collection, not to mention their contribution to possible mitigation of environmental degradation. With respect to tenure security, it would be more secure to introduce forestry programs at the level of the community compared with private plantations particularly if (the ‘fear’ of) redistribution of individual land by PAs is to continue. But community woodlots would most definitely fail and be unnecessary if they are planned and implemented the same way it was done in the past--top-down approach with little community involvement in the decision making and in the benefits it brings. It is by now well established that the success of common property resources depends very much on the specific rules and regulations and practices that are applied in their management and use. As Kidane (1994: 15) argues, the lack of participatory approach in the planning and implementation of social forestry programmes is one major reason for the limited success of past efforts in the forestry sector in Ethiopia and “the initiative for community forest development should emanate from the farmers themselves”.

In this paper we use the contingent valuation method (CVM) to examine the determinants of peasants’ willingness to pay for community woodlots that are financed, managed and used by the communities themselves. The analysis of such information is likely to help government and international donors to identify salient community features that would increase the targeting and subsequent success of community plantation activities. The study is also an addition to the limited literature on application of the CVM on social forestry issues in developing countries in general and sub-Saharan Africa in particular.

From a methodological point of view, we attempt to examine problems associated with the single closed-ended value elicitation format in developing countries like Ethiopia. This is based on experience from earlier application of the CVM in Ethiopia (Alemu 2000) and India (Köhlin 2001) where the researchers found that responses to a single closed-ended question, a format widely used and recommended by the NOAA-panel, may not be a true reflection of a household's preferences in a developing country community setting. The researchers discovered this with the use of a closed-ended format with an open-ended follow-up. In this paper we try to find out more carefully whether and why there is inconsistency between the responses to the first closed-ended value elicitation question and a follow-up question. We also try to identify the characteristics of households with such responses.

Yet another issue that we examine in this paper relates to intra-household resource allocation decision in the context of developing countries. Using responses to CVM questions on community forestry we attempt to provide a test of the common preference model (Alderman et al. 1995; Lampietti 1999). A similar test was done by Lampietti (1999) in Northern Ethiopia for preventive health care within the household. Lampietti considered willingness to pay for bednets and a hypothetical vaccine for malaria. The respondents were husbands and wives. Using a likelihood ratio test, the author failed to reject the null hypothesis that gender has no significant effect on the decision to purchase bednets but rejected this same null hypothesis for a hypothetical vaccine. This suggests, the author concludes, that husbands and wives behavioral characteristics may be pooled for bednets but may not be pooled for the hypothetical vaccine. In our case the good has also an expected gender dimension which makes it particularly interesting to analyze the bid functions of the spouses separately.

The rest of the paper is organized as follows. In section 2 we present survey design and description of the data. Section 3 presents the econometric model, and discusses the subsequent empirical analysis. Section 4 concludes the paper.

2. SURVEY DESIGN AND DESCRIPTION OF DATA

2.1 Survey Design

The data for this paper come from a survey as part of a rural household survey on sustainable land use in the Ethiopian highlands conducted in 2000. The data was collected through a Sida/SAREC funded collaborative research project of the Departments of Economics of Addis Ababa University and Göteborg University. The survey covered a total of 1520 households from two zones in the Amhara region of Ethiopia. Twelve research sites were purposely selected while households within

each site were selected at random. There was one supervisor for each of the sites under which enumerators were employed to conduct the interviews.

The scenario was described to the respondents followed by value elicitation questions. In order not to make the scenario too hypothetical a suitable area of land was identified for each site for the establishment of the proposed community plantations. The head of the household (who is typically the husband in our case) and another member of the household (typically the spouse) were asked the willingness to pay questions. Five different starting prices were randomly assigned to respondents.[5] The closed-ended question was followed by an open-ended question (What is your maximum willingness to pay for the proposed plantation?) This design makes it possible for us to analyze inconsistent answers. In cases where the 'Yes' response to the closed-ended question was followed by a willingness to pay amount for the open ended question lower than the amount they said yes to in the closed ended question, the respondent was asked why this was the case.

2.2 Description of Data

The expressed willingness to pay is expected to depend on characteristics pertaining to the individual, the household, the proposed plantation and alternative sources of biomass in the community. The descriptive statistics for the selected explanatory variables are shown in Table 1. We have two variables that vary at the level of individual – age and literacy. The data show that the average age of the respondent was about 40 years. About 32 percent of the respondents were able to read and write. The average family size was 5.4 with a range of 1 to 15. We have three indicators of household wealth and income – corrugated roof, livestock holding and (non-food) expenditure. A dummy variable indicates whether the roof of the house is made of corrugated iron or not. The data show that about 43 percent of the respondents had houses with corrugated iron roofs. The number of livestock and poultry owned were converted into tropical livestock units and the data show that on average a household owned about 2.9 tropical livestock units. Non-food expenditure was used as an indicator of discretionary income (expected to be positively related to willingness-to-pay) and the average (non-food) expenditure of a household per year was Birr 1184 (about USD 145).

