

Are Actual Donations to the Provision of a Public Good Sensitive to the Elicitation Format?

Patricia A. Champ¹
USDA Forest Service, Rocky Mountain Research Station

and

Richard C. Bishop
Department of Agricultural and Applied Economics, University of Wisconsin

Abstract

This study examines elicitation effects for actual donations to a public good. Specifically, responses to a dichotomous choice format are compared to responses to a payment card format. We find that in this actual donation situation, the elicitation format affects the distribution of donations. Based on this result we argue that elicitation effects found in contingent valuation studies may not be due the hypothetical nature of the decision making context as has been suggested in previous studies.

JEL Codes: H41, Q42

¹ Please send all correspondence to Patricia Champ, Rocky Mountain Research Station, 2150 Centre Avenue, Bldg A., Fort Collins, CO 80526. Voice 970-295-5967. Fax 970-295-5959. Email pchamp@fs.fed.us. This study was funded by the Energy Center of Wisconsin, USDA Forest Service, Rocky Mountain Research Station and the College of Agricultural and Life Sciences, University of Wisconsin, Madison. We are also grateful to Madison Gas and Electric and in particular to Greg Bollom and Jeff Ford for their cooperation. Mike Welsh generously provided help with the statistical estimation. John McPeak managed the data collection. All remaining errors are the sole responsibility of the authors.

Are Actual Donations to the Provision of a Public Good Sensitive to the Elicitation Format?

1. Introduction

Although use of stated preference data are prevalent and essential, some economists remain skeptical about the validity of stated preference data and the contingent valuation method in particular. One of the more widely researched criticisms with respect to contingent valuation data has been the consistent finding that the elicitation format of the willingness to pay question influences the value estimates. The conventional wisdom has been that willingness to pay questions with differing elicitation formats (e.g., open ended, dichotomous choice, payment card, double bounded dichotomous choice) all measure the same Hicksian surplus measure and should therefore provide equivalent value estimates. Given that all measures of Hicksian surplus have some associated bias, this conventional wisdom implicitly assumes that the measurement biases are commensurate across the elicitation formats. As a result, found elicitation effects have been portrayed as an artifact of the hypothetical nature of the contingent valuation method (McFadden 1994). There has been some questioning of this premise. For example, Bohara, McKee and Berrens (1998) suggest that differences between elicitation formats may be justified if respondents actually think differently about the information in the two formats. In other words, the elicitation effects are not due to the hypothetical nature of contingent valuation and would also be found in an actual payment situation.

In this study we investigate whether there are elicitation effects associated with actual payments for a public good. The motivation for investigating elicitation effects with actual

payments is that actual payment decisions are what contingent values are intended to mimic and we expect respondents to a contingent valuation survey to respond as they would in an actual payment situation. Therefore, if there are elicitation effects when individuals are making real payment decisions, there should be elicitation effects when individuals are making hypothetical payment decisions. And if this is the case, a more productive research focus may to understand the causes of elicitation effects and develop a framework for assessing the relative validity of the various elicitation formats.

The study described in this manuscript makes several contributions to the current state of knowledge. First it compares two elicitation formats, dichotomous choice and payment card, in an actual payment situation. The study also involves a good whose total value is comprised largely of nonuse value. Another contribution of this study is that the analyses and willingness to pay estimates for both data types use consistent maximum likelihood functions.

In the next section we summarize previous elicitation studies. We also describe the hypotheses we set out to test. Then we describe the data collection effort and the wind power program. In the last sections we summarize the results of our empirical study and provide some discussion.

2. Background

In the survey research literature there is an extensive discussion of the effects of posing a question with an “open” versus “closed” response format (Sheatsley 1983). An “open” response format does not provide any information to the respondent about possible answers to the question,

whereas a “closed” format provides answer categories from which a response is chosen. The focus on elicitation effects associated with contingent values has been on open versus closed response formats and on differences between various closed response formats. Two of the most prevalent closed response formats used in contingent valuation are dichotomous choice and payment card.² Each of these formats has strengths and weaknesses in terms of cognitive burden on the respondent, statistical efficiency, incentive compatibility, and anchoring effects. The benefits of the dichotomous choice format, which has been endorsed by the NOAA panel (Arrow et al. 1993) for use in damage assessments, include a relatively lower cognitive burden on the respondents as the format replicates real life decision making (purchases in markets and voting), and incentive compatibility under some circumstances (Carson, Groves, and Machina 1999). The drawbacks of the dichotomous choice format include the difficulty in choosing the appropriate offer amounts (Alberini 1995) and the need for large sample sizes due to the statistical inefficiency of such data. There is also the issue that the dichotomous-choice format only allows for positive expressions of support for a program at the stated offer amount and some individuals may say “yes” at offer amounts above their maximum willingness to pay to show support for the program. By comparison the payment card format allows for smaller sample sizes than the dichotomous choice format, however choosing an amount from the payment card may be a more cognitively burdensome task for respondents. There have also been concerns about the effects of the range and increments used on the payment card.³ The bottom line is that one elicitation format is not

