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HOUSEHOLD VALUATION OF A PILOT CURBSIDE RECYCLING PROGRAM: PARTICIPANTS, NON-PARTICIPANTS, AND THE NON-TARGETED

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Arthur J. Caplan and Therese Grijalva

ABSTRACT

This study estimates willingness to pay (WTP) of households in Logan, Utah, for a pilot curbside recycling program that required households to separate fibrous from non-fibrous recyclable materials. We generate a conservative estimate of WTP based on corrections for over-sampling of certain types of households and potential hypothetical bias. We also find that inter alia women, younger, higher income, higher educated, drop-off recycling users, and non-participants in the pilot program are willing to pay more for a CRP patterned after the pilot program. We also find that if curbside recycling is bundled with more options under a variable pricing scheme for garbage pickup, a large percentage of households would choose a smaller garbage container size.
HOUSEHOLD VALUATION OF A PILOT CURBSIDE RECYCLING PROGRAM: PARTICIPANTS, NON-PARTICIPANTS, AND THE NON-TARGETED

1. Introduction

The purpose of this study is to measure the benefits of a curbside recycling program in Logan, Utah. Logan is similar to many other small cities across the country. It is growing quickly and bumping up against some of its physical constraints. One of these constraints is solid waste disposal. The city's 85-acre landfill—which also services the 19 other cities located in Cache County—is projected to reach capacity within the next 15 years. The 'usual suspects' lie behind the county's evanescing landfill capacity—a high population growth rate and concomitant increase in the amount of solid waste generated within the county.¹

In recent years, Logan has implemented several programs to reduce its solid waste stream, resulting in what it estimates to be a 30-percent diversion rate. For example, to reduce its residential waste stream the city presently maintains 18 drop-off recycling sites that collect a variety of materials (including green waste). The city also provides a modest volume-based pricing scheme for residential garbage collection, where households can choose between a 60-gallon, 90-gallon, or 300-gallon container.² In an effort to complement its drop-off recycling program and to capitalize on its volume-based pricing scheme, Logan is also experimenting with

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¹Cache is Utah's northern-most county, abutting Idaho's southern border. Total population in the county is currently 91,400, representing a growth of approximately 28 percent since 1990. Slightly under half of the population (43,400) resides in Logan, the county's largest city (U.S Census Bureau, 2002).

²Average monthly household rates for the 60-, 90-, and 300-gallon container sizes are $6.85, $11.90, and $25.30, respectively. Households are charged an extra $2.00, $3.75, and $23.00 per month, respectively, for each additional container (City of Logan, Utah, Environmental Services Division, 2002).
residential curbside recycling.\textsuperscript{3} Between the months of January and June 2002, a curbside recycling program (CRP) was piloted in two neighborhoods with the twofold objective of assessing the program's potential impact on recycling rates and to obtain information on household willingness to pay (WTP). This paper addresses the pilot program's latter objective.

The 200 households that agreed to participate in the pilot program were each provided with one 90-gallon container to hold their separated-out fibrous material (mixed paper and cardboard) and non-fibrous material (aluminum, tin, and plastic). According to a pre-arranged monthly schedule, the households set out their fibrous material one week and their non-fibrous material the next. Each household was therefore required to figure out for themselves how to store the material that was not scheduled to be collected at the end of that week.\textsuperscript{4}

At the conclusion of the six-month pilot period, an attempt was made to interview face-to-face each of the 200 participating households (henceforth "participants") to obtain information on (1) their recycling behavior (including whether they anticipated being able to switch to a smaller cart size for garbage collection as a result of having curbside recycling, say from two 90-gallon containers to one, or from one 90-gallon container to a 60-gallon container), (2) their degree of satisfaction with the pilot program (in particular, their WTP for the program and also for the hypothetical convenience of not having had to separate fibrous from non-fibrous material), and (3) their household demographics. Similar face-to-face surveys were also

\textsuperscript{3}Although the literature generally concurs that volume-based, or "pay-as-you-throw" pricing induces households to increase their recycling rates (see Miranda, et al. (1996) for a survey of this literature), there are notable exceptions concerning the strength of this argument (c.f. Fullerton and Kinnaman, 1996; Reschovsky and Stone, 1994; and Hong and Adams, 1999).

\textsuperscript{4}For example, if fibrous material was scheduled to be collected at the end of the week, the household filled the city-provided 90-gallon container with fibrous material during the week and stored its non-fibrous material in a container provided on its own. Once the fibrous material was collected, the household then transferred the non-fibrous material stored during that week into the 90-gallon container and used its own container to store the fibrous material that accumulated during the coming week. The city's motive for structuring the collection process in this way was to reduce sorting costs on its end.
conducted with households that were originally given the opportunity to participate in the pilot program but declined (henceforth “non-participants”), and households that are located in neighborhoods that were not targeted for the pilot program (henceforth “non-targeted”). These households were asked to value a hypothetical CRP that was described identically to the pilot program.

