Journal of Forest Economics 18 (2012) 259–270

Contents lists available at SciVerse ScienceDirect

Journal of Forest Economics

journal homepage: www.elsevier.de/jfe

Non-market valuation of forest goods and services: Good practice guidelines

Pere Riera[a], Giovanni Signorello[b], Mara Thiene[c], Pierre-Alexandre Mahieu[d,*], Ståle Navrud[e], Pamela Kaval[f], Benedicte Rulleau[g], Robert Mavsar[h], Lívia Madureira[i], Jürgen Meyerhoff[j], Peter Elsasser[k], Sandra Notaro[l], Maria De Salvo[b], Marek Giergiczny[m], Simona Dragoi[n]

[a] *Autonomous University of Barcelona, Campus, 08193 Bellatera, Spain*
[b] *University of Catania, 98 Via Santa Sofia, 95123 Catania, Italy*
[c] *University of Padova, 16 Viale dell'Università, 35020 Legnaro, Italy*
[d] *University of Nantes, LEMNA, Chemin de la Censive du Tertre, 44322 Nantes cedex, France*
[e] *School of Economics and Business, Norwegian University of Life Sciences, P.O. Box 5003, 1432 Ås, Norway*
[f] *University of Waikato, Private Bag 3105, Hamilton, New Zealand*
[g] *University of Versailles Saint-Quentin-en-Yvelines, 47 Boulevard Vauban, 78280 Guyancourt, France*
[h] *European Forest Institute, Castella 33, 08018 Barcelona, Spain*
[i] *University of Trás-os-Montes e Alto Douro, Avenida Almeida Lucena, 1, 5000–660 Vila Real, Portugal*
[j] *TU Berlin, Straße des 17 Juni. 145, 10623 Berlin, Germany*
[k] *von Thünen Institute, Leuschnerstraße 91, 21031 Hamburg, Germany*
[l] *University of Trento, 5 via Inama, 38122 Trento, Italy*
[m] *University of Warsaw, Dluga 44/50, 00-241 Warsaw, Poland*
[n] *Forest Research and Management Planning Institute, Sos. Stefanesti 128, 077190 Voluntari, Romania*

ARTICLE INFO

Article history:
Received 22 July 2011
Accepted 11 July 2012

JEL classification:
Q51, Q23

Keywords:
Revealed preferences
Stated preferences
Benefit transfer

ABSTRACT

The European COST Action E45 on European Forest Externalities (EUROFOREX) participants developed a set of good practice guidelines for the non-market valuation of forests, elaborating on stated and revealed preference methodologies, as well as benefit transfer and meta-analytical procedures. This article presents a summary of the guidelines.

* Corresponding author.
E-mail addresses: prieram@gmail.com (P. Riera), g.signorello@unict.it (G. Signorello), mara.thiene@unipd.it (M. Thiene), pamahieu@gmail.com (P.-A. Mahieu), stale.navrud@umb.no (S. Navrud), pam98k@yahoo.com (P. Kaval), benedicte.rulleau@iut-velizy.uvsq.fr (B. Rulleau), robert.mavsar@gmail.com (R. Mavsar), lmadurei@utad.pt (L. Madureira), juergen.meyerhoff@tu-berlin.de (J. Meyerhoff), peter.elsasser@vti.bund.de (P. Elsasser), sandra.notaro@unitn.it (S. Notaro), mdesalvo@unict.it (M. De Salvo), si_dragoi@yahoo.co.uk (S. Dragoi).

1104-6899/$ – see front matter © 2012 Department of Forest Economics, Swedish University of Agricultural Sciences, Umeå. Published by Elsevier GmbH. All rights reserved.
http://dx.doi.org/10.1016/j.jfe.2012.07.001

Introduction

The field of non-market valuation originated in the discipline of economics as a tool to assist valuation practitioners estimate the value of goods and services that are not directly traded in markets, incorporating environmental resources, such as forest goods and services. The confluence of economics with other disciplines, including ecology and forestry, makes the application of non-market methodologies distinct. However, this has also resulted in noticeable differences among valuation applications performed by practitioners with an economics background versus those with another background.

Concerned by the lack of common protocols, a group of scientists with diverse backgrounds took the initiative of discussing, and eventually agreeing upon, some good practice protocols. The means to undertake this process was a COST Action called European Forest Externalities (EUROFOREX) or COST Action E45. COST (European Cooperation in Science and Technology) is a European Union framework program instrument supporting cooperation among scientists and practitioners across Europe, however, some non-European members were also invited to participate in the action.

This article highlights the primary points of the good practice non-market valuation guidelines developed by the COST Action E45 team. The article is primarily devoted to practitioners of valuation studies related to forest goods and services, as well as to agencies interested in commissioning a forest valuation study. The first section discusses two types of revealed preference (RP) methods, namely the hedonic pricing (HP) and travel cost (TC) methods. The second section summarizes the stated preference (SP) method guidelines, focussing on the contingent valuation (CV) method and choice modelling (CM) techniques. The third section tackles benefit transfer (BT) and meta-analytical procedures. The last section provides final remarks. The full set of guidelines corresponding to the RP, SP, and BT/meta-analysis is available at http://www.efi.int/portal/projects/cost_e45.

Revealed preferences

This section summarizes the good practice guidelines used to estimate the monetary value of forest externalities by means of RP methods. Based on actual behaviour, these methods can be used to estimate the value of forest goods and services, such as air quality, outdoor recreation, and landscape quality. The most commonly used RP methods include TC and HP, while the defensive expenditure and household production function methods are less popular.