²The dichotomous choice format poses the willingness to pay question in a take-it-or-leave-it format. The individual responds either *yes* or *no* to paying a specified amount. The payment card format asks which dollar amount from a menu of amounts, is the maximum the individual would be willing to pay.

³Rowe et al. (1996) argue that the range of the dollar values is not an issue if a sufficiently large range is used on the payment card.

unequivocally better than the other. In the case of voluntary environmental programs, the payment card format is more consistent with how actual programs are implemented in that the individual chooses the level at which to participate.

Table 1 summarizes recent elicitation studies. Some of the comparisons implemented different statistical approaches to estimate the willingness to pay values for the various treatments.⁴ It is possible that some of differences in reported results are statistical rather than data generated as argued by Huang and Smith (1998). There are a few notable patterns in the study results. First, in general, the contingent valuation willingness to pay estimates based on closed ended response formats (namely dichotomous choice and payment card) are larger than those based on open ended data. Furthermore, dichotomous choice estimates tend to be larger than payment card estimates. This result is consistent whether the study involved a private or a public good. There are a few cases (Reaves, Kramer, and Holmes 1999; Bohara et al. 1998; Loomis et al. 1997; Boyle et al. 1996; Kealy and Turner 1993) where the willingness to pay estimates were found to be equivalent across elicitation formats. It is also interesting to note that the studies involving actual payments provide very mixed results. Loomis (1997) and Frykblom and Shogren (2000) did not find any difference between willingness to pay estimates for private goods based on open ended and dichotomous choice response formats. One study (Cadsby and Maynes 1999) found willingness to pay estimates for a public good to be larger based on the open-ended data relative to the dichotomous-choice data. This study was a controlled laboratory experiment involving a threshold public good in which the a priori expectation was described as “To the extent that the availability of a symmetric pure strategy equilibrium acts as a behavioral focal point, we should find more

⁴ For example, with open ended data mean willingness to pay is sometimes calculated as the simple mean of the responses while with dichotomous-choice data, willingness to pay estimates are usually based on a parametric models (i.e. logit or

contributions and provision in the continuous contribution case which is consistent with such a threshold equilibrium, than in the binary contribution case which is not” (Cadsby and Mynes 1999, p. 57). Actual nonmarket valuation field settings do not offer the control of the laboratory setting so it is difficult to know how laboratory results generalize. Two studies (Lunander 1998, Brown et al. 1996) found willingness to pay estimates based on dichotomous choice data to be larger relative to open-ended data. This survey of the literature suggests that the results of the private good experiments are not at all consistent. Of the few actual payment elicitation studies, only Brown et al. and Cadsby and Maynes involved public goods. We might expect elicitation effects to be more prevalent with public goods as respondents are often less familiar and have less experience paying for public goods. In such situations, the elicitation format may send a signal to the individual about the value of the good. For example, the offer amount in the dichotomous choice format might be viewed as a signal about the value of the good.

3. Hypotheses

Economic theory provides little guidance on the relationship one would expect between willingness to pay estimates based on differing elicitation formats. If two elicitation formats measure the latent construct without bias or more realistically with an equivalent level of measurement bias (in the same direction), one would expect the two formats to provide equivalent measures of willingness to pay. The contingent valuation elicitation effects studies have often been motivated by the notion that differing elicitation formats should provide similar estimates of willingness to pay and failure to find equivalent willingness to pay measures is due to the hypothetical nature of the contingent valuation method. In this study we test two hypotheses: (1)

Are willingness to pay estimates based on the payment card data and dichotomous choice data equivalent? (H_0 : Mean $WTP_{pc} = \text{Mean } WTP_{dc}$) and (2) Are the underlying distributions the same for the responses to the dichotomous choice and payment card willingness to pay question equivalent? (H_0 : Dist $WTP_{pc} = \text{Dist } WTP_{dc}$). Before testing the main hypotheses of interest, we will compare the response rates and item non-response for the two treatments. Taking these factors into consideration may allow us to comment on which elicitation format is preferable (Reaves, Kramer, and Holmes 1999).

