Invalid Benefit Transfers: for Whom the Bell Tolls?

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The testing of benefit transfer so far has been unable to validate the practice. It is believed to be due to a technical problem by environmental economists who tried to remedy it by constructing a universal model based on data from a wide variety of conditions.

This paper argues that the problem of invalidated benefit transfer is much more fundamental than that acknowledged by environmental economists. Specifically, the universal model conflicts with what benefit-transfer-friendly ecosystem valuation requires. Therefore, neo-classical environmental valuation itself has to be changed. In light of system ecology and institutional economics, we should start by clearly defining the subject and the object of the valuation in their social and ecological contexts

1. Valid and invalid benefit transfer: define and diagnose

1) What is benefit transfer?

Benefit transfers can be defined practically as the transfer of existing economic values estimated in one context to estimate economic values in a different context

(Brookshire and Neill 1992). In the case of natural resource and environmental policies and projects, benefit transfer involves transferring value estimates from a "study site" to a "policy site" which can vary across geographic space and or time.

Benefit transfer methods are divided into three major types by environmental economists: unadjusted or fixed point estimate transfer, adjusted or expert judgment point estimate transfer, and function transfer (Bergstrom and De Civita 1999; (Brouwer 2000).

2) What does "invalid" mean?

There have been numerous attempts to gauge the predictive capabilities of benefits transfer (Atkinson, Crocker et al. 1992; Desvousges, Naughton et al. 1992; Loomis 1992; McConnell 1992; Smith 1992; Walsh, Johnson et al. 1992; Kask and Shogren 1994; Parsons and Kealy 1994; Johnson and Button 1997; Kirchhoff, Colby et al. 1997; Piper 1998; Scarpa 2000; Piper and Martin 2001; Shrestha and Loomis 2001; Barton 2002; Leon, Vazquez-Polo et al. 2002; Morrison, Bennett et al. 2002; Chattopadhyay 2003; Shrestha and Loomis 2003). Transfers are generally interpreted to be "valid" or "reliable" if the estimates are not statistically different from one another. However, in most applications this test of convergent validity is rejected.

A recent summary study (Brouwer 2000), for instance, found that the transfer errors can be as large as 56% in the case of unadjusted unit value transfer and 475% in the case of adjusted value transfer. Little can be concluded from the

large differences in upper limit transfer errors between undusted and adjusted value transfers, though the evidence did suggest that function transfers are more reliable than point transfers (including both adjusted and unadjusted methods) (Bergstrom and De Civita 1999).

3) Does "invalid" mean "useless"?

People with different philosophies have different answers to this question. Idealists might say "yes" because there are too many differences between the study and the policy site, and these differences obviously result in different values at each of the sites so benefit transfer is impossible.

On the other extreme, the pragmatist may answer "no", and answer emphatically. Given the cost and time involved with the collection of primary data, the pragmatist would argue that the practical solution is to expand the number and diversity of benefit transfer studies. Such an expansion is facilitated by the rapid increase in the number of non-market valuation studies being conducted, particularly related to natural resources and environmental issues.

A third type of philosophy, which I prefer personally, provides a "common ground" between the two extremes. "Practical idealist" would acknowledge that benefit transfer is a reasonable concept to entertain, but try to improve the process of accomplishing benefit transfer.

In essence, benefit transfer is simply the application of secondary data to a new policy site. Statistical models are often used to describe how the estimates of unit values vary with changes in the new context studied (in the case of function transfer as well as adjusted point estimate transfer). All applied models are wrong. What is at issue, then, is how important these errors are to their intended use(Smith 1992). In other words, the degree of accuracy of benefit transfer depends on how the results will be used.

Several researchers provided a discussion regarding a continuum of accuracy for benefit transfer based on the intended use(Brookshire and Neill 1992; Desvousges, Naughton et al. 1992; Desvousges and Johnson 1998) (Figure 1). That is, the minimum degree of accuracy necessary is related to the cost of making a wrong decision based on the result of the benefits transfer. For example, using benefits transfer approaches to assist an environmental policy decision-maker to set broad priorities for assessment and possible action may require a middle level of accuracy. This type of use of benefit transfer provides knowledge with only a small cost to society due to any inaccuracies therein.

