Environment and Development Economics 6 (2001): 237–258

Contingent valuation in project planning and evaluation: the case of social forestry in Orissa, India

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ABSTRACT. There have been few applications of the contingent valuation method (CVM) to forests in developing countries. When applied, the method is seldom utilized to improve the implementation of development projects. In this paper an application of CVM to the Orissa Social Forestry Project is reported. The results show considerable variation between villages and the analysis of the bid function shows underlying factors to project success that can be used in project planning. The policy implications are to plant new VWL where natural forests are inaccessible, where people have prior experience of VWL, and where fuel consumption relies heavily on market purchases. Such plantations are expected to give greatest benefit to families with few men and many women. An analysis of the reliability of the study concludes that many of the observed biases originate from the enumerators. The study also recommends that one should be careful with the use of a discrete design in a cultural context such as this that is prone to yea-saying, and that strategic bias can arise from an open ended question that follows up the start bid in a culture characterized by bargaining.

> *Ten years ago only a handful of very rudimentary contingent valuation studies had been conducted in developing countries; at the time conventional wisdom was that it simply could not be done. The problems associated with posing hypothetical questions to low-income, perhaps illiterate respondents were assumed to be so overwhelming that one should not even try. Today we have come full circles; it is now assumed by many environmental and resource economists working in developing countries that CV surveys are straightforward and easy to do* (Whittington, 1998).

1. Issues in application of CVM in developing countries

There is now a range of applications of the contingent valuation method (CVM) in developing countries. Most studies are concerned with fresh water investments and sanitation. (see e.g., Whittington, 1988; Whittington *et al*., 1993; World Bank Water Demand Research Team, 1993; Griffin *et al*.,

This study was made possible through grants from the Swedish International Development Cooperation Agency. The author thanks W.F. Hyde, colleagues at Göteborg University, especially Fredrik Carlsson, and a number of anonymous referees for comments. Usual disclaimer applies.

1995.) There are fewer studies that look at forest values. Shyamsundar, Kramer and Sharma (1995) present a study that elicits the willingness to accept (WTA) compensation by villagers for nearby rainforests to be converted to a national park. In a study from Zimbabwe (Lynam, Campbell, and Vermuelen 1994) the willingness to pay (WTP) for services from trees on communal lands was estimated using a combination of scoring method and WTP questions for reference goods (borehole and latrine). No application of CVM on a plantation project has been found.[1]

In order for a method to be generally applicable for project and policy analysis it needs to be both reliable and relevant. If we start by looking at the relevance of CVM in developing country applications we can note that quantitative analysis seldom is used in many development projects. In an analysis of reasons for this limited use in aid organizations, it was found that many desk officers felt that existing methods did not capture the reality of the countries and problems encountered (Carlsson, Kohlin, and Ekbom, 1994). CVM has a potential to remedy this. It can elicit important non-use values that other economic techniques overlook. It is participatory to the extent that it reveals the preferences of target populations. Still, it has to prove its relevance over and above statements of WTP for a specific environmental change since 'policy makers often consider distributional and political criteria in addition or instead of welfare economic criteria' (Carson, Flores and Meade, 1996). The idea of using CVM in aid projects is of course not novel. The potential for CVM to improve planning and implementation of projects to improve water services was mentioned already in a report to the USAID in 1988 (Whittington, 1988).

It is therefore unfortunate that little emphasis has been given to the possibilities for policy analysis of information contained in CVM applications to forestry. Sometimes only an average value of the resource in question is reported (e.g. Lynam, Campbell, and Vermuelen, 1994) or an average and an aggregate value (Navrud and Mungatana, 1994). In Shyamsundar, Kramer, and Sharma (1995) an average and aggregate compensation figure was presented but the multivariate analysis was not used to discuss how a fair compensation scheme could be established.

More has been done in this respect in the large number of CVM studies on water and sanitation carried out for the World Bank. In a synthesis of these studies (The World Bank Water Demand Research Team, 1993) determinants of household demand for improved water services are identified and policy implications are drawn in terms of a set of four stylized villages with different characteristics. Still, it turned out to be difficult to predict behaviour in one village based on the findings in a similar village (Griffin *et al*., 1995).

There is thus still a challenge to prove the relevance of the method in developing country policy contexts. This needs to be done in a cross-section of villages with emphasis on project design, including cost-efficient implementation, gender impacts, distributional effects, etc. In this paper

[1] After this study was conducted, a similar study was carried out in Ethiopia (Mekonnen, 2000).

we analyse the bids with this particular motive in mind. The lessons for the planning of plantation projects are presented in section 6.

If we then turn to the reliability, much more emphasis has been given to this aspect of CVM, both in developed and developing country contexts. In the aftermath of the Exxon Valdez controversy, proponents of CVM continue to pile up evidence that the method can be reliable in eliciting WTP for well-defined changes in environmental quality. However, to make it reliable is neither simple nor inexpensive (Carson, Flores, and Meade, 1996). All the potential problems with CVM studies in developed countries are also relevant in a developing country context. Some aspects are aggravated since training of enumerators and supervision of data collection is rendered more difficult, due to language and cultural barriers. This necessitates a closer look at variations in the bids correlated to the individual enumerators. The discussion of these and other potential biases can be found in section 7 which addresses the reliability of the study.

The study was carried out in connection to the Orissa Social Forestry Project. A brief description of social forestry and the project is given in section 2. This is followed by descriptions of the design of the study in section 3 and the models and data in sections 4 and 5.

2. The Orissa Social Forestry Project

Social forestry was introduced as a concept in the mid 1960s. It is largely associated with dissemination of individual and communal plantations in the Indian sub-continent (Hyde, 1991) but by the mid 1980s such activities were carried out in about 50 developing countries (Foley and Barnard, 1984). The rapid expansion was at least partly due to a large number of reports published in the 1970s that pointed out the large scale of fuelwood use in developing countries, the increasing time expended for its collection, and the alarming rate at which natural forests were receding. A causal relationship was conjectured and fuelwood gathering was exposed as a major reason for deforestation. As a result, many large social forestry projects were carried out in the 1980s. In India, Sweden supported social forestry in Bihar, Tamil Nadu, and Orissa with about USD 125 million. Other donors such as the World Bank, the British Overseas Development Authority, and the Canadian International Development Agency were involved in other states in India. Also domestic resources were used to this effect. At least 25 per cent of the total outlay for rural development schemes in India were earmarked for social forestry by the end of the 1980s (Sharma, McGregor, and Blyth, 1991).

