Using Donation Mechanisms to Value Nonuse Benefits from Public Goods*

Patricia A. Champ

Rocky Mountain Forest and Range Experiment Station, USDA Forest Service, Fort Collins, Colorado 80526

Richard C. Bishop

Department of Agricultural and Applied Economics, University of Wisconsin, Madison, Wisconsin 53706

and

Thomas C. Brown and Daniel W. McCollum

Rocky Mountain Forest and Range Experiment Station, USDA Forest Service, Fort Collins, Colorado 80526

This paper discusses an experiment in which the value for an unfamiliar environmental good, whose total value has a large nonuse component, is verified using a revealed-preference method. As we were unable to observe preferences via an incentive compatible mechanism, we collected voluntary contributions toward the provision of the good. We make a case for interpreting these contributions as a "theoretical lower bound" on the value of the public good and estimate the lower bound. We also investigate whether we can use contingent donation data to estimate such lower bounds on values. We used a follow-up to the contingent donation question about the respondent's level of certainty with respect to her response to the contingent donation question. The results of this study suggest that use of the follow-up certainty question to differentiate respondents who would actually donate from those who would not is a promising approach to estimating a lower bound to Hicksian surplus measures.   © 1997 Academic Press

Do people hold positive values for environmental goods that are unfamiliar to them and of limited apparent personal economic relevance? One need think no further than the Exxon Valdez damage assessment to motivate such a question. The well-known contingent valuation (CV) study [8] indicated that many people in the lower 48 states place a positive value on protecting the resources of Prince William Sound from oil spills. However, given that most of us were unfamiliar with the area prior to the spill, given that most of us will never benefit from resource protection there by visiting or otherwise personally "using" the resources of the Sound, and given that contingent values are only "hypothetical," questions remain about whether the values of protecting the resources there from future oil spills

---

are "real." Thus, we designed an experiment in which the values for an unfamiliar environmental good, whose total value has a large nonuse component, are verified using a revealed-preference method. As we were unable to observe preferences via an incentive compatible mechanism, we collected voluntary contributions toward the provision of the good. We make a case for interpreting these contributions as a "theoretical lower bound" on the value of the public good and estimate that lower bound.

We also investigate whether, in cases where collecting actual donations is not feasible, CV studies employing donation vehicles can be used to estimate such lower bounds on values. Several CV studies have used donation vehicles [4–7, 11, 13–15]. Donations are useful mechanisms for CV because they offer a plausible means of providing small-scale public goods. Survey respondents may not find it credible that a referendum would be conducted to determine whether to implement a project which, although of national interest, costs a relatively modest amount. They may also find it implausible that their taxes or the prices they pay will increase substantially as a result of such projects or they may object to mandatory payment schemes such as taxes or entrance fees. Because individuals are often asked to make contributions for such projects, donation vehicles often seem more plausible. Unfortunately, Duffield and Patterson [11], Seip and Strand [14], and Navrud [13] found that contingent donations are not good predictors of what individuals will actually donate. Though seriously questioning the validity of contingent donations, these studies left the possibility that contingent donations might be made to perform better. Perhaps, we reasoned, if the product to be obtained through donations could be made more specific than in the previous studies and the implications of the individual's donation for the provision of the good were more clearly delineated, then contingent donations would better predict actual donations.

To address these issues, we set up an experiment involving contingent donations and actual donations for an environmental project along the North Rim of the Grand Canyon. The project involved removal of old, unpaved roads that must be removed before the area can be officially designated as a Wilderness Area. Study subjects were residents of the state of Wisconsin, most of whom presumably will never visit the Grand Canyon, much less the North Rim, and were unfamiliar with the road removal project prior to becoming involved in the study.

