Incommensurable preferences in contingent valuation: the case of Natura 2000 Network in Finland

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Date submitted: 12 May 1999 Date accepted: 12 July 2000

Summary

In the literature of contingent valuation, a rights-based system of environmental ethics claiming that natural objects have absolute rights, has frequently been regarded as the main reason for incommensurability, i.e. for citizens' inability to find a common measure according to which all values could be ranked. In a study of 2400 Finns aged between 18 and 70, we tested whether a respondent's commitment to guaranteeing private property rights could be a reason for incommensurability beyond the respondent's possible commitment to absolute nature rights. It was found that incommensurability, modelled with lexicographic preferences, was attributable more often to private property rights than to nature rights. However, Finnish respondents who had lexicographic preferences for nature rights based their choice more often on an ethical judgement, whereas lexicographic preferences for property rights could rather be explained with an ambivalent preference construction. Lexicographic preferences for nature rights increased the willingness to pay for conservation, while lexicographic preferences for property rights decreased it. The result, which was predicted by the theory, supported the validity of incommensurability measurement. The study therefore indicates that several reasons for incommensurable preferences may exist and that it is possible to measure these reasons in contingent valuation surveys in order to judge the validity of the welfare measures in environmental policy decision-making.

Keywords: contingent valuation, incommensurability, lexicographic preferences, property rights, decision confidence, willingness–to–pay

Introduction

Empirical contingent valuation studies provide evidence that a portion of respondents do not reveal commensurable preferences according to standard economic theory. These individuals feel that there is no common measure according to which all values can be ranked and they do not make trade-offs between all goods. For instance, they feel that changes in environmental quality cannot be compensated with changes in their income. Lexicographic preferences have been used to characterize this kind of incommensurability in choice behaviour (Georgescu-Roegen 1954; Fishburn 1975; Slovic *et al.* 1988; Encarnación 1990). With lexicographic preferences, utility is modelled as a vector consisting of a set of hierarchically-ordered wants. Each want has a satiation level, and choices are made so that they satisfy the greatest number of wants starting with the most important, continuing down a hierarchy to the least important.

Several non-market valuation studies assume that the reason and motivation for incommensurability are ethical positions whereby natural objects, animals, plants, or ecosystems, are claimed to have absolute rights that are to be protected regardless of what such protection costs society (Stevens *et al.* 1991; Hanley *et al.* 1995; Spash & Hanley 1995; Hanley & Milne 1996). According to these studies, nature rights as a source of incommensurability emerge from the individual's commitment to Kantian, deontological ethics, where decisions are made on the basis of whether acts themselves are right or wrong regardless of the consequences. In other words, choices should be made according to absolute rights or duties (MacLean & Mills 1988; Vatn & Bromley 1994; Blamey 1996; Peterson *et al.* 1996; Spash 1997).

The starting point for the analysis in this paper was a transaction interpretation of a contingent valuation (CV) study. CV is a survey method for measuring people's preferences for public goods such as recreation areas or environmental amenities (Bishop *et al.* 1995; Mitchell & Carson 1989). Public goods are not exchanged in markets, which means that individuals' preferences for them cannot be determined from typical economic market data consisting of prices and quantities. A CV survey describes a hypothetical scenario, namely a constructed market or referendum, which provides a context for transactions in the same manner as real markets or referenda. The attributes of a satisfactory transaction are (1) a good, (2) a payment, and (3) a social context (Fischhoff & Furby 1988). Because all three attributes are relevant to valuation, not only is 'the good' itself, for example, protected nature, valued, but the whole transaction, for example, a conservation programme, is valued (Randall 1986). Therefore, there are no theoretical reasons to disregard the attributes of a transaction other than a good, such as a protected area, from a possible explanation of incommensurability.