The interest among farmers for social forestry projects has often been limited because of uncertainties regarding ownership and access and more fundamentally because it has not addressed their main concerns. With a number of cheap substitution possibilities available, fuel might not be perceived as the most pressing need (O'Keefe and Munslow, 1989). Because of this and of other reasons many social forestry projects have been considered failures, due to problems of implementation, low survival rates, or skewed distribution of benefits, and subsequently terminated. Other continue due to the inertia of foreign assistance and vested interests of governmental agencies. Still new projects are planned to meet the basic needs of rural poor through social forestry approaches. There is therefore a great need to find out when social forestry projects are successful and why. Such analysis could be helpful in decreasing the wasteful use of resources that result from establishment of plantations that are not surviving. It could also be used to identify the location of plantations that lead to the greatest welfare improvements.

The social forestry project chosen for this study is located in Orissa, which is one of India's poorest states, situated on the Indian east coast, southwest of West Bengal (Calcutta). The average rainfall is about 1,500 mm/year, which gives a rather lush landscape dominated by rice cultivation. The largest component of the Orissa Social Forestry Project (OSFP) was the establishment of more than 100,000 ha of village woodlots (VWL) since 1985 (SIDA, 1992). A VWL is a mixed plantation with a substantial component of fast growing trees, predominantly Eucalyptus. The plantation is often close to a village and only a few hectares in size, although repeated plantation can lead to as much as 40 hectares for a single village. The VWL is expected to provide wood and leaves for fuel, fodder, and other subsistence uses. It has also become an important source of cash income.

However, the success rate has been extremely varying both within but mainly between districts. In the district dealt with in this study, 70 per cent of the plantations had survived after three years. In the worst district this was instead the failure rate (Orissa Forest Department, 1995). Although the overall return of the state-wide plantation component has a positive, although moderate return (Köhlin, 1994), this is severely affected by the low survival rates in some districts. The reasons for failure differ between plantations. At least part of the problem stems from the planning and allocation system that has not been sensitive enough to local demand for new plantations. The project is therefore very suitable for application of a contingent valuation study that can relate the villagers willingness to pay for a plantation to actual costs as well as to give insights as to which factors are important for such demand.

3. Study design

The selected field study area is located in the Khurda district, 90 km south of the state capital, Bhubaneswar, and a few kilometers from the coast. It is quite densely populated and is intensively used for agriculture. The area includes the border between the agricultural plain and the forested highland. The sample is a random selection of villages from an area around Dhani Reserve Forest. The interviews, 170 in a pilot survey in 1993, and 743 in the main survey in 1995, include detailed questions regarding use of VWL and natural forests, fuel use in different seasons specified by kind and source, as well as additional household data. In the 1995 survey, the data from which we will use, 22 villages were randomly selected in the area. In these villages all households were mapped by the author. A random sample of the households was then drawn from each village. The interviews were carried out by a team of enumerators that all worked in all villages and by working side by side usually covered a village in a day. We would therefore not expect any differences in responses between enumerators due to survey design.

The household surveys also included WTP questions for a new plantation (Appendix 1). The respondent was asked to consider not only the direct benefits (both final and intermediate benefits were specified) of the plantation but also the reduced time for collection, reduced pressure on the natural forest, and alternative use for dung and residues that previously were used as fuels. The final harvest has a potentially high value but with significant uncertainty in its distribution to individual households. The respondent was therefore asked to exclude this value.

To make it as realistic as possible, a specific plot was pointed out to be planted and the distance to the plot and its size was specified. The size of the proposed plantation depends on the often limited amount of land available for plantation of VWL, which in turn depends on previous plantations, etc. The result was proposed plantations of similar size, roughly 4 ha, but where the size depended on the land available and location chosen. In a number of villages the CVM questions could not be asked at all due to non-availability of land.

The household's WTP for a new plantation was elicited in two steps. First the respondent was asked a discrete question about whether he would be willing to pay a specific sum per month for the establishment and management of the plantation. This referendum question was then followed by an open-ended question to reveal the maximum WTP for a plantation. In the following analysis we will make use of information given in both of these steps.

Five prices (Rs 10, 20, 30, 45, 75)[2] were used in the discrete question. They were chosen according to the distribution of bids given in a pre-test sample. Since the open-ended question followed upon the answer to this discrete question, there is a risk that the open-ended bid could be anchored to the price stated in the discrete question. It is therefore relevant to check for starting point bias in the open-ended bids.

4. Econometric approach

The CVM questions are designed to reveal the WTP for a specific change in forest availability. This change implies, as mentioned above, a number of resulting changes in levels of use- and non-use values. The WTP can be used as a welfare measure, in this case it represents the Hicksian compensating variation (CV), since it leaves the respondent at the same utility level after the suggested plantation and resulting expressed WTP. This is easily described by adjusting the income (y) in an indirect utility function (V) by the bid (WTP) given an increased availability of plantations ($q^1 > q^0$),

$$V(p,y,q^0) = V(p,y - WTP,q^1) \quad (1)$$

From the preceding discussion it is clear that WTP is a function of prices, income, and the forest status before and after the intervention. For policy reasons we are interested in understanding how these and other potential reasons affect WTP. In the literature there are a number of examples of

[2] The exchange rate at the time was Rs. 30/USD.

demand functions for forests derived from models of utility-maximizing households (e.g., Mercer, 1991; Amacher, Hyde and Kanel, 1996). These models have focussed on use-values, especially fuel. Resulting demand functions typically include fuel prices, measures of forest stock, and its accessibility (**R**), and a vector of household characteristics (**A**). In this case we are especially interested in the empirical representations of **R** and **A** that can be analysed in a project context. We are also interested in variables in the design (**D**) that can affect the WTP, and thus shed light on the robustness of the design and implementation of the study. We thus have a bid function of the following very general form

$$WTP = f(\mathbf{6}'\mathbf{W} + u) \tag{2}$$

with **W** being the vector of explanatory variables (vectors **R**, **A**, **D**) and u the error term.