Ideally, we would have elicited an unbiased measure of Hicksian compensating surplus for the road removal program, but doing so involved the rather obvious set of problems that so often plague nonmarket valuation studies. Though collecting donations for road removal was more feasible, it raised questions about the economic interpretation of donations relative to the Hicksian surplus measure. Free-riding behavior makes it natural to interpret donations as theoretical lower bounds on values: If people tend to hold back hoping that others will donate toward the provision of environmental goods, then donations actually collected must surely undervalue those goods. One possible hitch in this interpretation has to do with warm glow. Followed to its full logical conclusion, the theory of free riding would lead one to expect that no one would donate. Substantial donations for some public goods in the real world have led some researchers, most notably Andreoni [3], to hypothesize that donations must be motivated in part by the personal satisfaction or warm glow that comes from giving. This raises questions about the interpretation of donations as lower bounds on Hicksian values. We

show in the first section that donations can be interpreted as lower bounds even if they are motivated partly or completely by Andreoni's warm glow. Later sections of the paper describe how we implemented an experiment to estimate actual willingness to donate for Grand Canyon road removal on the part of Wisconsin residents and compared the results with contingent donations.

We found that many Wisconsin residents held positive values for the road removal project despite the fact that it was located far from where they live and was previously unfamiliar to them. Our lower bound estimate of compensating surplus—based on actual donations—is $7 million for Wisconsin residents alone. However, as in previous studies, we also found that contingent donations substantially overestimated actual donations. Nevertheless, we did find an interesting result that we believe holds some potential for using donation vehicles to establish lower bound estimates of Hicksian surplus. We developed a statistical model of actual donations and used it to predict which respondents to the contingent donation exercise would actually donate and which were ''inconsistent'' in the sense that our prediction of whether or not they would actually donate differed from their responses to the hypothetical donation question. Statistical analysis of survey results indicated that consistent respondents expressed stronger attitudes than inconsistent respondents about such factors as the road removal project, their willingness to donate toward it, and their intentions to visit the North Rim in the future. In an additional contingent donation treatment, we attempted to capture these attitudes more directly by asking respondents how ''certain'' they were about whether they would actually donate the stated amount if asked to do so. While no one study can be conclusive, the results are encouraging. There was close correspondence between the characteristics of those who were quite certain about their response to the contingent donation question and the characteristics of those who actually did donate.

WARM GLOW AND WELFARE

The purpose of this section is to show that when a budget-constrained, utility-maximizing consumer, who is motivated in part by Andreoni's warm glow, actually donates money toward provision of a public good, the amount of the donation is less than or equal to that consumer's Hicksian compensating surplus for the public good.[1] Quoting Andreoni [3, pp. 1448–1449],

> In this model, individuals are assumed to contribute to a pubic good for two reasons. First, people simply demand more of the public good. This motive has become known in the literature as ''altruism.'' Second, people get some private goods benefit from their gift per se, like a warm glow. Because of this second and seemingly selfish motive, this is called a model of ''impure altruism.''

To adapt this model to our research problem, let us take the ith Wisconsin resident's decision as one of maximizing a well-behaved utility function

$$U_i = U_i(Q_i, \Gamma, \gamma_i, G, g_i) \tag{1}$$

[1] We focus here only on the interpretation of actual donations. The implications of our conclusions for value estimates based on CV are beyond the scope of this paper.

subject to the budget constraint

$$P \cdot Q_i + u \cdot \gamma_i + g_i = Y_i, \tag{2}$$

where Q_i is a vector of market goods, possibly including the market inputs required to visit the North Rim; Γ is a vector of total contributions by all members of society (including consumer i) for the provision of all public goods other than removal of roads from the North Rim of the Grand Canyon; γ_i is a vector of donations for these same public goods by consumer i; G is the total donations by all members of society (including consumer i) for the removal of roads from the North Rim (a scalar); g_i is the donation of the ith consumer for North Rim road removal (a scalar); Y_i is income; P is the price vector for market goods; and u is a unit vector conformable to γ_i.

We will assume that the provision of other public goods and road removal, Γ and G, respectively, are increasing functions of total donations. In keeping with the impure altruism argument, we will assume that utility is nondecreasing in all its arguments.