Travel cost method

The TC method investigates the behaviour of individuals in relation to the cost of a trip, observed site characteristics and observed trip patterns. This information is gathered and used to value the characteristics, or existence, of a site-specific environmental amenity. To accomplish this, the TC method estimates values for site-specific amenities, particularly use values that can only be obtained by visiting the site. TC use requires that costs vary across users. The basic TC method consists of two steps: (1) the estimation of demand functions for trips to a site, or group of sites; and (2) the derivation of the willingness-to-pay (WTP) from the demand functions.

An individual's demand is typically modelled as a function of the cost of a trip to the site, the cost of visiting substitute sites, the characteristics of the site (e.g. type of forest), the characteristics of substitute sites, income and other demographic characteristics. The number of trips is expected to decrease with an increase in the cost and augment with an improvement in site quality.

Several TC approaches currently exist. They differ in the way variables are defined and measured, model specifications, estimation procedures and consumer surplus computations. Moreover, if the aim of the practitioner is to value the changes of the characteristics of different sites simultaneously, an appropriate model which handles multiple-sites needs to be specified.

TC models can be implemented for different purposes; therefore, the practitioner needs to have the aim of the study in mind. TC models can be used to value access to sites, e.g. the welfare effects of the closure of a recreational site, or to value the quality characteristics of a site, e.g. change in the level of some site attributes, like the introduction of new tree species.

The following four critical issues are involved in the selection of the TC approach. The first issue assumes that individuals have preferences over recreational amenities and other goods and that they maximize their utility subject to a budget constraint. A practitioner can then begin by assuming a demand function (or a system of demand functions) approach or a utility function approach (Haab and McConnell, 2002). The utility function approach deals with discrete-choice models based on random utility maximization. Bockstael et al. (1987) presented the first application of a random utility model in recreation. Welfare changes are estimated following the modification of the characteristics of the site(s) or the implementation of environmental policy. A second issue relates to whether a practitioner considers all the sites in the investigated area, some sites or just one. A third issue focuses on whether to model participation or not. The last issue deals with modelling the behaviour of individuals or modelling the aggregate behaviour of people living in equally distant zones from the site.

Attending to the participation aspect and the consideration of single or multiple sites, three model approaches can roughly be defined: the single site TC and the Zonal TC model, the site choice model and the site choice and participation model (for a more detailed description, see Bockstael and McConnell, 2007; Haab and McConnell, 2002). The latter is the most complete model and includes both the participation and site-choice models, taking into account the choice of whether to visit the site and the number of visits (Phaneuf et al., 2000; von Haefen et al., 2004). The generalized corner solution approach is attractive because of its consistency with demand theory. The practitioner should consider that estimating a site-choice model, rather than a participation and site-choice model, would provide limited information on the welfare measure of a site or its characteristics (Morey et al., 1993; Morey and Waldman, 1998).

The following steps are relevant in investigating forest externalities by means of TC (Parsons, 2003):

(1) *The definition of the site(s).* (a) The number of sites and their definition in terms of the extension and attributes should ensure that it reflects the real choice set of the respondents. (b) The definition of the forest boundaries should be accurate. (c) The practitioner should ensure enough variation in the quality across sites; excessive homogeneity would prevent the estimation of the quality effect of interest. (d) A large number of well-defined sites, rather than a small number of larger ones, is recommended. If one needs to aggregate, it could be done on the basis of similar characteristics.

    Focusing on the potential of aggregation bias in recreation site choice models, Haener et al. (2004) found that accounting for the size of the aggregate sites in the estimation improves the model fit and alleviates the aggregate parameter bias. A discussion on choice set definition can be found in Phaneuf and Smith (2005). It is also important to note that substitute patterns in outdoor recreation are relevant (Thiene and Scarpa, 2008).
(2) *The target population*. People visiting the site may take a day-trip or stay overnight; generally, it is preferable not to mix one day and two or more day trips in the same analysis.
(3) *Strategy for sampling and model specification*. It is important to be aware of the shortcomings associated with both on-site and off-site sampling.
(4) *Survey implementation*. It is important to make respondents familiar with the issue of the survey, i.e. to let them know about the potential problems affecting the forest (e.g. congestion or lack of services) or a short list of amenities (e.g. the presence of secular trees in the forest). The memory of trips needs special attention, one wishes to make sure respondents recall accurately past trips.
(5) *Multipurpose trips*. It is better to avoid the inclusion of trips with multiple purposes, as the allocation of expenses to purposes other than the primary recreation experience is difficult and questionable.
(6) *Time*. It is important to account for the opportunity cost of time.
(7) *Model estimation and welfare estimates*. Flexible specifications of count models are suggested within the demand function approach. Random utility travel cost models have recently focussed on preference heterogeneity by using either finite or continuous-mixture distributions. Recently introduced in outdoor recreation, the specification of utility in the WTP space is suggested, because it allows for the estimation of the distributions of the WTPs directly, rather than deriving them indirectly, as in the traditional setting of the utility in the preference space (Scarpa et al., 2008; Thiene and Scarpa, 2009).

Hedonic pricing method

The HP method focuses on market transactions for differentiated goods to estimate the economic values associated with environmental amenities (or disamenities), such as proximity to recreational site or aesthetic views (Paterson and Boyle, 2002). HP is commonly applied to variations in housing prices that reflect the value of local environmental attributes (Taylor, 2003). As a consequence, this method is suitable for investigating the influence of a nearby forest on house prices.

The basic premise of the HP method is that the price of a marketed good is related to its characteristics, or the services it provides. For example, the price of a house reflects the characteristics of the property (e.g. size, appearance, features) and the characteristics of the surrounding neighbourhood (e.g. accessibility to a forest, park, school, hospital).

