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TRANSFERRING LANDSCAPE VALUES: HOW AND HOW ACCURATELY?

1. INTRODUCTION

Market failure provides a rationale for public intervention in the management of landscape change: to ensure that non-market benefits we derive from rural landscapes (i.e. aesthetics, recreation and ecological function) are kept at socially adequate levels. A variety of policies, including planning controls and agri-environmental schemes, have been designed and implemented for this purpose.

The potential significance of the costs of landscape policy, including the social opportunity cost of environmentally sensitive management as well as policy administration costs, suggests that the landscape benefits actually delivered by policy should be directly valued and weighted against policy costs.

This direct valuation and cost-benefit approach is not yet systematically used in the evaluation of landscape policy. Nonetheless, a number of valuation studies have been carried out in this policy context (e.g. Willis et al. 1993a; Hanley et al. 1996 and Santos 1998), some of which commissioned by public agencies running agri-environmental schemes and included in official evaluation reports (European Commission 1998). Contingent valuation (CV) is the non-market valuation technique most extensively used in these studies and the one best fitting of the typical valuation problem facing policy analysts in this context (Willis et al. 1993b).

However, carrying out an original CV study for every single policy decision is not possible in practice. It would not match the time and budget constraints of most policy-evaluation exercises. Transferring valuation information from previous studies sounds as an attractive alternative, in that, being faster and cheaper, it would allow for a more systematic use of valuation and cost-benefit analysis.

Benefit transfer is the application, with the necessary adjustments, of valuation information from an original study, or from multiple studies, to a different context, where such information is required to evaluate a new policy. Several issues involved in transferring valuation information may affect the quality of the transfer. Desvousges et al. (1998) offer a comprehensive review of these issues. Here, we are interested in the following:

- how to select the original studies for a transfer (source-studies);
- whether to transfer a single best benefit estimate or multiple estimates, possibly from multiple studies;
- how to use valuation information from multiple studies in order to produce the benefit estimate to be transferred; and

S. Navrud and R. Ready (eds.), Environmental Value Transfer: Issues and Methods, 45–75.

- whether to transfer (1) an unadjusted benefit estimate; (2) an estimate adjusted for differences between the original study and the policy context; (3) a source-study-specific valuation model; or (4) a meta-model accounting for the inter-study variation in benefit estimates across the relevant valuation literature.

Some of these issues have already been addressed using rather controlled 'transfer experiments' (see e.g. Loomis 1992; Downing and Ozuna 1996), where original benefit estimates at the policy site were compared to estimates transferred from other sites, with both types of estimates produced under very standardised methodological conditions. It is usually impossible to ensure such standardisation in most practical benefit transfers carried out for policy evaluation purposes.

Moreover, most of these past 'transfer experiments' only test for convergent validity, i.e. for whether differences between transfer estimates and original benefit estimates are statistically insignificant. They do not investigate whether those differences are large enough to imply divergent policy recommendations, i.e.: whether transfer error leads, in practice, to wrong decisions. This second type of test is known as an importance test, which requires information on policy cost, usually not available in those more experimental studies.

This chapter is focused on a real policy-evaluation case, that of the Pennine Dales Environmentally Sensitive Area (ESA) scheme, for which we had a large amount of available cost and benefit information, as well as many candidate source-studies for transfer (Santos 1998). This focus on a real-world policy setting, with available cost information, enabled us both (1) to address the issues raised above in not so standardised ways, which is more relevant for real-world benefit transfers, and (2) to carry out importance as well as convergent validity tests.

The Pennine Dales comprise some of the most spectacular upland scenery in England. The interesting patterns of colour and texture in the Dales landscapes, which are so appreciated by visitors, were shaped by farming practices that evolved over the centuries. Many cherished landscape features, such as stone walls, flower-rich meadows and broadleaved woods, are threatened by current changes in farming practice, comprising a mix of abandonment of some features (walls and field barns) and intensification of meadows use for forage production. The Pennine Dales ESA scheme is a voluntary scheme which offers farmers management agreements aimed at conserving the cherished landscape attributes of the Dales.

The cost-benefit problem in this case was to compare aggregate landscape benefits for visitors with policy costs, including farm income foregone, and additional work for wall and barn repair and better wood management; policy-administration costs were to be included as well.

Within this cost-benefit frame, a CV survey of visitors to the Pennine Dales ESA was undertaken in 1995, in order to estimate visitors' willingness-to-pay (WTP) for the ESA scheme on a per-household per-year basis. 422 visitors were successfully interviewed, producing usable questionnaires. Respondents were asked to choose between (1) the continuance of a specified policy scheme, at a given tax-rise cost, and (2) giving up the scheme altogether with no tax increase. This implies a discrete-choice (DC) approach to the elicitation of WTP.

Different policy schemes were offered to different respondents, which represented diverse mixes of three basic measures: P1, or the conservation of existing stone walls and field barns; P2, or the conservation of flower-rich hay meadows; P3, or the conservation of remaining small broadleaved woods.

The DC (would/wouldn't pay) answers were analysed through censored logistic regression (Cameron 1988). Among the independent variables in the model were the presence/absence of each programme ($Pi = 1/0$, for $i = 1, 2$ or 3) and the respondent's first-choice programme (FIRST $Pi = 1/0$, for $i = 1, 2$ or 3). The estimated model is presented in Table 1.

This model allows us to predict average WTP conditional on any combination of the independent variables. For our current purposes, we are interested in WTP for the most complete policy mix (i.e.: $\mathrm{Pi} = 1$ for $\mathrm{i} = 1, 2$ and 3) by the average individual in the sample (i.e. sample averages for all other independent variables). This value of the most complete policy mix for the average individual is estimated at £112.19 per household per year. Matrix-algebraic manipulation of the variance-covariance matrix of the censored WTP model (Cameron 1991) enabled us to build a 95% confidence interval for this WTP estimate: [£101.08; £123.30].

In what follows, this original benefit estimate is supposed to represent the 'correct' estimate of the landscape benefit of this ESA scheme for visitors. Assuming this

Table 1. Censored-regression model of WTP for the Pennine Dales ESA scheme

Variable	Parameter estimate	t-ratio	Label
INTERCEPT	–47.53	–2.898	Intercept
P1	22.05	3.650	Program 1: stone walls and field barns
P2	13.27	2.465	Program 2: flower-rich meadows
P3	19.36	3.691	Program 3: broad-leaved woodland
P1*FIRSTP1	10.97	1.530	Programme 1 when first in preferences
P2*FIRSTP2	37.85	4.769	Programme 2 when first in preferences
P3*FIRSTP3	19.57	2.292	Programme 3 when first in preferences
INCOME	0.00079	3.952	Household income before taxes (£)
DAYTRIP	14.53	2.715	Day trip
ACTBIRD	–26.36	–2.980	Birdwatching in the Dales
ACTOTHER	–13.00	–2.490	Other activities in the Dales
LANDQUAL	10.95	2.641	Quality/uniqueness of the landscape (4-point scale)
ATTPROD	15.00	2.659	Selected env. friendly products
ATTCHAR	8.95	1.794	Gave money to env. or cons.charities
MEMBNT	18.93	3.579	Member of National Trust
MEMBRSPC	25.51	2.455	Member of RSPCA
MEMBAC	34.05	2.441	Member of angling club
MEMBOTHE	30.69	2.970	Member of other env. group
CATB	–14.43	–2.251	Retired
CATD	34.11	2.652	Employer or managerial profession
FEMALE	13.04	2.346	Sex (female =1)
κ	43.86	20.476	Dispersion parameter

original benefit estimate is (as usual) unknown, the next section will look for sources of valuation information from past studies in the literature that would be relevant for predicting this benefit without the need to carry out a full CV survey at the policy site.

2. SELECTING THE CANDIDATE STUDIES FOR TRANSFER

Which original studies could we use as sources of valuation information to be transferred to our policy case-study? This question led us to undertake a review of the relevant CV literature, using the, broad, selection criterion of keeping all studies providing at least one CV estimate of WTP for the conservation of agricultural landscapes. This search considered the following sources: (1) past literature reviews of valuation studies;[1] (2) recent issues of journals of environmental and agricultural economics; (3) references in collective books on farming and the countryside;[2] (4) conference papers; (5) bibliographical references included in all landscape studies that have been found; (6) some prominent practitioners, who have added some references to our list (namely, research reports) and confirmed its completeness.

As it is usually impossible to ensure complete coverage of the literature, selection criteria and sources should always be fully reported, as above. Only this will enable readers to assess how representative and complete the final list of studies is, while ensuring this list is replicable using the reported criteria and sources (Glass et al. 1981).

