

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

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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 elicited 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 alternative 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 the 159 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

vulnerable to such factors is not very clear. Some researchers think the DC format is not subject to biases caused by such factors (Arrow et al. 1993) while others argue that the DC format is also vulnerable (Diamond and Hausman 1993; Ryan and San Miguel, 2000). The statistical analysis of the survey results suggest that the use of DC elicitation format may not totally solve the problem, but may mitigate the bias.

Four respondents in the OE sample and two respondents in DC sample thought that their water quality would become worse if the amendments to the SDWA passed and two of them gave positive stated WTP. One may argue that these respondents might not have understood the questions correctly because it is unlikely that, with additional efforts to improve the quality of drinking water, the quality of their tap water would become worse instead. However, as far as the issue of irrational response is concerned, whether they understood the questions correctly or not does not matter because their calculation of WTPs should be based on their perception of the value of the underlying commodity. If they did think their water quality would decrease as a result, they should not support the program. Thus, we retained these observations in our analysis.

Estimation Based on the DC and the OE Samples

Formal econometric estimations may help to gain further insights into the impacts of irrational responses on the estimates of the mean stated WTPs. Several models are estimated for both the DC and the OE samples. Probit models are estimated for the DC sample while OLS was applied to the estimation based on the OE sample. Since literature abounds in the specifications of such models in CV studies (Loomis et al; McFadden), we omit the derivation of the theoretical frameworks. Table 1 presents a description of the explanatory variables.

Once irrational responses are identified, there is the question of how to treat them in the estimation of mean stated WTP. In his study of internal consistency of choice, Sen argues that there may be rational reasons for inconsistent responses. The irrational responses in this study refer to a specific kind of inconsistency in choice behavior. If there exist rational reasons for inconsistent responses, then such responses should be included in analysis. With this consideration and for the purpose of comparison, we estimate a model for the whole sample with the original stated WTPs for both the DC and the OE samples. For a specific elicitation format (DC or OE), the mean stated WTPs from the whole sample are used as benchmarks against which the impacts of irrational responses are measured.

In spite of Sen's arguments, there is no widely accepted agreement in empirical studies whether such responses should be excluded from estimation. Ryan and Bate argue that such responses should be dropped from the analysis because these respondents might not have taken the survey seriously or they might have misunderstood the questions. They argue that if the personal characteristics do not differ significantly across the "rational" and the "irrational" groups of respondents, then excluding the irrational responses will not bias the estimates because the omission of such responses simply reduce to random error. In the case of this study, the personal characteristics did not differ significantly across the "rational" and "irrational" groups. Thus, for the purpose of comparison, we also estimated models in which the irrational responses were excluded from the estimation.

The issue of irrational responses in this study represents a unique type of choice inconsistency in that the respondents would pay for something they perceived to be worthless. If they did think the re-authorization of the SDWA would not result in any improvement in the quality of their drinking water, then they should not state that they were willing to pay a positive

amount to support the program, no matter whether their perception of the quality effect of the re-authorization was correct or not. Further, since the survey was policy relevant and the respondents were clearly told so, the seriousness of their attitudes should not be questioned. Moreover, it is unlikely respondents misunderstood the relevant question because the question of quality effect was simple and straightforward. Thus, we estimated a model in which the WTPs of the no-better subsample were assigned a value of zero.

Only ten respondents in the OE sample stated a WTP larger than their monthly water bill, mostly by a couple of dollars. However, one respondent gave a real startling stated WTP which was 15 times as large as her mean monthly water bill and about 16 times as large as the mean stated WTP of the whole sample calculated using the raw data. We believe this observation is an outlier and dropped it in the estimations.

Table 2 presents the estimation results of the open-ended sample. The results show that concerns about water quality had a positive effect on the stated WTP in all three models. The greater the perceived health risk from the consumption of a necessary good, the more a consumer was willing to pay to improve the quality of the good. Therefore, respondents who had concerns about current water quality were willing to pay more for water quality improvement.

Monthly water bill was found to have a positive effect on WTP in all the three models. Households with high monthly water bills consume more water than households with low monthly water bills. Consequently, a household with a high monthly water bill benefits more from water quality improvement than a household with a low monthly bill.

Age negatively affected stated WTPs in all three models. We have no convincing explanation for the age effect. Gender had a negative sign in all the models, but the effect was statistically significant only when irrational WTPs were set to be 0. On the other hand, household income had a positive sign in all the models, but the effect was statistically significant only when the irrational responses were excluded. This result is consistent with our expectations that a consumer with more income would be willing to pay more for a good of improved quality than a consumer with less income.

