

# Household Willingness to Pay and Farmers' Willingness to Accept Compensation for Establishing a Recreational Woodland

IAN J. BATEMAN,\*† EMILY DIAMAND,\* IAN H. LANGFORD†‡  
& ANDREW JONES\*

\*School of Environmental Sciences, University of East Anglia, Norwich NR4 7TJ, UK

†Centre for Social and Economic Research on the Global Environment (CSERGE), University of East Anglia, Norwich NR4 7TJ, and University College London, London WC1E 6BT, UK

‡Health Policy and Practice Unit, School of Health and Social Work, University of East Anglia, Norwich NR4 7TJ, UK

(Received February 1995; revised August 1995)

**ABSTRACT** *The UK Forestry Commission's recently implemented Community Woodland scheme sets out to provide new recreational woodland facilities near to towns and cities where such resources are in short supply. This study examines household willingness to pay (WTP) for such a proposed woodland by means of the contingent valuation (CV) method. A stratified sample of 325 households in Wantage, Oxfordshire, was interviewed and asked to state both their annual and per-visit WTP. Analysis of a number of recognized potential biases suggested that the results obtained must be treated with caution although we argue that the CV provides a useful ballpark indication of preferences. A simultaneous CV survey of farmers' willingness to accept compensation for converting agricultural land into woodland proved to be far more robust, despite a small sample size. We conclude that farmers are more familiar with the concept of assessing potential compensation than are households with estimating hypothetical payments for increased provision of public goods.*

## Introduction

In 1991 the Forestry Commission (FC) introduced the Community Woodland Scheme (CWS) with the intention of stimulating woodlands "within 5 miles of the edge of a town or city and in an area where the opportunities for woodland recreation are limited" (Forestry Commission (FC), 1991). This emphasis upon public access, recently restated in the FC's *Walkers Welcome* initiative (FC, 1994), represents the culmination of several decades of effort by the FC to provide woodland recreation throughout the UK. However, to date only 4099 ha of land have been registered under the CWS (FC, personal communication, 1995).<sup>1</sup> Amongst farmers it would seem likely that a primary reason for this low rate of uptake is that financial inducements are inadequate. From its inception the CWS has paid a flat rate, once-and-for-all planting grant of £950 per ha. Farmers can supplement this with annual grants paid under the Farm Woodland Premium Scheme ranging from £250 for prime arable land down to zero for unimproved

lowland areas (Ministry of Agriculture, Fisheries and Food (MAFF), 1992). However, these annual payments are limited to 10 and 15 years for mainly conifer and broadleaved woodlands respectively but are repayable if farmers reconvert their land within 20 or 30 years respectively.<sup>2</sup> Such returns are relatively poor by most agricultural standards. One of the two experiments reported upon in this paper looks at how much farmers would require in terms of a constant annual subsidy in order to convert land into recreational woodland of the sort envisioned under the CWS. Ancillary questions examined here include the extent of involvement which they would be prepared to undertake in return for such subsidy payments, and the motivations behind farmers decisions.

The other experiment reported upon here focuses upon the benefits side and essentially asks whether or not the levels of subsidy required by farmers to provide community woodlands can be justified by the recreational benefit values created. This issue is addressed via interviews with the relevant consumers of such services, namely those householders within the catchment area of such woodlands.

While these are interesting questions, this paper has a further underlying purpose. In economic terms the measures of value we are investigating are, in the case of the farming experiment, farmers' willingness to accept compensation (WTA) for switching from their present activities into the provision of recreational woodland, while for householders the relevant measure is their willingness to pay (WTP) for the recreation benefits gained (Just *et al.*, 1982).<sup>3</sup> Recent years have seen an explosion in the use of a direct questioning approach to the estimation of such values. This approach, most commonly referred to as the contingent valuation (CV) method<sup>4</sup>, has generated a powerful academic debate, with distinguished proponents (e.g. Hanemann, 1994) and critics (e.g. Diamand & Hausman, 1994) arguing fiercely about the validity of the estimates produced. Consequently, while the object of study is important, the methodology employed is itself of at least equal interest.

## Study Design

To avoid the stratification problems raised by sampling over a large region, the study interviewed farmers and households within a relatively small area, namely the town and environs of Wantage, Oxfordshire. To ensure comparability, both surveys hypothesized the setting up of a recreational woodland within five miles of the town (as per the CWS). This section presents study design and questionnaire details for both the household WTP and farmers' WTA experiments.

### *Householders WTP Survey*

Wantage is a rural town in Oxfordshire with a population of 11 495 adults as recorded in the 1991 electoral register. It is 15 miles from any city and although there are a few recreational facilities within this distance there are no nearby open access woodlands. The town therefore provides a discrete sample population for which some demand for additional recreational facilities is likely.

The survey covered the four census wards of the town, including the connected village of Grove. Out of these areas a stratified sample of 400 households

was selected by targeting every 29th household on the electoral role. This method is consistent with that recommended by Tunstall *et al.* (1988) in their review of CV sampling procedure. Between July and September of 1991 each selected household was visited and the head of household interviewed.<sup>5</sup> Of the 400 households visited, 29 were unobtainable after three visits, a further 37 refused to answer the questionnaire and a further nine interviews yielded incomplete questionnaires. A useable sample of 325 responses was therefore collected.

*Household questionnaire design.* An initial questionnaire was tested in a pilot survey of 30 households not selected for use in the main study. The pilot was undertaken in order to:

- (1) Clarify the meaning of the contingent market description with respect to the respondents' understanding of it, in order to avoid market misspecification (Mitchell & Carson, 1989). At this point set responses to certain questions regarding the market scenario were developed.
- (2) Assess the level of non-response to an open-ended valuation question<sup>6</sup> as certain commentators have highlighted this as a problem (Eberle & Hayden, 1991). Levels of non-response were found to be acceptable and therefore the format was retained.
- (3) Assess payment instrument effects. Initially only an annual trust fund payment vehicle was used. After the pilot a per-visit entrance fee vehicle was also included to provide some comparison.

A questionnaire for the main survey was drawn up following the above revisions.<sup>7</sup> Here initial questions asked respondents how long they had lived in the area. This was both to provide data on a potential explanatory variable and to accustom respondents to the interview process. Subsequent questions asked respondents to name sites of recreation that they had visited on a day trip basis during the last year and to state their preferences with respect to urban or rural sites. These questions were included to encourage consideration of preferences for competing recreation facilities and to establish a measure of familiarity with the proposed good.

Following this the contingent market and payment vehicle were introduced via a 'constant information statement' which was read out verbatim to all respondents. This informed households about the size (100 acres) and facilities (recreational walks and car parking) of the proposed wood and its open access nature. Respondents were then asked whether or not they would be prepared to pay towards provision of the wood. Such a 'payment principle' question was included mainly as a way of validating zero bids as it was felt that directly presenting respondents with a WTP question might intimidate those who hold zero values (Harris *et al.*, 1989). Respondents who answered "no" to this question were asked to state their reasons for such a response whilst those who answered positively were asked the WTP questions.

As indicated above, two WTP questions were used in the main study. Firstly, respondents were asked how much they were WTP per household per annum in extra taxes (referred to subsequently as the per-annum question). Secondly, respondents were then asked how much they would be WTP per adult per visit as a car parking fee (referred to subsequently as the per-visit question). Here then all respondents who were WTP some amount were presented with, in turn,

both the annual and per-visit format question.<sup>8</sup> In all cases an 'open-ended' question format was used wherein respondents are allowed to freely state their WTP response.<sup>9</sup>

After the valuation questions, respondents were asked to assess their expected use of such a woodland. This was included both to provide a potential explanatory variable for analysis of the bid function and to indicate the distribution of use and of non-use values included in WTP responses. This indirect method was considered preferable to asking respondents to divide their valuation into subcategories of existence, use and option value (as per Loomis *et al.*, 1984) which we considered to be a suspect procedure, liable to allow respondents to inflate the non-use motivations of their valuations.

Finally all respondents were asked questions regarding their household characteristics in order to establish socio-economic factors affecting willingness to pay.

### *Farmers' WTA Survey*

The study also examined the levels of payment required by local farmers for them to undertake the proposed woodland scheme, i.e. their WTA compensation. The relatively small local farming population posed an immediate problem regarding sample size.