A final list of 19 studies was arrived at, which is probably biased towards works written in English and already published in the Spring of 1997.[3] These 19 studies were quite uneven with respect to research quality. Rough indicators of quality of survey design, sampling procedures and CV methodology vary widely across studies (cf. Santos 1997), which meant that different studies were characterised by rather different levels of: sampling and non-response biases; understanding and acceptance of the CV scenarios by respondents; and statistical reliability of WTP estimates. Yet, no a priori exclusion of studies on quality grounds was made: the effect of research quality on results should be empirically assessed, as part of the literature review itself, not prejudged at its very beginning (Glass 1976; Glass et al. 1981).

Table 2 presents the studies retained for analysis. Each study includes one or more surveys, which referred to different populations or used different CV formats. A total of 36 surveys are reported in the 19 studies. In some cases, each survey respondent valued different landscape changes, which raises the number of results to 49. Taking into account different estimators (i.e.: levels of α-trimming of open-ended data, truncation of DC data), the total number of estimates rises to 64.[4]

Table 2 shows the wide variation in WTP estimates within the 19 CV studies of agricultural landscapes, with a minimum of £0.95 and a maximum of £233.7. Variation in estimates is large not only across studies but also within each study.[5]

Table 2. CV studies of changes in agricultural landscapes

Study	Landscape change and population	Surveys	Estimates	WTP range
Pruckner (1995)	Nationwide conservation of Austrian agricultural landscapes, valued by Summer tourists (mainly foreign people)	1	2	2.67–4.47
Drake (1992 and 1993)	Nationwide preservation of Swedish agricultural landscapes from conversion into forestry, valued by national residents	1	1	77.42
Stenger and Colson (1996)	Nationwide conservation of French agricultural landscapes; enhancement of the 'bocage' landscape in the Loire-Atlantique 'departement', and in one 'canton' in it; valued by the departement's residents	1	3	4.99–77.65
Halstead (1984)	Preventing urban development of the farmland area closest to respondent's home; valued by residents in three Massachusetts towns (USA)	1	3	45.80–233.72
Bergstrom et al. (1985); Dillman & Bergstrom (1991)	Preserving public amenity benefits of prime agricultural land from development in Greenville County (South Carolina, USA), valued by the County residents	1	1	9.32
Bateman et al. (1992 and 1993)	Preservation of the Norfolk Broads landscape from flooding by the sea; valued by visitors; local and UK residents (OE and DC format)	3	7	23.98–160.08
Willis and Garrod (1991 and 1992)	Conserving the Yorkshire Dales (UK) 'today's landscape', as opposed to the 'abandoned landscape'; valued by local residents and visitors	2	2	29.12–29.74
Willis et al. (1993a)	Maintaining 2 ESAs (South Downs and Somerset Levels and Moors) and the ESA scheme in England as a whole, valued by visitors; local and national residents (OE and DC format)	6	17	2.18–103.97
Santos (1997)	Conserving today's agricultural landscapes in the Peneda-Gerês NP (Portugal); valued by visitors	1	2	47.40–56.48
Willis (1982); and Willis & Whitby (1985)	Preserving Tyneside Green Belt (UK) from urban development; valued by residents in two communities surrounded by Green Belt land	2	2	43.33–79.13
Willis (1990)	Preventing detrimental landscape changes from current trends in farming practices in three SSSI (Skipwith Common, Derwent Ings, and Upper	1	3	0.95–2.02

(Continued)

Table 2. (Continued)

Study	Landscape change and population	Surveys	Estimates	WTP range
	Teesdale; all in the North East of England); valued by residents up to 200 Km from sites			
Hanley et al. (1991)	Conservation of typical lowland heath in Avon Forest Park (Dorset, UK); valued by visitors	1	1	11.78
Hanley and Craig (1991)	Preservation of the Flow Country of Caithness and Sutherland (Northern Scotland) from afforestation; valued by Scottish residents	1	1	20.33
Campos and Riera (1996)	Conservation of the 'dehesa' landscape (traditional Iberian agro-forestry farming system, combining holm and cork oaks with grazing and cereal fields) in the Monfragüe NP (Spain); valued by NP visitors	1	1	37.20
Hanley et al. (1996)	Breadalbane, and Machair ESA schemes (in Scotland); valued by visitors; local and national residents (using both OE and DC formats)	8	12	9.19–100.35[a]
Gourlay (1995)	Loch Lomond and Stewartry ESA schemes (in Scotland); valued by local residents	2	2	13.78–21.83
Bullock and Kay (1996)	Landscape improvement from reduced grazing pressure in the Southern Uplands ESA, Scotland; valued by visitors and national residents	2	2	70.66–84.99
Beasley et al. (1986)	Preserving remaining farmland in the Old Colony and Homestead areas of south Central Alaska (USA); valued by residents in 2 communities adjacent to existing farmland	1	2	76.64–145.21
Total		36	64	0.95–233.72[a]

Note: a. Excluding a figure of £387.07, resulting from a DC CVM estimate based on a quite small sample and exhibiting an extremely wide confidence interval (cf. Hanley et al. 1996).

3. A META-ANALYSIS OF THE RELEVANT VALUATION LITERATURE

How to take stock of all this valuation information from multiple source-studies in producing the WTP estimate to be transferred to our policy case-study? A meta-analysis of that valuation information is used here to deal with this problem. Later, an alternative procedure is also considered: simply taking WTP averages across studies.

Meta-analysis emerged as an alternative to the classic, rhetoric, approach to literature review in the social sciences (Glass 1976; Glass et al. 1981; Wolf 1986).

In these sciences, many studies on the same research problem often produce different answers, with such contradictory findings typically accumulating over long periods of research practice. This divergence in findings is due to three types of factors: (1) different sampling procedures, types of tests or variable definitions, as well as other method differences; (2) differences between studies' participants, with respect to class, age, education and other socio-economic variables; and (3) sampling variation.

There is an important task for literature reviews in interpreting and integrating this type of divergent findings. For this purpose, leading authors often adopt an idiosyncratic, authoritarian and impressionistic approach. Authors such as Glass (1976), Glass et al. (1981) or Wolf (1986) recommend an alternative approach, which is based on the idea that to understand and make sense of the variety of empirical findings on the same research problem, one should take into account the three types of factors that explain this variety. Accounting for the role of so many factors across large numbers of studies is generally well beyond the capacity of the human mind. Hence, the same statistical techniques which assist analysts in extracting information from individual studies' data should also be recommended to assist the reviewer in making sense of a complex collection of studies' findings and characteristics.

Several meta-analyses of non-market valuation studies have been published to date. In a pioneer paper, Smith and Kaoru (1990) reviewed the literature of travel cost recreation studies carried out between 1970 and 1986 in the USA. Walsh et al. (1992) reviewed both travel cost and CV studies of recreation benefits. These meta-analyses, as well as more recent ones (cf. e.g. Loomis and White 1996; Smith and Huang 1995), have at least two points in common.

First, the individual studies reviewed are not studying the same cause-effect link (as in typical meta-analyses, e.g. of the effect of class size on student achievement). Yet, they all provide measurements of WTP for particular environmental commodities.

Second, the purpose of meta-analyses of valuation studies is not to summarise their findings with respect to a common research problem, but to address a new problem: that of accounting for the variation in WTP estimates across studies. This is done by analysing the inter-study co-variation of WTP estimates, on the one hand, and, on the other, site attributes, population characteristics and method options characterising each study. Multiple regression techniques are the natural choice for this task.

In this chapter, the variation in mean WTP estimates across studies is explored using inter-study models of this type, that is meta-models. Variables characterising the studies with respect to (1) the landscape change (or programme) under valuation, (2) the surveyed population, and (3) the method applied are used as the predictors.

Depending on whether or not each of these variables should count for valuation, the analysis is gauging either theoretical validity (conformity with expectations for variables that should count) or evidence of unreliability (significant effects of variables that shouldn't count). Thus, in addition to taking stock of differences across studies with respect to landscapes and surveyed populations (some of which should count for valuation) our analysis enables us to assess the effect of particular methodological options that vary across studies, such as the elicitation format (e.g. OE vs DC elicitation format). The problem with these methodological options is that, when there is no consensus about the preferred option for the particular valuation problem, difficult reliability problems are raised if WTP is found to be sensitive to different options. Problems are also raised when using the model for benefit transfer purposes, as in this chapter, because this implies selecting the preferred methodological alternative.