Mean stated WTPs were calculated using the parameter estimates from these three models and the results are presented in Table 2. Tests of statistical significance of the difference of the mean stated WTPs were conducted using t-test. The results indicated a statistically significant difference between the mean stated WTP of the whole sample with original data and the mean stated WTP of the sample with the irrational WTPs set to be 0. However, exclusion of the irrational responses from the estimation did not result in an estimated mean WTP significantly different from that estimated using the whole sample with original WTPs.

The estimation results of the dichotomous choice sample are presented in Table 3. Monthly water bill and respondents' concern about their water quality had the same signs as they did in the OE sample (Table 2), but their impacts were statistically insignificant. Age also had the same sign as it did in the OE sample, but it had a significant impact on the WTP only when the irrational responses were set to be 0. The bid value in the DC models was expected to have a negative effect on WTP because water quality is an ordinary good. Consistent with our expectations, the bid value had a statistically significant negative effect in all models.

Mean stated WTPs for the DC sample were calculated using the method proposed by Boyle et al. The results are presented in Table 3. Differences between the mean stated WTPs of the three models can be tested by examining the equality of the corresponding estimated coefficients (Loomis, Gonzalez-Caban, and Gregory). The test involves a likelihood ratio test

that compares the value of the log-likelihood function when the data are pooled across relevant models (restricted) versus individual models (unrestricted).

The likelihood ratio tests show that the hypothesis of equality of parameter estimates between the model of original data and the model with irrational responses set to 0 can be rejected at 5% significance level. This result holds for the model with irrational responses excluded from the estimation and the model with irrational responses set to 0. However, we failed to reject the hypothesis of equality of parameter estimates between the model of original data and the model with the irrational responses dropped for estimation.

In both the DC sample and the OE sample, the estimated mean stated WTPs of the model of the original data are greater than that of the model with irrational responses set to 0. Likewise, the estimated mean stated WTPs of the model where the irrational responses are excluded are greater than that of the model with irrational responses set to 0. The difference was statistically insignificant between the estimated mean stated WTP of the model with original and that of the model without the irrational responses. The result implies that, if the irrational responses caused bias in the estimated mean stated WTP, excluding the irrational responses in the process of estimation would not correct the bias.

Estimation of WTP Using the No-better Subsamples

To investigate the possible factors causing the irrational responses, we estimated three models using the no-better subsamples. For the DC sample, the dependent variable was a dummy variable which was assigned a value of 1 if a respondent was willing to pay the presented bid value, otherwise it was assigned the value of 0. For the OE sample, it was appropriate to estimate a model in which the dependent variable was the stated WTPs. However, one could argue that as long as a respondent in the no-better subsample stated that he would pay a positive amount for the re-authorization, then the response was irrational, no matter how large the value. For this reason and for the purpose of comparison, we also estimated a model in which the binary dependent variable was assigned a value of 1 when a respondent gave a positive WTP, 0 otherwise. There is no well established theoretical basis or guidelines for the specification of an econometric model for irrational choices and the explanatory variables were selected according to our perception of potential factors affecting such choices.

Table 4 presents the estimation results based on the no-better subsamples. Age had a negative sign in both the DC and the OE samples, but its impact on irrational WTP was significant only in the OLS estimation of the OE sample. Income had a negative sign in both the DC and the OE samples, but its effect was statistically significant only in the DC sample and in the probit estimation of the OE sample.

Respondents who thought the survey was interesting were likely to be more serious and careful in the calculations of their WTPs. Thus, the variable “Interest” was expected to have a negative effect on the irrational WTP. But the results show that respondents’ interest in the survey did not have any significant effect on the WTP.

Generally, it can be expected that experience reduces the probability of irrational choice. Respondents with phone survey experience should be less likely to give an irrational response. The results show that such experience reduced the probability of giving an irrational response in the DC sample.

Although the economics literature does not provide any theoretical background for the expectation of the effect of bid value on irrational WTP, we expect the bid value in the DC sample to have a negative effect on irrational WTP. Facing a small bid value, a respondent who

thought the SDWA amendments would not improve water quality might have given a positive reply, thinking a couple dollars a month was inconsequential; but when presented with a large bid value, she might have thought more carefully and gave a negative reply. Consistent with our expectations, the bid value had a negative effect on the probability of giving an irrational response.

