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Who Knows What Willingness to Pay Lurks in the Hearts of Men? A Rejoinder to Egan, Corrigan, and Dwyer

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LINK TO ABSTRACT

The present article is the fourth piece in a sequence of articles, the three previous having appeared in *Journal of Environmental Economics and Management*. In *JEEM*, Kevin Egan, Jay Corrigan, and Daryl Dwyer (hereafter "ECD") published an article with findings from their survey of Ohio residents, collecting contingent valuation data for a wetlands project (ECD 2015). They elicit willingness to pay (WTP) with annual and one-time payment schedules in dichotomous choice contingent valuation method questions and compare these to consumer surplus estimates derived from the travel cost method. Using a conservative nonparametric estimator, they conclude that WTP from the annual payment schedule is a "better match" with consumer surplus estimates. Dissatisfied with their strong claims, I published a comment in *JEEM* (Whitehead 2017a). I showed that the contingent valuation method data is of relatively low quality and, with an alternative nonparametric estimator, showed that WTP from the one-time payment schedule is a better match with the consumer surplus estimates (Whitehead 2017a). The theme of my comment in *JEEM* is that the range of WTP estimates from ECD (2015), resulting from the low quality data, is too wide to draw *any* conclusions about the appropriate payment schedule. In a reply to my comment, ECD (2017) defend the theoretical validity of their data by appealing to the statistical significance of the entire bid schedule. They conduct three sensitivity analyses, which they say "overwhelmingly support our original conclusion in favor of using annual payments in" contingent

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valuation surveys (ECD 2017, 1).[2] I regard that to be an overly strong conclusion about the dominance of annual payment schedules over one-time payment schedules when eliciting WTP in such surveys.

In the present rejoinder, I use standard parametric approaches to measure WTP and conduct more symmetric sensitivity analyses. ECD's (2017, 1) conclusion that the annual payment results "better match" the consumer surplus estimates is not supported by my analysis. This paper supports the argument made in Whitehead (2017a) that ECD's contingent valuation data is not useful for the payment schedule issue. As I proceed in the paper, I do not provide a recapitulation of ECD (2015), Whitehead (2017a), and ECD (2017). That is, I pick up the conversation where it now stands, supposing familiarity with the prior discussion.

Testing the data's conformance to basic theoretical validity

In Whitehead (2017a) I made pairwise comparisons of 'yes' responses (yes = 1 if $WTP \geq Bid$; 0 otherwise) from consecutive and non-consecutive bids within each payment schedule using differences in proportions tests. A number of comparisons have the incorrect sign. A majority of comparisons with correct sign yield no statistically significant differences (one-tailed tests, p = .10). ECD (2017) argue that the more appropriate statistical test considers differences over the entire range of bids. Using a likelihood ratio test, they find that over the entire bid range there is a statistically significant difference in proportions for the annual and one-time payment schedules. Given that the likelihood ratio test is not signed, it is not clear whether the differences in proportions are due to positive or negative changes in the 'yes' responses as the bid amount increases.[3]

I estimate linear probability models, $\pi = a + \beta Bid$, and linear logit models, $\log(\pi/1-\pi) = \gamma + \delta Bid$, where $\pi = \Pr(WTP \geq Bid)$, and I test for the sign and significance of the slope of the bid curves. I estimate the models with annual and one-time payment schedule data pooled with separately estimated constants and slopes.[4] The results are presented in Table 1. The linear probability model estimates

2. Whitehead (2017a) and ECD (2017) have not yet been assigned to an issue of *JEEM*. Page numbers cited here for those articles refer to the "article in press" PDFs currently available from *JEEM* (**link**).

3. As pointed out by a referee, a more appropriate likelihood ratio test accounting for expected sign can be found in Agresti and Coull (2002). As an alternative, I proceed directly to the parametric tests to facilitate consideration of the economic, in addition to statistical, significance of the data.