However, a common feature in the analysis of open-ended CVM-bids is that there are a large number of responses with zero WTP. One way to deal with this is to use a censored model such as the standard Tobit model. However, the standard Tobit is restrictive in that it assumes that the same factors affect both the decision to pay and the size of the payment and it imposes the same structure on these two decisions. A more general approach that still maintains the assumption of dependence between the two decisions through a covariance between the error terms is the Tobit model with selectivity (Greene, 1995). For the analysis of the maximum WTP bids we therefore use the latter model.

In the Tobit model with selectivity we first estimate the probability for a positive WTP for a plantation with a probit model and then we estimate the bid function. This entails the following specification where z^* is unobserved

$$z^* = \alpha'\mathbf{v} + u \tag{3}$$

$$WTP^* = \beta'\mathbf{x} + \epsilon \tag{4}$$

$$\epsilon, u \sim N[0,0,\sigma^2_{\epsilon}, \sigma^2_{u}, \rho],$$

The observed variable is $z = 0$ if $z^* \leq 0$ and $z = 1$ if $z^* > 0$; $WTP = 0$ if $z^* \leq 0$ and $WTP = WTP^*$ if $z^* > 1$. The expected WTP is

$$E[WTP \mid WTP > 0] = \beta'\mathbf{x} + \rho\sigma\lambda\ (\alpha'\mathbf{v}) = \beta'\mathbf{x} + \beta_{\lambda}(\alpha'\mathbf{v}) \tag{5}$$

where λ is the Inverse Mill's Ratio $= \varphi(\alpha'\mathbf{v}/\sigma_u)/\Phi(\alpha'\mathbf{v}/\sigma_u)$; φ is the standard normal density function, and Φ the standard normal function. Since σ_u cannot be estimated it is normalized to 1 (Greene, 1995).

The explanatory variables used in the two steps are **v** and **x**, respectively, which are subsets of **W**. We can expect that most factors that are important in the decision to pay for a plantation will also be important for the size of the WTP. However, identical specifications in the two steps gives us an identification problem that according to Maddala (1983: 229) is solved by at least one of the variables used in the first stage being omitted in the second stage.

For analysis of the referendum bids we will also use a probit specification, similar to (3). However, in this case $z = 1$ if the respondent answers yes to the referendum question and $z = 0$ if the answer is no.

5. Description of data

As mentioned in the preceding section we need explanatory variables that represent measures of forest stock and its accessibility (**R**), household characteristics (**A**), and the design (**D**) that can affect the WTP.

In table 1 the descriptive statistics of the chosen variables are presented. The first four variables are the dependent variables in the following analyses. The first is a dummy variable to identify those with a positive WTP, to be used in the first (probit) step of the maximum WTP answers. The second is the answer to the maximum WTP question that followed the referendum question. The third variable is the response to the referendum question (1 if the respondent accepted the price proposed) while the fourth dependent variable to be used is a dummy variable taking on the value of 1 when respondents stated a lower maximum WTP in the follow-up question than the price they had just accepted in the referendum question.

The second set of variables are chosen to test the design of the study (**D**). They include the prices used in the referendum question, dummies for all the enumerators (except one), and a dummy for the two categories that showed the least interest in answering the questions, according to a follow-up question by the enumerator.

The third set of variables describes household characteristics (**A**). We would expect that the likelihood of a long-term commitment to monthly payments for a VWL would depend on the wealth of the respondents. Different proxies for wealth were tried. Total income, i.e. the sum of labour income, remittances and proceeds from agriculture, handicraft, etc was tried and found insignificant. A much higher explanatory power was found in land which is the most important indicator of wealth in this agrarian society. The size and composition of the household can affect demand for biomass and labour availability for collection in plantations and forests. Given the results from analyses of collection patterns (Köhlin, 1998) we can expect that the demand for VWL would be sensitive to the number of men and women in the household and whether the household is Schedule Caste or Schedule Tribe (SCST) or Brahmin, to take two extremes in the Indian caste system that is still very influential in this area.

The last set of variables deals with accessibility of different sources of biomass (**R**). The present reliance on fuels from existing VWL, defined as the stated collection from VWL divided by the total consumption of traditional fuels, have policy implications since decisions need to be taken regarding whether to plant in villages that already have plantations or in new villages. A squared term is included to test for non-linearity since a saturation effect is expected. The natural forest is an important substitute to plantations and it is also an important policy variable since attempts to reduce the pressure on natural forests have led to buffer zone plantations in many places. The reliance on fuels from the market is included to reflect scarcity and also, to a certain extent, the opportunity cost of fuel collection. This variable is dropped in the second stage, together with the caste vari-

Table 1. *Description and descriptive statistics of variables*

Variable	*Variable category (exp sign)*	*Description*	*Mean*	*STD*	*Min*	*Max*
Positive WTP	Dependent	1 if max WTP > 0	0.65	0.48	0	1
Willingness to pay	Dependent	Max WTP in Rupees	14	17	0	100
Referendum answer	Dependent	1 if yes to start price	0.50	0.50	0	1
Inconsistent answer	Dependent	1 if max WTP < price accepted	0.22	0.41	0	1
Start price	D (+)	Start bid Rs 10,20,30,45,75	33	21	10	75
Banishree	D	Enumerator dummy	0.13	0.33	0	1
Minati	D	Enumerator dummy	0.16	0.37	0	1
Padhi	D	Enumerator dummy	0.12	0.33	0	1
Subrat	D	Enumerator dummy	0.04	0.2	0	1
Mishra	D	Enumerator dummy	0.14	0.35	0	1
Samanta	D	Enumerator dummy	0.12	0.32	0	1
Paul	D	Enumerator dummy	0.15	0.36	0	1
Uninterested respondent	D	Dummy for two categories	0.15	0.36	0	1
Land	A (+)	Total land holding in acres	2.2	2.61	0	20
Men	A (−)	No. of men in household	1.9	1.06	0	6
Women	A (+)	No. of women in household	1.9	1.05	0	7
Schedule caste	A (−)	Dummy for SCST	0.2	0.4	0	1
Brahmins	A (+)	Dummy for Brahmins	0.02	0.14	0	1
Reliance on VWL*	R (−?)	VWL-fuels /total trad. fuel	0.27	0.51	0	5
Distance to NF	R (+)	Distance in metres	2200	1300	300	5000
Market reliance	R (+)	Purchases of fuel/total fuel	0.1	0.23	0	1

Notes: *The numerator and denominator are taken from different parts of the household questionnaire, therefore the possibility of a ratio above 1. Still, the data from the section on collection from VWL is preferred since it is more specific. $N = 418$.

ables, since they are not expected to affect the size of the bid, once the decision is taken to support/make use of the plantations.