4. The Study Design

To investigate the effect of elicitation format on actual payments for a public good, we implemented a split sample design in which the survey instrument and all survey materials were identical for the two treatments except the response format to the willingness to participate question. The good described in the surveys was a voluntary pilot program for residential customers to purchase wind-generated electricity from the Madison Gas and Electric Company (MG&E), a local private provider of gas and electricity in Madison, Wisconsin. The sample frame was MG&E residential customers who were MG&E customers for at least one year.⁵ Although the program was sponsored by MG&E, the study was conducted by the Department of Agricultural and Applied Economics at the University of Wisconsin. The data were collected via mail surveys with customers randomly assigned to either the dichotomous choice or payment card treatment.

⁵Madison, Wisconsin is a University town and many of the customers are students who live together in a dwelling for the academic year. Participation in the program required a 12 month commitment so we wanted to avoid students who would be moving sometime during the 12 months. To minimize contacting the student population we also removed multiple-unit dwellings from the sample frame.

4.1 *Survey Development*

Eight focus groups with MG&E customers were used to develop and refine all of the survey materials and the description of the wind-power program in particular. Developing the description of the wind-power program was the most challenging aspect of the preliminary design effort. From the first focus groups, it was clear that respondents were a bit confused about what it meant to purchase wind power. Some thought that if they purchased wind power, then the wind power would somehow be delivered directly to their household rather than feeding into the general electricity supply. There was also confusion about why wind generated electricity would cost more given the wind is free. Based on feedback from the focus groups, we developed a scenario that clarified exactly how the program would work.

Focus group participants did not actually have an opportunity to participate in the wind-power program because electricity rates must be approved by a regulatory agency, the Wisconsin Public Service Commission, and at the time of the focus groups we did not yet have permission to actually sell wind power. Hence, all focus group participants were asked about hypothetical, rather than actual, participation in the wind-power program. We explored the reasons why focus group participants responded positively to the willingness to participate question. They told us the environmental benefits of wind power and the desire to encourage future renewable energy development were important factors. We also explored reasons for *negative* responses to the willingness to participate question and were told that the program was too costly, that all MG&E customers should share in the burden, that it was better to conserve energy than develop new sources, that they objected to the wind generators because of potential birds kills, and that they did

not believe the wind technology was cost effective. These comments were used to develop a scenario that was balanced in terms of explaining the costs and benefits of wind-generated electricity. Focus group participants also suggested that we make clear in the cover letter why the University of Wisconsin was recruiting customers for an MG&E program. The focus groups also allowed us to test and revise the attitude and demographic questions in the survey. We conducted a pilot study to help predict the final response rate, provide a test of the survey implementation procedures and assess whether the offer amounts for the payment card and dichotomous choice willingness to purchase questions were appropriate.

4.2 The Final Scenario and Valuation Question

The survey explained that MG&E had an opportunity to purchase a limited amount of power from wind turbines being built in northeastern Wisconsin. If enough customers were willing to pay the extra cost of wind power, MG&E would purchase the wind power from the wind turbines and ultimately construct more wind turbines. Customers were told that most of the electricity MG&E currently sells is generated from coal and the environmental drawbacks of coal were explained. The benefits of wind-generated electricity were described as well as the disadvantages such as the sound of the turbines, bird kills, appearance of the wind turbines themselves. It was made clear in the wind program description that the environmental impacts of this specific program would not be substantial; however, if the program were successful MG&E would offer more wind power in the future. The unusual aspect of this good is that payment is linked to a market good (electricity) but the benefits accrue to all customers. In other words, a market mechanism was used to facilitate donations toward the purchase of a public good.

Following the informational part of the scenario, survey respondents were asked if they would purchase wind-generated electricity. In one treatment a single-bound dichotomous choice format was used for this question. The amount of wind power respondents were asked to purchase was independent of their current electricity usage and randomly assigned from one of the seven offer amounts described below. In the payment card treatment, the respondents were asked to choose the amount of wind-generated electricity they would like to purchase from a menu of amounts. For both treatments the amounts were expressed in kilowatt-hours per month, cost per month, and total cost for the year. The additional cost of wind-generated electricity was four cents per kilowatt-hour and offer amounts started at 50 kilowatt-hours per month. The next amount was 100 kilowatt-hours per month and the amount increased in 100 kilowatt-hour increments up to 600 kilowatt-hours per month (that corresponds to \$24, \$48, \$96, \$144, \$192, \$240, or \$288 per year).⁶ The offer amounts used in the dichotomous choice treatment were the same offer amounts as listed on the payment card. If survey respondents agreed to purchase the wind-generated electricity, their monthly electricity bill would include the extra cost of wind-generated electricity for twelve months. The text of the willingness to participate questions is shown in Figure 1. The format of the willingness to purchase question is different from the traditional willingness to pay format where the quantity of the good is the same across offer amounts. In this case, paying more was linked to purchasing more wind power. However the total amount of wind power that could be purchased was fixed at 430,000 kilowatt hours which is a small amount of wind power even for this pilot study population.

