The Value of Preserving Nature
Preference Uncertainty and Distributional Effects

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Abstract

This thesis deals with valuation of nonmarket goods using contingent valuation and consists of four papers and an introduction to the research area.

Paper [I] examines the public benefits from preserving old-growth forest in the submountainous region in Sweden. Specifically, it analyzes a preservation program suggested by the Swedish Environmental Protection Agency. The results show that people value preservation for different reasons, not necessarily related to physical use. The paper finds that the estimated public benefits of the program exceed the estimated opportunity cost of forgone timber revenues and it should therefore be implemented. The paper also finds that there is no regional imbalance in the distribution of the benefits.

Paper [II] examines the public benefits from preserving the four large predators in the Swedish fauna. Specifically, the paper focuses on the differences in attitudes and willingness to pay between people in wolf areas and other regions. We find that a clear majority of people in wolf areas are against preserving predators and that many of them need to be economically compensated in order to accept implementation of the predator policy package. The public in Sweden is, by a narrow margin, against implementation. The overall mean WTP is approximately SEK 300. It cannot be ruled out that the public benefits may be outweighed by the public costs following implementation.

Paper [III] presents a new approach for treating preference uncertainty in contingent valuation. Specifically, it studies how data elicited from a multiple bounded question should be modelled. The new approach is compared to one of the conventional approaches and we find that: (1) it is more intuitive; (2) it better fits the data; (3) it gives more precise estimates of mean and median WTP; (4) it is less sensitive to distributional assumptions; and (5) it is better suited for policy analysis.

Paper [IV] examines the income-effect in contingent valuation. Specifically three issues are analyzed: (1) the choice of income measure; (2) the choice of modelling assumptions; and (3) the social context. The results show that the estimated income-elasticity of WTP is fairly sensitive to different choices. The most statistically precise estimate is produced using household income and controlling for household characteristics. The third issue (social context) is approached by studying the answers to a WTP question conditioning respondents on a change in (1) their personal income and (2) the average income in Sweden. The results suggest that not only the income level per se influences WTP, but also its relation to the income of others.

Keywords: contingent valuation, nonuse values, preference uncertainty, income-effect.
Acknowledgement

Let me start by defining the model. Assume that I get my Ph.D. degree and that I survive the seminar the 6th of December 2007. Under these circumstances, it is possible to derive some very pleasant results. First, it is evident that the things that do not kill you, makes you stronger. Second, neither necessary nor sufficient conditions are satisfied to reject the saying that you suffer and then you die. A strong notion, though, is that it is incorrect. Instead it should say; you suffer, become a Ph.D.-student, suffer even more, get your Ph.D. degree, get happy (or suffer more), and then you die. Today, I am very happy and we will see how it continues!

Many of you who read this have “walked the line” before me and you know what it is all about; blood, sweat and tears. Probably you have rewritten the history and say “it was the best days of my life”, or “I never had so much spear time”, or even “it was so easy to relax after work, just thinking about nothing”. Brothers and Sisters! I talk about the hard way, the rollercoaster and schizophrenia of a Ph.D.-student. Sometimes everything is great and sometimes everything is just shit (there is no better word). The papers do not write themselves, one suffers for each little symbol added, and then when it all comes around few people find them interesting or even well written. Today, after five years, five hundred new CD records (at least), millions of dead brain cells, seven kilos heavier, and as poor and confused as ever, it is over. This will be the day to remember for the rest of my life. Amen!1

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1 If you are not from Norrland in Sweden, do not misunderstand my feelings. Truly, I am very satisfied with how things turned out for me.
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Umeå, October 31, 2007

Thomas Broberg
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Introduction and summary of the papers


Appendix
1. Introduction

The four papers presented in this thesis relate to the economic valuation of nonmarket goods using the contingent valuation method. Paper [I] and Paper [II] estimate the public benefits derived from implementation of two Swedish preservation policies, one concerning old-growth forests and the other predators. The contributions of these papers to the existing literature are strictly empirical. Paper [III] and Paper [IV] deal with two methodological issues specific to the contingent valuation method: preference uncertainty and the income-effect.

