**Is Willingness to Pay for Farmland Preservation Transferable Across States?
Evidence from a Choice Experiment**

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May 22, 2007

AAEA Submission #171678

Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Portland, OR, July 29-August 1, 2007.

This research was funded by the National Research Initiative of the Cooperative state Research, Education and Extension Service, USDA, Grant # 2003-35400-13875. The experimental design was completed by Lidia Rejto and Diccon Bancroft at the University of Delaware STATLAB. Any remaining errors are those of the authors. Opinions belong solely to the authors and do not imply endorsement by the funding agencies.

Abstract

In stated preference assessments of farmland preservation programs, respondents are often told that preservation will occur within a given scale—e.g., community, state, county—but do not know the specific location of parcels in question. Hence, welfare estimates may be available for different scales, providing numerous avenues for benefit transfer. This paper provides a systematic assessment of transfer error, contrasting methods for the transfer of farmland preservation values across states and jurisdictional scales. The data are drawn from choice experiments conducted simultaneously in two different states and at two different scales. Results suggest that transfers across state outperform transfers across scale, and that simpler methods often outperform more complex approaches that calibrate for differences across scale.

Introduction

Notwithstanding over two decades of stated preference (SP) research[1] measuring farmland amenity values, little published work addresses the potential transferability of valuation estimates across policy contexts (Bergstrom and Ready 2005). This lack of research is striking, particularly given the relevance of farmland amenity values for policy (Irwin et al. 2003) and the ubiquity of benefit transfer in policy analysis (Bergstrom and De Civita 1999). Nonetheless, with the exception of the literature review of Bergstrom and Ready (2005) and unpublished work of Ozdemir et al. (2004), the authors are aware of no research that provides findings relevant to the transfer of farmland amenity values.

The transferability of farmland amenity values is particularly germane with respect to the issue of scale. Here, scale is defined as the size of the jurisdiction or area over which a given amount of land is preserved. Most SP research occurs at the political-boundary scale since these jurisdictions offer the most realistic funding and implementation mechanisms.[2] For example, community or regional farmland valuation studies (e.g., Bergstrom et al. 1985; Halstead 1984; McLeod et al. 2002) typically estimate willingness to pay (WTP) for delivery of user and nonuser services within an identified locality such as a town or county. In such cases, the scale ensures a close proximity between service delivery and the respondents' homes, leading to the potential for significant use and nonuse values. In contrast, statewide studies (Duke and Ilvento 2004; Ozdemir et al. 2004) generally solicit WTP for preservation at the state scale, with a concomitant expectation that preserved land will not be located close to respondents' homes. Given that proximity to preserved farmland is not expected at the state scale, nonuse values

[1] Here, we adopt the more general definition of "stated preference" methods, to include all generally-accepted, direct methods of survey-based valuation (e.g., contingent valuation, choice experiments, etc.).
[2] Loomis (2000) found that the use of political jurisdictions, rather than the more relevant economic jurisdictions, may lead to significant underestimation of willingness to pay.

become the primary motivation for survey responses (although limited use values may also be anticipated in some cases).

The issue of scale also is relevant for farmland preservation because funding decisions, such as referenda on preservation bonds, are typically made before the identities of targeted parcels are known. SP surveys replicate this lack of spatial certainty and rarely specify the exact location of targeted farmland parcels. Respondents are simply told that farmland preservation will occur somewhere within a given community, county, or state—thereby defining the scale over which preserved land will be distributed. This approach contrasts with many other types of SP studies, which specify the exact location of resource changes and which thereby allow for the estimation of quantifiable distance-decay relationships (Bateman et al. 2006; Hanley et al. 2003).

The issue of policy scale is distinct from concerns related to benefit aggregation, i.e., the number and location of households over which given SP estimates are aggregated (Bateman et al. 2006). Rather, the issue here is the potential transferability of *per household WTP for a specific quantity and type of farmland preservation*, where per household WTP may depend upon on the jurisdictional scale over which a given amount of farmland will be preserved. For example, the per acre, per household WTP for land preservation will likely depend on, among other things, whether a given quantity of land is preserved somewhere within the household's *home community* versus somewhere within the household's *home state*. The issues of benefit aggregation and policy scale, however, both share an association with the spatial dimensions of policy impacts and sampled households.

In sum, estimates of farmland amenity values are often characterized by (1) values linked to preservation at a particular scale and (2) an absence of specifics regarding exact location of parcels in question. These characteristics lead to a variety of possibilities for benefit transfer.

For example, a policymaker desiring state-scale welfare estimates for a particular state (e.g., for preservation that will occur within the State of Connecticut) might have access to results estimating WTP for farmland preservation, but only from surveys conducted at the community scale (e.g., for preservation that will occur within specific Connecticut communities, estimated from surveys of community residents). There might also exist state- and community-scale WTP estimates derived from surveys conducted in other states (e.g., Delaware). The resulting out-of-state welfare functions could either be transferred directly, or could be used to derive a mechanism to calibrate for differences in welfare estimates across scale. In the present example, such a mechanism could be used to calibrate the available Connecticut community scale welfare estimate(s) to approximate the desired state scale Connecticut value.

The benefit transfer literature provides little information to assist analysts in determining which of the above possibilities is likely to generate welfare estimates with the least transfer error (Rosenberger and Stanley 2006). Intuition suggests that WTP estimates applicable to different scales could differ greatly, given variations in expected resource proximity and the associated potential for use values. Given this intuition, however, it is unclear whether more valid transfers may be obtained by conducting transfers across different states (rather than across scale within states), or by somehow calibrating welfare estimates across scale within a given state. Such information is critical to the application of benefit transfer to land preservation and other policy contexts in which transfer validity does *not* depend on quantifiable distance-decay relationships (Bateman et al. 2006), because the *ex ante* policy context is not characterized by spatial certainty regarding the exact location of resource changes. Rather, the relevant issue is the size of the political or other jurisdiction (or scale) over which a given amount of resource change will occur.

This issue may also be viewed within the framework of site similarity (Johnston 2007). The benefit transfer literature often addresses similarity in terms of population and site attributes, where site attributes traditionally reflect such factors as the availability of substitutes and complements within a given political jurisdiction (e.g., Barton 2002; Loomis 1992; VandenBerg et al. 2001; Piper and Martin 2001; Rosenberger and Loomis 2001). Policy contexts such as farmland preservation, however, also invoke the notion of similarity in scale. Based on similar reasoning to that found in the distance-decay literature (Bateman et al. 2006), intuition suggests that scale similarity should have a critical role in transfer validity. However, the literature provides no systematic findings to assess the legitimacy of this expectation, or the extent to which scale similarity influences transfer error.

