Vertically Summing Public Good Demand Curves: An Empirical Comparison of Economic versus Political Jurisdictions

John B. Loomis

Land Economics, Vol. 76, No. 2 (May, 2000), 312-321.

Stable URL:
http://links.jstor.org/sici?sici=0023-7639%28200005%2976%3A2%3C312%3AVSPGDC%3E2.0.CO%3B2-F

Land Economics is currently published by University of Wisconsin Press.

Vertically Summing Public Good Demand Curves: An Empirical Comparison of Economic versus Political Jurisdictions

John B. Loomis

ABSTRACT. *Fiscal equivalence for efficient provision of a public good requires perfect correspondence between political and economic jurisdictions. However, the spatial extent of the economic jurisdiction is an empirical question. Drawing on four survey-based valuation studies, we measure the "relative public good benefit gradient" as a function of residential location from six natural resource public goods. The results indicate commonly used state political jurisdictions reflect an average of 13% of total benefits in the economic jurisdiction, although with a logarithmic form for distance the upper confidence interval of state benefits can include 100% for some species.* (JEL H41; D61)

I. INTRODUCTION

As formalized by Samuelson (1954) the benefits of public goods are non-rival in consumption and non-excludable. Allocative efficiency in a second best world of distortionary taxes, between a public good, (y) and a purely private good (x) requires:

$$\sum_{i=1}^{n} \text{MRS}^{i}_{xy} = \text{MRT}_{xy} * \text{MCF} \qquad [1]$$

where MCF is the marginal cost of public funds (Atkinson and Stiglitz 1980; Ballard and Fullerton 1992).

A natural question that should arise in economic analysis of public goods is the size of "n." That is, how broadly should we vertically sum individuals' marginal benefit schedules? Should it be just residents in the immediate area where the public good is located, the entire country that may (or may not) care about the services of the public good, or the entire world? Implicitly we make this judgment when we distinguish between "local public goods" and national public goods. This distinction is far more than semantics, however, as it ties directly to determining the appropriate level of government financing and provision. This is the heart of fiscal federalism (Oates 1972) and concerns for coordination of environmental policies in a federal system or transboundary public good or bad. If the public good provides benefits well beyond the immediate jurisdiction where the good is located, then either federal grants-in-aid or even federal provision may be needed to improve the allocation of resources involving the public good. Comparing only the local public benefits to marginal cost of supply will result in underprovision if substantial spillover benefits to other non-payers are ignored.

What guidance does economic theory provide in the search for answers regarding the geographic extent of the public good? Cornes and Sandler (1996) draw upon Olson's concept of *fiscal equivalence* to state that optimality will be more likely when the *political jurisdiction* and the *economic jurisdiction*, correspond. The political jurisdiction is the level of government making the provision decision. The economic jurisdiction "includes all individuals receiving the good's benefits" (Cornes and Sandler 1996, 33). Fiscal equivalence is similar to internalizing the *positive* externality provided by provision of a public good.

The author is a professor, Department of Agricultural and Resource Economics, Colorado State University. This research draws upon work the author has conducted with Jennifer Pate, Kelly Giraud, Charles Revier, and C. M. Fan of Colorado State University, Earl Ekstrand of the Bureau of Reclamation, and Armando Gonzalez-Caban of the U.S. Forest Service. Brian Roach, University of Maine, provided the distance calculations used in this paper. Partial funding was provided by Colorado Agricultural Experiment Station project W-133. Helpful suggestions were provided by participants in the department seminars at University of Colorado and Colorado State University. The advice of two anonymous reviewers improved the clarity of the manuscript.

This issue is of some recent policy relevance in the debates over reauthorization of the federal Endangered Species Act (ESA) and proposed federal excise taxes to fund state agency nongame wildlife programs. Critics of ESA contend protection of endangered species would be best handled at the local level. Environmentalists not only oppose this, but have been prime supporters of the Fish and Wildlife Conservation Act to provide federal grants-in-aid to *state* nongame wildlife programs. Which of these conflicting directions in the fiscal federalism debate is appropriate might profit from some empirical analysis.