Let Γ_{-i} represent total other donations and let G_{-i} represent the total donations for road removal by consumers other than i (i.e., $\Gamma = \Gamma_{-i} + \gamma_i$; $G = G_{-i} + g_i$). Again following Andreoni, we assume that Γ_{-i} and G_{-i} are exogenously determined. Donating money for road removal and other causes may generate utility both by augmenting G and Γ (altruism) and directly through g_i and γ_i (warm glow). To represent the dual source of utility that donations can provide, it will prove useful to write the indirect utility function in the following form:

$$V_i(P, Y_i, \Gamma_{-i}, G_{-i} \mid \gamma_i, g_i) \tag{3}$$

Now we are prepared to explore the implications of donations for welfare measurement.[2] Consider first the total compensating surplus associated with road removal for this consumer. Let Q_i^*, γ_i^*, and g_i^* equal the ith consumer's optimal private goods bundle, other donations bundle, and road removal donation, respectively. To make the analysis interesting, suppose the consumer in question wishes to donate toward road removal, setting $g_i^* > 0$. Also, define $G^* = G_{-i} + g_i^*$ and $\Gamma^* = \Gamma_{-i} + \gamma_i^*$. Finally, let γ_i^{**} equal the optimal donation for other public goods, conditional on $G_{-1} = g_i = 0$. Then, the ith consumer's compensating surplus for road removal associated with G^* and g_i^* compared to no road removal at all is given by CS_i, defined by

$$V_i(P, Y_i - \mathrm{CS}_i, \Gamma_{-i}, G_{-i} \mid \gamma_i^*, g_i^*) = V_i(P, Y_i, \Gamma_{-i}, 0 \mid \gamma_i^{**}, 0). \tag{4}$$

Finally, let us explore the ith consumer's willingness to donate toward road removal. Let $\bar{\gamma}_i$ equal an optimal vector of other donations conditional on consumer i being constrained to set $g_i = 0$ but allowing G to take on its exogenously determined level of donations by others, G_{-1}. Then define d_i to equate utility with

---

[2] Andreoni and others who have used the warm-glow model [3, 10] have not, as far as we know, explored its welfare implications. They have focused instead on people's behavior when donating money. For example, much attention has been devoted to the so-called crowding-out hypothesis, where taxes collected and devoted to supplying a public good ''crowd out'' private donations.

and without the opportunity to personally donate:

$$V_i(P, Y_i - d_i, \Gamma_{-1}, G_{-1} \mid \gamma_i^*, g_i^*) = V_i(P, Y_i, \Gamma_{-1}, G_{-1} \mid \overline{\gamma}_i, 0). \qquad (5)$$

In terms of interpretation, d_i reflects the extra utility gained from the roads removed with the infra-marginal dollars donated.

By the assumption that utility is nondecreasing in G, it must follow that

$$d_i \leq \text{CS}_i. \qquad (7)$$

That is to say, this consumer would not be willing to donate her full compensating surplus in addition to her actual donation, g_i^*. If asked in a dichotomous choice framework whether she would actually be willing to donate some amount more than $d_i + g_i^*$ rather than not donate at all, she would refuse because she can gain more utility by free riding. However, if given the opportunity to donate some amount less than or equal to $d_i + g_i^*$ rather than not donate at all, take it or leave it, she will agree. $\text{CS}_i + g_i^*$ might be referred to as this consumer's maximum willingness to pay for road removal, while $d_i + g_i^*$ might be referred to as her maximum willingness to donate for road removal, the difference being accounted for by free riding.

Following this line of reasoning, we estimate the mean maximum willingness to donate based on responses to an actual payment dichotomous choice question. Except for sampling error, this should be less than or equal to mean willingness to pay for the road removal program. Thus, we will refer to the estimated mean actual willingness to donate as a theoretical lower bound on mean compensating surplus for road removal.[3]

We now turn to our experiment which applies this principle to road removal on the North Rim of the Grand Canyon, both to estimate the lower bound using actual donations and to evaluate the prospects for estimating such lower bounds using CV.

THE GOOD

Because some individuals were asked to actually donate for the good, it was desirable that the good be divisible so there would be a relationship between the amount each individual paid and provision of the good. A program at Grand Canyon National Park to remove compacted dirt roads on the North Rim of the Canyon fulfilled these requirements. The North Rim is 215 miles by road from the popular and often-visited South Rim. As a result, relatively few visitors to the Grand Canyon visit the North Rim. The National Park Service wanted to remove the roads and ultimately designate the area where the roads are located as wilderness. Volunteers were available to provide the labor but Grand Canyon National Park did not have funding to pay for food and supplies for the volunteers, which cost approximately $640 per mile of road removed. At the time of this study,

---

[3] One of our reviewers pointed out that environmental economists use the term lower bound in ways that are inconsistent with the traditional statistical definition of the term. This point is well taken. Following conventional usage among CV researchers, we will not use the term in the *statistical* sense, but in the *theoretical* way just explained.

our project was the only source of funding for the road removal program. Although the number of study participants was not revealed, it was made clear that roads would be removed only to the extent that funds were provided by study participants.