4. The coefficient estimates are identical to those produced by separate regressions. The standard errors are slightly smaller relative to separate models (and therefore more conservative when I conduct sensitivity analyses below). I use the pooled models to facilitate estimation of the implicit discount rate and its

an annual bid curve with a probability of a vote in favor of 66 percent when the bid is zero and a decrease in the probability of 0.64 percent for each $1 increase in the bid. For the one-time bid curve the probability at a zero bid is 47 percent, which decreases by 0.1 percent for each $1 increase in the bid.

TABLE 1. Regression models

	Linear Probability			Logit		
Constant	Coeff.	s.e.	t-stat	Coeff.	s.e.	t-stat
Annual	0.6592	0.0528	12.49	0.6500	0.2217	2.93
One-time	0.4739	0.0532	8.92	−0.0894	0.2230	−0.40
Slope	Coeff.	s.e.	t-stat	Coeff.	s.e.	t-stat
Annual	−0.0064	0.0019	−3.35	−0.0260	0.0080	−3.24
One-time	−0.0010	0.0005	−2.00	−0.0042	0.0021	−2.00
R^2	0.038			0.028		
Sample size = 656						

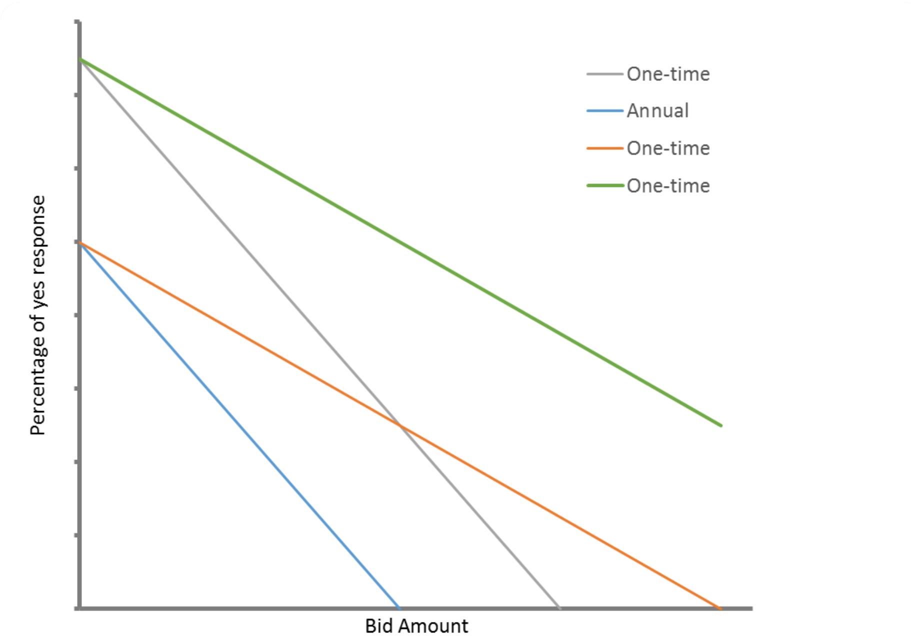
The logit models produce a positive and statistically significant constant with the annual payment data but the constant in the one-time payment data is negative and not statistically different from zero. Both of the slopes in the logit models are statistically different from zero. The marginal effects of the logit slopes evaluated at the means are identical to the slopes in the linear probability model. The bid curves are downward sloping as theory would predict. But sloping downward is only weak evidence of theoretical validity since such downwardness relies on the contributions of only a few bids. For example, with the annual payment schedule data, dropping the $5 ($\pi = 0.70$) and $40 ($\pi = 0.36$) bids and running a linear regression on the remaining data produces a slope coefficient that is not statistically different from zero in a one-tailed test at the p=.10 level ($t = -1.16$). Dropping the $60 ($\pi = 0.54$) and $120 ($\pi = 0.16$) bids in the one-time payment schedule data produces a slope coefficient that is not statistically different from zero in a one-tailed test at the p=.10 level ($t = -0.98$). Statistical significance of both slopes relies on two of the eight bids. In general, researchers using the contingent valuation method should proceed cautiously when the statistical relationship is not robust to this type of sensitivity analysis.