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The rights of other people, such as human rights or property rights, may also be a reason for not making trade-offs. People may have commitments to social interests that are irreducibly distinct from private self-interest (Margolis 1982; Stevens *et al.* 1993). To many people, landowners' rights belong to the category of inviolable rights such as human rights. No trades are acceptable between these rights and other resources (MacLean & Mills 1988; Vatn & Bromley 1994). Therefore, respondents' commitment to landowners' rights may be the other main reason, besides nature rights, for incommensurability.

In the literature, lexicographic choice has also been seen as an implication of unstable preferences in addition to ethical judgement (Opaluch & Segerson 1989; Slovic 1995). According to this explanation, a CV questionnaire imposes on respondents new, often complex, and unfamiliar choices between money and environmental quality, where simplifying decision rules, such as lexicographic rules, may be used.

In this study, our aim was, firstly, to use empirical data to demonstrate the existence of several incommensurable attributes in citizens' values besides nature rights as proposed by the theory of lexicographic preferences (Fishburn 1975). Secondly, we wished to show how incommensurability could be measured with attitude statements and how it could be explained. Special emphasis was placed on the analysis of the role of perceived choice complexity. Thirdly, we aimed to assess the effect of lexicographic preferences on willingness-to-pay (WTP) measures.

The empirical data used in this study originated from a CV survey conducted as part of the environmental impact assessment of a nature conservation project, namely the European Union nature protection programme Natura 2000 Network in Finland. The programme faced strong opposition, especially in that it was deemed to abuse private landowners' property rights, because it was clear that not all new protected area could be obtained from private lands through voluntary transactions. The Finnish Ministry of Environment obtained in all more than 14 000 written complaints (Hildén *et al.* 1998), a major reason for which was the view that landowners' opinions were not taken into account in the planning. Many non-landowners also shared this view.

Lexicographic preference structures

Lexicographic preferences are based on hierarchical structures of wants (Georgescu-Roegen 1954; Fishburn 1975). Several variants of lexicographic preferences exist. The model labelled as 'L*-ordering' by Hayakawa (1978) and Encarnación (1990) assumes that an individual has several hierarchically-ordered wants with a satiation level or a threshold attached to each want. Some textbook models (e.g. Gravelle & Rees 1992; Varian 1992) which do not include satiation levels are considered less useful, because the choice depends only on the first want (Encarnación 1990). In the L*-ordering, utility is a vector consisting of separate wants or attributes. An individual satisfies these from the most important down to the least important, so that all alternatives (bundles of goods) that do not meet the threshold of the first want or attribute are first dropped. All the alternatives that do not meet the threshold of the second want are then dropped, and so on. Using hierarchically-ordered wants, the alternatives are thus ranked according to the same principle, just as words are ordered using letters in a lexicon.

There is theoretically no reason to limit the number of dimensions in a utility vector, and therefore we argue that several other incommensurable attributes may exist in addition to nature rights (N). There is no restriction against including property rights (P) in a lexicographic utility vector just as N is included. They are both public goods, which means that the amounts of N and P, as well as the amount of the payment, are given for an individual (Boadway & Bruce 1984). It is an empirical issue whether a respondent has separate dimensions for N or P in his or her utility vector. It is also possible to have both as separate dimensions at the same time in one's utility vector.

In order to construct a complete L*-ordering, one should know the minimum acceptable levels of N, P and other possible attributes, such as income, as well as their hierarchical order. To our knowledge, such a construction has not yet been employed in any valuation study. In the present study, the aim was only to see whether lexicographic preferences may be present, and establish whether property rights as well as nature rights might be allowed as a motive for lexicographic behaviour.