Farm addresses were taken from the local telephone directory. Initially, addresses were restricted to those within a three-mile radius of the town in order to maintain consistency with the scenario presented in the household survey. However, this failed to produce an acceptable sample size and a six-mile radius was finally adopted. Just over 40 farms were contacted by mail to request a face-to-face interview. A considerable proportion of farms refused to be interviewed, the main reason being that, as interviews coincided with the harvest season (the surveys being conducted between July and October 1991), farmers faced heavy workloads and were not available for interview.<sup>10</sup> Because such refusals were for reasons unconnected with the content of the questionnaires, the farmer participation rate is not seen as a serious problem for the validity of the survey. In total 19 farm interviews were completed. Whilst we recognize and accept problems regarding such a sample size, we would highlight the difficulty of assembling a large sample here and feel that the results can be accepted as generally indicative of farmers' attitudes.

*Farm questionnaire design.* Due to the limited availability of respondents it was impossible to conduct a pilot survey of farms. Initial questions were related to the value of present agricultural production and associated costs. These data provided a comparison between the expressed value of the woodland as given in the household survey, and the current value due to agricultural production. Furthermore, by initially establishing the value of the land on the farm, it was hoped to focus the farmer's attention on an acceptable and reasonable level of compensation for income loss due to the removal of land from present production. Such an approach was designed to minimize any tendency to overstate compensation requirements.

This part of the study was designed to assess farmers' responses to the Forestry Commission's Community Woodland scheme (Forestry Commission,

1991). The relevant payment conditions and contingent market were introduced by means of the following statement:

The purpose of this survey is to assess the feasibility in this region of planting an area of mixed woodland for recreational purposes. As you may know, under the Farm Woodland Scheme<sup>11</sup> the government provides grants for planting areas of at least 3 hectares on farms. The scheme being examined in this survey would allow participating farmers to take up these grants, but in addition to receive further payments from a local woodland trust. These extra payments would be conditional on the woodland being accessible to the public (with a small area allocated for parking space). The land would remain your property but you or your subcontractor would be expected to provide basic maintenance.

The respondents were then asked to state a minimum level in pounds per annum per hectare (or acre), which would be acceptable to them in order to commit land into such a scheme. They were also asked how much land they would allocate to the scheme at the payment level stated. It should be noted that respondents were not told the payment levels available under existing schemes. This was in order to avoid the possibility of such information providing an anchoring point for the valuations given. However, it was clear from the interviews that some of the farmers had prior knowledge of the scheme and levels of payment and this may have affected responses.

## Household WTP Study

### *Household Characteristics*

Questions regarding length of residence revealed that less than 5% of the sample had lived in Wantage for one year or less while the mean was 18.5 years (median = 17 years). This indicated a high degree of familiarity with the local environment.

Respondents were invited to list up to four recreation sites which they had visited over the past year and state average annual frequency of visits to stated sites. Responses were subsequently classified into three categories of recreation attraction: urban (e.g. leisure centres); estate park (i.e. non-urban attractions with entrance fees); and rural (open access). Responses indicate a significantly higher frequency of visit to rural sites (a mean of over 8 visits/household p.a.) than either urban or estate park sites (means of 2.0 and 2.6 visits respectively). This trend was borne out by a direct question asking households whether, given the choice, they would prefer to visit a rural (outdoor) or an urban (indoor) recreation site. Of the 325 households surveyed 298 (92%) stated that they would prefer to visit a rural/outdoor site leaving just 27 households (8%) stating a preference for an urban/indoor site.

Following the WTP questions (discussed subsequently), respondents were asked to predict how often they would visit the proposed wood annually. Only 11 households (3.4%) stated that they would not visit the wood. Mean predicted visitation frequency was just under 15 visits per annum.

Comparison of responses regarding existing recreation visits and expected visits to the proposed woodland revealed that predicted demand for the wood

was relatively high. Whilst some of this difference may be due to over-enthusiasm in favour of provision,<sup>12</sup> and there is clearly a rounding effect in predicting visits, this does demonstrate a very significant demand for the proposed wood. This is perhaps not surprising given the notable absence of open access public space in the locality, particularly of quality rural land.

Data detailing household composition by age was also collected. Observations were categorized into groups roughly corresponding to dependency criteria (i.e. pre-school, school, young/mid/older income-earners, pensionable) and these categories proved useful in the subsequent bid curve analysis.

Finally data were gathered regarding the economic characteristics of households. Principal amongst these variables was household income.<sup>13</sup> Assurances of confidentiality and the use of information cards employing alphabetical income categories, appear to have allayed any resistance to providing such information and a 100% response rate was achieved on this question.<sup>14</sup> Sample income was found to approximate a normal distribution about the median £15 000–£19 999 category.

### *Refusals to Pay*

Prior to both the annual and per-visit format WTP questions, respondents were asked whether they were, in principle, WTP some amount for the proposed woodland. This question was included primarily to validate a zero bid as it was felt that, in the absence of such a question, asking respondents for their WTP might inhibit such bids and upwardly bias mean WTP. Such an approach accords with the emphasis upon 'conservative design' which underpins the National Oceanic and Atmospheric Administration 'blue ribbon' survey design protocol (Arrow *et al.*, 1993). All those who responded negatively regarding the principle of payment were asked to specify their motivations for such a response. Details of these reasons and overall refusal rates are given in Table 1.

Table 1 indicates a relatively higher refusal rate regarding the annual WTP question (24.3%) than we have encountered for more major environmental goods such as the Norfolk Broads (Bateman *et al.*, 1994). This seems logical and as an economic constraint (insufficient income, etc) was by far the prime motivation for refusal; such zero WTP sums do not pose a theoretical problem. The residual

**Table 1.** Refusal reasons and refusal rates for annual and per-visit WTP formats

Reason for refusal	Annual WTP		Per-visit WTP	
	No.	%	No.	%
Insufficient income or other economic constraint	70	21.5	37	11.4
Access to woodland should be free	5	1.5	11	3.4
The Government should pay	3	0.9	0	0.0
The land should remain in agriculture	1	0.3	0	0.0
Total refusal numbers/rate	79	24.3	48	14.8

*Note:* Percentages are based upon the entire sample of 325 households. All respondents were presented with both WTP formats.

refusals for this format include three respondents who indicated an extreme free-riding (the Government should pay) motivation underlying their response. Such a strategy was expected to occur to some extent. However, the rate of extreme free-riding is not excessive and is considerably lower than that observed in large scale user studies (Bateman *et al.*, 1993). Those respondents who refuse to bid upon the grounds that the woodland should be open-access could arguably be interpreted as articulating a fundamental objection to the entire principle of the economic appraisal of projects (not just monetary evaluation of environmental preferences), arguing instead for a policy-led approach to decision making (Sagoff, 1988). If such responses were widespread they might provide a serious criticism of the basis of this study. However, the observed scarcity of such responses can be interpreted as a counter argument that individuals recognize the need to allocate finite resources in an economically efficient manner.

The lower refusal rate for the per-visit format might be seen as reflecting a wider acceptance of use-related entrance fees over the more general annual payment vehicle. In particular this may reflect resistance to the per annum vehicle because it is insensitive to the level of usage enjoyed by the respondent. A second, less favourable interpretation could be that, as our sample will include households who do not enjoy woodland recreation and would not visit the site, the entrance fee vehicle allows such households to state a per-visit WTP sum (where they are unwilling to pay an annual fee) in the knowledge that, as non-visitors, they will also ultimately be non-payers. Analysis of the data provided some rather weak evidence for such an interpretation. Those who estimated a low or zero number of visits to the wood were found to be relatively less likely to agree to pay at least some amount per annum, but relatively more likely to agree to the principle of paying via entrance fees. However, these relationships failed to satisfy tests of statistical significance. Furthermore, anecdotal evidence for such strategic behaviour arises from noting that not one household stated that its reason for refusing to pay was that it had no intention of visiting. Given that it is likely that some such households were interviewed, this raises concerns regarding the per-visit measure. However, such a conclusion needs to be tempered by the observation that, within stated reasons for refusal, the majority centred upon economic constraints which themselves pose no theoretical problems.