Viewed in terms of "who's benefits count" the issue has been a recurring theme in discussions about benefit-cost analysis. Howe (1971) clarified the question with the concept of *accounting stance,* although other authors refer to it as an issue of who has *standing* in benefit-cost analysis (Whittington and MacRae 1986; Trumbull 1990, Zerbe 1991). The accounting stance defines the relevant political jurisdiction for including benefits and costs. As noted by Whittington and MacRae (1986, 666) which individuals should be included is a crucial but rarely addressed issue in the application of benefit-cost analysis. Of course the essence of economics, as compared to financial analysis, is that for efficiency in resource allocation to prevail, the accounting stance should be large enough to capture all Pareto-relevant spillovers (Trumbull 1990).

Oakland's *Handbook of Public Economics* chapter on Public Goods as well as Cornes and Sandler's recent book on public goods, do not go beyond this conceptual level of discussion. Musgrave (1997, 66) suggests that various public goods will have different "spatial ranges." Thus, it appears to be an empirical question. Unfortunately studies of the benefits of environmental public goods continue to predetermine the measurement of benefits by limiting the sample to only residents of the state where the public good is located (Walsh, Loomis, and Gillman 1984, Boyle and Bishop 1986; Loomis 1987; Sanders, Walsh and Loomis, 1990; Carson et al. 1994; Wegge, Hanemann, and Loomis 1996). As noted by V. Kerry Smith (1993, 21) "Definitions of the extent of the market are probably more important to the values attributed to environmental resources as assets than any changes that might arise from refining our estimates of per unit values." In one of the few (unpublished) papers to address this question, Smith, Schwabe, and Mansfield (1997) use a single case study to investigate the relationship between the extent of environmental spillovers and the size of the "regulatory market". These authors conclude that there can be cases where nature will dictate the appropriate level of government. The only published study to address this question found there were passive use values received by households living in states adjacent to Flathead Lake in Montana (Sutherland and Walsh 1985).

The purpose of this paper is to use a variety of public goods to empirically estimate the economic jurisdiction over which to vertically sum public good benefits. From the survey data we empirically estimate a "*relative* benefit gradient" relating the percent of local willingness to pay (WTP) at varying distances from the resource being protected. A relative benefit gradient is used since there is some controversy regarding the accuracy of contingent valuation for measuring public good values of households (see Portney 1994; Cummings, Harrison, and Rutstrom 1995; Hanemann 1994). We expect that whatever hypothetical bias might be present in the absolute dollar magnitude of WTP, as long as this bias is invariant to distance from the natural resource, our percent benefit gradient should be a credible relative measure. We believe this to be the case because contingent valuation has been shown to repeatedly yield reliable measures of WTP in several test-retest reliability studies (Loomis 1990; Reiling et al. 1990; Carson et al. 1997). To explicitly evaluate the degree of fiscal equivalence, we calculate the percentage of nationwide public good benefits that are reflected in typical political jurisdictions commonly used in benefit-cost or policy analyses.

II. HYPOTHESIS TESTS

The benefits of increasing the quantity of a public good beyond the current level can be measured by compensating surplus or

willingness to pay (WTP). Testing whether public good benefits fall with distance and providing an empirical limit for the economic jurisdiction is facilitated by including distance from the respondent's home to the public good under study in the WTP function. For the purpose of illustration, assume for the time being a linear relationship between individual i's WTP and the following set of explanatory variables:

$$\text{WTP}_i = Bo + B_1Q + B_2T_i - B_3\text{DISTANCE}_i + B_4\text{INCOME}_i, \quad [2]$$

where Q is the quantity of public good being offered; T_i is a variable(s) reflecting an individual's tastes and preferences; DISTANCE_i is miles the individual lives from the particular natural resource being protected.