Theory suggests that WTP from the one-time payment schedule should be larger than WTP from the annual payment schedule. For such result to hold, the coefficient on the one-time constant should be greater than the coefficient on the annual constant (with equal slopes, the gray line in Figure 1) or the absolute value

confidence interval. The WTP and discount rates are estimated using the Delta Method with Limdep statistical software from Econometric Software, Inc. All data and code are provided among the appendixes at the end of this paper.

of the coefficient on the one-time slope should be less than the coefficient on the annual slope (with equal constants, the orange line in Figure 1), or both (the green line in Figure 1). An F-test rejects the hypothesis of equality between the two constants (F[1, 652] = 6.12) in the linear model. A likelihood ratio test rejects the hypothesis of equality between the two constants in the logit model (χ^2=5.58[1]). The regression results indicate that the difference in the constants has the wrong sign, which suggests a lack of theoretical validity in the data. Tests for differences in the slope also reject the equality hypothesis. But the differences in slopes are in the expected direction.[5]

Figure 1. Theoretical restrictions on constants and slopes in annual and one-time payment schedule bid curves



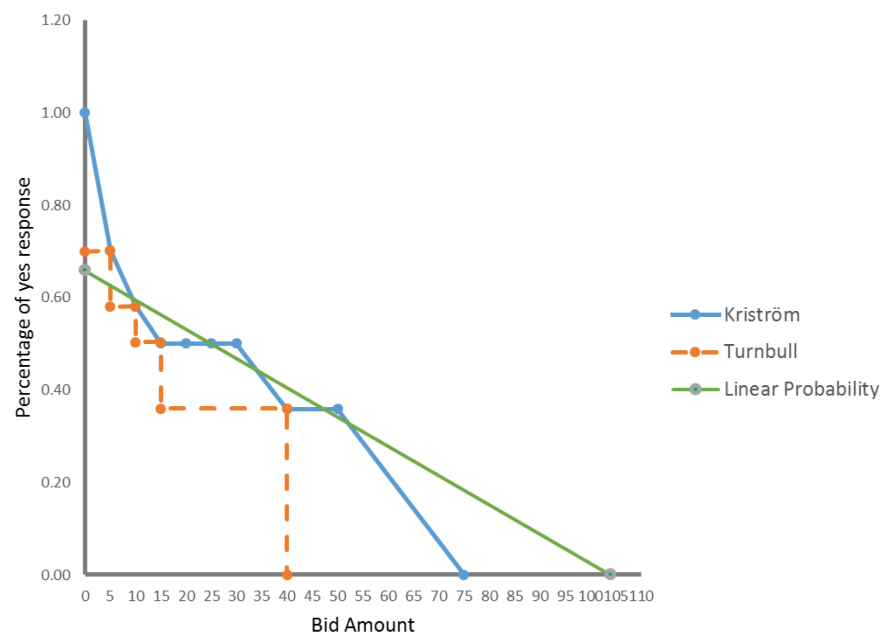
Parametric willingness to pay

Willingness to pay in the linear probability model is the triangle formed by the regression line: $WTP = .5 \times a \times (-a/\beta)$. This estimate is a parametric hybrid of the Turnbull and Kriström estimators used by ECD (2015) and Whitehead (2017a),

5. Similar results are found in ECD's (2015) bound probit model.

respectively (see Figure 2).

Figure 2. Alternative bid curves with the annual payment schedule data



The linear probability model is one way to implement ECD's suggestion (2017, 5 n.3) of estimating the choke bid with the slope over the entire range of the bid curve (instead of linear interpolation with the last two bids as in Kriström). The choke bids (where $(-a/\beta)$ is the bid amount that leads to $\pi = 0$) are \$104 [56, 151] and \$485 [98, 873] from the annual and one-time data models (in the brackets are given 95 percent confidence intervals). These choke bids are 108 percent and 143 percent larger than the highest bid in the annual and one-time payment schedules, which suggests a relatively flat bid curve. The choke bids are 39 percent and 62 percent higher than the choke bids estimated using the Kriström approach, which suggests the Kriström approach is conservative.