⁶ Residential customers currently pay about 7 cents per kilowatt-hour so the total cost of wind-generated electricity is approximately 11 cents per kilowatt-hour.

The surveys for both treatments also elicited measures of attitudes toward wind-generated electricity, MG&E, renewable energy, the environment in general and demographic characteristics. These measures allow us to conduct multivariate analyses.

5.0 Results

In this section, we first compare the response rates and item non-response for the two treatments then we focus on the responses to the willingness to participate question.

5.1 Response Rate

The initial sample sizes were 1260 for the dichotomous-choice treatment and 500 for the payment-card treatment. Response rates were 56% and 50% respectively giving final samples sizes of 700 for the dichotomous-choice treatment and 251 for the payment-card treatment. The response rate for the dichotomous-choice treatment was significantly higher than for the payment card treatment ($P^2 = 4.134$, $p = .042$). This result is consistent with the premise that the ease with which respondents can answer a dichotomous choice willingness to participate question manifests in more individuals returning the survey. However, we do not really know the cause of the difference in response rate.

Because the response rates were significantly different for the two treatments in this study, analyses were conducted to assess whether the respondents in the two treatments had statistically similar responses to the measures elicited in the surveys other than the willingness to participate question. Based on these analyses we conclude that the two treatments are representative of similar respondent populations.

5.2 *Item Non-response*

One might also expect that more survey respondents would skip (not answer) the willingness to participate question in the payment card treatment if indeed responding to that format is more difficult than responding to a dichotomous choice question. However, that was *not* observed in this study. Of the 700 surveys returned in the dichotomous choice treatment, 648 had valid responses to the willingness to participate question (i.e. 7% of the returned surveys did not have any response circled for the willingness to participate question). In the payment card treatment, twelve of the 249 returned surveys (5%) did not have a response to the willingness to participate question. The difference in the item non-response for the two treatments is not statistically significant ($P^2 = 1.98$; $p = .159$). This higher item non-response in the dichotomous-choice treatment might have been due to survey respondents simply skipping the willingness to participate question and completing the rest of the survey. Whereas in the payment card treatment, it is possible that some respondents started the survey but threw the entire survey away (thus the lower overall response rate) when they got to the willingness to participate question rather than skipping that question and completing the rest of the survey. Again we can not comment on *why* individuals skip questions or do not return the surveys but it is clear that we got a higher percent of the surveys returned in the dichotomous choice treatment and did not get a significantly higher percent skipping the willingness to participate question.

Given the mixed result of no statistically significant difference in item non-response but a significant difference in the overall response rates, it is interesting to look at the *aggregate* non-response to help us sort out the net effect, if any. We calculate the aggregate non-response by starting with all the individuals who were sent a survey (1260 for the dichotomous treatment and

500 for the payment card treatment) and considering how many of those individuals provided a valid response to the willingness to purchase question (648 for the dichotomous choice and 237 for the payment card). We find no statistical difference between the dichotomous choice and payment card treatments in terms of aggregate non-response ($P^2 = 2.324$, $p = .127$). This result suggests that we cannot make a claim based on response rate and item non-response that one treatment is unequivocally better or worse than the other.

5.3 *Response to the Willingness to Participate Question*

When comparing responses to the willingness to participate question between treatments, it is important to keep in mind that the questions are fundamentally different. In the dichotomous choice treatment, the question is whether the individual will participate at the specified payment level, whereas in the payment card treatment, the question asks if the individual would participate at any one of the payment levels offered on the payment card. This difference leads us to expect more individuals to respond positively to the willingness to participate question in the payment card treatment, as the respondent can choose the payment level. We found that to be the case with a significantly higher percent of the respondents agreeing to pay for the wind-generated electricity in the payment card treatment (36%) relative to the dichotomous-choice treatment (23%) ($P^2 = 14.29$; $p < .001$). However respondents in the dichotomous-choice treatment agreed to purchase larger quantities of wind power than the respondents in the payment card treatment as is evident by looking at the empirical survival functions (Table 2 and Figure 2).