In order to understand the WTP results and their implications for the welfare analysis, it is useful to discuss a few properties of L*-ordering. It fulfils four of the five axioms of consumer theory, namely completeness, transitivity, reflexivity, and non-satiation (Deaton & Muellbauer 1980, pp. 25–9). In fact, standard consumer theory can be seen as a special case of L*-ordering where utility has only one dimension (Encarnación 1990). However, L*-ordering does not fulfil the continuity assumption, and this is because there is no trade-off between wants. For example, whatever the amount of the second most important attribute in bundle B, B is ranked below bundle A if it does not meet the threshold for the first attribute and bundle A does. This incommensurability means that the utility functions and indifference curves do not exist, in other words that there are no indifferent bundles of goods (Fishburn 1975). Thus, compensation or equivalent variation or surplus cannot be used in the welfare analysis for incommensurable groups (Spash & Hanley 1995). For policy purposes, one needs to know the degree of incommensurability in a sample.

Besides the ethical aspect, lexicographic choice may also be attributed to the complexity of the choice situation or it may occur when the decision time is limited (Billings & Marcus 1983; Slovic *et al.* 1988; Harris *et al.* 1989; Mazzota & Opaluch 1995). In this case, lexicographic preferences for nature rights and property rights can be attributed either to ethical judgement or the complexity of the decision. Complex

Table 1 Choice setting in the contingent valuation survey.

	Option 1	Option 2
Nature conservation area		
Change to current area	same as current area	6% larger than current area
% of the land area of Finland	11.3%	11.9%*
Conserved nature types	Currently conserved: swamps, shores, bird habitats, eskers, wilderness, old growth forests, groves	In addition to option 1: rich fens, springs, lakes, rivers, river deltas, sea shores
Change in the income tax of your household	No change	FIM 340 increase in income tax**

* The amount of increase in conservation area was varied between 11.6, 11.9 and 12.1%. Sub-samples were lumped together in this study.

** The amount of increase in income tax had values from FIM 60 to FIM 1200 (FIM 1 ≈ US$0.17, October 1999).

decision problems may cause ambivalence, in other words difficulty in combining positive and negative aspects of decision objects (Opaluch & Segerson 1989; Ready *et al.* 1995). In such situations, individuals have been found to apply simplistic decision processes, so-called heuristics. A non-compensatory lexicographic L*-ordering can serve as a decision heuristic because it may be hard for individuals to construct trade-offs between all values; this is an ability that is assumed in ordinary consumer theory. Instead, it can be easier to make a choice based on the satisfactory threshold levels of characteristics that are considered most important (Slovic *et al.* 1988; Mazzota & Opaluch 1995).

Methods

Valuation context

The topic of the CV survey was the European Union's nature protection programme, Natura 2000 Network in Finland (Pouta *et al.* 1998). Natura 2000 Network coordinates the European Union's nature protection policy. The aim of the programme is to protect natural habitats of wild fauna and flora in order to guarantee a favourable level of protection. The planning of the Natura 2000 Network in Finland began in the spring of 1997 with a proposal prepared by the Finnish Ministry of Environment. Purely biological criteria were used to choose sites for the proposal, which covered a total of 3.5 million ha of land (11.9% of the total Finnish land area), 95% of which comprised existing nature conservation areas. However, the first proposal also included 114 000 ha of newly-protected land and 376 000 ha of newly-protected aquatic areas. This CV study contributed to the environmental impact assessment of the Natura 2000 Network. The scenario described in the questionnaire was based on this proposal and was written to meet the topics emerging from the public discussion.

Survey administration

The sample for the mailed questionnaire was 2400 Finns between the ages of 18 and 70, selected randomly from the Census Register of Finland. The questionnaire consisted of eight pages together with a cover letter and postage-paid envelope. The questionnaire was tested in the pilot survey in October, and mailed out in November 1997. After the first mailing, reminder postcards were sent. No focus group or re-mailing of the questionnaire was conducted.

Measurement

The WTP question was in a dichotomous choice referendum format. The choice situation was presented in an illustrative table where the protection area, natural biotopes protected, and the costs of the alternatives in income taxes to households, were summarized (Table 1). The first alternative was the existing level of protection and the second was based on the programme, which entailed an increase in the amount of protected land and water area.