The analysis proceeds in two stages. The first stage estimates the HP function by analysing the prices of a market good and its characteristics. In this way, the implicit prices of the characteristics of the good and the structure of the preferences can be obtained. The second stage estimates the demand functions for the characteristics of the good by using the implicit prices obtained during the first stage (Taylor, 2003). Bockstael and McConnell (2007) emphasize the difference in terms of the welfare effects between marginal and discrete changes in attributes within a policy context.

Estimating HP functions typically involves collecting data (e.g. property values, property attributes, environmental quality attributes); sampling; estimating the model; and estimating the welfare measures. When conducting an HP analysis, the source and selection of the data are crucial for property values (e.g. market or rental prices), property attributes (e.g. quality of services, logistics and location) and environmental quality attributes, as they can give rise to a potential bias in the estimation. The choice of the functional form for the HP function can substantially impact the results (Taylor, 2003).

Stated preferences

SP methods typically simulate a market where a good, or bundle of goods, is offered at a given price. To accomplish this, people in a targeted population are asked to complete a questionnaire. A statistical procedure is then applied to the obtained data to estimate the representative maximum WTP, or less frequently, the minimum willingness-to-accept (WTA). Non-use values can be estimated with SP methods; this aspect represents one of its advantages over RP methods.

SP methods are generally grouped into two categories: CV and CM methods. In CV surveys, people are presented with a hypothetical change in the provision of a good or service and are asked to state their WTP (or WTA) for the change. In CM surveys, respondents are faced with several alternatives, generally including the status quo, and are asked to pick their most preferred alternative from the choice set (choice experiment), or to rank (contingent ranking), rate (contingent rating), or group (contingent grouping) the given alternatives. They can also be asked to successively indicate their best and worst alternative from the choice set (best–worst approach).

The preparation of a valuation survey is a long and complex process. If it is not carried out properly, the survey results might not be fully reliable, regardless of the effort invested in data treatment. Several basic steps in the survey creation process should be followed and several issues are to be considered with care.

Basic steps

The first crucial step is to determine the goal of the survey. In relation to survey development, a practitioner needs to be specific in question wording. For example, “prohibiting” access to a forest for 2 years is different from “limiting” access to a forest for 2 years. Another important step is choosing between the use of CV and CM. This depends on several criteria, such as the study aim and the nature of the change. When a change is multi-dimensional, CM may be preferred over CV, because attribute-specific welfare measures can be derived.

The next step is determining how to conduct the survey: in-person, on the phone, through the mail or via the Internet. This choice depends on the population of interest, characteristics of the sample,

types of questions, response rate, cost and time available. For example, in-person surveys are more in-depth and may collect more information than email surveys, but are also more expensive and time consuming (Bateman et al., 2002; Champ et al., 2003).

It is recommended that focus groups and pre-tests be conducted before the final survey is administered. Focus groups, where individuals get together to discuss survey questions, ensure that the questionnaire is well understood, correctly worded, and has a credible scenario. Once the questionnaire has been modified according to the focus group comments, the questionnaire is tested on a larger scale. During this 'pre-test' stage, debriefing questions are often used to detect anomalies, such as large numbers of protest answers for a specific question, which may be an undesired result. After adjustments to the questionnaire are conducted to attempt to alleviate this issue, other pre-tests and pilot surveys can be undertaken.

The target population for the final survey should then be correctly defined. The target population generally corresponds to those people who may benefit from the good in question. If a survey involves the recreational activities of a forest located in Spain, the sample might include the actual and potential users of that particular forest. In addition, the sample size should be correctly defined. The sample size will depend on the valuation task used, as well as the precision of the welfare estimates a practitioner strives to reach.

Null alternative

In the questionnaire, it should be clear to the respondent what would happen if the change does not take place. When an afforestation program is valued, some participants may think that the forest would naturally shrink if the program is not implemented, while others may imagine that it would naturally expand. This may render the responses to be difficult to interpret, as people may not value the same change. As a result, care must be taken to describe the status quo, or business-as-usual situation. When possible, in CM surveys, the status quo can be described in the same fashion as the other alternatives, with the level of each attribute being provided. In CV surveys, the status quo situation can be made explicit by describing what would happen if the program is not implemented.

In CM, welfare estimates of the value of supply changes are not consistent with economic theory when the status quo is not available, as the results will reflect conditional demand. An issue related to the status quo is the so-called "status quo bias," which refers to an unduly high number of people favouring the status quo. This bias may occur when a high cognitive burden is placed upon the respondents; in this case, the status quo may be perceived as an easy way out.

Payment card and delivery conditions

The payment vehicles in a survey, which may include taxes, entrance fees and donations, should be realistic (e.g. it might not be realistic in many countries to ask about entrance fees to a forest that currently has no entrance fees). The payment vehicle should also be relevant. If part of the target population does not pay income tax, funding the program through a 10% increase in income tax might not be relevant.

The frequency of the payment must be provided. A lump sum payment and an annual payment for, say 10 years, may lead to different WTP statements. In addition, it should be clear whether the cost of the program is supported by the household or the respondent. If there are other contributors, they should be mentioned. For instance, part of the cost could be supported by the households, while the other part supported by private forest owners. In this case, the repartition details must be provided.

The decision rule should then be stipulated. For example, the program could be implemented as long as the majority of people would pay the cost amount. Finally, it should be specified as to who will deliver the good, as well as when, where, and how it will be delivered. As an example of illustrating the "where", it is believed that people may state higher amounts if the afforestation program takes place near their house, rather than far away from it.

Willingness-to-pay or willingness-to-accept compensation

WTP refers to the maximum amount of money an individual would pay to obtain a good or amenity (or not to lose it), while WTA refers to the minimum amount of money an individual would ask to cede a good (or give up the right to use it). In theory, these two measures should lead to comparable results when marginal changes in supply are being assessed and when the monetary value represents a low share of people's income, as in most surveys. In practice, WTA estimates are often at least two times greater than the corresponding WTP estimates (Horowitz and McConnell, 2002). More detailed explanations can be found in Brown and Gregory (1999).