The willingness to pay models based on the payment card and dichotomous choice data were estimated using a maximum likelihood interval approach (Welsh and Poe 1998; Cameron and

Huppert 1991). Using consistent statistical modeling for the two types of data allows for statistical comparisons between the treatments. The univariate logit models (Table 4) suggest that the underlying distributions differ significantly between the payment card and dichotomous choice treatments. A likelihood ratio test confirms that the distributions are significantly different ($LR=35$; $P^2_{=.05;2} = 5.99$). Not surprisingly, the estimates of mean willingness to purchase wind-generated electricity based on the logistic models are also very different for two treatments with the mean for the dichotomous choice treatment (\$81) more than double that of the payment card treatment (\$36).

The multivariate models (Table 5) also suggest that the underlying distributions of willingness to pay are significantly different for the two treatments ($LR=27$; $P^2_{=.05;9}=16.93$). However we note that with the exception of three coefficient estimates, the other estimated coefficients have similar signs and levels of significance for the dichotomous-choice and payment-card models. One of the differences in the significance level, but *not* in the sign, of the estimated coefficients for the two models occurs for the variable “I like the idea of wind power.” For this variable we find that the sign to be positive suggesting individuals who agree or strongly agree with this statement are more likely to actually purchase wind power. However the coefficient is not significant in the payment-card model. A second notable difference between the two multivariate models is found with the variable “I would rather encourage conservation of electricity than pay to develop renewable energy sources.” For this variable, individuals who agreed or strongly agreed were less likely to actually purchase wind power and the estimated coefficient is significant in the payment-card model but not the dichotomous-choice model. A third disparity between the payment-card and dichotomous-choice multivariate models occurs in the statistical

significance of the coefficient on the gender variable in the dichotomous-choice model that is not found in the payment-card model. However the sign on the gender variable in both models suggests that females are more likely than males to purchase wind power. In both models we do not find the income variable to be significant. In the models shown in Table 5, the income variable is continuous. This result suggests that support for wind power is independent of income. Written comments in some of the surveys suggested that there are less expensive alternative energy sources, namely nuclear energy. The inclusion of the variable “I can’t afford to pay the extra cost of wind power” in the multivariate model may also be a proxy for income. Overall, comparisons of the multivariate models suggest substantial difference between the elicitation formats.

6.0 Conclusions

This study offered a unique opportunity to observe elicitation effects in an actual payment situation for a public good. We argue that elicitation effects associated with contingent values are not likely a result of the hypothetical nature of the willingness to pay questions. Rather elicitation effects are a prevalent survey research issue. As such, the bigger question is which format is most “appropriate” for a particular application? The results of this research also suggest that the payment card format may encourage *more* participants in a voluntary program, but the dichotomous choice format results in a higher level of participation for those who do participate.

Table 1: Recent Elicitation Studies since 1990

| Authors | The Good | Public or Private Good | Response Formats | Results |
|--------------------------------------|--------------------------------------------------|-------------------------------------------|-----------------------------|----------------------------------------|
| <i>Actual Payment Studies</i> | | | | |
| Frykblom and Shogren (2000) | A Swedish national atlas | Private | DC, OE | $WTP_{DC} = WTP_{OE}$ ⁷ |
| Cadsby and Maynes (1999) | Tokens which are converted into Canadian Dollars | Public | DC, OE | $WTP_{DC} < WTP_{OE}$ |
| Lunander (1998) | Preview of a movie | Private | DC, OE | $WTP_{DC} > WTP_{OE}$ |
| Loomis et al. (1997) | Art Print | Private | DC, OE | $WTP_{DC} = WTP_{OE}$ |
| Brown et al. (1996) | Road removal in the North Rim of Grand Canyon | Public | DC, OE | $WTP_{DC} > WTP_{OE}$ |
| <i>Contingent Valuation Studies</i> | | | | |
| Ready, Navrud, and Dubourg (2001) | Avoidance of an episode of illness | Private | DC, PC ⁸ | $WTP_{DC} > WTP_{PC}$ |
| Cameron, Poe, Ethier, Schulze (1999) | Green Power Program | Public | DC, OE, PC | $WTP_{DC} > WTP_{PC} > WTP_{OE}$ |
| Reaves, Kramer, and Holmes (1999) | Recovery of an endangered species | Public | DC, ⁹ OE, PC | $WTP_{DC} = WTP_{OE} = WTP_{PC}$ |
| Bohara et al. (1998) | Protection of Instream Flows | Public | DC, OE | $WTP_{DC} \geq WTP_{OE}$ ¹⁰ |
| Lunander (1998) | Preview of a movie | Private | DC, OE | $WTP_{DC} > WTP_{OE}$ |
| Welsh and Poe (1998) | Reduced fluctuations in Glen Canyon Dam releases | Public | DC, PC | $WTP_{DC} > WTP_{PC}$ |
| Kramer and Mercer (1997) | Tropical Rain Forest Protection | Public | DC, PC | $WTP_{DC} = WTP_{PC}$ ⁷ |

⁷The OE treatment involved a Vickery auction.