A negative constant in the logit model will lead to a negative mean willingness-to-pay estimate when evaluated over the entire range of bids and probabilities, $WTP = (-\gamma/\delta)$ (Hanemann 1984). Negative parametric WTP is one of the rationales for estimating the WTP with the Turnbull approach (Haab and McConnell 1997). Another approach to negative WTP is the conditional mean WTP. Conditional mean WTP in the logit model is equal to $WTP = (-1/\delta) \times \ln(1 + \exp(\gamma))$ when evaluated over the positive portion of the probability distribution (Hanemann 1989). The linear probability WTP and logit conditional WTP estimates are presented in Table 2.

TABLE 2. Parametric willingness to pay estimates

	Linear Probability			
	WTP	s.e.	95% confidence interval	
Annual	34.22	6.20	22.06	46.38
One-time	115.00	37.56	41.37	188.62
	Logit			
	WTP	s.e.	95% confidence interval	
Annual	41.19	8.42	24.70	57.68
One-time	153.46	56.53	42.67	264.26

As ECD say, the Turnbull and Kriström nonparametric estimators generate small standard errors. But excessive pooling over bids obscures the weakness of the data, a weakness that is revealed when parametric estimation approaches are used to estimate WTP. The 95 percent confidence intervals around WTP in the one-time payment schedule data are much wider relative to those in the nonparametric WTP approaches. Such wideness reflects the low precision of the estimate of the slope coefficient in both regression models. The low precision is due to the lack of theoretical validity as described in Whitehead (2017a). Due to the wide confidence intervals there are no statistically significant differences between WTP elicited with annual and one-time payment schedules.

Another problem that is common with flat bid curves is the wide range of WTP estimates from different estimation approaches. For WTP elicited with the annual payment schedule the WTP estimates range from a low of $18 (Turnbull) to $41 (logit). For WTP elicited with the one-time payment schedule the WTP estimates range from a low of $47 (Turnbull) to $153 (logit). Again, the wide range of possible WTP estimates that are candidates for benefit-cost analysis is due to the low quality of the contingent valuation method data.[6]

Finally, the implicit discount rates from the linear and logit models are 0.30 [0.080, 0.52] and 0.26 [0.047, 0.50]. These rates are not statistically different from the discount rate estimated in the ECD (2015) "non-hypothetical" lottery experiment. In Whitehead (2017a) I use a discount rate of 21 percent as an illustration which the parametric analysis suggests is not inappropriate.

6. See Appendix A for an example of a similar analysis with higher quality, but not textbook, dichotomous choice data.

Sensitivity analysis

ECD (2017) say that their sensitivity tests "overwhelmingly support" using the annual payment schedule. But the construction of the sensitivity analyses in ECD (2017) is "asymmetric" in favor of that conclusion. An asymmetric sensitivity analysis is similar to the concept of breakeven analysis. In a breakeven analysis assumptions are logically relaxed in the direction of the intended effect. For example, if B > C in a benefit-cost analysis, a breakeven analysis would consider differences in the estimation of B that lowers B towards C. A symmetric, non-breakeven, sensitivity analysis considers logical changes in assumptions that both increase and decrease B.

In ECD (2015) the authors follow the travel cost method literature and use an opportunity cost of time estimate of 33 percent. In their sensitivity analysis they use 50 percent and 75 percent estimates of the opportunity cost of time. A higher opportunity cost of time will increase consumer surplus estimates from the travel cost method. When the opportunity cost of times rises from 33 percent to 50 percent the present value of the consumer surplus point estimate rises from $95 [70, 120] to $120 [85, 150] with the base case discount rate of 20 percent.

