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Motives behind willingness to pay for improving biodiversity in a water ecosystem: Economics, ethics and social psychology

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ABSTRACT

This paper reports on empirical work extending the standard economic approach to valuation by including psychological and philosophical factors. More specifically a contingent valuation method survey was applied to biodiversity improvement while simultaneously assessing rights based beliefs, consequentialism and the theory of planned behaviour. The latter was assessed using measures of attitudes, subjective norms and perceptions of control over willingness to pay. The results show that standard socio-economic explanatory variables are far inferior to those of social psychology and philosophy, and that these factors offer a better understanding of the motives behind responses to contingent valuation. The implication is that alternative means of measuring an individual's pluralistic values should be taken into account in order to assess the validity and meaning of willingness to pay.

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1. Introduction

There is a growing concern expressed in European legislation that the value of such things as water and biodiversity be taken into account. In the former case this has been boosted by the Water Framework Directive which has several elements calling upon economists to produce monetary values. The contingent valuation method (CVM) has a great appeal amongst environmental economists due to its claimed ability to measure a wide range of non-priced project impacts from the effects of management options on water quality to changes in biodiversity. While CVM can indeed produce numbers there is considerable controversy over their content and meaning (Urama, 2003). In attempts to validate CVM, economists have tended to devote their energy to matching intended or stated willingness to pay (WTP) with actual payments, but such research has largely failed to question what motivates respondents to answer

in the first place. Understanding individual behavioural intentions, such as stated WTP, requires analysis of psychological factors (e.g., Ajzen et al., 1996; Spash, 2002).

Social psychologists have developed models of human behaviour which include motivational concepts (e.g. attitudes and norms). These models challenge the assumptions of mainstream economics but can be integrated into CVM models to test hypotheses about motives for bids. The basic economic model assumes complete, pre-existing invariant and transitive preferences, which are maximised in static equilibrium frameworks. Conversely, social psychology uses models focused on the influence of specific psychological attributes (such as attitudes) on cognitive decision-making processes (Jones, 1998). Both mainstream economics and social psychology share a focus on the individual and their behaviour. However, the former makes processes of learning endogenous, and excludes social and institutional context.

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Individual motives are treated as unquestionable and mainstream economics leaves them unquestioned. Social psychology sees behaviour as the result of the interaction between the individual and their psychological, social and institutional environments. The CVM study reported here introduces factors from social psychology to test the standard economic model of human behaviour, while also addressing ethical motives which have been neglected by both economists and social psychologists.

The following section describes the theoretical approach used to explain the role of ethics and social psychology in understanding human values. This involves building upon previous work measuring rights based beliefs and contrasting them with consequentialism. The measurement of attitudes is also taken beyond previous work in the economic valuation field by paying attention to specific attitudes, social norms and perceived behavioural control. The theoretical model is then applied to a case study where changes in water management lead to improvements in biodiversity. The case study and CVM survey design are then explained. This is followed by the results section which contrasts standard economic explanatory variables with the ethical and behavioural psychology variables to reveal a reduced form model showing the key motives behind willingness to pay for biodiversity improvement.

2. Expanding the standard model of valuation

There are key elements of the way in which humans value the environment that appear to be missing from economic explanations of behaviour, and in particular this is due to the philosophical basis of economic theory and the psychological model of behaviour adopted. Economics assumes a preference utilitarian philosophy so that consequences determine whether an action is right or wrong, rather than a common philosophical alternative which is rights based or deontological. The psychological model in mainstream economics assumes a narrow self interest which ignores the role of attitudes and social rules. Some branches of institutional economics do address concerns over social rules as informal institutional arrangements. This section describes how ethical, attitudinal and social factors can be measured to reveal their influence upon human behaviour.

2.1. The role of fundamental ethical beliefs

The dominant economic theory of decision-making requires a fundamental philosophical assumption; that individuals believe the net utility from the consequences of an action determines whether that action is right or wrong. Cost-benefit analysis and its tools, such as CVM, assume that individuals are able and willing to consider trade-offs in relation to the quantity and/or quality of public goods. Debates in environmental ethics have raised the issue of individuals refusing to make these trade-offs and so questioned the applicability of economic efficiency arguments (Sagoff, 1988). One aspect of refusal can be beliefs based upon inviolable rights so that actions are intrinsically of value or deontological (Spash, 1997). Standard cost-benefit analysis rejects such notions because there is an assumed rationality attributed to the ability to make trade-offs,

whatever the commodity, as long as enough compensation is offered in return. Empirical work directly addressing the issue has found that a significant proportion of survey respondents treat the environment in a manner which is inconsistent with economic theory (Spash and Hanley, 1995; Spash, 2000a, 2006).

If an individual believes that certain aspects of the environment, such as biodiversity, have an absolute right to be protected, then that individual is expected to refuse all money trade-offs which degrade the environment. In other words, such individuals should reject the “commodification of environmental resources”. Such preferences mean that utility functions including environmental aspects which are to be protected at all cost are undefined for an individual since the axiom of continuity is violated, and that indifference curves collapse to single points, denying the principle of substitution. These preferences are termed lexicographic in the neo-classical economic model because they give absolute priority to one commodity over all others and therefore imply a strict ordering, as in lexicon. A modified form of the proposition can be offered as more likely and, following Spash (1998, 2000a, 2006), was used in the current research in terms of first attaining a minimum standard of living prior to being prepared to defend the environment on the basis of ethical rights.