#### *Mean and Aggregate Willingness to Pay Results*

The CV design employed used open-ended (OE) WTP questions. In the light of our research into the effects of using alternative WTP elicitation technique this seems a valid approach, although our findings indicate that OE questions may elicit lower bound estimates of WTP (Bateman *et al.*, 1993, 1995). Given a general desire for conservative design in CV studies (Arrow *et al.*, 1993) this seems a potentially desirable feature of this study. Accepting these riders, Table 2 gives univariate WTP statistics for responses to the two formats. To guard against the potential non-normality of the response distributions (see subsequent discussion of Figure 1) we report bootstrapped 95% confidence intervals, calculated via the BCa percentile method (Efron & Tibshirani, 1993) using 999 simulations. This method is based on a refined normal approximation which corrects for bias and

**Table 2.** Summary WTP results: per-annum (*WTP<sub>pa</sub>*) and per-visit (*WTP<sub>fee</sub>*) formats

Format	<i>n</i>	Mean	Median	Q1	Q3	95% CI (non-parametric)
<i>WTP<sub>pa</sub></i>	325	9.94	50.00	2.00	15.00	8.92–11.14
<i>WTP<sub>fee</sub></i>	325	0.82	0.75	0.05	1.00	0.75– 0.89

Note: All values in 1991 prices. Minimum bid = zero for both formats (included in calculation of mean etc.)

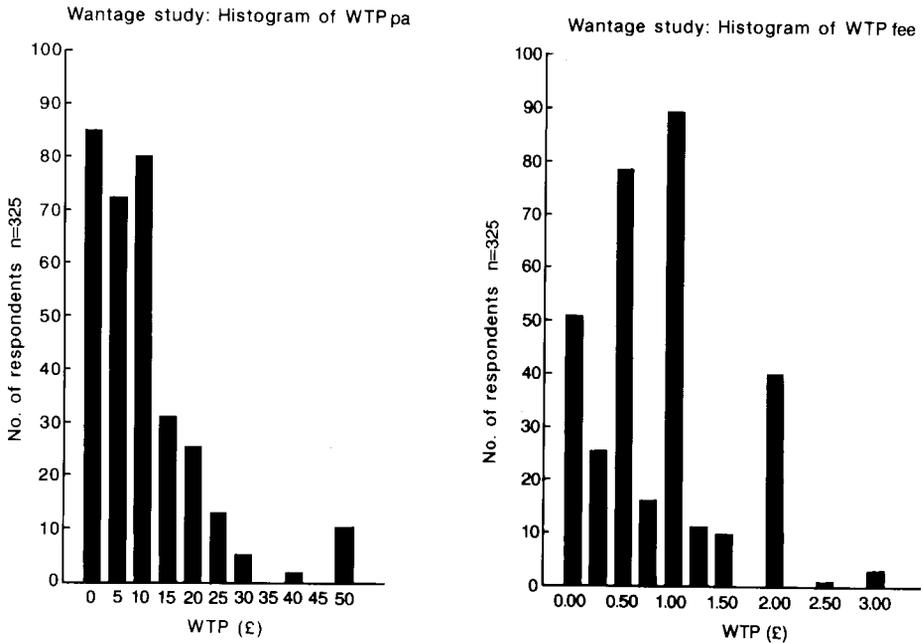
skewness in the distribution of mean WTP and is hence an improvement over the basic non-parametric bootstrap.

The procedure used to calculate aggregate WTP varies according to the question format used. The per annum format question elicited a mean WTP (including those who refused to pay as zeros) of £9.94 per household. The town of Wantage has an adult population of 11 495 so, even if we take an extreme upper bound estimate on household size (so as to derive a lower bound estimate on household WTP) of 2.57 (Central Statistical Office, 1991),<sup>15</sup> this would give an estimate of some 4473 households in Wantage which would in turn imply an aggregate WTP of £44 450 per annum for the woodland.

Turning to consider our per-visit measure of WTP, we elicited a WTP of £0.82 per adult visit (again including those who refused to pay as zeros). The mean estimated number of visits (including those who would not visit) was just under 15 per annum<sup>16</sup> implying a total annual entrance fee expenditure of £12.29 per adult. Grossing up across all adults<sup>17</sup> implies a total annual WTP entrance fees of £141 252.

### *Analysis of WTP Responses*

Figure 1 illustrates WTP response distribution for both the annual and per-visit questions. All refusals to pay are included as zeros. At first glance there may appear to be certain fundamental differences between the distributions illustrated in Figure 1, with the annual responses seemingly more skewed than the per-visit values. Furthermore, whilst the per-annum distribution appears smoothly declining as values increase, the per-visit distribution appears to be clustered upon certain round figures (50p, £1, £2, etc.). However, upon closer inspection these distributions exhibit some similarities. The characteristic of respondents giving round number answers in the per-visit scenario is, to some extent, repeated in the annual sum experiment (where responses were typically £5, £10, etc.), although examination of the overall distributions shows that this rounding effect is more pronounced in the per-visit format question. This rounding of WTP responses does not of itself present any serious problem provided that upward and downward rounding occurs in roughly equal measure.<sup>18</sup> However, we now turn to consider various potential biases which, if operating at a significant level, would cause us to doubt the overall validity of our results insofar as they are estimators of true WTP.



**Figure 1.** Response distributions for annual and per-visit format WTP questions (*WTPpa* and *WTPfee* respectively).

*Spurious non-zero responses.* Further examination of the two distributions illustrated in Figure 1 shows that, examining non-zero bids, both exhibit an initial increase in positive responses as the WTP level increases from zero to some relatively low amount after which the distributions tail off. This trend has been observed elsewhere (Bateman *et al.*, 1992) and may indicate an effect similar to the 'warm-glow giving' phenomenon proposed by Andreoni (1990) or the 'purchase of moral satisfaction' idea put forward by Kahneman & Knetsch (1992).

Andreoni (1990) discusses the concept of 'impure altruism' whereby individuals donate to charitable good-causes so that they can enjoy a 'warm-glow' of giving. Therefore, in answering our questionnaire, certain respondents may state some (probably small) bid for 'warm-glow' reasons. This poses no problem provided that such respondents are genuinely prepared to pay the amounts stated. However, it may be that some respondents see the CVM hypothetical scenario as an opportunity to endow themselves with a 'warm-glow' satisfaction at no cost. Such respondents will be unwilling to state a true WTP of zero and will prefer to state some (again probably small) bid.<sup>19</sup> A related issue here is that some respondents may have an aversion to stating a zero response. Motivations for such a response are many and complex but centre upon the interactive interview process. Orne (1962) discusses the 'good respondent' who attempts to please the interviewer by stating what they perceive as a 'correct' answer. A zero bid is unlikely to be thought to conform to such specifications. Similarly the respondent may hold the interviewer in high esteem and again 'try to please'. A further motivation may be the desire (either conscious or subconscious) to

conform to some 'social norm' where stated WTP reflects a mixture of the respondent's notions of a socially fair level of WTP and prior experience of payments for comparable goods (entrance fees, car-parking fees, etc.).

All the above motivations are liable to lead respondents who would not actually pay, away from a stated bid of zero and towards one which arises from the interview mechanism. Such a response cannot necessarily be attached to the specific good in question, i.e. we could change the good for any similar scale 'good cause' and those individuals concerned (note, not all respondents) would still give the same response.<sup>20</sup>

If 'warm glow' motives are reflected in low value bids then we might expect that our bid function model (discussed in detail subsequently) would fit less well for these random low amounts than for the rest of the dataset.<sup>21</sup> Inspection of bid function residuals (for equation (1)) indicated that this seemed to be the case (although the effect was not strong enough to invalidate our modelling approach) while partitioning the dataset to isolate those predicting less than 10 visits per year noticeably reduced the overall fit of the model.<sup>22</sup>

We therefore have some evidence that such low-sum 'warm glow' bidding may be occurring. But, given that these are small amounts, does it matter? To assess this, a simple analysis was undertaken in which we assumed that all bids below a certain level fell into the 'warm-glow' category. This is clearly a crude approach but one which was dictated by limited resources. The distribution of bids under both formats was examined for evidence of any appropriate cut-off point. The rounding of bids observed earlier suggested certain low category amounts which respondents might choose to give under 'warm-glow' bidding. For the annual format let us assume that the relevant bid threshold is £5 p.a. whilst for the per-visit question we can assume a threshold of £0.50. We can now recalculate mean WTP by setting all bids up to and including these thresholds to zero. Table 3 details the results of such an analysis.

