Estimating the willingness to pay for the benefit of AES using contingent valuation method

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Abstract

This paper presents results of a Contingent Valuation Method (CVM) study based on responses from household members living in Winterswijk, the Netherlands. The respondents are asked to report their preferences on a range of willingness to pay (WTP) values for the multi dimensional land use benefits, within Agri-Environmental Schemes (AES), provided by farmers. Estimated WTP based on both two-step Heckman selection technique and single equation OLS is reported. Results indicate that the willingness to pay appears to depend positively on the level of trust and membership status of household members towards environmental organizations.

Keywords: Contingent Valuation Method, Sample Selection, 2-step method.
JEL Classification: C35, C51, C81, D60, Q12, Q28.

1 Introduction

Since the 1990s there has been a significant shift in the emphasis of agricultural policy of the European Union (EU). Instead of supporting agricultural commodity prices, the policy is directed to integrate environmental aspects into agricultural policy. Different agri-environmental schemes (AES) have been developed and introduced in different member states of the EU to give incentives to farmers for a voluntary reduction of those farming practices, which have a negative effect on conserving nature and landscape. In line with this, the Dutch government would like

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farmers in the Netherlands to provide environmental goods by switching to more environmentally friendly production methods, i.e., paying attention to soil, water and air quality and to conserving wildlife and landscape. To achieve these objectives, the government sets contractual agreements with individual farmers who receive compensation for certain environmental goods. Intrinsic in the programme is the belief that farmers will respond to incentives and adapt their current land use practices.

From an economic point of view, the incentives should be tied with both the costs and the benefits of AES. In the Netherlands farmers receive a compensation intended to cover the production loss in exchange for nature and landscape preservation. While knowing the opportunity cost might not be problematic (Beintema and Rijk, 1998; Schrijver and Wiersma, 1994), defining the benefit of AES is hard to quantify since valuation of non-market goods underscore a lot of information. That is, even though many people derive benefits from the consumption of environmental non-market goods and services, the benefits are not reflected in prices of marketable products. To aid government policy appraisal, economists have devised numerous approaches for the collection of information on public preferences for non-market goods. Here, we will describe how the corresponding public benefits have been valued by means of the CVM.

The CVM tries to overcome problems associated with measuring the benefit of AES by creating a hypothetical market where households are able to express their preferences for the AES in question in monetary terms. The CVM experiment investigates the willingness to participate in AES and the amount the households are willing to pay. The use of the method, which has become increasingly popular, is supported by a substantial body of theoretical and empirical literature (e.g., Bockstael and McConnel, (1980); Hanemann (1984); Desvousges, Smith, and Fisher, (1986); Carson and Mitchell (1989)). Contrary to other valuation techniques (e.g. travel costs or hedonic pricing), the CVM is, in principle, able to take into account the whole bundle of varying attributes in a spatial area and measure both their use and non-use value.

We apply the method to elicit the benefit of the application of AES by the inhabitants in the municipality of Winterswijk, the Netherlands. The study area is characterized the usage of the government's nature and land management program, in which farmers, who already receive payments for environmental goods or multifunctionality of land use, contract out some part of their land for environmentally produced goods. The CVM is used to estimate social benefits resulting from improvements in the quality of non-marketed environmental goods which are of direct use to the household members in Wingterswijk, namely, management of nature, landscape, monumental farm buildings and paths for walkers and bicyclers. Each surveyed respondent is presented with a series of options via payment cards in which

respondents are asked to choose among different payment schedules. In this paper we employ the technique that relies on a payment card method that is particularly useful in the context of CVM surveys. That is, the survey responses are recorded in different groups or categories defined by limits on the value of the goods in service.

The survey contained various attitudinal questions and demographic information questions, including household income, level of education that is reported in various CVM studies. More so, the context of social capital (including trust and the membership status) that was not explained in the previous CVM studies is included in the survey. Trust is perhaps the most important component of social capital: "Virtually every commercial transaction has within itself an element of trust, certainly any transaction conducted over a period of time" (Dasgupta, 2000: 329). In this paper we include the level of trust of households towards local government, farm management and nature organizations. In addition to trust, other elements of social capital include networks of civic engagement that enhance cooperation. To take this into account, in this paper we also integrate membership status of households in multifunctional activities.

