20 years of stated preference valuation of non-timber benefits from Fennoscandian forests: A meta-analysis

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(Short title: Non-Timber Benefits from Fennoscandian Forests: A Meta-Analysis)

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Abstract
Stated preference (SP) surveys have been conducted to value non-timber benefits from forests in Norway, Sweden and Finland for about 20 years. The paper first reviews the literature and summarises methodological traditions in SP research in the three countries. Second, a meta-regression analysis is conducted explaining systematic variation in Willingness-to-Pay (WTP). Two important conclusions emerge, with relevance for future research: (1) WTP is found to be insensitive to the size of the forest, casting doubt on the use of simplified WTP/area measures for complex environmental goods; and (2) WTP tends to be higher if people are asked as individuals rather than on behalf of their household.

JEL Classification: Q23, Q26, Q51, H41

Introduction

Stated preference (SP) surveys (Contingent Valuation, CV, and Choice Experiments, CE) have been conducted to value non-timber benefits (NTBs) from forests for about 20 years in Norway, Sweden and Finland ("Fennoscandia"), the three largest of the Nordic countries. Time is ripe for taking stock and synthesising this body of research. In the economics literature the meta-analysis tool, more commonly used in other disciplines, is increasingly being put to such tasks (Stanley 2001, Stanley & Jarrel 2005). The non-market valuation branch of environmental economics has developed a rich but still immature meta-analysis literature since Smith & Karou's (1990) seminal study[1] of recreational benefits. Since then, meta-analyses have been conducted for the purposes of research synthesis, hypothesis testing and benefit transfer for a number of environmental goods (Smith & Pattanayak 2002). Meta-analyses of recreational benefits for various outdoor activities are the most common, but other goods studied include for example endangered species (Loomis & White 1996), wetlands (Brouwer et al. 1999, Woodward & Wui 2001), noise (Button 1995), aquatic resource improvements (Johnston et al. 2005), and air quality and visibility (Smith & Osborne 1996, Desvousges et al. 1998).

The methodological hypotheses explored through meta-analysis include "classical" questions in the non-market valuation literature such as the Willingness-to-Pay (WTP) vs Willingness-to-Accept (WTA) compensation disparity and income effects (Horowitz & McConnell 2003, Sayman & Öncüler 2005, Schläpfer 2006), WTP's (in)sensitivity to change in quality or quantity ("scope") of the good (Smith & Osborne 1996), convergent validity of benefit estimates from different valuation methodologies (Carson et al. 1996), the relationship between use values (UV) and non-use values (NUV) (Johnston et al. 2003), and differences in real and hypothetical WTP ("hypothetical bias") (List & Gallet 2001, Murphy et al. 2005).

[1] Sometimes also credited to Walsh et al (1989), for example by Shrestha & Loomis (2001), or to Walsh et al (1990) by Smith & Pattanayak (2002).

More recently, meta-analysis has also been used to synthesise WTP estimates for the purpose of benefit transfer to new unstudied, policy sites (Shrestha & Loomis 2001, 2003). Accurate benefit transfer with its savings in primary study costs enabling increased use of cost-benefit analysis is one of the "holy grails" of environmental economics, though still some way from its promise (Florax et al. 2002, Navrud & Ready 2006).

Although the use of meta-analysis in the non-market valuation literature has grown in recent years, no studies we are aware of have looked at SP surveys of forest protection or multiple use forestry (MUF). The existing studies on recreational benefits often include forests, but are typically focused on consumer surplus estimates for activity days (such as fishing, hunting, hiking etc), and not people's WTP for protection or change in forestry practices per se (Rosenberger & Loomis 2000a, Shrestha & Loomis 2001, Bateman & Jones 2003). Further, this literature is dominated by the travel cost method, often pooling meta-datasets with a smaller number of SP surveys. This approach rules out an analysis of potentially important NUV[2] of forests related to for example biodiversity protection, and often limits the analysis of important features of SP research. Several unanswered questions remain in understanding people's preferences and WTP for NTBs related both to the UV and NUV components[3]. This paper aims to begin to answer some of them based on a synthesis and meta-analysis of around 50 studies reporting results from 30 SP surveys of both urban[4] and non-urban forests in the Fennoscandia over the last 20 years. The paper first reviews this literature and summarises and categorises methodological traditions in SP valuation of forests in the three countries. Second, a selection of methodologically similar SP studies is included in a meta-regression analysis attempting to explain the variation in WTP for protection and/or MUF by differences in survey methodology, good characteristics, study quality, socio-economic variables and

[2] Asking people to state their preferences is the only method that can capture NUV.
[3] The sum of UV, including the timber values, and NUV are often termed the total economic value (TEV)
[4] The differences between urban and non-urban forests are often not clear-cut in the Nordic countries, as even the capital cities have patches of forests (rather than parks) within their city zones.

other variables. In addition to investigating WTP's conformity with standard theoretically and empirically derived expectations, the paper attempts to answer novel questions about WTP's seasonal variability, country differences, WTP for MUF vs full protection, sensitivity to scope, WTP's development over time, and differences between WTP for avoiding a loss and achieving a gain. Finally, the paper concludes and suggests future research directions – not losing sight of the main goal of meta-analysis and SP research in the flood of WTP estimates, studies and methodological twists: a better understanding of individual preferences for forest protection and management[5].

Valuation of non-timber benefits from Fennoscandian Forests

Norway, Finland and Sweden are very similar countries in many respects and there are good reasons to study them together[6]. Their location on the Fennoscandian Shield yields similar climatic, geological and ecological conditions, resulting in a large cover of boreal forests. Second only to Russia, Sweden is the most forested country in Europe with its 22.7 million ha of productive forest. Finland and Norway have approximately 20 and 7.5 million ha (Framstad et al. 2002), respectively. The similarities between the three countries extend to the judicial, economic and cultural dimensions of recreation, forest conservation and forestry. The countries are on roughly the same level of economic and human development measured by GDP/capita and UN's human development index. Forestry is an important industry and seen together with agriculture as the backbone of local economies and the key to retaining dwindling populations in rural areas. All three countries have a large number of small, private forest owners. The everyman's right to access and harvesting of certain resources (for example mushrooms and berries) regardless of land ownership is an important and age-old traditional basis for the forest activities carried out by the public. Semi-private markets for

[5] Paraphrased after Smith & Pattanayak (2002).
[6] Denmark, Iceland and the Faroe Islands were left out of the analysis as their forests can be considered to be different goods (both in terms of size, ecology and use) to the Fennoscandian.

fishing (for example salmon) and hunting permits are allowed and broadly accepted, while markets for other NTBs are generally not, among others due to the everyman's right. Growing wealth, and with it increasing demand for environmental goods, has resulted in high conflict levels between timber production and the supply of NTBs (Vatn et al. 2005). As a response to this, forest protection has increased and MUF, in accordance with various certification schemes, have been taken up by the industry. Sweden, Finland and Norway have protected about 4, 5 and 1 percent of their productive forests, respectively, and the distribution of protected areas tends to a large degree to reflect economic rather than ecological considerations (Framstad et al. 2002, Lehtonen et al. 2003).