2.2. Specific attitudes and subjective norms

The Fishbein and Ajzen (1975) attitude-behaviour model, or theory of reasoned action, and more recently the related theory of planned behaviour of Ajzen (1991) offer some useful insights into how economists could improve their understanding of human behaviour by studying social psychology. The theory of planned behaviour postulates three conceptually dependent determinants of human intention. The first is the attitude toward a behaviour and refers to the degree to which a person has a favourable or unfavourable evaluation or appraisal of the behaviour in question. The second relates to subjective norms which refers to the perceived social pressure to perform a specific behaviour. The third is the degree of perceived behavioural control, which refers to the believed ease or difficulty of performing the behaviour.

Ajzen (1991: 191) defines the attitude towards a behaviour as the degree to which performance of the behaviour is positively or negatively valued. Specifically, the outcome's subjective value contributes to the attitude in direct proportion to the strength of the belief, i.e., the subjective probability that the behaviour will produce the outcome in question. This was computed as: $ATB_{i,\infty} = \sum b_i e_i$; where “ r ” is the respondent, “ b ” the strength of each salient belief, “ e ” the respondent's subjective evaluation of a belief attribute, and “ i ” is the specific item (or question) related to the behaviour. For each question eliciting respondent's salient beliefs a corresponding question on subjective evaluation of the specific belief attribute is asked. The product of the response to both questions provides a scale item of attitudes towards a behaviour, which can be summed to provide an attitude scale.

Subjective norms are defined as the perceived social pressure to engage in a behaviour. The formulae for calculating a subjective norm (SN) is: $SN_{i,\infty} = \sum n_i m_i$; where “ n ” is the strength of each normative belief and “ m ” the respondent's motivation to comply with the personally important referent in question

(Ajzen, 1991, p. 195). A subjective norm scale is computed as directly proportional to the sum of the product of n and m .

The available “resources and opportunities” underlie the perception of control an individual believes they possess, just as beliefs about consequences of a behaviour determine attitudes towards it, and normative beliefs determine subjective norms. “The more resources and opportunities individuals believe they possess, and the fewer the obstacles or impediments they anticipate, the greater should be their control over the behavior” (Ajzen, 1991: 196). Perceived behavioural control (PBC) is directly proportional to the sum of products of each control belief “ c ” and the perceived power “ p ” of the particular control factor to facilitate or inhibit performance of the behaviour: $PBC_i \propto \sum c_i p_i$. Perception of behavioural control is assumed to reflect past experience as well as anticipated impediments and obstacles.

As a general rule, the more favourable are attitudes towards a behaviour and subjective norms and the stronger the perceived behavioural control with respect to a specified behaviour then the stronger should be an individual's intention to perform the behaviour (Ajzen, 1991: 188). Critical to the success of the model is that it complies with the ‘principle of compatibility’, i.e. relations between attitudes and behaviour should be assessed (in terms of action, target, context, and time elements) at the same level of generality or specificity (Eagly and Chaiken, 1993: 164). Fishbein and Ajzen (1975) described three determinants or criteria (correspondence, proximity, and familiarity) of strong attitude–behaviour relationships. The greater the correspondence between the attitude/intention measures, the more likely the latter will predict the former. Proximity concerns the hypothesis that the fewer are the intervening stages between a component in the model and a behaviour, the greater the predictive power of that component. Finally, familiarity states that the more familiar the behaviour, the more likely the respondent's attitude and/or behavioural intentions will predict that behaviour. A well designed CVM should then be able to take these factors into account in order to test for the relevance of the theory of planned behaviour.

3. Survey design

The case study selected for the survey was the Tummel catchment with an area of 1713 km², draining into the River Tay, in the Grampian Highlands of Scotland. The area includes eight reservoirs and pre-existing lakes which are used for hydro-power generation, along with the rivers and streams draining into and connecting them. The Tummel area has a population density of less than 0.10 persons per hectare and is classified as a less remote rural zone (Black et al., 2002).

At the time of the study, the Tummel catchment was provisionally designated as a heavily modified water body under the Water Framework Directive and a number of implementation measures were being discussed to achieve good ecological potential in the river catchment. One of these was the introduction of a compensation flow regime from the dammed lochs to mimic the natural flow in some of the rivers within the catchment; the aim being to restore the diversity and abundance of species and habitats in the river catchment. This scenario presented a suitable case for a CVM study with a

payment vehicle in the form of increased energy bills. Increasing river flows from the hydro-system would potentially reduce electricity generation and increase costs for the hydro-power companies. Such costs would then be (wholly or partially) transferred to electricity consumers. Various aspects of the survey scenario were based upon information contained in a report by Black et al. (2002).

Information for the survey was selected and reviewed through several stages which involved: reports on the case study and associated environmental impacts; expert consultation with aquatic ecologist; social psychologist; economists; end users through informal discussion; the general public via two focus groups and a pilot survey; researchers via presentations to project partners. Three types of information were used in the final survey. First, information was supplied about biodiversity in general, aquatic biodiversity and the web of life provided background on the declines in biodiversity due to hydro-power, and the potential increases in biodiversity. Figures were used to graphically show the web of life and how its structure would be affected by changes due to altering in-stream flows. This fed into the second set of information which concerned the Tummel catchment and hydro-power schemes in the area along with details of the decline in biodiversity specific to those schemes. Third, information was given which familiarised respondents with two scenarios. A “business as usual” scenario described biodiversity at 14% of natural levels due to reduced water flow in the catchment. The alternative scenario involved an increase in water flows and an associated increase in biodiversity in the catchment to 70% of natural levels at the expense of reduced energy generation and increased electricity bills. A follow-up question asked respondents how well (7-point scale) they had understood the impacts described.