To determine whether there is any spatial or geographic limit to the market, one might test the null hypothesis *Ho*: $B_3 = 0$ versus the alternative hypothesis *Ha*: $B_3 < 0$. If the null is accepted, then in principle the economic jurisdiction would be at least nationwide and could be worldwide, if similarity of preferences are likely as might be the case for clean air or prevention of stratospheric ozone depletion. However, the specific nature of the public good may allow us to determine whether *Ho* or *Ha* is likely to hold. Specifically, some public goods studied in this paper provide both on-site use values as well as off-site, non-use values such as existence value. Following the logic of the travel cost method for estimating recreation demand curves, the use benefits would fall with distance, causing total economic value (the sum of use and non-use) to fall rapidly. In contrast, protection of endangered plants would primarily have non-use value, and the total economic value might fall very slowly, if at all, with distance. In addition, one could test whether there is a discontinuous jump in the WTP function or change in slope for residents within the state where the resource is located versus non-residents. This could be done by adding a resident intercept shifter and/or resident-distance interaction term. As in any demand relationship, the availability of substitute public goods may also change with distance and influence the WTP distance-decay function.

If we reject the null hypothesis in favor of the alternative that $B_3 < 0$, then to calculate the distance where WTP = 0, one can rearrange equation [2] to [3] to solve for DISTANCE:

$$\text{DISTANCE}_0 = (Bo + (B_1 * Q_m) + (B_2 * T_m) + (B4\text{Income}_m))/B_3 \quad [3]$$

where subscript m indicates variable sample means.

In principle, the economic jurisdiction extends to the point where WTP = 0. One measure of the divergence of political and economic jurisdictions can be made by comparing the distance covered by the political jurisdiction relative to the distance where WTP = 0. The economic efficiency bias from using a political jurisdiction smaller than the distance to where WTP = 0 can made by comparing benefits within the political jurisdiction to the total public good benefits. In this paper we "test" the null hypothesis of state level government fiscal equivalence for wildlife protection. The test is carried out by comparing the computed percentage of benefits within the state political jurisdiction to the economic jurisdiction of the public good. If the upper confidence interval for the percentage of benefits in the political jurisdiction is less than 100%, we would reject the null hypothesis of state level fiscal equivalence.

III. SPECIFIC METHODS ADOPTED FOR VALUING PUBLIC GOODS

While equation [2] is the general form of a WTP equation, most contingent value method (CVM) surveys no longer directly elicit WTP. Rather, the WTP question is framed as a referendum in which the individual is asked whether they would vote in favor of the program at a cost of $X per household, where $X varies across households. There are numerous advantages of this dichotomous choice referendum format over directly asking WTP (see Hoehn and Randall 1987). The referendum question format has also

been recommended by the "blue ribbon" panel on CVM (Arrow et al. 1993), although Cummings, Harrison, and Rutstrom et al. (1995) presents empirical evidence questioning this recommendation. Hanemann (1984) provided a utility-theoretic basis for the dichotomous choice question format in terms of a utility difference model. If the utility difference from paying $X and receiving the public good versus not paying $X and foregoing the public good is distributed logistically, then a standard binary logit model can be used (Hanemann 1984). The basic form of the logit model is:

$$\text{Prob}\,[Y = 1] = \frac{e^{\beta o+\beta 1(\$X)+\beta 2\text{DISTANCE}}}{1 + e^{\beta o+\beta 1(\$X)+\beta 2\text{DISTANCE}}} \qquad [4]$$

where Y is a binary indicator variable, taking on a value of 1 if the respondent answers "Yes, [they] would pay."

Cameron (1988) showed that [4] could be converted to a WTP equation like [2], by reparameterizing the logit equation [4] by dividing the coefficients ($\beta 2$ and βn) through by the coefficient on bid ($\beta 1$). For computational convenience we adopt this reparameterization approach here. Using Cameron's approach, the logit coefficients are rescaled into units with a conventional regression interpretation (e.g., change in WTP for one additional mile).

IV. DATA

The data for testing the geographic extent of public good benefits comes from three nationwide CVM surveys and one survey of California, Oregon, and Washington residents. The first two surveys are mail surveys of U.S. households.