⁸Ready, Navrud and Dubourg refer to the payment card treatment as open-ended. However, the treatment was like a payment card in that respondents were shown a card with offer amounts and asked to check the amount they would pay.

⁹The DC question used a double-bounded format where respondents who said yes to the initial offer amount were asked a follow-up question with a higher offer amount and respondents who said no to the initial offer amount were asked a follow-up question with a lower offer amount.

¹⁰ $WTP_{DC} > WTP_{OE}$ when a log normal distribution was used and $WTP_{DC} = WTP_{OE}$ when a Weibull or Gamma distribution was used.

Table 1: Recent Elicitation Studies since 1990

| Authors | The Good | Public or Private Good | Response Formats | Results |
|-----------------------------------------|----------------------------------------------------------------------------|-------------------------------------------|-----------------------------|-----------------------|
| Loomis et al. (1997) | Art Print | Private | DC, OE | $WTP_{DC} = WTP_{OE}$ |
| Donaldson, Thomas, and Torgerson (1997) | A bone mineral density scan | Private | OE, PC | $WTP_{PC} > WTP_{OE}$ |
| Kramer and Mercer (1997) | Tropical Rain Forest Protection | Public | DC, PC | $WTP_{DC} = WTP_{PC}$ |
| Boyle et al. (1996) | Ex post WTP to hunt moose in Maine | Private | DC, OE | $WTP_{DC} = WTP_{OE}$ |
| | WTP of individuals who applied for a moose hunt permit but did not get one | Private | DC, OE | $WTP_{DC} > WTP_{OE}$ |
| | Creation of a local response center to clean up oil spills | Public | DC, OE | $WTP_{DC} = WTP_{OE}$ |
| Brown et al (1996) | Road Removal in the North Rim of the Grand Canyon | Public | DC, OE | $WTP_{DC} > WTP_{OE}$ |
| Ready, Buzby, Hu (1996) | Food safety improvements | Private | DC, PC | $WTP_{DC} > WTP_{PC}$ |
| Holmes and Kramer (1995) | Protection of a forest ecosystem | Public | DC, PC | $WTP_{DC} > WTP_{PC}$ |
| McFadden (1994) | Wilderness Preservation | Public | DC, OE | $WTP_{DC} > WTP_{OE}$ |
| Kriström (1993) | Protection of forest areas in Sweden | Public | DC, OE | $WTP_{DC} > WTP_{OE}$ |
| Kealy and Turner (1993) | Candy Bar | Private | DC, OE | $WTP_{DC} = WTP_{OE}$ |
| | Reduction in acid rain damage in Adirondacks | Public | DC, OE | $WTP_{DC} > WTP_{OE}$ |
| Johnson, Bregenzer, and Shelby (1990) | Permit for one whitewater recreation trip on the Rogue River | Private | DC, OE | $WTP_{DC} > WTP_{OE}$ |

Figure 1: Willingness to Purchase Questions

Dichotomous Choice

Are you willing to purchase a [insert kw amount] kilowatt hour block of wind generated electricity each month for twelve months at an additional cost of \$ [insert dollar amount] per month (that is \$ [insert dollar amount] for the year)? **(CIRCLE ONE NUMBER)**

- 1 No
- 2 Yes

Payment Card

MG&E is currently able to offer you wind generated power according to the terms listed in this table.

| Size of block | Extra cost per month | Extra cost per year |
|--------------------|----------------------|---------------------|
| 50 kilowatt hours | \$2 | \$24 |
| 100 kilowatt hours | \$4 | \$48 |
| 200 kilowatt hours | \$8 | \$96 |
| 300 kilowatt hours | \$12 | \$144 |
| 500 kilowatt hours | \$16 | \$192 |
| 600 kilowatt hours | \$24 | \$288 |

Are you willing to purchase any of the blocks or wind generated electricity at the cost which are described in this table? **(CIRCLE ONE NUMBER)**