The CVM survey followed a specific design developed over several years and studies (e.g., Spash, 1993, 1997, 1998, 2000a, 2002, in press; Spash and Hanley, 1995). This had five sections (A to E): A, introductory framing and information; B, monetary valuation and follow-up; C, environmental ethics, psychological questions; D, socio-economic information; and E, interviewee and interviewer evaluations.

In order to assess the value of restoring species diversity and ecosystem structure in the Tummel three types of questions were asked. Payment in principle covered a respondent's agreement with being willing to accept an increase in their energy bill in order to increase biodiversity. Specific WTP was the maximum additional amount they would be willing to pay each quarter on their electricity bill over the next year to restore biodiversity in the river Tummel and its surrounding area from 14% to 70%. A qualitative valuation was the personal value of the restoration of biodiversity in the river Tummel and its surrounding area from 14% to 70%; this was measured on a scale from 1 to 7 (not at all to extremely valuable). The first two questions followed each other directly and were preceded by the scenario on improving the Tummel river in-stream flows by reducing electricity generation to mimic a more natural flow regime making the electricity generating companies incur extra costs. The third question came after the follow-up questions on reasons for payment and refusals to pay.

Ethical questions were employed to measure the level of belief in species protection extending from animal rights to economic to human centred. The method used replicated

Spash (1998, 2000a). The respondents were told that “A major aim of maintaining natural flows of water is to provide habitat for endangered wildlife species such as otters and kingfishers”. They were then asked which one of four statements most closely matched their opinion about the scheme to get hydro-power companies to release more water to the rivers to mimic a natural flow. The respondents also had a fifth choice “can't answer — this is too complicated”. Rights based respondents were then given an additional question which split them into strong and weak categories.

The theory of planned behaviour was measured in terms of attitudes, subjective norms and perception of control over the situation. A total of thirteen pairs of questions elicited respondent's attitudes towards WTP to restore biodiversity in the Tummel catchment. An example of an attitude pairing is: “Paying more for electricity to restore biodiversity will increase the diversity and abundance of plant and animal species in the Tummel area.” This was evaluated from extremely likely to extremely unlikely. This was combined with the subjective evaluation of that specific belief: “Increasing the diversity and abundance of plant and animal species in the Tummel area is...” with the evaluation being from extremely bad to extremely good. Six pairs of subjective norm questions were included. An example which elicits a normative belief is: “My spouse/partner would think that I... pay more for electricity to preserve biodiversity in the Tummel area.”, where the evaluation was from “should” to “should not”. This is combined with a motivation to comply assessed by asking: “Generally speaking, how much do you want to do what your spouse/partner thinks you should do?” with the scale going from “not at all” to “very much”. A total of five PBC questions were included as single items (i.e., not paired). An example is: “I can easily afford to pay more for my electricity.” with responses being from “strongly agree” to “strongly disagree”. All evaluative scales were 7 point with 4 designated as “cannot decide”. The full set of questions covering the theory of planned behaviour is reported in Appendix A.

Development of the survey took place through two focus groups of 10 individuals each and a pilot survey. A total of 81 questionnaires were completed by face-to-face personal interviews for the pre-test. The main sample consisted of 1012 face-to-face interviews that took place between August and December 2003.

4. Testing the model of environmental valuation

This section reports the results regarding the ethical and theory of planned behaviour models in turn. This is followed by regression analysis and comparison with a more standard socio-economic valuation model. The section ends with the results for a reduced form model which best explains WTP results for biodiversity valuation within the context of water management.

4.1. Ethical motives for behaviour

The classification of ethical positions on a rights versus consequentialists basis was conducted within the context of endangered species protection with respect to the scenario of

hydro-power companies changing in-stream flows. The picture which emerges is similar to past research in that a third or more of the sample find rights based statements most closely match their opinions about the scheme to protect endangered species such as otters and kingfishers. About half the sample takes a consequentialist position consistent with the ethics underlying mainstream economic theory. In terms of the relative strengths of the two rights based positions this sample shows more people maintaining a strong rights position than found in previous work (see Spash, 2000b). This might indicate an increasing polarisation in the environmental debate.

A long standing but largely untested hypothesis in the CVM literature was that individuals protest against CVM and bid nothing rather than take part in a process which implicitly buys and sells improvements in biodiversity. That is, if you hold a philosophical position which disagrees with monetary valuation of the environment you will refuse to cooperate with a survey which requests such a valuation. In the current work approximately 43% of those who bid positively did so on the basis of non-economic reasoning (i.e. they failed to choose consequentialist ethical categories to support their reason for giving). Past work has found even higher percentages (e.g., Spash, 2000a found 53% used non-economic reasoning). In fact, most respondents try to be accommodating to the requests made of them. So we find rights based individuals do bid positively as well as appearing in other bid categories (zero, don't know, refuse). However, the question is whether there is a significant difference due to an individual's ethical position or are these distributions merely random.