Good modelling practice requires reporting all independent variables initially considered for inclusion in the model, even if later dropped on grounds of statistical significance. This enables the reader to check whether a particular variable is not in the final model because it was not statistically significant or, simply, because it was not considered in the first place. For such list of initially considered variables, as well as problems in defining and measuring these variables for the limited information reported in the case-studies in the literature see Santos (1998).[6]

The log transformation of the dependent variable (WTP) yielded the best results, both in terms of goodness-of-fit and significance of individual predictors. Hence, the semi-log (dependent) functional form was selected, except as regards the income variable, for which the log-linear form performed better. Given the selected functional form, the parameter estimates are interpreted as elasticity, in the case of income (log-linear), or percentage-effect on WTP of marginal changes, for the other continuous variables (semi-log). With respect to dummy variables (semi-log), the formula put forward by Halvorsen and Palmquist (1980) was used to calculate the percentage-effect on WTP of a change from 0 to 1 in the value of each sdummy.

According to Wolf (1986), explicitly weighting individual observations to take into account research quality is a current practice in meta-analysis. In the valuation literature reviewed here, small sample sizes were observed to lead to low precision of WTP estimates (Santos 1997). So, weighting individual observations according to sample size would be a good option. However, weighted-least-squares (WLS) estimators were not significantly different from OLS ones, and did not improve statistical significance. Hence, only the OLS results are presented here.

Three outlier observations were identified, for which the residuals were consistently larger than twice the estimated standard deviation of the random term, whatever the specification assayed. Outliers were high-variance WTP estimates, mainly associated with small sample size and/or the DC CV format. They were dropped, as they would be given too much weight if included in an un-weighted (OLS) model.[7]

Hypothesis testing in a OLS setting is subject to bias in the presence of heteroskedasticity and autocorrelation. It is probable that several forms of heteroskedasticity are present in this data set, which includes studies with different levels of research quality. Furthermore, the fact that several WTP estimates were drawn from each individual study gives a panel structure to our data, which creates potential for correlation among residuals of individual observations from the same study. Hence, resort was made to the technique proposed by Newey and West (1987) for robust estimation of the parameter variance–covariance matrix in the presence of many known forms of heteroskedasticity and autocorrelation. Newey–West-based t-ratios for the parameter estimates do not lead to significantly different conclusions, and thus, for simplicity, we report only the usual OLS t-ratios.

Despite a relatively small sample size (N = 61), 14 of the 16 variables in our first model in Table 3 (meta-model 1) have statistically significant coefficients at the 5-per cent significance level. Some detailed scrutiny will also reveal that all parameter estimates have the expected signs. This is taken as evidence of theoretical validity for the policy and population variables, which should count for valuation, and evidence of unreliability for those method variables that shouldn't count for valuation. For these latter, serious transfer problems are raised if we have no

Table 3. Regression of log (WTP) on variables describing the landscape change (policy), the population, and the method

	Meta-model 1			Meta-model 2		
Independent variables	Coeff.	t-ratio	Adjust. factor[a]	Coeff.	t-ratio	Adjust. factor[a]
Constant	−198.9	−2.873		−2.081	−0.724	
• Landscape type, landscape change and substitution effects (policy variables):						
Small site	−0.576	−1.705	−0.438			
ESA or NP	0.669	2.795	0.952	0.909	3.091	1.482
Absolutely Unique Site	0.559	1.695	0.748			
Nationwide scope	1.312	6.959	2.713			
Change in character	0.346	1.045	0.414			
Change to Moderate/heavy development	1.084	2.457	1.956			
Format involves sequential or embedded valuation	−0.348	−1.987	−0.294	−0.210	−1.314	−0.190
• Surveyed population (population variables):						
NIMBY situations	1.358	3.709	2.888			
Majority non-users	−0.676	−4.919	−0.491	−0.358	−2.193	−0.301
Majority Foreign	−2.336	−6.008	−0.903			
log(GDP per capita)	0.593	2.070		0.457	1.578	
• Survey and estimation effects (method variables):						
DC and IB format	0.948	6.441	1.580	1.193	6.242	2.296
Level of trimming (OE)	−0.077	−3.009		−0.188	−3.157	
Truncation (DC data)	−0.203	−0.720	−0.183			
'Tokens' technique	−1.291	−4.005	−0.725	−1.816	−5.617	−0.837
Year of survey	0.098	2.844				
Sample Size		61			32	
R^2		0.933			0.892	
Outliers Excluded		3			1	

Note: a. For dummy variables, this column provides the percent effect on WTP of a ceteris paribus change from 0 to 1 in each variable; figures in this column were calculated from regression coefficients according to a formula put forward by Halvorsen and Palmquist (1980). The parameter estimates for continuous dependent variables should be interpreted as usual, that is: (1) as an elasticity when the specification is log-linear (income, in our case); (2) as percentage effect on WTP of a small change in the independent variable when the specification is semi-log (level of trimming, year).

certainties about the best methodological option. A full discussion of the effects of all these variables on WTP, as regards their implications for theoretical validity and reliability of CV landscape benefit estimates can be found in Santos (1998).

Another meta-model was estimated from a smaller subset of the CV benefit estimates in the reviewed literature on agricultural landscapes. This subset comprises only those WTP estimates for the cases better matching the type of policy under evaluation: an ESA scheme. This subset was secured by dropping all WTP estimates for which at least one of the following criteria (in terms of the independent variables) applied:

- conservation or recreational site = 1;
- nation-wide scope = 1;
- considerable change in character = 1; or
- moderate/heavy development = 1.

Excluding these observations, not all parameters in meta-model 1 could be estimated. The model estimated from this (more homogeneous and closer to our policy's context) subset of WTP estimates is meta-model 2, also presented in Table 3. Later in this chapter we will compare our two meta-models as regards their performance as predictive devices used for benefit transfer purposes.

4. HOW TO TRANSFER LANDSCAPE VALUES?

In order to address, in an applied way, the issues involved in transferring WTP information that were raised in the introduction, a series of different benefit-transfer exercises were carried out, by considering different source-studies in the reviewed literature and different transfer procedures. These exercises illustrate how landscape values can be transferred in a practical policy evaluation setting.

To assess the different transfer sources and procedures against the three criteria also referred to in the introduction (i.e.: convergent-validity, importance and the value-of-information criteria), we were required to produce not only point transfer estimates but also interval estimates.

To classify the different transfer exercises that follow, the first criterion is whether (1) a single best study or (2) multiple studies were transferred.

For the single-best-study approach, two best-studies were selected: one matching the policy case (Pennine Dales ESA scheme) as regards surveyed population and the particular policy, but not as regards the method used in the Pennine Dales original survey; another, methodologically similar, but different as regards population and policy. For both source studies, three transfer procedures were considered: (a) transferring an unadjusted scalar WTP estimate reported by the source-study; (b) transferring such a scalar estimate after adjustment for CV format or income difference; and (c) transferring a valuation function reported by the source-study, to adjust for differences in the independent variables in this function. Procedure (c) was only possible for one of the selected studies. Thus, a total of 5 benefit transfers were carried out following the single-best-study approach.

For multiple-study transfers, two different procedures were considered: (a) taking averages of reported WTP estimates for all ESA-like policy schemes; and (b) using the two meta-models referred to above to predict WTP estimates for the Pennine Dales ESA setting. Both in (a) and (b), the DC and open-ended (OE) elicitation formats were dealt with separately, which produced 6 benefit-transfer estimates for the multiple-study approach.

5. TRANSFERRING A SINGLE BEST STUDY

As above mentioned, two alternative best-studies were selected: one fitting well the policy and population relevant for the Pennine Dales ESA, but fitting poorly the type of method used in the Pennine Dales ESA survey (OE, as opposed to the DC format); another, which fits poorly the relevant policy and population, but uses exactly the same methods as in that survey. This choice of source-studies is aimed at assessing the relative importance of adjusting for real value differences (i.e.: due to different landscapes, policies and people), as compared to methodological differences.

In real-world cases, both differences will typically occur simultaneously, which will generally lead to less accurate transfers. Thus, the level of accuracy achieved here for the single-best-study approach to benefit transfer can be interpreted as providing an upper bound for accuracy in most real-world transfer problems.

5.1. Similar Population, Similar Policy, Different Method

Willis and Garrod (1991) carried out a CV survey of 300 visitors to the Yorkshire Dales National Park (NP) in 1990,[8] exactly five years before the Pennine Dales ESA survey. Willis and Garrod's survey provides an excellent source-study for the transfer problem we are analysing here. They asked all respondents how much they would be willing to pay to preserve 'today's' landscape as opposed to the 'abandoned' landscape (hence, they used the open-ended, OE, CV format).