The three sub-groups in our sample – participants, non-participants, and non-targeted – allow us to control for the level of respondent experience with the service in a manner similar to Bergstrom, et al. (1990), Kealy, et al. (1990), Boyle, et al. (1993), and Cameron and Englin (1997). In particular, we are able to test for the fixed effect on WTP of a household having participated in an actual CRP (participants) rather than having been described an identical hypothetical CRP (non-participants and non-targeted). We are also able to control for unobserved factors that distinguish participants from those who did not agree to participate (non-participants). In addition to these controls for experience and the choice of whether to participate in the pilot program, we also test the effectiveness of a neutral “cheap talk” script in mitigating potential hypothetical bias in the WTP responses from participants, non-participants, and non-targeted alike.

Our mean WTP estimate for curbside recycling across all households in the sample is estimated to be $4.65 per month, which, as shown in Table 1, is larger than estimates reported in Lake, Bateman, and Parfitt (1996) and Aadland and Caplan (1999), but less than that reported in Caplan, et al. (2002) and Aadland and Caplan (2003). By accounting for potential hypothetical bias in our data, over-sampling of women, over-sampling of higher-educated individuals, and over-sampling of older individuals we are able to calibrate our overall mean WTP estimate down to a more conservative estimate of $3.80 per month. Similar to the earlier studies, we find
several household-specific characteristics that are significantly related to WTP for curbside recycling. Those willing to pay the most are (1) female; (2) highly educated; (3) higher income; (4) motivated to recycle because of an ethical duty to help the environment; (5) households with fewer children under the age of 5 years old; (6) young; (7) members of an environmental organization; and (8) households that did not participate in the pilot CRP.

[INSERT TABLE 1 HERE]

Similar to the previous literature on the role of experience in valuing environmental goods, we find that participation in the pilot CRP affects a household’s WTP. Overall, participants are willing to pay approximately $1.60 less for the pilot CRP, all else equal, than the non-participants and non-targeted who were described an identical, albeit hypothetical, program. This difference could be motivated by hypothetical bias in our data as individuals who did not actually experience (i.e. participate in) the pilot program expressed higher WTP amounts simply due to the fact that the described program was hypothetical, rather than real. Or, the difference may indicate that on average participants lowered their valuations of the service as a result of having used it. Nevertheless, participants who believe that the pilot program did at least a “good job” collecting their recyclables (26 percent of those who participated) are WTP $1.90 more per month than participants who do not believe the pilot program did a good job. 5

Further, unlike previous cheap talk studies (e.g., Cummings and Taylor, 1999; List, 2001, and Aadland and Caplan, 2003), which have used scripts explicitly directed toward mitigating positive hypothetical bias in their data, we find that a more neutral cheap talk script is ineffective in lowering WTP responses. This result leads us to question the robustness of cheap talk in

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5 The fact that only 26 percent of the participants consider the program as having done a “good job” in collecting their recyclable materials lends (unconditional) support to the hypothesis that participants lowered their valuations of the service as a result of having used it, rather than to the alternative hypothesis that non-participants and non-targeted households increased their valuations due to hypothetical bias.
mitigating positive hypothetical bias. The ability of cheap talk to correct for hypothetical bias in contingent-valuation (CV) surveys may be too sensitive to script length and content for any general recommendations to be made about its efficacy. This is particularly true for CV surveys, where a baseline level of observed bias in the sample cannot easily be determined \textit{a priori}.

The next section discusses the survey instrument designed for this study, describes the variables used in the econometric analysis, and provides descriptive statistics. Section 3 presents the empirical model used to estimate WTP from the data. Section 4 provides results from various specifications of the empirical model. Section 5 concludes.

2. Survey Design, Variables, and Data

A representative sample of Logan residents were surveyed over a four-month period, June through September 2002, to obtain preferences and values for the piloted curbside recycling program. A total of 516 interviews were conducted by a team of Utah State University undergraduate students and Logan city employees. The survey team was managed by the former coordinator of the Cache Valley Clean Team, a city-sponsored organization initiated in 1998 to advertise recycling and waste reduction efforts throughout the county.

To get a representative sample of Logan residents, the team of interviewers surveyed participants, non-participants (those asked to participate in the pilot program, but refused), and non-targeted residents. Of the 516 households interviewed, 147 were participants (33%), 138 non-participants (29%), and 173 non-targeted (38%).\textsuperscript{6} Specific surveys were designed for each of these sub-groups due to the inherent differences between them.\textsuperscript{7} For example, the participant

\footnotesize{\textsuperscript{6}Since 200 households comprised the sample frame for each sub-group, the response rate for participants, non-participants, and non-targeted are 73.5%, 69%, and 86.5%, respectively.}

\footnotesize{\textsuperscript{7}The survey instruments are available upon request from the authors. One of the six versions is provided in the appendix.}
survey includes additional questions to obtain their opinions about the pilot program and the extent of their participation in the program. The non-participant survey includes additional questions directed toward understanding their decision not to participate.