Table 1 shows that ethical categories do indeed have a strong influence on WTP. The chi-squared results are highly significant. This also shows some deviation from what might be expected on the basis of standard economic explanations. The strong rights and consequentialist favouring species seem close together in that they are over represented in positive bid categories and underrepresented in the zero bid category. Consequentialist favouring people and humans first are also similar to each other in showing the opposite bias, i.e. less likely to bid positively and more likely to be zero. Those placing humans first also tend to be more likely to reject the scenario in principle while those with strong rights and favouring species tend to accept the idea of payment in principle. The weak rights give relatively weak results and are far closer to an expected frequency distribution across categories. As Table 2 shows, those in the strong rights position also have the highest mean WTP and, with the consequentialist favouring species, the highest median WTP.

4.2. Theory of planned behaviour model results

In the current context the intended behaviour is the WTP for the change of in-stream flows in the Tummel catchment to improve biodiversity. The method chosen to estimate the three model elements required a list of forty three questions (see Appendix A). The thirteen paired questions on attitudes consisted of one question on the strength of belief that a behaviour will have a specific outcome (likely/unlikely) and a second on the desirability of that behavioural outcome (good/bad). For subjective norms there were six paired questions with the first addressing the salience of the norm in terms of

Table 1 – Ethical position on species protection compared with WTP category

		WTP category ¹				Total ²
		Positive WTP	Zero principle	Don't know principle	Don't know specific	
Strong species rights	Actual	104.0	66.0	25.0	34.0	229
	Expected	74.5	97.0	32.5	25.0	229
	Adj. res.	4.9	–4.9	–1.7	2.2	
Weak species rights	Actual	13	28.0	9.0	5.0	55
	Expected	17.9	23.3	7.8	6.0	55
	Adj. res.	–1.5	1.3	0.5	–0.4	
Consequentialist favouring species	Actual	122.0	79.0	38.0	39.0	278
	Expected	90.4	117.8	39.5	30.3	278
	Adj. res.	4.9	–5.7	–0.3	2.0	
Consequentialist favouring people	Actual	36.0	131.0	29.0	13.0	209
	Expected	67.9	88.6	29.7	22.8	209
	Adj. res.	–5.4	6.8	–0.2	–2.5	
Humans first	Actual	2	57.0	20.0	2.0	81
	Expected	26.3	34.3	11.5	8.8	81
	Adj. res.	–6.1	5.4	2.8	–2.6	
Total N ²		277	361	121	93	852
Chi-square tests		Value		df		Asymp. sig. (2-sided)
Pearson chi-square		144.266		12		0.00
Likelihood ratio		160.460		12		0.00
Linear-by-linear association		18.000		1		0.00

Notes:

1. No cells have an expected count less than 5 (minimum expected count is 6.00).

2. Excludes refusal of WTP and “don't know” responses to ethical categories: missing N=160.

what others think should be done about a specified behavioural act and the second the motivation to comply with those others. The subjective norms related to six social relationships covering the following individuals/groups: partner, colleagues, children, parents, friends and environmental groups. Each paired question is intended for use as a product to be summed into the respective attitudes or subjective norm scale.

The questions covering perceived behavioural control were slightly different. The recommended approach under theory of planned behaviour is again to use the sum of products. In this case the first is the individual's belief in their control over a given factor (e.g. paying money) and the second is their perception of the factor in achieving a given end (e.g. biodiversity improvement). The type of behaviour under a CVM survey was more difficult to conceptualise as a product and space precluded a large range of additional questions. The aim was to assess the extent to which respondents perceived that they could perform the target

behaviour at will. In this respect there are in fact two target behaviours involved: first is control over payment, second is achieving a biodiversity improvement via that payment. Other studies were found to have used single questions rather than products and given the complexity of the CVM context this approach was taken. Two questions then addressed the first and three the second target behaviours. This led to a more experimental approach which makes the results here of particular interest.

The first question in each pair for attitudes and subjective norms was phrased negatively and the second positively to encourage cognitive engagement. The perceived behavioural control questions were a mixture of positive and negative phrasing. The results give a measure from 1 to 49 for the attitude and subjective norm scales and a scale from 1 to 7 for the perceived behavioural control. That is, the summed products (attitudes, norms) and summed items (perceived control) are divided by the number of items in the scale. Item non-response

Table 2 – Mean and median WTP by ethical position

	Strong species rights	Weak species rights	Consequentialist favouring species	Consequentialist favouring people	Humans first	Total WTP sample ¹
Mean	£10.6	£4.4	£7.3	£2.5	£0.5	£5.6
5% trimmed mean	£7.2	£2.3	£5.8	£1.2	£0.0	£3.4
Median	£5.0	£0.0	£5.0	£0.0	£0.0	£0.0
Maximum	£120.0	£50.0	£60.0	£50.0	£30.0	£120.0
Minimum	£0.0	£0.0	£0.0	£0.0	£0.0	£0.0
N	229	55	278	209	81	719

1. Total WTP sample column provided for comparison includes positive and zero principle bids, excludes 9 WTP refusals, and 284 WTP don't knows.

leads to exclusion in the summation process.¹ Generally, the more favourable attitudes and norms and the stronger the perceived behavioural control with respect to a specified behaviour then the stronger should be an individual's intention to perform that behaviour.

The first stage in data analysis of the results required testing the integrity of the attitudinal scale. This was done using reliability and factor analysis. The attitude scale had good initial reliability including all items with a Chronbach's alpha of 0.9416 from 976 responses. The integrity of the attitude scale was increased to 0.9466 by removing one item (attitude questions 10a/b). This item related to the price increase in the electricity bill and the desirability of using less electricity as a result. From the protest bid reasons there was a clear concern over the electricity bill and this question was as a result unclear with regard to the association with the biodiversity improvement scenario. A second item (attitude questions 4a/b) of concern in this regard related to biodiversity improvements leading to tourism; a consequence which could be seen as either beneficial or problematic. In the factor analysis this was a weaker element but still made a statistically significant contribution (while excluded attitude questions 10a/b failed to do so).