Valuation function

The determinants of WTP are often explored in valuation studies to check the validity of the results. Therefore, we are referring to a valuation function in a broad sense which is the regression model that relates the WTP or an indicator of it (a yes/no answer in the closed-ended elicitation schemes) with variables, such as attitudinal experience, with the good and the socioeconomic characteristics of the respondents.

Theoretical validity can be checked by analysing some of the variables, such as the income and attributes of the good's quality or quantity. Attitudinal variables can also be used to check data quality, for instance, when the change valued is an increase in forest biodiversity, individuals with pro-environmental behaviour, like being involved in conservation organizations or practicing eco-tourism, are expected to state a higher WTP than the average respondent. Other validity aspects, such as the scope effect, can also be tested. This potential bias relates to the lack of sensitivity of WTP to the provision of the good, for example, where a person may value a small forest area the same as a larger area of the same forest type.

Estimating the valuation function for validity testing purposes requires two main steps: (1) The missing values should be considered, and (2) the explanatory variables should be selected. The most important explanatory variables, from a theoretical point of view, are generally included, regardless of their actual influence on WTP (such as income), while less important candidates are included, as long as their influence on WTP is statistically significant. Note that a stepwise approach may be used for the latter (Carson et al., 2003) and that the explanatory power of the validity function is also an indicator of data quality.

When specified as direct relationship between WTP and its determinant variables, the valuation function can be a useful tool for benefit transfer purposes.

Hypothetical bias and scope effect

Hypothetical bias and the scope effect are the primary biases, or threats, to the validity of a WTP estimate (Bonnieux and Desaigues, 1998). Hypothetical bias, or the difference between hypothetical and real values, corresponds with the tendency to overestimate WTP. It can be detected by placing part of the participant's answers in a hypothetical setting and part in a real setting, after which, these values are then compared with the stated WTP. Several approaches exist to conduct this testing; some aim at mitigating the bias through questionnaire design, while others aim at calibrating answers.

Cheap talk (Cummings and Taylor, 1999) and consequentialism (Cummings and Taylor, 1998) belong to the first category. Cheap talk warns participants about the tendency to overestimate WTP just before they are presented with the valuation question, while consequentialism attempts to make the participants believe that their responses could have actual consequences. Empirical evidence tends to suggest that the latter approach is more effective than the former (e.g. Bulte et al., 2005).

The second category of instruments consists of calibrating the answers. A certainty scale ranging from 0 to 10 is sometimes included after the valuation question, where the "yes" respondents, who may be unsure about their answers, as suggested by their certainty scores, are treated as "no" respondents (Champ et al., 1997).

A scope effect problem occurs when, for instance, respondents state the same WTP for an afforestation program of 10 and 1000 hectares. A common way to detect this phenomenon is to vary the

provision of the good between participants and check whether different WTP's are stated. The scope effect can be mitigated through questionnaire design, as argued by Carson (1995) page 3, who stated that the respondents must: "(i) clearly understand the characteristics of the good (...) (ii) find the CV scenario elements related to the good's provision plausible, and (iii) answer the CV question in a deliberate meaningful manner".

Specific factors for contingent valuation

Several elicitation questions are available to the practitioner, differing with respect to their incentives for strategic behaviour, the information they convey and collect from respondents, the sample size and the econometric approach. In the open-ended question format, people directly state their WTP for the change in the provision of the good. This format is highly informative and the statistical approach is straightforward. However, it places a large cognitive burden upon the participants, favouring a larger number of protest responses and outliers. This format is infrequently utilized, given the pros and cons of this and alternative formats.

When using a single dichotomous choice format, people are assigned a unique bid amount and asked to state "yes" or "no," as to whether they would be willing to pay (or willing to accept) the specific payment amount. This single bounded format only provides information on whether the WTP of each individual is above or below a given amount. To collect more information, a higher, or lower, bid amount is sometimes assigned, depending on the first response (double-bounded format). If the two responses are not found to be consistent, an investigation can be conducted by comparing the WTP distributions issued during the first and second responses (McFadden, 1994). To overcome the possible inconsistency, some practitioners advocate for the one-and-half bounded dichotomous choice question, where only part of the respondents – the "yes" respondents – are assigned a second bid (Cooper et al., 2002).

With a payment card, a series of bid amounts are presented to the participants, who are then asked to state either the highest amount that they would pay or the amounts they surely would pay and surely would refuse to pay; the latter procedure is sometimes referred to as a two-way payment ladder (Hanley et al., 2009). These approaches also have some shortcomings in that the choice of the bid amounts, especially the lowest and highest amounts, may influence the welfare estimates (Rowe et al., 1996). The presentation of the amounts, either in ascending or descending order, may also influence the welfare estimates (Alberini et al., 2003).

As can be seen, the bid amounts for the dichotomous choice and payment card formats should be chosen with care. The number of different bid amounts should be relatively small (often between 5 and 8) when using single or double-bounded dichotomous choice questions. It should also be close to the median WTP, i.e. where most people's WTP lie, not at the tails of the distribution (Hanemann, 1999). On the other hand, when using the payment card method, the bid amounts should not be clustered around the median, but should include high and low bid amounts (Boyle, 2003). When attempting to determine the bid amounts, the focus group and pre-test stages can be of great help. In these stages, it is not uncommon to use an open-ended elicitation question to obtain information about the WTP distribution.