This paper assesses different approaches to benefit transfer of farmland amenity values, with an emphasis on transfers across scale. The analysis emphasizes function-based transfers from choice experiment (CE) results (Morrison et al. 2002; Johnston 2007), although parallel issues apply to any transfer of SP welfare estimates. The data are drawn from CE analyses conducted simultaneously in two Northeastern states, addressing farmland preservation within two different states, and at two different jurisdictional scales within each state. Various function-based methods are proposed for benefit transfer, each of which draw from one or more existing studies to provide transferable, function-based estimates of WTP. These include the transfer of like scale per acre WTP values between two different states, denoted a transfer across state. We also consider transfer across scale within a given state. An example would be the use of per acre WTP estimated at the community scale to approximate per acre WTP for a state scale preservation program in the same state. Finally, we develop and test transfer mechanisms that calibrate for differences across scale. Systematic assessment of transfer error provides case-study evidence of transfer validity, and offers insight regarding the most appropriate means to conduct benefit transfer of farmland amenity values.

Benefit Transfer Across Scale and Region—A Theoretical Framework

To promote more manageable discussion, the analysis is narrowed to a specific case. The conceptual model, however, may easily be extended to a number of parallel valuation contexts, involving any number of scales or states. In the present case, assume that the researcher has access to SP results from *three* of the following *four* analyses. These include:

1. An empirical valuation function applicable to farmland preservation at jurisdictional *scale x,* derived from studies conducted in one or more communities in *state i*.
2. An empirical valuation function applicable to farmland preservation at jurisdictional *scale y*, derived from a study conducted in *state i*.
3. An empirical valuation function applicable to farmland preservation at jurisdictional *scale x,* derived from studies conducted in one or more communities in *state j*.
4. An empirical valuation function applicable to farmland preservation at jurisdictional *scale y*, derived from a study conducted in *state j*.

Given the assumed absence of one of the above four analyses, analysts must consider the most appropriate ways to analyze the data available from the three existing models to generate the desired, but unavailable, benefit estimate. This might involve transfer across scale within a single state, transfer between states, or some combination of the two.

Formally, assume that the willingness to pay, $WTP_{hk}(\cdot)$, of household h for farmland preservation program k is given by the general function

$$WTP_{hk}(\mathbf{X_k}, S_{hk}, R_{hk}, Y_h), \qquad (1)$$

where

$\mathbf{X_k}$ = vector of variables characterizing outcomes and policy attributes of preservation program k;

S_{hk} = categorical variable identifying the policy scale (e.g., community or state) within which preservation will occur and within which the household resides;

R_{hk} = categorical variable identifying the state in which preservation will occur and within which the household resides;

Y_h = disposable income of household h.

Presume that $R_{hk} = \{ i, j\}$ represents two different states (or other defined regions), e.g., Connecticut ($R_{hk} = i$) and Delaware ($R_{hk} = j$). Further, $S_{hk} = \{x, y\}$ represents two different policy scales within each state within which preserved farmland might be distributed, e.g., community ($S_{hk} = x$) and statewide ($S_{hk} = y$). As an illustrative example of this notation, the WTP of household h, in state i, for farmland preservation at scale x is given by the function $WTP_{hk}(\mathbf{X_k}, R_{hk}=i, S_{hk}=x, Y_h)$. To further condense this notation we adopt a convention in which superscripts are used to identify scale and region, i.e., $WTP_{hk}^{ix} = WTP_{hk}(\mathbf{X_k}, R_{hk}=i, S_{hk}=x, Y_h)$, whereas $WTP_{hk}^{jy} = WTP_{hk}(\mathbf{X_k}, R_{hk}=j, S_{hk}=y, Y_h)$.[3]

For example, assume that the desired but unavailable welfare function is given by WTP_{hk}^{iy}, or WTP for farmland preservation in state i at the scale y. Benefit transfer must somehow capitalize on information in the three available functions $W\hat{T}P_{hk}^{ix}$, $W\hat{T}P_{hk}^{jx}$, and $W\hat{T}P_{hk}^{jy}$, where the hat (^) indicates an empirically estimated function. We consider four possibilities for benefit transfer, based on structural use of information embedded in available preference functions:

1. Function based transfer using only information from $W\hat{T}P_{hk}^{ix}$, or WTP for scale x

[3] To simplify the model, we assume that regardless of preservation scale households are only asked to consider preservation that occurs in their home state for state scale welfare assessment, or home community for community scale assessment. While the model could easily be extended to address this possibility, the resulting notation and complexity would detract from the main issues addressed here.

preservation in state *i*. This approach conducts a function-based transfer across geographic scale (*x* to *y*), within the same state (*i*). We denote this *transfer across scale*.

2. Function based transfer using only information from $W\hat{T}P_{hk}^{jy}$, or WTP for scale *y* preservation in state *j*. This approach conducts a function-based transfer across states (*j* to *i*), but at the same jurisdictional scale (*y*). We denote this *transfer across state*.
3. Combine information from $W\hat{T}P_{hk}^{jx}$ and $W\hat{T}P_{hk}^{jy}$ to derive a meta-function forecasting the *difference* between WTP at the community (*x*) and statewide (*y*) scales for otherwise identical preservation activities, based on information from state *j*. This function is then used to calibrate $W\hat{T}P_{hk}^{ix}$ in state *i* to obtain the desired estimate WTP_{hk}^{iy} in the same state. This approach uses results from state *j* to estimate a calibration function predicting the difference between WTP at scale *x* and scale *y*. This function is then used to calibrate state *i* WTP at scale *x* to scale *y*. We denote this *cross scale difference calibration*.
4. Combine information from $W\hat{T}P_{hk}^{jx}$ and $W\hat{T}P_{hk}^{jy}$ to derive a meta-function forecasting the *ratio* between WTP at the community (*x*) and statewide (*y*) scales for otherwise identical preservation activities, based on information from state *j*. This function is then used to calibrate $W\hat{T}P_{hk}^{ix}$ in state *i* to obtain the desired estimate WTP_{hk}^{iy} in the same state. This approach uses results from state *j* to estimate a calibration function predicting the ratio between WTP at scale *x* and scale *y*. This function is then used to calibrate state *i* WTP at scale *x* to scale *y*. We denote this *cross scale ratio calibration*.

The four presented methods each incorporate distinct assumptions regarding household welfare from farmland preservation; none has a clear theoretical advantage. In the absence of any theoretical preference, the relative performance of each method becomes an empirical question.