In addition to the CV question, the questionnaire contained statements that explored the existence of lexicographic preferences, decision confidence in the referendum choice, the perceived budget constraint, and attitudes both toward nature conservation in general and toward the proposed programme in particular. Responses to all were all measured with either a five-point Likert-scale or a five-point semantic differential scale; the measurement and formation of variables is explained in detail in Table 2. Questions concerning socio-economic background variables were included at the end of the questionnaire.

Earlier studies have used attitude-like statements to measure incommensurability (Stevens *et al.* 1991; Hanley & Milne 1995; Hanley *et al.* 1995; Spash & Hanley 1995; Spash 1997). Lockwood (1998, 1999) has applied, in turn, paired comparisons that can provide more information than attitude measures. In a mail survey, however, it is extremely difficult to apply paired comparisons. This study applied attitude statements, but unlike most of the previous studies we utilized 5-point scales instead of simple yes/no questions. The reliability of dichotomous CV studies has been improved by using similar scales instead of dichotomous choice and interpreting only the extreme answers such as 'extremely sure', as 'yes' answers (Li & Mattsson 1995; Brown *et al.* 1996; Champ *et al.* 1997). We propose that lexicographic preferences are also more reliably measured in this way.

The lexicographic preferences for nature conservation were measured via the five-point statement: 'Nature conservation is always more important than increasing income

Table 2 Measurements and construction of variables.

Statements and scale (translated from Finnish)	Variables	Mean (SD)* Value (frequency)**
Lexicographic preferences		
'Nature conservation is always more important than increasing income level.' (1-strongly disagree–5-strongly agree)	NLEXPRE = 0 if answer was 1–4, or 1 if answer was 5.	0 (825) 1 (237)**
'Nature conservation may never be based on compulsory purchase of land even if landowners were compensated.' (1-strongly disagree–5-strongly agree)	PLEXPRE = 0 if answer was 1–4, or 1 if answer was 5.	0 (715) 1 (349)**
Confidence in referendum choice		
(1) 'It was difficult to compare pros and cons of the program.' (1-strongly agree–5-strongly disagree)	SURE = mean for statements 1–3	2.98 (0.86)*
(2) 'It was very difficult to compare the alternatives.' (1-strongly agree–5-strongly disagree)		
(3) 'Proposal has no meaning for me.' (1-strongly agree–5-strongly disagree)		
Attitude to the programme		
The Natura 2000 programme as a whole is	PROGRAMAT = mean for statements 1–3.	3.72 (1.09)*
(1) '1-necessary–5-worthless'		
(2) '1-supportable–5-objectionable'		
(3) '1-positive–5-negative'		
Attitude to conservation in general		
(1) 'Nature conservation has already been taken care of well enough in Finland.' (1-strongly agree–5-strongly disagree)	CONSERAT = mean for statements 1–5.	3.29 (0.89)*
(2) 'Profound changes in life style are needed to save nature for future generations.' (1-strongly disagree–5-strongly agree)		
(3) 'Pristine nature should be protected even if costs a lot' (1-strongly disagree–5-strongly agree)		
(4) 'Nature conservation is needed even if it causes unemployment.' (1-strongly disagree–5-strongly agree)		
(5) 'Nature conservation allows society to regulate private land use.' (1-strongly disagree–5-strongly agree)		
Activities connected to nature		
(1) 'Do you read literature concerning nature?' (1 = never, 2 = sometimes, 3 = often)	NATURDO = sum of statements 1–5.	10.65 (1.18)*
(2) 'Do you read articles or magazines concerning nature?' (1 = never, 2 = sometimes, 3 = often)		
(3) 'Do you follow nature programs on TV or radio?' (1 = never, 2 = sometimes, 3 = often)		
(4) 'Do you spend your leisure time outdoors in natural settings?' (1 = never, 2 = sometimes, 3 = often)		
(5) 'Do you spend work time outdoors in natural settings?' (1 = never, 2 = sometimes, 3 = often)		
Perceived budget constraint		
'I do not have enough money for nature conservation (1-strongly agree–5-strongly disagree)	NOMONEY = 1–5.	1 (203) 2 (193) 3 (199) 4 (269) 5 (198)**