- 1 No
- 2 Yes ---> Circle the particular kilowatt block you wish to purchase and fill out the form below:

50 100 200 300 400 500 600

Table 2: Response to Willingness to Participate Question

| | Dichotomous Choice (N=648) | Payment Card (N=237) |
|-----|----------------------------|----------------------|
| Yes | 24% (n=153) | 37%(n=87) |
| No | 76% (n=495) | 63%(n=150) |

Table 3: Response Distributions

| | Dichotomous Choice (% Yes) | Payment Card (%) |
|-------|-------------------------------|---------------------|
| \$24 | 47% | 33% |
| \$48 | 35% | 31% |
| \$96 | 23% | 9% |
| \$144 | 18% | 13% |
| \$192 | 18% | 7% |
| \$240 | 16% | 3% |
| \$288 | 7% | 3% |

Figure 2: Empirical Survival Functions

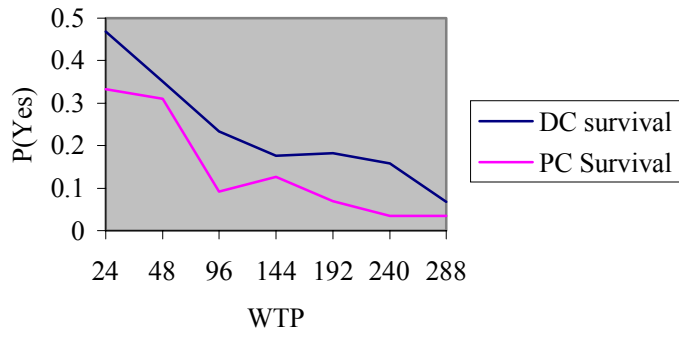


Table 4: Logit Models

| | Dichotomous Choice (N=648) | Payment Card (N=249) | Pooled (N=897) |
|--------------------------------------------------------------|----------------------------------|----------------------------|-------------------|
| Constant (Std. Error) | -0.173 (0.163) | -0.291 (0.142) | -0.138 (0.099) |
| Offer Amount (Std. Error) | -0.008 (0.001) | -0.015 (0.002) | -0.010 (0.001) |
| -2*Log Likelihood | 664.59 | 617.20 | 1316.91 |
| Hanemann's Estimate of the Mean (95% confidence interval) | \$81 (\$69, \$100) | \$36 (\$29, \$45) | |

Table 5: Multivariate Models

| Independent Variables | Coefficient (Standard Error) | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|--------------------------------|-------------------------------|
| | Dichotomous Choice (n=518) | Payment Card (n=190) | Pooled (n=708) |
| Constant | -4.713 ^a (.824) | -2.882 ^a (1.050) | -4.073 ^a (.635) |
| offer amount (\$24, \$48, \$96, \$144, \$192, \$240, \$288) | -.015 ^a (.001) | -.024 ^a (.002) | -.017 ^a (.001) |
| I can't afford to pay the extra cost of wind power (1=agree or strongly agree; 0=otherwise) | -2.400 ^a (.390) | -2.782 ^a (.589) | -2.531 ^a (.323) |
| I think it is a good idea for MG&E to use wind power to meet the growing demand for electricity in the Madison area (1=agree or strongly agree; 0=otherwise) | 1.201 ^a (.444) | 1.123 ^a (.568) | 1.110 ^a (.337) |
| I like the idea of wind power (1=agree or strongly agree; 0=otherwise) | 1.241 ^a (.605) | 1.185 (.913) | 1.322 ^a (.496) |
| I felt if I said I would buy the wind power, more renewable energy sources like wind, solar, and biomass are likely to be used in the future (1=agree or strongly agree; 0=otherwise) | 1.966 ^a (.334) | 1.831 ^a (.418) | 1.792 ^a (.247) |
| I would rather encourage conservation of electricity than pay to develop renewable energy sources (1=agree or strongly agree; 0=otherwise) | -.420 (.336) | -.926 ^a (.426) | -.469 (.252) |
| I am willing to make personal sacrifices for the sake of the environment (1=agree or strongly agree; 0=otherwise) | 1.318 ^a (.446) | 1.076 ^a (.534) | 1.199 ^a (.337) |
| gender (1=male; 0=female) | -.490 ^a (.248) | -.442 (.376) | -.477 ^a (.203) |
| income | .000 (.000) | .000 (.000) | .000 (.000) |
| -2 log likelihood | 837 | 381 | 1234 |