Table 3 indicates that, for both formats, even if we adopt the very strong assumption that all bids up to and including the chosen threshold are 'warm-glow' responses and (again, a strong assumption) should really be zeros, then this makes relatively little difference to the estimated mean, which declines 11% for the annual format and 17% for the per-visit format (medians remain constant throughout). We would suggest that such assumptions are, in fact, too strong as they omit some bids which are non-spuriously non-zero.

**Table 3.** Impact upon estimated means of truncating potential 'warm-glow' bids

WTP format	Truncation option <sup>a</sup>	Mean WTP (£)	Median WTP (£)	Standard deviation
Annual	Untruncated	9.94	10.00	10.66
	Truncated	8.85	10.00	11.36
Per visit	Untruncated	0.82	0.75	0.64
	Truncated	0.68	0.75	0.63

<sup>a</sup>Untruncated = all bids included as received. Truncated = all per annum bids up to £5 (inclusive) set to zero; all per visit bids up to £0.50 (inclusive) set to zero. All refusals to pay are included as zeros throughout ( $n = 325$ ).

We conclude then that although 'warm-glow' bidding may be a feature of this and other CV surveys, with regard to this study the impact of any such tendency is not severe.

*Free-riding.* A number of studies have suggested that some respondents may understate their true WTP thereby relying upon the payments of others to secure provision of public goods.<sup>23</sup> Hoehn & Randall (1987) and Loomis (1990) suggest that OE WTP questions may be particularly susceptible to such 'free-riding' behaviour when respondents believe that individual payments will directly correspond to individual responses. We have stated in our analysis of refusals to pay that extreme free-riding (i.e. refusing to pay anything at all for a good which the respondent has stated will be used) does not appear to be particularly evident in this study. However, less extreme free-riding (in the form of a downward revision of bids) may operate within non-zero responses so as to reduce mean WTP. If both a 'warm-glow' and 'free-riding' effect are in operation then these would act in opposite directions. However, to suggest that such effects might be self-cancelling would, on the basis of the paucity of evidence to hand, be seriously premature. All we can conclude is that either or both effects may be in operation to uncertain degrees.

*Strategic overbidding.* Bateman *et al.* (1995) discuss the possibility of certain respondents overstating their true WTP for strategic reasons. This may occur where respondents have high WTP but feel that they will only have to pay the mean amount rather than their individual response amount. Here a high bid will raise the mean and so (respondents feel) may increase the probability of provision of the good. Extreme strategic overbidding will be evidenced by upper tail outliers and a consequent high responsiveness in mean WTP to their omission. In Figure 2 WTP responses have been sorted from lowest to highest along the horizontal axis showing that, for both payment vehicles, a few relatively high responses were recorded.

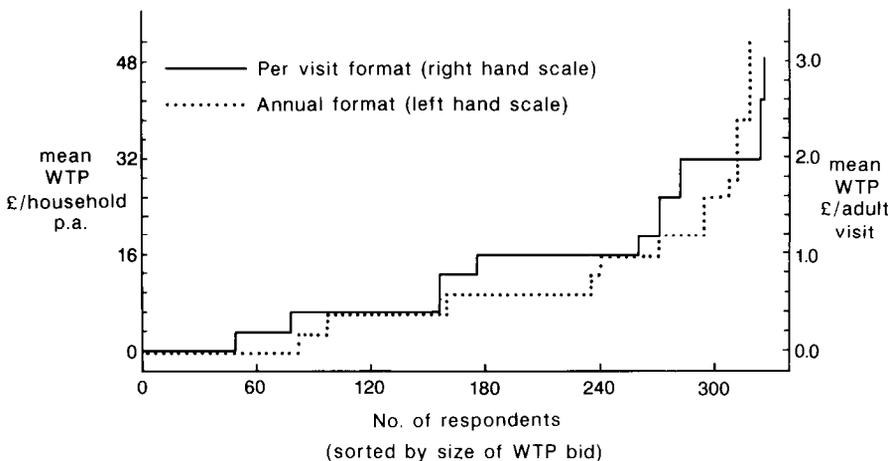


Figure 2. Potential strategic overbidding responses: impact upon mean WTP.

Consideration of Figure 2 suggests that, if extreme strategic overbidding is present, then it is confined to a relatively small number of respondents. In both the per-annum and per-visit formats, omission of the very highest few bids does cause the mean to fall rapidly, suggesting these are the extreme outliers indicative of strategic overbidding. However, the rate of decline slows rapidly once these most extreme bids have been removed. Clearly at some point we move from bids which are high because of (possibly) strategic behaviour, to bids which are high because of the interaction of preferences and ability to pay. If we assume that strategic overbidding can be identified by very disproportionately high bids, then Figure 2 suggests that there are relatively few of these. We therefore conclude that strategic overbidding may occur in a small minority of cases. However, the impact of such bids will be relatively high and may be responsible for inflating per-visit mean WTP by perhaps 10% and per-annum mean WTP by anything up to 20% although, without carefully designed, specific experimentation, such estimates are merely ballpark figures.

The result that per-visit values seem less responsive to upper bid truncation could be taken as indicating that answers to this format are more resistant to strategic behaviour. However, an alternative explanation follows our 'social norms' hypothesis. If responses to per-visit questions relate more to a notion of a 'reasonable' entrance fee amount than to true WTP then this would account for the apparent relative lack of strategic behaviour but in turn question the validity of such an approach.

*Bid curve analysis.* Following Mitchell & Carson (1989) validity testing was undertaken in part through bid curve analysis. Prior expectations were that WTP should be related to factors such as respondents' income, their expected useage of the proposed site, existing use of substitute sites, etc. However, expectations regarding an appropriate functional form were less certain and so a variety of specifications were tested.

*The per-annum responses (WTP<sub>pa</sub>):* analysis showed that a log-linear specification of the dependent variable WTP<sub>pa</sub> performed significantly better than linear versions. Table 4 reports results from a forward-entry stepwise regression analysis relating the log-linear dependent variable, lnWTP<sub>pa</sub>, to significant explanatory variables.

The final equation reported in Table 4 contains certain explanatory variables which we might expect to be collinear. However, inspection of coefficient values across steps does not immediately reveal any obvious significant problems as they remain fairly stable.

Explicit tests for multicollinearity suggested that only the correlation between lnRURVIS and lnVISWOOD gave any real cause for concern.<sup>24</sup> Accordingly the latter variable was dropped from our best-fit model which is reported as equation (1):

$$\begin{aligned} \ln WTP_{pa} = & -4.21 + 0.647 \ln INCOME + 0.156 \ln RURVIS \\ & (-6.70) \quad (8.54) \quad (3.61) \\ & + 0.239 \ln PKVIS - 0.556 PREFTOWN + 0.167 AGE \ 17-25 \quad (1) \\ & (3.62) \quad (-2.75) \quad (2.32) \end{aligned}$$

$R^2 = 32.1\%$   $R^2$  (adj) = 31.0%. Figures in brackets are  $t$ -values

Regression  $F = 30.17$  ( $P = 0.000$ )

Variables as defined in Table 4

**Table 4.** Stepwise regression of  $\ln WTP_{pa}$  on 34 predictors

Step	1	2	3	4	5	6
Constant	-5.397	-5.335	-5.096	-4.418	-4.214	-4.374
$\ln INCOME$	0.755	0.726	0.683	0.683	0.647	0.630
<i>t</i> -ratio	(9.79)	(9.56)	(9.06)	(9.16)	(8.54)	(8.33)
$\ln RURVIS$		0.165	0.160	0.140	0.156	0.131
<i>t</i> -ratio		(3.78)	(3.74)	(3.25)	(3.61)	(2.98)
$\ln PKVIS$			0.246	0.227	0.239	0.235
<i>t</i> -ratio			(3.69)	(3.43)	(3.62)	(3.59)
$PREFTOWN$				-0.59	-0.56	-0.52
<i>t</i> -ratio				(-2.90)	(-2.75)	(-2.58)
$AGE17-25$					0.167	0.173
<i>t</i> -ratio					(2.32)	(2.42)
$\ln VISWOOD$						0.140
<i>t</i> -ratio						(2.34)
$R^2$	0.2877	0.2614	0.2915	0.3096	0.3211	0.3326

Notes:  $n = 325$ . Figures in brackets are *t*-values. Variable definitions as follows (see also note 39):

$\ln WTP_{pa}$  = natural logarithm of households' annual WTP (£)

$\ln INCOME$  = natural logarithm of households' annual income (see note 40)

$\ln RURVIS$  = natural logarithm of number of visits made by household to rural sites per annum

$\ln PKVIS$  = natural logarithm of number of visits made to parks

$PREFTOWN$  = 1 if prefers town-based recreation; = 0 otherwise

$AGE17-25$  = number of persons in household aged 17-25 years

$\ln VISWOOD$  = natural logarithm of households' predicted no. of annual visits to proposed wood.