Table 4 presents the differences between 'today's' and the 'abandoned' landscape scenarios, as presented to respondents, including differences between the pictures used to convey these alternative future states of landscape. Note that the qualitative landscape change implied by these two alternative states is similar to that valued, five years later, in the Pennine Dales ESA survey. Moreover, the pictures (water-colour paintings) representing the policy-off and policy-on states of landscape are almost identical between the two surveys.

The only significant differences between these surveys' scenarios are that the former (Yorkshire Dales NP survey) underlines the impacts on the local economy and refers to threats to heather moors, whilst the latter (Pennine Dales ESA survey) does not. In fact, the ESA scheme is focussed on landscape effects alone and does not protect heather moors on the fells.

Another difference refers to the geographic extent of the landscape good: in the Yorkshire Dales NP survey, respondents valued the landscape change at stake as occurring all over this NP, including both dales (valleys) and fells (upland ridges),

Table 4. 'Today's' and 'abandoned' landscape scenarios in the Yorkshire Dales questionnaire

TODAY'S LANDSCAPE
'This typical Dales scene supports a community earning a living from farming or tourism. It is the product of an agricultural system that was, until recently, supported by subsidies intended to increase food production and maintain a healthy rural economy. Some meadows are cut for hay, while others are used for silage production. Some walls and field barns remain in good order, but many derelict ones are replaced by fences or modern sheds. Many broad-leaved woodlands are being damaged by stock and some heather moorland is deteriorating due to over-grazing.'
(Picture: shows a flower-rich meadow in the foreground; a field barn in good condition; some well-kept stonewalls as well as some derelict ones, and some modern fences; a small broad-leaved wood and field trees are present in the middle and background.)
ABANDONED LANDSCAPE
'In this landscape future farming subsidies have been taken away, leaving upland farmers to compete with better farms in the lowlands. In this situation, many owner-farmers would sell-up, while tenanted farms would be taken back into estates and their buildings used for alternative purposes. The few remaining farmers would keep smaller flocks on improved land, but outlying meadows and pastures would be abandoned. With no money to maintain field barns, walls and woodlands, they would decay and become derelict. To survive some farmers would turn to farm-based tourism or forestry.'
(Picture: the most striking differences, as compared to the picture for 'today's' landscape, are the absence of flowers in the foreground meadow; the field barn ruined, without roof; only derelict walls and fences; the broad-leaved wood reduced to a few trees, and almost no field trees.)

Source: Adapted from Willis and Garrod (1991's) appendix 1.

where the heather moors are. On the other hand, in the Pennine Dales ESA survey, respondents were asked to value that change as occurring all over the (broader) Pennine Dales,[9] but excluding fell land, where the ESA scheme does not apply. Hence, the former survey valued a change that is more inclusive in one respect (includes fell land) but less in other (does not include the northern half of the Pennines).

The surveyed population was the same in both cases, i.e.: only visitors to the Yorkshire Dales NP were interviewed in both cases. Thus, we can expect that the fact of the ESA scenario including dales outside the NP (while the NP survey scenario does not) has not caused large value differences. For visitors to the NP, changes taking place outside the NP might have a rather marginal value (at least use value).

Still concerning survey population, there is the possibility that rising income and concern for landscape degradation might have led to increase WTP for landscape conservation over the 5-year period separating the two surveys.

Taking stock of all these comparisons between surveys, we would expect elicited WTP values to be not very different between surveys. This enhances the prospects for a successful benefit transfer, perhaps adjusted for income and cultural change. Indeed, such an appropriate source-study for transfer (as Willis and Garrod's is for the current transfer problem) is very rarely available in practice for most benefit transfer problems.

There is, however, an important methodological difference between Willis and Garrod's benefit estimate and the original estimate from the Pennine Dales ESA survey: the first used the OE format whilst the latter used the DC format. An adjustment of the former would, therefore, be justified if the DC format is judged superior in methodological terms.

5.1.1. Transferring an unadjusted scalar The sample average of WTP to preserve today's landscape is £24.56 per household per year (Willis and Garrod 1991). Adjusting for price changes between 1990 and 1995 yields an estimated £29,04.[10] Using estimated standard deviation and sample size, reported by the authors, a 95-per cent confidence interval was built for the population mean of WTP, which, after price adjustments, is: [£23,30; £34,79].

These point and interval benefit estimates can be transferred without any other adjustment to deliver the benefit estimate that is required to evaluate the ESA scheme. Given the similarity between the context of Willis and Garrod's original study and that of the ESA scheme, as regards both the relevant population and the valued policy, this simple transfer procedure is supposed to deliver a sufficiently accurate benefit estimate for policy evaluation. Note that this procedure has the advantage of not requiring any information in addition to the original study used as the source for the transfer (i.e.: Willis and Garrod's).

5.1.2. Transferring an adjusted scalar As above mentioned, Willis and Garrod's OE benefit estimate needs to be adjusted for CV format if the DC format is judged superior in methodological terms. This requires more information on past CV studies of landscape changes, so that the appropriate adjustment factor can be derived. Additional information of relatively good quality is available in this case: that resulting from the previously discussed meta-analyses of the literature of CV studies of landscape changes. To derive an appropriate adjustment factor for CV format, we used meta-model 2, as this includes estimates for ESA-like policies alone, which more closely match the relevant policy setting.

Note that estimating meta-model 2 does not require the estimates from the Pennine Dales ESA survey, which we are trying to predict here. Thus, an adjustment factor was derived which is independent from the (generally unknown) difference between the source-study's estimate and the true value one is trying to predict — i.e.: that adjustment factor is only based on the analysis of available literature, as in any practical transfer exercise.

From meta-model 2 (Table 3), we know that the estimated increase in WTP resulting from using the DC as compared to OE format is 229.6 per cent Adjusting

Willis and Garrod's (1991) estimate (after adjustment for price changes) based on this figure yielded an estimated WTP for a DC CV study carried out under similar circumstances which is £95,73, with a 95%-confidence interval of [£76,79; £114,66].

A similar adjustment could easily be made for the income change in the population between 1990 and 1995, by using the income-elasticity parameter in meta-model 2 and the estimated income difference between the two survey samples. However, average household income in the first survey's sample is not known.

5.1.3. Transferring a valuation function Income, other socio-economic variables, cultural attitudes and recreational uses of the landscape could have changed over the 1990–95 period, which could have led to changes in WTP. A possible way to take these changes into account is deriving adjustment factors from meta-analysis, as referred to in the previous section for the CV-format and income variables. Another way is to use a WTP model provided by the original study (usually for purposes of theoretical validity testing) and transferring this whole functional relationship, instead of the final scalar benefit estimate. This allows one to take account of differences between the original and transfer contexts as regards the values of the independent variables in the WTP model.

Willis and Garrod (1991) provided such a WTP model with seven independent variables: (1) income, (2) number of kids, (3) rating given to the Dales landscape in a 4-point scale, (4) whether did engage in walking, or (5) cycling, (6) whether knew Dales is a national park, and (7) number of days spent in the Dales over previous 12 months. We had measurements of variables (1), (2), (5) and (7) from our 1995 Pennine Dales ESA survey. Yet, we had no measurement of variable (6) for 1995, and 1995 measurements of variables (3) and (4) were based on a different variable definition. For these three variables, the only possible solution was using sample averages from the 1990 survey. However these were not known,[11] which precluded the transfer of the model.

Note that if the transfer of the model could be successfully completed, the final estimate should still be adjusted for CV format if the DC is judged superior, as the transferred functional relationship is based on OE data.

5.2. Different Population, Different Policy, Similar Method

Santos (1997) carried out, in 1996, a CV survey of 704 visitors to the Peneda-Gerês National Park (NP), the only NP in Portugal. This survey was designed to value the landscape benefits for visitors of national agri-environmental measures currently in application within the NP.

This study used a similar survey instrument and was run in approximately the same way (by the same researcher, using the same procedures for interviewer selection and training, the same type of questionnaire, pilots, and sampling procedures) as the Pennine Dales ESA survey, whose results we are trying to predict here. In particular, both surveys used the DC format for the valuation question. Moreover, WTP estimates were secured, in both cases, from similarly specified models, estimated with the same econometric techniques (e.g., censored logistic regression, using the same type of stepwise procedures for variable selection) and data-correction procedures (e.g. for protest answers).