[5] The starting prices which were determined based on information from a pilot survey were: Birr 1,3, 5, 10 and 15.

Household resources such as land and trees are expected to be substitutes to community plantations. The average land area "owned"[6] by the households is about a hectare. This average would be higher if we exclude about 10 percent of the households in the sample who do not own land at all. As to the number of trees, Table 1 shows an average of more than 400 trees per household. More than three fourths of these are eucalyptus trees. Eucalyptus is also the proposed species in the contingent valuation study and they are very common in Ethiopia in general and in the study area in particular (Jagger and Pender 2003). About 19 percent of households in our sample did not grow trees at all.

Size of, and distance to, proposed and existing plantations are also expected to influence willingness to pay. For the proposed plantations we use the distance to the household's homestead in minutes. We also asked questions on whether there were any community plantations in the sites and we find that there were no such plantations for about 31 percent of the households. Given that there were communities without community plantations, we used the inverse of the distance to existing plantations to the household's homestead (in minutes). For households where there are no community plantations, the value of this variable is zero which is equivalent to saying that they are living too far away from plantations.

[6] All land in Ethiopia is owned by the government. However, households have user right to a particular area of land. It is this area that is referred to as land owned in this paper.

Table 1: Descriptive statistics

Variable	Description	Mean	Stdv	Min	Max
Age	Age of respondent in years	40	15.5	16	101
Read and write	= 1 if respondent can read and write	0.3	0.5	0	1
Family size	Number of household members	5.4	2.2	1	15
Corrugated roof	= 1 if house has corrugated roof	0.4	0.5	0	1
Livestock	Animal holdings converted to tropical livestock units	2.9	2.5	0	15.3
Expenditure	Non-food household expenditures/year	1184	1116	0	20278
Num. of trees	Number of trees owned by household	410	825	0	8000
No trees	= 1 if household has no trees	0.2	0.4	0	1
Land area	Land area in hectares	1.0	0.9	0	5.8
No land	= 1 if household has no land	0.1	0.3	0	1
No CPL	= 1 if no existing community plantation (CPL)	0.3	0.5	0	1
Distance CPL	1/distance to CPL in minutes (0 if no CPL)	0.07	0.4	0	13
Size CPL	Size of existing plantation in ha	3.7	2.4	0	20
Size Ha	Size of proposed plantation in ha	3.0	2.8	1	10
Distance Plantation	Distance to proposed plantation in minutes	45	34	0	340
WTP	Open-ended WTP	2.15	3.44	0	20

3. ECONOMETRIC MODEL AND EMPIRICAL ANALYSIS

3.1 Econometric model

In the analysis of the closed-ended responses we estimate a simple spike model where we allow for the respondent to be indifferent about the project (see Kriström, 1990; 1997). We use the answer to the follow-up open-ended question to determine if the respondent is indifferent or not, i.e. if the respondent has a zero WTP. Let F_{wtp} denote the CDF of WTP. This function is assumed to have the following form:

$$F_{wtp} = \begin{cases} 0 & \text{if } t < 0 \\ p & \text{if } t = 0 \\ G_{wtp} & \text{if } t > 0 \end{cases}$$

where t is the bid offered to the respondent. If we assume that G_{wtp} has a logistic distribution and that the willingness to pay function is linear in the parameters, the response function can be written:

$$F_{wtp} = \begin{cases} 0 & \text{if } t < 0 \\ \left(1 + \exp(\beta z)\right)^{-1} & \text{if } t = 0 \\ \left(1 + \exp(\beta z - \lambda t)\right)^{-1} & \text{if } t > 0 \end{cases}$$

Where z is the vector of socio-economic characteristics described in the preceding section and β is the corresponding parameter vector and λ is the marginal utility of money. With the spike, mean WTP is then given by $\frac{1}{\lambda}\ln(1+\exp(\beta z))$, while the median is given by $\frac{\beta z}{\lambda}$ (Kriström, 1997).

3.2. Analysis of bid function

In total 2600 individuals were interviewed, due to item non-response 1699 are available for analysis.

The results of the estimated spike model are presented in Table 2 below. One interesting aspect in the analysis is the potential differences between the head of the household and the other family member that answered the valuation question. Therefore separate models are also estimated. We can also strongly reject the hypothesis of equal parameters, even when allowing for a difference in the scale parameters. In the analysis we therefore focus on the separate models.

Table 2: Estimated spike models and mean and median WTP.