As ECD (2017) point out, a range of opportunity cost of time assumptions from 0 percent to 100 percent can be found in the literature. So, the sensitivity analysis is asymmetric towards favoring annual payment schedules by construction.[7] A more symmetric sensitivity analysis would consider lower opportunity cost of time assumptions. For example, if consumer surplus estimates are symmetric with respect to the opportunity cost of time assumption, then an approximation of the annual and present value of consumer surplus will be $14 [8, 21] and $70 [40, 105] with a 16 percent opportunity cost of time assumption (Table 3). In this comparison, the Kriström WTP estimate from the annual payment schedule, $30 [26, 34], is statistically greater than the annual consumer surplus estimate with a 16 percent opportunity cost of time assumption. The Kriström WTP estimate from the one-time payment schedule, $96 [80, 112], is not statistically different than the present value of the consumer surplus estimate. Both of the Turnbull WTP estimates are not statistically different from the consumer surplus estimates, so the result of the test on competing payment schedules is ambiguous. In other words,

7. ECD use a unit cost for miles driven estimate of $0.25. This is greater than the variable cost of $0.17 estimate from the AAA and includes a portion of the depreciation costs ($0.22 per mile). Hang et al. (2016) argue that depreciation costs should not be included in the travel cost estimate. Another sensitivity analysis could adjust the travel cost estimate up and down so that it is strictly equal to the variable cost and total (variable plus fixed) cost per mile. The former would favor the one-time payment schedule and the latter would favor the annual payment schedule.

when one considers symmetric movements away from the opportunity cost of time assumption at the baseline discount rate, one sees that there is no clear preference for annual or one-time payment schedules.

TABLE 3. Symmetric sensitivity analysis

	Opp. cost of time	20% discount rate
Turnbull	0.16	Both
	0.33	Annual
	0.5	Annual
Kriström	0.16	One-time
	0.33	One-time
	0.5	Both

It is not clear which payment schedule would be favored with another 16 percent symmetric change in the opportunity cost of time (0 percent, 66 percent) since the change in consumer surplus with the opportunity cost of time assumption is nonlinear. Yet, considering this symmetric sensitivity analysis, the annual payment schedule is not such an overwhelming favorite when the discount rate is 20 percent.

Similarly, ECD (2017) conduct a sensitivity analysis for the discount rate that favors the annual payment schedule. From the baseline of 20 percent they assess convergent validity at discount rates of 5 percent, 10 percent, 15 percent and 20 percent. The authors fail to conduct the sensitivity analysis for higher discount rates, say 25 percent, which are not different from some market rates (e.g., credit card interest rates, rent-to-own interest rates). Also, ECD (2017) conduct a sensitivity analysis with Turnbull and Kriström WTP estimates with 'yes' responses recoded to 'no' responses for uncertain respondents. Including these in the sensitivity analysis, since it decreases WTP estimates, will increase the number of times the annual payment schedule is preferred over the one-time payment schedule, which creates the appearance that the analyses "overwhelmingly support" using the annual payment schedule.[8]

Symmetric sensitivity analysis with parametric WTP estimates

I conducted additional sensitivity analysis with the parametric WTP esti-

8. ECD (2017) use the same choke bid from the unrecoded data to estimate the Kriström WTP with the recoded responses. It is not clear what, if any, effect this ad-hoc assignment has on the WTP estimates.

mates from Table 2 and linear and logit models estimated with the recoded data (see the Appendix B to this article). These WTP estimates are compared to consumer surplus estimates estimated with four different opportunity-cost-of-time assumptions over five discount rates. I conducted 160 convergent validity tests (2 payment schedules, 16 WTP estimates, 5 discount rates) in Table 4.

TABLE 4. Sensitivity analysis with the WTP estimates from parametric models

		Discount Rate				
Model	Opp. cost of time	0.05	0.1	0.15	0.2	0.25
Linear Raw	16%	One-time	One-time	One-time	One-time	One-time
	33%	Annual	*	*	*	*
	50%	Annual	*	*	*	*
	75%	Annual	*	*	*	*
Linear Recoded	16%	Annual	*	*	*	*
	33%	Annual	Annual	*	*	*
	50%	Annual	Annual	*	*	*
	75%	Annual	Annual	Annual	*	*
Logit Raw	16%	One-time	One-time	One-time	One-time	One-time
	33%	Neither	One-time	One-time	One-time	One-time
	50%	Annual	*	*	*	*
	75%	Annual	Annual	*	*	*
Logit Recoded	16%	*	*	*	*	*
	33%	Annual	*	*	*	*
	50%	Annual	*	*	*	*
	75%	Annual	Annual	*	*	*

*Both present value of annual payment WTP and one-time pay WTP converge with the present value of consumer surplus.