The conservation scheme valued in the Portuguese survey also exhibited some similarities with the one valued in the Pennine Dales ESA survey. Three basic measures were also designed, with respondents valuing all possible bundles of these programmes. There were even some interesting parallels between the particular three programmes for the Portuguese study and those for the Dales ESA study (Table 5).

Table 5. Comparison of the scenarios valued in the Pennine Dales ESA and Peneda-Gerês NP surveys

	Pennine Dales ESA survey	Peneda-Gerês NP survey
Programme 1	P1. STONE WALLS AND BARNS Will ensure the conservation of the currently existing dry stone walls and barns, by providing farmers with funds for repair of walls and barns.	P1. TRADITIONAL TERRACED FARMING Agricultural area typically occupies the lower slopes of the NP with small terraced fields. P1 will ensure the conservation of this landscape, by providing farmers with payments for keeping traditional farming practices.
Programme 2	P2. HAY MEADOWS Will ensure the conservation of the meadows at the current levels of flower diversity and habitat conditions for breeding birds, by paying farmers to maintain traditional meadow management practices.	P2. TRADITIONAL IRRIGATED MEADOWS Meadows introduce a green note, sometimes reinforced by the presence of hedge trees, in an otherwise dry landscape dominated by rocks on the uplands. They are also an important habitat for wildflowers. P2 will ensure the continued management of currently existing meadows, using agri-environmental contracts with farmers.
Programme 3	P3. SMALL WOODLAND Will ensure the conservation of currently existing small broad-leaved woodlands, by paying farmers to adopt better management practices.	P3. SMALL OAK WOODS IN FARMS This is an important ecological resource in the Park, crucial for many animal and plant species, as these oak woods represent the only remains of a broader ecosystem in the past. P3 aims at conserving existing wood area by contracting practices with farmers, which will promote the natural regeneration of trees.

Source: Santos (1997).

There are, however, important differences between the studies' contexts, which concern, for example, the relevance of agricultural elements in the landscape. Agricultural area represents a larger share of the land and is more visible a landscape attribute in the Dales than in the Peneda–Gerês. This stronger weight of agricultural landscape elements in the Dales was clearly perceived by visitors, who, in turn, had stronger preferences for agricultural elements in the Dales (walls, barns and meadows) and for more 'natural' elements (oak woods) in the Peneda–Gerês. As the conservation schemes in both areas were mainly targeted at agricultural attributes, this difference in landscapes and preferences for landscapes led us to expect that WTP for the conservation scheme in the Peneda–Gerês was lower than the value we were trying to predict for the Dales.

Differences between visitors to each area also led us to expect lower WTP for conservation in the Peneda-Gerês. In fact, visitors to the Peneda-Gerês had lower levels of income, environmental concern, environmental group membership, familiarity with the area and frequency of visits; they also engaged less often in landscape-dependent activities such as long walks during their visits (Santos 1997). All of these factors were revealed to be strong predictors of WTP, at least in the Portuguese study, which we are using here as the transfer source.

Summarily, we had a source-study using almost the same method as in the Pennine Dales ESA survey, but that did not match so well the transfer setting as regards the policy and the population. Differences in these two factors led to the judgement that the Peneda-Gerês NP WTP figure should be adjusted, somewhat upwards, to secure a more accurate benefit transfer for the Pennine-Dales-ESA policy context.

5.2.1. Transferring an unadjusted scalar If we assume that the required adjustment is, nevertheless, small and can be ignored, we can simply take the per-household benefit estimate arrived at in the Portuguese study and transfer it directly for the Pennine Dales ESA case. So, using the exchange rate of PTE for £s in 1996 (the year of the Portuguese survey), and adjusting back to 1995£s using the UK price index, we transferred the benefit of £56.48 per visiting household per year for the Pennine Dales ESA policy, with a 95-per cent confidence interval of [£52.11; £60.86].

5.2.2. Transferring an adjusted scalar From the several differences between the Peneda-Gerês NP and the Pennine Dales ESA cases, the only that is controlled for by our meta-model 2 (data on ESA-like landscape changes alone) is the income difference. 'Income' in this meta-model is GNP per capita at constant prices (1990 US$) for the country and year of the survey. This is because the sample average of household income was not available for all studies. This GNP was $6472 for Portugal 1996, and $17968 for the UK 1996. Thus, using meta-model 2, we predicted that WTP in the Pennine Dales case would be approximately 1.595 times that in the Peneda-Gerês case. Multiplying the unadjusted scalar benefit transfer by this factor yielded a benefit transfer adjusted for income differences of £90.11, with a 95-per cent confidence interval of [£83.13; £97.08].

Note that the income difference between the Peneda-Gerês NP visitors and the Pennine Dales ESA visitors is actually smaller than the difference between the corresponding countries' GNPs. However, as argued elsewhere (Santos 1997), using the meta-analytical income-elasticity estimate (which requires using the variable defined in the same way as in the meta-model) has advantages for predicting purposes, as it may account for GNP-correlated differences between countries as regards cultural attitudes towards landscape conservation.

Furthermore the use of a meta-analysis of existing studies combined with available statistical GNP data has the practical advantage of avoiding the need for a survey of the visitors to the Pennine Dales to determine their average household income.

5.2.3. Transferring a valuation function The transfer just described only adjusts for the income difference. This was the only possibility of adjustment based on our meta-analysis of ESA-like landscape policies. However, as previously discussed, there are many other differences between the two relevant contexts, as regards the policy and the population. Some of these differences could be adjusted for by transferring not the scalar benefit estimate resulting from the Portuguese study, but the whole valuation function provided by this source study. Assuming that this functional relationship holds for the Pennine Dales context, we need to evaluate the independent variables in the Dales case and, then, use the model and these evaluations to predict WTP for the Pennine Dales ESA policy.

Note that this procedure, while allowing that adjustments are made for a large number of context-differences, has further information requirements: it needs the values of the relevant independent variables for the Dales case, which requires, in practice, carrying out new data collection operations, such as a simplified survey of visitors. As we actually had this information from the Pennine Dales ESA survey, this is not a problem here. But it will often be in practice.

The WTP model from the Peneda-Gerês case that is relevant for our present transfer purposes is presented in Table 6. As the contents of the policy measures P1, P2 and P3 and the preferences for these measures were markedly different between cases, no adjustments were made for the first five independent variables (plus the intercept).

Likewise, no adjustment was made for RURALRES and RURALCHI. The fact of living in a rural area (or having been born in such type of area) is a negative WTP predictor in the Portuguese case and has been shown to be a positive predictor in some Northern European cases. It was argued elsewhere (Santos 1997) that this is understandable, as, basically, many of those living in rural areas live there by 'obligation' in Portugal and 'by option' in the UK. And if this is by option, the beauty of the rural landscape will definitely be a factor for some.

For all other independent variables, except two, we had the average value in the Pennine Dales ESA sample, using the same variable definition, which is an obvious advantage of having two very similar studies for the Dales and Peneda-Gerês cases. For the two variables for which we had not average

Table 6. WTP model from the Peneda-Gerês study used for benefit transfer

Variable	Parameter estimate	t-ratio	*Label*
INTERCEPT	−4665	−2.838	Intercept
P1	3396	5.929	Program 1: traditional farming - terraces
P2	2185	4.374	Programme 2: irrigated hay meadows
P3	2640	4.184	Programme 3: oak woods
P1*FIRSTP1	4018	5.307	Programme 1 when first in preferences
P3*FIRSTP3	4540	6.186	Programme 3 when first in preferences
LANDQUAL	762	1.747	Quality/ uniqueness of the landscape (4-point scale)
DAYTRIP	2821	3.730	Day trip
DAYS	85	2.708	Days in the NP over the last 12 months
FIRSTIME	−2119	−3.689	First visit ever made to the area
WALKING	2253	3.275	Walking more than 3 Km
WILDWATC	5076	4.180	Looking for wildlife species
VILLAGES	1417	2.108	Visiting traditional villages
OTHERACT	−2973	−1.751	Other recreational activities
ENVCAMP	5189	4.209	Actively campaigns for environment
HIGHED	−1402	−2.471	Went on to higher education
RETIRED	−6602	−4.449	Retired
SELFEMP	2569	2.455	Self employed
INCOME	0.00091	9.448	Household annual pretax income (esc.)
RURALRES	−2624	−4.131	Rural residence
RURALCHI	−3994	−4.899	Urban residence but rural childhood
FOREIGN	−3536	−2.805	Non-Portuguese
κ	6250	24.047	Dispersion parameter

Source: Santos (1998).

sample values for the Pennines, that is WILDWATCH and FOREIGN, we used the following proxies; BIRDWATCH and 'living more than 400 miles away' respectively.