Below I will provide an introduction to the increasingly salient field of economic valuation of environmental goods. First, I argue that the need for using nonmarket valuation is an essential part of informing prudent and defensible policy making. Next I further develop the theoretical basis for one of the most predominant methods for valuing nonmarket environmental goods: contingent valuation (CV). Finally, I conclude with a short history of CV, with a special focus on the specific methodological issues discussed in this thesis.

2. The need for nonmarket valuation and contingent valuation

In economic theory, the concept of value reflects the utility humans derive from goods and services. It is easy to see that most things in this world have a value, positive or negative. Whenever there is a choice, a valuation has to be made. Choices reflect individuals’ preferences and concern, issues such as: how much time to spend on different activities; what commodities to buy; what hairdresser to employ; and how much money to save for future consumption. Preferences, choices and values cover more than the goods and services traded in markets. Many things that we enjoy are for free and not subject to any market transaction, still we value them, e.g. the value of picking berry, watching birds, breathing clean air and swimming in the ocean. Krutilla (1967) argued that people may even derive utility (value) from “things” just because they exist, i.e. “things” may be valuable without being physically used. For example, utility may originate from the pure knowledge that there exists a virgin nature somewhere. Krutilla labeled such values “existence values”.

The concept of economical value, described above, implies that it is important to consider the citizens preferences, and values, when decisions are to be made in a social welfare context. Two particularly relevant examples for this thesis include: (1) when deciding whether to clear-cut a public forest, not only the timber benefits should be considered but also the opportunity cost in terms of foregone use and nonuse values following timber harvesting; and (2) when designing hunting laws concerning predators not only the predation costs should be considered but also the existence values that people hold for these animals.
To make values comparable, they have to be expressed in terms of a similar unit of measurement, typically money. For example, it would be hard to know whether people prefer forest conservation or timber harvest without being able to measure their preferences for these two outcomes with a common measuring stick. The most familiar and recognizable measuring stick for this purpose is, money. Given the social importance of this money metric, it would be extremely useful to apply a method that can measure preferences in terms of money. This is where contingent valuation (CV) enters. Below I provide a brief overview of welfare theory under imposed quantity constraints (Johansson, 1987) in order to understand the application of CV in this thesis.

Welfare theory starts with the assumption that people derive utility (“happiness”) from the consumption of both private and public goods. To simplify, assume that there is only one public good that (1) is not traded in the market, and (2) can be consumed free of charge. Assume further that people are capable by themselves of making the best choices available to them (i.e. maximize their utility with respect to their budget constraints). To be relevant to a typical resource problem, we also assume that individuals cannot adjust the quantity (or quality) of the public good available to them (i.e. there is a fixed amount of clear air, clear water, health forest, etc.) and therefore they must make consumption choices conditioned on a given supply.

Under these assumptions the relevant welfare measures of a changed supply (or quality) of a public good are compensating surplus (CS) and equivalent surplus (ES). If the valuation scenario is perceived as an improvement by an individual, CS and ES correspond to her willingness to pay (WTP) and willingness to accept (WTA), respectively. The relevance of money enters the equation here because it can be used indirectly to help assess an individual’s trade-off between her consumption of a public good (Z) and private goods. Since money (Y) can be used to purchase private goods, it is equivalent to an amount of private goods. This trade-off between a public good and money are illustrated in Figure 1.