In order to quantify the preference of respondents, we estimate the data using both OLS and Heckman's two-step model. This is similar to a few of the previous CVM studies who have suggested means to deal with zero WTP responses, however, are not uncommon in CVM surveys and must be appropriately taken into account in estimating WTP. To avoid discarding observations, for example, Whitehead et al. (1993) and Messioner et al. (2000) use models which are variants of Heckman's (1979) two-step procedure to detect and correct for sample-selection bias in the context of a referendum-style, or dichotomous-choice, CVM.

We proceed as follows. The next section describes the design of the CVM survey to be analyzed. In section 3, we describe our econometric model and the estimation technique. In section 4, we discuss the results of our estimation exercise, regarding the determinants of a respondent's decision to respond to the CVM question and the magnitude of WTP towards the AES. In section 5, we present the predictions of the individual and aggregate WTP amounts based on the model estimates. The last section concludes.

2 Survey

In 1994 the area surrounding Winterswijk was included in the policy "Valuable cultural landscapes" of the Dutch Government. This policy aims to protect high-valued landscapes with a rich history in the area surrounding Winterswijk, from the pressure of intensifying agriculture. To this end, the development of AES could help maintain the cultural landscape and nature in the area surrounding Winterswijk.

The CVM survey analyzed here covered a major part of the Winterswijk and is carried out by mail survey, in the fall of 2005, to a large sample of households in an attempt to value the benefits of nature and landscape management programmes. This questionnaire is developed by the Agricultural Economics and Rural Policy Group at Wageningen University so as to explore the value the inhabitants of the Winterswijk obtain from the landscape of their region.

This study is implemented to elicit the benefit of the application of AES to the household members. These schemes consist of the management of nature, landscape, monumental farm buildings and the creation of access to farmer's lands for walkers and/or bicyclers. The overall sample for the survey consisted of 1100 households. The sampling frame was based on the utilizing systematic random sampling; the survey sample was chosen to furnish a statistically good representation of the inhabitants. To improve the overall survey design, pilot surveys involving several households were administered before the main survey. In order to prevent the generally low response and consequent biases of postal questionnaire, the mail survey was complemented with a follow-up reminder and a lottery ticket. The latter was attached to the questionnaire to increase the response rate. The overall response rate was nearly 18.27%, lower than that normally achieved in mail surveys of this kind. Out of a total of 201 participants, 180 are a usable sample for the contingent valuation questions.

In CVM studies, it is common to have some participants who, at least initially, refuse to answer as a protest response or, respond that their maximum WTP is zero. For registering their responses, the residents were asked to choose between a "yes" or a "no" answer to the general WTP question, before proceeding to specify their WTP amount conditional upon their "yes" answer. To gauge the actual WTP amount, the survey utilized a "payment card" (Mitchell and Carson, 1989) in which the respondents were given the choice of the following range i.e., a big range is used from €0 to €500, and people could also fill in an amount above €500 so as to avoid biases due to the range of the numbers on the card, Table 1 shows the payment card used in the survey. The amounts on the payment are chosen to be amounts payable in money billets, because it might be assumed that most people think probably in paper currency when thinking of the amount they would be willing to pay rather than in coins. Ranges are: zero to €50, €50 to €100, €100 to €400 and after €400 to infinity;with €5, €10, €20 and €50 respectively. This is because the difference between €5 and €10 feels like more than the difference between €400 and €405.

The payment card did explicitly include the zero WTP option. This design of the survey was chosen to enable us to analyze the possibility that the zero response represented some kind of protest by respondents rather than a manifestation of their true WTP. The payment-card method was preferred because it is essentially a more

efficient form of referendum or sequential bidding, avoids starting point bias of the bidding game and yea-say problem of dichotomous choice, allowing a much higher effective sample size and saving effort on the part of respondents because thresholds can be scanned much more quickly. Payment cards also avoid most of the problems of open-ended questions, although the range of values on the payment card can create its own bias. This should facilitate the valuation task for the respondent and avoid the starting point bias of the bidding game. However, the careful use of the two pretests, we believe, would have mitigated this problem in the present case.