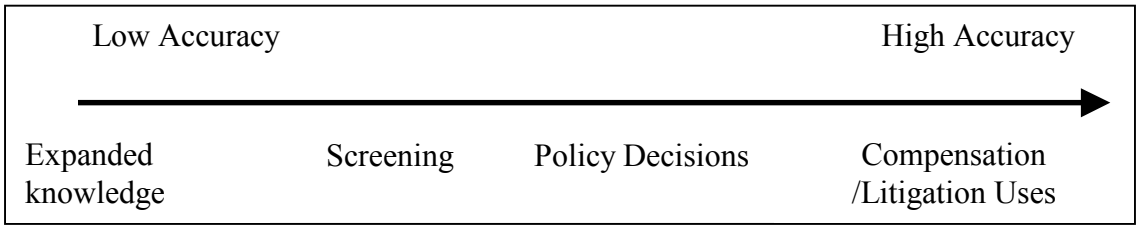

Figure 1. Continuum of accuracy for benefits transfer analysis
Source: (Desvousges and Johnson 1998)

On the other hand, if benefit transfer is used as a basis for determining just compensation in the context of natural resource damage litigation, the costs of a wrong decision to society could be quite high. In that case, the accuracy of a benefit transfer should be very high.

But how can the accuracy of benefit transfer be improved? To answer this question, first we have to understand the causes of invalid benefit transfers. However, environmental economists and ecologist economists certainly have a divergence here therefore the solutions to remedy the problem.

2. Invalid benefit transfer: cause and treatment from two perspectives

1) Environmental economists' perspective

To environmental economists, the invalidity of benefit transfer is a technical problem (Downing and Ozuna 1996) and there are two solutions proposed , i.e. better documentation and meta-analysis.

Better documentation refers to the practice of improved reporting on original data at the study site. In the early days of non-market valuation, considerable descriptive

statistics, diagnostic statistics, and estimation procedures might be reported. However, in recent years, the tendency has been to simply report mean values and, perhaps, median values.

This problem certainly provides lots of headaches to benefit transfer practitioners because original studies are the basis of benefit transfer via the provision of data and models needed. Thus, some researchers believe that original investigations must not simply focus on the end result of estimating a value for the policy issue at hand. Original analyses using primary data, and reporting of these analyses, must reflect their future use as data for benefit transfer studies (Boyle and Bergstrom 1992). However, this requirement is believed to be difficult to encourage without incentives because full documentation to assist subsequent policy transfers is a costly activity(Smith, Van Houtven et al. 2002)[1]

However, original environmental valuation studies have expanded at a dramatic pace over the past twenty-five years, often without satisfactory (for the purpose of benefit transfer) documentation, With a clear danger of being overwhelmed, scholars and policy makers have responded by conducting meta-analysis to take stock of the available, and sometimes competing, empirical estimates.

[1] The documentation problem is more complex and deep than covered here. For example, research efforts have focused mainly on the theoretical issues but not practical/decision-marking such as benefit transfer. Economics is not (though is supposed to be) an applied science!

[2]s benefit transfer. Economics is not (though is supposed to be) an applied science!

Meta-analysis refers to the practice of using a collection of formal and informal statistical methods to synthesize the results found in a well-defined class of empirical studies (Smith and Pattanayak 2002). First used in the medical science field, now meta-analysis is widely used in many disciplines (Rosenthal and DiMatteo 2001)

In the case of benefit transfer, meta-analysis is used to pool the data from existing studies and apply multiple regression analysis. If the basic model specification is complete, that is, if it includes the relevant explanatory variables in the correct functional form, then it could explain the variation in benefits embodied in differences among the explanatory variables. The net benefit estimate for the policy site then would be estimated by inserting appropriate values of explanatory variables into the model fitted with data from other study sites (Walsh, Johnson et al. 1992).

Though it sounds feasible, meta-analysis seems to be incapable of saving the suspect reputation of benefit transfers. The biggest problem is the meta-analyses summarization of non-market valuation studies has often NOT met the requirement of measuring "identical" concepts, which is the core idea of this technique (Smith and Pattanayak 2002). Or, put it in other way, it takes apples and oranges and averages such measures as their weights, sizes and flavors—the arrived results from this exercise could well be meaningless (Hunk 1997).

It can be argued, however, that it is a good thing to mix apples and oranges, particularly if one wants to study fruit. This is exactly how the new preference

calibration approach works—it assumes economic consistency of the transfers. When multiple benefit estimates from different methods are available such as hedonic pricing, travel cost, and contingent valuation, the framework uses the definition of the benefit concept from each method in a single preference function to reconcile differences (Smith, Van Houtven et al. 2002).