If the quantity of Z increases, the individual will experience a higher utility (U) and would therefore be willing to pay for such a change (i.e. give up money in order to obtain the increase in Z). The individual could pay as much as CS for the increase without being worse off compared to the initial situation, i.e. the individual’s maximum WTP for the quantity increase equals CS. The ES measure equals the minimum compensation needed to make the individual willing to forgo the increase. The two welfare measures differ with respect to the baseline (i.e. starting) level of utility used to derive them; CS is based on the pre-environmental change utility level and ES on the post-environmental change utility level.
In principle, it is possible to derive a monetary measure of the welfare effect that follows from a changed supply of the public good by directly asking the individuals to state their maximum WTP or minimum WTA (i.e. to state their personal trade-off between money and the proposed environmental change). Ciriacy-Wantrup (1947) suggested such an approach to gather information about the demand for non-excludable benefits from preventing soil-erosion (such as reduced siltation of streams). However, the author did not put the theory into practice. Instead Davis (1963), became the first CV publication by estimating the value of a specific recreational area in the U.S. Today hundreds of CV studies, concerning all kinds of goods and services, have been conducted (an overview of the literature can be found in Carson et al., 1994; Carson, forthcoming).

Since the initial application of the CV method over 40 years ago, its use has been heavily scrutinized by critics. As a direct result of the scrutiny provided by the publication and peer review process, the CV method has evolved (perhaps to the dismay of some adamant critics). The evolution has led to a number of refinements (some dare say improvements) which are too numerous to discuss here. However, two issues are relevant enough to deserve further discussion in this thesis: (1) the WTP question itself (e.g., the format for eliciting WTP in the survey) and (2) the statistical measure (mean/median) to estimate the distribution of the key random variable: an individuals WTP for an environmental change.

The state-of-art has evolved from an open-ended format (leaving it open to individuals to state their maximum WTP) to closed-ended formats (where researchers provide different levels of bid(s) which respondents accept or reject). In this move toward closed-ended formats the dichotomous choice (DC) structure has become increasingly popular. The DC format includes only a single bid and assumes that
the individual will accept the bid if her WTP is higher than or equal to that bid amount. The amount or amounts used in closed-ended formats are varied over individuals which makes it possible to apply various statistical techniques to reveal information about the distribution of WTP among the population. A third approach, which is a mix of the open-ended and closed-ended formats, is to present a payment card listing several amounts and ask people to circle the highest amount they would agree to pay (or as an alternative the amount that is closest to their maximum WTP). To the authors knowledge the earliest applications of the two latter formats are found in Bishop and Heberlein (1979) and Mitchell and Carson (1981), respectively. Important contributions to the DC and the payment card format are provided in Hanemann (1984), Cameron and James (1986), Cameron (1988), Cameron and Huppert (1989) and Kriström (1997).

The DC format has two appealing attributes to researchers, both of which are frequently mentioned in the CV literature. First, the format mimics the “take it or leave it” offer typically found in a market scenario (i.e. it is familiar to people). Second, it reduces an individual’s incentive to influence the final outcome by falsely reporting a WTP that is higher or lower than she would actually pay. This is often referred to as the “incentive-compatibility” problem inherent in the CV method (Arrow et al. 1993). The major drawback with the DC format is that the researcher receives relatively little information about a respondent’s WTP. That is, the DC survey data can only tell the researcher if a respondent’s WTP is higher or lower than the amount presented to her (in contrast, the open-ended format provides an unequivocal data point). A relatively large number of respondents are therefore needed to estimate the WTP distribution with sufficient precision. As a result, the DC format can be more expensive compared to other elicitation formats.

A second theme in the evolution of the CV method is the statistical measure used to describe the WTP distribution (i.e. the estimated random variable in the CV model). When applying the open-ended format, the aggregated arithmetic mean can be used as the welfare measure, which is not possible when using closed-ended formats. The typical procedure for analyzing such data first derives, non-parametrically or parametrically, the survival function, which gives the probability of accepting a specific bid. The average WTP is then calculated by integrating the area under the survival curve (see Figure 2). Parametric approaches typically follow Cameron (1988) and initially assume the distributional pattern of the WTP, e.g. assume that WTP follows a logistic probability distribution. Statistical techniques are then applied on the data to determine the location and shape of the specific distribution. Several studies have shown that the average WTP is sensitive to the initial distributional assumption (e.g. Kriström, 1990; Johansson, 1993; Hanemann and Kanninen, 1999). The problem arises because there is too little information about the tails of the distribution, and can in extreme cases lead to an infinite mean (Bishop and Heberlein, 1979). To solve the problem, some researcher suggest truncating the data (e.g. cutting extremely high or low values), but such approaches are criticized for
being arbitrary since the researcher herself cannot objectively decide the WTP levels at which to truncate the distribution (Johansson, 1993; Hanemann, 1984). Instead, the median WTP, which has been found to be less sensitive to the distributional assumption of WTP, is the preferred measure of central tendency in many studies.