In parallel with the growing tension in the forestry sector a substantial literature has developed in Fennoscandia to value NTBs to compare with timber values. Navrud (1992) sums up some of the early literature. Some SP studies value single forest species such as large carnivores (Boman 1995) or birds (Fredman 1995), recreation activities such as fishing (Laitila & Paulrud 2006), or hunting activities (Johansson et al. 1988). Our focus here will be on those primary studies that value forest protection and/or MUF only. In addition, we include two studies that look at the value of forest biodiversity in general (which would directly require increased forest protection and/or MUF practices). The values from these studies can be interpreted as the WTP to obtain a positive change (or WTP to avoid a loss) in at least one element in an attribute vector describing the forest environment, i.e. level of biodiversity, forest density, forest size, scenic beauty etc. A broad search for published (peer-reviewed papers and book chapters) and unpublished studies (Master and PhD theses, working papers, research reports) was conducted in the three countries. The starting point for Sweden was a recent and comprehensive database of valuation studies (Sundberg & Söderqvist 2004), and for Finland a recent meta-analysis (in Finnish) (Pouta & Rekola 2005). The relevant

references in these studies were supplemented by a few more recent studies[7]. The search was limited to studies written in Swedish, Norwegian or English, which most likely has not skewed the selection unduly[8]. The search turned up about 50 studies reporting different aspects of the results from around 30 different SP surveys (see Table 1).

[Table 1 about here]

As can be seen from the table, the number of surveys is distributed fairly evenly between countries, though more surveys have been conducted in Finland in recent years. There is a mix between valuing full forest protection and MUF at the local, regional and national levels. Many of the Norwegian studies focus on the forest area just north of the capital Oslo ("Oslomarka"), an area of significant friction between forestry and environmental and recreational interests. All the national (and to some extent regional) level surveys cover both users and non-users. It is interesting to note that Norway has a tradition of conducting more in-person interview surveys, perhaps reflecting the funding situation for such research. There is a mix of dichotomous choice (DC) and open-ended (OE) CV WTP question formats used, while the CE approach, which has come into fashion internationally in recent years (Hanley et al. 1998), has been tried only once or twice. Other interesting features of the Fennoscandian forest SP research, not displayed in the table, is that a range of payment mechanisms are used (from voluntary contributions to tax and user fees) and that only one study use an actual payment mechanism (Veisten & Navrud 2006). All studies but one ask for WTP (either for a gain or to avoid a loss), and not WTA. No studies use more advanced WTP question formats, such as the double-bounded DC or iterative bidding. Econometric approaches to estimate the data vary widely (see next section), and cover a range of parametric and non-parametric approaches especially in the Swedish and Finnish studies. Many studies specifically test for

[7] Olsson (1993) was excluded since the study valued a cableway entry to a forest, while Johansson & Zavisic (1989) was excluded due to insufficient reporting.

[8] Swedes and Norwegians generally understand the two languages, but not Finnish. A large number of Fins, on the other hand, also understand Swedish and Norwegian. Only two studies referenced in Pouta & Rekola (2005) are known be excluded by this rule, as most of the relevant studies from Finland are in English.

WTP's sensitivity to scope, most often presented as size of forest (in percentage or hectare - ha). As we shall see, this simple approach is fraught with difficulties for forest goods. Few surveys remind the respondents of substitutes and budget constraints. While it is difficult to discern a trend in the research judging from an overview like this, it seems that the DC approach has become more common in the years after the NOAA panel report (Arrow et al. 1993), but that the in-person interview mode has not. Another trend, as can be expected, is that survey instruments have gradually become more realistic, informative and sophisticated. The selection procedure for estimates included in the meta-regression analysis and explanation of the WTP estimate format and variation (the last two columns in the table above) are left for the next section

Metadata and hypotheses

Data

SP studies typically explore impacts of different methodological assumptions and to a lesser extent conduct the survey to obtain one single WTP estimate of the environmental change in question, for example for use in cost-benefit analysis (CBA). This practice, driven by which studies tend to get published, makes the reporting very diverse and the metadata coding process complex. Some of the studies report extensively and also annex the full survey instrument while others are silent or very brief on important dimensions of the survey design and results. Even the average WTP for the sample is sometimes not reported. The collected SP studies in Table 1 were coded in a spreadsheet for variables hypothesised to have explanatory power for the variation in WTP. The coding procedure is an iterative process as new studies added to the spreadsheet may require recoding of previously recorded ones. The explanatory variables were chosen based on theory and previous empirical meta-studies, and the availability of information in the SP studies. It is a challenge and a judgment call for the meta-analyst to make the trade-off between the number of potentially interesting explanatory

variables to include in the analysis and exclusion of relevant studies due to limited reporting. The more explanatory variables that are included, the fewer studies will have complete reporting for all variables. Further, too many variables will lead to over specification of the model, while too few will fail to capture important variation in the data. There is no consensus in the literature on how to resolve this meta-analysis scope problem, or other judgments required by the meta-analyst, other than to state clearly which choices have been made in the analysis and to conduct sensitivity analysis. Some meta-analysis applications may require a narrower scope, for example including studies using certain specific methods only. Generally, many meta-analysts recommend "to err on the side of inclusion" of studies and estimates (Stanley & Jarrel 2005). This is the principle we abide by here, but we also investigate the sensitivity of our results to changes in the scope of the meta-analysis. We began by recording all raw WTP estimates reported in the 50 studies, which amounted to some 250 observations from the 29 surveys[9] [10]. The number of observations ranged from around 35 in Strand & Wahl (1997) to one observation from several studies. Many of the estimates reported from the same study varied only along dimensions of statistical modelling choices (especially for DC or OEPC data), which were often impossible to code accurately due to insufficient reporting. Instead of including all of these as study-to-study level background, as recommended for variation due to "*minor modelling choices"* by Stanley & Jarrel (2005:137), we averaged them into one or more observations. For example, if a study reported 9 WTP estimates for probit, logit and non-parametric statistical models, respectively, for three different sized forest protection plans and all other variable values are the same, we include one average WTP estimate for each protection plan in the meta-data (i.e. three measurements). In this way all estimates were included but weighted down. This was done to reduce substantial variation and

[9] Two or three studies reported WTP estimates by socioeconomic categories (age groups, income and education levels) within the sample in addition to sample WTP estimate with average socioeconomic variable values. In these cases, only the sample average WTP estimates were included in the meta-data set.