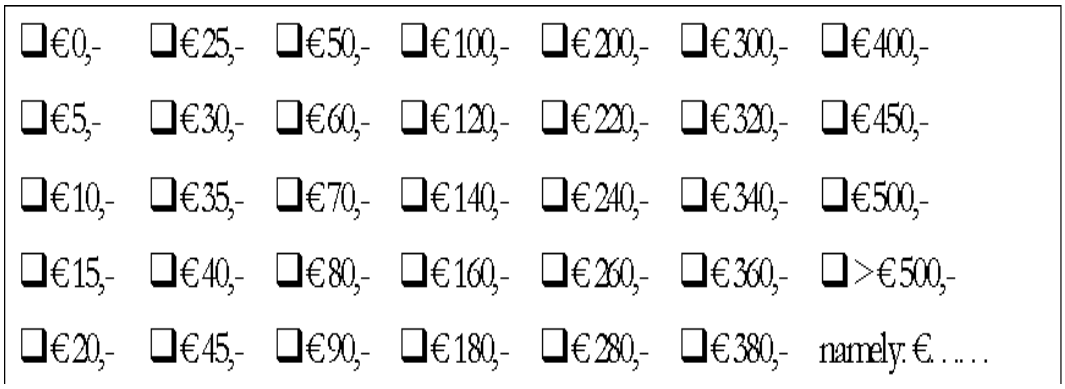

Figure 1: The payment card used in the survey

A disadvantage of the payment card format is that people cannot state the exact amount of money they would be willing to pay, but only the amounts shown on the payment card. That is, it is vulnerable to biases relating to the range of the numbers used in the card. More so, it has been alleged that CVM surveys often fail to measure the scope of an environmental problem. Carson and Mitchell (1993b) and Whitehead et al. (1998), however, conclude that upon careful analysis most CVM studies are able to detect differences in the scope of the environmental problem being considered. We now turn to a description of the estimation technique.

3 The Econometric Model

The survey design described in the preceding section suggests that the efficient estimation of the WTP for the multifunctionality of land use demands that we simultaneously explain both the decision to respond to the CVM question and the size of the WTP amount. Running a regression on the censored variable of WTP on the explanatory variables with Ordinary Least Squares (OLS) would result, among other problems in omitted variable bias. Using OLS will also generate inconsistent estimates of the average WTP amount, because one would be implicitly assuming that the underlying decision model is the same for respondents and nonrespondents,

and this may not be tenable. Moreover, discarding observations will reduce the efficiency of the estimates in both cases as full use cannot be made of the information contained in the sample. This is particularly true to the other observed characteristics of the nonrespondent which may have a bearing on the WTP. In any case, discarding observations may not even be a viable option if the survey sample is not sufficiently large.

A two-step Heckman Selection model is chosen, because this model will also be able to explain why some respondents are willing to pay and others not. The two-step Heckman Selection model explains both the decision of the respondent, whether or not to pay, as well as the size of the WTP amount. The model consists of two steps: In the first step, the decision of the respondent to pay or not to pay is modeled. In the second step, how much the respondents are willing to pay is modeled for all observations with a positive WTP. In the present context, let the binary variable Z_i represent the ith individual's observed response to the general contingent valuation question ($Z_i = 1$, indicates the willingness to participate and $Z_i = 0$, indicates the willingness not to engage in), and the variable W_i be the WTP amount category chosen by the individual. Thus we fitted the model via the following two equations:

$$W_i^* = \beta_w^{'} X_{wi} + \epsilon_{wi};\ W_i^* = j \text{ if } a_j \leq W_i^* < a_{j+1} \tag{1}$$

and W_i^* is observed only when $Z_i = 1$, and

$$Z_i^* = \begin{cases} 1 \text{ if } \beta_z^{'} X_{zi} + \epsilon_{zi} \geq 0 \\ 0 \text{ if } \beta_z^{'} X_{zi} + \epsilon_{zi} < 0 \end{cases} \tag{2}$$

where $i = 1, 2, ..., N$ and $j = 1, 2, ..., J$. N is the total number of respondents and J is the amount of WTP chosen by the respondents, including the implied zero option. The two β's are the unknown coefficient vectors. Similar to Heckman's two step procedure, the variable Z_i^* is an unobserved continuous index assumed to determine the observed response to the general WTP question in terms of a vector of exogenous variables X_{zi}. In particular, if the respondent will choose to pay any amount ($Z_i = 1$), the index Z_i^* will turn out to be positive. On the other hand, a non-positive Z_i^* implies a missing response with regard to the individual's WTP amount ($Z_i = 0$). Therefore equation (2) allows a positive probability of not responding to the WTP question. Alternatively, it suggests that all values of the dependent variable that takes a value of 0 and below are censored at 0. As a result, 29 left censored observations at $Z_i^* < 0$ from 180 observations remain.