Scale reliability for perceived behavioural control was much weaker. The Chronbach's alpha for all five items was 0.42 from 983 responses. This was increased to 0.49 (from 988 responses) by removing the two items relating to electricity bill payment. Testing those two items as a separate scale shows a weak result with alpha 0.27 (from 988 responses). Factor analysis supported the separation of the scale.

Factor analysis gave four factors. The first two were attitudinal and norm scales. The third and fourth were the two elements of the perceived behavioural control scale. The excluded attitude item (question 10a/b) was confirmed as the weakest of the attitude scale and in an unrotated component matrix fell marginally below the 0.4 loading criteria. As the item was borderline and reduce alpha reliability it was dropped from the regression analysis. Perceived behavioural control split into two factors. These are weaker but at the same time do hold together statistically and are in-line with the item focus of each factor being biodiversity and the electricity company respectively.

Analysis of the partial correlation coefficients showed attitudes and subjective norms to have a consistently significant relationship to the valuation measure, although the relationship is weaker for qualitative valuation. The two factors are also significantly related to each other and this correlation is increased under qualitative valuation. Overall the relationship between internal elements of the theory of planned behaviour seems to be one where attitudes are closer to subjective norms and perceived behavioural control relates more to subjective norms than attitudes.

Perceived behavioural control has a mixed strength and significance. The separation of the two aspects of perceived behavioural control shows they are uncorrelated themselves and have different relationships with other variables. Their

main consistent relationship is with subjective norms. In terms of payment versus qualitative scenarios of valuation, perceived behavioural control with respect to biodiversity improvement (PBCbio) is most significant for the qualitative value (although unexpectedly negative and a small correlation) whereas perceived behavioural control with respect to electricity bills (PBCElec) is significant in the two other cases and with a stronger correlation. The change in significance of perceived behavioural control between the payment in principle and specific WTP stages indicates those who "refused" or "didn't know" at the first stage also lacked a belief in their ability to control the behaviour being requested, i.e. biodiversity improvement via electricity company bills.

4.3. WTP analysis

This section examines the variation in WTP to increase biodiversity in the Tummel catchment according to socio-economic characteristics, ethical categories and the theory of planned behaviour model. The statistical relationships are explored using standard multivariate regression analysis of three separate models (socio-economics, ethics and social psychology) which are then combined. The bid function for WTP was explored using a log linear form where zero bids were assigned the value of £0.001 to obtain the natural log (lnWTP).

Amongst the 1012 individuals interviewed there were 282 positive bids and 437 zero bids. The 293 refusals and don't knows were excluded from the analysis reported next. Regression analysis further reduced the 719 sample size due to item non-responses. In this respect income was a particularly problematic variable. In this study, 38% of the sample (382 individuals) refused to give their income by category while 68% (688 respondents) refused to answer when asked their disposable income. A comparison of income data with occupational class implied some inconsistency, and including the income variable would have reduced the total sample size considerably. Instead, following Spash (1998), a dummy variable (INCREf) was created to cover a respondent's refusal to give income level so this could be tested for importance. In addition, dummies were used for occupation classes and education both of which can act as a surrogate for income. The variables to be discussed in the various models are described in Table 3 and the coefficients for all models are summarised in Table 4.

Underlying the results is the contribution of adding each variable following a stepwise procedure. Under such an approach, the socio-economic model shows the largest contribution to explaining variation in WTP is from the respondents understanding of the information which was given on the impacts of hydro-power generation on biodiversity in the Tummel catchment (INFO), and this is followed by the belief in an upward trend in biodiversity (WBDinc). As shown in Table 4 both variables are significant and positive. For WBDinc a negative correlation might have been expected as a belief that biodiversity is increasing could be taken to signify that all is well. The explanation may be that although biodiversity is on the increase it has a long way to go. Alternatively, if people are more aware of species and notice their presence they may also value them more and want to see more of them and protect them from harm. The lowest contributing variable, under a stepwise procedure, is also concerned with belief in the trend in Scottish

¹ Note using a mean summation would result in respondents who answer say one set of paired ATB questions being treated exactly the same as one who answered all 13 pairs. This would be highly misleading, implying that all scale items are identical to the one for which an answer was obtained.

Table 3 – Model variable descriptive statistics

	N	Min	Max	Mean
URBAN: respondent from urban or rural location	1012	0.0	1.0	0.64
CONQGE: concern for quality of global environment	1011	1.0	7.0	5.15
WBDinc: water system biodiversity in Scotland has increased	1012	0.0	1.0	0.64
WBDstable: water system biodiversity in Scotland stable	1012	0.0	1.0	0.10
INFO: understanding of information on impacts	1003	1.0	7.0	4.56
EDUNIV: educated to university undergraduate level	996	0.0	1.0	0.16
EDUNIVPG: educated to university postgraduate level	996	0.0	1.0	0.05
JOBMP: occupation in management, professional	978	0.0	1.0	0.16
SERIOUS: seriousness of respondent estimated by interviewer	1004	1.0	7.0	5.69
INCREf: income refused	1012	0.0	1.0	0.68
SRIGHTS: strong species rights	1012	0.0	1.0	0.23
WRIGHTS: weak species rights	1012	0.0	1.0	0.05
CONSa: consequentialist favouring animals	1012	0.0	1.0	0.27
CONSh: consequentialist favouring humans	1012	0.0	1.0	0.21
ATB: attitude towards behaviour scale with 12 items	967	2.5	49.0	23.68
SN: subjective norm scale	789	1.0	49.0	15.99
PBCelec: perceived behavioural control on electricity company	988	1.0	7.0	3.80
PBCbio: perceived behavioural control on biodiversity	988	1.0	7.0	2.92
LNWTP: log of willingness to pay	719	-6.9	4.8	-3.30
Valid N (listwise)	523			