[10] The full data set is available in an Excel spreadsheet on request from the author.

noise in the data due to statistical modelling choices our statistical model was not intended to explain. Averaging was also done with WTP estimates reported for different subsamples that could not be distinguished by our explanatory variables (for example samples split depending on attitudes to conservation or ethical dimensions, various trimming procedures etc). Further, we excluded overall sample averages if sub-sample averages for the same survey had also been reported. Some of the studies reported income, age, and education levels for their sample. Preliminary analysis with some 40-50 observations showed that these variables were generally insensitive to differences in WTP estimates[11]. This is a very common result in SP meta-regression analyses (Rosenberger & Loomis 2000a, Johnston et al. 2003, 2005). Finally, about ten observations that only varied along socioeconomic dimensions, for example WTP for different education or age segments of the sample, were taken out leaving a final meta-data set of 72 observations. The density of the WTP estimates are given in Figure 1 below, and has a similar shape as in other meta-studies (for example, Rosenberger & Loomis 2000a):

[Figure 1 about here]

The variables that were eventually retained and fully coded are given in Table 2 below, and explained and justified in the next section. We chose long-term[12] average annual WTP per household as the base format (as this is most commonly asked) and coded WTP given in other formats (such as WTP per individual, per month, lump sum contribution etc) using dummy variables. An alternative would have been to adjust all reported estimates into an annual household WTP. Since respondents' discount rates are not known, we felt it was more prudent to use dummies. To make WTP from different countries comparable, estimates from Sweden and Finland were converted to NOK at the year of the survey[13] (rather than the publication

[11] Some meta-analyses supplement lacking primary socioeconomic data with official statistics. This is not likely to make WTP *more* sensitive to variation than for the primary data, so this approach was not followed here.

[12] WTP asked for 10 years was included in this category as people most likely do not distinguish between 10 years and an indefinite horizon.

[13] In some rare cases the year of reported WTP estimates was unclear. We have assumed reported in current values of the year of the survey (rather than for instance year of submission to a journal etc)

year) using annual average OECD Purchase Power Parity (PPP) rates, and then adjusted to 2005 figure by use of the standard Norwegian consumer price index (CPI)[14]. The reason for using PPP to adjust for differences in actual purchasing power is that nominal exchange rates may not accurately measure differences in income and consumption (and therefore WTP) between countries. Using the Norwegian CPI implicitly assumes that WTP for NTBs increases at the same rate as market goods.

We included a set of methodological variables that are often used in SP meta-analyses, such as WTP question and reporting formats, survey mode and response rates for mail surveys, payment vehicles, and whether the WTP is asked from an individual or on behalf of a household. Instead of excluding observations on the basis of subjective judgement of study quality, a procedure that is generally not recommended in the meta-analysis literature (Woodward & Wui 2001), we include proxy variables for quality; whether a study is a master thesis or otherwise unpublished (i.e. a research report or working paper). It is, however, difficult to capture the quality dimension with the "unpublished" variable as some of the studies (especially working papers) at some point may be published. In addition, SP meta-analyses sometimes use the year of the survey as a proxy for methodological quality assuming that advancements in SP methodology over time introduce prudence in survey design resulting in lower WTP estimates (Johnston et al. 2005). We favour a different interpretation (see next section). We also separate whether a mail survey has high, medium or low response rates. Finally, the last set of variables tries to capture the variation in good characteristics, along dimensions of geography (local or regional), country, time of the year (autumn/winter vs spring/summer), scope (forest area percentage or ha) and other characteristics (use vs. non-use, urban forest). Our expectations and hypotheses regarding the signs of the model parameters are provided in the next section.

[14] This procedure is also recommended in the health benefit transfer literature, where international comparisons and transfer are more common (Eiswerth & Shaw 1997, Pattanayak et al. 2002)

[Table 2 about here]

Hypotheses and expectations

The large body of theoretical and empirical SP research, for example as summed up by Carson (2004) and Carson et al (2001) provide a rich set of expectations regarding the signs of our model parameters. We have indicated these in the third column of Table 2 above and provide justification in the following. Regarding the methodological variables and WTP question formats first ("OE" and "OEPC"), with some exceptions, most comparisons of OE and DC question formats suggest that the DC format produces estimates that tend to be larger (for example Cameron et al (2002)). The reasons are that OE tends to give a high number of zero bids due to free-riding behaviour and protest responses, and DC higher bids due to biases related to "yeah-saying" and different starting points, and distributional assumptions in the statistical analysis[15]. Comparisons between OE with the use of payment card and DC tend to show the same pattern (Cameron et al. 2002), though the results are more mixed. WTP estimates from OEPC surveys tend to be higher that those from OE surveys, among others since PC tend to reduce zero-responses (Mitchell & Carson 1989). We therefore expect both the OE and OEPC variable parameters to be negative (though less so for the OEPC) as compared with the DC base case.

Empirical comparisons of WTP estimates from mail surveys with in-person interviews are few and results mixed, though it is clear that survey modes do affect value estimates (Boyle 2003). There are forces at work in both directions. While an in-person interview may be better able to convey information about goods, it is not clear in general if this would lead the respondent to state a higher or lower WTP. However, in the case of highly complex goods such as forest protection and management, we hypothesise that interviews will lead to higher

[15] As pointed out by an anonymous referee, the log-logistic type of models tend to give very high WTP estimates, and further, if the DC model does not allow for zero responses (the distribution does not include a spike), the WTP difference caused by a higher number of zero responses in the OE data may be spurious. We believe this problem is relevant to relatively few estimates in our data, and not significant enough to cloud the overall question mode comparison.

WTP simply due to a better understanding of the good. Further, the reporting in in-person survey studies is often silent on the number of houses visited or people asked, before someone accepted to take the time for an interview. The people included in the data are of course the ones who accepted, who are likely to have higher WTP than the average person. This is the real response rate that should be compared with mail surveys. As is generally assumed, the higher the response rates, the lower the average WTP, since the survey has managed to capture more of the less-interested, low-WTP respondents. We use three mail survey dummies depending on reported response rates for the mail surveys, "Mailhigh", "Mailmed" and "Maillow". For the reasons above we expect them to be negative, and for the "Mailhigh" to be more negative than the "Maillow" coefficient. Response rates can also be interpreted as a proxy for study quality. As for the other proxy variables for quality, "Mscthesis" and "Unpub", it is unclear a priori how these variables relate to WTP.

To distinguish between different payment vehicles we use dummy variables for hypothetical voluntary contributions and actual payments ("Volunpv" and "Actualpay"). It can be expected that surveys requiring actual payments yield (much) lower WTP (Murphy et al. 2005). Research on voluntary contributions is more limited but it is likely that the voluntary payment vehicle may induce statements of higher WTP, since people do not expect to be charged the amount they stated if the project goes ahead (Boyle 2003). As pointed out by Mitchell and Carson (1989), choice of payment vehicle is about balancing realism with payment vehicle rejection and protest responses. Whether WTP is stated on other than a long-term annual basis, related to use or by (or on behalf of an) individual rather than a household, is captured by the three dummies "Otherpay", "Userpv", and "Individual". The "Otherpay" coefficient can be expected to be positive a priori. This is because WTP estimates stated for a limited time period, as once for all lump sum contributions, per month or per season would be higher, the latter two simply due to human calculation and discounting errors (for example Rabin

1998). The "Userpv" dummy can be expected to be negative, as WTP related to use does not include potentially important NUV. Very limited research we are aware of has studied whether WTP for environmental goods tend to be different if stated by an individual or by (or behalf of) a household[16]. Quiggin (1998) finds that under certain conditions household WTP will be higher than individual WTP. On the other hand, there are also reasons why individuals may state higher WTP. For instance, as is known in marketing, the individual may in practice invoke one (and a higher) budget for personal consumption goods and one (and lower) budget when "forced" to take the whole household into account. On balance the a priori sign of the "Individual" parameter is not clear.