We emphasize that parallel transfer methods apply regardless of the specific welfare measure considered unavailable. For example, one could consider WTP_{hk}^{jy} as the desired but unavailable welfare estimate and use the four proposed methods to conduct benefit transfer using existing welfare estimates $W\hat{T}P_{hk}^{jx}$, $W\hat{T}P_{hk}^{ix}$,and $W\hat{T}P_{hk}^{iy}$.

The Random Utility Model

The four above-noted benefit transfer approaches are assessed through their performance in applied function-based benefit transfer, based on CE results.[4] The theoretical model for CEs is derived from the standard random utility specification in which utility is divided into observable and unobservable components (Hanemann 1984). Following (1) above, we assume that assume that the utility of household *h* from preservation program *k* is given by

$$U_{hk}(\mathbf{X_k}, Y_h\text{- } Fee_{hk}) = v_{hk}(\mathbf{X_k}, Y_h\text{- } Fee_{hk}) + \varepsilon_{hk} \qquad (2)$$

where notation follows (1) above with

Fee_{hk}	=	cost to the respondent of preservation plan *k*, through a mandatory payment vehicle;
$v_{hk}(\cdot)$	=	function representing the empirically measurable component of utility;
ε_{hk}	=	unobservable component of utility, modeled as econometric error.

As above, we allow utility functions to be conditional on both scale and state. We suppress this notation from the functional specification, and instead incorporate it as superscripts. This provides for four possible utility functions drawn from (2): $U_{hk}^{jx}(\cdot)$, $U_{hk}^{jy}(\cdot)$, $U_{hk}^{ix}(\cdot)$ and $U_{hk}^{iy}(\cdot)$.

Given the above specification, household *h* chooses among three policy plans, (*j*=*A*,*B*,*N*). The household may choose option *A*, option *B*, or may reject both options and choose the status

[4] As noted by Johnston (2007), "the ability of choice experiments to explicitly adjust for differences in the attributes of environmental goods or policies provides an increased capacity to adjust for differences between study and policy sites—thereby improving the potential accuracy of benefits transfer (Morrison et al. 2002; Jiang et al. 2005)."

quo (neither plan, j=N). A choice of neither plan would result in zero preservation and no preservation policy $\mathbf{X_k}$=0, and zero household cost, $Fee_{hk}=0$. The model assumes that household h assesses the utility that would result from available choice options ($j=A,B,N$) and chooses that which offers the greatest utility. That is, given (2), household h will choose plan A if

$$U_{hA}(\mathbf{X_A}, Y_h - Fee_{hA}) \geq U_{hz}(\mathbf{X_z}, Y_h - Fee_{hz}) \quad \text{for } z=B,N, \tag{3}$$

such that

$$v_{hA}(\mathbf{X_A}, Y_h - Fee_{hA}) + \varepsilon_{hA} \geq v_{hz}(\mathbf{X_z}, Y_h - Fee_{hz}) + \varepsilon_{hz}. \tag{4}$$

If the ε_{hk} are assumed independently and identically drawn from a type I extreme value distribution, the model may be estimated as a conditional logit (CL) model or mixed logit (ML) analog (Maddala 1983; Greene 2003). Estimation of parallel models within scales (x, y) and states (i, j) allows for unique estimates of $\hat{v}_{hk}^{jx}(\cdot)$, $\hat{v}_{hk}^{jy}(\cdot)$, $\hat{v}_{hk}^{ix}(\cdot)$ and $\hat{v}_{hk}^{iy}(\cdot)$, from which welfare estimates may be derived following Hanemann (1984). Benefit transfer assessments draw from welfare measures derived from these estimated functions, either alone or in combination.

The Data

The data draw on six parallel CE surveys conducted in Connecticut and Delaware. The *Mansfield* and *Preston Land Preservation Surveys* addressed land preservation in these two Connecticut communities, and were implemented over random samples of residents in each community. The *Georgetown* and *Smyrna Land Preservation Surveys* followed a matching approach in two Delaware communities.[5] The *Connecticut* and *Delaware Land Preservation Surveys* represented parallel surveys targeted at statewide preservation in each state, and

[5] Surveyed communities were selected based on a number of factors, including the presence of similar development pressures, the lack of a major urban center in close proximity, and the existence of large areas of undeveloped land (Johnston and Duke 2007).

implemented over random statewide samples.

Survey development required over 18 months of background research, interviews with land use experts and stakeholders, and 14 focus groups (Johnston et al. 1995) including cognitive interviews (Kaplowitz et al. 2004). Extensive pretests were conducted during survey design to ensure that the survey language and format could be easily understood by respondents, that respondents shared interpretations of survey terminology and scenarios, and that survey scenarios captured land use and policy attributes viewed as relevant and realistic by respondents. Focus groups led to a self-administered mail survey, following a CE framework (Adamowicz et al. 1998). Prior to administration of choice questions, the survey provided information on land use and change in respondents' local areas, tradeoffs implicit in land conservation and reminders of the budget constraint. The survey also provided instructions and information for CE questions. This included attribute levels that might occur in choice questions, following guidance in the literature regarding visible choice sets (Bateman et al. 2004).

The CE asked respondents to consider alternative preservation options for hypothetical parcels located in their community or state, depending on the survey version. Respondents were provided with two preservation options that would each preserve farm or forest with varying attributes, "Option A" and "Option B," as well two status quo options. The first status quo option stated, "I would not vote for either program.". The second stated, "I support these programs in general, but my household would/could not pay for either Option A or B." This option was included based on focus group results and prior research (Loomis, Traynor and Brown 1999; Brown et al. 1996) as an outlet for those who might wish to express symbolic support for land preservation, yet nonetheless would not pay for either of the provided options. For purposes of estimation the two status quo options—both indicating a choice of no preservation—were combined into a single category.[6]

Each respondent was provided with three CE questions and was instructed to consider each question as an independent, non-additive choice. Attributes characterized land use outcomes identified by focus groups, interviews, and background research as significant to choices among land preservation options, including type of land preserved, the number of acres, the provision and type of public access, the likelihood of development of unpreserved parcels, and the cost of preservation to the respondent's household. Choice questions also specified the technique that would be used to preserve the land in question, as well as the agent that would be responsible for implementing the technique (Johnston and Duke 2007). Table 1 describes the attributes that distinguished hypothetical preservation options. The fractionated experimental design was constructed by the University of Delaware STATLAB based on a D-optimality criterion (Kuhfeld and Tobias 2005). Table 2 shows attributes and levels in the design.

Surveys were implemented during fall 2005. Surveys were mailed to 3000 randomly selected residents of the four CT and DE communities (750 surveys per community), and 2000 randomly selected residents of the two states (1000 per state). Implementation followed Dillman's Tailored Design Method (2000). Of the 2763 deliverable community surveys, 1136 were returned, for an average response rate of 41.1%. Of the 1834 deliverable statewide surveys 622 were returned, for an average response rate of 33.9%.