biodiversity (WBDstable), and in this case concerns stability which may be most easily understood as signifying recognition of a need to pay to increase biodiversity. Another significant environmental variable is the concern for the global environment (CONQGE) which, given reasons for positive bids is unsurprising but does imply more of a general motive than consideration of the specific issue being discussed. The model also includes a variable on how seriously the respondent took the survey in the opinion of the interviewer (SERIOUS) and this proves positive and significant. Thus, those who were cognitively engaged had a higher WTP. Education was important and increased WTP, but was also partially correlated with occupational class as indicated by the management/professional dummy variable. The two University education categories of undergraduate (EDUNIV) and postgraduate (EDUNIVPG) degrees reduced the significance of the occupation variable (JOBMP). The occupation class and education variables covered the absence of income data. This is also addressed in a different way by the income refused variable (INCREf) which was negative and significant showing that refusal to give income was associated with reduced WTP. Being from an urban area (URBAN) increased WTP and could signify higher incomes levels but may also be due to general attitudinal differences (this indicates a need for further analysis of urban–rural differences). Overall the model showed the higher are the levels of education and occupational attainment the greater WTP. Other key factors were concern for

Table 4 – Regression models compared

	Socio-econ. model	Ethics model	TPB model	Combined model
(Constant)	-10.65 (0.00)	-6.45 (0.00)	-12.47 (0.00)	-17.90 (0.00)
URBAN	1.37 (0.00)			2.81 (0.01)
CONQGE	0.22 (0.02)			1.00 (0.32)
WBDinc	2.03 (0.00)			3.16 (0.00)
WBDstable	1.25 (0.03)			1.67 (0.10)
INFO	0.43 (0.00)			-0.44 (0.66)
EDUNIV	1.00 (0.03)			1.96 (0.05)
EDUNIVPG	2.28 (0.01)			3.05 (0.00)
JOBMP	0.91 (0.04)			0.69 (0.49)
SERIOUS	0.39 (0.00)			0.72 (0.47)
INCREf	-1.10 (0.00)			0.01 (0.99)
SRIGHTS		5.20 (0.00)		6.23 (0.00)
WRIGHTS		2.42 (0.00)		0.73 (0.47)
CONSa		5.06 (0.00)		5.58 (0.00)
CONSh		1.47 (0.00)		1.25 (0.21)
ATB			0.17 (0.00)	9.63 (0.00)
SN			0.12 (0.00)	4.75 (0.00)
PBCelec			0.60 (0.00)	4.86 (0.00)
PBCbio			0.23 (0.04)	3.35 (0.00)
Adj R ²	0.22	0.23	0.48	0.57
F-test	20.13	52.99	125.73	39.32
	0.00	0.00	0.00	0.00
Total df	667	718	552	522

the environment, understanding biodiversity impacts and taking the survey seriously. The model's adjusted R² at 22% was quite respectable for a CVM study (e.g. Mitchell and Carson, 1989; Bateman et al., 2002 take 15% as acceptable).

All the ethical variables were significant and the four variables together explained as much variance in WTP as the ten socio-economic variables. A stepwise procedure revealed the greatest contribution to explaining variations in WTP as coming from the strong rights (SRIGHTS) position which shows how WTP is based upon non-economic motives. The standard economic approach has been to describe ethical positions as leading to protest bids while in contrast here we found they contributed to a positive WTP. The problem for the standard approach is then that these results offer little comfort for regarding the resulting WTP as reflecting a trade price or valuation of biodiversity in terms of a preference utilitarian ethical theory. Instead they support the need for further understanding of the motives underlying

Table 5 – Contribution of variables to a combined model

Model	Variables entered	R	R ²	Adj R ²	SE
1	ATB	0.609	0.371	0.370	3.576
2	PBCelec	0.663	0.439	0.437	3.379
3	SN	0.690	0.477	0.474	3.268
4	SRIGHTS	0.705	0.497	0.493	3.206
5	CONSa	0.735	0.540	0.536	3.068
6	URBAN	0.741	0.550	0.544	3.040
7	EDUNIVPG	0.747	0.557	0.552	3.017
8	WBDinc	0.751	0.563	0.557	2.998
9	PBCbio	0.756	0.572	0.564	2.973
10	EDUNIV	0.759	0.575	0.567	2.963

responses to CVM surveys and the range of values which people associate with such environmental issues as biodiversity.

Next the model was restricted to the theory of planned behaviour model. Stepwise contribution to adjusted R^2 was in the order attitude scale, subjective norms and perceived behavioural control over electricity. The perceived behavioural control over biodiversity was a much weaker contributor and far less significant factor, and this is despite being the more robust of the two perceived behavioural control scales on the reliability tests and in factor analysis. The adjusted R^2 for the social psychology model at 0.48 is well above standard findings within the CVM context, where 0.14 to 0.20 is more normal and taken as acceptable. Clearly the theory of planned behaviour is highly relevant to the WTP results and this has strong implications for their interpretation.