	Pooled		**Head of household**		**Not head of household**	
	Coeff	**P-value**	**Coeff**	**P-value**	**Coeff**	**P-value**
Intercept	1.2165	0.000	1.2675	0.001	0.8815	0.001
Age	-0.0035	0.280	0.0046	0.429	**-0.0087**	**0.054**
Read and write	**0.2262**	**0.046**	0.1572	0.364	0.3163	0.067
Family size	0.0084	0.754	-0.0272	0.516	0.0269	0.458
Corrugated roof	**0.3025**	**0.014**	**0.3636**	**0.038**	0.3405	0.060
Number of trees	**-0.0001**	**0.055**	-0.0001	0.128	-0.0001	0.242
No trees	0.1204	0.411	-0.0007	0.998	0.2132	0.275
Land area	0.0401	0.548	-0.0057	0.942	0.0706	0.491
No land	**0.4901**	**0.019**	0.3607	0.199	**0.7008**	**0.023**
No community plantation	**-0.7408**	**0.000**	**-0.7111**	**0.000**	**-0.5279**	**0.005**
Distance CPL	0.0798	0.327	-0.1332	0.429	**4.1814**	**0.001**
Size CPL in ha	0.0031	0.566	0.0025	0.755	0.0026	0.716
Size of prop. plantation	0.0121	0.111	0.0046	0.805	0.0119	0.150
Distance to prop plantation	**-0.0018**	**0.008**	-0.0036	0.088	-0.0003	0.725
Livestock in TLU	**-0.0748**	**0.005**	**-0.0814**	**0.048**	**-0.0758**	**0.034**
Expenditure	0.0000	0.756	0.0000	0.970	0.0000	0.555
Bid	**0.1749**	**0.000**	**0.1846**	**0.000**	**0.1733**	**0.000**
Log-likelihood	1438		618		859	
Share zero WTP	0.45		0.46		0.44	
Median WTP*	5.863 (4.45-7.28)		7.123 (4.44-9.82)		6.244 (4.48-8.02)	
Mean WTP*	7.615 (6.53-8.70)		8.418 (6.62-10.61)		7.928 (6.54-9.32)	

* 95% confidence intervals in parenthesis.

Table 2 gives some interesting information regarding factors affecting households' willingness to pay (WTP) for community plantations in the Ethiopian highlands and how this differs between household heads and spouses. Although there are female headed households the opposite is the norm, so we can also interpret the heads as a predominantly male group and the non-heads as a predominantly female group.

If we start with the *individual characteristics* we find that age is only significant for the non-heads, where the older tend to have a lower WTP. We see a similar pattern for literacy where the ability to read and write is a significant and positive factor for the non-heads WTP. This has some potential implications on the application of contingent valuation to non-heads of households. Köhlin (2001) found in India a

reluctance among non-heads to reveal a household WTP for community plantations. In Ethiopia this seems to be less of a problem, and the mentioned results might suggest that is particularly the case for younger and more well-educated spouses.

We then turn to the general *household characteristics*. Household size was expected to increase the WTP due to greater demand for biomass. This is not confirmed by the data. A possible explanation might be that this effect is offset by the increased availability of labour in the household. Our indicator of wealth, corrugated roof, has the expected positive sign and has similar significance and coefficient values throughout the three estimations. Expenditure, as a proxy for discretionary income in this cash constrained economy, is insignificant throughout. Livestock turned out to be a highly significant explanatory variable throughout the estimations. Interestingly enough it is negative. This implies that it should probably not be seen as a wealth indicator but rather a factor that has direct impact on the preference for a community plantation. One reason why livestock holding might be negatively correlated with WTP for a plantation is that such plantations typically decrease the availability of common grazing land. Dung from livestock could also be seen as a substitute to fuel from the plantations. A more obvious substitute is number of private trees. This also turns out to be moderately significant and with the expected negative sign, at least in the pooled regression. Maybe the most interesting finding is the fact that landless households have significantly higher WTP for community plantations. The coefficient is particularly large for the non-heads. This gives further strength to the conventional wisdom that the landless are most dependent on commons. It also implies that interventions directed towards community plantations are likely to benefit landless households the most, and within these households, particularly the women.

The *resource characteristics* had mixed explanatory power. The size of the proposed plantation is not significant, but this could be due to the fact that we have not been able to control for size of the village. The distance to the proposed plantation has the expected negative sign and is significant for the pooled but highly insignificant for the non-heads. This could be an indication that non-heads are less time-constrained than heads of household. With regards to existing community plantations we find a very interesting result. While one would expect that those who do not have a community plantation would have a higher WTP than those who have, here we find the opposite. This implies an adoption to community plantations as a source of biomass. The policy implication is that it might be better to target plantation activities to communities that already have plantations than to those who do not.