The multiplicative bid curve model given in equation (1) fits the data well in comparison to most CV studies employing OE elicitation methods and satisfies the more stringent guidelines on theoretical validity testing (Mitchell & Carson, 1989; Bateman & Turner, 1993). More importantly the relationships suggested by individual explanatory variables are highly significant and in accord with *a priori*

**Table 5.** Descriptive statistics for the untransformed explanatory variables used in equations (1) and (2)

	<i>n</i>	Mean	Median	Minimum	Maximum	Q1	Q3
$INCOME^a$	325	4.015	4.0	1.0	8.0	3.0	5.0
$RURVISNO$	325	8.040	2.0	0.0	110.0	0.0	10.0
$PKVISNO$	325	2.618	1.0	0.0	150.0	0.0	3.0
$PREFTOWN$	325	0.0831	0.0	0.0	1.0	0.0	0.0
$AGE17-25$	325	0.4769	0.0	0.0	3.0	0.0	1.0
$VISWOOD$	325	14.98	10.0	0.0	200.0	5.0	20.0
$PENSION$	325	0.2123	0.0	0.0	3.0	0.0	0.0

<sup>a</sup>Household income was recorded on an eight point scale using the following categories (numbers in brackets are frequencies): 1 = £5-10K (34); 2 = £10-15K (38); 3 = £15-20K (48); 4 = £20-25K (81); 5 = £25-30K (57); 6 = £30-35K (38); 7 = £35-40K (18); 8 = £40-45K (11).

expectations. Household income is both the most statistically significant variable and, when assessed at its mean value (reported in Table 5), the most dominant in determining annual WTP. Bids are also positively linked to visits to rural or estate park recreation sites while those who prefer town-based leisure pursuits exhibit significantly lower levels of WTP. A final interesting factor is the positive influence upon WTP exerted by the presence of household members between the ages of 17 and 25. This may be due either to higher recreation demand or to an enhanced environmental awareness amongst this group.

In summary the per-annum study appears to pass a standard bid-curve test of theoretical validity.

*The per-visit responses (WTP fee):* responses to the per-visit WTP question were much less firmly linked to standard explanatory variables than were the *WTPpa* bids. Regression analysis of the bid curve for per-visit responses confirmed this observation. While a log-linear dependent variable provided a best fit of the data, the resulting bid curve model, detailed in equation (2), exhibits a very low degree of overall explanatory power:

$$\ln WTP_{fee} = 0.595 - 0.135 PENSION - 0.00175 VISWOOD \quad (2)$$

(25.33) (-3.94) (-2.26)

$R^2 = 5.7\%$   $R^2(\text{adj}) = 5.1\%$ . Figures in brackets are *t*-values  
Regression  $F = 9.76$  ( $p = < 0.001$ )

where:

$\ln WTP_{fee}$  = natural logarithm of stated WTP per visit

*PENSION* = number in household aged 65 or over

*VISWOOD* = predicted number of household visits to the proposed wood per annum

The model given in equation (2) takes a semi-log (dependent) functional form. Explanatory variable relationships are as expected. The negative sign on *PENSION* accords with the expected lower visitation rate and ability to pay of this age group. The negative sign on *VISWOOD* accords with marginal utility theory, confirming that marginal WTP will be lower at higher visit frequencies. These factors provide the strongest support for the validity of our per-visit results. However, contrary evidence is suggested both by the poor overall fit of this model and the very strong nature of the constant. We believe that this latter factor provides further evidence for our contention that per-visit WTP responses are affected by social norm factors.

#### *Household WTP Study: Summary*

It seems that responses to the per-annum WTP questions were strongly linked to expected explanatory variables and therefore pass a simple test of theoretical validity.<sup>25</sup> Responses to per-visit format questions were less strongly linked to such factors and, while they may still have some justification as magnitude estimates, these results seem to support our social norm hypothesis.

Convergent validity testing (see Mitchell & Carson, 1989) was complicated both because of a lack of directly comparable off-site, household surveys,<sup>26</sup> and because the bulk of the sample stated that they would be making use of such a site (making their present non-user status seem somewhat misleading).

A within-format comparison with over 30 on-site (user) CV studies of a variety of outdoor recreation resources (ranging across woodlands, wetlands, National Parks, etc.) using per annum WTP measures showed that the above  $WTP_{pa}$  mean for woodland was logically related to the substitutability, uniqueness and provision-change factors which differentiated results between these studies (full details in Bateman *et al.*, 1994). Cross-study comparison of our  $WTP_{fee}$  result with other surveys of users was easier given the relatively high numbers of comparable studies in the literature. Our  $WTP_{fee}$  mean falls above but well within one standard deviation of the mean of all other comparable UK studies (full details in Bateman *et al.*, 1995). These comparisons suggest that, in this study, respondents saw themselves as 'users' and answered from such a perspective.

## Farmers' WTA Study

### *Farm Characteristics*

Responses were elicited from 19 farmers using face-to-face interview techniques. Whilst we have already recognized problems associated with inferring from small sample sizes, eliciting even this sample proved difficult given the necessary steps to secure each interview during the harvest season. We have no reason to suppose that those interviewed form a biased sample and therefore report percentage responses (as well as numbers) as an approximate guide to expected farmer attitudes in similar areas.<sup>27</sup>

The interview opened with questions regarding the general characteristics of the farm. Specifically farmers were asked to state the agricultural land use, farm tenure and average profit per acre (or hectare). Table 6 details individual farm responses to these and the WTA questions. Most farms (10 farms, equivalent to 53% of the total sample) were mixed agricultural producers combining arable with a variety of other standard activities. The remainder of the sample consisted mainly of purely arable producers (seven farms; 37%), one purely dairy farm and one farm entirely in set-aside (5% each) completed the sample. Nearly all those interviewed owned their farms (17 farms; 90%). This may limit the applicability of results to rented tenure farms.

Farmers were asked to state their average profit<sup>28</sup> per acre under existing production. This was asked so as to encourage farmers to sensibly consider the immediately following question regarding acceptable levels of financial compensation and to allow a comparison between these two amounts. Mean stated profit was £125/acre (£309/ha). Individual stated profit varied considerably between farms. This may be due in some measure to an unwillingness to reveal profits to the interviewer (three farmers (16%) refused to answer this question which in turn may indicate a wider understatement of true profit). However, it appeared that the majority of this variation was due to changes in economic efficiency and consequent productivity across farms.