Transferring the WTP model yielded a benefit estimate of PTE 16 864 for the Pennine Dales ESA, which converted to 1995 £s gives an estimated £67.52 per household per year.[12] The variance-covariance matrix of the model and the Dales independent-variable vector were then combined to analytically compute the variance of our benefit transfer, according to simple matrix algebraic procedures proposed by Cameron (1991) for censored logistic regression. In this way the 95-per cent confidence interval for our model-based benefit transfer was estimated as [£61.74; £73.31].

It is interesting to note that, when adjusting for differences between the Peneda-Gerês and Pennine Dales cases, some of the independent variables in the WTP model lead to much stronger adjustments than others, and that these adjustments often take different signs across variables. For example, the variables INCOME, WALKING, DAYTRIP, ENVCAMP and FIRSTIME implied upward adjustments between 13 and 48% (this last for income); on the other hand, RETIRED implied a downward adjustment of 37%. Adding up, the several adjustments partly offset each other, which leads to an overall upward adjustment of only 19,5%.

6. TRANSFERRING MULTIPLE STUDIES

If, as it is often the case, there is no single best study, as no single study best matches the policy evaluation problem over the policy, population *and* method dimensions altogether, then it is possibly better to transfer multiple studies rather than a single study. Transferring the average, or other more complex model, of multiple studies conveys more information and enables one to avoid the unpredictable effects on the benefit transfer of a more or less arbitrary selection of one single study, plus more or less arbitrary adjustments to the selected estimate.

6.1. Transferring Averages of Similar Studies

A simple option to transfer multiple studies is to take the average of a series of benefit estimates, whose contexts are judged sufficiently close to each other and to that of the policy to be evaluated. This average is then transferred with or without adjustments.

If some studies match better the policy, others the population, and others the method, the probability of the average of all studies being close to the real value (to be predicted with the transfer) is higher than the corresponding probability for any individual study chosen arbitrarily and taken in isolation.

Alternatively, we may view the several estimates in the literature that sufficiently match our policy evaluation problem as independent samples from the same WTP distribution. In this case, it would be advisable to use their average rather than one single estimate, as the former is a more precise estimator of the central tendency of WTP in the population.

Of course, the appropriate procedure would be using a weighed average (inverse of standard deviations, or sample sizes, used as weighs) or even ‘random-effect averages’ if we cannot assume that the same WTP distribution characterises all studies; but, instead, that each study is a sample from a particular WTP distribution which is, itself, extracted from a same underlying common distribution (Desvousges et al. 1998).

In this chapter, we use simple arithmetic averages as a first approach. For this purpose, we used only those benefit estimates in the reviewed literature of landscape CV studies that could be considered close enough to the policy evaluation problem at stake, that is the evaluation of the Pennine Dales ESA scheme. Thus, we excluded from our initial set of 64 estimates all those estimates that matched at least one of these conditions:

- correspond to small sites, which people tend to perceive as having many substitutes, even at the regional level;
- involve nation-wide landscape conservation programmes;
- involve considerable or very considerable, and abrupt, landscape changes, completely modifying landscape character; such as massive afforestation and

urban development of the land; these changes do not match the kind of gradual, progressive, changes that characterise the ESA scheme;
- involve elicitation mechanisms implying substitution effects, such as embedded or sequential values, as we wanted to evaluate the ESA scheme as the next addition to the status quo.

Also excluded was an extreme outlier estimate, which was more than threefold the next highest estimate. This selection procedure left us with only 20 out of our initial 64 estimates.

Next we had to decide whether to average across all OE and DC estimates or to produce separate average estimates for each CV format. The latter option was selected, which implied that, once averages were taken, a decision had to be made about the best CV format, hence the best average estimate to use for the transfer.

There were 13 OE estimates selected by the criteria above, with an average WTP estimate of £20.67 per household per year (median: £21.32; 95-per cent confidence interval of [£16.05; £25.28]; all figures after conversion to 1995 £s).

There were 7 DC estimates retained by the selection criteria above, with an average WTP estimate of £68.46 per household per year (median: £69.00; 95-per cent confidence interval of [£54.15; £82.77]). This would, in principle, provide the best prediction for the original Pennine Dales ESA survey's estimate, which was based on the DC format as well.

6.2. Transferring Meta-Model Predictions

If we consider that there is not a sufficiently homogeneous set of benefit estimates in the literature, which can be taken as a set of independent samplings from the same WTP distribution (or, at least, from a mother distribution of WTP distributions), then the average becomes a meaningless operator.

However, there are still ways to transfer multiple studies: one is using a probabilistic model of the effects of policy-differences, population-differences, and method-differences on estimated WTP. This model is then interpreted as a model of the underlying process that is supposed to have generated all the benefit estimates in the literature — that is as a meta-model. Thus, it can be used to predict the benefit estimate that would be arrived at by a new study for which we know the values of the appropriate independent variables, that is it can be used to predict average WTP conditional on these independent variables. This only requires assuming that the same basic underlying meta-model applies.[13]

There are two possible strategies to use meta-models of this type for benefit transfer purposes: (1) one is using a model such as meta-model 1, estimated from a vast sample, including estimates for a broad range of different landscape changes, policies and populations; and (2) the other is using models such as meta-model 2, estimated from smaller, more homogeneous, sub-samples including only landscape changes, policies and populations of a particular type, better matching the policy evaluation problem. The first strategy has the advantage that, as more things vary (and vary more) across estimates, it is possible to estimate the effects on WTP of more factors, hence leading to models accounting for more independent variables. It has, however, the limitation that model parameters estimated for this broader class of studies are probably not accurate estimates of the same parameters for the more homogenous subset of studies that are of interest to us. Strategy (2) circumvents this problem, but at the cost of accounting for less factors: note the fact that meta-model 1 has 16 independent variables while meta-model 2 has only 7 variables (table 3).

The combined effect of these limitations and advantages on the accuracy of benefit transfers is, in general, undetermined and needs to be empirically assessed. Hence, in this chapter, we use both strategies for comparative and assessment purposes.

6.2.1. Using the meta-model estimated from all available CV landscape studies To predict the WTP value to be transferred to the Pennine Dales ESA case based on meta-model 1, we simply evaluated the vector of 16 independent variables (data vector) characterising this case.[14] Note that these independent variables could be evaluated without any field data collection at the Pennine Dales (the policy site). So the rough definition of policy, population and method variables in our meta-model (most of them dummies), though causing some error-in-variables problems, presents a clear practical advantage: no additional information is required to predict with the model. Only the original studies in the literature and the meta-analysis of these studies are required to carry out a transfer.

According to the procedure used for transferring averages of several studies, we also produced here a separate benefit transfer (model prediction) for each of the two main CV elicitation formats.

As with the transfer of the Peneda-Gerês WTP model, we also used the variance-covariance matrix of the meta-model, combined with the data vector, to produce the variance estimates used to build confidence intervals for the benefit transfers.

For the OE format the transfer estimate is £33.83 per household per year (after conversion from 1996 to 1995 prices); the 95-per cent confidence interval is [£26.39; £43.38]. For the DC format, the benefit transfer estimate is £87.30 per household per year, with a 95-per cent confidence interval of [£64.34; £118.46].[15]

6.2.2. Using the meta-model based on CV estimates of ESA-like policies only To predict the WTP figure to be transferred to our policy case, based on meta-model 2, we simply combined this model with the vector of independent variables characterising the Pennine Dales ESA scheme. Again, we produced here separate benefit transfers for the two CV formats and built confidence intervals for the benefit transfers.

Hence, for the OE format, the benefit transfer estimate is £26.72 per household per year, with a 95-per cent confidence interval of [£20.75; £34.40]. For the DC format, it is £88.06 per household per year, and the 95-per cent confidence interval is [£61.75; £125.59].

7. HOW TRANSFERABLE ARE LANDSCAPE VALUES?

In this section, the several sources and procedures for benefit transfer considered so far in this chapter are assessed against three criteria. First, convergent validity; second, the practical importance of transfer errors; and, third, the value of the information an original study at the policy site would add to that available from a transfer.

7.1. Convergent Validity

All eleven transfers estimated in this chapter are presented in Table 7 in terms of both point estimates and 95 per cent confidence intervals. Assuming that 'true' WTP is known with certainty and equal to the average benefit estimate from the Pennine Dales ESA original study, point and interval predictions for benefit transfers are also represented as percentages of that 'true' value. This makes easier (1) to assess the per cent deviation of each transfer from the 'true' value (transfer error); and (2) to check whether this 'true' value is inside the 95 per cent confidence intervals for the several transfers.