Differences Across statewide and Community Scale Choice Experiments

To avoid protests and the potential for respondent confusion, it is critical that policies described in survey scenarios are "perceived as realistic and feasible" (Bateman et al. 2002, p. 116). Hence, while state- and community-scale choice experiments maintain a high degree of

[6] This treatment of responses, while simplifying the data, has no substantive impact on model results.

parallelism, some differences were necessary in order to maintain realism. While this presents limitations in terms of statistical analysis (e.g., state and community data cannot be pooled within a single statistical model), it also allows for a more realistic assessment of benefit transfer potential (i.e., it recognizes the fact that realistic policy contexts may differ across scale).

Differences apply to attributes characterizing the number of acres, public access, and program cost (table 2). Preservation acreages, for example, are larger at the state scale. This reflects the fact that statewide farmland preservation programs generally target a greater number of acres than those implemented at the community scale—a fact recognized by focus group participants.[7] Similarly, program cost levels diverge across the two survey scales in response to pretest responses revealing differences in the range of household WTP, and payments perceived as realistic, as related to the range of other question attributes (table 2).

Finally, the public access attribute diverged across state and community scales. The goal for this attribute was to provide access levels interpreted as high, medium, and low by respondents. Focus groups for the community survey revealed that scenarios were viewed as most realistic and salient if they allowed for different types of access on individual preserved parcels (e.g., hunting, walking/biking). At the state scale, in contrast, it was perceived as unrealistic that the state could mandate access for any specific activity on all preserved acres. Hence, the statewide survey characterized public access as the percentage of preserved acres for which access would be permitted (i.e., 100%, 50%, 0%). Additional details are found in table 2.

Given the experimental design, there are 180 unique combinations of land preservation attributes for which per acre welfare measures may be estimated across statewide and

[7] When presented with preliminary surveys showing statewide preservation programs that targeted small numbers of acres, focus group respondents often considered such programs either trivial or unrealistic.

community models.[8] As detailed below, per acre transfer errors are calculated and averaged across all possible combinations of preservation attributes. As is typically the case with benefit transfer, this requires reconciliation of variables across study and policy sites (Smith et al. 2002; Johnston et al. 2005). Here, all variables characterizing preservation type are identical across scale (and hence require no reconciliation), except those associated with public access. To reconcile public access variables, we match high, medium, and low categories across scales; this provides an approximation that allows access levels to be compared across state and community scales. Although one would expect that a perfect match among state and community attributes would provide the ideal context for benefit transfer, the current situation presents a more realistic situation in which variable definitions are similar but not universally identical.

The Empirical Model

The literature offers no firm guidance concerning the most appropriate econometric functional form for the observable component of respondents' utility; while linear functions forms are most common, alternative forms are also used depending on theoretical and empirical considerations (Johnston et al. 2002). In the present case, all scenario attributes (except the number of preserved acres) characterize outcome or policy features of preserved land (table 2). Hence, the influence of these attributes on utility is expected to depend on the number of acres preserved. Given this expected conditionality and to avoid unrealistic model forecasts associated with linear terms in the utility function[9], all non-acreage preservation attributes (land type, preservation method, public access, development risk) enter the model as multiplicative

[8] This number is derived by including all combinations of the 4 land types, 5 preservation methods, 3 access types, and 3 risk levels in the design, leading to $4\times5\times3\times3=180$ options for which per acre welfare measures are estimated.
[9] For example, a linear specification would predict a fixed utility impact of land attributes regardless of the number of acres preserved. As a result, a linear model would forecast a utility change associated with various land attributes even if zero acres were preserved—a clearly unrealistic outcome.

interactions with the number of acres preserved. The remaining attributes, including preservation acres, program cost and an alternative specific constant (ASC) for "neither plan" enter linearly. Hence, following (2), representative household utility from policy option k is given by

$$v_k(\cdot) = \beta_0^{SR}(Neither) + \beta_1^{SR} Acres_k + \sum_{n=2}^{N} \beta_n^{SR}(Acres_k)(X_{kn}) + \beta_{N+1}^{SR}(Fee_k)\,, \tag{5}$$

where *Neither* is the ASC for "neither plan," $Acres_k$ is the number of acres preserved by option k, X_{kn} are attributes of preserved acres, Fee_k is the unavoidable household cost of the plan, and the betas (β) are parameters to be estimated. The superscripts S and R reflect the fact that parameters β^{SR} may differ across both jurisdictional scale $S_{hk} = \{x, y\}$ and state $R_{hk} = \{i, j\}$.

As the final data are comprised of three responses per survey, there is a possibility that responses provided by individual respondents may be correlated even though responses across different respondents are considered *iid*. Moreover, CL models are subject to the independence from irrelevant alternatives (IIA) property. For these and other reasons, researchers are increasingly considering ML models for CE applications (Hensher and Greene 2003). ML models allow for coefficients on attributes to be distributed across sampled individuals according to a set of estimated parameters and researcher-imposed restrictions (Hu et al. 2005).

In the present case, both the coefficient on the ASC (*Neither*) and program cost (*Fee*) are specified as random in the final ML models. A normal distribution is assumed for the coefficient on *Neither*; a lognormal distribution is assumed for the coefficient on *Fee*. Sign-reversal is applied to the cost variable prior to estimation. These conventions follow standard approaches for variables of these types (Hensher and Greene 2003). Preliminary models were also estimated in which the coefficient on preserved acres (*Acres*) was randomized; the majority of these models showed no statistically significant improvement over specifications in which a fixed (non-random) coefficient was specified. Hence, a fixed coefficient is specified for this variable. In addition, to simplify subsequent welfare simulations (see below) and prevent convergence difficulties, coefficients on multiplicative interactions were also specified as fixed.

Four final ML models are estimated, following the model above. Model one is a model estimated from pooled Delaware community data for Smyrna and Georgetown. Model two is estimated from the statewide Delaware data. Model three is estimated from pooled Connecticut community data for Mansfield and Preston. Model four is estimated from the statewide Connecticut data. Specifications are identical for all models, subject to caveats noted in the previous section concerning the differences in variable definitions between state and community surveys. Log-likelihood tests (Mazzotta and Opaluch 1995) fail to reject the appropriateness of pooling individual community data within each state (p=0.38 in DE; p=0.13 in CT), supporting the current model specification. All ML models are estimated using maximum likelihood with Halton draws applied in the likelihood simulation. The statistical fit of ML models is superior to that of their CL counterparts—at p<0.01 in all cases—hence ML results are illustrated below.