Similarly, W_i^* is the true but unobserved continuous WTP amount, determined by the set of exogenous variables, X_{zi}. The $a_j's$ show the limits for the various WTP amount categories such that ith respondent chooses the jth category if his/her true WTP satisfies the condition $a_j \leq W_i^* < a_{j+1}$. Moreover, ϵ_{wi} and ϵ_{zi} are random error terms that may be correlated. In light of the discussion above, a nonzero correlation is the result of the dependence of Z_i^* on the respondents true willingness to pay, W_i^*. A positive correlation between ϵ_{wi} and ϵ_{zi} indicates that individuals with greater WTP are more likely willing to pay and participate in the scheme. A negative correlation suggests the opposite. In other words, a positive correlation indicates that those who do not participate are more likely to come from those with lower WTP categories and a negative correlation implies that the missing WTP observations stem largely from the higher WTP categories.

4 Empirical analysis

We report a regression analyses that helps to quantify the effects of the socioeconomic information on the WTP, but first the data and hypothesis will be presented.

4.1 Data Description and Hypothesis

In addition to the contingent valuation questions, the survey included a number of queries regarding respondents' characteristics. The first question includes the usual socioeconomic variables of contingent valuation studies, namely, INCOME, AGE, EDUCATION and whether the respondent is a member of an environmental organization. The second question consists of variables regarding their attitudes and beliefs concerning the environment. The respondents were asked about their perception of the current AES quality, their frequency use patterns of environmentally friendly goods. The questions also include respondents' perception of whether inhabitants should pay for AES, and the opinions towards the attractiveness of the area. The third question tries to figure out respondents' trust in local government, nature organizations and on the ongoing practices of AES.[1] These questions were posed on a Likert scale. Table 2 shows the Likert scale specification for the variables TRUST INDEX, ATTRACT, USE, AES, COMPENSATE and PAY.

Table 3 reports summary statistics of the variables used in the model along with their definitions and some descriptive statistics. In total, 201 respondents partici-

[1] A factor component analysis is utilized to construct a variable called TRUST INDEX based on the consumers' response on the views related to three different questions. These questions include respondents' views on the trust level of local government, farm management and nature organizations.

Variables	1	2	3	4	5
TRUST	not	little	neutral	a lot	completely
USE	never	seldom	sometimes	often	daily
ATTRACT	very unattractive	unattractive	neutral	attractive	very attractive
AES & PAY	strongly disagree	disagree	neutral	agree	strongly agree
COMPENSATE	strongly disagree	disagree	neutral	agree	strongly agree

Table 1: Lkert Scale Specifations

Variable	Mean	Std. Dev.	Min.	Max.	Definition of Variables
WTP	69.81	78.52	0	500	Amount of WTP
PARTICIPATION	0.84	0.368	0	1	Decision to participate
AGE	48.38	12.88	21	92	Years of age
INCOME	6.98	0.929	5.52	8.29	Log of average income
MEMBER	0.422	0.495	0	1	1 if member of nature organization
EDUCATION	0.617	0.489	0	1	Dummy 1 if Educated
TRUST INDEX	2.00	0.985	1	5	Trust in local, nature and AES organizations
ATTRACT	2.00	0.61	1	5	Level of Attractiveness of the area
USE	2.00	0.638	1	5	Frequency in the use of the AES
AES	2.00	0.722	1	5	View that farmers should apply AES
PAY	3.00	0.962	1	5	Inhabitant should pay for AES
COMPENSATE	2.00	0.87	1	5	View that farmers should be compensated

Table 2: Summary and Descriptive Statistics

pated in the experiment, out of which 180 respondents provided complete answers to the survey questions. In our regressions, we include the control variables AGE, AGE^2, INCOME, EDUCATION[2], attitudinal questions and finally we also include participant beliefs concerning the AES. The variable names are self-explanatory, as one can see, from Table 3.