Some economists base their support for the median measure of WTP on considerations of fairness related to public projects. Contingent valuation studies are typically conducted to assess benefits and costs attached to a specific good or project. The standard criteria that economists apply to judge whether solutions, or decisions, are socially wanted or efficient, is the Pareto-criteria. According to the Pareto-criteria a public project should not be implemented if it will bring negative consequences for any individual or firm in the society. Public projects typically imply both winners and losers and therefore the Pareto-criteria are of little use in policy analysis (i.e. an otherwise beneficial project should be prevented if it produces a single loser). An alternative is the Kaldor-Hicks potential compensation criteria which suggest that a project is socially beneficial if the winners can theoretically compensate the losers. However, some critics point out that the Kaldor-Hicks potential compensation criteria is not democratic. This is because policy measures based on mean WTP estimates tend to favor those at the extreme ends of the spectrum (i.e., those that are willing to pay a lot or nothing). In contrast, policy decisions that are based on a median measure of WTP tend to have more attractive distributional impacts on society because such decisions place less weight in the “extreme” WTP estimates (the median is said to be democratic because the majority of the population would agree to pay that amount). Rigorous discussions of the mean versus median issue can be found in Johansson (1993) and Hanemann and Kanninen (1999).

3. Nonmarket values and contingent valuation
People may hold values for goods and services (including natural resources) for many reasons. Commonly, we refer to four different value categories: (1) \textit{use value}, people derive utility from the direct use of goods or services; (2) \textit{existence value}, people may derive utility based on the mere existence of a good or a service (Krutilla, 1967); (3) \textit{option value}, people may value the option to use resources in the future (Weisbrod, 1964), or the option to procrastinate decisions into the future when more information is available (Fisher and Krutilla, 1985); and (4) \textit{altruism/bequest value}, people may value the availability of goods and services for other people or future generations. The first of these four values is distinct from the other three in that it involves physical use of a good. To distinct it from the other values described above, we refer to, existence, option, bequest/altruism values, as nonuse or passive-use values.

The CV method has appeal because its hypothetical nature makes it possible to estimate values that are seemingly unrelated to human behavior, which is a prerequisite for the travel cost and the hedonic approaches to nonmarket valuation (Carson et al., 2001; Portney, 1994; Hanemann, 1994). Nunes and van den Bergh (2001) surveyed the literature on the valuation of biodiversity and concluded that the contingent valuation approach is the preferred valuation method for valuing goods and services related to biodiversity; “\textit{since it is the only one that can assess the magnitude of nonuse values, such as the existence value of the knowledge that the natural habitats, and its wildlife diversity, is kept free from commercial development and closed to visitors}”. This conclusion is theoretically strong, though it is perhaps a bit misleading by referring to the CV method as the only one capable of estimating nonuse values. In fact, other methods that rely on hypothetical markets, such as choice-experiments, could also be used to assess nonuse values (Christie et al., 2006).