Specific factors for choice modelling

The valuation methods used in CM studies differ with respect to the information collected and their ability to produce consistent welfare estimates. Contingent rating collects a large amount of information, because respondents assign a score to each alternative, but does not lead to consistent welfare estimates and may be cognitively burdensome. On the contrary, choice experiments produce consistent welfare estimates, but collect less information. Contingent ranking does yield consistent welfare estimates under some conditions (Hanley et al., 2001), but is more demanding for respondents than choice experiments. The best–worst approach produces more information than choice experiments, but is more cognitively demanding (Louviere and Islam, 2008).

In CM, a series of decisions has to be made regarding the number of attributes, alternatives and choice cards, as well as the levels of attributes. Including a large number of attributes is appealing,

because of the amount of information collected. Nevertheless, this comes at a cost, as the quality of the data might be low due to the cognitive burden placed upon the participants. The same issue applies when increasing the number of choice cards or the number of alternatives. Finally, the number of attribute levels should depend on the relationship between the attributes and utility. If the relationship is expected to be linear, two levels may be sufficient (Hensher et al., 2005).

Another important decision is whether to use labelled or unlabelled alternatives. The alternatives are said to be unlabelled when the name, or expression, attached to the alternative conveys no information. "Program A" and "Program B" are not informative, but "Recreation" and "Nature conservation" can be. According to Blamey et al. (2000), the choice depends on the study aim. When the attribute values or marginal rates of substitution are estimated, generic alternatives may be preferred. On the other hand, when the total WTP for a given policy value is estimated, the labelled approach may be preferred.

The choice card design should be considered jointly with the experimental design. A "full factorial design" includes all possible combinations between attribute levels. The number of combinations increases quickly when the number of attributes increases. A "fractional factorial design" limits the number of combinations, but implies some drawbacks. While a "full factorial design" allows the practitioner to investigate the parameter estimates for the primary effects and all possible interactions between them; this is not the case with a "fractional factorial orthogonal design," which generally only focuses on the main effect. The same problem applies when using an "efficient design": the practitioner has to decide whether interactions will be allowed in the estimation stage. In forestry applications, interactions between attributes have often been ignored. However, Giergiczny and Riera (2010) find, based on an empirical forestry application that two-way interactions account for a significant part of the choice, and therefore, should be included.

Benefit transfer and meta-analysis

BT involves transferring value estimates from previous studies (often termed study sites) of similar changes in environmental quality to value the environmental change at the policy site. While the term BT seems to be dominating the literature in this area, it is sometimes referred to as value transfer. The most frequent use of BT is in the cost–benefit analysis of projects and policies, but it is also applied in environmental accounting, damage assessment and the like. There are two main groups of BT techniques (Navrud, 2004): (1) unit value transfer, which includes a simple ("naïve") unit value transfer and a unit value transfer with income adjustments; and (2) function transfer, including the benefit function transfer and meta-analysis.

Unit value transfer

A simple (naïve) unit transfer (i.e. from one study, or as a mean value estimate from several studies) is the simplest approach to transferring benefit estimates from a study site, or as a mean from several study sites, to the policy site. This approach assumes that the well-being experienced by an average individual at the study site is the same as will be experienced by the average individual at the policy site, and that the change in the environmental amenity being valued is the same at the two sites. Thus, we can directly transfer the benefit estimate, often expressed as a mean WTP/household-year, or as consumer surplus per visitor day or per visitor year for recreational use values, from the study site to the policy site.

A problem with the simple unit value transfer for recreational activities is that individuals at the policy site may not value recreational activities the same as the average individual at the study sites. There are two principal reasons for this difference. First, people at the policy site might be different from the individuals at the study site in terms of income, education, religion, ethnic group and/or other socio-economic characteristics that affect their demand for recreation. Second, even if individual preferences for recreation at the policy and study sites were the same, the recreational opportunities (i.e. substitute sites and activities) and the change in the good valued might not be.

Unit values for non-use values, e.g. environmental amenities, from CV studies might be more difficult to transfer than recreational use values for at least two reasons. Firstly, the unit of transfer is

more difficult to define. While the obvious choice of the unit for use values might be consumer surplus per activity day or year, for instance, there is greater variability in reporting non-use values from CV surveys, both in terms of WTP for whom, and for what, time period. WTP can be reported as per household or per individual, and as a one-time payment, annually for a limited time period, annually for an indefinite time, or as an indefinite monthly payment. Secondly, the WTP is reported for one or more specified discrete changes, like forest ecosystem services, and not on a marginal basis (e.g. per hectare).

It is advisable to use the WTP/household-year as the transfer unit when possible and then aggregate it over the total number of affected households to obtain an estimate of total benefits. Transferring the WTP/individual-year might lead to the overestimation of total benefits when aggregated over individuals (Lindhjem and Navrud, 2009). WTP, as a one-time amount, might lead to an underestimation of annual WTP, as reported WTP will be the present value of a flow of annual WTP amounts and will be constrained by the respondents' income in the year they report their one-time WTP amount. Using this transfer unit for a specified change in environmental amenities also avoids the procedure of scaling up, or down, the reported WTP in relation to the size of the area at the policy site. Such scaling assumes a constant value per hectare and linearities in valuation, which often does not seem to be the case in practice (Lindhjem, 2007; Lindhjem and Navrud, 2008).

The simple unit value transfer approach is not advisable for transfers between countries or regions with large income and cost of living differences, because the differences in the budget constraints may lead to a biased BT result. To conduct this operation properly, a unit transfer with income adjustments should be applied, using income elasticities for WTP between 0 and 1 (Kristrom and Riera, 1996). When there is a lack of income data for the affected populations at the policy and study sites, gross domestic product (GDP) per capita figures can be used as proxies for income in international BT. However, this approach may incorrectly estimate the results for the international BT when income levels at the local study and/or policy site deviate from the average country income level.