The responses to these questions furnish the data on the observable determinants of the indirect utility function and the WTP amounts as discussed in the preceding section. It is not possible, however, to derive an appropriate set of personal and household characteristics for the empirical analysis in a straightforward way. On theoretical and intuitive grounds relevant variables will be discussed in detail below. Some variables are expected to affect the choice towards the question and the size of the WTP amount in the same (positive or negative) direction. We will discuss, as we deem relevant, the personal characteristics and the expected effect on the choice of the different attributes.

The variable AGE can take either sign. It is expected that there will be no difference between young and old for the degree of the WTP. Young people might

[2]Individuals with secondary, technical training and university degrees are considered to be educated while the individuals with less than secondary certificates are categorized as uneducated.

be more sensitive to the future of the environment goods, since they have a longer time to utilize the environment. At the same time, however, aged and elderly people with children might also be sensitive to the future of the environment if they are altruistic.

Income and education are important independent variables in explaining the demand for AES. It is expected that there is a positive relation between income and the decision to respond and the size of the WTP amount. That is, people with a higher income can spend more on environmental goods than people with a lower income. High income people spend comparatively more time on leisure activities like going out, visiting parks etc., suggesting a positive income effect. On the contrary, the effect of education is not clear. Individuals with a higher education might have more knowledge of environmental problems and might, therefore, have greater concerns about the environment than people who do not have a higher education. On the other hand, educated people understand the free riding problem of the public good and, therefore, it is possible to expect a negative effect of education to the participation or contribution nature of AES.

Besides personal characteristics, preferences for the choice of AES are likely to be influenced by other factors. One can think of the membership of nature organizations, trust in organizations involved in AES, demand for the use of environmentally friendly goods, type of occupation, and attitude of individuals on how the procedure of AES is carried out, could all have an influence on the choice to participate in and contribute to the AES. For instance, people who are members of a nature organization will be likely to have a positive attitude towards AES and, therefore, have a higher WTP than people who are not members of a nature organization. People who believe that local residents should pay for farmers applying AES in their surroundings are more likely to pay more. That is, respondents who agree that the local residents should pay for AES will probably be more likely to have a larger WTP. We also hypothesize that respondents who have high trust in management or nature organizations will probably have more trust in AES and, therefore, have a higher WTP than people who have a low trust in organizations involved in AES.

4.2 The Determinants of the WTP

Using the complete data set, the Heckman two step procedure is specified in the following way. The first step of the two-step Heckman model consists of the probit model estimating the probability of a respondent choosing the decision to pay or not to pay:

$$\begin{aligned}\Pr(Z_i^* &= 1) = \Phi[(\alpha + \beta_{z1}AGE + \beta_{z2}AGE^2 + \beta_{z3}INCOME + \beta_{z4}EDUCATION + \\ &\beta_{z5}TRUST\ INDEX + \beta_{z6}MEMBER + \beta_{z7}PAY + \beta_{z8}USE + \\ &\beta_{z9}ATTRACT + \beta_{z10}AES + \beta_{z11}COMPENSATE)/\sigma] \qquad (3)\end{aligned}$$

where Φ is the cumulative density function and σ is the standard error. The second step of the Heckman model takes the decision conditional on the choice of positive bid amounts people stated at the contingent valuation question and specifies the relationship between the dependent variables and the independent variable in a linear functional form:

$$\begin{aligned}W_i^* &= \alpha + \beta_{w1}AGE + \beta_{w2}AGE^2 + \beta_{w3}INCOME + \beta_{w4}EDUCATION + \\ &\beta_{w5}TRUST\ INDEX + \beta_{w6}MEMBER + \beta_{w7}PAY + \beta_{w8}USE + \\ &\beta_{w9}ATTRACT + \beta_{w10}AES + \beta_{w11}COMPENSATE + \varepsilon_i \qquad (4)\end{aligned}$$

where ε_i denotes the independent identically distributed (i.i.d) error term, which is assumed to be normally distributed with a mean of zero and constant variance. As it is highly unlikely that a respondent's decision to respond positively to a particular contingent valuation question and the subsequent choice of the WTP amount category are determined by entirely different considerations, we begin the model estimation for each question by employing the entire set of explanatory variables in both equations.