level'. If the respondent agreed with this, he or she was in general accord with the tenet that income cannot compensate nature conservation and thus reveals incommensurability. In principle, the existence of incommensurability can be viewed as a dichotomous phenomenon; lexicographic preferences exist if the number of dimensions in utility is greater than one, and standard preferences exist if there is only one dimension. The statement was therefore further coded into a dummy variable (NLEXPRE) so that only the 'strongly

agree' responses were interpreted as incommensurable. Lexicographic preferences for private property rights were measured via the statement: 'Nature conservation may never be based on compulsory purchase of land even if private landowners were compensated'. A respondent who agreed with the statement felt that an owner's right to use his or her land was inviolable, so that the establishment of a nature reserve could never compromise this right even if compensation were forthcoming. This judgement further indicates the

incommensurability between private property rights and nature conservation. The five-point variable was further coded into a dummy variable (PLEXPRE) using the same principle as above.

The respondent's perception of decision confidence was measured after the dichotomous choice CV question (Timmermans & Vick 1994). The variable SURE consisted of three 5-point Likert-type statements. The variable PROGRAMAT, which measured the attitude toward the proposed programme, consisted of three 5-point semantic differentials. The variable CONSERAT measured the attitude toward conservation in general using 5-point Likert-type statements. The activities connected to nature were measured with five questions, each having three options, which were summed to construct the variable NATURDO. The perceived budget constraint (NOMONEY) was measured with the statement 'I do not have enough money for nature conservation'. The household's annual total income was measured on an 8-point scale of categories and coded into the variable INCOME using the midpoint values for each income category and divided by 1000 to obtain income in thousands of Finnish Marks. The living environment was measured on the 5-point categorical variable and it was coded into a dummy variable LIVING having the value 0 for urban and 1 for rural respondents. The values for the variable GENDER were 0 for male and 1 for female respondents.

Statistical treatment

To explain the existence of lexicographic preferences, logit models were applied. The dependent variables were NLEXPRE and PLEXPRE. The choice between the status quo and the conservation programme (option 2 in Table 1) was explained using the logit models. A logit model was first estimated for all respondents and then separately for three groups of observations. The same explanatory variables were included in all the models. The model with all observations also had dummies for incommensurable observations. Using the dummy variables NLEXPRE and PLEXPRE, respondents were classified into N and P incommensurable observations. Respondents who had zero values for both NLEXPRE and PLEXPRE, belonged to the commensurable group. Using the Hausman test the structure of the models for incommensurable N and P groups were compared with the commensurable group (Greene 1995, p. 150). Statistical models were constructed using LIMDEP 7.0 Software (Greene 1995).

Results

The survey produced 1085 responses, so that the response rate was 45%. Due to item non-responses, the number of available observations in the analyses varied from 882 to 931. Of 1062 respondents to the statement 'Nature conservation is always more important than increasing income level', 237 (22.3%) were interpreted to reveal lexicographic preferences

Table 3 Logit models explaining the existence of lexicographic preferences. Dependent variables: the probability of having lexicographic preferences for nature rights (NLEXPRE = 1) and the probability of having lexicographic preferences for property rights (PLEXPRE = 1).

Variable	*NLEXPRE*		*PLEXPRE*	
	B	p	B	p
SURE	0.2474	0.0308	−0.3413	0.0002
INCOME	−0.0030	0.0026		
PROGRAMAT	0.4668	0.0006	−0.3025	0.0008
CONSERAT	1.0344	0.0000	−0.4858	0.0000
NATURDO	0.1344	0.0162		
GENDER			0.5918	0.0002
LIVING			0.5948	0.0001
Constant	−8.6545	0.0000	1.1132	0.0273
Correct predictions (%)	81.86		73.04	
Log likelihood	−361.85		−513.58	
Log likelihood (constant only)	−453.02		−578.07	
n	882		931	

for nature conservation (Table 2). Of 1064 respondents to the statement 'Nature conservation may never be based on compulsory purchase of land even if landowners were compensated', 349 (32.8%) revealed lexicographic preferences for private property rights. Those with both arguments for incommensurability numbered only 62 (5.8%).