The focus on benefits transfer implies a comparison of WTP results across models (convergent validity) rather than detailed individual results for each model. As a basis for initial comparison, however, table 3 presents individual ML results for each of the four models. All are statistically significant at p<0.01, with statistically significant coefficients conforming to prior expectations, where expectations exist. Relative magnitudes of parameter estimates are also as expected—with the intuitive implication that per acre welfare effects associated with community scale preservation exceed those associated with state scale preservation, *ceteris paribus*.[10] The

[10] One might expect lower per acre WTP measures at the state scale both because of the lesser degree of expected proximity to preserved land, and also due to diminishing marginal utility; the statewide survey incorporated much larger acreages, such that the marginal utility per acre would be expected to decline relative to the community scale analysis.

significance of parameter estimates also varies in many instances across state and community models, providing additional evidence that preferences differ across scale.

Given that the estimated models involve random coefficients, welfare measures (implicit prices, compensating surplus) are simulated following the approach of Hu et al. (2005), following the general framework of Hensher and Greene (2003). We follow Hu et al. (2005) and Johnston and Duke (2007) and present welfare estimates as the mean over the parameter simulation (1000 draws) of median WTP calculated over the coefficient simulation (1000 draws).[11] Additional methodological details are suppressed here for the sake of conciseness, but may be found in Hu et al. (2005), Johnston and Duke (2007) or Hensher and Greene (2003).

Assessments of Transfer Error

A variety of tests relevant to the validity of benefits transfer may be conducted. For example, past assessments have included tests of estimated utility parameters and implicit prices (Jiang et al. 2005; Johnston 2007; Morrison et al. 2002). In the present case, we are interested primarily in the relative performance of different approaches to transferring per acre WTP for farmland preservation—a compensating surplus (CS) measure and, as such, the measure most directly relevant to policy (Morrison et al. 2002). Nonetheless, as an initial comparison of model results, table 4 presents implicit prices associated with the four estimated models. We also present two-tailed *p*-values for the null hypothesis of equal implicit prices across scale in Connecticut and Delaware, based on the method of convolutions (Poe et al. 2005).

As shown by table 4, point estimate magnitudes of implicit prices vary to a substantial degree across scale, with community scale implicit prices always larger in absolute value than

[11] This approach avoids unrealistic mean WTP estimates related to the lognormal distribution of the program cost coefficient, resulting from the long right-hand tail of the distribution (Hensher and Greene 2003). As noted by Hu et al. (2005), there is no strong theoretical preference for either mean or median welfare measures.

analogous state scale values. Despite these large point estimate differences, the sometimes large variances of ML parameter estimates (table 3) lead to a failure to reject the null hypothesis of implicit price equality for the majority of implicit prices. However, for 8 out of 24 implicit prices (33%), we reject equality at p=0.10 or better, suggesting that differences in scale, even in the same state, can lead to statistically significant differences in welfare estimates.

Notwithstanding the insight that may be available from implicit prices alone, assessment of CS generally provides a more policy relevant perspective on transfer performance (Morrison et al. 2002). Given the 180 possible preservation types noted above, we consider cases in which each of the four state-scale combinations is treated as the policy site for purposes of benefit transfer. That is, assessments of transfer error are conducted for cases in which each of the four welfare measures (WTP_{hk}^{iy}, WTP_{hk}^{ix}, WTP_{hk}^{jx}, and WTP_{hk}^{jy}) is considered the unknown ,but desired, estimate over all preservation types.

As described above, four empirical, function-based approaches to benefit transfer are tested. These include (a) transfer across scale within the same state, (b) transfer across states at the same scale, (c) cross scale WTP difference calibration using a state-community calibration function estimated in one state, then applied to the second, and (d) cross scale WTP ratio calibration using a state-community calibration function estimated in one state, then applied to the second. The first two methods capitalize on data available from a single source to conduct benefit transfer. The third and fourth, in contrast, use information from the three available estimates to, at least in a sense, triangulate the missing welfare measure.

Given (5) and the associated CS derivation (Boxall et al. 1996), one may easily calculate the per acre WTP difference and ratio within each state R, across scales x and y, as a parametric function of preservation attributes X_{kn}. The WTP difference calibration function across state and community scales is thus specified

$$WTP_{dif,k} = \left[\frac{(\hat{\beta}_1^{xR} + \sum_{n=2}^{N} \hat{\beta}_n^{xR}(X_{kn}))}{\hat{\beta}_{N+1}^{xR}} \right] - \left[\frac{(\hat{\beta}_1^{yR} + \sum_{n=2}^{N} \hat{\beta}_n^{yR}(X_{kn}))}{\hat{\beta}_{N+1}^{yR}} \right]$$

$$= \left(\frac{\hat{\beta}_1^{xR}}{\hat{\beta}_{N+1}^{xR}} - \frac{\hat{\beta}_1^{yR}}{\hat{\beta}_{N+1}^{yR}} \right) + \left(\left(\frac{\sum_{n=2}^{N} \hat{\beta}_n^{xR}}{\hat{\beta}_{N+1}^{xR}} \right) - \left(\frac{\sum_{n=2}^{N} \hat{\beta}_n^{yR}}{\hat{\beta}_{N+1}^{yR}} \right) \right) X_{kn} \qquad (6)$$

where superscripts x and y denote the two different scales in question. Note that (6) is simply the sum of implicit price differences across scale, where $Acres_k = 1$ (so that WTP reflects marginal value per acre) and X_{kn} are individual attributes upon which WTP per acre is conditional.[12] The function forecasts a unique WTP difference for each preservation type, as characterized by X_{kn}. For the state whose results are used to calculate equation (6), $WTP_{dif,k}$ perfectly forecasts the WTP difference between the state and community scales, for each preservation type.

To conduct benefit transfer using (6), one estimates $WTP_{dif,k}$ for all 180 preservation types, based on parameter estimates for community (scale x) and state (scale y) models in the first state (considered the study site). Then, to calibrate across scale in the policy site, one either adds or subtracts $WTP_{dif,k}$ from the corresponding estimates of state (scale y) or community (scale x) WTP per acre, respectively, in the second state. The result is a calibration across scale in the policy site, based on a WTP difference function estimated at the study site.[13] This calibration in per acre WTP is unique for each possible preservation type, as characterized by X_{kn}, and presumes that the calibration function (6) is transferable from region $R=i$ to $R=j$.

The fourth method is conceptually analogous to that based on (6), but calibrates

[12] As we are calculating WTP for a marginal acre of preservation, and not a new preservation program, we drop the coefficient associated with the alternative specific constant from CS calculations.