We begin our discussion with some general remarks. On examining the results displayed in Table 4, it is quite apparent that there exists a significant difference between the determinants of the decision to respond to a WTP question and those of the corresponding size of WTP amounts. There are also differences in the exogenous determinants across questions, indicating that the respondents are generally able to distinguish between them and to bring different considerations to bear upon their responses.

Next, we note that the estimated ρ, the cross-equation correlation coefficient, is positive and restricted between 0 and 1 for the two equations ($Z_i^*(1)$ and $W_i^*(2)$). This implies that for the two equations, concerned with gauging WTP to deal for the proposed AES, the Winterswijk residents with greater true WTP are more likely to answer the questions, and thus the missing responses are more likely to originate from lower WTP categories. Moreover, we observe that the estimated value of σ is larger than one, providing, we believe, some additional support for the choice of the estimation technique over the equation methods.

Turning now to the specific determinants of an individual's decision to respond to the WTP questions, $Z_i^*(1)$, and to the size of WTP amount $W_i^*(2)$ as reported in

	$Z_i^*(1)$		$W_i^*(2)$		$W_i^*(3)$	
	Coefficient	z-stat	Coefficient	z-stat	Coefficient	t-stat
Intercept	8.580	2.88	108.17	111.02	106.30	1.24
AGE	-0.261	-2.33	-2.801	-0.90	-1.92	-0.78
AGE^2	0.003	2.25	0.030	0.91	0.02	0.77
INCOME	0.161	0.93	4.603	1.00	2.79	0.43
EDUCATION	-1.068	-2.70	18.718	1.06	15.13	1.21
TRUST	0.069	0.48	16.324	2.31	12.36	2.07
MEMBER	1.054	2.99	49.200	2.88	41.89	3.55
PAY	0.639	4.03	8.171	0.87	9.68	1.68
USE	-0.183	-0.76	-3.142	-0.28	-4.26	-0.44
ATTRACT	0.051	0.17	-11.018	-0.89	-13.02	-1.15
AES	0.241	1.18	10.374	0.92	5.92	0.72
COMPENSATE	-0.027	-0.15	6.344	0.79	5.68	0.88
λ	41.558	1.68				
ρ	0.835					
σ	78.465					
Wald Chi2	59.44				3.13	
#Observation	180		180		180	

Table 3: Determinants of the willingness to response (Z*) and to pay (W*) .

Table 4, we notice immediately substantial differences between the two equations.[3] For the decision to respond to the WTP we notice that a respondent's membership status (MEMBER), participants level of education (EDUCATION) and years of age (AGE) of the respondents are the significant determinants from the socioeconomic category. An increase in membership status tends to increase the response rate. Perhaps respondents show some sort of herding behaviour i.e, individuals form their preferences as part of the social group to which they closely relate (See for example, Vatn and Bromley, 1993). The level of educated participants, however, decreases the propensity to engage in the response rate to the WTP questions. If people with a higher education understand the free riding effect of public good, then educated people might be less encouraged to participate to the provision of AES. The negative value of education (likely proxies for better understanding) variable might also capture respondent's protest behavior that funds for these AES services should come from government agencies or farmers themselves should be responsible for taking good care of lands they cultivate. The effect of age is not monotonic, i.e. the AGE variable has a negative and significant sign, but the marginal effects of age is increasing as the AGE^2 has a positive and significant sign. Thus the response rate to the WTP question increases with age at an increasing rate indicating that the

[3]We have experimented with a specification including cross-terms but none was found to be statistically significant.

intensity of preferences towards the willingness to contribute to environmental public good increases dramatically with age. The variable INCOME does not appear to be significant, however.

Regarding the environmentally related variables, we find that respondents' attitude towards paying for public environmental goods (PAY) generates a higher response rate for the propensity to participate in the WTP. We also find the TRUST variable has an expected positive sign though statistically insignificant. The attitude related variables (USE, COMPENSATE, AES) do not play any significant role in the determination of the response rate toward WTP questions.