We use the mean WTP from the DC sample with original WTPs, the mean WTP from the OE sample with original WTPs, and the corresponding estimated WTPs in the no-better subsamples to compute an index of the irrational response impact in the DC sample relative to that in the OE sample. For both the DC and the OE samples, we divide the mean WTP from the no-better subsample by the mean WTP from the sample with original WTPs and divide the number of observations in the no-better subsample by that of the sample with original WTPs. The product of the two ratios serves as a proxy of the impact of irrational responses on the mean WTP of the sample with original WTPs. Then, we divide the proxy for the DC sample by the proxy for the OE sample to get a measure for the impact in the DC sample relative to that in the OE sample. The resulting measure is 0.794, implying that the impact of irrational responses in the DC sample is about 80% percent of that in the OE sample. It appears that the use of the DC elicitation format reduced the prevalence of irrational responses, but did not eliminate them.

Discussion and Conclusion

In empirical studies, it is generally assumed that in evaluating a potential policy or non-market priced goods, consumers compute their WTPs on the basis of constrained utility maximization. If WTPs are based on utility maximization, then, the responses should be consistent in preferences and rational. However, empirical results show that this assumption may not hold.

The results from this study show that a significant portion of a subsample stated a positive WTP for a project they perceived to be useless, providing further evidence for the existence of irrational responses. The irrational responses have a significant impact on the mean stated WTPs in both the DC and the OE samples in that if the irrational responses are set to 0, the resulting estimated mean stated WTP was significantly lower than that computed from the original data. However, excluding the irrational responses in the estimation does not help to solve the problem.

We find it difficult to explain the irrational responses in terms that previous studies used to explain their findings. Misunderstanding of survey questions and lack of seriousness on the part of participants are often considered to be main causes of irrational responses (Ryan and Bate). In this study, the criteria to decide irrationality were very straightforward and it is highly unlikely that respondents could have misunderstood the question. Respondents were simply asked to give their opinions regarding the impacts of the program on their water quality. If a respondent thought the quality of her drinking water would remain the same or even become worse as a result of the program, and she indicated a positive WTP to support the program, then the response was considered to be irrational. Further, it was unlikely that lack of seriousness could be a severe problem because respondents were clearly told that the survey was policy relevant and they knew that the cost of the project would ultimately be borne by them.

Cost-based evaluations were reported in previous studies and they were considered to be a source of irrational responses. In cost-based responses, people benefit from the consumption of the commodity and they want to pay a fair price for the commodity. As a result, they compute the WTP according to their perceived costs of the underlying commodity. But in this study, the

irrational respondents thought that they would not benefit from the program at all and the existence of the program depends on their valuation. Thus, cost-based evaluation is not a convincing explanation for the irrationality in this study.

Strategic overbidding has been a long standing concern in CV studies (Posavac). Respondents may intentionally misrepresent their valuations by reporting exceedingly high WTP to influence the result of a CV study. The purpose of strategic overbidding is to bring something into existence so that the respondents can benefit from it. But this does not provide a meaningful explanation for the irrational responses in this survey because, if a respondent really thought that he would not benefit from the program, there was no reason for him to purposely overbid to bring the program into existence.

Contingent valuation responses may reflect the value of moral satisfaction rather than economic value (Kahneman and Knetsch). In such cases, respondents acquire a sense of moral satisfaction by making a contribution for the provision of a commodity. But obtaining moral satisfactions from contribution to the existence of something perceived to be useless, as in this study, is meaningless. Further, there is no convincing reason that a respondent would think the quality of other people's drinking water would improve due to the program if she thought that the quality of her own drinking water would not improve.

The US National Oceanographic and Atmospheric Administration Panel proposed the referendum style WTP approach to the method of choice in WTP studies. Their recommendation was based on the assumption that this method would not be subject to biases. The results of this study show that the referendum style approach (represented by the dichotomous choice elicitation format in this study) mitigates the severity of irrational responses, but can not totally solve the problem.

The regression results provide some information about the irrational responses. Respondents' age was found to have negative effect on irrational responses in both the DC and the OE samples. Household income, gender, bid value, and phone survey experience were found to have a negative impact on irrational responses in the DC sample. Except phone survey experience, we do not have convincing explanations for the effects of the variables on the irrational responses.

This study addresses the issue of irrational responses on a straightforward premise that if a respondent thinks a project is useless, then she should not be willing to pay to support the it. However, respondents may be somewhat irrational in their evaluation of the usefulness of the underlying project, such as considering a project aiming at the improvement of their drinking water quality will bring harm to their water quality instead. Future contingent valuation studies may consider adding some follow up question, for example, "are you sure that the project will not result in anything good?" and "are you sure you are willing to pay the amount you stated?" Addition of relevant follow up questions may mitigate the problem of irrational responses.

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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.

Variables	The whole sample with original WTPs		The whole sample with irrational WTPs set to 0		The whole sample with irrational responses deleted	
	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.

Variables	The whole sample with original WTPs		The whole sample with irrational WTPs set to 0		The whole sample with irrational responses deleted	
	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.

Variables	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	
	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			