The CV method received great attention in the aftermath of the Exxon Valdes oil spill off Alaska’s coastline in 1989. This large damage incident in a sensitive ecosystem provided economists with a unique opportunity to apply the CV method to estimate how the public valued this environmental change. The CV assessment, estimated a loss in “existence value” to the American Public to be as large as US $3 billion (Carson et al., 1992 and 2003). This enormous sum of money attracted criticism from those who did not believe CV was a sound method to elicit such values (though most economic critics did not disagree with the assertion that such nonuse values exist). To the extent that this exercise captured how Americans value a resource that they may never use, the result indicates the importance of considering all relevant benefits and costs attached to public environmental projects (e.g. incident). The strong message to policy makers was that nonmarket values may be as large as or even larger than the traditionally-accepted use of market values in considering the social benefits attached to public projects.
Paper [I] and Paper [II] found in this thesis applies the CV method to estimate public benefits derived from preservation of old-growth forests and the four large predators in the Swedish fauna, respectively. Both of these represent public projects for which citizens likely hold nonuse values. These papers also address the spatial distribution of the benefits (e.g. where the winners and losers are found in the population).


In 2002 the Swedish Environmental Protection Agency was commissioned by the government to assess the environmental value of the State’s forests, with a focus on old-growth forests. The State owns almost all of the old-growth forests in Sweden, which are mainly concentrated in the sparsely populated sub-mountainous area in Northwestern Sweden. A large part, 43% or 660,000 hectares, of the old-growth forests in this area were protected in 2002. The results from the forest assessment were published in 2004 and concluded that there were an additional 126,000 hectares (8 percent) of productive old-growth forest in the sub-mountainous region worthy of additional preservation. However, this conclusion was based only on biological assessment without any consideration of the economic costs or benefits. The objective of this paper is to estimate the public willingness to pay for implementing the suggested preservation program using the method of contingent valuation.

The primary reason of this in-situ (i.e. “in-place”) conservation of biodiversity is the forest’s relative diversity and richness, which provides important habitat for threatened species. Thus, benefits arise predominantly from nonuse values. The results show that a majority of the Swedish population is unwilling to contribute financially to the preservation program (median WTP equals zero). The estimated annual mean WTP, conditioned on a five year payment commitment, is SEK 300. This implies an aggregate benefit of approximately SEK 9 billion. An upper bound for the preservation program’s opportunity cost is estimated to be approximately SEK 3.5 billion, which suggests that the preservation program is socially beneficial and should be implemented. The conclusion is based on the Kaldor-Hicks criteria, which says that a project is socially beneficial if it is possible for the “winners” to fully compensate the “losers”. This criteria, do not consider distributional effects on the affected population. Therefore it is particularly relevant to explicitly study value determinants, i.e. the characteristics of an individual that leads her to support or reject the proposal. The distribution of benefits is of particular interest to this study because the old-growth forests are concentrated in one geographical area which potentially may cause a spatial imbalance relevant to the dispersed Swedish population.

The paper estimates two different valuation functions to study determinants of the WTP. First, a binary logit model indicates that variables related to a respondent’s education level, income level, and
concern about the environment are positively correlated with the likelihood of supporting the preservation program, while being a male and wanting the public expenditures on the environment to decrease are negatively correlated. After controlling for whether locals are employed in forest-related industries, it is found that locals, in general, are more likely than non-locals to have a positive WTP. Second, the paper estimates a valuation function conditioned on respondents with a positive WTP and the results show that the sizes of respondents’ contributions are explained by income, general concern about the environment, and the motive underlying their valuation. Respondents that stated that they only valued the proposed program for its nonuse attributes reported rather large values but still lower than those who based their valuation on use attributes as well. No significant difference concerning the size of WTP is found between locals and non-locals. The results suggest that the benefits from the proposed preservation program are evenly distributed among the Swedish population.


The governmental predator policy, which was decided in 2001, aims at securing the survival of the four large predators in the Swedish fauna: (1) wolves (Canis lupus); (2) bears (Ursus arctos); (3) lynx (Lynx lynx); and (4) wolverines (Gulo gulo). Successful implementation of the Swedish government’s predator policy means that the number of wolves and wolverines will increase significantly in the Swedish fauna while the populations of bears and lynx will remain at their current levels. The attitudes toward the predator policy are to a large extent driven by the attitudes toward the wolf population since the wolverine is unfamiliar to many people.