A combined form of the three models above increased the explanatory power with regard to WTP. The adjusted R^2 was 0.57 which is very high for a CVM model. However, there were many variables which proved insignificant. This combined model shows that a reduced form with very few variables and improved statistical significance can be created. Indeed the socio-economic variables normally associated with a bid curve appear to be the least important. The approach for the reduced form model was to look for variables which remained significant at the 5% level while contributing to the overall explanation of WTP. This is shown in Tables 5 and 6. The top five variables relate to the theory of planned behaviour and ethical model allowing 53.6% of the variation in WTP to be explained. The remaining five variables explain just an additional 3.1% of variation. Thus, the key to understanding WTP results is shown to lie with the social psychology and ethical beliefs of the respondents. In terms of the theory of planned behaviour model, the explanatory power of perceived behavioural control dominates subjective norms. For the ethical variables the strong rights position and the consequentialist favouring animals both prove significant. Overall the model has intuitive explanation and appears statistically robust.

5. Discussion and conclusions

The current study extends previous work on the motives behind economic valuations under the CVM by adopting an approach to explaining intended behaviour from social

psychology, namely the theory of planned behaviour. This theory was employed as one major thread of thinking in social psychology on understanding the link between motives, such as attitudes, and behaviour. However, there are other avenues by which the same issues may be addressed such as the literature on awareness of consequences and pro-social behaviour (e.g., see Stern, 2000) and this may also provide insight into CVM results (Spash, in press).

Where attitudes have been discussed or incorporated as potential variables in CVM surveys this has tended to be as warm-up questions due to recommendations attributed to the NOAA panel (Arrow et al., 1993) and has failed to use a psychometric scale but instead relied upon such things as membership of environmental organisations (e.g., Bateman et al., 2002: 330). Besides the paucity of such measures in addressing attitudes their use as warm-up questions is known to pre-load any ensuing WTP question (Pouta, 2004). This study has employed a specific pre-tested measures of attitudes, social norms and perceived behavioural control based upon theories from social psychology and used them as follow-ups to the main CVM survey.

Kahneman and colleagues have argued that stated WTP under the CVM has striking resemblance to a measure of attitudes as described and measured by social psychologists (Kahneman et al., 1993; Kahneman, Ritov and Schkade, 1999). They present extensive evidence which explains anomalies of the CVM as characteristics of attitudes and attitude expression. Yet they fail to show any direct relationship of stated WTP to a measure of attitudes under standard CVM procedures. The present results provide support for the contention of Kahneman and colleagues that stated WTP is closely related to attitudes. However, the results also show there is more going-on than can be captured by a standard attitudinal scale alone. Indeed the concepts of perceived behavioural control and social norm both proved highly relevant, as did ethical motives.

The role of rights has been put forward as a potential restriction on the willingness to trade in the CVM context. Here a third of the sample held rights based beliefs and 27% strong species rights. However, a consistent result, reconfirmed here, appears to be the positive WTP of those holding strong rights. This means stated WTP is being justified by an ethical motivation which explicitly rejects the consequential reasoning assumed by standard economic explanations. Focussing purely upon the outcome, a positive WTP, regardless of motives would misconstrue the intentions of the respondents (e.g. as trade process as opposed to charitable contributions). The importance of strong rights as differentiated from weak rights also has practical implications for replication of these results. Where less care and attention is paid to the categorisation of ethical beliefs significant results may be obscured e.g. if strong and weak rights were merged as a single category.

From the results presented here, the CVM can be seen to reflect psychological and ethical factors which are excluded by standard economic models. This means that intentions to pay cannot be easily interpreted as a trade price for environmental change or an economic welfare measure. The extent to which the implications of the evidence presented are regarded as relevant to more everyday market trades depends upon the similarity accepted between the CVM and actual choices. For those who reject the CVM, but maintain the relevance of standard rational choice theory for market choices, the evidence

Table 6 – Statistics for the combined model

	B	SE B	Beta	t	Sig t
(Constant)	-13.74	0.50		-27.49	0.00
ATB	0.14	0.01	0.36	10.45	0.00
PBCelec	0.51	0.09	0.18	5.76	0.00
SN	0.09	0.02	0.17	4.87	0.00
SRIGHTS	2.52	0.34	0.24	7.53	0.00
CONSa	2.19	0.32	0.22	6.85	0.00
URBAN	0.73	0.28	0.08	2.61	0.01
EDUNIVPG	2.39	0.70	0.10	3.41	0.00
WBDinc	0.84	0.28	0.09	2.97	0.00
PBCbio	0.35	0.11	0.10	3.36	0.00
EDUNIV	0.83	0.37	0.07	2.21	0.03
R	R^2	Adj R^2	Std. error	F	F sig
0.76	0.58	0.57	2.96	72.11	0.00

will not be compelling. However, there is a growing need for economists to be less dogmatic and accept the repeated message of a need for revision of choice theory rather than persistently shooting the messenger. Exploring the middle ground by looking for insights into theory and results from practical work appears the best way forward (Vatn, 2004). Market place behaviour seems just as likely to be more explicable with the model of valuation explored here while behavioural theories seem highly relevant for microeconomics, business and marketing (Earl, 1995). As empirically trained scientists, economists should not be so ready to dismiss the evidence as perhaps some rational choice theorists appear.