6. Results—lessons for project planning

In table 2 the results from the analysis of the maximum WTP answers are presented. It shows the virtues of the Tobit type 2 specification that deals separately with the participation decision and size of bid. This gives a flexibility to the model that is warranted if we compare the size, significance, and even signs, of the coefficients in the two steps. The overall result is that of high significance of chosen explanatory variables and in most cases expected signs. The slightly significant coefficient for the inverse Mill's ratio indicates some correlation between the error terms in the two steps.

The analysis gives some indications regarding which categories in the

Table 2. *Analysis of maximum WTP-bids – Heckit estimation*

	Probability of positive WTP		*Size of ln(WTP)*	
Variable	*Marginal effect*	*t-value*	*Marginal effect*	*t-value*
Intercept	−0.076	−0.50	2.21***	7.13
Start price (ln)	0.017	0.45	0.24***	4.14
Banishree	0.20**	2.09	−0.35**	−2.20
Minati	0.13	1.50	−0.48***	−3.26
Padhi	0.07	0.79	−0.65***	−4.04
Subrat	−0.21	−1.58	−0.24	−0.93
Mishra	−0.12	−1.24	−0.53***	−2.91
Samanta	0.23**	2.39	−0.43***	−2.53
Paul	0.32***	3.41	0.10	0.61
Uninterested respondent	−0.15*	−1.94	0.22	1.39
Men	−0.07**	−2.38	0.10**	2.27
Women	0.06**	3.38	−0.08*	−1.86
Schedule caste	−0.22***	−3.31		
Brahmins	−0.18	−1.14		
Land	0.06***	4.12	0.03	1.42
Reliance on VWL	0.19*	1.71	−0.31**	−2.00
Reliance on VWL squared	−0.02	−0.52	−0.10**	2.32
Distance to natural forest (10^{-3})	−0.012	−0.53	0.08**	2.19
Market reliance	0.33***	2.66		
Inverse Mill's Ratio			−0.39*	−1.74
Number of observations	419		275	
Log likelihood	−213		−246	
Restricted log likelihood	−270		−310	

Notes: Zero bids = 34%. Significance at 1%, 5%, 10% level indicated with ***, **, *. The estimation follows the Heckman two-stage approach and was done using LIMDEP7 (Greene, 1995). As noted by a referee, the reported 'marginal effects' for dummy variables are approximations under the assumptions that the variables are continuous. According to William Greene (personal communication, 1997) these values are generally very close to those obtained if we calculate the effect of the actual discrete change. This is also utilized in the following tables.

villages are most in favour of new plantations. Successful implementation and protection of a village plantation is dependent on a firm support among villagers. Information on salient factors for adoption can therefore be found in the probit analysis of the open-ended answers.

The results of the probit analysis are fully consistent with the results from an analysis of collection behaviour (Köhlin, 1998). The number of men and women in the household affects the probability of a positive bid, with more men decreasing the probability while more women increases the probability. This is also consistent with the observation that families with more women are more culturally constrained with regards to household labour allocation to fuel collection in this area. Families with more men are less dependent on nearby sources of fuel while families with more women can benefit more from such sources. From a gender perspective it also strengthens the case of plantation projects as a support to women. However, this constraint holds less for Schedule Caste and Schedule Tribes. These groups are also less involved in collection from VWL. This is consistent with the significant negative marginal effect of Schedule Caste in table 2.

The wealth indicator, land, is significant and positive. This is yet another indication of a common experience in social forestry projects, viz. that adoption is much easier and faster among better-off people, including land owners. Another indication of this is the positive and large effect of market reliance on the probability of a positive bid. This is consistent with observations that collection in VWL is a close substitute to purchase of fuel on the market (ibid.). This observation could be used in project planning for the location of new plantations, since it strengthens the case for peri-urban plantations.

The analysis of the open-ended bids gives some additional information regarding where new plantations are valued highly. The variable 'reliance on VWL' is the proportion of traditional fuels that comes from collection in VWL. The quadratic form was added since we expect a saturation effect in villages with large existing plantations. Instead we found that the squared term in the second step was positive. The combined effect is a slight positive effect on WTP from increased dependence on VWL. The policy implication would be that it is not necessarily wise to spread the plantations thinly. Parts of fuel production are indivisible and enough VWL enables a complete shift away from, for example, collection in natural forests.

It has already been mentioned that the success of the social forestry project has been very unevenly distributed. In many of the more forested districts of the state the survival rate has been low. Intuitively, one would expect that a new source of biomass would be most demanded where biomass is scarce. The distance to natural forest is included to test this. The variable was, surprisingly, insignificant in the probit analysis, while it was positive and significant when it came to the size of the bid. This supports the view that plantations close to readily accessible forests are less valued than those further away. This is also consistent with the finding in Köhlin (1998) that collection in VWL increases with distance to the natural forest, while the collection in the forest decreases with distance to the forest. This finding should be of interest in the choice of location of plantations, for example between peri-urban plantations and buffer zone plantations for protection of natural forests and national parks.

7. Reliability of CVM in this context

In a number of studies, CVM has proved to be a useful technique for eliciting preferences for environmental changes in developing countries. However, this needs to be tested in each new application. The most basic test is that the bids can be explained by variables proposed by economic reasoning. Table 2 gives many examples of significant explanatory variables with expected signs. Still, the variables included to test the reliability of the method indicate a number of biases.