In other words, neo-classical economists try to solve the problem by universalizing. However, I have to doubt if this is the right direction to go, at least in the case of benefit transfer. If there were only one preference function applicable everywhere and all the time, why do we still have so many invalid

Apparently, benefit transfer practitioners, at least those guided by the neo-classical model, haven't been able to tell the difference between *universalizing* and *generalizing*. The former begins with a set of observations and attempts to subsume them under a governing scientific theory that is applicable everywhere and anytime. The latter also begins with a set of observations, but understands them as signs that are meaningful only within the particular context in which they were observed, and attempts to specify the characteristics of that context (Hukkinen 2003).

Appling these concepts to the case of benefit transfer, ecosystem economists believe values are context relative, therefore the functions describing these values might also be context relative. And the neo-classical economic universal model is the root cause for invalid benefit transfers.

2) Ecological Economists' perspective

For ecological economists, the problem of invalid benefit transfer is much more fundamental than a technical issue, as acknowledged by environmental economists. Specifically, the neo-classical economics universal model conflicts with what benefit-transfer-friendly ecosystem valuation requires.

First, the "commodity", i.e. the ecosystem goods and services are not universal. On the contrary, these are well known (at least by people other than neo-classical economists) by their complexity and multidimensional nature. The differences between scales, stock and flow, states of the system, and the types of disturbance all matter when describing a commodity (Turner, Paavola et al. 2003). A valuation study which fails to address these differences certainly will put subsequent benefit transfer practitioners into danger of "comparing apples and oranges". As one researcher noticed, "One of the most important steps in benefit estimation and transfer is careful specification of the commodity to be valued. The most significant limitation is the difficulty in matching the commodity specification of the policy site to the set of existing valuation studies" (Kask and Shogren 1994).

Second, the people who value ecosystem goods and services are not universal. To be exact, there is no universal preference function as modeled in the study before (Smith, Van Houtven et al. 2002). It is clear that social norms, conventions, and shared values are necessary components in defining and deciding these preferences, no matter how economists tend to overlook the contextual framing of individual preferences (Vata and Bromley 1994).

Now that the universal model is dismissed, how do we move from criticism of mainstream theory to applying the general model into the ecosystem valuation practices? Again, the arguments split on two sides, the object (i.e. the ecosystem goods and services) and the subject (i.e. the people who value) of the valuation. I will briefly cover both below.

Two corresponding linkages that are currently missing have to be established. First, the information produced by ecological studies and the information needed to implement valuation need to be linked. Second, people who value the ecosystem goods and services have to be linked to their social and cultural contexts.

The first linkage is to bring ecological context into the valuation process, that is, to describe and quantify ecosystem attributes, and ideally, to predict the consequences of human actions on those attributes. For instance, there are very few studies which encompass a range of interdependent ecological functions, uses and values at a given site; or which track site changes in values across different states of ecological disturbance. But it is just this type of study that is of great relevance to decision makers faced with the complex trade-off between local, national, and global conservation net benefits (Turner, Paavola et al. 2003).

The place to start is with service flows, and we do have a whole list of them (Costanza et al. 1997; de Groot et al. 2001). However, there are other issues we don't have an answer for yet These include dealing with uncertainty, irreversibility, and double counting (Turner, Paavola et al. 2003).

The second linkage introduces the social context within which people assign values to ecosystem goods and services. Institutional economists have done substantial work in this area (North 1990). Though not within our field of expertise, ecosystem economists have to learn from institutional economists in order to improve both fields overall..

3. Invalid benefit transfer tolls the bell for the universal model

My tolling bell metaphor was intended to portray a situation where invalid benefit transfer announces the death of the neo-classical economic universal model. I am not arguing that all such 'benefit transfer' based on it must be invalid, but I do believe that such procedures have real limits. Many value estimates will not be amenable to transfers beyond local or regional scales, as defined by the interaction of ecological and social contexts. Further research to precisely define these boundaries, and to formulate a process which encourages robust validity and reliability testing protocol, is an urgent requirement.

Reference

Atkinson, S. E., T. D. Crocker, et al. (1992). "Bayesian Exchangeability, Benefit Transfer, and Research Efficiency." Water Resources Research **28**(3): 715-722.

Barton, D. N. (2002). "The transferability of benefit transfer: contingent valuation of water quality improvements in Costa Rica." Ecological Economics **42**(1-2): 147-164.

Boyle, K. J. and J. C. Bergstrom (1992). "Benefit Transfer Studies - Myths, Pragmatism, and Idealism." Water Resources Research **28**(3): 657-663.

Brookshire, D. S. and H. R. Neill (1992). "Benefit Transfers - Conceptual and Empirical Issues." Water Resources Research **28**(3): 651-655.

Brouwer, R. (2000). "Environmental value transfer: state of the art and future prospects." Ecological Economics **32**(1): 137-152.