The use of economic valuation techniques is persistently popular within sections of civil service institutions and hence appears in legislation e.g., the Water Framework Directive. As a result cost-benefit tools, such as CVM, will continue to play a key role in determining monetary values of environmental change and be used as the basis for transferred values to justify decisions. However, assessing environmental values for policy purposes requires understanding the importance of motives behind values, including ethical positions, environmental attitudes and social norms. As shown here, these multiple motives can be seen as offering greater insight into how individuals perceive the environment and as a result how policy should be designed. The implication for environmental policy is that multiple values are relevant to management decisions and that monetary valuation which aggregates and assumes commensurability without cross-checking motives will fail to represent public opinion.

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Appendix A. Theory of planned behaviour

A.1. Specific attitudes

- 1a. Paying more for electricity to restore biodiversity will increase the diversity and abundance of plant and animal species in the Tummel area (extremely likely to extremely unlikely).
- 1b. Increasing the diversity and abundance of plant and animal species in the Tummel area is (extremely bad to extremely good).
- 2a. Paying more for electricity to restore biodiversity will increase genetic diversity in the Tummel area (extremely likely to extremely unlikely).
- 2b. Restoring genetic diversity in the Tummel area is (extremely bad to extremely good).
- 3a. Paying more for electricity to restore biodiversity will reduce the number of injuries caused to animals in the river (extremely likely to extremely unlikely).

- 3b. Reducing the number of injuries caused to animals in the Tummel area is (extremely bad to extremely good).
- 4a. Paying more for electricity to restore biodiversity will increase the number of tourists to the Tummel area (extremely likely to extremely unlikely).
- 4b. Increasing the number of tourists to the Tummel area is (extremely bad to extremely good).
- 5a. Paying more for electricity to restore biodiversity will increase river flows in the Tummel area (extremely likely to extremely unlikely).
- 5b. Increasing river flows in the Tummel area is (extremely bad to extremely good).
- 6a. Paying more for electricity to restore biodiversity will help restore the web of life in the Tummel area (extremely likely to extremely unlikely).
- 6b. Restoring the web of life in the Tummel area is (extremely bad to extremely good).
- 7a. Paying more for electricity to restore biodiversity will enhance water quality in the Tummel Area (extremely likely to extremely unlikely).
- 7b. Enhancing water quality in the Tummel area is (extremely bad to extremely good).
- 8a. Paying more for electricity to restore biodiversity will teach people to think more about the environmental impacts of industry (extremely likely to extremely unlikely).
- 8b. Teaching people to think more about the environmental impacts of industry is (extremely bad to extremely good).
- 9a. Paying more for electricity to preserve biodiversity will restore the Tummel area to its natural state (extremely likely to extremely unlikely).
- 9b. Restoring the Tummel area to its natural state is (extremely bad to extremely good).
- 10a. Paying more for electricity to restore biodiversity would mean that I have to reduce my electricity usage (extremely likely to extremely unlikely).
- 10b. A reduction in my electricity usage would be (extremely bad to extremely good).
- 11a. Paying more for electricity to restore biodiversity will help extinct species to be reintroduced to the Tummel area (extremely likely to extremely unlikely).
- 11b. Reintroducing extinct species to the Tummel area is (extremely bad to extremely good).
- 12a. Paying more for electricity to restore biodiversity will reduce the area flooded under hydro lochs (extremely likely to extremely unlikely).
- 12b. Reducing the area under hydro lochs in the Tummel area is (extremely bad to extremely good).
- 13a. Paying more for electricity to restore biodiversity will improve the appearance of the rivers and lakes in the Tummel area (extremely likely to extremely unlikely).
- 13b. Improving the appearance of rivers and lakes in the Tummel area is (extremely bad to extremely good).

A.2. Subjective norms

- 1a. My spouse/partner would think that I.. pay more for electricity to preserve biodiversity in the Tummel area (should to should not).
- 1b. Generally speaking, how much do you want to do what your spouse/partner thinks you should do? (very much to not at all).

- 2a. My work colleagues would think that I... pay more for electricity to preserve biodiversity in the Tummel area.
- 2b. Generally speaking, how much do you want to do what your work colleagues think you should do?
- 3a. My children would think that I... pay more for electricity to preserve biodiversity in the Tummel area.
- 3b. Generally speaking, how much do you want to do what your children think you should do?
- 4a. My parents would think that I... pay more for electricity to preserve biodiversity in the Tummel area.
- 4b. Generally speaking, how much do you want to do what your parents think you should do?
- 5a. My friends would think that I... pay more for electricity to preserve biodiversity in the Tummel area.
- 5b. Generally speaking, how much do you want to do what your friends think you should do?
- 6a. Environmental groups would think that I... pay more for electricity to preserve biodiversity in the Tummel area.
- 6b. Generally speaking, how much do you want to do what environmental groups think you should do?

A.3. Perceived behavioural control

1. I can easily afford to pay more for my electricity (strongly agree to strongly disagree).
2. How much control do you believe you have over selecting your electricity supplier (no control to complete control).
3. How much control do you think you have over ensuring that the collected money will go into improving biodiversity? (no control to complete control).
4. I trust electricity companies to spend the extra money on improving biodiversity (strongly agree to strongly disagree).
5. I don't think paying more for electricity to improve biodiversity will produce any significant results (strongly agree to strongly disagree).

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