Using official exchange rates to convert transferred estimates from the value at the study site, such as U.S. dollars, to the national currency, does not reflect the true purchasing power of the currencies, since the official exchange rates also reflect political and macroeconomic risk factors. Thus, purchasing power parity, otherwise called adjusted exchange rates, should be used when transferring values from other countries.

Function transfer

Transferring the entire benefit function is conceptually/theoretically more appealing than just transferring unit values, because more information is effectively taken into account in the transfer. However, transfer evidence is mixed in regard to whether function transfers perform better than unit value transfers (Bateman et al., 2009; Ready et al., 2004), but in many instances, the benefit function transfer does not seem to reduce transfer errors significantly, compared to a simple (naïve) unit value transfer. The benefit relationship to be transferred from the study site(s) to the policy site could be estimated using either of the RP approaches, like the TC and HP methods, or the SP approaches, like the CV and CM methods.

To implement this approach, the analyst would need to locate a study in the existing literature, such as a SP study expressing WTP as a function of the characteristics of an environmental good and the socio-economic variables of the households valuing the change in the environmental good. Then the analyst would have to collect data on these two groups of independent variables at the policy site, insert their mean values into the benefit function, and use the same coefficients as those at the study site to estimate the mean household WTP at the policy site.

Instead of transferring the benefit function from one selected valuation study, results from several valuation studies could be combined in a meta-analysis to estimate one common benefit function (see Lindhjem, 2007; Zandersen and Tol, 2009 for a meta-analysis of forest externalities). The meta-analysis enables the researcher to evaluate the influence of a wider range of characteristics of the environmental good, the features of the samples used in each analysis (i.e. including characteristics of the population affected by the change in environmental quality), and the modelling assumptions. In practice, however, detailed characteristics of the good/study site and the population are often not

reported in the primary studies. The regression equation for a meta-analysis would look similar to a benefit function, but with a third group of independent variables reflecting the differences in the environmental valuation method applied; meta-analyses typically find that differences in valuation methodologies account for a significant part of the variation in the mean WTP across studies.

Due to the failure of existing databases to report the results of primary studies in terms of all determinants/variables necessary to conduct a valid value transfer, COST E45 has begun to develop a separate, detailed database for non-market environmental goods in forests. They populated it with studies from selected European countries. The determinants of the database have been developed, and the studies from Austria, France, Germany and Switzerland have been added (Elsasser et al., 2009; http://www.bfafh.de/DB_forestvalues.htm).

Based on the few existing general guidelines for BT/value transfer, we developed an 8-step set of guidelines for the transfer of non-timber forest benefits for use in cost–benefit analysis and other policy analyses: (1) identify the change in the environmental good to be valued at the policy site; (2) identify the affected population at the policy site, including size and socioeconomic characteristics; (3) conduct a literature review to identify relevant primary studies, preferably based on a database, but also supplemented by journal and general web searches; (4) assess the relevance/similarity and quality of study site values for possible transfer; (5) select and summarize the data available from the study site(s); (6) transfer value estimate(s) or value functions from the study site(s) to the policy site; (7) calculate total benefits or costs; and (8) assess the uncertainty and transfer error, including a sensitivity analysis.

A unit value transfer from a potential study site seems recommendable solely when that site is extremely similar to the policy site; based on a comparison of the selected site and the population characteristics. It is also advisable to compare this transferred value with the outcome of transfers based on meta-analyses to determine if they are within the same range. The transferred value should be a range, rather than a point, estimate. The following accompanying transfer errors, depending on the level of similarity, can be taken into account: ranging from +20% for cases where the primary study is a perfect fit for the policy being analysed through +40% and 100% to "not acceptable for BT". These errors are based on a review of general BT tests (Navrud and Ready, 2007), specifically for forest externality studies (Bartczak et al., 2008). Note that these transfer errors have to be added to the uncertainty in the primary studies due to sampling procedures, survey modes, and valuation methods.

Additional remarks

The aggregation of use and non-use aspects is often called the "Total Economic Value" (TEV). TEV does not need to refer to an entire forest, it can just refer to a change in the recreational facilities or a change in the amount of carbon sequestered annually. Some forest valuation studies explicitly estimate the TEV by independently accounting for a plethora of values which can then be aggregated. This is a procedure with many potential problems and has to be applied with much caution. A common problem is that separately valuing the different values, be them use or non-use, may lead to some double counting, or might ignore the consumers' budgetary constraints. Another common problem is that there might be interaction effects. For instance, picking mushrooms and 4-wheel driving in forests may separately be valued positively, but if allowed simultaneously, the joint value might be negative, as mushroom pickers may not want to see 4-wheel drivers and vice versa. An alternative is to base the analysis on the social value, which refers to the same overall value, but emphasizes externalities. However, social value estimations also have their difficulties (Riera, 2008).

Forest related measures are often expressed in units per hectare or other similar units (e.g. mean standing tree volume in cubic meters/hectare, production of mushrooms/hectare). It is also tempting to refer to non-market values as surface units, like Euros/hectare for biodiversity conservation or recreation. What may be generally wrong with this approach is to scale the entire value from those unitary values. For example, if a recreational valuation study of a forest of 100 hectares estimates an overall WTP of 500,000 Euros, and therefore, 5000 Euros/ha, a forest with similar characteristics, but of 1000 ha, may not necessarily have a value of 5 million Euros. Similarly, the loss of 10 ha of a 100 ha forest would not necessarily imply a recreational loss of 50,000 Euros.