The probabilities of belonging to lexicographic groups NLEXPRE and PLEXPRE were explained in the logit regression models with choice confidence, attitudes and socio-economic variables (Table 3). The models correctly predicted 82% and 73% of the cases, respectively. The variable SURE measuring the decision confidence was included in both models. In the first model, SURE increased the probability of being N lexicographic. In the second model, SURE had a statistically significant but negative effect on the probability of belonging to the P lexicographic group.

Other variables were included in models based on their explanatory power. Income had a significant negative effect on lexicographic preferences for nature conservation. A positive attitude to the programme (PROGRAMAT) and to conservation in general (CONSERAT) had a similar effect. In contrast, these variables had opposite effects on property rights. Activities connected with nature (NATURDO) contributed positively to the existence of incommensurability for nature. Regarding the socio-economic variables, women were more likely to be in favour of property rights than men, and respondents living in a rural environment tended to be more in favour of such rights than those living elsewhere (LIVING).

The logit models explaining the choice between the status quo and the conservation programme were estimated for all respondents and then separately for three groups of observations (Table 4). In all models, the first two explanatory variables, the change in the income tax per household (BID)

Table 4 Logit models explaining responses from a dichotomous contingent valuation question. The dependent variable was the probability of choosing the nature conservation project in a dichotomous CV question.

Variable	All observations		N *incommensurable observations**		Commensurable observations		P *incommensurable observations**	
	B	*p*	*B*	*p*	*B*	*p*	*B*	*p*
BID	−0.0012	0.0000	−0.0004	0.6741	−0.0018	0.0000	−0.0002	0.6829
INCOME	0.0024	0.0102	0.0008	0.7760	0.0026	0.0309	0.0025	0.2213
SURE	0.4875	0.0001	0.6044	0.0935	0.5895	0.0006	−0.0249	0.9211
PROGRAMAT	0.6005	0.0000	0.6644	0.0929	0.5942	0.0003	0.6392	0.0076
CONSERAT	0.9988	0.0000	0.7155	0.1334	1.1110	0.0000	1.1098	0.0006
NOMONEY	0.5348	0.0000	0.5062	0.0114	0.5191	0.0000	0.5981	0.0002
NLEXPRE	0.6201	0.0138						
PLEXPRE	−0.3764	0.0643						
Constant	−8.8449	0.0000	−7.7507	0.0010	−9.2803	0.0000	−8.7933	0.0038
Correct predictions (%)	79.78		85.11		78.06		83.98	
Log likelihood	−387.25		−46.19		−224.31		−87.27	
Log likelihood (constant only)	−614.30		−59.34		−326.50		−127.94	
Hausman test**			7.41				10.72	
N	890		141		474		231	

* Observations having lexicographic preferences for both *N* and *P* deleted. ** Hausman test for the structural change compares the commensurable model with incommensurable models. Critical levels of $\chi^2_{df=7}$ for 50% and 25% risk were 6.35 and 9.04.

Table 5 Willingness-to-pay estimates for different incommensurable and commensurable groups.

Variable	N *incommensurable observations**	Commensurable observations	P *incommensurable observations**
Mean WTP**	6636	545	668
Median WTP***	6410	269	−7987
SD**	14 851	74	1493
Confidence interval (95%)**	(4191,9077)	(538,552)	(475,861)

* Observations having lexicographic preferences at the same time for *N* and *P* were deleted. ** Assumption: $WTP \in [0,\infty[$ *** Median and mean coincided. Assumption: $WTP \in]-\infty, \infty[$

and household income (INCOME), had the expected signs based on standard consumer theory. The sign of the bid variable was negative; higher bids reduced the probability of choosing the proposed conservation project. Household income had a positive effect on the choice probability. In the incommensurable models, however, the coefficients were insignificant and smaller in absolute terms than in the commensurable model.