Although we have more confidence in a (good) original study than in a transfer, it is impossible to know if the former is actually closer to true WTP than transfers, as we have no access to true WTP. So, to be accurate, what we are evaluating here is whether the transfer estimates and the original estimate at the policy site, both supposedly measuring the same value concept, actually converge, i.e.: we are assessing convergent validity.

Table 7. Point and interval benefit-transfer estimates

Type of transfer	in 1995£s			% of Original		
	LL	Mean	UL	LL	Mean	UL
Single-best-study approach						
Similar site, similar policy, different method						
Unadjusted scalar	23,30	29,04	34, 79	20,8	25,9	31, 0
Adjusted scalar	76,79	95,73	114, 66	68,5	85,3	102, 2
Different site, different policy, similar method						
Unadjusted scalar	52,11	56,48	60, 86	46,4	50,3	54, 2
Adjusted scalar	83,13	90,11	97, 08	74,1	80,3	86, 5
Valuation function	61,74	67,52	73, 31	55,0	60,2	65, 3
Transferring multiple studies						
Transferring multiple-study averages						
Average of OE estimates	16,05	20,67	25, 28	14,3	18,4	22, 5
Average of DC estimates	54,15	68,46	82, 77	48,3	61,0	73, 8
Transferring a meta-analytical model						
Meta-model 1 - OE format	26,39	33,83	43, 38	23,5	30,2	38, 7
Meta-model 1 - DC format	64,34	87,30	118, 46	57,4	77,8	105, 6
Meta-model 2 - OE format	20,75	26,72	34, 40	18,5	23,8	30, 7
Meta-model 2 - DC format	61,75	88,06	125, 59	55,0	78,5	111, 9

Notes: LL are lower limits of 95 per cent confidence intervals and UL, upper limits.

From Table 7 it is possible to conclude that the most accurate transfers, and the only ones whose confidence intervals include 'true' WTP, are: (1) the scalar transfer from the Willis and Garrod's (1991) Yorkshire Dales study *adjusted for the DC format*; and (2) both of the two transfers from meta-analytic models (i.e. using meta-models 1 and 2) *when predicting for the DC format*. Transfer error is, in these cases, in the 15–22% range.

Note that the scalar transfer from the Santos' (1997) Peneda-Gerês source-study adjusted for the income-difference alone clearly outperforms the transfer of the WTP model from the same source-study. This model would allow for finer adjustments of many other factors in addition to income. Thus, this result suggests the superior performance of meta-analytic-based adjustment factors — drawing on inter-study variation of WTP estimates — as compared to the transfer of study-specific models. Probably, many study-specific models of intra-study variation of WTP are simply not transferable for the inter-study context.

The worse transfer procedures were all of those implying an OE elicitation format. These are: (1) the unadjusted scalar transfer from the Willis and Garrod's (1991) Yorkshire Dales study; (2) the average of all OE estimates of ESA-like policies; and (3) both of the two transfers of meta-analytic models (i.e. using meta-models 1 and 2) *when predicting for the OE format*. Note, however, that all these transfers produced benefit estimates rather close to each other, with most confidence intervals overlapping. So, while performing badly to predict a DC estimate, OE-based transfers are quite good transfer-sources for each other. This points to a potentially embarrassing problem: transfers provide quite reasonable predictions of true WTP for landscape conservation, but these predictions strongly depend on selecting the 'right' elicitation format, i.e.: the one yielding 'true' WTP. Note that this is not a 'transfer problem' but one involving CV as a whole, because the 'right' elicitation format is also a problem for original CV studies. This is not an absolute limitation of CV if we have reasons to believe that one of the formats is preferable, e.g. on incentive compatibility grounds (Carson et al. 1999).

Earlier proponents of meta-analyses of non-market valuation studies were rather reluctant about using meta-models as direct predictive devices. Thus, another important implication of these results is the good performance of both meta-models when directly used for predicting WTP values for the particular policy context at hand. They provided two of the three best transfers for the Pennine Dales ESA scheme – the third being derived from a CV study carried out in the same area 5 years earlier, a type of source-study that is usually unavailable in practice.

To reinforce this positive assessment of meta-models used as direct predictive devices, we mention that elsewhere (Santos 1998), meta-model 1 was used to predict all of the 66 landscape benefit estimates in the reviewed literature. This was done by, first, estimating the model with all observations from a particular survey dropped from the data; second, using the estimated model to predict the particular benefit estimates that had been dropped. Comparing these predictions with the dropped estimates, we concluded that 44 per cent of the estimates could have been predicted without the original survey, with an error of up to 30 per cent. If one accepts a deviation of up to 50 per cent (still within the bounds set by Cummings et al. 1986 and Mitchell and Carson 1989), 75 per cent of the estimates could have been accurately predicted without the original survey.

Summarily, our transfer results support, in this particular case, the following conclusions:

- first, all transfers based on DC data, predicting for the DC format, or, when based on OE data, adjusted for the DC format using meta-analytic adjustment factors performed rather well in predicting a DC original estimate;
- second, if one aims at a really small and non-significant (in statistical terms) error, the only options are either transferring from a study of practically the same policy and same population, or using meta-model predictions (always adjusting for the elicitation format);
- third, a source-study of a not-very-different policy, different population and using similar method might provide a rather accurate transfer if adjusted for income using a meta-analytic-based factor;
- the next best options are either transferring a valuation function from a study of a not-very-different policy with a different population but using similar method, or transferring a simple average of multiple not-very-different studies (using the same CV format);
- transferring a scalar from a source-study of a not-very-different policy, different population and using similar method, without adjustments, performed slightly worse;
- predicting with meta-models estimated from a smaller data set, which better matches the policy context, such as meta-model 2, does not outperform predictions from a more general meta-model of all landscape changes, such as meta-model 1.

7.2. Practical Importance of Transfer Error

What is practically important as regards transfer error is not whether it is statistically significant, but whether it really makes a difference for policymakers, that is whether it leads to wrong policy recommendations. How large transfer error must be, in order to be of practical importance, depends on the degree of precision required by the evaluation problem. Different such problems, e.g. screening studies to prepare a full cost-benefit analysis as compared to a study aimed at determining compensation required in a court case, have rather different precision requirements (Desvousges et al. 1998).

Fortunately, we have two types of information allowing us to determine the level of precision required by the evaluation of the Pennine Dales ESA scheme: (1) a good estimate of the visiting population, over which to aggregate our per-household benefit estimates; and (2) two ballpark estimates of the social cost of this scheme, including administrative costs (Santos 1998). Dividing policy costs by the number of visiting households, we secure two figures that are directly comparable to the benefit estimates in Table 7,that is a lower bound of £15.50 per visiting household per year, and an upper bound of £28.37.

Table 8 presents the benefit/cost ratios secured by dividing all of our (original and transfer) benefit estimates for the Pennine Dales ESA scheme by these two social-cost ballparks. For each benefit estimate, we have six benefit/cost ratios, that is three benefit figures (mean WTP and the 2 limits of the confidence interval) for each of the two cost ballparks. Particularly important is the ratio corresponding to the lower limit of the confidence interval for benefits. If this is larger than one, policy makers should proceed with the scheme if they are prepared to accept a 2.5 per cent probability of making the wrong decision. Assuming this is acceptable, only benefit/cost ratios based on lower limits of confidence intervals are discussed in what follows.

Table 8. Point and interval estimates of benefit/cost ratios for the original and transfer benefit estimates

Type of transfer		Benefit/Cost ratio		
		LL	Mean	UL
ORIGINAL benefit estimate	LB	6,52	7,24	7,96
	UB	3,56	3,95	4,35
Single-best-study approach				
Similar site, similar policy, different method				
Unadjusted scalar	LB	1,50	1,87	2,24
	UB	0,82	1,02	1,23
Adjusted scalar	LB	4,96	6,18	7,40
	UB	2,71	3,37	4,04
Different site, different policy, similar method				
Unadjusted scalar	LB	3,36	3,64	3,93
	UB	1,84	1,99	2,14
Adjusted scalar	LB	5,36	5,81	6,26
	UB	2,93	3,18	3,42
Valuation function	LB	3,98	4,36	4,73
	UB	2,18	2,38	2,58
Transferring multiple studies				
Transferring multiple-study averages				
Average of OE estimates	LB	1,04	1,33	1,63
	UB	0,57	0,73	0,89
Average of DC estimates	LB	3,49	4,42	5,34
	UB	1,91	2,41	2,92
Transferring a meta-analytical model				
Meta-model 1 - OE format	LB	1,70	2,18	2,80
	UB	0,93	1,19	1,53
Meta-model 1 - DC format	LB	4,15	5,63	7,64
	UB	2,27	3,08	4,18
Meta-model 2 - OE format	LB	1,34	1,72	2,22
	UB	0,73	0,94	1,21
Meta-model 2 - DC format	LB	3,98	5,68	8,10
	UB	2,18	3,10	4,43

Notes: LL are lower limits of 95 per cent confidence intervals and UL, upper limits; LB is the lower bound ballpark for social cost and UL, the upper bound.