Historically, the wolf population has been spread all over the Swedish mainland, but is today concentrated in the mid-west of Sweden. After many years of human persecution the wolf population was almost exterminated from the Swedish fauna. By the late 1960’s the wolf population consisted of approximately ten adult animals. Today it totals about 120 animals. The wolf population is still classified as endangered and, according to biologists, requires protection from illegal hunting to maintain a sustainable population. Implementation of the predator policy means that the number of wolves in the Swedish fauna will grow to about 200 animals in a first stage.

In 2004 a survey study were conducted to investigate the attitudes toward the predator policy and to ultimately estimate the welfare effect that would follow from its implementation. The results from the survey study show that fifty percent of the Swedish population is willing to contribute financially to implement the predator policy. The estimated overall mean WTP is approximately SEK 300. Further, we test for spatial differences in attitudes and WTP and find that respondents in Stockholm have the highest overall mean WTP, while respondents living in wolf-territories have the lowest. A clear
majority in the wolf areas do not support the predator policy. Our overall estimated mean WTP measure is flawed with upward bias, since we cannot estimate the willingness to accept for those with clearly negative preferences regarding the predator policy package. In this paper, we set their WTP equal to zero. However, it is possible and even plausible that these respondents would actually have a negative WTP (i.e. they would require compensation, rather than pay to support, the predator policy). Finally, the estimates of the overall WTP are sensitive to response-uncertainty. When the respondents indicate uncertainty about their valuation, they tend to state higher values. An absolute upper bound of the overall mean WTP is approximately SEK 800.

6. Preference uncertainty and the income-effect in contingent valuation

The legal process following the Exxon Valdez catastrophe resulted in a fundamental evaluation of CV, its ability to estimate existence values and its use in damage assessment in the U.S. In 1993 an important reference in the CV literature was published, the report of the National Oceanic and Atmospheric Administration panel (the NOAA-panel). The panel of expert economists concluded that CV could be used in legal damage assessment to estimate existence values, assuming that certain characteristics of the valuation study were consistent with the state-of-the-art. For example, the panel concluded that data collection should be based on personal interviews with respondents rather than on phone- or mail surveys. Other conditions that CV surveys should meet to ensure their conclusions are credible and defensible include the following: preference for WTP rather than WTA; the use DC format phrased as a referendum; a reminder for respondents to consider budget constraints and substitutes; a precise description of the valuation scenario; inclusion of a “no response” option; inclusion of control variables; and follow-up questions to test the consistency of WTP responses.

Today, the CV method has become one of the predominant nonmarket valuation methods, presumably due to its ability to capture nonuse values. In spite of its popularity, it has been criticized by critics who suggest that the estimated values are flawed due to hypothetical and strategic bias (Kahneman and Knetsch, 1992; Diamond and Hausman, 1994; Harrison, 2006). Several studies have found that the DC format overestimates the actual WTP, and that individuals are more likely to accept hypothetical offers from a survey rather than actual offers in a market transaction (Cummings et al., 1995; 1997). A number of studies have further shown that individuals uncertain about their WTP tend to say “yes” when answering a DC question (Champ et al, 1997; Welsh and Poe, 1998; Champ and Bishop, 2001; Vossler et al., 2003). According to these results, the WTP estimates based on CV may not reflect the true value of the studied good and may need to be adjusted.

During the last fifteen years several studies have examined preference uncertainty and different calibration techniques have been suggested. Within the DC format two main approaches have been

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1 Arrow et al. (1993)
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suggested. The first asks respondents to state how certain they are about their answer to the WTP question (Li and Mattsson, 1995; Champ et al, 1997; Loomis and Ekstrand, 1998; van Kooten et al., 2001). The second approach, introduce uncertainty directly into the WTP question by including uncertainty options such as “probably yes”, “unsure” and “probably no” (Ready et al, 1995; Wang, 1997). Extensions of the payment card, multiple bounded and open-ended formats have also been suggested (Welsh and Poe, 1998; Cameron et al., 2002; Evans, et al., 2003; Alberini et al., 2003; and Håkansson, 2007). No consensus has emerged on how to treat preference uncertainty, neither theoretically nor empirically. This is clearly a research area that needs further attention in the future.