If both annual payment schedule and one-time payment schedule WTP estimates are not statistically different from the present value of consumer surplus then there is no preference over payment schedules.[9] I find this result in 47 of the 80 comparisons. In only one comparison do neither of the WTP estimates converge with the consumer surplus estimate. Lack of convergence with WTP from either payment schedule occurs with the raw (unrecoded) logit estimates, a 33 percent opportunity cost of time and a 5 percent discount rate. Fourteen of the 80 comparisons result with the one-time payment schedule WTP estimates converging with the consumer surplus estimates while the annual payment schedule WTP estimates do not converge. Ten of these occur when the oppor-

9. It should not go unsaid that this is the preferred result, providing support to contingent valuation method survey designers who need to tailor their scenarios to the most realistic payment circumstances.

tunity cost of time assumption is 16 percent, lowering the consumer surplus estimate. The other four occur when the opportunity cost of time estimate is 33 percent, the baseline. Eighteen of the 80 comparisons result with the annual payment schedule WTP estimates converging with the consumer surplus estimates while the one-time payment schedule WTP estimates do not converge. Twelve of these occur when the discount rate is 5 percent, increasing the present value of the annual consumer surplus estimate the greatest. Five comparisons that favor the annual payment schedule occur when the discount rate is 10 percent. One comparison favors the annual payment schedule when the discount rate is 15 percent and the opportunity cost of time estimate is 75 percent.

Conclusions

In Whitehead (2017a) I suggested that there was convergent validity between one-time payment schedule WTP and the consumer surplus estimates at a discount rate of 0.21, but I did so only to illustrate the sensitivity of the ECD results to an alternative WTP estimation approach. My hope was that the authors would reconsider their strong conclusion that the annual payment schedule is unambiguously preferred. In hindsight, it is clear that I should have presented the parametric models to bring home the notion that the poor contingent valuation method data quality generates wide confidence intervals in parametric models. In the parametric models estimated here, it cannot even be concluded that there is divergent validity between WTP elicited with annual and one-time payment schedules. The findings do not "overwhelmingly support" that either payment schedule dominates the other in convergent validity tests.

The Turnbull nonparametric estimator is misused by ECD (2015). The Turnbull is appropriate only in a limited context, in order to provide a lower bound WTP estimate for sensitivity analysis in benefit-cost analysis or natural resource damage assessment. It should never be used for hypothesis testing in isolation from other nonparametric and parametric approaches, and especially not when the data are not monotonically decreasing over the bid range.[10] Whenever bids are pooled using dichotomous choice data, the researcher implicitly acknowledges that something went wrong with the execution of the study or with the contingent valuation method itself. It might be that (a) bid subsamples are too low to generate enough power to conduct the statistical test, (b) bids are poorly designed (too close together, too far apart, or there is inadequate coverage of the range of WTP),

10. In future studies, journal referees should demand robustness checks with parametric models when dichotomous choice data is not monotonically decreasing over the bid range (see also Whitehead 2017b).

or (c) contingent valuation method respondents are highly inconsistent. There is substantial evidence in the literature to reject reason (c). The nonparametric WTP estimation approaches presented in ECD (2017) yield small standard errors, but this is an artifact of pooling bids from non-monotonically decreasing bid curves when there are problems such as (a) and (b). In other fields of economics this might be negatively described as data cleaning when the data does not fit the theory. This is legitimate practice when the goal is to produce lower and upper bound nonparametric WTP estimates as conventionally practiced with the Turnbull and Kriström approaches. Data cleaning and pooling bids should not be considered a valid research method when the research goal is conducting validity tests over payment schedules or any other issue in the contingent valuation method.[11]