First of all, we have signs of significant enumerator bias. Dummies for all but one enumerator are included in table 2. If we start by looking at the probit step in table 2 we find that Banishree, Samanta, and Paul have a significantly higher frequency of respondents who have a positive WTP. In the second step Paul and the reference have significantly higher bids than many of the others. There is no evidence of a gender bias among the enumerators though. Since the enumerators seem to have a significant impact on both the probability of positive bids and on the size of the bids we will return to this issue when we deal with the aggregation of bids.

The bid was followed by a question to the enumerator regarding how much consideration the respondent gave to arrive at the best possible value. This should pick up the risk that bids from respondents that give little consideration to the question, and thus might not express their actual WTP, would bias the sample. A dummy for the two lowest categories of consideration shows a downward bias in the probit step of table 2 with a significance at the 10 per cent level. However, in the second step the variable is insignificant. This can make us quite confident that the results are not inflated by haphazard bids. On the other hand, we cannot exclude the observations since it might very well be the case that it is the good in question that makes them uninterested in answering the questions.

7.1 Yea-saying and strategic behaviour

CVM is developed on the basis of conventional welfare theory and is designed to reveal individual utility or disutility. In this case we attempt to value the utility from a local public good in a social context that is dominated by community decision making and a paternalistic government. This poses both a problem and an opportunity. The problem with this is that people are not used to being asked about their individual preferences and might therefore be hesitant to respond. This is particularly true for women. Many women refuse to answer the contingent valuation questions since the husband was not present to decide. The opportunity is that communal cohesion leads the households to internalize non-use benefits to a larger extent than otherwise and that free-riding is minimized in bidding.

To make the scenario credible it had to be associated with an existing village institution, in this case the Village Committee. But by doing so, there is a risk that the respondent, instead of expressing his/her preference for a VWL, rather states the WTP for abiding to the perceived ruling of the Village Committee. In the follow-up questions to zero bids 6 per cent stated that the Village Committee should decide. These observations were excluded from the bid analysis, as they probably were not true zero bids.

An indication of resulting yea-saying, i.e. acceptance of the start bid not reflecting true preferences, would be if many respondents said yes to the bid, irrespective of the size of the bid. This is not the case, since 50 per cent of the sample, or 210 households, reject the start bid. In figure 1 we can also see that the rejection rate increases with the size of the bid. However, if we compare the answers to the referendum question with the maximum WTP question that followed we would have expected a much steeper decline in acceptance of the starting prices. Not only those who rejected the start price but also 41 per cent of those who accepted the start price gave a maximum WTP lower than the start price. This inconsistency could result from a number of sources.

First of all, this could be an indication of the anticipated yea-saying. The respondents have not said yes to the good in question but rather followed a social norm. When given the opportunity to state their own preference they reduced the bid. This would be consistent with a cultural context characterized by courtesy and collective or paternalistic decision making.

A second possibility is that the follow-up question is perceived as an invitation to a bidding game. One would therefore expect a strategic behaviour by the respondents where they understate their WTP in order to reach a beneficial final deal. The enumerator has an important role to play in encouraging or discouraging such behaviour.

We need to take a closer look at the answers to the referendum question and the inconsistent open-ended answers in order to indicate whether we have either yea-saying or strategic behaviour or maybe both. In table 3 we have a probit analysis of the answers to the referendum question.

If we had extreme yea-saying, everyone would have said yes and there would be no explanatory power of our independent variables. This is not the case. We see the expected significant reduction in acceptance as the start bid is increased but the coefficient is smaller than expected and the marginal effect is extremely small. There are also other significant coeffi-

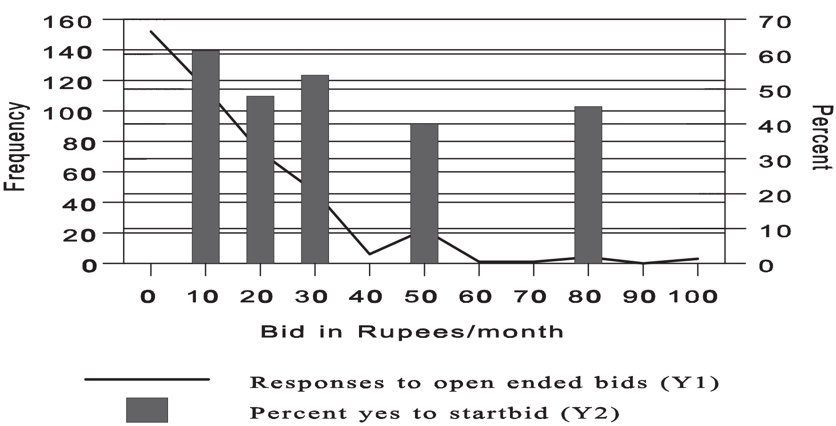

Figure 1. *Distribution of bids*

cients with the expected signs which means that the responses to the start bids are sensitive to the needs and ability to pay of the respondents. The results from table 3 are thus mixed. We can rule out extreme yea-saying since we have 50 per cent who say no to the start bid and these are not random. On the other hand, we do not see the reduction in affirmative answers that we would expect. This combined with the inconsistent answers would indicate yea-saying. The answer may be found in the significant effect of many of the enumerators. One sub-sample has been able to reveal their preferences according to caste, income, consumption patterns, etc. The other sub-sample has probably been more affected by the enumerators. In the latter group we can expect more yea-saying and inconsistent answers than in the former.

In order to say something about the potentially strategic behaviour let us analyse the inconsistent responses, i.e. those that first say yes and then give a maximum bid lower than the previously accepted start bid. A probit estimation of these is reported in table 4. We would expect that a purely strategic behaviour would not necessarily follow from our previous explanatory variables such as household wealth, reliance of VWL, etc. Rather it could stem from household and village characteristics, such as caste affiliation, educational level, and sex of head of household, etc.