The decision confidence (SURE) had a positive effect on choosing the proposed project for everyone except the *P* incommensurable group. Furthermore, a positive attitude toward the proposed programme (PROGRAMAT) and general conservation attitude (CONSERAT), significantly increased the willingness to support the conservation project within all groups. The perceived budget constraint (NOMONEY) significantly reduced the probability in all models. Regarding the dummy variables, NLEXPRE increased, and PLEXPRE reduced, significantly the probability of choosing the project in the model for all observations.

The explanatory power of different logit models was around the same level, with 78 to 85 per cent of cases predicted correctly. According to the Hausman test the models for commensurable and incommensurable obser-

vations did not statistically differ at the 5% significance level.

The WTP estimates were calculated using the estimated logit models (Table 5). Calculations were dependent on the assumptions of the sign of the WTP, the parameter estimates and the mean values of the explanatory variables (Hanemann 1989). The estimates in the first row assumed the WTP had only positive or zero values. The estimates in the second row also allowed WTP to be negative. In this case, the mean and the median coincided.

The mean WTP for the *N* group was FIM 6636 (FIM 1 ≈ US$0.17, October 1999) or FIM 6410, depending on the assumption concerning the utility distribution. The mean WTPs for the *P* group were FIM 668 and FIM −7987, respectively. The standard deviations estimates were used to calculate confidence intervals for the WTP estimates in the first line. The confidence intervals of *N* and *P* estimates did not overlap, which meant that their WTPs had statistically significant differences. The mean WTPs for the commensurable group were FIM 545 and FIM 269 respectively.

The non-response bias was analysed using national census data (Mitchell & Carson 1989, p. 273). According to these data, the mean age was 43.3 and in the sample it was similar, namely 42.3 years. The mean annual incomes were respect–

ively FIM 187 000 and FIM 161 000. The mean WTP was also calculated using population income and sample income. The mean WTP estimates were FIM 543 and FIM 280 for the commensurable group using the population income and respectively FIM 545 and FIM 269 using the sample income. There were not statistically significant differences between sample and population based WTP estimates.

Discussion

In the valuation literature, the frequency of lexicographic preference has varied a great deal, depending on the question format and the good concerned. The proportion of incommensurable responses in this study was 55%, which is around the same proportion reported in several other studies (Spash & Hanley 1995; Hanley & Milne 1996; Spash 1997; Lockwood 1999). The existence of lexicographic preferences for nature rights was explained in this study by positive attitudes to conservation and activities connected with nature. This result is in line with Spash (1997). We cannot fully explain the result that women were more likely to belong to the property-rights group. However, the role of the living environment can be justified. The majority of private land to be taken into the Natura 2000 Network was located in rural areas where the opposition against the protection programme was also greatest.

Being less confident about the choice seemed to increase the probability of lexicographic preferences for property rights. These respondents more frequently also chose the status quo in the CV question than the N respondents. This result is similar to Ready *et al*. (1995) who found that ambivalent respondents tended to reject any move from the baseline. On the other hand, decision confidence increased the probability of N lexicographic preferences. This supports the idea that lexicographic choice due to nature rights is rather based on ethical consideration than ambivalence.

Spash and Hanley (1995) required a lexicographic respondent to refuse to report WTP in the open-ended CV question. Such refusals are, however, not a measure of lexicographic preferences in discrete-choice WTP questions. This is because in the discrete choice question, bundle A (status quo amount of nature conservation and income) is compared with bundle B (increased amount of nature conservation and decreased amount of income). According to lexicographic preferences, an individual can choose between A and B so that either A or B is preferred, but he can never be indifferent between these bundles. Therefore, the refusal rate in this study of 2.7% was in line with the number of lexicographic respondents (55%).