Each survey commences with a series of questions about the household’s awareness and use of drop-off recycling, followed by a series of WTP questions for curbside recycling. For non-participants and non-targeted, the description of the hypothetical program preceding the WTP questions read,

For the next few questions, please imagine that you COULD have a curbside recycling service that collects aluminum cans, cardboard (corrugated and non-corrugated), paper, plastics #1 and #2, tin cans, and steel on staggered weeks. During weeks 1 and 3 fibrous material (cardboard and paper) would be collected, while during weeks 2 and 4 non-fibrous material (aluminum, plastics, tin cans, and steel) would be collected. The city would provide you with one additional cart, which you would put the fibrous material in during weeks 1 and 3, and the non-fibrous material in during weeks 2 and 4. Your household would pay a fee for the recycling service, in addition to your current monthly garbage collection fee.

Households within each sub-group were randomly selected to either receive the cheap talk statement before the WTP questions or not (thus approximately half of the respondents received cheap talk in each group). The cheap talk statement read,

As you prepare to answer the next few questions, please keep in mind the following three things. First, keep in mind your household budget. In a typical month, at what price would your household be able to afford curbside recycling? Second, keep in mind that there are alternatives to curbside recycling such as recycling drop-off centers and landfills. And third, keep in mind that in previous surveys we have found that the amounts that people say they are willing to pay for curbside recycling are sometimes different from the amounts that they would actually be willing to pay when curbside recycling became available in their community. For this reason, as I read the following curbside recycling fees, please imagine your household is actually paying them.

This script is more neutral than what has recently been proposed in the literature, and reflects the caution implied by Carson, et al.’s (1996) convergent-validity results suggesting that
responses to hypothetical WTP questions may in fact *understate* those provided through revealed preference. Cummings and Taylor (1999) inform their respondents that people faced with a referendum on increasing the amount of a public good with hypothetical payments are more likely to vote in favor of it than individuals facing the same referendum but with real payments. List (2001) similarly informs his respondents that “[previous studies have shown] that on average . . . people overstated their actual WTP by 150 percent.” Using a much shorter cheap talk script, Aadland and Caplan (2003) remind their respondents that “. . . studies have shown that many people say they are willing to pay more for curbside recycling than they actually will pay when (it/curbside recycling) becomes available in their community.”8

Similar to Cameron and James (1987) and Aadland and Caplan (2003), our WTP questions are set in the double-bounded, dichotomous-choice (DBDC) format to elicit a household’s WTP through a series of yes-or-no valuation questions. The first question is: “Would you be willing to pay $\tau$ for the service?” The opening bid $\tau$ is chosen randomly from a set of pre-determined values.9 By randomizing the opening bid, the possible effects of “starting-point bias” are reduced (Cameron, 1988 and Alberini, 1995a and b).10 Contingent upon her response to the opening bid, the respondent is then asked a similar follow-up question, but with a larger bid, $\tau_H = 2\tau$, if she answered “yes” (i.e., willing to pay at least $\tau$ for the service) or a smaller bid $\tau_L = 0.5\tau$ if she answered “no” (i.e., unwilling to pay $\tau$ for the service).

Based on the responses to the opening bid and follow-up questions, the respondent’s latent WTP may be placed in one of four regions: $(-\infty, \tau_L)$, $(\tau_L, \tau)$, $(\tau, \tau_H)$ or $(\tau_H, \infty)$. Unlike other

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8Notable exceptions to the use of non-neutral scripts are Neill (1995) and Loomis et al. (1994), which provide very brief reminder statements about budgetary substitutes and constraints. Similar to our results, they do not find statistically significant WTP responses to these statements.

9For this study, the opening bid values are randomized across $2$, $4$, and $6$. 
CVM studies, we follow up with a third valuation question for those who respond “no” to the first two valuation questions, that is, “Would you be willing to use the service if it were free of charge?” Previous experience with household recycling surveys suggests that some households apparently need to be paid (i.e., have negative WTP values) to participate (Haab and McConnell, 1997; and Aadland and Caplan, 1999). As a result, our survey generates five rather than four valuation regions with \((-\infty, \tau_L)\) being replaced by \((-\infty, 0)\) and \((0, \tau_L)\).\(^{11}\)

The series of WTP questions is followed up with a preference-certainty question and a query about whether the respondent would be willing to pay extra for the added convenience of not having to sort fibrous from non-fibrous recyclable material. The preference-certainty question asks the respondents how certain they are of their WTP responses on a scale from 0% to 100%, with the former (latter) percentage implying perfect uncertainty (certainty). Following Li and Mattsson (1995) and Aadland and Caplan (2003), responses to this question enable us to control for heterogeneity in the structure of the estimated variance of each individual’s WTP response. Before ending the survey with a series of demographic questions, respondents are queried about their households’ current garbage container size and whether they would choose a smaller size if a hypothetical array of container sizes were available.\(^{12}\)

Table 2 contains a listing of the explanatory variables used in our final regression models (reported below in Section 4). The variable names, descriptions, means and standard deviations

\(^{10}\)Whitehead (2002) proposes an alternative approach to controlling for starting-point bias and incentive incompatibility across multiple-bounded referendum bids. We plan to adopt his approach in a later version of this paper.