Forests also have some attributes that are typically subject to satiation in people's preferences. An example is tree composition in mixed forests. Some people might like oak trees (*Quercus* spp.), but may not like to have an entire forest be 100% composed of this species, as they may like to see diversity in forest species. The same could apply to tree density or the proportion of mature trees. When satiation is likely to occur and the marginal values of those attributes are to be obtained, the statistical analysis should take this into account.

Another specificity related to forests is that their rotation may take several decades. Oftentimes, WTP estimates are stated in annual terms or indefinitely. When this is the case, it is relevant to state whether the payment would increase with inflation or would remain unaltered. In SP applications, some respondents interpret payments as increasing with inflation, while others do not. Studies with annual values should clarify this issue.

A good standard in reporting the details surrounding the results of a valuation study may be crucial for a cost–benefit analysis, forest management, policy design, or BT consideration. When reporting results, the change being assessed should be clear. For instance, a specific amount of hectares for a particular type of forest should be managed with particular timing and in a particular manner. The payment conditions should also be clear, including the year(s) of the payment and who will have to pay, i.e. individuals over a certain age, families, residents in a given territory, visitors, or mushroom pickers, according to the amount picked, for example.

Acknowledgments

The authors acknowledge the contribution of all participants in COST Action E45 http://www.cost.esf.org/domains_actions/fps/Actions/E45, as well as the economic support of COST.

References

Alberini, A., Boyle, K., Welsh, M., 2003. Analysis of contingent valuation data with multiple bids and response options allowing respondents to express uncertainty. Journal of Environmental Economics and Management 45 (1), 40–62.

Bartczak, A., Lindhjem, H., Stenger, A., 2008. Review of benefit transfer studies in the forest context. In: Scandinavian Forest Economics 42 Proceedings of the Biennial Meeting of the Scandinavian Society of Forest Economics, Lom, Norway, 6–9 April 2008, pp. 2276–2304.

Bateman, I.J., Brouwer, R., Ferrini, S., Schaafsma, M., Barton, D., Dubgaard, A., Hasler, B., Hime, S., Liekens, I., Navrud, S., De Nocker, L., Sceponaviciute, R., Semeniene, D., 2009. Quantifying and valuing the non-market benefits of water quality improvements across Europe: a multi-country common valuation design implementation and tests of benefits transfer for the water framework directive. Paper Presented at the Envecon 2009: Applied Environmental Economics Conference, London.

Bateman, I.J., Carson, R.T., Day, B., Hanemann, M., Hanley, N., Hett, T., Jones-Lee, M.W., Loomes, G., Mourato, S., Ozdemiroglu, E., Pearce, D.W., Sugden, R., Swanson, J., 2002. Economic Valuation with Stated Preference Techniques: A Manual. Edward Elgar, 458 pp.

Blamey, R.K., Bennett, J.W., Louviere, J.J., Morrison, M.D., Rolfe, J., 2000. A test of policy labels in environmental choice modelling studies. Ecological Economics 32 (2), 269–286.

Bockstael, N.E., Hanemann, M.W., Kling, C.L., 1987. Estimating the value of water quality improvements in a recreational demand framework. Water Resources Research 23 (5), 951–960.

Bockstael, N.E., McConnell, K.E., 2007. Environmental and Resource Valuation with Revealed Preferences: A Theoretical Guide to Empirical Models. Springer, 374 pp.

Bonnieux, F., Desaigues, B., 1998. Economie et politique de l'environnement. Dalloz, 328 pp.

Boyle, K.J., 2003. Contingent valuation in practice. In: Champ, P.A., Boyle, K.J., Brown, R.E. (Eds.), A Primer on Nonmarket Valuation. Kluwer Academic Publishers, pp. 111–169.

Brown, T.C., Gregory, R., 1999. Why the WTA-WTP disparity matters. Ecological Economics 28 (3), 323–335.

Bulte, E., Gerking, S., List, J.A., de Zeeuw, A., 2005. The effect of varying the causes of environmental problems on stated WTP values: evidence from a field study. Journal of Environmental Economics and Management 49 (2), 330–342.

Carson, R.T., 1995. Contingent Valuation Surveys and Tests of Insensitivity to Scope. University of California. Available at: http://www.econ.ucsd.edu/~rcarson/papers/gscope.pdf.

Carson, R.T., Mitchell, R.C., Hanemann, M., Kopp, R.J., Presser, S., Ruud, P.A., 2003. Contingent valuation and lost passive use: damages from the Exxon Valdez oil spill. Environmental and Resource Economics 25 (3), 257–286.

Champ, P.A., Bishop, R.C., Brown, T.C., McCollum, D.W., 1997. Using donation mechanisms to value non-use benefits from public goods. Journal of Environmental Economics and Management 33 (2), 151–162.

Champ, P.A., Boyle, K.J., Brown, R.E. (Eds.), 2003. A Primer on Non-market Valuation. Kluwer Academic Publishers.

Cooper, J.C., Hanemann, M., Signorello, G., 2002. One-and-one-half-bound dichotomous choice contingent valuation. Review of Economics and Statistics 84 (4), 742–750.

Cummings, R.G., Taylor, L.O., 1998. Does realism matter in contingent valuation surveys? Land Economics 74 (2), 203–215.

Cummings, R.G., Taylor, L.O., 1999. Unbiased value estimates for environmental goods: a cheap talk design for the contingent valuation method. American Economic Review 89 (3), 649–665.