Unfortunately, readers of the original article, comment, and reply are going to be left with the erroneous conclusion that ECD's findings "overwhelmingly support" favoring annual payment schedules over one-time payment schedules in the contingent valuation method. This could lead to policy mistakes. If future studies use annual payments to elicit WTP and the present value is calculated with discount rates below those used by contingent valuation method respondents, but consistent with market rates, then aggregate benefits will be overestimated at discount rates recommended for benefit-cost analysis. In the context of benefit-cost analysis of environmental policy, use of annual payments instead of one-time payments may bias environmental benefits upwards. When able, researchers should use WTP elicited from both payment schedules for sensitivity analysis of benefit estimates.

Appendix A.
A comparison with relatively high-quality data

In these comments I make assertions about low quality contingent valuation method data without presenting a counterexample. So, here is a counterexample with some unpublished dichotomous choice data with a similar sample size (n = 317) and identical bid range (to the annual payment schedule).[12] There are four bids, \$5, \$20, \$35, and \$50, and the data exhibits "fat tails" with very little difference

11. ECD (2017) also conduct their likelihood ratio tests with their pooled bid data. Given that the data has been recoded/cleaned to avoid situations where the results are not what theory would predict, there is very little information being provided by these tests.

12. The data are from a supplementary (Charleston Harbor and North Edisto River System) sample from a contingent valuation mail survey conducted in 2004 (see the primary sample results in Whitehead and Rhodes (forthcoming)).

in percentage of 'yes' responses at bids of $35 and $50. Yet, there is a clear difference in the percentage of 'yes' responses between bids $5 and $20 and $20 and $35 (Figure A-1).

Figure A-1.

```
|-> dstat;rhs=yes1;str=bid$

-----------------------------------------------------
Descriptive Statistics for YES1
Stratification is based on BID
-----------------+-----------------------------------
Subsample        |       Mean     Std.Dev.     Cases
-----------------+-----------------------------------
BID       =    5 |    .674419     .471340        86
BID       =   20 |    .472973     .502677        74
BID       =   35 |    .337662     .476014        77
BID       =   50 |    .337500     .475840        80
Full Sample      |    .460568     .499231       317
-----------------+-----------------------------------
```

The Turnbull and Kriström (choke bid = $140 estimated from the slope of the $20 and $50 bids) WTP estimates are $21 and $39. The linear probability model and logit model produce coefficient estimates that are not very different from the ECD annual payment schedule data. However, the coefficient of determination and t-statistic on the slope are much higher relative to the ECD data. The choke bid is estimated at $87 in the linear model (Figure A-2). Even with the fat tail, the WTP estimate from the linear model, $29, has a tighter confidence interval [23, 35] relative to the ECD data. The logit model produces a WTP equal to $34 [26, 43].

Figure A-2.

```
|-> regress;lhs=yes1;rhs=one,bid$

-----------------------------------------------------------------------------
Ordinary    least squares regression ............
LHS=YES1    Mean                 =      .46057
            Standard deviation   =      .49923
----------  No. of observations  =         317  DegFreedom   Mean square
Regression  Sum of Squares       =     5.49927           1       5.49927
Residual    Sum of Squares       =     73.2578         315        .23256
Total       Sum of Squares       =     78.7571         316        .24923
----------  Standard error of e  =      .48225  Root MSE          .48073
Fit         R-squared            =      .06983  R-bar squared     .06687
Model test  F[  1,    315]       =    23.64619  Prob F > F*       .00000
--------+--------------------------------------------------------------------
        |                Standard            Prob.      95% Confidence
    YES1|  Coefficient     Error       t    |t|>T*         Interval
--------+--------------------------------------------------------------------
Constant|     .66988***     .05086    13.17  .0000      .57020     .76956
     BID|    -.00771***     .00159    -4.86  .0000     -.01082    -.00460
--------+--------------------------------------------------------------------
***, **, * ==>  Significance at 1%, 5%, 10% level.
Model was estimated on Jun 30, 2017 at 10:03:26 AM
-----------------------------------------------------------------------------
```