The next set of variables describing the good are included to investigate how peoples' preferences for forest protection and/or MUF are related to time, scope, geographical dimensions and certain other characteristics[17]. Many of the hypothesised relationships are largely of an exploratory kind, as the literature on forest valuation (or indeed SP research in general) is relatively silent and give limited theoretical or empirical guidance. Starting with the time dimension, standard neoclassical environmental economics would state that whether an individual is asked to value the same good at different times of the year should not matter to her valuation (Jakus et al. 2006)[18], as WTP would take into account the (discounted) stream of benefits to her over all years and seasons from the proposed scenario. However, if asked specifically about WTP for forests activities in the winter season as compared to the summer, the WTP can of course be different as two essentially different goods are valued. As literally all of the SP forest surveys in the meta-analysis ask for WTP for protection or MUF unrelated to different seasons as such, we thought it would be interesting to study whether people would see through this "season illusion". If they do not, we hypothesise that they have a lower WTP

[16] Bateman & Munro (2005) and Strand (2005) compare household and individual valuation related to risk reductions, but the results are not immediately relevant for forests goods.
[17] Some of the variables included under the good description heading could also be called "methodological", but are included here as they relate specifically to the good valued.
[18] Given constant utility function, budget constraint and supply of other unpriced, environmental goods.

when asked during the darker and colder autumn and winter months[19], i.e. the "Season" parameter would be negative.

Another interesting, and largely explorative, question we ask is whether people value scenarios that involve full protection more or differently from scenarios that only propose MUF or a mix (using the dummies "Forestpract" and "Protmix"). It is not clear which direction this relationship would go. NUV is higher for protection almost by definition, though some people may have a positive WTP to keep up "traditional" forestry rather than to leave forests "idle" even if they will never use the forest. Full protection may also increase UV for example related to certain recreation activities, but may also make forests dark and less accessible due to fallen trees and dense undergrowth (Horne et al. 2005). Another factor is that people may prefer alternatives to full protection due to the (perceived) economic and cultural importance of forestry and high conflict levels in the three countries.

It is difficult to capture the quality and/or quantity (scope) of a forest good to study whether peoples' WTP is sensitive to different provision levels of the good. Protection vs. MUF captures one quality dimension, while the size in hectares or share of total land or forest area is a crude measure of quantity (included as the dummies "Forestarea", "Hafperc" and "Haperc"). To probe deeper into the issue of scope sensitivity, we code those surveys that explicitly mention as part of their good description the size and percentage of forest to be valued (dummy variable "Impl"). A complication is that when MUF is valued, the survey sometimes does not refer to a specific forest area (but implicitly, perhaps, means all the productive forests in the country). We therefore do not include the forest area and percentage variables in our primary estimation models in the next section, but utilise them when we look closer at the issue of scope sensitivity. Another factor complicating the issue of scope sensitivity is the geographical dimension of the good (captured in the dummy variables

[19] The much documented psychological effect of lighter seasons on happiness, and its potential effect on WTP, may be difficult to discern from other aspects related to differences in the perceived forest good being valued.

"Localgood", "Reggood"). The protection of a local municipality forest may yield higher WTP per person than for a national forest protection plan although the size of the forest is marginal. An interpretation of this phenomenon and a common result in the literature is that WTP decays with distance. Multiplied with the relevant population around the municipality forest, however, the total WTP is of course much lower. Using a measure of per person WTP/area as dependent variable or relating average WTP per person blindly to the size of the forest would of course not be meaningful. We return to the issue of scope in the next section.

We further include dummy variables for forest environments that are primarily urban ("Urban") (in or adjacent to large cities). Urban forests have potentially high UV but arguably lower NUV for example related to biodiversity, which leaves an ambiguous sign for the parameter. A confounding factor is the higher incomes of populations in urban areas potentially pushing WTP estimates upwards, which we cannot easily control for. Without having strong a priori expectations related to country differences, we include dummies for Sweden and Finland (base case is Norway). Incomes in Norway are somewhat higher, the forest good somewhat scarcer (both in terms of percentage protected and total forest area), which would tend to generate higher Norwegian WTP estimates. On the other hand, the demonstrated willingness to protect forests in Sweden and Finland and the relatively lower levels of user conflicts (Vatn et al. 2005), could reflect a higher underlying WTP for forests in these countries.

We include a dummy for whether respondents are asked WTP to avoid a loss or achieve a gain ("Avoidloss"). In principle, these need not be equal for an equal size change in environmental quality, as the reference scenarios are different. The extensive literature on psychological economics show that people tend to value losses higher than equal-sized gains (Kahneman & Tversky 2000), which would indicate a positive parameter value for this variable. However, in many studies it is not always very clear whether respondents are asked

their WTP to avoid a loss or to achieve a gain. For example, if you ask for WTP for forest protection, and the baseline scenario is accelerating loss of biodiversity, the estimate should be interpreted as WTP to avoid a loss. However, in another survey, the default scenario may be status quo, and increased protection a genuine positive change. As we indicated in Table 1 above, both of these approaches are equally common[20]. These ambiguities are generally caused by unclear good definitions and fuzzy scenario descriptions.

Further, we separate those surveys that stress user respondents over a mix of use and non-use respondents (not necessarily related to user payment vehicles, "Userpv") with the dummy "Use" [21]. We hypothesise that users generally have higher WTP than non-users, because users are likely also to have higher NUV, i.e. they are more likely to want to protect or better manage forests (over and beyond providing them with for example recreational areas). Finally, we include a dummy for the year of survey. Rather than interpreting year as variable indicating quality, as discussed in the previous section, we would rather interpret this variable as capturing trends over time in WTP, for example reflecting increasing relative value of forest goods compared to other goods measured in the CPI due to growing scarcity and higher interest in and use of environmental goods in Fennoscandia[22]. We would therefore expect a positive parameter for this variable.

[20] In principle, one could imagine three different cases: (1) *Increasing* environmental quality over time compared to a constant path, (2) *Decreasing* environmental quality compared to a constant path, and (3) Increasing environmental quality compared to a decreasing path.

[21] It was impossible to classify estimates into UV and NUV, as most of the studies do not explicitly use this distinction. However, we were able to classify studies that were predominantly asking users or focusing on use values, while the rest would include a mix.

[22] As mentioned, we found that WTP is generally insensitive to income (in the subset of the studies that reported it). Hence higher incomes can in our case not explain the increase in WTP over time. However, the way income is measured in CV surveys may not adequately capture the growing wealth in Fennoscandia (for example in property values). A study in Sweden that pools several data-sets allowing a more comprehensive analysis finds positive elasticity of WTP for environmental services to income (Hökby & Söderqvist 2003).