The results from the logit model explaining the dichotomous contingent choice were generally in accord with theoretical expectations. In the incommensurable models, the coefficients of bid and income were insignificant and smaller than in the commensurable model. This indicates that respondents having lexicographic preferences for N or P did not make trade-offs between money and N or P respectively.

On the other hand, the perceived budget constraint had a significant effect on the choice and this was somewhat contradictory to the effect of bid and income. That is why it seems probable that the variable NOMONEY measured general attitudes to conservation, in addition to the budget constraint itself.

To formulate an exact hypothesis for the effect of lexicographic preferences on WTP, the thresholds and hierarchical orders of the attributes have to be known (Lockwood 1999). In this study, the lack of these data was a particular problem concerning respondents having lexicographic preferences for both N and P. For this reason, they were eliminated from the analysis for the sake of simplicity.

It seems realistic that respondents in the N group had relatively high WTP estimates because they revealed nature rights to be a separate, non-compensatory, attribute, and had a positive attitude to nature conservation in general. Spash and Hanley (1995) discussed the effect of having a minimum living standard on WTP, in other words of having a threshold level for income. This threshold explains why the WTP estimates were not equal to respondents' total income even if they have lexicographic preferences for N.

In contrast to the N group, relatively low or even negative WTPs were reasonable for the P group because they revealed property rights to be a separate, non-compensatory attribute, and they also had a negative attitude to conservation in general and to the project in particular. They clearly saw Natura 2000 Network as a threat and a loss of private owners' rights and hence of utility. It was therefore logical for these respondents to choose the status quo instead of the conservation project. The situation with this project seems to be similar to that in the study by MacMillan and Duff (1998) where the non-market costs of environmental projects were considerable. The possibility of negative WTP is also discussed by Hanemann (1989), Johansson *et al*. (1989), and Lockwood *et al*. (1994). Kriström (1995) argued that there is a theoretically sound explanation for an environmental good actually to provide disutility. It is the given supply of a public good. An individual cannot choose his own optimum level of a public good, unlike a market good, but he or she is instead obliged to consume a fixed amount.

The commensurable respondents did not reveal either nature or property rights to be a separate, non-compensatory attribute. Thus their preferences can be said to have been between the N and P groups. Consequently, the relatively low but positive WTP estimates make sense. It should be noted that WTP estimates for the N and P groups are not valid compensation surplus measures because they do not exist for incommensurable preferences by definition. However, the WTP estimates described the direction of preferences in the present study.

Conclusions

In this study we argued that there can be several goods, including public goods, or attributes that people do not want

to trade for each other. Rights of nature and private property rights are both public goods that may exist as separate non-compensatory dimensions in individuals' utilities as proposed in the theory of lexicographic preferences. From the present empirical analysis, it was found that landowners' property rights were an even more frequent category of incommensurability than rights to nature conservation. However, the analysis explaining the existence of incommensurable attributes revealed that respondents having lexicographic preferences for nature rights had based their choice more on ethical judgements, whereas lexicographic preferences for property rights could rather be explained with ambivalence.

About 50% of all respondents were found to have incommensurable preferences, and this accords with earlier studies. However, to better understand the implications of these results, more analytical work on lexicographic preferences and more sophisticated measurement instruments are required.

The property right argument was more frequent amongst rural respondents with negative attitudes to conservation, and the explanations for nature rights incommensurability were related to the positive attitude toward conservation and activities connected to nature. Therefore, the qualitative implications of the WTP results seem reasonable; respondents having lexicographic preferences for nature had fairly high WTPs. By contrast, respondents with lexicographic preferences for property rights had small or even negative WTPs. The commensurable observations were between these groups. It is essential to understand that WTP estimates for incommensurable individuals did not describe their compensation surpluses but correctly indicated the direction of preference. Therefore, WTP estimates cannot be used to measure welfare changes in quantitative terms.

Acknowledgements

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