Washington State Salmon

The first is a survey regarding WTP to remove two dams from the Elwha River in the State of Washington and restoration of the river back to its natural pre-dam condition and associated increases in four species of salmon and steelhead. The survey booklet was the result of several focus groups and pre-tests with residents of the state of Washington and of Boston, Massachusetts. The dichotomous choice WTP question was worded "If an increase in your federal taxes for the next 10 years costs your household $X each year to remove the two dams and restore both the river and fish populations would you vote in favor? YES NO" The questionnaire was sent to a random sample of 900 Washington households (the dams are located in Washington.) One thousand surveys were sent to U.S. households to provide enough spatial detail to test the extent of the U.S. market. After two mailings, 523 surveys were received from residents of the State of Washington, and 482 surveys from the rest of the U.S. The response rate for deliverable surveys was 68% in Washington and 55% for the rest of the U.S. More details on the survey can be found in Loomis (1996).

Mexican Spotted Owl and 62 Threatened and Endangered (T&E) Species

We designed and sent two versions of a mail survey to a random sample of U.S. households provided by Survey Sampling, Inc. Each survey contained detailed maps showing the location of the Critical Habitat Units in states of Arizona, Colorado, New Mexico, and Utah that form what is known as the Four Corners Region along with a description of the current recovery effort. This was followed by proposals to reduce the protection for the Threatened Mexican spotted owl (or 62 T&E species) to allow for increased economic activity and reduce federal management expenditures. The survey then proposed a Mexican Spotted Owl Recovery Trust Fund (or Four Corners Region T&E Species Trust Fund) to continue the current recovery program. Households were told if they agreed to pay, the program would continue, with the likelihood the Mexican spotted owl would recover in 15 years and could be delisted. They also were told if they did not pay then it was likely the Mexican spotted owl would become extinct in 15 years. Similarly for the 62 T&E species, they were told that payment would result in delisting of 25 species and lack of payment would result in half the species becoming extinct within

15 years. After two mailings the overall survey response rate was 54.4% of deliverable surveys. The exact wording of the Mexican Spotted Owl WTP question was: "If the Mexican Spotted Owl Recovery Trust Fund was the only issue on the next ballot and it would cost your household $X every year, would you vote in favor of it? YES NO"

California Wetlands and Agricultural Contamination

The sample frame was households in California, Nevada, Oregon, and Washington. Random-digit dialing was used to generate the sample frame. Households were then sent a 16-page booklet that described the two programs: (1) increasing the acres of wetlands for waterfowl in the San Joaquin Valley of California by 40,000 acres; and (2) reducing the percentage of waterbirds exposed to contaminated agricultural drainage waters. The interviews were conducted over the phone with the respondent reading along in the survey booklet. The exact wording of the wetlands question was "Improving habitat conditions and increasing wildlife populations above current levels is more costly than just maintaining the existing conditions. If the improvement program was the only program you had an opportunity to vote on and it cost every household $XX each year in taxes, would you vote for it? YES NO."

The response rate was 51% of those initially contacted during the random digit dialing.

California Spotted Owl

A survey booklet and telephone script was administered to California and New England residents. The sample was derived from random-digit dialing. The program was protection of California Spotted Owl habitat from catastrophic fire. The survey booklet contained both text and graphics to portray the effect of the program in reducing the number of acres of habitat that would burn each year. Households were told that there was inadequate funding to pay for the improved fire prevention and control programs. The text of the script read to the respondent was "While fire control programs such as Programs A and B have been proven to protect old-growth forests and associated wildlife habitat there is not sufficient funding available to apply either Program A or B on the 5 million acres of old-growth forests in California. Thinking about Program B which reduces the proportion of high intensity fires and also includes a 20% reduction in the acreage of old-growth forests that burns each year: If Program B were the only program available and your household was asked to pay $XX each year to help pay for Program B would you pay this amount? YES NO"

The response rate of deliverable surveys for California was 49%, and 44% for New England.