THE DATA

Separate samples of Wisconsin residents drawn from the same sample frame participated in mail surveys in October of 1993 and 1994. The mail survey packets included a cover letter, a sheet containing questions and answers about the study, and two separately bound questionnaires labeled Part 1 and Part 2. The Part 1 questionnaire included a description of the road removal program and the willingness to donate question. The Part 2 questionnaire contained questions about why the individual responded as she did to the willingness to donate question, past experience with national parks, expected future experience with the Grand Canyon, attitudes toward wilderness and the environment in general, and the respondent's sociodemographic characteristics. The first survey mailing was preceded by a letter which informed respondents they would be receiving a survey packet within a week. A reminder postcard was sent one week after the first survey packet and two follow-up survey packets were sent to nonrespondents.

In 1993, 1700 surveys were mailed. A total of 850 of those surveys posed a dichotomous choice (DC) question which gave respondents the opportunity to actually donate a specified amount for road removal.[4] This treatment is designated AD, for "actual donation," whereas the other half were asked a parallel contingent donation question. The six offer amounts used in the 1993 questionnaires for both treatments were $1, $5, $8, $12, $15, and $50.

In 1994, 900 additional contingent donation surveys were sent. Two offer amounts used in 1993 were duplicated ($15 and $50) and offer amounts of $75, $100, $150, and $200 were added.[5] The combined 1993 and 1994 contingent donation data sets are labeled DC CD, for "dichotomous choice contingent donation." An additional treatment ($n = 300$) posed the same DC CD question, then followed up in Part 2 with a question asking respondents to rate, on a 10-point scale, how certain they were that they would actually send a check if asked to do so (or not send a check if they said no to the DC contingent donation question).[6] Only the endpoints of the scale were labeled, with 1 corresponding to "very uncertain" and 10 corresponding to "very certain." We refer to this treatment as CDWC, for

[4] The willingness to donate question asked individuals to pay a specified amount but many individuals decided to send a check for an amount greater than the specified amount. In particular, several people who were asked to pay $1 sent checks for $10. We coded their response to the bid amount posited in the survey.

[5] The two duplicate offer amounts were used to test whether the 1993 and 1994 data were comparable. We found that the distributions of yes and no responses to each of those offer amounts were *not* significantly different between the two years based on contingency table analysis.

[6] The reasoning was that putting the willingness to pay (WTP) question in Part 1 and the follow-up certainty question in Part 2 would lessen the chance that the subsequent question would affect the response to the WTP question. Comparing the distribution of responses via contingency table analysis to the WTP question with the follow-up certainty question to the distribution of responses to the DC CD question without the follow-up question suggests that the certainty question did not influence the response to the WTP question.

"contingent donation with certainty." The willingness to donate questions, the rest of the questionnaires, and all other survey material such as cover letters were designed to be as similar as possible for all treatments.

Table I lists initial sample size, number of returned surveys, and response rates for each offer amount of each treatment. Because the treatment groups were randomly selected from the same population, one would expect similar response rates across treatments. However, there was a significant difference in response rates between some of the treatments (i.e., 51% for the DC CD treatment in 1993 and 44% for the AD group in 1993). For the measures elicited in this survey, contingency table analysis [2] was used to test for response rate effects among the various treatments. Results of that analysis suggested that the respondents from various treatment groups were very similar and, hence, any differences among the willingness to donate measures of the various treatments can be attributed to factors other than sampling or response rate effects.

ASSESSING CONSTRUCT VALIDITY

It is important to confirm that the responses to the willingness to donate question from both the AD and the DC CD data are more than random noise and are related to other empirical measures in a manner consistent with economic theory. In other words, we assess the construct validity of the willingness to donate measures before discussing treatment effects.