Model and results

Meta-regression model

To analyse the impact on WTP of the explanatory variables above, the following standard meta-regression model is applied. A number of m (m = 1,...,M_s) WTP estimates are identified from each study s (s = 1,..,S), and the total number of WTP estimates can then be denoted $M = \sum_{s=1}^{S} M_s$. The set of k (k = k,..,K) explanatory variables or regressors are further denoted $x_{k,ms}$. Measurements from the same SP study may share many of the same values (for example year, geographical area, payment vehicle etc) while varying along other dimensions (for example WTP question format). Hence, generally the random error for both the study and measurement levels may have an impact on the measurement of WTP, and the metadata may display panel effects. A meta-regression model that captures these two levels of error can be formulated as follows (Bijmolt & Pieters 2001):

$$WTP_{ms} = \beta_0 + \sum_{k=1}^{K} \beta_k x_{k,ms} + e_{ms} + u_s \qquad (1)$$

where β_0 is the constant, β_k the slope parameter, and e_{ms} and u_s the random error terms for the measurement and study levels, respectively. The error terms are assumed to be normally distributed with zero mean and variances σ_e^2 and σ_u^2. There are several approaches to estimating this model depending on assumptions regarding the error covariance matrix. The simplest approach to the data, which has been used in several meta-analyses (Loomis & White 1996, Rosenberger & Loomis 2000a), is to treat all measurements (regardless of the source study) as independent replications and hence assume that study level error is zero. This model can be estimated using simple ordinary least squares (OLS) and may in many cases work well (Rosenberger & Loomis 2000b). A more advanced approach often used in meta-analysis is to apply a Huber-White robust variance estimation procedure to adjust for potential

heteroskedasticity and intercluster correlation[23] (Smith and Osborne 1996). If such correlation exists, the OLS regression will be inefficient and inconsistent in estimated parameters. The Huber-White procedure does not affect the parameter estimates of the model, but provides robust standard errors of the parameters. Several authors advise against weighing estimates from different studies so that each study counts equally in the data, on the grounds that the information from the data is not used optimally (Bateman & Jones 2003). Regarding specification of the functional form of the regression equation, there is no clear consensus in the meta-analysis literature. The most common specifications are linear, double log, semi- and translog (Johnston et al. 2005). Given this empirical framework, we choose four different models. The first is a simple OLS, the second and third are Huber-White robust estimations for the untransformed variables and a double log specification[24], respectively. The fourth, and final model is a version of model 2, where we following Rosenberger & Loomis (2000a), retain only those variables that are significant at an 80 per cent level or better based on t-statistics.

Model results and discussion

Results

The regression results displayed in Table 3 below show that the models fit the data well and that many of our empirical or theoretical expectations are confirmed. The four models explain more than three quarters of the variation in the data, which is high compared to other meta-studies with R^2's sometimes as low as 0.25 (Rosenberger & Loomis 2000a). Likelihood ratio tests further demonstrate that the parameters are jointly significant at $p < 0.01$ in all models. Starting with the first model, it confirms several of our expectations to the methodological variables, where such prior expectations exist. Open ended WTP format (OE, though not

[23] Some meta-analysis studies use multilevel models, but often find little improvement on the standard models applied here (for example Bateman & Jones (2003), Rosenberger & Loomis (2000b)). We therefore do not pursue this approach here.
[24] Only the continuous "Year" variable of the regressors is transformed, while the dummy variables are kept on a linear form.

OEPC), payment vehicles ("Voluntpv" and "Actualpv"), and the mail survey variables all have the expected signs and are highly significant ("Mailhigh", "Mailmed", "Maillow"). It is worth noting that the coefficients for the mail survey variables are ranked as expected: the higher response rates the lower WTP. OEPC shows, somewhat unexpectedly, a low positive coefficient, though statistically insignificant. The "Otherpay" variable has the expected sign, but is not significant.

[Table 3 about here]

The model further shows that people have significantly higher WTP when stated as an individual than for a household. This result is interesting, but there is little research, we are aware of, that study such differences. One possible explanation we have mentioned is that a person asked for household WTP automatically is forced to think about a more restrictive family budget constraint, than an individual considering her own private consumption budget only. There are very few observations for CE, and the model is unable to distinguish CE estimates from CV DC estimates. The study quality dummies related to whether the estimates have been published or not ("Unpub") or are from Master theses, give significantly different (negative) WTPs as compared with the other studies in the meta-data. This result is not immediately easy to explain, as a normal assumption many analysts make (though likely not based on hard evidence) is that higher methodological prudence should lead to more conservative and lower WTP estimates. This is not the case here, and may raise questions about inclusion of such studies in meta-analysis and benefit transfer exercises.

We included a range of good description variables of a more explorative kind, i.e. not much research has been conducted on which to base solid prior expectations. The geographical variables in the model show as expected that regional and local forest goods are valued higher than a forest on a national level (the base case), though the latter is not statistically significant. Further, Sweden and Finland do not have significantly different WTP than observed in

Norway. Urban forests are valued lower than other forests, which may indicate that NUV of non-urban forests is important. As hypothesised, WTP to avoid a loss is higher (though not significantly so) than WTP for a gain. WTP from users or related primarily to use ("Use") is not statistically different than from a mixed group. We also hypothesised that respondents would consider protection, MUF or a mix of the two as different types goods. Our results here are somewhat puzzling, as it seems that respondents value full protection lower than MUF ("Forestpract" is significantly positive), but higher than a mix between the two ("Protmix" is significantly negative). Further, it also seems to be important to the stated WTP whether forest area and percentage have been explicitly mentioned in the survey ("Impl" is positive and significant). These results are of an exploratory kind, but shows at least that it is not immaterial to people whether it is question of full protection or just a change in existing forestry practices. More research is required to probe deeper into people's preferences for different types of forest regulation.

Finally, the results regarding the temporal dimension are interesting. We hypothesised that people may value forests lower in the autumn/winter as compared to the spring/summer, due to a "season illusion". Our model shows that the season variable is negative and highly significant. In trial runs of the OLS model we also coded a winter-variable (November-March) to see if the snowy season would be a better categorisation, but for this variable we found no significant effects. There is not much theory and empirical evidence we can rely on to explain the negative season parameter, so it should be interpreted with caution. We also find as expected that the year of the survey influences WTP positively, indicating increased relative value of forest amenities in Fennoscandia over the last 20 years. Also for the temporal dimension, more research is required to better understand which forces are at work.

Sensitivity analysis

If we look at the results of the other three models the significance of many of the parameter values is relatively robust. Contrasting the first with the second model, where potential study level correlation and heteroskedasticity have been adjusted for, the results show small changes. Most notably, "Actualpay" is now significant at the 5 per cent level, while the variables "Protmix", "Forestpract" and "Year" are no longer significant. For the other parameters there are minor changes. This supports the findings of other meta-studies that the effects associated with systematic study (or author) level variance are often not significant (Rosenberger & Loomis 2000b, Johnston et al. 2003, 2005). As pointed out by Johnston et al (2005) this is an important result suggesting that systematic variation in WTP is not driven by unobservable attributes unique to particular studies. The double-log transformation in model 3 shows a slightly better fit to the data compared to models 1 and 2, due to the relative skewedness of the average WTP-distribution towards zero. However, postestimation commands comparing residuals between the models, show that this is of minor importance to the performance of models 1 and 2. The results also display some degree of robustness to the double log specification, though there are some changes. Most notably both the Swedish and Finnish WTP estimates are now significantly positive. Many of the parameters are significant across the three models. We also estimated semilog and translog model formulations, which were found not to perform as well as the models reported. The fourth model in Table 3 removes variables from model 2 whose parameters have $p<0.20$, and is a first step towards making the model more suitable for benefit transfer applications (Shrestha & Loomis 2001, 2003). The model loses some explanatory power by removing variables, but the model now contains variables where all, but one ("Avoidloss"), are significant.