\(^{11}\)This is true when we treat a “don’t know” response to a given bid as a no response. If instead we treat a “don’t know” response as simply a signal that the respondent’s true WTP lies somewhere below the given bid level, then we generate 11 possible valuation regions. Results for both of these approaches to handling “don’t know” responses are reported in Section 4.

\(^{12}\)Respondents are offered four separate container sizes – 30-, 40-, 60-, and 90-gallon. They are asked whether they would reduce their container size both with and without a CRP available.
are provided. Further, the last column in Table 2 presents a comparison of sample to the U.S. census data. Most of our variables are typical demographics—MALE controls for sex, HS through GRAD for educational attainment, MEDINC and HIGHINC for household income level, HOME for home ownership status, and CHILD and AGE for household age distribution.

Control variables specific to this study include CHEAP for whether a respondent received a cheap talk script prior to answering the series of WTP questions, PART and NONTARG for whether the household participated in or was not targeted for the pilot CRP, GOODJOB for whether a participant household thought the pilot program did at least a “good job” collecting its recyclable materials, ETHIC and MONEY for the household’s motivation for recycling, ENVORG for the household’s membership status in an environmental organization, DROPOFF for the household’s use of drop-off recycling, CONVEN for whether a household would pay for the added convenience of not having to separate fibrous from non-fibrous recyclable material, and CERTAIN for preference certainty.

While approximately 82% and 66% of the sample says they are ethically motivated to recycle and use drop-off recycling, respectively, only 9% says they belong to an environmental organization. Approximately 25% of the sample says they would pay extra for the convenience of not having to separate fibrous from non-fibrous recyclable material, and 86% are certain of their WTP responses.

For age, sex, income, and education U.S. Census Bureau (2000) estimates for Logan are also provided in Table 2. The sample is reasonably representative of the Logan population with respect to income, although we have slightly greater percentages of females (67% sample vs. 52% census), high school and college graduates (33% sample vs. 18% census for high school;
35% sample vs. 22% census for bachelors degree; and 26% sample vs. 12% census for graduate degree), younger individuals (median age sample 23.5 years vs. 42.78 years census), and home ownership (76% sample vs. 44% census).

3. Empirical Model

We posit that the household’s true WTP (WTP*) is represented by the equation

\[ WTP_i^* = X_i \beta + \varepsilon_i, \]

where \( X_i \) is a row vector of household-specific control variables, \( \beta \) is a corresponding column vector of coefficients, and \( \varepsilon_i \) is a normally distributed error term for households \( i = 1, \ldots, n \). We allow for possible heteroscedasticity by modeling the variance of the WTP error term as

\[ \sigma_i^2(Z_i \gamma) = \exp(Z_i \gamma), \]

where \( Z_i \) is a row vector of variables related to the disturbance variances and \( \gamma \) is a column vector of parameters.

By assuming independence across error terms, we then form the likelihood function conditional on (1), (2), and the observed data. Letting \( \Phi \) indicate the standard normal cumulative density function, the probability that household \( i \)'s true WTP falls in each of the five intervals is:

\[ P_{1,i} = \text{Prob}(-\infty < WTP_i^* < 0) = \Phi(-X_i \beta / \sigma_i(Z_i \gamma)); \]

\[ P_{2,i} = \text{Prob}(0 \leq WTP_i^* < 0.5 \tau_i) = \Phi((0.5 \tau_i - X_i \beta) / \sigma_i(Z_i \gamma)) - \Phi(-X_i \beta / \sigma_i(Z_i \gamma)); \]

\[ P_{3,i} = \text{Prob}(0.5 \tau_i \leq WTP_i^* < \tau_i) = \Phi((\tau_i - X_i \beta) / \sigma_i(Z_i \gamma)) - \Phi((0.5 \tau_i - X_i \beta) / \sigma_i(Z_i \gamma)); \]

\[ P_{4,i} = \text{Prob}(\tau_i \leq WTP_i^* < 2\tau_i) = \Phi((2 \tau_i - X_i \beta) / \sigma_i(Z_i \gamma)) - \Phi((\tau_i - X_i \beta) / \sigma_i(Z_i \gamma)); \]

\[ P_{5,i} = \text{Prob}(2\tau_i \leq WTP_i^* < \infty) = 1 - \Phi((2 \tau_i - X_i \beta) / \sigma_i(Z_i \gamma)), \]
where $\tau_i$ represents household $i$'s opening bid. Using (1) through (3), the (log) likelihood function for all households in the sample is

\[
\ln(L) = \sum_{i=1}^{n} \sum_{j=1}^{5} \omega_{ij} \ln(P_{ij}),
\]

where $\omega_{ij} = 1$ if the stated WTP value falls in the $j$th region and 0 otherwise. Maximizing the (log) likelihood function (4) results in an estimation problem requiring nonlinear optimization techniques to generate estimates of the $\beta$ parameters (see Greene, 2000).