V. RESULTS

Table 1 provides the reparameterize coefficients calculated from the logit equations using the technique of Cameron 1988. For several programs we estimated a coefficient on miles in the linear and log form if the *t*-statistics and pseudo R squares (defined as 1 − [max log likelihood/restricted log likelihood]) did not indicate one functional form was particularly superior to the other. In terms of our hypothesis, respondent's distance from the wildlife habitat is negative in all of the seven regressions and statistically significant at the .05 level for six of the seven regressions (it is significant at the .1 level in the seventh). For the WA salmon enhancement program we tested whether there was either an intercept shift or slope change in the WTP function when one crosses the state boundary. We found neither significant individually (t = 1.34 for WA Resident dummy; t = 1.42 for WA resident × distance) or used in combination (t = .72 for WA Resident dummy; t = .86 for WA resident × distance).

Using the coefficients in Table 1 we calculated the per household WTP at 100 mile distance intervals from 100 miles to 2,500 miles. The benefits received by local households (defined as those living within 100 miles of the resource) was set at 100%. Figure 1 plots the percent of this local household WTP for respondents living at the other dis-

TABLE 1
REPARAMETERIZED RESULTS FOR LOGIT WTP EQUATION

Model	Mex Spotted Owl		62 T&E Species		CA Wetlands	CA Contamination	WA Salmon
	Linear	Log	Linear	Log	Log	Log	Linear
Constant	61.38	93.07	76.56	86.53	480.75***	452.5***	−155.85***
Miles	−0.0343**	−16.84***	−0.031*	−13.38**	−32.71*	−45.62**	−0.0101***
Protect	22.68***	22.51***	24.05***	23.88***			
Projob	−35.45***	−35.48***	−38.64***	−38.46***			
Tknow		21.32**		24.09**			
Member					85.99***	136.34***	
Age					−2.64***	−2.97***	
Recreation Expend					0.018**	0.021**	
Fish Importance							69.51***
Electricity Importance							−35.73***
Native Am. Imp.							28.80***
D.O.F.	671	668	671	667	998	998	946
Pseudo R^2	.286	.297	.307	.318	.05	.04	.20
% Correct	77	76	78	77	67	65	71

Note: Protect: importance of protecting endangered species.
Projob: importance of using public lands for commercial uses and jobs.
Member: dummy variable equal to one, if individual was member of environmental or hunting/fishing organization.
Tknow: is the knowledge of the respondent regarding T&E, owls, and fish species.
Fish Importance: importance of rivers as habitat for fish.
Native Am. Imp: importance of providing Native Americans with their traditional fishing areas.
* = significant at 0.10; ** = significant at 0.05; *** = significant at 0.01.

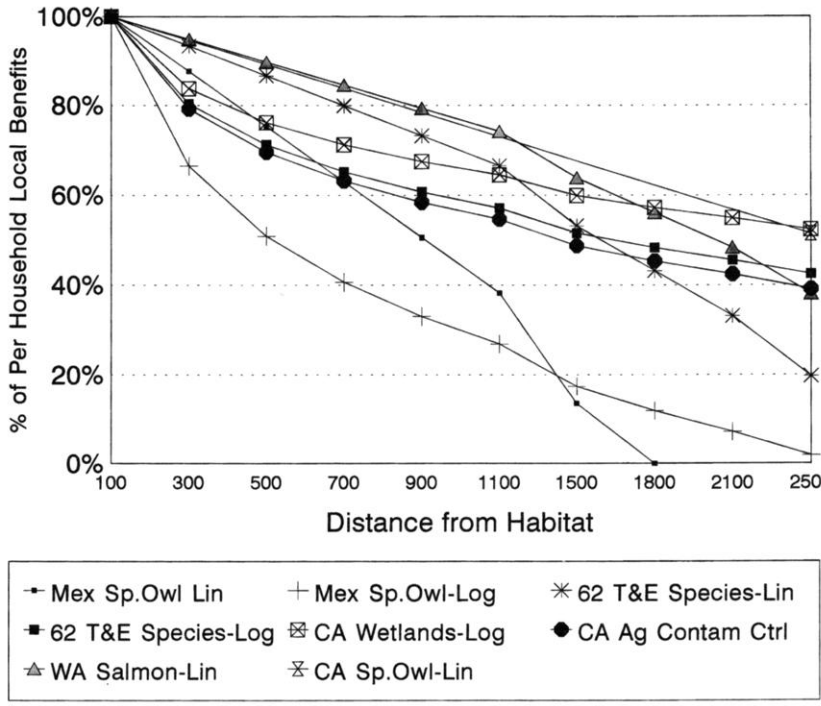

FIGURE 1
PER HOUSEHOLD BENEFIT GRADIENTS FOR PUBLIC GOOD VALUES OF WILDLIFE: PERCENT OF LOCAL WTP AS A FUNCTION OF DISTANCE FROM HABITAT