The 86 respondents who have inconsistent answers have a mean WTP from their open-ended responses of 14 Rs/month which is the same as the full sample. In table 4 we see that a major part of the explanation of who is inconsistent and who is not can be found in which enumerator they met. The

Table 3. *Analysis of answers to start bids – probit estimation*

Variable	*Coefficient*	*Marginal effect*	*t-value*
Intercept	0.26	0.10	0.88
Start price	−0.011***	−0.004***	−3.16
Banishree	0.84***	0.34***	3.20
Minati	0.84***	0.34***	3.46
Padhi	−0.37	−0.15	−1.42
Subrat	−0.63*	−0.25*	−1.69
Mishra	−0.83***	−0.33***	−2.81
Samanta	−0.35	−0.14	−1.32
Paul	1.13***	0.45***	4.41
Uninterested respondent	−0.11	−0.04	−0.47
Men	−0.04	−0.02	−0.52
Women	0.06	0.02	0.82
Schedule caste	−0.52***	−0.21***	−2.68
Brahmins	−0.82	−0.33	−1.59
Land	0.06**	0.03**	2.18
Reliance on VWL	0.59***	0.23***	3.16
Distance to natural forest (10^{-3})	−0.16***	−0.06***	−2.59
Market reliance	0.77***	0.31***	2.55
Number of observations		419	
Log likelihood		−222	
Restricted log likelihood		−290	

Notes: Significance at 1%, 5%, 10% level indicated with ***, **, *.
The dependent variable is 1 if respondent accepted start bid.

Table 4. *Analysis of inconsistent answers 1–1 probit estimation*

Variable	*Coefficient*	*Marginal effect*	*t-value*
Intercept	−2.62**	−0.60***	−4.66
Start price	0.017***	0.004***	4.48
Banishree	1.36***	0.31***	3.94
Minati	1.86***	0.43***	5.63
Padhi	0.66*	0.15*	1.79
Subrat	0.31	0.07	0.58
Mishra	0.58	0.13	1.45
Samanta	−0.15	−0.03	−0.32
Paul	1.00***	0.23***	2.92
Uninterested respondent	0.06	0.01	−0.20
Men	0.08	0.02	0.85
Women	0.004	0.001	0.05
Head of household (men = 1)	0.59	0.13	1.36
Education of head of household (years)	−0.01	−0.003	−0.49
Schedule caste	−0.32	−0.07	−1.20
Brahmins	−0.34	−0.08	−0.55
Khandayat	0.69	0.02	0.36
Land	−0.06	−0.01	−1.48
Reliance on VWL	0.12	0.03	0.79
Distance to natural forest (10^{-3})	−0.14**	−0.03**	−2.07
Market reliance	0.49	0.11	1.47
Number of observations		418	
Log likelihood		−166	
Restricted log likelihood		−212	

Notes: Significance at 1%, 5%, 10% level indicated with ***, **, *.
The dependent variable is 1 if the respondent accepted the start bid and than gave a lower bid in the open-ended question.

eight enumerators can roughly be divided into two groups with four of them not significantly affecting the probability for inconsistency while the other four seems to have encouraged or at least readily accepted such answers.

Apart from the enumerators we find that increased starting price, not surprisingly, increases the probability of inconsistency. We do not find any significance in the household characteristics that we included to capture potential strategic behaviour. Instead we find that the distance to the natural forest decreases the tendency for inconsistency.

This suggests, although not very strongly, that economic behaviour is a factor behind the perceived inconsistency. Those that are faced with a high starting price and live close to the forest attempt to opt out. The results are thus more consistent with the yea-saying hypothesis, than with the strategic behaviour hypothesis.

7.2 Starting point bias

Closely related to yea-saying is starting point bias where we expect the respondent to anchor their open-ended bid to the price given in the referendum question. An indication of starting point bias would be if the respondents not only accepted the start bid but also kept this as their maximum WTP. However, this is only the case for 15 per cent of the respondents while 74 per cent had a final bid lower than the start bid and the remaining 11 per cent had a higher final bid than the start bid.

Still, table 2 indicates a significant and positive starting point bias. Mitchell and Carson (1989) noted that there did not exist any generally valid method to compensate for the effect of starting point bias. This is still the case and for good reasons. We simply know too little about how different starting points affect the relationship between real preferences and stated preferences. A number of reaction functions have been proposed in the literature and some have been empirically tested. Thayer (1981) assumed a linear and positive response in WTP to the size of the starting point and he also proposed a linear correction mechanism. More complicated formulations may have to be considered, since starting points above and below the respondents WTP are likely to yield different response patterns, which may be nonlinear (Mitchell and Carson, 1989).

This is elaborated in Farmer and Randall (1995). They distinguish between five different reaction models: (i) bid unaffected by starting point; (ii) bid equal to starting point; (iii) incomplete adjustment (such as Thayer's linear adjustment); (iv) incomplete but rational adjustment, where respondents would approach their true WTP asymptotically from below as the starting point rises; (v) surplus maximizing adjustment, where the bid array results in a starting point effect that at first increases to influence the passage of proposals that appear net beneficial and then falls as the respondent seeks to influence the process by overcorrecting to defeat proposals that may become net losses. The latter turns out to be the most preferred model in their empirical illustration. If we agree with Farmer and Randall that respondents never are expected to bid higher than their true WTP, then all the models imply that if a significant starting point effect biases WTP estimates, it is still likely to be a systematic underestimation of WTP. The size of the underestimation depends on the functional form of the reaction function.

Starting point bias is more of a problem if the distribution of the starting bids is very different from the distribution of true WTP. In this case the starting bids cover the relevant interval well, although the distribution led to a mean of the starting bids of Rs 33 which is higher than the mean values calculated from the continuous data but the same as the mean of the discrete responses. Given the potential downward bias from strategic behaviour in the open-ended responses and the lack of reliable methods to deal with starting point bias, no adjustment is made.

7.3 Lessons for CVM-design

The most fundamental question with regard to the CVM design is the format for preference revelation. An argument put forward in support of dichotomous choice is that it mimics actual market and referendum decisions. In a developing country context this is not necessarily true. A bidding game can be a more culturally apt way of preference revelation but it demands careful design and training of enumerators in order to reach consistent bids.

In this study we had indications of anchoring of maximum WTP to the start bids. A referendum approach is sometimes claimed to be less prone to starting point bias than for example bidding games. Herriges and Shogren (1996) assume for example that the respondents prior bid is not affected by the level of the initial referendum question, but that it affects the answers to follow-up questions. In an empirical application they find evidence of such bias in one of two sub-samples. Holmes and Kramer (1995) on the other hand are open to potential starting point bias in the form of yea-saying when using dichotomous choice. They reject the hypothesis that dichotomous choice and payment card methods are procedurally invariant and their analysis suggests significant starting point bias when dichotomous choice is used which is also what this study indicates.