Contingency table analysis showed there were 30 variables for which the distributions of responses were significantly different between respondents who answered yes and those who answered no to the AD and DC CD questions. These 30 variables are related to saying yes or no in ways that one would expect. For

TABLE I
Offer Amounts, Subsample Sizes, Responses, and Response Rates

Offer amount	Number of surveys mailed/number of useable surveys returned			
	AD	DC CD (1993)	DC CD (1994)	CDWC
$1	125/50	125/56	*	*
$5	175/66	175/82	*	*
$8	175/68	175/75	*	*
$12	125/60	125/65	*	*
$15	125/38	125/59	100/45	100/35
$50	125/50	125/56	100/42	100/42
$75	*	*	100/35	100/35
$100	*	*	100/43	*
$150	*	*	100/50	*
$200	*	*	100/40	*
Response rate[a]	44%	51%	47%	42%

Note. * indicates data not available.
[a] Response rate = ((number complete)/(number mailed − number undeliverable)) × 100.

example, individuals who said they had visited a National Park were more likely to say yes. Twenty-five of the 30 variables, which are individually significantly related to saying yes or no to the DC CD question, are also significantly related to saying yes or no in the AD treatment. Furthermore, the distributions of these 25 variables are statistically similar in the AD and DC CD treatment groups. These similarities suggest that both actual and contingent donations are related to measures of attitudes, past experience with national parks, expected future experience with the Grand Canyon, and demographic characteristics. The relationships are similar whether payment is real or hypothetical. The five variables that were related in a statistically significant manner to the response to the DC CD question but not to the response to the AD question include having ever hiked the Grand Canyon, likelihood of visiting the North Rim in the future, having contributed time or money to an environmental organization in the past, age, and gender.

LOWER BOUND ON COMPENSATING SURPLUS

The AD column of Table II presents the results of the actual donations. It demonstrates that maximum willingness to donate for the road removal program is positive. Not only does the 95% confidence interval around the expected value of $9 exclude zero, but negative values for road removal are highly unlikely in this population. Following the very conservative practice of assigning zero values to

TABLE II
Percentage Yes Responses to Willingness to Donate Question by Treatment and Offer Amount

	AD (1993)	DC CD (1993)	DC CD (1994)	DC CD (1993 + 1994)	CDWC[a] (1994)	CDWC[b] (1994)
$1	24%	53%	*	53%	*	*
$5	15%	51%	*	51%	*	*
$8	25%	39%	*	39%	*	*
$12	17%	48%	*	48%	*	*
$15	13%	39%	54%	46%	60%	23%
$50	4%	34%	19%	27%	36%	12%
$75	*	*	31%	31%	34%	3%
$100	*	*	19%	19%	*	*
$150	*	*	18%	18%	*	*
$200	*	*	28%	28%	*	*
Estimated willingness to donate[c]	$9	$46	$89	$79	$52	$12
95% confidence interval	[6, 24]	[26, 284]	[62, 271]	[58, 128]	[36, 140]	[7, 20]

Note. * indicates data not available.
[a] These data were *not* recoded for the level of certainty.
[b] These data were coded such that only yes responses to the DC CV who also rated their response a 10 (very certain) were coded as yes. All other responses were coded as no.
[c] Means were calculated using Hanemann's [12] formula for the positive area of the distribution.

nonrespondents and expanding to the population of households in Wisconsin implies that compensating surplus for the road removal project is greater than or equal to $7 million. This value holds despite the fact that most respondents were unfamiliar with the North Rim and the prospects for road removal prior to the study. Furthermore, nonuse values seemed to be the major motivating factor. As noted above, those expecting to visit the North Rim in the future were no more likely to donate than those not expecting to do so.

COMPARING CONTINGENT AND ACTUAL DONATIONS

Even a casual examination of Table II will also verify that the contingent donations were not very good predictors of the actual donations. At each offer amount having both DC CD and AD responses, AD respondents were less likely to respond positively to the willingness to donate question than DC CD respondents. As a result, the estimated mean willingness to donate based on the AD data is significantly lower than that estimated from the DC CD data.