tances from the natural resource in question. The percent of household benefits drop the fastest for the Mexican Spotted Owl, implying very low benefits per household beyond 1,500 miles from the species four corner states habitat (e.g., households in the eastern seaboard appear to receive almost no benefit per household). However, for the other wildlife protection programs, more distant residents receive benefits per household that are about half the benefits received by local households. Even households 2,500 miles away receive nearly 40% of the local household benefits. Figure 1 also suggests there may often be large benefits to residents in other countries, as the percentage WTP remains sizeable for these species as one moves north to Canada or south to Mexico, although there may be cultural differences in WTP.

Figure 1 however, abstracts from the uneven population distribution surrounding the wildlife habitat areas. With the exception of California and Washington, very little of the nation's population lives within 100 miles of the protected wildlife habitat areas. Thus, while benefits per household may fall off rapidly for the Mexican Spotted Owl, only about 4% of the U.S. population lives in the four corner states of Arizona, Colorado, New Mexico, and Utah. Thus, to determine the degree of error from using state level political jurisdictions commonly employed in policy analyses, one must account for benefits per household *and* the number of households at varying distances from the natural resource. The total public good benefits were calculated by multiplying the benefit per household times the population living at various distance increment from the resource. To calculate the percent of economic benefits reflected in the political jurisdiction (Table 2) the amount of the public good benefits received by state residents was divided by the

TABLE 2
PERCENTAGE OF TOTAL ECONOMIC BENEFITS REFLECTED IN STATE OR REGIONAL POLITICAL JURISDICTIONS FOR SIX WILDLIFE PROTECTION PROGRAMS

WA	Mex Spotted Owl		62 T&E Species		CA	CA	CA
Salmon	Linear	Log	Linear	Log	Wetlands	Contamination	Cal Sp. Owl
4.6%	16.0%	13.5%	6.7%	6.4%	17.9%	18.7%	17.4%
(2.3–24)	(4.3–38)	(4.4–100)	(4.3–19)	(4.1–100)	(11.6–100)	(13.3–100)	(15.8–20.3)

Note: 90% confidence intervals in parentheses.

national benefits. For example, the vast majority of Washington's population lives within 100 miles of the Elwha River. A state of Washington distance weighted WTP was $73.63 million. The distance weighted WTP for the U.S. as a whole is $1,577 million. Dividing the Washington state benefits by U.S. benefits yields 4.6% shown in Table 2. For the Mexican Spotted Owl and 62 T&E species, we used the sum of benefits to the four corner states (AZ, CO, NM, UT) as the political jurisdiction.

Table 2 summarizes the percent of national public good benefits reflected in commonly employed state or regional accounting stances. Even when the resource being protected is in the most populous state in the country (California), this political jurisdiction, accounts for less than 20% of the economic benefits to the U.S. for increased wetlands and protection of California Spotted Owl habitat. For resources located in small population states such as Washington, only about 5% of the total public good benefits are reflected in the state political jurisdiction. Table 2 also presents the upper and lower confidence intervals on the percent of economic benefits within the political jurisdiction. In all of the linear in distance models, we reject the null hypothesis of state level fiscal equivalence for these wildlife protection programs (the tight confidence interval on the California Spotted Owl program is due to use of the double-bounded dichotomous choice method, rather than single-bounded as in all of the other programs). However, with the log of distance functional form, the exponential decline in WTP with distance and large standard errors (although the log of distance is significant at the 5% alpha level in all but one of these log of distance models) results in an upper limit on the confidence interval including 100% of the economic benefits within the political jurisdiction. This suggests an important area of future research may be to apply Box-Cox functional form tests to allow for more flexible functional forms.