4. Results

We estimate (1) and (2) simultaneously with two models. Model 1 retains "don't know" responses, while Model 2 treats "don't knows" as "no" responses. Since the results for both models are very similar, we focus our attention on Model 2, where the mean WTP estimate of $4.65 per household per month is lower, thus representing a lower-bound estimate from the two models. As shown in Table 3, we find several household-specific characteristics that are significantly related to WTP for curbside recycling. Those willing to pay the most are (1) female; (2) highly educated; (3) higher income; (4) motivated to recycle because of an ethical duty to help the environment; (5) households with fewer children under the age of 5 years old; (6) young; and (7) member of an environmental organization. These marginal effects are similar to those found in Lake, Bateman, and Parfitt (1996), Tiller, et al. (1997), Aadland and Caplan (1999), Caplan, et al. (2002), and Aadland and Caplan (2003).

[INSERT TABLE 3 HERE]

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13 As mentioned in Section 2, when "don't know" responses are considered unique, rather than as "no" responses, the total number of possible intervals in (3) expands to 11. For example, if a respondent answered "don't know" to whether they would be willing to pay $7 and "yes" to whether they would be willing to pay $7L, their unknown WTP falls in the region $(\tau_L, \infty)$. The likelihood function is then adjusted accordingly.
Several other effects deserve further mention. First, cheap talk has neither the expected sign, nor is it statistically significant. Therefore, unlike the cheap talk scripts used by Cummings and Taylor (1999), List (2001), and Aadland and Caplan (2002), which explicitly describe hypothetical bias as being positive, we find that a more neutral script does not influence the average household’s WTP, all else equal. Second, experience with the pilot CRP reduces the average household’s WTP. Although the direction of this effect was unexpected, its significance in explaining WTP was not, given the facts that (1) participants “experienced” the pilot CRP for six months (a relatively long period of time), and (2) the previous findings of Bergstrom, et al. (1990), Kealy, et al. (1990), Boyle, et al. (1993), and Cameron and Englin (1997) indicate that experience matters.

Third, use of drop-off recycling during the previous 12 months increases the average household’s WTP for curbside recycling. Aadland and Caplan (2003) find that households using drop-off recycling tend to be willing to pay less for curbside recycling. They hypothesize that this is due to the fact that for these households the added convenience of curbside recycling is not as large as for households that do not use drop-off. In our sample, this result is reversed – it appears that those who have experienced drop-off are motivated to pay more for a curbside service. Fourth, those households that are willing to pay something extra for the added convenience of not having to separate fibrous from non-fibrous recyclable material are unwilling to pay either more or less for the (inconvenient) pilot program. This implies that households that value added convenience for a given CRP are not necessarily willing to pay less for the existing inconvenient program.

Finally, we find evidence of heteroscedasticity. The likelihood ratio statistic used to test the null hypothesis that $\gamma = 0$ in (2) is 4.60 with a 5% critical value equal to 9.49. We therefore
reject the null in favor heteroscedasticity. The variables included in the Z vector are shown in the lower portion of Table 3. The coefficient on CHEAP TALK is positive but insignificant at the 5% level. Unlike Aadland and Caplan (2003), this result indicates that a more neutral cheap talk reminder statement, in addition to not reducing hypothetical bias for the average individual in our sample, is also ineffective in reducing the uncertainty associated with stated WTP values. By construction of the bid design, we are not surprised to find that BID is positively related to the variance of the latent WTP errors. Recall that the opening bids are even integers between two and six, with subsequent bids equal to either half or twice the opening amount. Therefore, the bid design generates larger WTP intervals (and thus more uncertainty regarding the true WTP) for higher opening bids.

In contrast to Li and Mattsson (1995), who impose a constant variance across households, but similar to Aadland and Caplan (2003), we allow households stating different levels of certainty to have different error distributions. However, as Table 3 shows, the coefficient associated with the preference-certainty response is not statistically different than zero. This implies that the stated level of certainty by a household in its WTP has no statistical effect on the estimated variance associated with its response.

Table 4 breaks out the estimated mean WTP for each sub-group, as well as for our calibrated measures. Correcting only for the differences between our sample means and those from the U.S. Census, our mean WTP rises from $4.65 to $4.95 per month. This result is driven by the over-sampling of older people, since younger people state a higher willingness to pay, all else equal. When we then assume positive hypothetical bias from non-participants and non-targeted households (and thus assume that all households were participants) our mean WTP drops from $4.95 to $3.80 per month.
Table 5 presents a comparison of household responses to the question of which garbage cart size they would choose if additional options were available with and without curbside recycling. The first part of the table reports the responses when the curbside program is assumed to be unavailable. Note that only 12% of the households said they would reduce down to a 40- or 30-gallon container in this case. However, when a curbside recycling program is made available, this percentage increases to 30%. Further, the number of households using a 60-gallon cart would increase from 21% to 35%, indicating that several households currently using a 90-gallon cart would reduce down to the 60-gallon size. Thus, it appears that more households would reduce their garbage cart size if a curbside recycling program is made available along with the option of smaller cart sizes.