Elsasser, P., Meyerhoff, J., Montagne, C., Stenger, A., 2009. A bibliography and database on forest benefit valuation studies from Austria, France, Germany and Switzerland: a possible base for a concerted European approach. Journal of Forest Economics 15 (1–2), 93–107.
Giergiczny, M., Riera, P., 2010. The importance of interactions. Three policy relevant applications. Paper Presented at the 6th COST E45 Conference, Porto, Portugal.
Haab, T.C., McConnell, K.E., 2002. Valuing Environmental and Natural Resources: The Econometrics of Non-market Valuation. Edward Elgar, 326 pp.
Haener, M.K., Boxall, P.C., Adamowicz, W.L., Kuhnke, D.H., 2004. Aggregation bias in recreation site choice models. Land Economics 80 (4), 561–574.
Hanemann, M., 1999. Welfare analysis with discrete choice models. In: Herriges, J.A., Kling, C.L. (Eds.), Valuing Recreation and The Environment: Revealed Preference Methods in Theory and Practice. Edward Elgar, pp. 33–64.
Hanley, N., Kristrom, B., Shogren, J.F., 2009. Coherent arbitrariness: on value uncertainty for environmental goods. Land Economics 85 (1), 41–50.
Hanley, N., Mourato, S., Wright, R.E., 2001. Choice modelling approaches: a superior alternative for environmental valuation? Journal of Economic Surveys 15 (3), 435–462.
Hensher, D.A., Rose, J.M., Greene, W.H., 2005. Applied Choice Analysis: A Primer. Cambridge University Press, 717 pp.
Horowitz, J.K., McConnell, K.E., 2002. A review of WTA/WTP studies. Journal of Environmental Economics and Management 44 (3), 426–447.
Kristrom, B., Riera, P., 1996. Is the income elasticity of environmental improvements less than one? Environmental and Resource Economics 7 (1), 45–55.
Lindhjem, H., 2007. 20 years of stated preference valuation of non-timber benefits from Fennoscandian forests: a meta-analysis. Journal of Forest Economics 12 (4), 251–277.
Lindhjem, H., Navrud, S., 2008. How reliable are meta-analyses for international benefit transfers? Ecological Economics 66 (2–3), 425–435.
Lindhjem, H., Navrud, S., 2009. Asking for individual or household willingness-to-pay for environmental goods? Environmental and Resource Economics 43 (1), 11–29.
Louviere, J.J., Islam, T., 2008. A comparison of importance weights and willingness-to-pay measures derived from choice-based, constant sum scales and best–worst scaling. Journal of Business Research 61 (9), 903–911.
McFadden, D., 1994. Contingent valuation and social choice. American Journal of Agricultural Economics 76 (4), 689–708.
Morey, E.R., Rowe, R.D., Watson, M., 1993. A repeated nested-logit model of Atlantic salmon fishing. American Journal of Agricultural Economics 75 (3), 578–592.
Morey, E.R., Waldman, D.M., 1998. Measurement error in recreation demand models: the joint estimation of participation, site choice, and site characteristics. Journal of Environmental Economics and Management 35 (3), 262–276.
Navrud, S., 2004. Value transfer and environmental policy. In: Tietenberg, T., Folmer, H. (Eds.), The International Yearbook of Environmental and Resource Economics 2004/2005. A Survey of Current Issues. Edward Elgar, pp. 189–217.
Navrud, S., Ready, R.C. (Eds.), 2007. Environmental Value Transfer: Issues and Methods. Kluwer Academic Publishers.
Parsons, G.R., 2003. The travel cost method. In: Champ, P.A., Boyle, K., Brown, C.M. (Eds.), The Economics of Non-market Goods and Resources: A Primer on Nonmarket Valuation. Kluwer Academic Publisher, pp. 269–329.
Paterson, R.W., Boyle, K.J., 2002. Out of sight, out of mind? Using GIS to incorporate visibility in hedonic property value models. Land Economics 78 (3), 417–425.
Phaneuf, D.J., Kling, C.L., Herriges, J.A., 2000. Estimation and welfare calculations in a generalized corner solution model with an application to recreation demand. The Review of Economics and Statistics 82 (1), 83–92.
Phaneuf, D.J., Smith, V.K., 2005. Recreation demand model. In: Maler, K.G., Vincent, J. (Eds.), Handbook of Environmental Economics: Valuing Environmental Changes. Elsevier, pp. 671–761.
Ready, R., Navrud, S., Day, B., Dubourg, R., Machado, F., Mourato, S., Spanninks, F., Rodriquez, M.X.V., 2004. Benefit transfer in Europe: how reliable are transfers between countries? Environmental and Resource Economics 29 (1), 67–82.
Riera, P., 2008. Total economic value or social value? Paper Presented at the 4th COST E45 Conference, Cork, Ireland, September 22–24.
Rowe, R.D., Schulze, W.D., Breffle, W.S., 1996. A test for payment card biases. Journal of Environmental Economics and Management 31 (2), 178–185.
Scarpa, R., Thiene, M., Train, K., 2008. Utility in WTP space: a tool to address confounding random scale effects in destination choice to Alps. American Journal of Agricultural Economics 90 (4), 994–1010.
Taylor, L.O., 2003. The hedonic method. In: Champ, P.A., Boyle, K.J., Brown, T.C. (Eds.), A Primer on Non-market Valuation. Kluwer Academic Publishers, pp. 331–394.
Thiene, M., Scarpa, R., 2008. Hiking in the Alps: exploring substitution patterns of hiking destinations. Tourism economics 14 (2), 263–282.
Thiene, M., Scarpa, R., 2009. Deriving and testing efficient estimates of WTP distributions in destination choice models. Environmental and Resource Economics 44 (3), 379–395.
von Haefen, R., Phaneuf, D.J., Parsons, G.R., 2004. Estimation and welfare analysis with large demand systems. Journal of Business and Economic studies 22 (2), 194–205.
Zandersen, M., Tol, R.S.J., 2009. A meta-analysis of forest recreation values in Europe. Journal of Forest Economics 15 (1–2), 109–130.