This thesis takes a closer look at one of the criticized aspects of the CV method: the fact that respondents may be uncertain about their true value for an environmental good. Understandably, respondents are expected to be familiar with typical market transactions such as how much they would be willing to pay for a loaf of bread or a new apartment. However, it should not be surprising that respondents may be less certain about the value they hold for things they do not usually purchase such as a preserved old-growth forest or biodiversity conservation. The key question addressed in this thesis is how researchers can take into account this natural level of preference uncertainty in interpreting CV results. Paper [III] in this thesis discusses how preference uncertainty should be incorporated into the multiple bounded and payment card formats.

A first justification test of CV estimates is to check their consistency with economic theory and a priori expectations. The goods and services valued in CV studies are often related to environmental quality and a strong notion within the literature has been that such goods are “luxury goods”, meaning that the demand for them should increase more than proportional to income. However, the income-elasticities found in the CV literature are typically below unity, meaning that the increase in WTP is less than proportional to the increase in income (Kriström and Riera, 1996; Hökby and Söderqvist, 2003). In addition, insignificant income-effects are not unusual (Schläpfer, 2006). These results have been used to undermine the reliability of CV estimates (McFadden and Leonard, 1993; Diamond and Hausman, 1993).

However, Flores and Carson (1997) showed theoretically that there is a fundamental difference between the income-elasticity of demand and that of WTP. The income-elasticity of WTP, estimated by CV, is conditioned on a given quantity change. Information about one of the elasticities alone (e.g. WTP) is not enough to draw conclusions about the other one (e.g. demand). Thus, an income-elasticity of WTP below unity does not disqualify the corresponding good from being a luxury. Although the income-elasticity of WTP is not sufficient to classify goods as being basic or luxury

2 The CV question aims at measuring the welfare effect of a given change in the quantity of the good being valued. Since the quantity change is given in the constructed market scenario individuals cannot freely maximize their utility with respect to quantity. For that reason, the demand function cannot be derived trough CV.
goods, it says something about the distribution of benefits and, therefore, is important to study in policy analysis.

Paper [IV] in this thesis concerns estimation of the income-effect on WTP, particularly its sensitivity to the underlying choices of income measure, modelling assumptions, and the social context read into the valuation scenario.

7. Summary of Paper [III]: A new approach for analyzing multiple bounded WTP data—Certainty dependent payment card intervals

During the last fifteen years several articles have addressed the issue of preference uncertainty. The purpose of these efforts were to develop approaches that capture the inevitable uncertainty that respondents face when asked to value a good or service which is unfamiliar to them. In this paper, we analyze methodological issues concerning one of those approaches, the multiple bounded (MB) format introduced by Welsh and Poe (1998). We present a new approach for analyzing MB data, which is not only more intuitive compared to the conventional approaches, but also more precise in its estimate of mean and median WTP.

A MB question is a combination of an ordinary payment card and a polychotomous choice question introduced by Ready et al. (1995). In the MB format respondents face multiple bids rather than one bid, as in a polychotomous choice question. The respondents are asked how likely an actual “yes-vote” would be by marking one of several verbal probability statements associated with each amount presented to them (e.g. “definitely yes”, “probably yes”, “unsure” “probably no” or “definitely no”). Our suggested approach for treating such data is based on the intuitive assumption that individuals, uncertain about their WTP, want to state intervals rather than precise values. The higher the degree of uncertainty, the wider the respondent’s stated interval. Following this assumption, we allow the respondents to expand their WTP intervals by shifting their upper bounds as the degree of uncertainty increases. This differs from the seminal Welsh and Poe (1998) approach which condition each respondent’s WTP interval on a specific probability statement. This implies that the entire WTP interval shifts upwards and, therefore, overestimates mean and median WTP in the presence of uncertainty.