[13] For example, assume that the desired but unavailable welfare estimate is per acre WTP at the state scale in Connecticut. One would calculate (6) from available state and community results in Delaware, then use the resulting function to calibrate community scale results available from Connecticut—to obtain a transfer approximation of the desired Connecticut state scale estimate.

according to a *WTP ratio function* across scales x and y. The function is given by

$$WTP_{ratio,k} = \frac{\left[\left(\hat{\beta}_1^{xR} + \sum_{n=2}^{N} \hat{\beta}_n^{xR} (X_{kn}) \right) \Big/ \hat{\beta}_{N+1}^{xR} \right]}{\left[\left(\hat{\beta}_1^{yR} + \sum_{n=2}^{N} \hat{\beta}_n^{yR} (X_{kn}) \right) \Big/ \hat{\beta}_{N+1}^{yR} \right]} \qquad (7)$$

To conduct benefit transfer using (7), one estimates $WTP_{ratio,k}$ for all preservation types, based on parameter estimates for community (scale x) and state (scale y) models in the first state (considered the study site). To calibrate across scale in the policy site, one then either multiplies or divides $WTP_{ratio,k}$ by the corresponding estimates of state (scale y) or community (scale x) WTP per acre, respectively, in the second state. The result is a calibration across scale in the policy site, based on a WTP ratio function estimated at the study site.

Empirical Results: Implications of Transfer Approach for Transfer Error

Following common convention, transfer error is quantified as a percentage divergence of transfer estimates from an estimated "true" value—as estimated by the CE for the state/scale combination assumed to be the study site in each case. Percentage errors in per acre WTP are presented as an average over all 180 preservation types. Results are illustrated by table 5, along with the true average WTP across preservation types.

As shown by table 5, the choice of function-based transfer approach has crucial implications for transfer error—particularly where the transfer target is a state scale value. As an average, transfer across states at the same scale (method two) far outperforms other approaches, with an average transfer error of less than 16% in absolute value. In contrast, transfer across scale within the same state (method one) generates an average transfer error in excess of 2000% in absolute value. Although the relative performance of simple across-scale transfer varies depending on whether the community or state scale is the transfer target, there is greater error potential when one seeks to transfer across scale. Interestingly, the two simpler methods (across state and across scale transfer) generate the best and worst average performance of the four illustrated transfer approaches.

Of the two more complex transfer methods (WTP difference and ratio calibration across scale), ratio calibration outperforms difference calibration, on average. The poorer average performance of difference calibration is solely related to large transfer errors associated with the prediction of state scale values, with absolute value errors exceeding 3500% in Delaware and 4500% in Connecticut. In contrast, ratio calibration performs more acceptably in these cases—with average transfer errors less than 125% in absolute value.

Standard deviations of transfer error across preservation types suggest similar conclusions (table 4). Standard deviations—and thus the variability in transfer error—are greater, on average, for the three methods involving transfers across scale. Particularly large are standard deviations associated with simple across scale transfer (method one) and difference calibration (method three), particularly when associated with transfer to the state scale. For example, the average standard deviation associated with simple across scale transfer (5941.43) exceeds that associated with across state transfer (399.05) by nearly a factor of fifteen. Even for across state transfer, however, the standard deviation is relatively large. This suggests the potential for substantial transfer errors in individual cases (e.g., types of land or preservation), notwithstanding average transfer errors that may be relatively small. As a result, the superior average performance of across state transfer does not necessarily imply that small errors are to be expected for all types of preservation.

As noted above, results also suggest that transfer errors, at least in percentage terms, depend on whether the policy site (or transfer target) is at the state or community scale. Transfer to community scale preservation generally results in smaller transfer errors than transfer to state scale preservation. These results, however, must be taken in context of the larger WTP baseline from which community scale transfer errors are assessed (table 5). For example, in Delaware, average community scale WTP exceeds analogous state scale WTP by a factor of 27.72; the analogous factor in Connecticut is 103.39. As a result, a given magnitude transfer error will be greater in percentage terms when compared to the lower baseline welfare measures estimated at the state scale.

Consolidating these results into general findings, a few principal messages emerge. First, results indicate that substantial errors may result if one conducts benefit transfer across scale. That is, scale similarity is a critical determinant of transfer validity. In the present study, across scale transfers generate the worst average performance, by a large margin. Even the more complex methods that calibrate across scale fare more poorly than simple transfers between states at the same jurisdictional scale. Based on these findings, it is better to transfer at the same jurisdictional scale than at different jurisdictional scales. Such results suggest caution in the application of welfare results to policies that extend beyond the original valuation scale. For example, based on these results, one should recognize the substantial bias that may occur if one seeks to use land preservation values estimated at the community scale to approximate benefits for a state scale preservation policy.

In the present case, it is unclear whether the poor performance of across-scale transfers is related to differences in proximity between state and community scale preservation, or the fact that statewide preservation programs typically target a greater number of acres—a pattern also reflected in our experimental design (table 2). Both of these factors will encourage larger per acre WTP at the community scale, *ceteris paribus*, and these effects cannot be disentangled effectively using the present data. Hence, it is left for future research to determine the relative contribution of each factor to the observed differences in welfare measures across scale.

The dominance of simple across region transfers over across scale transfers also validates prior findings that geographical proximity alone is insufficient to guarantee transfer validity, when aspects of the policy context differ. Here, transfers within the same state can nonetheless entail substantial point-estimate transfer errors related to differences in policy context (i.e., changes in the scale over which preservation occurs). Similar patterns have been established by Johnston (2007) in the CE benefit transfer literature and by Piper and Martin (2001) and others in non-CE benefit transfer research—that proximity alone is a poor predictor of transfer error.

Finally, the superior performance of the most common, simple function-based transfer method in the present case provides an interesting—though far from definitive—counterpoint to recent works such as Smith et al. (2002), which propose complex models to improve transfer performance. Such methods invoke a variety of assumptions and mathematical derivations as a means to better ground transfer estimates in underlying welfare theory, thereby rendering transfer more defensible. The current results, in contrast, reflect *lex parsimoniae*. The common across state transfer, invoking perhaps the fewest assumptions, generates the smallest point-estimate transfer error. This is an encouraging finding for analysts who seek to apply benefit transfer, yet lack the ability to conduct more complex analyses. Assessment of the general applicability of such findings, however, including potential applicability to the utility-theoretic transfer methods of Smith et al. (2002) and others, requires additional targeted research and more specific evidence than is available from the present analysis.