### *Willingness to Allocate Land to the Woodland Project*

Twelve farmers (63%) initially stated that they were unwilling to allocate land for public access recreational woodland. Of these the most commonly stated reason for refusal was that the farmer did not want to allow public access to the

**Table 6.** Farm characteristics and farmers' willingness to accept compensation for transferring from present output to woodland

Farm	Land use	Tenure	Profit/ acre (ha)	WTA/ acre (ha)	Allocation acres (ha)	Reason for non-allocation
1	Mainly arable	Owned	£100 (£247)	£250 (£618)	0	Land should be used to produce food
2	Mainly arable	Owned	—	£20 000 (£49 440)	0	Does not like government policy
3	Mainly arable	Owned	£125 (£309)	£300 (£741)	0	Does not want public access to the farm
4	Arable	Owned	£30 (£74)	£200 (£494)	5 (2)	—
5	Arable	Owned	£105 (£260)	£250 (£618)	30 (12)	—
6	Arable	Owned	£45 (£74)	£150 (£370)	2 (0.8)	—
7	Mainly arable	Owned	£130 (£321)	—	0	Does not want public access to the farm
8	Arable	Owned	—	—	0	Land not suitable to grow trees upon
9	Dairy	Rented	£85 (£210)	—	0	Does not want public access to the farm
10	Arable	Owned	£116 (£287)	£300 (£741)	0	Farm too small for the scheme
11	Mainly arable	Owned	£100 (£247)	—	0	Does not want public access to the farm
12	Mainly arable	Owned	£186 (£459)	£100 (£247)	125 (50)	—
13	Mainly arable	Owned	£186 (£459)	£200 (£494)	100 (40)	—
14	Mainly arable	Owned	£163 (£402)	£250 (£618)	20 (8)	—
15	Mainly arable	Rented	£150 (£370)	£250 (£618)	0	Does not want public access to the farm
16	Arable	Owned	£280 (£692)	£600 (£1 483)	3 (1.2)	—
17	Arable	Owned	£145 (£358)	£150 (£370)	0	Farm too small for scheme
18	Mainly arable	Owned	£140 (£346)	—	0	Farmer too old to undertake long-term project
19	Set-aside	Owned	—	£250 (£617)	0	Unwilling to undertake another scheme to set-aside
Total	—	—	£130 (£321)	£250 (£617)	—	—
Mean	—	—	£57 (£141)	£121 (£300)	15 (6)	—

farm (five farms or 42% of those refusing to enter the scheme). Concerns regarding a loss of rights following entrance to such a scheme may be well founded. Repeated public use of footpaths within a wood may lead to their classification as public rights of way. Furthermore, subsequent interviews with senior Forestry Commission staff revealed that current policy will not allow farmers to be granted felling licences unless equivalent areas of replanting are

agreed.<sup>29</sup> In other words the decision to allocate a certain area from agriculture into recreational forestry may, in practice, be difficult to reverse. Such irreversibility may perversely prove to be a considerable block to the extension of farm-forestry. Other reasons for refusing to participate can be broadly classified as: three (25%) which were farm specific (farm size or land type); two (17%) which disliked the particular policy; and two (17%) which reflected the farmer's particular preferences. It is notable that both of the rented tenure farms declined to allocate land to the scheme.<sup>30</sup> This may be because farmers felt that permission would have to be sought from the owners (which was highlighted as a legal requirement) or a greater disinclination towards delayed return schemes. However, the sample size precludes any firm conclusion being drawn.

Seven farmers (37%) were initially willing to allocate land to the recreational woodland scheme. Given concerns regarding public access, this was felt to be an encouragingly high percentage rate. Mean allocation was just over 40 acres (just over 15 ha) per participating farm. This mean falls to approximately 15 acres (about 6 ha) if non-participating farms are also taken into consideration. Uptake amongst participating farms appears to be bimodally distributed with two farms willing to allocate 100 acres or more into woodland and the remainder only willing to undertake small scale afforestation projects. Whilst grant aiding is available for small scale schemes, if the objective is to provide a viable, discrete recreational area then such small pockets (unless they can be combined) may not be suitable. Nevertheless the agreement to large scale planting by two farmers is encouraging particularly where the objective (as under the Forestry Commission Community Woodland Scheme) is simply to ensure that the local community has nearby access to a woodland recreation site.

#### *Mean and Aggregate Willingness to Accept Compensation*

The majority of interviewees (14 farms; 74%) stated a sum which they would be willing to accept in annual compensation for allocating land out of agriculture and into public access woodland (*WTA<sub>pa</sub>*). This included seven (58%) of those farms who initially rejected the principle of such allocation. This latter result seems to indicate that, if the price was right, such farms would consider a move out of conventional agriculture. However, there is one very noticeable 'protest bid'<sup>31</sup> amongst this subsample which at £20 000/acre is not only more than 150 standard deviations above the mean of the remaining sample and more than 30 times larger than the next highest bid, but is also likely to be of equal magnitude to the entire annual net farm income. It is feasible that this respondent had in mind a discounted total net present value sum for the entirety of the project, in which case such a response would be reasonable. However, given that no other respondents gave answers within even the same magnitude, we felt that such an explanation is unlikely and a protest strategy seems much more likely.

Excluding this one outlier, the mean stated *WTA<sub>pa</sub>* is £250/acre (£617/ha).<sup>32</sup> Restricting the sample to those who initially stated an area which they were willing to allocate into the scheme has no effect upon this result, adding support to the validity of non-allocators' responses (and thereby the entire sample)<sup>33</sup> as being valid bids. Almost all farms require higher annual subsidy compensation rates than they currently achieve under agriculture. This seems reasonable given most farmers who consequently require a risk premium compared to standard activities.

To allow comparability with our household WTP survey, aggregate farm WTA should be calculated for a similar 100 acre site, implying a total compensation requirement for such a woodland of £25 000 per annum.

#### *Analysis of WTA Responses*

Analysis of responses showed that stated compensation levels were strongly related to both existing profit levels and the overall size of the farm. No further significant explanatory variables were identified and the best fitting regression model of  $WTA_{pa}$  is given in equation (3):<sup>34</sup>

$$WTA_{pa} = 94.04 + 1.48 PROFIT - 1.93 ACRES \quad (3)$$

(1.81) (4.04)                      (-3.37)

$R^2 = 69.9\%$      $R^2(\text{adj}) = 63.2\%$ . Figures in brackets are  $t$ -values  
Regression  $F = 10.43$  ( $p = 0.005$ )

where:

- $WTA_{pa}$  = farmers' required compensation (£/acre) for entering the woodland scheme  
 $PROFIT$  = level of profit under existing agriculture (£/acre)  
 $ACRES$  = the number of acres which the farm is prepared to allocate into the woodland scheme.

The model presented in equation (3) fits the data well (although sample size is clearly a problem) and reports logical relationships between the dependent and explanatory variables. Farms with higher profit levels from existing activities demand higher levels of compensation for entering the woodland scheme. Furthermore those who are only willing to consider small scale planting require higher per-acre payments. This implies, logically, that large scale plantations, which presumably will benefit from economies of scale, are considered viable alternatives at a relatively lower per-acre subsidy rate than small scale woodlands.

The area of land which farmers were prepared to allocate into woodland was positively related to overall farm size and thence to per acre profit levels so that a significant correlation exists between  $PROFIT$  and  $ACRES$  ( $r = 0.359$ ). Stepwise analysis indicated that this has caused a significant increase in the coefficient and  $t$ -value on the  $PROFIT$  variable. We cannot therefore place too much faith in the precise coefficient estimates given in equation (3). However, the observed multicollinearity is not strong enough to make such estimates invalid, rather they should be treated as having wide confidence intervals.

The degree of explanation of the WTA bid curve is not affected by collinearity between explanatory variables. Even allowing for the small sample size, the degree of fit is exceptionally high for an OE CV study, particularly as this survey employed a WTA question. We can conclude that farmers' responses were logically consistent and in accord with economic theory. The strength of the bid function is unusual when compared to most WTA studies and we subsequently consider reasons why this may be so.

#### **Comparison of Household WTP and Farm WTA Measures**

Either measure of aggregate household WTP exceeds our estimate of aggregate farm WTA to a considerable degree. In the case of our annual format we have

a simple<sup>35</sup> benefit/cost ratio of 1.78 whilst the entrance fee format yields a ratio of 5.65. Such results point strongly in favour of the setting-up of such schemes. However, we prefer to retain a cautious approach to the WTP sums. Another way of examining these is to consider the minimum number of payments needed to meet the required aggregate compensation level. Using the per-annum format and our above estimate of household size implies that some 2515 households (i.e. 56% of all those in Wantage) would need to pay the £9.94 mean *WTP<sub>pa</sub>* for the scheme to break even. Alternatively all households in Wantage would have to pay £5.59 per annum for the scheme to again break even.<sup>36</sup> Using the per-visit mean WTP of £0.82 implies that 30 487 individual visits per annum would be required to pay for the forest, i.e. each individual in Wantage would need to make 2.65 paying visits per annum for the site to break even.