Concerned that the price and exchange rate adjustments would cloud our results, we also reran the simple OLS model using 1998 (mean survey year) as the base year, varying between PPP,

market exchange rates, and using a weighted price index for the three countries. Both practices of choosing the current and mean survey year as the base year for analysis are common in the meta-analysis literature, though we have seen no studies testing for potential effects of such choices. The results of the model runs under these alternative WTP adjustments, left out of the table above for sake of brevity, did not indicate that choice of base year, currency rates or inflation index had significant impact on results. Recalling that we decided in our meta-analysis to average over reported WTP estimates from the same studies that varied across dimensions that could not be meaningfully coded (especially econometric model specifications, trimmed vs untrimmed estimates, etc), we decided to assess preliminary the effects of this procedure. The model runs with all unweighted observations show that R^2, not surprisingly, falls significantly (to around 0.4) and many of the parameters are no longer significant (though their signs are generally preserved). Since the variation is too large just to be included as study background, we think it is justifiable to apply our weighting procedure as long as it is carried through consistently for all estimates. In this way we are able to pick up important and significant relationships from the meta-data that would otherwise remain obscure. In this case we can identify the main source of the variation (DC modelling choices especially), but cannot control for it due to insufficient study reporting practices. As a final check of the robustness of our parameters, we excluded two high estimates (WTP > NOK 5000), and one low estimate (from the only study measuring *actual* WTP) (WTP < NOK 15) and reran model 2. There are changes to parameter significance for "OE", "Forestpract", "Unpub", "Impl" and "Protmix" (no longer significant), "Swe" (now significant), while the other variable parameters remain significant at $p < 0.1$ or better. We think including the three observations above is the most prudent approach, as none of them are unrealistically large or small. Our sensitivity considerations here can at least be seen as a preliminary assessment of robustness of the meta-analysis model.

Is WTP sensitive to scope?

A CV critique that has been hotly debated since it was first raised is the issue of embedding effects (Kahneman & Knetsch 1992). Embedding has come to mean at least three different things (Hanemann 1994), the most important being scope insensitivity; i.e. that WTP is not (sufficiently) sensitive to changes in the quantity or quality of the good being valued. Second, WTP is sometimes found to depend on which number the good is in a sequence of items to be valued (sequencing effect). Third, WTP of a change of a composite public good may be less than the sum of the WTP for individual changes separately (sub-additivity effect). If these phenomena cannot be explained by legitimate economic reasons, the theoretical validity of the CV method can be challenged. Since both convergent and criterion validity are hard to judge for CV of NUV, a presumably important component of forest values, the pillars of theoretical and content validity will need to be all the more solid (Mitchell & Carson 1989). Many of the studies in the meta-analysis consider within sample (internal) or split-sample (external) scope tests, often offering two or three different sized forest protection plans as measured in hectares and/or as percentage protected. A smaller number of the studies that only consider MUF assess sensitivity to scope. Only one or two consider the two other elements of embedding (Veisten et al. 2004b). In all cases the results are mixed. As discussed previously, it is problematic to assess scope sensitivity in the meta-models above due to higher WTP for local/regional goods and because some studies valuing MUF sometimes do not specify area (neither to the respondent nor to the reader) forcing us to code the whole productive forest area in the country. Another complicating issue is that some surveys do not distinguish clearly enough between the *change* in forest area, which is the good that should be valued, and the existing area of forests under certain protection or forestry restriction regimes. Further, the surveys use both the terms “productive forest area” and “total forest area” (with and without for example lakes and marshland). In other words, the good and scenario descriptions become unclear.

To account for these problems, we ran several models for subsets of the data to try to detect sensitivity to forest size (area in hectares and as a percentage of total land area of productive forest size). We first ran model 2 only for those 64 observations that had indicated a relevant forest area in the study. Second, for these observations, we also ran the model for surveys that value protection only and forests on a national level (i.e. excluding local and regional forest goods), hypothesising that protection may be more sensitive to scope than MUF. Finally, we estimated a small-sample model for those estimates from surveys where size and percentage protected where explicitly given to respondents in survey instruments, and for those estimates that were considered especially related to use. The somewhat discouraging result is that neither of these model approaches was able to detect any significant scope effects, beyond a generally weak, near-zero positive relationship. On the other hand, forests are complex environmental goods which scope may not be easily captured by simplified indicators such as area size or percentage. While other meta-analyses detect sensitivity to scope (Smith & Osborne 1996), our findings strongly suggest showing caution in using WTP/hectare or similar measures in meta-analysis and benefit transfer applications for complex goods, as done for example in Woodward & Wu (2001). Since value per hectare is also a format much sought after in policy applications, it is tempting to overlook the challenges involved in estimation and interpretation.

Conclusions

This paper has taken stock of 20 years of stated preference (SP) research valuing non-timber benefits (NTBs) in Norway, Finland and Sweden by the use of meta-analysis. The paper first reviewed the literature and summarised methodological traditions and trends showing a rich and varied body of SP research. Second, a meta-regression analysis was conducted attempting to explain the variation in Willingness-to-Pay (WTP) for protection and multiple use forestry (MUF) by differences in survey methodology, good characteristics, socio-economic and other

variables. The model results are promising with regard to revealing systematic and expected variation in WTP along methodological variables, and to some extent along various characteristics of the forest good. Most notably, it is shown that geography (urban; local; regional), seasons (autumn/winter vs spring/summer), year and institution (full protection vs MUF) are important, but WTP does not seem to be different between the three countries. The results are fairly robust to changes in model specification and meta-analysis scope, but it is acknowledged that some of the included variables are of an explorative kind requiring further research.

Two key conclusions with relevance for future research can be drawn from the meta-analysis. First, analysing several subsets of the data, no sensitivity to scope of WTP to the size of the forest (in hectare or percentage) was detected. It is likely that this result stems from a combination of weaknesses in SP survey design (especially unclear scenario and good descriptions) and respondent difficulties in assessing a complex and multidimensional forest good. In any case, it is an important result casting doubt on the validity of using simplified WTP/area measures, at least at current state of knowledge, pointing towards more research to understand embedding effects for complex environmental goods. Second, we find that individuals tend to value forests higher than households do. This result may run counter to some of the limited research in this area, but suggests that much is still unknown about which budgets people invoke in their minds when asked as individuals rather than on behalf of a household.

A final point of relevance to the meta-analysis literature worth emphasising in closing is the importance of conducting sensitivity analysis, varying the scope of the meta-analysis in particular. Since the reporting in Fennoscandian and international SP research still leaves much to be desired, the meta-analyst is left with difficult choices about which variables and studies to include. Many of the meta-analyses in the environmental economics literature

conduct sensitivity analysis by applying different econometric model specifications, but tend to overlook and/or underreport the potentially important effects of varying the scope of the meta-analysis.