As a final piece of information, Figure 1 shows how expected total monthly revenues from a CRP will change as the monthly fee increases, based on a city size of 25,000 households. To generate this relationship between monthly revenues and fees, we first calculated the predicted WTP for each of the 416 households used in our empirical estimation. We then computed the percentage of our sample that has a higher predicted WTP than the fee at each of the given fee levels, $0 through $10. We then multiplied that percentage by the 25,000 households to get the number of households that would participate at that fee level. Finally, we multiplied the number of participating households by the given fee level to get the corresponding total monthly revenue.
Note that the revenue curves for both models first rise and then peak at the $4 fee level. Consistent with our earlier finding that the mean WTP is lower for Model 2, the revenue curve for Model 2 lies everywhere beneath Model 1’s. The main relationship depicted in this figure is that between participation rates and the fee. As the fee level increases from $0 to approximately $4, revenues increase. This is due to the fact that although fewer households are participating as the fee level rises, the rate at which households drop out of the program is less than the rate at which the fee level increases. However, beyond the $4 fee level this relationship reverses itself—now the rate at which the fee level increases is less than the rate at which households drop out. The main lesson here is that if Logan chooses a voluntary CRP, where households pay for the program only if they sign up for it, then to maximize revenues it would set the monthly fee at approximately $4.14

5. Conclusions

The Logan pilot curbside recycling study has provided important information to two different audiences. The first audience—local policymakers—can use this study’s empirical findings as an echo of earlier studies, which find that several household characteristics explain WTP for curbside recycling. Similar to these earlier studies, we find that those willing to pay the most for curbside recycling are (1) females; (2) the highly educated; (3) those with higher income; (4) those motivated to recycle because of an ethical duty to help the environment; (5) households with fewer children under the age of 5 years old; (6) the young; and (7) members of an environmental organization. Therefore, when designing a curbside recycling program

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14 These revenue curves are unadjusted for the over-sampling of women, younger, and more highly educated people, as well as for potential positive hypothetical bias (see Table 4). Correcting for these factors would likely shift the revenue curves downward and the peaks of the curves to the left, indicating a lower monthly fee corresponding to maximum monthly revenue.
these characteristics can be used to guide policymakers in the setting of household monthly fees, and in the direction of on-going educational programs to increase participation rates.

The second audience—academic researchers interested in stated preference techniques—should find the results for cheap talk and respondent experience to likewise be of interest. We find that a neutral cheap talk script is ineffective in influencing respondents’ WTP for curbside recycling. We therefore conclude that the type of script used may be important in determining cheap talk’s effectiveness in mitigating potential hypothetical bias in the data. With respect to respondent experience with the environmental good being valued, we find that participation in a pilot program affects the respondent’s valuation of the program relative to both non-participants and those who were not targeted in the first place to participate in the program. Therefore, a piloted CRP not only yields valuable insights into the practical obstacles a city may encounter in implementing it on a citywide basis, but also may affect a participating household’s valuation of the services provided.
References


<table>
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<tr>
<th>Study</th>
<th>Year</th>
<th>Area and description of CRP</th>
<th>Valuation Method</th>
<th>WTP ($ per month)</th>
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<tbody>
<tr>
<td>Caplan, Grijalva, and Jakus</td>
<td>2002</td>
<td>Ogden, Utah CRP for green waste and recycling</td>
<td>Contingent Ranking</td>
<td>$6.44- $9.66</td>
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<td>Lake, Batemean, and Parfitt</td>
<td>1996</td>
<td>South Norfolk, U.K. CRP for recycling</td>
<td>DC CVM</td>
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<td>Aadland and Caplan</td>
<td>1999</td>
<td>Ogden, Utah CRP for recycling</td>
<td>Ordered-Interval CVM</td>
<td>$2.05</td>
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<td>Aadland and Caplan</td>
<td>2003</td>
<td>State of Utah CRP for recycling</td>
<td>DBDC CVM</td>
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<td>Variable Description</td>
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<td>---------------------------------------------------------------------------------------</td>
<td>---------------------------</td>
<td>-----------------------------------</td>
<td></td>
</tr>
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<td>Dummy Variable – 1 indicates that the respondent is male, 0 otherwise</td>
<td>0.33±(0.47)</td>
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<td>0.51±(0.50)</td>
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<td>PART</td>
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<td>0.33±(0.47)</td>
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<td></td>
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<td>Dummy Variable – 1 indicates that a respondent was not offered a chance to participate in the pilot recycling program, 0 otherwise.</td>
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<td>---</td>
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<td>GOODJOB</td>
<td>Dummy Variable – 1 indicates that a participant thought the pilot program was good to excellent.</td>
<td>0.26±(0.44)</td>
<td>---</td>
<td></td>
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<td>Dummy Variable – 1 indicates that a respondent recycles for ethical reasons, 0 otherwise.</td>
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<tr>
<td>Variable Name</td>
<td>Variable Description</td>
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<td>U.S. Census Bureau Estimate, 2000</td>
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<tr>
<td>---------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>-----------------------------</td>
<td>----------------------------------</td>
<td></td>
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<td>Dummy Variable – 1 indicates that a respondent recycles to save money, 0 otherwise.</td>
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<td>Number of children under the age of 5 living in the household.</td>
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<td>Age in years of the respondent.</td>
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<td>ENVORG</td>
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<td>DROPOFF</td>
<td>Dummy Variable – 1 indicates that a respondent has used drop-off recycling during the past 12 months, 0 otherwise.</td>
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<td>Dummy Variable – 1 indicates that a respondent would be willing to pay more for added convenience of not having to separate fibrous from non-fibrous material, 0 otherwise.</td>
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<td>BID</td>
<td>Respondent’s starting bid amount.</td>
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<td>Percent certain of final response to last WTP bid amount.</td>
<td>0.86± (0.26)</td>
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a Number of observations = 418.
b Median age.
Table 3: Results