Conclusions

In many policy contexts, researchers have a variety of options for benefit transfer. These may include transfers across different geographical areas or across different jurisdictional scales within the same region. The current literature provides little information to assist analysts in determining which of these possibilities is likely to generate welfare estimates with the least transfer error. This paper seeks to provide insight regarding the validity of across state and across scale benefit transfers, with specific applicability to land preservation values. As in most empirical assessments, there are a variety of analyses that are omitted for the sake of conciseness, and numerous topics that remain unexplored. For example, the present analysis does not seek to adjust welfare estimates for differences in populations across policy scales. Moreover, the analysis applies only to a single state-community scale dichotomy, and to the single policy context of land preservation.

These and other limitations notwithstanding, the analysis offers strong evidence that across state transfers of amenity values outperform transfers across jurisdictional scale—even when systematic mechanisms are used to calibrate welfare estimates across scale. Put another way, similarity in jurisdictional scale is a critical aspect of benefit transfer. We also find that the simplest, most common function-based method for benefit transfer—the function-based transfer of per acre WTP across states—outperforms other methods on average. It is hoped that such findings, combined with future work, may assist analysts in identifying the most appropriate mechanisms for benefit transfer when original studies are infeasible.

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Table 1. Variables and Descriptive Statistics

Variable	Description	Mean Value [a] (std. dev)			
		Connecticut Community	Connecticut State	Delaware Community	Delaware Community
Neither	Alternative specific constant (dummy) identifying the status quo option.	0.33 (0.47)	0.33 (0.47)	0.33 (0.47)	0.33 (0.47)
Acres	Number of acres preserved.	62.68 (70.01)	4001.18 (3958.15)	63.10 (70.78)	4007.79 (3956.68)
*Acres*Nursery*	Multiplicative interaction between *Acres* and a binary (dummy) variable indicating that the parcel is an active nursery (omitted default is a food or dairy farm).	12.71 (40.54)	840.78 (2441.58)	11.98 (39.52)	846.88 (2464.72)
*Acres*Forest*	Multiplicative interaction between *Acres* and a binary (dummy) variable indicating that the parcel is forest (omitted default is a food or dairy farm).	12.49 (40.21)	825.49 (2433.69)	12.80 (41.22)	777.10 (2347.00)
*Acres*Idle*	Multiplicative interaction between *Acres* and a binary (dummy) variable indicating that the parcel is idle farmland (omitted default is a food or dairy farm).	12.93 (40.73)	798.82 (2364.06)	13.35 (41.37)	793.02 (2355.59)
*Acres*Trust Easement*	Multiplicative interaction between *Acres* and a binary (dummy) variable indicating that preservation is accomplished through conservation easements, implemented by land trusts, using block grant funds from the state (omitted default is preservation by conservation zoning).	6.64 (29.53)	419.22 (1795.87)	6.73 (30.43)	468.16 (1889.80)
*Acres*State Purchase*	Multiplicative interaction between *Acres* and a binary (dummy) variable indicating that preservation is accomplished through fee simple purchase of the parcel, implemented by the state (omitted default is preservation by conservation zoning).	20.92 (50.44)	1278.43 (2908.46)	20.85 (50.44)	1291.67 (2914.34)
*Acres*Trust Purchase*	Multiplicative interaction between *Acres* and a binary (dummy) variable indicating that preservation is accomplished through fee simple purchase of the parcel, implemented by the land trusts, using block grant funds from the state (omitted default is preservation conservation zoning).	20.42 (49.08)	1427.84 (3046.66)	21.31 (50.77)	1326.22 (2951.25)
*Acres*State Easement*	Multiplicative interaction between *Acres* and a binary (dummy) variable indicating that preservation is accomplished through conservation easements, implemented by the state (omitted default is preservation by conservation zoning).	7.27 (31.59)	412.16 (1751.07)	6.95 (30.53)	450.20 (1847.70)
Acres Moderate*	Multiplicative interaction between *Acres* and a binary (dummy) variable indicating	14.38 (42.54)	812.16 (2393.19)	14.56 (43.00)	832.32 (2430.74)

Access	that the preserved parcel would offer moderate levels of public access. This is defined as access for walking and biking in the community survey, and access on 50% of preserved parcels in the state survey (omitted default is no public access).				
*Acres*High Access*	Multiplicative interaction between *Acres* and a binary (dummy) variable indicating that the preserved parcel would offer high levels of public access. This is defined as access for hunting in the community survey, and access on 100% of preserved parcels in the state survey (omitted default is no public access).	12.37 (39.12)	903.14 (2510.63)	12.91 (40.57)	916.67 (2529.63)
*Acres*No Development 30 Years*	Multiplicative interaction between *Acres* and a binary (dummy) variable indicating that the land, if not preserved, would likely remain undeveloped for at least 30 years (omitted default is development likely in less than 10 years).	20.54 (49.27)	1390.98 (3045.31)	22.00 (52.40)	1357.05 (2991.33)
*Acres*Development 10 - 30 Years*	Multiplicative interaction between *Acres* and a binary (dummy) variable indicating that the land, if not preserved, would likely be developed in 10 to 30 years (omitted default is development likely in less than 10 years).	19.81 (48.49)	1225.88 (2817.58)	19.79 (47.95)	1290.99 (2911.03)
Fee	Unavoidable household cost of preservation (state/town taxes and fees), with sign reversal.	-44.27 (63.10)	-75.63 (100.52)	-43.53 (61.79)	-77.49 (102.24)

[a] Includes zeros for the ‘neither’ option.

Table 2. Attributes and Levels for Choice Experiment Design

Attribute	Levels	
Acres (4 levels)	Community (one parcel) 1. 20 2. 60 3. 100 4. 200	State (multiple parcels) 1. 1,000 2. 5,000 3. 8,000 4. 10,000
Land type (5 levels)	1. Active Farmland a. Nursery b. Food Crop c. Dairy or Livestock 2. Farmland (currently idle) 3. Forest	
Policy technique and implementing agency (5 levels)	1. Preservation Contracts a. By State b. By Land Trusts using Block Grants 2. Outright Purchase a. By State b. By Land Trusts using Block Grants 3. Conservation Zoning	
Public access (3 levels)	Community (one parcel) 1. No Access Allowed 2. Access for Walking & Biking 3. Access for Hunting	State (multiple parcels) 1. No Access Allowed 2. Access on 50% of Parcels 3. Access on 100% of Parcels
Development risk (3 levels)	1. Development likely in less than 10 years if not preserved 2. Development likely in 10-30 years if not preserved 3. Development NOT likely within the next 30 years	
Cost (6 levels)	Community 1. \$5 2. \$15 3. \$30 4. \$50 5. \$100 6. \$200	State 1. \$10 2. \$30 3. \$50 4. \$100 5. \$200 6. \$300

