Irrational Responses in Contingent Valuation and Their Potential Impacts on Mean Stated Willingness-to-pay

Senhui He

Post-Doctoral Associate

Wojciech J. Florkowski

Associate Professor

and

Jeffery L. Jordan

Professor

Department of Agricultural and Applied Economics

University of Georgia

Paper Submitted for the Xth Congress of the EAAE

Abstract

This paper addresses the issue of rationality of responses in contingent valuation. We found a significant portion of respondents stated a positive willingness-to-pay for a project they perceived to be worthless. The irrational responses had a significant impact on the mean stated willingness-to-pay and the effect can not be removed by simply excluding the those observations from estimation. The dichotomous-choice elicitation format helps to mitigate the effect of the irrational responses, but can not completely solve the problem.

Key words: contingent valuation, elicitation format, irrational responses, willingness-to-pay.

Irrational Responses in Contingent Valuation and Their Potential Impacts on Mean Stated Willingness-to-pay

The contingent valuation (CV) technique is the most frequently used method to elicit individuals' willingness to pay (WTP) for nonmarket goods (Carlsson and Martinsson). With the use of CV to elicit the economic value of nonmarket goods gaining popularity, it is becoming increasingly important to assess the validity of the instrument.

The validity assessment of the CV method determines whether contingent valuation measures the correct theoretical specification of Hicksian surplus values (Reiling, Boyle, and Philips). Studies on the validity assessment issue can be roughly grouped into two types, internal tests and external tests. Standard properties of consumer preferences are tested with internal tests while external tests are mostly concerned with the issue whether the hypothetical WTP differs from the actual WTP (Carlsson and Martinsson).

The validity of CV estimates as a measure of Hicksian surplus or the maximum WTP has been challenged (Hausman; Kahneman and Knetsch,1992; Kahneman et al, 1993). Special attention has been paid to such aspects as temporal effects (Bateman and Langford; Kahneman and Knetsch, 1992); the embedding of the good to be valued within a broader category (Kahneman and Knetsch, 1992); the effects of ordering of goods in the elicitation survey (Samples and Hollier; Bateman and Langford); the effects of elicit value (Fisher; Irwin et al; McFadden); effects of strategic responses (Mitchell and Carson; Posavac); and the effects of elicitation formats (Welsh and Poe, Loomis et al). Empirical results show that all these aspects can result in variations in respondents' stated WTP.

Several recent papers addressed the issue of rationality or theoretical validity of responses in CV studies. In their efforts to test rationality in choosing treatment scenarios of rheumatology care, Ryan and Bate found that over 30% of respondents provided at least one irrational response because they did not choose the dominant options. Respondents who gave irrational responses were assumed either to have misunderstood the questions or treat the survey subject as unimportant.

Ryan and San Miguel also found evidence of "economically irrational" responses in their testing for consistency in a WTP experiment. The results show that about 30% of the respondents stated they were willing to pay more for a less preferred alterative of medical treatment and thus violated the assumption of consistency. Ryan and San Miguel attributed the inconsistency of WTP responses to cost-based valuation, a choice behavior consistent with the 'fair price' explanation for WTP responses, where consumers tend to figure out their WTP according to the perceived cost of the goods under valuation. Those "fair play" consumers do not want to exploit others or society by paying less than what they perceive the commodity would cost. To these consumers, their "irrationality" is not without a reason because they do benefit from the consumption of the commodity and they want to pay a "fair price." This leads to our interest in examining whether respondents would be so irrational that they are willing to pay for the provision of a commodity which they believe to be totally useless. The objective is to be accomplished by a CV study of consumer WTP for quality improvement of drinking water, using survey data.

The Data and the Survey

The data were from a telephone survey of Georgia residents on their WTP for water quality improvement resulting from the re-authorization of the Safe Drinking Water Act

(SDWA). Amendments were proposed in the re-authorization to increase the public water systems' incentives to optimize their maintenance and leak detection programs. The water price will increase as a result of the amendments to the SDWA. Since the increased cost is ultimately borne by consumers, the level of consumer WTP for the resulting quality improvements is essential. This consideration led to the survey prior to the SDWA re-authorization, a policy relevant survey.

Policy relevance is very important in CV studies. Failure to establish the meaningfulness of the valuation exercise may result in respondents not taking the exercise seriously, and thus unreliable value estimates may be obtained (Cummings and Taylor). Policy relevancy of the survey should be emphasized to increase the incentives for careful value formation. To avoid frivolous valuation, respondents to the survey were clearly informed that the survey was policy relevant. Further, with the consideration that people whose interests are not likely to be affected by the survey results may not take the survey seriously, individuals who drank water from their private wells were excluded from the survey.