The elicitation method chosen could also affect the mean WTP. If we in this study use the discrete data and a non-parametric approach based on the Ayer theorem (Kriström, 1990) we get a mean WTP of Rs 42 per month. We can also estimate the mean WTP from a logit regression of the discrete responses by dividing the constant by the coefficient for the starting bid, given a utility function linear in income (Kriström, 1990). Such a simple logit regression has a constant of 0.217 (0.115) and a coefficient of −0.00661 (0.00292).[3] This approach gives a mean WTP of Rs 33 per month. These values can be compared with Rs 14 per month which is the mean WTP from the open-ended data.[4] A t-test of the two latter mean values rejects the null hypothesis of equal means at the 1 per cent level ($t = 20$, $df = 836$). A welfare analysis is thus sensitive to the choice of elicitation method.

Another problem that may arise in a semi-subsistence economy is that a monetary bid is biased downwards because respondents are cash constrained. Attempts were made to state the bids in the local staple rice,[5] but in this area the economy is quite monetized and it was soon evident that the preferred mode of payment actually was Rupees. Still, in a situation with cash-constrained respondents and imperfect credit markets we can also expect the payment schedule to be important.[6] In the first survey (1993) the respondents were asked for a lump-sum payment. In order to see if there was a cash-constraint the respondents were also given the opportunity to restate their bids in terms of labour days. It turned out that in many cases where there was a zero bid in money, with the motivation 'we are too poor', there was still a positive WTP in terms of labour. Monthly payments were therefore chosen in the 1995 survey in order to decrease the impact of cash-constraint, imperfect credit markets, and the uncertain outcome of the plantation. The change of payment schedule increased the WTP by roughly a factor of seven when using a ten year payment period and a 10 per cent discount rate. If the respondents had a shorter time horizon than ten years when giving their monthly bids or if

[3] Standard errors in parentheses.

[4] The mean of the open ended responses excluding the zero bids is Rs 22 per month.

[5] Rice is for example used in a willingness to accept study on forest protection in Madagascar (Shyamsundar and Kramer, 1996)

[6] That temporal embedding can be evident under much less extreme conditions is reported by Spaninks and Hoevenagel (1995) who compare monthly and yearly payments for the environmental quality of a piece of Dutch countryside.

the implicit discount rate was higher, the difference between the two measures would be smaller.

To sum up this section we can note that the preceding analysis does not give us any conclusive evidence as to the source of the identified inconsistency in discrete and follow-up responses. The lessons learnt include the importance of selection, training, and supervision of enumerators in order to minimize biases. Although it is difficult to generalize between different contexts, it is fair to caution the use of a discrete design in a cultural context prone to yea-saying. However, one should also be careful with the introduction of a single-open ended question in a cultural context characterized by bargaining since it could be seen as an invitation to a bidding game.

We have thus shown that both discrete and open-ended approaches have their problems in this context. Preferred alternatives might then be a well-designed bidding game that could mimic everyday bargaining in developing countries. The opposite strategy, to leave the bargaining situation, is also possible. This could for example be done through the introduction of alternative elicitation formats, such as menus or rankings. More research and empirical evidence is needed on this.

8. Aggregation of WTP and CBA of plantation at village level

The most direct way to use CVM in project planning is to compare the WTP for a plantation with the expected costs. The mean WTPs for the different villages are given in Table 5. In the analyses of the bid functions we found a number of significant enumerator biases. The enumerator with most consistently positive bias is Paul. He increases the probability of yes to the start bid. He also increases the probability of a positive bid and has a more positive effect on the size of the open-ended bids than his colleagues. Paul's observations are therefore excluded in the aggregate analysis of bids in table 5. Mishra is the one with most consistently low bids. His bids are also excluded from the village analysis. The mean WTP in the different villages, excluding enumerator outliers, is shown in the second column. The latter is used to calculate the present value of monthly bids over 10 years[7] (one rotation) using a discount rate of 10 per cent (Shukla, 1997). This value is aggregated over the number of households in the village in order to establish the total village WTP. For project analysis these results should be compared with project costs. Direct plantation costs for a hectare of VWL is roughly Rs 800 in terms of material and Rs 9250 in terms of labor. If the village itself took responsibility for the plantation the opportunity cost of labour could probably be reduced. A village-level benefit–cost ratio, only including these costs, is presented in Table 5. If we instead look at the full cost of the project, and supplement the costs of material and labour with the opportunity cost of land[8] and overhead costs

[7] We use ten years here in order to be able to compare with the costs over one rotation. It is plausible that the respondents have a different time horizon in mind, which would give a different result. However, if time horizons are similar between villages, the rankings will remain unchanged.

[8] This opportunity cost could very well be accounted for in the bids but is included here to keep the comparison conservative.

for the project, we reach a present cost for one hectare, based on a ten year rotation, of Rs 27,400 (Köhlin, 1994). The resulting total benefit–cost ratio is conservative due to the inclusion of labour at the market wage and by the exclusion of final harvest. The value of the final harvest of an average surviving plantation is of the same magnitude as total project cost/ha.

Note, however, that any aggregation of WTP needs to make explicit assumptions with regard to the marginal social welfare impact of each particular individual's utility level and the individual's marginal utility of income (Kanninen and Kriström, 1992). In the preceding analysis we have made the implicit, and common, assumption of a utilitarian utility function and a constant utility of income. This is of course questionable in the context of a rural development project targeting rural poor that we fear are affected in their bids by cash constraints. There is no objective way of establishing the necessary welfare weights that we need, and politicians are hesitant in making such distributional considerations explicit. Still, it would be interesting to see how robust the ranking is in this particular case if we use a welfare weight of mean income divided by household income. Such a weight has the appeal of implying that utility is a logarithmic function of income.