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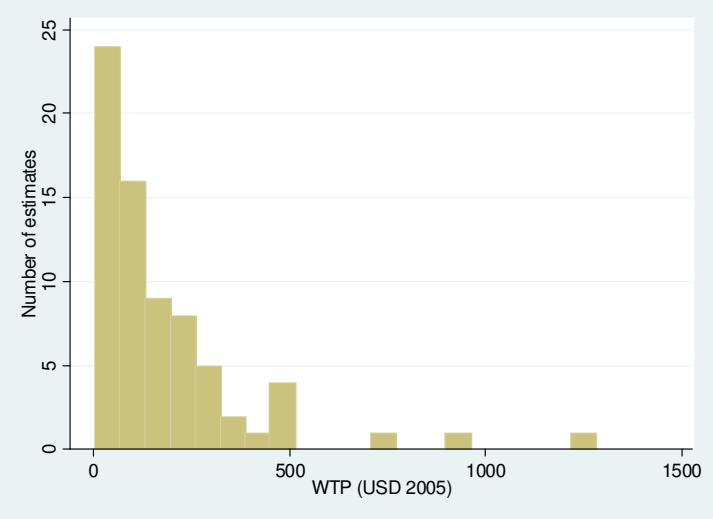
Figures

Figure 1 Distribution of the dependent variable, WTP in 2005 USD, N=72



Tables

Table 1 Stated preference valuation surveys of Fennoscandian forests, 1985-2005

Main references[a]	Year[b]	Good[c]	Gain/ loss[d]	Mode	Scope[e]	Method[f]	# [g]	WTP (USD)[h]
Finland								
Kniivilä (2004)[1]	2000	P	L	Mail	R, L	CV: DC	2	61-107
Lehtonen et al (2003)[2]	2002	P	G	Mail	R	CV: DC	5	190-342
Pouta et al (2000, 2002)[3]	1997	P	G/L	Mail	N	CV: DC	4	154-227
Pouta (2003, 2004, 2005)	1998	F	G	Mail	N	CV: DC	2	287-299
Rekola & Pouta (2005)	1995	F	G	Mail	L	CV: DC	1	20
Siikamäki & Layton (2005)	1999	P	G	Mail	N	CV: DC, CE	3	79-134
Mäntymaa et al (2002)	1999	P, B	G	Mail	N	CV: OE	4	224-380
Horne et al (2005)*	1998	P, M	G/L	Interv.	L	CE	1	-16
Tyrväinen & Väänänen (1998)	1995	P, O	L	Mail	L	CV: OEPC	5	31-124
Tyrväinen (2001)	1996	P, O	L/G	Mail	L	CV: OEPC	6	22-248
Norway								
Simensen & Wind (1990)	1989	P, M	G	Interv.	L	CV: OE	3	21-159
Hoen & Winther (1993)[4]	1990	P, M	G	Interv.	N	CV: OEPC	6	14-65
Veisten et al (2004a, b)[5]	1992	B	L	Interv.	N	CV: OE/OEPC	3	138-210
Sandsbråten (1997)	1997	M	L/G	Interv.	L	CV: DC	2	43-45
Leidal (1996)	1996	P	L	Interv.	L	CV: DC/OE	3	455-504
Skagestad (1996)	1996	P, M	G	Interv.	L	CV: OEPC	1	15
Veisten & Navrud (2006)	1995	P	L	Mail	R	CV: DC/OE	4	3-104
Hoen & Veisten (1994)	1992	M	G	Interv.	L	CV: OE	1	50
Hoen & Veisten (1994)	1993	M	G	Interv.	L	CV: DC	1	48
Strand & Wahl (1997)	1997	P	L	Interv.	L	CV: OE/DC	2	172-243
Sweden								
Bojö (1985)	1985	P	G	Interv.	L	CV: DC	1	58
Bostedt & Mattson (1991)	1991	M, O	L	Mail	L	CV: OE	1	385
Mattson & Li (1993)	1991	M, O	L	Mail	R	CV: OE/DC	2	469-907
Mattson & Li (1994)[6, +]	1992	M, O	L/G	Mail	R	CV: DC, CE	2	440-1280
Kriström (1990a, b)[7]	1987	P	G	Mail	N	CV: DC/OE	4	275-725

Johansson (1989)	1987	B	L	Mail	N	CV: OE	1	254
Bostedt & Mattson (1995)[8]	1992	M, O	G	Mail	L	CV: OE	2	78-84
Fredman & Emmelin (2001)	1998	M, O	G	Mail	R	CV: OE	1	92
Total number of estimates							**72**	

Notes:

a = Also reporting WTP estimates from the same survey: 1 = Ovaskainen & Kniivilä (2005), Kniivilä et al (2002); 2 = Lethonen (2005a, b); 3 = Rekola et al (2000), Li et al (2004), Pouta (2003); 4 = Garnes & Winther (1991), Veisten & Hoen (1994); 5 = Veisten et al (1993), Veisten (1993), Veisten & Hoen (1994); 6 = Li & Mattson (1995), Li (1996), Holgen et al (2000); 7 = Kriström (1989); 8 = Bostedt (1997)

b = Year of survey, rather than study publication year

c = Good type: P = Forest protection, M = Multiple use forestry (MUF), B = Forest biodiversity specifically, O = Other (e.g. tourism WTP attributed to forests in an area)

d = WTP for proposed improvement (gain) or to avoid a proposed negative change (loss)

e = Geographical scope: National (N), regional (R), local (L) forest good

f = Methodology: OE = Open ended WTP format, OEPC = OE with the aid of a payment card (a range of values presented to the respondent to choose from), DC = Dichotomous choice format

g = #: Number of estimates included in the final meta-regression analysis

h = WTP estimates converted from NOK used in the meta-regression analysis to USD 2005 using OECD Purchase Power Parity (PPP) and Norwegian Consumer Price Index (CPI), and may therefore not correspond exactly to the WTP estimates as they are reported in the studies. The WTP formats are given as reported (i.e. lump sum, per month, per household or individual, long-term annual etc), and are therefore not directly comparable.

*** =** This study, which uses a CE approach that is not directly comparable to CV, was judged too different from the other studies and taken out of the final meta-regression analysis. The WTP is negative here since people preferred open scenery (and less biodiversity) to a more closed forest (with more biodiversity). + One extreme WTP value from Li (1996) of SEK 158 116 was excluded.

