Valuing Environmental Impacts: Practical Guidelines for the Use of Value Transfer in Policy and Project Appraisal

Executive Summary – Technical Report

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eftec
73-75 Mortimer Street
London W1W 7SQ
tel: 44(0)2075805383
fax: 44(0)2075805385
eftec@eftec.co.uk
www.eftec.co.uk

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Report prepared for the Department for Environment, Food and Rural Affairs

by:

Economics for the Environment Consultancy (eftec)
73 – 75 Mortimer St, London, W1W 7SQ
Tel: 020 7580 5383
Fax: 020 7580 5385
www.eftec.co.uk

Study team (in alphabetical order):

Ian Bateman (University of East Anglia)
Roy Brouwer (Institute for Environmental Studies, VU University, Amsterdam)
Matthew Cranford (eftec)
Stephanie Hime (eftec)
Ece Ozdemiroglu (eftec)
Zara Phang (eftec)
Allan Provins (eftec)

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EXECUTIVE SUMMARY

ES1. Background

Value transfer (which is also known as 'benefits transfer') is a process of using secondary valuation evidence sourced from previously undertaken studies to apply to a new decision-making context. Its particular appeal lies in it being a quicker and lower cost approach compared to the alternative of specifically commissioning a primary valuation study. There is, however, a degree of uncertainty and potential for error inherent within the value transfer process. This arises from reliance on expert judgement in identifying and applying suitable valuation evidence in different contexts and also in some cases a lack of suitable studies from which to source valuation evidence.

This report and the accompanying *Value Transfer Guidelines* focus on the use of value transfer in appraisal and provide guidance for improving the quality and accuracy of valuing environmental impacts.

ES2. Objective

The objective of the Technical Report is to review and define best practice for value transfer. This includes reviewing key technical issues – for example the application of geographical information systems (GIS) in value transfer - and providing recommendations that inform the Value Transfer Guidelines.

In reviewing best practice, there is a need to reconcile the 'state of the art' with the practical use of value transfer by analysts tasked with appraising environmental impacts. The state of the art is typically driven by developments in academic research and as demonstrated in this report can involve sophisticated analysis. Where these developments improve the accuracy of value transfer there is a clear need for practical application to be based on such best practice principles. However, appraisal effort is governed by both time and resource constraints, meaning that the state of the art is not always feasible. There are also instances where greater uncertainty in evidence can be accommodated in decision-making, implying that less sophisticated, but still robustly implemented, analysis is sufficient.

ES3. Overview of requirements for value transfer

Value transfer is applicable to a wide range of both market priced and non-market goods. The transfer of values for market priced goods is typically straightforward and much attention instead focuses on the potential for undertaking transfers for non-market goods such as those provided by the environment. The typical application is one in which willingness to pay (WTP)[1] estimates from a previously undertaken study (the 'study good') are transferred to some policy context concerning a proposed change in provision of the good in question (the 'policy good'). The change in provision of the policy good could be a change in quality (e.g. water quality), quantity (e.g. the size of a protected area) or access (e.g. provision of visitor facilities at a woodland site).

[1] Willingness to pay (WTP), either in terms of WTP for a gain in provision or WTP to prevent a loss in provision, is the most commonly estimated measure of the value of environmental goods and services.

Estimating the total value of some provision change for an environmental good requires that three essential questions are addressed:

i). *What is the change in provision of the good in question*: understanding the change in the quantity and/or quality of the good, as determined by relevant scientific and technical assessments, is an essential precursor to value transfer analysis.

ii). *How valid and robust is the available economic valuation evidence*: assessment of the quality of source valuation evidence should be informed by three broad categories of validity test:
- *Scope sensitivity:* are valuations responsive to the scale (or 'scope') of the provision change under assessment; i.e. WTP should not fall as the scope of a good increases (put simply 'more' is better than 'less' subject to satiation).
- *Tests of theoretically derived expectations:* economic theory establishes prior expectations which can be tested for; for example it is expected that WTP will increase with an individual's income and fall as the availability of substitutes increases.
- *Procedural invariance:* economic theory suggests that WTP should not vary due to 'irrelevant factors' related to the methodology used to estimate it. For example, in stated preference studies, tests of 'procedural invariance' can be useful indicators of whether respondents hold well-formed preferences characteristic of valid economic values or are simply 'constructing' those preferences with respect to the ad-hoc heuristics they see in the questionnaire design.

iii). *How do changes in the provision of a good and the presence of substitutes alter its marginal value*: in many cases WTP should be expected to be 'non-constant' implying that substantial care is required in estimating aggregate (total) benefits and costs of policies and projects (see **Box ES.1)**. This is dependent on the marginal benefit individuals obtain from a unit increase in the provision of a good (so-called 'marginal utility') and/or available alternatives (so-called 'substitute' goods).

Ensuring that these three questions are addressed appropriately is integral to robust and defensible value transfer analysis.

ES4. Approaches to value transfer –unit value or value function transfer?

Much academic effort has focused on the development and testing of value transfer approaches, which can be broadly categorised as: (i) unit value transfer; and (ii) value function transfer.

Unit value transfer is the simplest approach and is frequently used in the appraisal of environmental impacts. The validity of the approach is dependent upon the correspondence between the context of the study good valuation and the context for the policy good. At some level the two contexts will always be dissimilar; for instance the distinct ecosystem habitats and the sites that study and policy goods are found in are all essentially unique. The key issue however is the degree to which this dissimilarity affects values, which in turn will determine the appropriateness of unit value transfer.