Table 5 shows that three quarters of the villages have an aggregate WTP higher than the direct costs and half of the villages have an aggregate WTP

Table 5. *Village willingness to pay for VWL*

Village name	*Mean individual monthly WTP for proposed plot*	*Mean WTP excluding enumerator outliers*	*Aggregate village WTP*	*Village benefit–cost ratio*	*Total benefit–cost ratio*	*Total weighted benefit–cost ratio*
Chandapur	12	15	709,000	11.8	4.3	5.2
Narasinghpur	12	13	263,000	9.1	3.3	8.9
Kerendatangi	17	15	135,000	6.7	2.5	2.5
Mayurjhelia	21	23	203,000	6.3	2.3−	1.0
Khandisi	18	13	122,000	6.1	2.2	3.8
Nakithana	18	17	113,000	2.8	1	3.1
Raipada	15	8	110,000	2.7	1	3.9
Dimiria	15	12	63,000	2.6	1−	1.1
Krushnapur	15	15	101,000	2.5	0.9+	3.7
Patharbandha	18	19	100,000	2.5−	0.9	0.9
Arjunpur	10	7	46,000	2.3	0.8	1.2
Hariharpur	11	12	78,000	2	0.7	1.2
Sinduria	12	11	106,000	1.8	0.7+	1.3
Balarampur	11	11	36,000	0.9+	0.3	0.6
Kiapalla	8	7	18,000	0.9	0.3	1.3
Barapalli	9	9	46,000	0.8	0.3	0.6
Kadamjhola	9	8	48,000	0.7	0.2	0.8
Average	14	13	111,000	2.9	1.1	2.5

Notes: + indicates that the village would be among the selected had the proposed welfare weight been used.
− indicates that the village would not be among the selected had the proposed welfare weight been used.

that would cover all project costs. With the proposed weights[9] that number increases to three quarters. If we used a benefit–cost ratio above 1 as a project selection criterion 13 villages would be selected if we looked at village level costs and benefits.[10] If we used the weighted ranking only one of these villages would fall out. If we were to use the same criterion but with the total benefit–cost ratio only eight of the plantations would be carried out. In this case the weighted ranking would imply that two of these eight would be changed. However, the fact that the WTP was relatively high among poor people give an average of the weighted ratio which is more than twice that of the unweighted. This indicates in itself that the plantations have a favourable distributive profile.

However, the most striking result is the great difference between villages. It is very likely that in some villages the establishment of a VWL is a very good investment. However, this is not true in all villages, and this is probably what has marred many social forestry projects. The welfare gains from a plantation project can be significantly increased if proper selection of sites is carried out. This would probably also improve survival rates considerably, which would result in even greater returns from final harvests.

The aggregation also gives us some further information with regard to project planning over and above the analysis of the bid function. We find that villages with high benefit–cost ratios are not only far from the forest and with high market purchases of fuel, but they are also large. Once again, this speaks in favour of peri-urban plantations which, incidentally, is exactly the opposite to the present policy that has discontinued plantations and instead supported management of natural forests. Villages that benefit from the present policy are typically close to natural forests, small, with good access to biomass and little market participation.

The large differences between villages is also interesting from a methodological point of view, since they dominate the biases identified. This implies that if sampling is done properly it is possible to use the survey information for certain policy conclusions, despite the existence of substantial biases.

9. Conclusion

Aid projects are always in need of ways to improve efficiency. This is especially true for social forestry projects that have fared so badly that many large-scale projects have been discontinued and few new ones are planned. One factor affecting the design of projects is the survey methodology used. We note that the CVM, although widely used today in developing countries, is seldom used on forest resources and when used the potential for policy analysis is not tapped. Here we find that CVM can

[9] In addition to the weight 'mean income/household income' for WTP, we are using a weight of 1 for the costs.

[10] Note that the plantation could have both regional and global positive externalities that could be considered too. Köhlin (1998) has e.g. shown that the plantations decrease the pressure on natural forests. Such considerations could lead to other decision criteria.

be fruitfully used to support design and implementation of social forestry projects and that analysis of the bid function can give qualitative information that is difficult to identify by other methods such as traditional baseline surveys and participatory rural appraisals. However, caution must be given to the risk of biases in eliciting WTP because of the difficult interview situation.

The empirical findings include that plantations tend to be more beneficial for people who live far from the forest and who are dependent on market purchases. Households with few men and many women are more restricted in their fuel collection and therefore favour VWL. Analyses of collection behaviour show that Schedule Caste and Schedule Tribe are less active in collection in VWL (Köhlin,1998). They are also shown to be less prone to have a positive WTP for a new plantation.

Conventional wisdom from developed country applications might not hold for the design of CVM in a developing country context and classical biases such as yea-saying and strategic behaviour can be aggravated by the cultural context. A referendum approach can for example suffer from yea-saying due to a tradition of collective decision making while an open-ended approach can suffer from strategic behaviour that stems from a culture of bargaining. A bidding game could possibly address this since it could, if well designed, mimic actual market behaviour. An alternative would be to do the opposite and leave the bargaining situation by introducing a menu approach or contingent ranking.

There is still scope for much more research on the application of CVM to projects in developing countries, especially if we consider the potential for policy advice that could lead to substantial improvements in efficiency of large projects. Such research might also establish best practices specific to various developing country contexts.

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Appendix 1. The contingent valuation question

You still have some land in your village that could be used for a VWL. The forest department does not have money to plant VWLs any longer. If the village decided to plant a woodlot anyway it would probably be a ___ acre site situated at ___________________, which is about ___ minutes away. It would be a mixed plantation with many species but mainly Nilgri, Babul and Chakunda (Eucalyptus, Acacia nilotica and Raintree).

The benefits you would receive from this plantation would include the pruning material, leaves and if the plantation is well managed it will also give a valuable harvest. You should also consider the other benefits that arise from the plantation: that the pressure decreases on the natural forest and that you don't have to spend so much time collecting fuel. Maybe you could also reduce your consumption of dung and straw as fuel, so that you can give more natural fertilizers to your fields.

Considering all this, except the value of the final harvest, would your household be willing to pay ____ Rs* per month to establish and keep the proposed plantation? Yes / No.

What is the maximum amount per month you would be willing to pay to establish and keep the plantation? ____ Rs

*The start bid was either Rs 10, 20, 30, 45 or 75