Table 3. Mixed Logit Results

	Delaware Community	Delaware State	Connecticut Community	Connecticut State
Neither (ASC)	-0.93298	-0.720424	-0.28075	-2.327030
	(0.20365)***	(0.293863)***	(0.16271)*	(0.422373)***
Fee (lognormal, sign reverse)	-3.72041	-4.520530	-4.88730	-4.474820
	(0.24206)***	(0.323230)***	(0.17596)***	(0.249562)***
Acres	-0.00237	-0.000009	0.00016	-0.000068
	(0.00207)	(0.000043)	(0.00145)	(0.000421)
*Acres*Nursery*	-0.00106	-0.000027	-0.00285	-0.000043
	(0.00123)	(0.000026)	(0.00285)**	(0.000029)
*Acres*Forest*	0.00008	-0.000006	0.00064	0.000038
	(0.00124)	(0.000029)	(0.00104)	(0.000029)
*Acres*Idle*	0.00066	-0.000011	-0.00104	0.000006
	(0.00126)	(0.000027)	(0.00103)	(0.000029)
*Acres*Trust Easement*	0.00171	0.000098	0.00223	0.000168
	(0.00226)	(0.000047)**	(0.00171)	(0.000047)***
*Acres*State Purchase*	0.00421	0.000089	0.00219	0.000053
	(0.00189)**	(0.000041)**	(0.00156)	(0.000045)
*Acres*Trust Purchase*	0.00096	0.000091	0.00334	0.000085
	(0.00197)	(0.000042)**	(0.00167)**	(0.000044)*
	0.00573	0.000091	0.00284	0.000096
*Acres*State Easement*	(0.00209)***	(0.000050)*	(0.00174)	(0.000053)*
	0.00803	0.000086	0.00773	0.000120
*Acres*Moderate Access*	(0.00156)***	(0.000030)***	(0.00126)***	(0.000038)***
	0.00609	0.000072	0.00155	0.000126
*Acres*High Access*	(0.00151)***	(0.000029)**	(0.00122)	(0.000034)***
	-0.00061	-0.000106	-0.00192	-0.000075
*Acres*No Development 30 Years*	(0.00097)	(0.000023)***	(0.00084)**	(0.000023)***
	-0.00149	-0.000019	0.00039	-0.000034
*Acres*Development 10 - 30 Years*	(0.00116)	(0.000022)	(0.00085)	(0.000025)
	1.53389	1.784680	1.98357	2.788900
std NE	(0.39456)***	(0.493429)***	(0.19766)***	(0.525565)***
	2.56899	2.677350	1.73848	2.569740
std Cost	(0.30388)***	(0.443947)***	(0.29246)***	(0.285337)***
Log-Likelihood Chi-Square	630.01***	444.83***	557.26***	400.82***
Pseudo-R^2	0.20	0.21	0.14	0.22
N	4308	2952	5625	2550

Note: Single (*), double (**) and triple (***) asterisks denote p-values of 0.10, 0.05 and 0.01, respectively.

Table 4. Implicit Prices and Policy Scale: Results for Delaware and Connecticut

Implicit Price[a]	Farmland preserved somewhere within—			Farmland preserved somewhere within—		
	Connecticut Community	Connecticut State	*p*-value[b]	Delaware Community	Delaware State	*p*-value[b]
Acres	0.0246	-0.0065	0.88	-0.1014	-0.0013	0.24
*Acres*Nursery*	-0.3783	-0.0038	0.00	-0.0429	-0.0024	0.44
*Acres*Forest*	0.0810	0.0035	0.58	0.0018	-0.0006	0.94
*Acres*Idle*	-0.1458	0.0006	0.30	0.0245	-0.0009	0.60
*Acres*Trust Easement*	0.2958	0.0157	0.22	0.0733	0.0097	0.52
*Acres*State Purchase*	0.2817	0.0052	0.16	0.1747	0.0090	0.04
*Acres*Trust Purchase*	0.4385	0.0081	0.06	0.0396	0.0092	0.70
*Acres*State Easement*	0.3882	0.0089	0.10	0.2462	0.0091	0.00
*Acres*Moderate Access*	1.0500	0.0108	0.00	0.3412	0.0083	0.00
*Acres*High Access*	0.2191	0.0115	0.20	0.2595	0.0068	0.00
*Acres*No Development 30 Years*	-0.2598	-0.0068	0.02	-0.0254	-0.0102	0.74
*Acres*Development 10 - 30 Years*	0.0535	-0.0031	0.62	-0.0628	-0.0018	0.20

[a] Implicit prices are calculated as the mean over the parameter simulation (1000 draws) of median implicit prices calculated over the coefficient simulation (1000 draws), following Hu, Veeman and Adamowicz (2005) and Johnston and Duke (2007).

[b] Illustrated two-tailed p-values are for the null hypothesis of equal implicit prices across scale (i.e., state versus community), and are derived using a complete combinatorial convolutions approach (Poe et al. 2005).

Table 5. Transfer Errors Across Scale and/or Region: Comparison of Four Methods

		Average Transfer Error[a]			
Assumed Policy Site for Benefit Transfer	Average per Acre WTP – actual [b]	Method One: Across Scale Within State	Method Two: Across States at Same Scale	Method Three: WTP Difference Calibration	Method Four: WTP Ratio Calibration
Connecticut Community (WTP_{hk}^{ix})	$0.549 ($0.528)	-99.56% (8.54)	-77.15% (500.49)	-77.10% (503.55)	-106.27% (735.12)
Connecticut Statewide (WTP_{hk}^{iy})	$0.005 (0.008)	6278.46% (20312.78)	-29.34% (204.97)	4519.03% (17697.65)	-123.99% (1905.24)
Delaware Community (WTP_{hk}^{jx})	$0.172 (0.176)	-98.93% (18.83)	48.57% (787.50)	50.93% (782.49)	-123.99% (1905.24)
Delaware Statewide (WTP_{hk}^{jy})	$0.006 (0.007)	2341.05% (3425.57)	-5.38% (103.25)	-3688.17% (7147.95)	-106.27% (735.12)
Average Error	--	2105.25%	-15.83%	201.18%	-115.13%
Average Standard Deviation	--	5941.43	399.05	6532.91	1320.20

[a] Transfer error in per acre mean of median WTP averaged over N=180 possible preservation types. Values in parentheses are standard deviations over preservation types. In two instances, a single outlier observation was omitted due to an actual WTP estimate that approximated zero, leading to nearly infinite percentage errors. For these two cases, N=179.

[b] Calculated as a mean (and standard deviation) in estimated mean of median WTP across all preservation types.