3.2 Analysis of inconsistent responses

There are two previous applications of this elicitation format on community plantations in developing countries (Alemu 2000; Köhlin 2001). In these applications it was found that some households chose to give a lower WTP in the open ended follow-up question than the value of the closed ended question that they had just accepted. A number of hypotheses were raised as to origin of this inconsistency including yea-saying (or compliance bias), strategic behaviour and a cultural experience of bargaining that might be triggered by the format (Köhlin 2001).

The prevalence of closed ended elicitation formats and the questions raised regarding its applicability to developing country settings led the authors to include a follow-up question to those who gave inconsistent answers. In this sample about 8 percent of the respondents gave an inconsistent answer, in the sense that their maximum willingness to pay was lower than the amount that they said yes to in the initial closed-ended question. When asked for the reasons for the inconsistency, about 57 percent responded that they initially thought it was an obligation to contribute, while 12 percent wanted to please the interviewer. This means that almost 70 percent of the inconsistent responses seem to stem from yea-saying or compliance bias. About 16 percent responded that they are poor. Also for these respondents, it is highly questionable whether their responses to the closed ended question actually reflected their true WTP. In Table 3 an attempt is made to find out whether there is any systematic relationship between the inconsistencies and our explanatory variables. The responses of heads and non-heads of the household are also compared.

Table 3: Estimated probit models of inconsistent responses.

	Pooled		Head of household		Not head of household	
	Coeff	**P-value**	**Coeff**	**P-value**	**Coeff**	**P-value**
Intercept	-1.6395	0.000	-1.6708	0.000	-1.6708	0.000
Age	-0.0013	0.677	0.0039	0.455	0.0039	0.951
Read and write	-0.1470	0.156	-0.1700	0.291	-0.1700	0.916
Family size	**0.0706**	**0.001**	0.0504	0.157	**0.0504**	**0.026**
Corrugated roof	-0.0217	0.836	0.1552	0.322	0.1552	0.505
Number of trees	-0.0001	0.156	-0.0001	0.341	-0.0001	0.351
No trees	0.0543	0.658	-0.2187	0.302	-0.2187	0.179
Land area	-0.0529	0.467	-0.0713	0.548	-0.0713	0.539
No land	0.1904	0.306	0.3376	0.230	0.3376	0.808
No community plantation	0.0087	0.936	0.2034	0.236	0.2034	0.612
Distance CPL	0.0311	0.770	-0.0045	0.974	-0.0045	0.399
Size CPL in ha	-0.0036	0.485	-0.0072	0.539	-0.0072	0.622
Size of prop. plantation	-0.0044	0.586	-0.0606	0.237	-0.0606	0.519
Distance to prop plantation	-0.0014	0.326	-0.0010	0.655	-0.0010	0.617
Livestock in TLU	**-0.0520**	**0.034**	**-0.0952**	**0.018**	-0.0952	0.318
Expenditure	0.0000	0.463	0.0000	0.406	0.0000	0.861
Bid	**0.0246**	**0.006**	0.0082	0.561	**0.0082**	**0.001**
Log-likelihood	444		180		254	
Share inconsistent	0.08		0.06		0.09	

As we can see from Table 3, an inconsistent behaviour cannot easily be explained by the chosen explanatory variables. A somewhat higher proportion of non-heads have inconsistent answers. In particular non-heads who have received – and accepted - high starting bids, seem to back off from this commitment when given the chance. A larger family size also increases the inconsistent answers for those who are not heads of household. The only other significant result is that heads of household with larger livestock ownership are less likely to be inconsistent.

4. CONCLUDING REMARKS

This application of the contingent valuation method on community plantations in the highlands of Ethiopia has made some methodological and policy contributions. We have found that there could easily be a problem in applying a closed ended elicitation format to community resources in developing countries since a community resource typically implies a community based scenario and such a scenario invites to yea-saying. The well-known problem of compliance bias is also difficult to avoid in such

settings. Application of a closed-ended format under such circumstances would exaggerate the WTP for the good in question.

The study has also shown that it is possible to not limit such surveys to heads of households, at least for this sample. Their spouses are perfectly capable of answering WTP questions, although the analysis of the bid function shows that the factors affecting their bids differ. The common preference model was thus rejected in this application.

The analysis of the bid function showed that landless, and in particular non-heads without land, have a significantly higher WTP for a new plantation. This is good news for those who hope for positive distributional implications of such plantation activities. The analysis also indicates that it might be a good idea to concentrate plantation efforts since there seem to be specialization going on in collection behaviour. The negative and significant relationship between livestock and WTP reminds us of the need to carefully consider the opportunity costs of such interventions. Land is scarce in the Ethiopian highlands and if a new use of the land is introduced, then there will always be losers.

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