## Conclusions

If taken at face value the results of this exercise appear to provide a variety of useful information regarding the viability and economic value of creating new recreational woodlands in the lowlands of England. Farmers' WTA responses confirm the suspicion that current levels of subsidy payment are too low to attract many into the provision of recreational woodland. Furthermore, factors such as a dislike of increased public access also featured in farmers' responses. However, consideration of households' stated WTP indicates the benefit values generated by such woodlands more than justify the necessary increase in subsidy payments which farmers seem to require to overcome their reluctance.

Such interpretations seem to indicate that there is considerable value in undertaking such CV studies and that the method may be of use even in small scale planning decisions such as these. However, such a view overlooks the considerable number of reservations raised throughout this paper. In particular the discrepancy and relationship between our elicited household measures of per annum and per visit WTP is disturbing. Our discussion of bid curves for these measures suggested that answers to the per-visit format questions did not represent true WTP valuations, but rather a 'price' influenced by social norm expectations of what respondents felt was reasonable to pay for a forest visit. Conversely we argued that answers to the annual format question were, at least in some way, related to respondents' true valuations. How then can 'aggregate price' exceed 'aggregate value'?

One explanation of this discrepancy arises from noting that we have reason to believe both that our annual format WTP measure may be downwardly biased by elicitation effects and that our per-visit measure may be upwardly biased by a number of factors. Regarding the annual format measure, our elicitation effect studies indicate the OE formats produce lower bound estimates of WTP (Bateman *et al.*, 1993, 1995). We have compounded this in our calculation of 'aggregate value' by adopting further lower bound assumptions regarding household size. In short 'true' WTP could lie some way above our per-annum estimate.

Turning to the 'aggregate price' derived from our per-visit measure, a number of points should be noted. Firstly, our aggregation assumptions regarding household composition are not as aggressively lower-bound as for our 'aggre-

gate value' estimate. Secondly, we have some reservations regarding respondents' estimated visit rate and note that the adoption of the 5% trimmed mean for this variable would result in a 22% fall in 'aggregate price'. More severe reductions in mean visit rate are quite feasible resulting in corresponding further reductions in this estimate. Thirdly, it is possible that in answering this question respondents are searching for a social norm response regarding a socially appropriate entrance fee. Considerations in forming such a response are likely to include experience of other entrance fees which, as responses to questions regarding other recreation destinations show, may be significant. Fourthly, the rounding effect commented upon earlier has a far greater relative impact upon answers to the per-visit question than the annual payment question. Thus, for example, many respondents said that they would pay "one pound" per visit. Multiplying through by predicted visits this rounding often leads to an estimation of annual entrance fee payments being above that given in response to the annual WTP question. Finally, as an extension to this, it may be that the spreading of payments via an entrance fee is relatively attractive when compared to the lump sum payment inherent in the annual format question.

In conclusion, the apparent disparity between 'aggregate value' and 'aggregate price' may reflect deeper problems in the validity of WTP responses to CV questions. However, we are not entirely pessimistic about the use of CV.

If we turn to consider farmers' WTA responses, the most striking feature of this analysis is the comparatively very high explanatory power of the WTA bid function. This result contradicts findings from many previous WTA studies,<sup>37</sup> where respondents have exhibited great difficulty in answering such questions. We believe that our result reflects the fact that UK farmers are well accustomed to making decisions regarding schemes and products which entail differing levels of compensation. These decisions are made with respect to the opportunity cost of forgone alternatives, a factor very well reflected in our bid function. Other WTA studies have interviewed individuals who have no experience of compensation decisions and consequently exhibit extreme uncertainty in answering WTA questions. In contrast the relatively weak nature of our WTP bid functions show that households are unfamiliar with the concept of setting, rather than responding to, a payment level. This unfamiliarity may well be compounded by the public goods nature of the asset under investigation.

Finally, while we have attempted throughout this study to highlight our reservations about the CV technique, nevertheless the magnitude of the excess of households' aggregate WTP (by either measure) over the WTA compensation amounts stated by farmers does seem to indicate that the implementation of a scheme, such as that hypothesized in the questionnaire scenario, may well result in the generation of a significant net social benefit.<sup>38</sup>

### **Acknowledgements**

The authors are grateful to an anonymous referee whose detailed comments substantially improved this paper. Remaining errors are our own. This research was jointly supported by the ESRC project Evaluating Recreation Demand for Natural Areas (grant number L320223002) and the Nature Conservancy Council for England (English Nature) as a development of their Natural Areas management programme (grant number FIN/NC10/01).

## Notes

1. Figures, kindly provided by the Grants and Licences Division of the Forestry Commission, are for Great Britain as at the end of January 1995.
2. Furthermore, in conversation with the FC it seems that felling licences will only be granted conditional upon replanting so that in effect a conversion into woodland is, in area terms, irreversible.
3. For an introduction see Johansson (1991).
4. For reviews of the CV method see Cummings *et al.* (1986); Mitchell & Carson (1989); Bateman & Turner (1993).
5. Problems regarding the definition of 'head of household' are recognized. Selection was necessarily a matter for the interviewer's discretion and it is not felt that any serious error was incurred here. All those interviewed were at least 18 years of age.
6. Here the respondent is simply asked to state the amount they are willing to pay, i.e. their response is open-ended. An alternative approach is to ask respondents whether or not they are WTP a specified amount (dichotomous choice) with that amount being varied across the sample. For an analysis of the impact of varying the elicitation method see Bateman *et al.* (1993, 1995).
7. A copy of the questionnaire and dataset is available from the authors.
8. Ideally we would want to either use separate samples for each format or vary the order in which questions are presented so that any ordering or anchoring effects might be assessed. However, such an analysis was not undertaken because we were *a priori* uncertain of obtaining sufficient sample size.
9. This differs from a dichotomous choice approach where respondents are asked whether or not they are WTP a set amount. For an analysis of a variety of response elicitation approaches see Bateman *et al.* (1995).
10. A second reason, given by four farmers, was that they had already participated in other research surveys and were unwilling to devote further time.
11. The Farm Woodland Premium Scheme, mentioned in our introduction, was introduced after this survey was undertaken and is a direct and comparable successor to the Farm Woodland Scheme.
12. Analogous to the subsequently discussed phenomenon of strategic overbidding in responses to WTP questions.
13. Data were also gathered regarding professional and employment status. However, a logical categorization of these data was not satisfactorily achieved and the information was not used in bid curve analysis.
14. We view this as a good test of questionnaire design (although, arguably, it could be interpreted as reflecting over-enthusiastic interviewers). Similarly, Bateman *et al.* (1993) record only a 6% refusal rate for a similar question in a face-to-face interview situation.
15. This figure refers to average UK total household size (including adults and children) rather than the average number of adults per household. If the latter were used this would increase our estimate of household WTP, i.e. we have employed a conservative, lower bound assumption.
16. This considerably exceeds the actual visit rates which we have observed at other woodland sites (see Bateman *et al.*, 1995) and is discussed further below.
17. Note that we have already accounted for non-visitors in the annual per-adult visit rate.
18. In Bateman *et al.* (1995) we argue that dichotomous choice techniques may be particularly liable to upward rounding effects.
19. This problem will be compounded by rounding effects which, as Bateman *et al.* (1995) argue, are likely to operate in a generally upward direction.
20. In short, such respondents would state such a bid for any similar good cause, e.g. woodlands, river corridors, the dogs'-home, the donkey-sanctuary, etc.
21. We are obliged to an anonymous referee for suggesting this line of enquiry.
22.  $R^2(\text{adj})$  falls from 31.0% for the entire sample to 26.6% for the 190 respondents predicting less than 10 visits per annum. The optimal model stays as per equation 1 with all explanatory variables still significant at  $\alpha = 5\%$ . Applying the model to more frequent visitors ( $10 +$  visits p.a.) improved its fit to  $R^2(\text{adj}) = 36.4\%$ . This seems to support our hypothesis. However, the situation is complicated by low bids being clustered upon a few discrete amounts (so called 'magic numbers'; see discussion of Figure 1) which limits variation and somewhat confounds this line of enquiry.
23. The original article on free riding is Samuelson (1954). Evidence for such behaviour in CV studies is reviewed in Mitchell & Carson (1989).