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Heteroscedasticity Variables

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E(WTP) $5.05 $4.65
LR test statistic 5.25 4.60
Total Log-Likelihood Value -480.16 -535.93
McFadden’s R² 0.12 0.11

* Model 2 treats “don’t know” responses to WTP bid amounts as “no” responses.
### Table 4: WTP Estimates by Targeted Populations

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<td>CENSUS</td>
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<tr>
<td>CENSUS (100% PART)</td>
<td>$4.24</td>
<td>$3.80</td>
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### Table 5: Choice of Cartsize (percentage of respondents)

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<thead>
<tr>
<th>Choice of Cartsize Without CRP</th>
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<tbody>
<tr>
<td>30-gallon at $4 per cart</td>
<td>6%</td>
</tr>
<tr>
<td>40-gallon at $5 per cart</td>
<td>6%</td>
</tr>
<tr>
<td>60-gallon at $6.55 per cart</td>
<td>21%</td>
</tr>
<tr>
<td>90-gallon at $11.65 per cart</td>
<td>67%</td>
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<table>
<thead>
<tr>
<th>Choice of Cartsize With CRP</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>30-gallon at $4 per cart</td>
<td>14%</td>
</tr>
<tr>
<td>40-gallon at $5 per cart</td>
<td>16%</td>
</tr>
<tr>
<td>60-gallon at $6.55 per cart</td>
<td>35%</td>
</tr>
<tr>
<td>90-gallon at $11.65 per cart</td>
<td>35%</td>
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</table>
Figure 1: CRP Revenue Function

CRP Revenue Function per 25,000 Households

Monthly Revenue

Monthly CRP Fee
Appendix

Logan Household Recycling Survey
Participants—Form 1

Interviewer Notes: Make sure to interview someone in the household who is 18 years or older and who is familiar with the household’s waste management decisions (e.g. pays the household’s monthly garbage bill, sets out the garbage each week, etc.). This person should also be familiar with his/her household’s participation in the pilot curbside recycling program.

1. GENDER
Respondent is
1 Male
2 Female

2. DRECY
I need to begin by asking you about drop-off recycling, which is a central collection place for recyclable materials. Do you know if Logan currently has any drop-off recycling centers (PROBE: for paper, plastic, glass, aluminum cans, tin cans, cardboard, green waste, hazardous waste, or any other type of recyclable materials)?
1 YES
2 NO \(\rightarrow\) SKIP TO QUESTION 9
3 DK/NA/REF \(\rightarrow\) SKIP TO QUESTION 9

3. DRUSE1
In the 12 months preceding the pilot curbside recycling program, when your household had materials that could be recycled, did your household take any recyclable materials to any of Logan’s drop-off recycling centers?
1 YES
2 NO \(\rightarrow\) SKIP TO QUESTION 6
3 DK/NA/REF \(\rightarrow\) SKIP TO QUESTION 8

4. DRUSE2
Which recyclable materials did you drop off in the 12 months preceding the pilot curbside recycling program? (Circle all that apply)
1 Paper (i.e. newspapers, magazines, or office paper)
2 Cardboard (i.e. corrugated cardboard boxes or cereal boxes)
3 Aluminum or tin-steel cans
4 Plastics
5 Green waste (yard trimmings)
6 Other (specify) ___________________________
7 DK/NA/REF
5. DRUSE3
Prior to the pilot curbside recycling program, when your household had materials that could be recycled, how often did you take them to a drop-off recycling center instead of putting them in the garbage - always, often, sometimes, or rarely?
1 ALWAYS  SKIP TO QUESTION 8
2 OFTEN   SKIP TO QUESTION 8
3 SOMETIMES SKIP TO QUESTION 7
4 RARELY  SKIP TO QUESTION 7
5 DK/NA/REF SKIP TO QUESTION 8

6. NODR1
Why hasn’t your household taken any of its recyclable materials to drop-off centers in Logan?
SKIP TO QUESTION 8

7. NODR2
Why didn’t your household take its recyclable materials to a drop-off recycling center more often?

8. DRECYMI
How many miles from your home is the nearest drop-off recycling center in Logan (PROBE: If the respondent struggles with the number of miles, ask for where the nearest drop-off center is located)?__________________________.