To compare empirically our expansion approach to the Welsh and Poe approach, we use survey data from 2004 that elicited WTP for implementation of the predator protection policy in Sweden. Our analysis shows that the suggested approach: (1) is more intuitive; (2) better fits the data; (3) gives more precise estimates of mean and median; (4) is less sensitive to distributional assumption; and (5) is better suited for policy analysis.
8. Summary of Paper [IV]: Examining the income-effect in contingent valuation- The importance of making the right choices

CV studies typically include income as a control variable in the WTP function to validate the estimates and/or to study distributional effects. The occurrence and size of a significant income-effect is presumably a function of the studied good, the characteristics of the sample, factors controlled for, the income measure used, and the functional form applied. However, there is no consensus in the previous literature on how to model the relationship between WTP and income, implying that estimation of the income-effect is seemingly ad-hoc.

This paper contributes to the previous literature on the empirical relationship between WTP and income by identifying and studying three important issues: 1) the choice of income measure; 2) the modelling choice; and 3) the social context. The first two issues are important because different choices may lead to different estimates of the income-effect. This paper performs a sensitivity-analysis of the income-effect with respect to different income measures and modelling assumptions to shed light on the importance of making the “right” choices. The study relies on WTP data from 2004 concerning preservation of predators in the Swedish fauna. The third issue is important to study because the social context has typically been assumed away from the valuation scenario in previous CV studies, i.e. income per se, independent of other individuals’ incomes and consumption patterns, has been judged as the relevant variable to study. The social context manifested in the relative income may play an important part since it may influence individuals’ perceptions about payment responsibilities, “fair-payments” and their propensity to free-ride on other tax-payers. If this is the case, the income-effect will be determined not only by the income level per se, but also on how it compares to the incomes of others. To study the importance of relative income, the study uses WTP data concerning preservation of old-growth forests in Sweden. More specifically, the study analyzes the answers to an experimental WTP question conditioning respondents on a hypothetical income change.

The results from the analysis show that estimates of the income-elasticity of WTP are fairly sensitive to the choices of income measure and functional form. Overall the estimated income-elasticity varies within the range of 0.07-0.49. Higher estimates are generally associated with a larger standard deviation and the differences between the estimates are almost exclusively insignificant. The highest point-estimate, which is also the most statistically precise, is produced assuming that the income-elasticity of WTP is a non-linear function of household income. The choice of using individual gross or net income shows no significant difference in the size of the income-elasticity. Using household income per household member yields a lower estimate and worse data fit compared to the model
where control variables are used. The results show that controlling for household characteristics is important when using the household income variable.

When analyzing the decisions of individuals, the household income should be adjusted for the number of adults in the household before it can be compared to the income of single households. If household characteristics are not controlled for, the household income will reveal little about the income disposable to a specific household member. The conclusion is to some degree contrary to the conjecture in Kriström and Riera (1996), that inclusion of covariates in the WTP function does not change the estimated income-elasticity in any fundamental way.

A split-sample approach, using survey data concerning preservation of old-growth forests in Sweden, is applied to study the importance of relative income. An experimental CV question asked respondents how they would change their WTP (stated earlier in the survey) if their absolute income and the average income in Sweden were about to increase with a specific amount. Two samples are compared, both conditioned on the same increase in their personal income, but on different information about the change in average income. The results from this analysis indicate that respondents react on the social context given in the valuation scenario. Respondents who received a decrease in their relative income stated a significantly lower increase in WTP (on average) compared to those whose relative income remained unchanged, all other things equal. Males seem to react stronger to the change in relative income compared to females.

The results may be flawed due to the hypothetical setting used as the foundation of the analysis. Judging from the item non-response, the second valuation question proved to be troublesome. Some respondents seem to have deliberately skipped the question after answering the first valuation question. The amount of text associated with the survey and the hypothetical setting might have discouraged some of these respondents. However, even if the results may be flawed they still indicate that the social context matter to respondents.
References


The value of preserving nature- Preference uncertainty and distributional effects