24. In particular the expected correlation between  $\ln RURVIS$  and  $\ln PKVIS$  proved not to be significant.
25. In effect, responses were in logical accordance with economic theory. Wider questions regarding the overall validity of CV responses may still apply (see Sugden, forthcoming).
26. See the recent literature review given in Stabler *et al.* (1995).
27. We would expect participation rates to rise as per-acre net agricultural incomes fall. Note that while other subsidies, such as those paid under the Woodland Grant Scheme, are lower in designated agriculturally disadvantaged areas (Johnson & Nicholls, 1991) this does not apply to the Community Woodland Supplement (Forestry Commission, 1991).
28. The simple term 'profit' was preferred to any more technical definition.
29. Interview with Chief Forester, Santon Downham, Thetford Forest, 1993.
30. Statistically significant at the 5% level.
31. The authors dislike the general application of this term to anyone who does not give an expected answer to a bidding (WTP or WTA) question. However, this particular respondent seems to satisfy all relevant requirements of an archetypal 'protester'.
32. Note that if we weight by the amount of land offered for the woodland scheme this mean falls to £169/acre.
33. Excluding the single 'protest' bid.
34. The previously identified outlier was excluded from this analysis.
35. The term 'simple' refers here to the fact that this study represents only a partial cost-benefit analysis of such a scheme.
36. Note that this is considerably less than the mean WTP excluding suspected strategic overbidders detailed in Table 3.
37. See review in Mitchell & Carson (1989).
38. A more certain statement concerning the total net benefits of such a scheme can be made if we assume that farmers have incorporated direct afforestation costs into their WTA compensation statements. This is feasible and, given the fact that grants in respect of many of these costs are available, this does not appear too strong an assumption.
39. To avoid problems generated by zero values in the various logarithmic variables used, a value of 1 was added to each of these variables prior to natural logs being taken.
40. Income was recorded on an eight point scale; Table 5 for details.

## References

- Andreoni, J. (1990) Impure altruism and donations to public goods: a theory of warm-glow giving, *Economic Journal*, 100, pp. 464-477.
- Arrow, K., Solow, R., Portney, P.R., Leamer, E.E., Radner, R. & Schuman, E.H. (1993) *Report of the NOAA Panel on Contingent Valuation*, Report to the General Counsel of the US National Oceanic and Atmospheric Administration, (Washington, DC, Resources for the Future).
- Bateman, I.J., Brainard, J.S. & Lovett, A.A. (1995) Modelling woodland recreation demand using geographical information systems: a benefit transfer study, *CSERGE Global Environmental Change Working Paper 95-06* (University of East Anglia, Norwich/University College London, Centre for Social and Economic Research on the Global Environment).
- Bateman, I.J., Langford, I.H., Turner, R.K., Willis, K.G. & Garrod, G.D. (1995) Elicitation and truncation effects in contingent valuation studies, *Ecological Economics*, 12(2), pp. 161-179.
- Bateman, I.J., Langford, I.H., Willis, K.G., Turner, R.K. & Garrod, G.D. (1993) The impacts of changing willingness to pay question format in contingent valuation studies: an analysis of open-ended, iterative bidding and dichotomous choice formats, *CSERGE Global Environmental Change Working Paper 93-05* (University of East Anglia, Norwich/University College London, Centre for Social and Economic Research on the Global Environment).
- Bateman, I.J. & Turner, R.K. (1993) Valuation of the environment, methods and techniques: the contingent valuation method, in: R.K. Turner (Ed) *Sustainable Environmental Economics and Management: Principles and Practice* (London, Belhaven/Wiley).
- Bateman, I.J., Willis, K.G., Garrod, G.D., Doktor, P., Langford, I.H. & Turner, R.K. (1992) *Recreation and Environmental Preservation Value of the Norfolk Broads: A Contingent Valuation Study*, Report to the National Rivers Authority (University of East Anglia, Environmental Appraisal Group).
- Bateman, I.J., Willis, K.G., & Garrod, G.D. (1994) Consistency between contingent valuation estimates: a comparison of two studies of UK National Parks, *Regional Studies*, 28(5), pp. 457-474.

- Central Statistical Office (1991) *Regional Trends 1991* (London, HMSO).
- Cummings, R.G., Brookshire, D.S. & Schulze, W.D. (Eds) (1986) *Valuing Environmental Goods: An Assessment of the Contingent Valuation Method* (Totowa, NJ, Rowman & Allenheld).
- Diamond, P.A. & Hausman, J.A. (1994) Contingent valuation: is some number better than no number?, *Journal of Economic Perspectives*, 8(4), pp. 45–64.
- Eberle, W.D. & Hayden, F.G. (1991) Critique of contingent valuation and travel cost methods of valuing natural resources and ecosystems, *Journal of Economic Issues*, 25, pp. 649–685.
- Efron, B. & Tibshirani, R.J. (1993) *An Introduction to the Bootstrap* (New York, Chapman & Hall).
- Forestry Commission (1991) *Community Woodland Supplement* (Edinburgh, Forestry Commission).
- Forestry Commission (1994) *Walkers Welcome! Woodland Access and the Woodland Grant Scheme* (Edinburgh, Forestry Commission).
- Hanemann, W.M. (1994) Valuing the environment through contingent valuation, *Journal of Economic Perspectives*, 8(4), pp. 19–43.
- Harris, C.C., Driver, B.L. & McLaughlin, W.J. (1989) Improving the contingent valuation method: a psychological approach, *Journal of Environmental Economics & Management* 17, pp. 213–229.
- Hoehn, J.P. & Randall, A. (1987) A satisfactory benefit cost indicator from contingent valuation, *Journal of Environmental Economics & Management*, 14(3), pp. 226–247.
- Johansson, P.O. (1991) *An Introduction to Modern Welfare Economics* (Cambridge, Cambridge University Press).
- Johnson, J.A. & Nicholls, D.C. (1991) The impact of government intervention on private forest management in England and Wales, *Occasional Paper 30* (Edinburgh, Forestry Commission).
- Just, R.E., Hueth, D.L. & Schmitz, S. (1982) *Applied Welfare Economics and Public Policy* (Englewood Cliffs, NJ, Prentice Hall).
- Kahneman, D. & Knetsch, J.L. (1992) Valuing public goods: the purchase of moral satisfaction, *Journal of Environmental Economics & Management*, 22, pp. 57–70.
- Loomis, J.B. (1990) Comparative reliability of the dichotomous choice and open-ended contingent valuation techniques, *Journal of Environmental Economics & Management*, 18, pp. 78–85.
- Loomis, J.B., Walsh, R. & Gillman, R. (1984) Valuing option, existence and bequest demands for wilderness, *Land Economics*, 60(1), pp. 14–29.
- Ministry of Agriculture, Fisheries and Food (MAFF) (1992) *The Farm Woodland Premium Scheme: Rules and Procedures* (London, MAFF).
- Mitchell, R.C. & Carson, R.T. (1989) *Using Surveys to Value Public Goods: The Contingent Valuation Method* (Washington, DC, Resources for the Future).
- Orne, M.T. (1962) On the social psychology of the psychological experiment, *American Psychologist*, 17, pp. 776–789.
- Sagoff, M. (1988) Some problems with environmental economics, *Environmental Ethics*, 10, pp. 55–74.
- Samuelson, P. (1954) The pure theory of public expenditure, *Review of Economics & Statistics*, 36, pp. 387–398.
- Stabler, M.J. & DTZ Debenham Thorpe (1995) *The Value of Conservation: A Literature Review of the Economic and Social Value of the Cultural Built Heritage* (University of Reading, Department of Economics and DTZ Debenham Thorpe).
- Sugden, R. (forthcoming) Alternative theories of choice, in: I.J. Bateman & K.G. Willis (Eds) *Contingent Valuation of Environmental Preferences: Assessing Theory and Practice in the USA, Europe and Developing Countries* (Oxford, Oxford University Press).
- Tunstall, S., Green, C. & Lord, J. (1988) The evaluation of environmental goods by the contingent valuation method, *FHRC Report* (Middlesex University, Flood Hazard Research Centre).