One way to gain insight into the difference between actual and contingent donations is to identify DC CD respondents who were ''inconsistent'' in the sense of responding differently to the willingness to donate question than they would have responded had they been asked to actually pay. Such inconsistency can be estimated. The AD data were used to construct a predictive model of willingness to donate.[7] The coefficient estimates from this model were used with the DC CD data to predict how DC CD respondents would respond if the requested donation were real. We found 23% of the DC CD respondents were inconsistent in the sense that they said yes to the DC CD question but our model predicts they would not actually donate if they had been in the AD treatment.

Because most of the people who were inconsistent said yes to the willingness to donate question, the following analysis focuses on the attitudes of those respondents. Consistent and inconsistent respondents who said yes to the willingness to donate question had many similar attitudes toward the environment and toward wilderness areas. However, some notable differences became apparent. Responses to statements about why individuals answered yes to the willingness to donate question showed that more consistent than inconsistent respondents circled ''definitely true'' to a statement that the road removal program might be worth the amount they were asked to pay. Likewise, more consistent respondents said it was ''definitely'' or ''somewhat'' true that the total number of feet of road to be removed was important in their decision to pay. Consistent respondents were more likely to respond ''definitely false'' to the statement ''I would rather see the money go to a better project.'' Consistent respondents were also more likely to say ''definitely true'' to a statement that it is important that the area be designated ''wilderness'' after the roads are removed. Furthermore, consistent respondents were more likely to think they would visit the North Rim of the Grand Canyon in the future.

---

[7] The model is described in detail in [9]. The model included 17 explanatory variables and predicted 81% of the yes responses and 97% of the no responses correctly. Six of the coefficient estimates were significantly different from zero at the 0.05 level.

Based on these differences in attitudes, we hypothesized that inconsistent respondents in contingent donation exercises might identify themselves more directly if asked how "certain" they were that they would actually donate the stated amount. This was the rationale for the CDWC treatment which, as noted above, asked respondents to rate how certain they were about their responses to the contingent donation question on a scale of 1 to 10.

FOLLOW-UP CERTAINTY QUESTION

To investigate whether data from the CDWC treatment could be used to provide a more accurate estimate of actual donations, two steps were taken. First, respondents who revealed uncertainty about their yes answers by circling any value less than 10 ("very certain") on the follow-up certainty question in the CDWC treatment were coded as if they answered no. For convenience those who responded with less than a 10 will be designated as "uncertain respondents." It should be emphasized that we are considering subjects who responded positively to the willingness to donate question *and* revealed uncertainty about that response through the follow-up certainty question (i.e., we are not considering individuals who responded negatively and expressed uncertainty). That allowed us to compare the distribution of values for the CDWC treatment where uncertain yes responses were interpreted as no with the distribution of values for the AD treatment. Second, we tested whether those who revealed uncertainty in the way just indicated were comparable to those who were earlier identified as inconsistent yes respondents in the DC CD treatment based on measures, other than willingness to donate, elicited in the questionnaire.

The percentage of yes responses in the AD treatment can be compared directly to the certain respondents in the CDWC treatment at the $15 and $50 offer amounts. These percentages are not significantly different at the 0.05 level. Table II also reveals that the estimates of mean willingness to donate based on data from the AD treatment and the CDWC treatment with only the very certain responses coded as yes are not significantly different. We considered other ways of recoding the CDWC data such as including both 9 and 10 ratings on the certainty scale as yes responses; however, coding the data in this manner did not give results similar to the AD data.

Next we compared uncertain yes respondents from CDWC with inconsistent yes respondents from DC CD. Such comparisons were only possible for those assigned to the $15, $50, and $75 cells. We found that the distributions of responses to all the measures elicited in the questionnaire were statistically indistinguishable between these two groups based on contingency table analysis with adjustments made for the multiple comparisons via the Bonferroni method [1]. Thus, the follow-up certainty question not only provided an estimate of mean willingness to donate that is similar to the AD data; it also had robustness in that it allowed us to identify potentially inconsistent respondents to the contingent donation question. Unfortunately, the small number of people who said yes to the willingness to donate question and said they were very certain in the CDWC treatment precludes meaningful comparison between this group and the individuals who actually donated in the AD treatment.