A long recognized potential problem in CV studies is the presence of the yea-saying responses, defined by Mitchell and Carson as "the tendency of some respondents to agree with an interviewer's request regardless of their true views." More inclusively, Blamey, Bennett, and Morrison define the yea-saying as a tendency to subordinate true economic preferences in favor of expressive motivations. The yea-saying tendency can be motivated socially where social pressure or desirability considerations motivate respondents to yea-saying. Previous economic studies have focused on the socially motivated yea-saying issue (McFadden and Leonard; Boyle et al.; Ready, Whitehead, and Blomquist) and empirical evidences were found for the existence of such responses (Kanninen). To mitigate such side effects, the respondents to the survey in this study were clearly told that they did not have to support the program and the interviewer was neutral about their responses.

Empirical results from previous studies show that elicitation formats may have different impacts on the stated mean WTP. However, whether irrational responses were affected by elicitation formats is not clear. To address this issue, half of the respondents were asked an open-ended WTP question (OE sample), while the other half were asked a dichotomous choice one (DC sample). The respondents in the OE sample were asked to state the maximum amounts they were willing to pay while the respondents in the DC sample were asked whether they were willing to pay a particular amount (bid value) for the resulting water quality improvement. The bid values were based on a pretest telephone survey of 60 households. Following Mitchell and Carson, the WTP question in the pretest survey used the open-ended format. A method suggested by Boyle, Welsh, and Bishop (1988) was then used to determine and assign bids to respondents in the actual survey.

Before the valuation question, respondents were told some common knowledge about drinking water, a brief history of the SDWA, a brief description of the expected effects of the SDWA re-authorization, and the reason for the survey. Next, the respondents of the OE sample were presented with the following statements:

> "Before I ask you the next question, I want you to think of your household's total income, your current water quality, your current water bill, and any expected problems you may have with your water in the future. And remember that any answer you give is fine with me. I'm neutral. Let me know when you are ready for the next question."

After the respondents expressed readiness to continue, the interviewer followed with:

> "Now, keeping all these things in mind, suppose that the water system would send you a higher water bill due to the adoption of the amendments. Remember that you are free to support or not support these amendments. What would be the maximum (the most) that you would be willing to pay EVERY MONTH (and for the rest of your life) ABOVE your current MONTHLY bill to support the amendments of the Safe Drinking Water Act?"

The respondents of the DC sample were presented with the same statements except they were asked whether they were willing to pay a specific amount every month to support the SDWA re-authorization.

After the valuation question, respondents were asked to give their opinions about the effects of the SDWA re-authorization, i.e., whether their water quality would be better, the same or worse if the re-authorization passed. This quality effect question was designed to address the issue of irrational responses. If a respondent thought her water quality would remain the same or even become worse, then she would not be willing to pay a positive amount to support the amendments. Otherwise, her response is economically irrational.

The survey was conducted by the University of Georgia Survey Research Center in the summer of 1995. A pilot test was conducted to the survey instrument in the vicinity of the Survey Research Center. After some revisions of the instrument, an additional test was conducted statewide. Random Digit Dialing probability sampling method was implemented in the survey to ensure that all Georgia adult residents had an equal opportunity of being selected for the interview. Response bias was minimized so that reliable inferences can be drawn from the survey results. The survey resulted in a useful sample of 400 observations with a response rate of 58.4%, a sample statistically significant for the population of Georgia.

Data Analysis

The percentage of respondents who considered the SDWA re-authorization to be valueless is high. In the OE sample, of the 139 respondents who provided useful answers to both the quality and the WTP questions, 57 thought the quality would be the same or even worse (about 41%). For convenience, we denote those who gave answers to both the quality effect and the WTP questions and considered the re-authorization to be valueless as "the no-better subsample". In the no-better subsample of OE sample, 38 out of the 57 respondents stated positive WTPs for the re-authorization, an impressive rate of 67% of irrational responses.

Fewer respondents in the DC sample considered the re-authorization to be worthless. Of the159 respondents who gave clear answers to both the quality effect and WTP questions, 51 thought the re-authorization would have no impact or even a negative effect on the quality of their drinking water (32%). The percentage of irrational responses is lower in the DC sample with 18 respondents of the no-better subsample of the DE sample indicated that they were willing to a positive amount to support the re-authorization (about 33%).

The percentage of irrational responses differ with the elicitation formats. About 67% of the respondents in the no-better subsample of the OE sample stated a positive WTP for the re-authorization while about 33% of the respondents of the no-better subsample of the DC sample responded positively. This implies that the influence of irrational responses on the mean stated WTP may be less in the DC sample than in the OE sample, a phenomenon worthy of further exploration.

Open-ended elicitation format has been shown to be vulnerable to some factors that can cause inconsistent responses, such as cost-based responses. Whether the DC format is also

References

Arrow, K. J., Solow R., Portney P. R., Leamer E. E., Radner R., Schuman E. H. "Report of the NOAA Panel on Contingent Valuation." *Federal Register* 58(1993):4602-4614.