Table 2 Meta-analysis variables and descriptive statistics

Variable	Description	Sign	Mean (SD)
Dependent variable			
WTP2005	WTP in 2005 NOK	….	1192 (1374)
Methodological variables:			
CE	Binary: 1 if choice experiment, 0 if CV	+/-	0.08 (0.25)
OE	Binary: 1 if OE without payment card, 0 if dichotomous choice	-	0.36 (0.48)
OEPC	Binary: 1 if OE with payment card, 0 if dichotomous choice	-	0.26 (0.44)
Volunpv	Binary: 1 if payment vehicle is described as a voluntary (unrelated to use) (e.g. donation to a fund), 0 if otherwise (e.g. tax)	+	0.18 (0.39)
Userpv	Binary: 1 if payment vehicle is related to recreational use or access (e.g. entrance fee etc), 0 if otherwise (e.g. tax)	-	0.19 (0.4)
Otherpay	Binary: 1 if payments were to occur on something other than an annual long-term basis, for example as a lump-sum, annual for a limited period, monthly or per season	+	0.5 (0.5)
Actualpay	Binary: 1 if payments were actually made, 0 if hypothetical WTP	-	0.03 (0.17)
Individual	Binary: 1 if individual WTP, 0 if household	+/-	0.32 (0.47)
Mailhigh	Binary: 1 if mail survey with high (more than 65% useable questionnaires), 0 if in-person interview	-	0.13 (0.33)
Mailmed	Binary: 1 if mail survey with medium (between 50% and 65% useable questionnaires), 0 if in-person interview	-	0.25 (0.44)
Maillow	Binary: 1 if mail survey with low (below 50% useable questionnaires), 0 if in-person interview	-	0.31 (0.46)
Study quality variables:			
UnPub	Binary: 1 if WTP estimate unpublished, 0 if published	+/-	0.38 (0.47)
Mscthesis	Binary: 1 if primarily a Master thesis, 0 if otherwise	+/-	0.15 (0.36)
Good characteristics variables:			
Forestpract	Binary: 1 if more cautious forestry practices; 0 if full protection	+/-	0.32 (0.47)
Protmix	Binary: 1 if mix of protection and forestry practices; 0 if full protection	+/-	0.07 (0.26)
Forestarea	Continuous: Total forest area of proposed change (ha).	+	See text
Impl	Binary: 1 if neither percentage of total land area nor forest area (ha) are mentioned in the survey, 0 if otherwise	+/-	0.78 (0.42)
Hafrerc	Continuous: Area percentage of total productive forest area in the country (estimated in year 2005, or based on info provided in study)	+	See text
Haperc	Continuous: Area percentage of total land area	+	See text
Localgood	Binary: 1 if local good, 0 if nationwide	+	0.42 (0.5)
Reggood	Binary: 1 if regional good, 0 if nationwide	+	0.21 (0.41)
Sweden	Binary: 1 if study conducted in Sweden, 0 if Norway or Finland	+/-	0.19 (0.4)
Finland	Binary: 1 if study conducted in Finland, 0 if Norway or Sweden	+/-	0.44 (0.5)
Urban	Binary: 1 if primarily urban forest (major town), 0 if otherwise	+/-	0.33 (0.47)
Season	Binary: 1 if surveyed in autumn/winter (i.e. Sept.-March), 0 if spring/summer (i.e. April-August)	-	0.6 (0.49)
Avoidloss	Binary: 1 if it is WTP for avoiding a loss, 0 if it is for an improvement	+	0.4 (0.49)
Use	Binary: 1 if primarily use/users, 0 otherwise (i.e. users and non-users are incl.)	+	0.36 (0.48)
Other variables			
Year	Continuous: Range 1 (1985, year of first survey) to 16 (2002).	+	10.6 (4.2)

Table 3 Meta-regression results for different models

Variable	Model 1: OLS	Model 2: Huber-White (linear)	Model 3: Huber White (dbl log)	Model 4: Model 2 restricted
Intercept	1549.256*	1549.256*	4.140617**	1342.252**
	(854.0126)	(875.5331)	(1.170449)	(627.3681)
CE	192.6951	192.6951	.3297439	
	(539.4353)	(378.0004)	(.2406569)	
OE	-1334.071***	-1334.071**	-.495455	-1287.111**
	(349.4965)	(594.0914)	(.3395935)	(468.0961)
OEPC	227.536	227.536	-.3608809	
	(385.0719)	(382.0898)	(.2204971)	
Volunpv	3799.7***	3799.7***	2.803627***	3044.605**
	(857.556)	(988.7608)	(.7711909)	(687.6332)
Userpv	-2564.024***	-2564.024***	-.3300177	-2106.395***
	(596.0903)	(424.8793)	(.4289763)	(368.3456)
Otherpay	183.4371	183.4371	-.066285	
	(554.1872)	(620.5135)	(.4875653)	
Actualpay	-571.5364	-571.5364*	-2.099854***	-784.9491*
	(822.7707)	(320.3029)	(.1061977)	(452.4138)
Individual	1834.944***	1834.944***	1.295294***	1887.775***
	(514.8866)	(471.8069)	(.2941284)	(356.5278)
Mailhigh	-6477.973***	-6477.973***	-4.986712***	-5414.957***
	(1302.404)	(1032.545)	(.7683036)	(1116.645)
Mailmed	-4864.702***	-4864.702***	-4.270923***	-3766.46***
	(1391.61)	(1043.229)	(.9019158)	(993.9104)
Maillow	-2476.168**	-2476.168**	-3.009995***	-1777.548**
	(1160.55)	(970.375)	(.9114381)	(710.3121)
Unpub	-791.1643*	-791.1643**	.0190386	-649.8414**
	(422.7837)	(320.2655)	(.3603327)	(276.8186)
Mscthesis	-1916.265**	-1916.265**	-1.730453***	-1377.964**
	(696.9262)	(754.8593)	(.5586125)	(633.7852)
Forestpract	765.1689**	765.1689**	.2771635	724.4589**
	(395.7878)	(320.39)	(.3163496)	(334.9457)
Protmix	-1261.768*	-1261.768	-.6688487	1277.131**
	(751.8913)	(808.1531)	(.5322865)	(560.8567)
Impl	1276.517**	1276.517	1.279632**	1461.405***
	(625.134)	(934.0211)	(.525085)	(511.5116)
Localgood	649.1225	649.1225	-.4468539	
	(575.4894)	(536.0937)	(.4902242)	
Reggood	2350.52***	2350.52***	.821114*	1576.816***
	(859.5872)	(746.4256)	(.471253)	(462.357)
Sweden	1111.561	1111.561	2.147048**	1032.856**
	(947.6924)	(822.4675)	(.9714438)	(484.5947)
Finland	644.2306	644.2306	2.131236*	
	(1110.856)	(1046.65)	(.6016583)	
Urban	-1551.158**	-1551.158***	-.5718084	-950.6182**
	(612.1044)	(552.4695)	(.4513243)	(350.0053)
Season	-1879.212***	-1879.212***	-.784065**	-1683.18***
	(433.4073)	(496.1174)	(.313954)	(473.2106)
Avoidloss	627.9457	627.9457	.5853566*	585.4352
	(401.3341)	(415.2456)	(.3072963)	(346.2406)
Use	451.9457	451.9457	.0224779	
	(526.0146)	(721.9776)	(.3540051)	
Year	130.3553*	130.3553	1.242805**	140.1013**
	(71.80079)	(82.63281)	(.5555091)	(61.82823)
Log likelihood χ^2	101.47***	101.47***	121.56***	97.45***
R^2	0.756	0.756	0.815	0.742
N	72	72	72	72

Note: *p < 0.10, **p < 0.05, ***p < 0.01, Number of survey clusters for models 2-4 = 27. Estimated using Stata ver. 9.2.