For the California Spotted Owl and Washington salmon programs *lack* of fiscal equivalence would result in serious underprovision of wildlife protection if these programs relied solely upon state funding or state level decisionmaking. In terms of fiscal federalism, the proposed grants-in-aid programs to state fish and game agencies funded by federal excise taxes on recreational equipment embodied in the Fish and Wildlife Conservation Act of 1980 may be welfare improving. Further, devolution of protection of endangered species from the federal level down to the state level could worsen fiscal equivalence. Since the benefits of the salmon and California Spotted Owl programs are nationwide, federal decisionmaking and funding internalizes the positive externalities of the program.

VI. CONCLUSION

This paper illustrates the national and international economic jurisdiction for protection of the California Spotted Owl and salmon. While benefits per household do exhibit a statistically significant decrease with distance from the wildlife habitat, aggregate benefits are still substantial at 1,000 miles from the public good with linear in distance models. While the upper confidence interval on state benefits is 100% with the logarithmic functional form for three of the six natu-

ral resources, on average, measuring only the benefits at the state level would result in just 13% of the national total public good benefits and an even smaller percentage of worldwide benefits. As noted by Smith (1993) this type of error dwarfs previously researched concerns regarding differences in WTP due to divergences in revealed versus stated preferences. While it is important to reflect the local area in benefit-cost analysis, since in some cases it may bear a disproportionate share of the costs, the benefits are often nationwide and can even be world-wide. Olson's fiscal equivalence suggests continued federal financing and federal decisionmaking for protection of threatened and endangered species in the U.S. as well as federal grants-in-aid to state non-game wildlife programs.

What guidance does this research offer to practicing economists? If additional research on a wider range of environmental programs substantiates what we have found for wildlife and wetlands programs, then it appears that economists should look more broadly when estimating the benefits of public goods. Additional investigation with national sample frames to test whether WTP for other environmental quality programs exhibit a similar distance-decay pattern is clearly needed before we can recommend national sampling. Given the limited analysis in this paper and the sensitivity of results to functional form, we suggest that during the scoping of a public goods analysis, pre-testing of surveys over a wide geographic region should be performed to determine just how geographically widespread the benefits are. The results of this pre-test data, can then be used to determine the economic jurisdiction for final analysis.

References

Arrow, K., R. Solow, P. Portney, E. Leamer, R. Radner, and H. Schuman. 1993. "Report of the NOAA Panel on Contingent Valuation." Federal Register 58 (10): 4602–14.

Atkinson, A., and J. Stiglitz. 1980. *Lectures on Public Economics.* McGraw-Hill: New York.

Ballard, C., and D. Fullerton. 1992. Distortionary Taxes and the Provision of Public Goods. *Journal of Economic Perspectives* 6 (Summer): 117–32.

Boyle, K., and Bishop, R. 1986. "The Economic Valuation of Endangered Species." Transactions of the 51st North American Wildlife and Natural Resources Conference, Wildlife Management Institute, Washington D.C.

Cameron, T. 1988. "A New Paradigm for Valuing Non-market Goods Using Referendum Data." *Journal of Environmental Economics and Management* 15 (Sept.): 355–80.

Carson, Richard, and 7 others. 1994. "Prospective Interim Lost Use Value Due to DDT and PCB Contamination in Southern California Bight." Report prepared for NOAA by Natural Resource Damage Assessment, Inc., La Jolla, California.

Carson, Richard, and 9 others. 1997. "Temporal Reliability of Estimates from Contingent Valuation." *Land Economics* 73 (May): 151–63.

Cornes, R., and T. Sandler. 1996. *The Theory of Externalities, Public Goods and Club Goods,* 2nd Ed. N.Y.: Cambridge University Press.

Cummings, R., G. Harrison, and E. Rutstrom. 1995. "Homegrown Values and Hypothetical Surveys: Is the Dichotomous Choice Approach Incentive Compatible?" *American Economic Review* 85 (Mar.): 260–66.

Dillman, D. 1978. *Mail and Telephone Surveys: The Total Design Method.* N.Y.: John Wiley and Sons.