Bateman, I. J., and I. H. Langford. "Budget-constraint, Temporal, and Question Ordering Effects on Contingent Valuation Studies." *Environment and Planning A*. 28 (1996):1215-1228.

Blamey, R. K., J. W. Bennett, and M. D. Morrison. "Yea-saying in Contingent Valuation Surveys." *Land Economics* 75(1999):126-141.

Boyle, K. J., H. F. MacDonald, H. Cheng, and D. W. McCollum. "Bid Design and Yea Saying in Single-Bounded, Dichotomous-Choice Questions." *Land Economics* 74(1998):49-64.

Boyle, K. J., M. P. Welsh and R. C. Bishop. "Validation of Empirical Measures of Welfare Change: Comment". *Land Economics* 64(1988):94-98.

Carlsson, F., and P. Martinsson. "Do Hypothetical and Actual Marginal Willingness to Pay Differ in Choice Experiments?" *Journal of Environmental Economics and Management* 41(2001):179-192.

Cummings, T. G., and L. O. Taylor. "Does Realism Matter in Contingent Valuation Surveys?" *Land Economics* 74(1998):203-215.

Diamond, P., and J. Hausman. "Contingent Valuation: Is Some Number Better than No Number?" *Journal of Economic Perspectives* 8(1994):45-64.

Fisher, A. C. "The Conceptual Underpinnings of the Contingent Valuation Method." In *the Contingent Valuation of Environmental Resources: Methodological Issues and Research Needs.* Bjornstad, D. J., and Kahn, J.R. (Eds.) Edward Elgar Publishing Company, Brookfield, VT, 1996.

Hausman, J. A., Contingent Valuation: a Critical Assessment. North-Holland, New York, 1993.

Irwin, J. R., P. Slovic, S. Lichtenstein, and G.H. McClelland. "Preference Reversals and Measurements of Environmental Values." *Journal of Risk and Uncertainty* 6(1993):5-18

Kahneman, D., and J. L. Knetsch. "Valuing Public Goods: the Purchase of Moral Satisfaction." *Journal of Environmental Economics and Management* 22 (1992):57-70.

Kahneman, D., I. Ritov, K. E. Jackowitz, and P. Grant. "Stated Willingness to Pay for Public Goods: A Psychological Perspective." *Psychological Science* 4 (1993):310-315.

Kanninen, B. "Bias in Discrete Response Contingent Valuation." *Journal of Environmental Economics and Management* 28(1995):114-125.

Krinsky, I., and L. A. Robb. "On Approximating the Statistical Properties of Elasticities." *Review of Economics and Statistics* 68(1986):715_19.

Loomis, J., T. Brown, B. Lucero and G. Peterson. "Evaluating the Validity of Dichotomous Choice Question Format in Contingent Valuation." *Environmental and Resource Economics* 10(1997):109-123.

Loomis, J., A. Gonzalez-Caban, and R. Gregory. "Do Reminders of Substitutes and Budget Constraints Influence Contingent Valuation Estimates?" *Land Economics* 70(1994):499-506.

McFadden, D. "Contingent Valuation and Social Choice." *American Journal of Agricultural Economics* 76(1994):689-708.

McFadden, D., and G. Leonard. "Issues in the Contingent Valuation of Environmental Goods: Methodology for Data Collection and Analysis." In *Contingent Valuation: A Critical Assessment.* J. Hausman (Ed.). Amsterdam: Elsevier, 1993.

Mitchell, R. C., and R. T. Carson. "Using Surveys to Valuate Public Goods: The Contingent Valuation Method." Washington, DC: Resources for the Future, 1989.

Posavac, S. S. "Strategic Overbidding in Contingent Valuation: Stated Economic Value of Public Goods Varies According to Consumers Expectations of Funding Source." *Journal of Economic Psychology* 19(1998):205-214.

Ready, R. C., J. Whitehead, and G. Blomquist. "Contingent Valuation When Respondents Are Ambivalent." *Journal of Environmental Economics and Management* 29 (1995):181-196.

Reiling, S. D., K. J. Boyle, and M. L. Philips. "Temporal Reliability of Contingent Values." *Land Economics* 66(1990):128-134.

Ryan, M., and A. Bate. "Testing the Assumptions of Rationality, Continuity and Symmetry When Applying Discrete Choice Experiments in Health Care." *Applied Economics Letters* 8 (2001):59-63.

Ryan, M., and F. San Miguel. "Testing for Consistency in Willingness to Pay Experiments." *Journal of Economic Psychology* 21(2000):305-317.