CONCLUSIONS

This paper began by demonstrating that actual donations can be taken as lower bounds on the relevant Hicksian measure of value even if such measures are motivated by warm glow. For Wisconsin residents, this bound appears to be positive for removal of roads from the North Rim of the Grand Canyon. This result supports the view that citizens can hold positive Hicksian values for environmental and other public goods even though they lack prior familiarity with those goods and nonuse values predominate.

Our results relating to the performance of contingent donations were mixed. While contingent donations badly overestimated actual willingness to donate in the context we created, our results also suggest that following a contingent donation question with a certainty question has some potential for providing a robust lower bound on the Hicksian surplus. This approach is particularly appealing because the cost of the additional question in a CV survey is low and the DC CD data are still available if the researcher decides not to use the follow-up information. Furthermore, results from this study suggest that the follow-up question did not significantly affect the response rate or the distribution of responses to the willingness to donate question relative to the DC CD treatment without the follow-up question.

More research is needed to investigate the usefulness of the follow-up certainty question as a means of providing a lower bound on the theoretical construct. The method should be tested with a variety of nonmarket goods and across a full range of bid levels. If results of future studies are consistent with those discussed here, the follow-up certainty question could be used to provide a robust lower bound on the policy-relevant theoretical measure.

REFERENCES

1. A. A. Afifi and V. Clark, "Computer-Aided Multivariate Analysis," Van Nostrand−Reinhold, New York (1984).
2. A. Agresti, "Categorical Data Analysis," Wiley, New York (1990).
3. J. Andreoni, Giving with impure altruism: Applications to charity and Ricardian equivalence, *J. Polit. Econom.* **97**(6), 1447−1458 (1989).
4. P. Bohm, Estimating demand for public goods: An experiment, *Europ. Econ. Rev.* **3**, 111−130 (1972).
5. K. J. Boyle and R. C. Bishop, Valuing wildlife in benefit−cost analyses: A case study involving endangered species, *Water Resour. Res.* **23**, 943−950 (1987).
6. T. C. Brown and J. W. Duffield, Testing part−whole valuation effects in contingent valuation of instream flow protection, *Water Resour. Res.* **31**, 2341−2351 (1995).
7. T. A. Cameron and D. D. Huppert, OLS versus ML estimation of non-market resource values with payment card interval data, *J. Environ. Econom. Management* **17**, 230−246 (1989).
8. R. T. Carson, R. C. Mitchell, W. M. Hanemann, R. J. Kopp, S. Presser, and P. A. Ruud, "A Contingent Valuation Study of Lost Passive Use Values Resulting from the Exxon Valdez Oil Spill," a report to the Attorney General of the State of Alaska (1992).
9. P. A. Champ, R. C. Bishop, T. C. Brown, and D. W. McCollum, "A Comparison of Contingent Values and Actual Willingness to Pay Using a Donation Provision Mechanism," RWU-4851 Working Paper No. 97-1, Rocky Mountain Forest and Range Experiment Station, U.S. Forest Service Research, Fort Collins, CO (1997).
10. R. C. Cornes and A. G. Schweinberger, Free riding and the inefficiency of the private production of pure public goods, *Canad. J. Econom.* **29**(1), 70−91 (1995).
11. J. W. Duffield and D. A. Patterson, "Field Testing Existence Values: Comparison of Hypothetical and Cash Transaction Values," paper presented at the annual meeting of the American Economic Association, New Orleans (January 1991).

12. W. M. Hanemann, Welfare evaluations in contingent valuation experiments with discrete responses, *Amer. J. Agric. Econom.* **66**, 332–341 (1984).

13. S. Navrud, Willingness to Pay for Preservation of Species—An Experiment with Actual Payments, ''Pricing the European Environment,'' Chap. 11, Oxford Univ. Press, New York (1992).

14. K. Seip and J. Strand, Willingness to pay for environmental goods in Norway: A contingent valuation study with real payment, *Environ. Resour. Econom.* **2**(1), 91–106 (1992).

15. B. M. Swallow and M. Woudyalew, Evaluating willingness to contribute to a local public good: Application of contingent valuation to tsetse control in Ethiopia, *Ecol. Econom.* **11**, 153–161 (1994).