We now consider the results of the determinants on the stated WTP amounts, W_i^*, as displayed in table 4. The picture with regard to the magnitude of WTP amount is somewhat different from that of the decision to participate in the WTP question. We observe that the common set of significant determinants of W_i^* is quite different from its counterpart for the decision to respond variable, Z_i^*, indicating perhaps the importance of quite different considerations bearing upon a resident's decision to answer a WTP question and the true, but unobserved, WTP amount. For example, while AGE1, AGE2, and EDUCATION, were important determinants of Z_i^*, they play no role in the determination of W_i^*. Another noticeable difference is that the households trust level (TRUST) appears to be an important determinant of the size of the WTP amount. This supports Alesina and La Ferrara (2002) finding that states with high trust levels tend to have higher provision of public goods. While some variables lose their significance in affecting the probability to pay a higher amount, respondent's membership status (MEMBER) continues to retain significance. With respect to the beliefs and attitudinal variables (PAY) and (ATTRACT), attachment to the AES turns out to be non significant.

While the estimated impacts may appear similar to those reported in Table 4, some important differences in predictions are noted in the following section. For comparison purposes, we also have estimated the WTP amounts W_i^* using only one equation $W_i^*(3)$ for the model based on the sample of respondents who answered the underlying WTP question and the results are reported in Table 4 in Column (3). The estimates look similar to those reported in Column (2), but some important differences in prediction are noted in the following section.

5 Prediction of the WTP

As prevously mentioned, the parameter estimates discussed above can be used to predict the size of the WTP amount for each of the individuals in the sample, conditional on whether the individual has answered the contingent valuation question under consideration. Table 5 reports the resulting average WTP amount. For com-

parisons with the full simultaneous equation model estimates, we also present the single-equation estimates as is reported in column 3 of Table 4.

The single equation estimates are larger than those of the simultaneous equation model for the WTP. Notice though, that the predictions of the single equation model are nearly equal to their observed sample means. For the Heckman model, unlike the linear regressions, the sample moments implied by the optimal solution to the model likelihood do not require that these predictions exactly match the observed averages. In the view of the estimated positive cross-equation correlation for the Heckman model, implying that the missing observations largely originate in the lower WTP amount categories, clearly indicates that the single equation was biased upwards.

Observed and Expected Willingness to Pay	
Observed Sample Mean	69
Single Equation	70.12
Simultaneous Equation	64.50

Table 4: Willingness to Pay for AES.

6 Concluding Remarks

Knowing the tastes of individual consumers and the pricing of commodities is important, since it allows identifying the opportunities for an appropriate supply level of non-market goods. However, the public good nature of many environmental goods masks the true preferences of individuals that make it difficult to estimate the benefits of AES. To elicit the WTP of the residents in Winterswijk for environmental goods, a survey has been developed. The main technique applied to elicit the WTP for AES is the CVM. We illustrate the technique by analyzing a large CVM survey aimed at measuring the WTP for the improvement of AES in the eastern part of the Netherlands, Winterswijk.

In this paper, we have illustrated the use of sample-selection estimation technique to deal with the problem of missing WTP responses in CVM surveys. Our method views the decision to respond to a survey question as endogenous to a system in which both the decision to respond and the size of the WTP amount are determined simultaneously, and generate consistent estimates for missing WTP amounts, utilizing the information contained in the entire sample, rather than on the basis of observations associated with only those who respond to the WTP question.

Our estimation reveals that the determination of the decision to respond to a particular CVM question and the resultant WTP amount are likely to be correlated, implying that the use of single-equation methods and restricting the sample to only observed WTP responses would lead to biased and inconsistent estimates of the true WTP amounts. The sign of the estimated correlation (which cannot be ascertained a prior) indicates the direction of the bias. Our estimates suggest the presence of a positive correlation between the WTP questions and the size of the WTP amount, implying that the use of single-equation methods would have led, in our sample, to an overestimation of the WTP amounts. Our estimation exercise also implies considerable gains in efficiency of the estimates of the mean WTP amounts as opposed to those generated by single-equation method based on only the observed WTP responses. Overall, the result implies an average WTP of €65 per household members, per applying AES.

The results confirm that the relative importance households ascribe to land use and their attributes depend on the socioeconomic characteristics of the local residents of Winterswijk. With regard to the determinants of the size of the WTP amount, the level of trust and membership status of households towards the institution which links to the awareness of environmental issues are significant determinants. These results suggest that trust in organizations involved in AES and environmentally conscious residents who are members of environmental organizations have reported a greater WTP amount to rectify for the improvement of AES.

For the decision to respond for the WTP question we also found that AGE, membership status to positively affect to the response rate while level of education affects negatively for the decision to participate in WTP questions.

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