Chattopadhyay, S. (2003). "A repeated sampling technique in assessing the validity of benefit transfer in valuing non-market goods." Land Economics **79**(4): 576-596.

Desvousges, W. H. and F. R. Johnson (1998). Environmental Policy Analysis with Limited Information, Edward Elgar.

Desvousges, W. H., M. C. Naughton, et al. (1992). "Benefit Transfer - Conceptual Problems in Estimating Water-Quality Benefits Using Existing Studies." Water Resources Research **28**(3): 675-683.

Downing, M. and T. Ozuna (1996). "Testing the reliability of the benefit function transfer approach." Journal of Environmental Economics and Management **30**: 316-322.

Hukkinen, J. (2003). "From groundless universalism to grounded generalism: improving ecological economic indicators of human-environmental interaction." Ecological Economics **44**(1): 11-27.

Hunk, M. (1997). How science takes stock. New York, Russell Sage Found.

Johnson, K. and K. Button (1997). "Benefit transfers: Are they a satisfactory input to benefit cost analysis? An airport noise nuisance case study." Transportation Research Part D-Transport and Environment **2**(4): 223-231.

Kask, S. B. and J. F. Shogren (1994). "Benefit Transfer Protocol for Long-Term Health Risk Valuation - a Case of Surface-Water Contamination." Water Resources Research **30**(10): 2813-2823.

Kirchhoff, S., B. G. Colby, et al. (1997). "Evaluating the performance of benefit transfer: An empirical inquiry." Journal of Environmental Economics and Management **33**(1): 75-93.

Leon, C. J., F. J. Vazquez-Polo, et al. (2002). "A Bayesian model for benefit transfer: application to national parks in Spain." Applied Economics **34**(6): 749-757.

Loomis, J. B. (1992). "The Evolution of a More Rigorous Approach to Benefit Transfer - Benefit Function Transfer." Water Resources Research **28**(3): 701-705.

McConnell, K. E. (1992). "Model-Building and Judgment - Implications for Benefit Transfers with Travel Cost Models." Water Resources Research **28**(3): 695-700.

Morrison, M., J. Bennett, et al. (2002). "Choice modeling and tests of benefit transfer." American Journal of Agricultural Economics **84**(1): 161-170.

North, D. (1990). Institutions, instituional change and economic performance, Cambridge University Press.

Parsons, G. R. and M. J. Kealy (1994). "Benefits Transfer in a Random Utility Model of Recreation." Water Resources Research **30**(8): 2477-2484.

Piper, S. (1998). "Using contingent valuation and benefit transfer to evaluate water supply improvement benefits." Journal of the American Water Resources Association **34**(2): 311-320.

Piper, S. and W. E. Martin (2001). "Evaluating the accuracy of the benefit transfer method: A rural water supply application in the USA." Journal of Environmental Management **63**(3): 223-235.

Rosenthal, R. and M. R. DiMatteo (2001). "Meta-analysis: recent developments in quantitative methods for literature reviews." Annu. Rev. Psychol. **52**: 59-82.

Scarpa, R. (2000). "Contingent valuation versus choice experiments: Estimating the benefits of environmentally sensitive areas in Scotland: Comment." Journal of Agricultural Economics **51**(1): 120-126.

Shrestha, R. K. and J. B. Loomis (2001). "Testing a meta-analysis model for benefit transfer in international outdoor recreation." Ecological Economics **39**(1): 67-83.

Shrestha, R. K. and J. B. Loomis (2003). "Meta-analytic benefit transfer of outdoor recreation economic values: Testing out-of-sample convergent validity." Environmental & Resource Economics **25**(1): 79-100.

Smith, V. K. (1992). "On Separating Defensible Benefit Transfers from Smoke and Mirrors." Water Resources Research **28**(3): 685-694.

Smith, V. K. and S. K. Pattanayak (2002). "Is meta-analysis a Noah's ark for non-market valuation?" Environmental & Resource Economics **22**(1-2): 271-296.

Smith, V. K., G. Van Houtven, et al. (2002). "Benefit transfer via preference calibration: "Prudential algebra" for policy." Land Economics **78**(1): 132-152.

Turner, R. K., J. Paavola, et al. (2003). "Valuing nature: lessons learned and future research directions." Ecological Economics **46**: 493-510.

Vata, A. and D. Bromley (1994). "Choices without prices without apologies." Journal of Environmental Economics and Management **26**: 129-148.

Walsh, R. G., D. M. Johnson, et al. (1992). "Benefit Transfer of Outdoor Recreation Demand Studies, 1968-1988." Water Resources Research **28**(3): 707-713.