Hanemann, M. 1984. "Welfare Evaluations in Contingent Valuation Experiments with Discrete Response Data." *American Journal of Agricultural Economics* 66 (Aug.): 335–79.

———. 1994. "Valuing the Environment Through Contingent Valuation." *Journal of Economic Perspectives* 8 (Fall): 19-43.

Hoehn, J., and A. Randall. 1987. "A Satisfactory Benefit Cost Indicator from Contingent Valuation." *Journal of Environmental Economics and Management* 14 (Sept.): 226–47.

Howe, C. 1971. "Benefit-Cost Analysis for Water System Planning." Water Resources Monograph 2, American Geophysical Union, Washington, D.C.

Loomis, J. 1987. "Balancing Public Trust Resources of Mono Lake and Los Angeles' Water Right: An Economic Approach." *Water Resources Research* 23 (Aug.): 1449–56.

———. 1990. Comparative Reliability of the Dichotomous Choice and Open-Ended Contingent Valuation Techniques. *Journal of Environmental Economics and Management* 18 (Jan.): 78–85.

———. 1996. "Measuring the Economic Benefits of Removing Dams and Restoring the Elwha River." *Water Resources Research* 32 (Feb.): 441–47.

Musgrave, R. 1997. "Devolution, Grants, and Competition." *Journal of Economic Perspectives* 11 (Fall): 65–72.

Oakland, W. 1987. "Theory of Public Goods." In *Handbook of Public Economics: Vol. 2,* ed. A. Auerbach and M. Feldstein. N.Y.: North Holland.

Oates, W. 1972. *Fiscal Federalism.* N.Y.: Harcourt, Brace, Jovanovich.

Olson, M. 1969. "The Principle of Fiscal Equivalence: The Division of Responsibilities Among Different Levels of Government." *American Economic Review* 59:479–87.

Portney, P. 1994. "The Contingent Valuation Debate: Why Economists Should Care." *Journal of Economic Perspectives* 8 (Fall): 3–17.

Reiling, S., K. Boyle, M. Phillips, and M. Anderson. 1990. "Temporal Reliability of Contingent Values." *Land Economics* 66 (May): 128–34.

Samuelson, P. 1954. "The Pure Theory of Public Expenditure." *Review of Economics and Statistics* 36:387–89.

Sanders, L., R. Walsh, and J. Loomis. 1990. "Toward Empirical Estimation of the Total Value of Protecting Rivers." *Water Resources Research* 26 (July): 1345–58.

Smith, V. K. 1993. "Nonmarket Valuation of Environmental Resources: An Interpretive Appraisal." *Land Economics* 69 (Feb.): 1–26.

Smith, V. K., K. Schwabe, and C. Mansfield. 1997. "Does Nature Limit Environmental Federalism." Resources for the Future Discussion Paper 97–30. Washington, D.C.

Sutherland, R., and R. Walsh. 1985. "Effects of Distance on Preservation Value of Water Quality." *Land Economics* 61 (Aug.): 281–91.

Trumbull, W. 1990. "Who Has Standing in Cost-Benefit Analysis?" *Journal of Policy Analysis and Management* 9 (Fall): 201–18.

Walsh, R., J. Loomis, and R. Gillman. 1984. "Valuing Option, Existence, and Bequest Demands for Wilderness." *Land Economics* 60 (Feb.): 14–29.

Wegge, T., M. Hanemann, and J. Loomis. 1996. "Comparing Benefits and Costs of Water Resource Allocation Policies for California's Mono Basin." In *Advances in the Economics of Environmental Resources: Marginal Cost Rate Design and Wholesale Water Markets,* ed. D. C. Hall. San Diego: JAI Press, Inc.

Whittington, D., and D. MacRae, Jr. 1986. "The Issue of Standing in Cost-Benefit Analysis." *Journal of Policy Analysis and Management* 5 (Summer): 665–82.

Zerbe, R., Jr. 1991. "Comment: Does Benefit-Cost Analysis Stand Alone? Rights and Standing." *Journal of Policy Analysis and Management* 10 (Winter): 96–105.