^a significant at $\alpha = .05$ level

LR=27; $\chi^2_{\alpha=.05;9}=16.93$

References

- Alberini, A. 1995. Optimal Designs for Discrete Choice Contingent Valuation Surveys: Single-Bound, Double-Bound, and Bivariate Models. *Journal of Environmental Economics and Management* 28 (3):287-306.
- Arrow, K., R. Solow, P. R. Portney, E. E. Leamer, R. Radner, and H. Schuman. 1993. Report of the NOAA Panel on Contingent Valuation. Federal Register.
- Bohara, A.K., M. McKee, and R.P. Berrens. 1998. Effects of Total Cost and Group-Size Information on Willingness to Pay Responses: Open Ended vs. Dichotomous Choice. *Journal of Environmental Economics and Management* 35:142-163.
- Boyle, K.J., F.R. Johnson, Daniel W. McCollum, W.H. Desvousges, R.W. Dunford, and S.P. Hudson. 1996. Valuing Public Goods: Discrete versus Continuous Contingent Valuation Responses. *Land Economics* 72 (3):381-96.
- Brown, Thomas C., Patricia A. Champ, Richard C. Bishop, and Daniel W. McCollum. 1996. Which Response Format Reveals the Truth about Donations to a Public Good? *Land Economics* 72 (2):152-166.
- Cadsby, Charles Bram, and Elizabeth Maynes. 1999. Voluntary Provision of Threshold Public Goods with Continuous Contributions: Experimental Evidence. *Journal of Public Economics* 71:53-73.
- Cameron, Trudy Ann, and Daniel D. Huppert. 1991. Referendum Contingent Valuation Estimates: Sensitivity to the Assignment of Offered Values. *Journal of the American Statistical Society* 86 (416):910-918.
- Cameron, Trudy Ann, Gregory L. Poe, Robert G. Ethier, and William D. Schulze. 1999. Alternative Nonmarket Value-Elicitation Methods: Are the Underlying Preferences the Same? Unpublished Manuscript
- Carson, Richard T., Theodore Groves, and Mark J. Machina. 1999. Incentive and Informational Properties of Preference Questions. Unpublished Manuscript.
- Frykblom, P., and J.F. Shogren. 2000. An Experimental Testing of Anchoring Effects in Discrete Choice Questions. *Environmental and Resource Economics* 16:329-341.
- Huang, Ju-Chin, and V. Kerry Smith. 1998. MonteCarlo Benchmarks for Discrete Response Valuation. *Land Economics* 74 (2):186-202.
- Kealy, Mary Jo, and R.W. Turner. 1993. A Test of the Equality of Closed-Ended and Open-Ended Contingent Valuations. *American Journal of Agricultural Economics* 75 (2):321-331.

- Kramer, R.A. and D.E. Mercer. 1997. Valuing a Global Environmental Good: U.S. Residents' Willingness to Pay to Protect Tropical Rain Forests. *Land Economics* 73(2):196-210.
- Loomis, John, Thomas C. Brown, Beatrice Lucero, and George Peterson. 1997. Evaluating the Validity of the Dichotomous Choice Question Format in Contingent Valuation. *Environmental and Resource Economics* 10:109-123.
- Lunander, Anders. 1998. Inducing Incentives to Understate and to Overstate Willingness to Pay within the Open-Ended and the Dichotomous-Choice Elicitation Formats: An Experimental Study. *Journal of Environmental Economics and Management* 35:88-102.
- McFadden, D. 1994. Contingent Valuation and Social Choice. *American Journal of Agricultural Economics* 76 (November 1994):689-708.
- Ready, Richard C., Stale Navrud, and Richard W. Dubourg. 2001. How do Respondents with Uncertain Willingness to Pay Answer Contingent Valuation Questions? *Land Economics* 77(3): 315-326.
- Reaves, Dixie Watts, Randall A. Kramer, and Thomas P. Holmes. 1999. Does Question Format Matter? Valuing an Endangered Species. *Environmental and Resource Economics* 14:365-383.
- Rowe, R.D, William D. Schulze, and W.S. Breffle. 1996. A Test for Payment Card Biases. *Journal of Environmental Economics and Management* 31 (2):178-185.
- Sheatsley, Paul B. 1983. Questionnaire Construction and Item Writing. In *Handbook of Survey Research*, edited by P. H. Rossi, J. D. Wright and A. B. Anderson. San Diego: Academic Press, Inc.
- Welsh, Michael P., and Gregory L. Poe. 1998. Elicitation Effects in Contingent Valuation: Comparisons to a Multiple Bounded Discrete Choice Approach. *Journal of Environmental Economics and Management* 36:170-185.