Unlike the ECD data, the model is not sensitive to dropping any single bid. The biggest concern is when the $5 bid is dropped the slope coefficient is statistically significant at only the p=.05 level in a one-tailed test (t=−1.70). The WTP estimates when one bid is dropped are sensitive to the fat tail but the 95 percent confidence intervals do not contain zero. From the linear model (logit model results tell the same story):

Delete	WTP	95% confidence interval	
5	33	15	50
20	30	36	36
35	32	23	41
50	23	17	29

In contrast, when the $120 bid is dropped from the one-time payment schedule data in ECD the WTP estimate in the linear, $160 [−4, 323], and logit, $218 [−25, 461], models are estimated very imprecisely. The logit WTP estimate is 43 percent larger when the $120 bid is dropped. The results are not so stark when the most influential bids are dropped in the annual payment data. From the linear model (relative to $34 [22, 46] with the full data):

Delete	WTP	95% confidence interval	
5	42	17	67
40	39	16	61

Appendix B. Analysis with uncertainty recoded data

TABLE B-1. Regression models with uncertainty recoded data

	Linear Probability			Logit		
Constant	Coeff.	s.e.	t-stat	Coeff.	s.e.	t-stat
Annual	0.516	0.049	10.62	0.095	0.222	0.430
One-time	0.284	0.049	5.80	−0.901	0.255	−3.540
Slope	Coeff.	s.e.	t-stat	Coeff.	s.e.	t-stat
Annual	−0.0057	0.0017	−3.27	−0.025	0.0084	−3.00
One-time	−0.00061	0.000045	−1.35	−0.0036	0.0025	−1.44
R^2	0.038			0.037		
Sample size = 656						

TABLE B-2. Parametric willingness to pay estimates with recoded data

	Linear Probability			
	WTP	s.e.	95% confidence interval	
Annual	23.34	4.06	15.37	31.31
One-time	66.43	31.63	4.44	128.41
	Logit			
	WTP	s.e.	95% confidence interval	
Annual	29.42	6.37	16.94	41.90
One-time	95.44	49.61	−1.80	192.68

TABLE B-3. One-time parametric willingness to pay estimates

Linear	WTP
Raw	160 [30,290]
Recoded	121 [−23, 264]
Logit	WTP
Raw	153 [43, 264]
Recoded	95 [−2, 193]

TABLE B-4. Present value of parametric annual willingness to pay estimates (WTPA/*i*)

	Discount Rate (*i*)				
	5%	10%	15%	20%	25%
Linear					
Raw	684 [441, 928]	342 [221, 464]	228 [147, 309]	171 [110, 232]	137 [88, 186]
Recoded	467 [307, 626]	233 [154, 313]	156 [102, 209]	117 [77, 157]	93 [61, 125]
Logit					
Raw	824 [494, 1154]	412 [247, 577]	274 [165, 385]	206 [123, 288]	165 [99, 288]
Recoded	588 [339, 838]	294 [169, 419]	196 [113, 279]	147 [85, 210]	118 [68, 168]
Note: Recoded = 'yes' responses recoded for respondent uncertainty.					

TABLE B-5. Present value of consumer surplus estimates (from ECD's Table 6 with a 25 percent discount rate added)

	Discount Rate (*i*)				
Opp. cost of time	5%	10%	15%	20%	25%
16%	280 [160, 420]	140 [80, 210]	93 [53, 140]	70 [40, 105]	56 [32, 84]
33%	380 [280, 480]	190 [140, 240]	127 [93, 160]	95 [70, 120]	76 [56, 96]
50%	480 [340, 600]	240 [170, 300]	160 [113, 200]	120 [85, 150]	96 [68, 120]
75%	840 [560, 1080]	420 [280, 540]	280 [187, 360]	210 [140, 270]	168 [112, 216]
Note: Estimates with 16% opportunity cost of time are approximated from ECD (2017).					

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