Using the original estimates of the Pennine Dales ESA survey, the ESA scheme clearly passes the cost-benefit test. The same happens if we use any of the benefit transfers based on the DC format, adjusted for this format or predicting for this format. Different conclusions are drawn if we use the benefit transfers based on the OE format or predicting for this format: using upper ballparks for costs, all benefit/cost ratios now drop below 1.00.

Again, we have the uncomfortable feeling that, in this case, the only difference that would actually matter in practice is the difference between the two CV formats – the most important single factor to explain differences between transfers. Note, however, that, in cases where benefits are much closer to costs than in the Pennine Dales ESA, adjusting for WTP differences much smaller than that due to different CV formats (e.g. WTP differences due to different recreation activities or landscape changes) will certainly matter in practice.

7.3. The Value-of-Information Test

The ultimate test for a transfer (with given accuracy) is whether the added information that would be acquired through an original valuation study at the policy site (or a better transfer) would justify carrying out such an original (or better transfer) study. This test is conveniently framed as a simple question (cf. e.g. Desvousges et al. 1998): does the difference between the expected value of a policy based on an original (or better transfer) study and the expected value of a policy based on the particular transfer procedure exceeds the added costs of carrying out the original (or better transfer) study as compared to those of the particular transfer study at stake?

In this final section, we compute the expected net-benefit values of policies for the Pennine Dales ESA based on three types of benefit estimates:

- the original Pennine Dales ESA study's estimate;
- the unadjusted scalar transferred from the Peneda-Gerês study (a reasonable transfer, but far from best; in fact, it is the worse using the DC format), thereafter called type I transfer;
- the transfer based on the prediction of meta-model 1 for the OE format (a bad transfer, though not the worse), thereafter called type II transfer.

In this exercise, we make some simplifying assumptions: (1) 'true' WTP is equal to the sample average from the original study; (2) policymakers decide according to benefit/cost ratios based on average benefit estimates; and (3) only upper bounds for costs are relevant for both actual net-benefit calculation and policy decision-making.

With all these assumptions, the 'true' net benefit of keeping the Pennine Dales ESA scheme is estimated as circa £14 000 000 per year. The 'right' decision obviously is continuing with the policy. What are the probabilities of replicated original studies, type I and type II transfers leading to decide not to go ahead with the policy (wrong decision)? This decision would require that the benefit estimate on a per-household basis drops below £28.37.

What is the probability of this happening with a replicated original study? Assuming normality, this probability is that of the standard normal variable being smaller than -14.8, that is practically zero. Therefore, replicating an original study will always lead to the right decision, and thus the expected value of the net benefits is circa £14 000 000 per year.

The required probability for a type I transfer is also very close to zero, which happens here with all transfers associated with the DC format. Hence, the insignificant difference between the expected net benefit of a decision based on this transfer and that of a decision based on an original study does not justify carrying out an original study.

What about this probability for a type II transfer? For this type of transfer, there is a 8.4 per cent probability of a decision of not going ahead with the policy. Thus, a policy based on this transfer will have an expected net benefit of $0.916\times$ £14 000 000 = £12 827 000 per year. The difference for a policy based on an original study (or a type I transfer) is £1 173 000 per year, which offsets any reasonable cost estimate for an original study (and, a fortiori, for a type I transfer if possible). Thus, carrying out an original study (or a type-I transfer if possible) is justified in this case.

Note that, of course, all of these results rely on the strong assumption that the 'true' WTP value coincides with the average benefit observed in the original study. Adopting a Bayesian approach (see e.g. Atkinson et al. 1992) allows the analyst to ignore what the 'true' WTP value is; by assuming all studies (transfers and the original one) are sampling from the same mother distribution, Barton (1999) uses a sequential Bayesian procedure to update previous valuation information as new information becomes available. This enables the analyst to select the optimal level of information collection.

Furthermore, the above recommendations about whether to carry out an original study or a transfer are only valid for the present context, in which benefits (except if using the OE format) systematically offset costs by several times. In other contexts, carrying out an original study may be justified in terms of the expected value of the gain of information so provided for the decision-maker. Therefore, more applied research in this crucial area, under different cost-benefit contexts, is needed.

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8. NOTES

1 Namely, Mitchell and Carson's (1989) Appendix A, Bonnieux et al. (1992), Römer and Pommerehne (1992), Mäntymaa et al. (1992), Hoevenagel et al. (1992), Navrud and Strand (1992), Johansson and Kriström (1992), Turner et al. (1992), Bennett (1992), Shechter (1992) and Bateman et al. (1994).

2 Such as Dubgaard & Nielsen (1989), Hanley (1991), and Whitby (1994).

3 This list possibly misses dissertation material, conference papers and recent research still waiting for publication at that date. Nine of the studies in our final list are journal articles; two are published research reports; three, unpublished research reports; one, a conference paper; and four report on recent research, still unpublished. The studies have been carried out in seven different countries (Sweden, UK, Austria, France, Spain, Portugal and the USA) and include: studies commissioned by the UK's Ministry of Agriculture Fisheries and Food; research projects funded by the EU or by national conservation agencies; and research independently carried out at several universities.

[4] Most of these WTP estimates have been originally elicited on a per-year per-household basis; only three required an adjustment to this basis (Santos 1997). All WTP estimates have been converted into 1996 £, using the 1996 consumer-price index for the respective country and an appropriate exchange rate against the sterling. Price indices for the seven countries were built from ONS (1997a) and UN (1995); average exchange rates for the years of 1994–1996 (ONS 1997b) were used, to avoid that an excessive weight was given to the increase in the value of the sterling over the last months of 1996.
[5] From an analytical point of view, variation in WTP estimates is a desirable fact if it can be associated with variation in some independent variables. Indeed, an important condition for using regression analysis as an analytical tool is that dependent and independent variables vary.
[6] For example not all studies reported sample averages for household income, which led us to take GDP per capita as a proxy.
[7] Note this is not ad hoc exclusion on quality grounds: a clear relationship between sample size and sampling variance was empirically established for this set of studies by Santos (1997), and these observations corresponded to particularly low-precision estimates.
[8] As well as a similar survey of residents, which is not relevant for the purposes of this chapter, and thus is not commented here. Cf. also Willis and Garrod (1992).
[9] I.e.: including not only the dales in Yorkshire, within the NP, but also those in the North Pennines (Cumbria, Durham and Northumberland counties), outside the NP.
[10] The price indexes used thereafter for adjusting current values for the inflation were based on the consumer price index for the respective country (ONS 1997a and UN 1995).
[11] Our thanks to Ken Willis and Guy Garrod for useful information on many other aspects of their questionnaire.
[12] Values in currencies other than £s were converted into 1996 £s using the appropriate exchange rate against the sterling (average of 1994/96 rates; ONS 1997b); conversion into 1995 £s used the ratio of 1996 to 1995 consumer price indexes (ONS 1997a).
[13] Of course, as with averages, random-effects regression models would be a more convenient description than the equal-effects ones used here (a fixed-effects model was impossible to estimate with so few observations from some of the studies). These more sophisticated approaches will be the subject of further research on these transfer issues.
[14] This data vector is: conservation or recreational site = 0; ESA or NP = 1; unique = 0; Nation-wide scope = 0; considerable change in character = 0; moderate/heavy development = 0; substitution effects = 0; NIMBY = 0; mainly non-users = 0; foreignvisitors = 0; log(income) = 9.80; DC and IB elicitation formats = 0 or 1 (depending on the CV format we are predicting for); level of trimming = 0; truncation of DC data = 0; tokens technique = 0; year = 1995.
[15] Note that these predictions were obtained by raising *e* to the predicted log (WTP) and thus represent medians, not means (obtaining means for a log-normal distribution such as this would require us to multiply by the moment-generating function of the normal distribution.). However, as the WTP data for the regression model are, by definition, sample averages of WTP, what we have here is a median of averages. That is: is a prediction of the WTP sample average that will be exceeded in half of the studies to which the meta-model applies.

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