Value function transfer relies on the application of statistical models that describe how the value of the change in provision of the study good changes with various explanatory factors (the value function

variables). The value function is used to 'predict' the value for the policy good context by applying the values of the explanatory variables at the policy good site.

A common expectation is that because value function transfers allow greater control for differences between the policy good and study good context, they should be preferred on the grounds of the likely higher accuracy of estimated values. There are however two important qualifications to this expectation:

(i) A value function should be specified to focus on factors which are generic across the study and policy good contexts

This precludes the inclusion of context-specific and ad-hoc variables that significantly assist in improving the estimation of models to explain the study site data but have no relevance to the policy site. Instead the value function to be transferred should focus on general relationships that economic theory suggests should hold across the study and policy good contexts. In particular:

- The extent (or 'scope') of the change in provision under consideration;
- The costs of using the good - for a physically located good this mainly relates to the proximity of the site to an individual's home and travel and time costs;
- The availability of substitutes; and
- The individual's income constraints.

(ii) Unit value transfer may generate as accurate a result as value function transfers if the policy and study good contexts are very similar

In practice the value function transfer approach 'comes into its own' when applied in relation to dissimilar sites (but not necessarily dissimilar contexts) and these differences relate primarily to expectations based principles set out above. Where close correspondence between the scope of the change, costs of use, availability of substitutes and income constraints of the study and policy good can be demonstrated, then unit value transfer is likely to be sufficient. In cases where the correspondence for one or more of these relationships is questionable, value function transfer should be preferred.

Overall the recommendation for best practice is that when transferring across similar goods and sites, unit value approach is likely to be sufficient. When transferring across similar goods, but dissimilar sites, value function transfer is more appropriate and the specification of those functions should be restricted to include only generic variables for which there are prior economic expectations.

The principles for the 'choice' between unit value and value function transfer of course give rise to the question of how to assess if policy and study goods and sites are sufficiently similar. Lack of scrutiny for this question has been a failure of value transfers to date, and, moreover source studies often report a relatively haphazard set of statistics from which such assessments could be made. While studies often provide data characterising certain aspects of the sample this does not always extend to the underlying population and information regarding the physical characteristics of valued goods or sites is rarely systematically presented.

ES5. Principles for the design of valuation studies, tests of value transfer, and practical use of value transfer

Improvements in the practical use of value transfer should be aided by valuation practitioners adhering to specific principles for the design of primary valuation studies:

- Study design should be developed from economic theoretic principles and employ a theoretically consistent utility specification;
- The study design should permit robust validity testing, including tests based on scope sensitivity, theoretically derived expectations and procedural invariance and also transfer error analyses where relevant;
- Studies should provide information on the location of the good and the location of respondents so that any reduction in values as distance from the site increases (distance decay) can be assessed;
- Studies should also provide information on the availability and location of substitutes for the good;
- In order to improve the amount and quality of information about the location and affected population, GIS should be used as widely as possible. GIS analyses provide ready quantification of off-site locational issues such as distance from respondent's home to site (proxying use in a readily transferable manner and allowing the estimation of distance decay in values) and the availability of substitutes (again via distance measures). GIS also facilitates the ready transfer of functions containing such variables; and
- Findings should be provided in full, including details of representativeness and response rates, descriptive statistics, econometric results, validity testing and interpretation of results.

ES6. Conclusions from case studies

The Technical Report illustrates the above best practice principles and recommendations through the use of case studies for spatially fixed environmental goods. In particular they focus on valuing water quality improvements in the context of: (i) value function transfers across European countries; (ii) value function transfers across UK regions using GIS; and (iii) the use of transfer techniques for estimating aggregating values. Each example illustrates how economic theory provides a guide for building transferable value functions and how the natural variation of the real world can be incorporated and allowed for within value transfer studies.

Key conclusions include:

- The fundamental issue for choosing between value transfer approaches – unit value or value function - concerns the degree of heterogeneity between the sites across which transfers are to be undertaken. The pertinent dimensions of similarity or difference can be assessed using data regarding the characteristics of those sites surrounding populations (e.g. GIS data proximity to the site and substitutes and Census data on socio-economic characteristics).
- When analysis is restricted to include only similar sites, transfer errors are minimised when unit value transfer is used.
- When dissimilar sites are included, value function (using generic variables) is preferred since this can better address greater heterogeneity between sites and provide lower errors. These errors are minimised when transfer functions are specified to only include generic variables which economic theory expects to be present in typical utility functions.

- Value function transfers also permit analysis of distributional aspects of environmental improvements. However, simultaneous maximisation of environmental and distributional goals is only likely to occur by chance and there are always trade-offs when considering multiple policy goals.
- The choice of whether to aggregate across an administratively defined or economic jurisdiction (the spatial extent over which households hold positive WTP for environmental good in question) can have a very substantial impact upon estimates of aggregate value. The latter, the economic jurisdiction, is the 'correct' basis for aggregation.
- The use of simple approaches such as aggregation via sample means can severely bias aggregate benefit and cost estimates. The alternative to such over-simplified approaches is to use a spatially sensitive valuation function, explicitly incorporating expected distance decay in values to both define the limits of the economic jurisdiction and investigate how values vary within that area.