Samples, K.C., J. R. Hollier. "Contingent Valuation of Wildlife Resources in the Presence of Substitutes and Compliments." In *Economic Valuation of Natural Resources: Issues, Theory and Applications.* Johnson, G.V.(Ed.). *Westview Press, Boulder, Co.,* 1990.

Sen, A. "Internal Consistency of Choice." *Econometrica* 61(1985):156-175.

Welsh, M.P., and G.L. Poe. "Elicitation Effects in Contingent Valuation: Comparisons to a Multiple Bounded Discrete Choice Approach." *Journal of Environmental Economics and Management* 36(1998):170-185.

Table 1. Description of the explanatory variables.

Variables	Description
Age	Respondent's actual ages in years.
Bill	Average monthly water bill in dollars.
Concern	=1 if a respondent was concerned with her water quality, 0 otherwise.
Education	=1 if a respondent had college education, 0 otherwise.
Gender	=1 if a male respondent, =0 if a female respondent.
Income	Gross household income in the previous year in thousand dollars.
Interest	=1 if a respondent thought the survey was interesting, =0 otherwise.
Phone Survey	=1 if a respondent had any experience with phone survey, =0 otherwise.
Bid value	Elicitation value presented to respondents in the DC sample.

Table 2. OLS estimation results of the open-ended sample.

	The whole sample with original WTPs		The whole sample with irrational WTPs set to 0		The whole sample with irrational responses deleted	
Variables	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Intercept	14.1413	2.51***	8.1307	1.60	7.0038	1.13
Age	-0.2398	-2.77***	-0.1567	-2.01**	-0.1761	-1.93*
Bill	0.1636	2.08**	0.1368	1.93*	0.1587	1.94*
Concern	5.2553	1.94*	7.4475	3.05***	10.1421	3.33***
Education	-1.1257	-0.39	–2.4592	-0.94	-1.5576	-0.51
Gender	-2.1174	-0.78	-4.6487	-1.89*	-3.9934	-1.28
Income	0.4729	0.64	0.7459	1.12	1.2394	1.65*
Mean WTP	10.24		7.71		10.19	
R^2	0.179		0.207		0.287	

Note: The mean WTP of the whole sample with original data is larger than the mean WTP with irrational responses set to 0 with a t-value=3.13. The mean WTP of the sample with irrational responses deleted exceeds that of the sample with irrational responses set to 0 with a t-value of 2.54; the mean WTP of original data is not statistically different from that of the sample where irrational responses deleted with a t-value of 0.054.

Table 3. Probit estimation results of the dichotomous choice sample.

	The whole sample with original WTPs		The whole sample with irrational WTPs set to 0		The whole sample with irrational responses deleted	
Variables	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Intercept	2.2601	2.97***	1.3425	1.96**	2.2604	2.32**
Age	-0.0147	-1.41	-0.0168	-1.72*	-0.0096	-0.73
Bill	0.0132	1.58	0.0072	0.69	0.0114	1.11
Concern	0.2046	0.71	0.3655	1.35	-0.1021	-0.29
Education	-0.1343	-0.42	-0.4299	-1.45	-0.2971	-0.72
Gender	0.0654	0.23	-0.0413	-0.15	-0.1903	-0.52
Income	-0.1079	-1.35	-0.0145	-0.19	0.0111	0.11
Bid value	-0.0832	-5.15***	-0.0486	-3.44***	-0.0866	-4.31***
Mean WTP	$17.52		$11.44		$21.67	
Pseudo R^2	0.253		0.139		0.263	

Log likelihood ratio test of Chi square test values: CD1 vs CD2 = 6.72, significant; CD1 vs CD3=3.66, insignificant; CD2 vs CD3=12.54, significant.

Table 4. Estimation results of the no-better subsamples.

	Probit estimation results of the no-better subsample of the DC sample		Probit estimation results of the no-better subsample of OE sample with WTPs transformed into 0s and 1s		OLS estimation results of the no-better subsample of OE sample with original WTPs	
Variables	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Intercept	7.0584	1.97**	2.2901	1.57	17.3406	1.53
Age	-0.0495	-1.26	-0.0289	-1.51	-0.2738	-1.78*
Concern	0.9701	0.78	2.1494	2.06**	-1.4515	-0.29
Education	-0.2124	-0.18	1.2393	1.34	1.1287	-0.21
Gender	0.7604	0.78	0.7641	1.21	2.8785	0.68
Income	-0.3411	-1.67*	-0.5043	-2.19**	-0.7077	-0.51
Interest	-0.4357	-0.54	0.3998	0.98	1.0935	0.31
Phone survey	-2.3931	-1.82*	-0.7197	-1.08	6.6076	1.32
Bid value	-0.1948	-2.63***				
Mean WTP	9.96		N/A		7.28	
R^2					0.175	
Pseudo R^2	0.562		0.404			