9. CURBAGREE
What was the main reason your household decided to participate in Logan’s pilot curbside recycling program?

At this point, I am going to ask you a few questions about your household’s willingness to pay for the pilot curbside recycling program that your household has been participating in over the past few months.
10. CURBWTP1
First, if this curbside recycling program became available to you on a voluntary basis (i.e. you only pay for it if you have signed up for it) would you be willing to pay ____ dollars per month for this program, in addition to your current monthly garbage collection fee?
1 YES → Multiply the amount by 2 and insert into QUESTION 11.
2 NO → Multiply the amount by ½ and insert into QUESTION 12.
3 DK/REF/NA → Multiply the amount by ½ and insert into QUESTION 12.

11. CURBWTP2
Would you be willing to pay ____ dollars per month for this curbside recycling program?
1 YES → SKIP TO QUESTION 15
2 NO → SKIP TO QUESTION 15
3 DK/REF/NA → SKIP TO QUESTION 15

12. CURBWTP3
Would you be willing to pay ____ dollars per month for this curbside recycling program?
1 YES → SKIP TO QUESTION 15
2 NO
3 DK/REF/NA

13. CURBWTP4
Would your household take part in this curbside recycling program if it was free of charge?
1 YES → SKIP TO QUESTION 15
2 NO
3 DK/REF/NA → SKIP TO QUESTION 15

14. NOGO
You stated that you would not participate in this curbside recycling program if it were offered free of charge. Please explain why.

15. PREFCERT
On a scale from 0 to 100%, how certain are you of your final willingness-to-pay amount (with 0 meaning completely uncertain and 100% meaning completely certain)? _____.

15A. EXTRAPAY
If instead of requiring you to separate fibrous from non-fibrous material, the program allowed you to combine these two materials in the same cart each week, would you be willing to pay a little more each month for this added convenience?
1 YES
2 NO → SKIP TO QUESTION 16
3 DK/REF/NA → SKIP TO QUESTION 16

15B. EXTRAMT
How much extra per month would you be willing to pay for this added convenience?
16. CRKNOW
What items are currently being collected in the pilot curbside recycling program? (Check all that apply).

- PAPER
- PLASTIC
- GLASS
- ALUMINUM
- TIN CANS
- CARDBOARD
- GREEN WASTE
- HAZARDOUS WASTE
- OTHER. Please Specify ____________________

17. CRMAT
Is your household currently recycling all the materials possible in the pilot curbside recycling program or only some of the materials?
1 ALL MATERIALS
2 SOME MATERIALS
3 DK/NA/REF

18A. STORAGE
Because the pilot curbside recycling program alternated the weeks in which fibrous materials (i.e., cardboard and paper) and non-fibrous materials (i.e., plastics and aluminum and tin cans) were collected, please explain what your household did with the materials that weren’t picked up during a given week.

________________________________________________________________________

________________________________________________________________________

18B. COMPLEXITY
Describe any difficulties you had with curbside recycling compared to how you disposed of items in the past.

________________________________________________________________________

________________________________________________________________________

18C. TRIALABILITY
Describe how your experience in the program changed the way you think about recycling.

________________________________________________________________________

________________________________________________________________________

18D. OBSERVABILITY
Have you talked to any of your friends/neighbors about the program? Who? Why?

________________________________________________________________________
19. CRJOB
Overall, would you say the pilot curbside recycling program has done an excellent job, a good job, a fair job, or a poor job?
1 EXCELLENT
2 GOOD
3 FAIR
4 POOR
5 DK/NA/REF

19A. ENCOURAGE
How do you think the city could encourage more recycling?

20. CART
What size garbage cart does your household currently use (and how many of each)?
1 60-gallon ($6.55 per month per cart) No. ______
2 90-gallon ($11.65 per month per cart) No. ______


21. WHYCARTS
What is the main reason(s) that your household currently uses more than one garbage cart?

22. REDUCE
If Logan City provided this curbside recycling service and your household chose to sign up for it, would your household reduce the number of garbage carts you currently use for all other garbage (PROBE: For example, a household that currently uses two 60-gallon carts with no curbside recycling program may be able to get by with only one 60-gallon cart for garbage with the curbside recycling program, since some of what was formerly in the second 60-gallon garbage cart is now put in the separate recycling cart)?
1 Yes ➔ SKIP TO QUESTION 25
2 No ➔ SKIP TO QUESTION 27
3 DK/NA/REF ➔ SKIP TO QUESTION 27

23. WHY90
What is the main reason(s) that your household currently uses one 90-gallon garbage cart as opposed to one 60-gallon cart? → SKIP TO QUESTION 25

24. WHY60
What is the main reason(s) that your household currently uses only one 60-gallon garbage cart as opposed to one 90-gallon cart?

25. REDUCE2
If your household signed up for this curbside recycling service and as part of the service a wider range of garbage-cart sizes were offered at different prices, which of the following would you prefer – 30 gallon cart at $4.00 per month, 40 gallon cart at $5.00 per month, 60 gallon cart at $6.55 per month, or 90 gallon cart at $11.65 per month (PROBE: These different cart sizes and prices refer only to the cart that is used for garbage, not for the separate cart that would be used for recyclable materials that would also be picked up at the curb at an additional cost)?
1 30 gallon cart at $4.00 per month.
2 40 gallon cart at $5.00 per month?
3 60 gallon cart at $6.55 per month?
4 90 gallon cart at $11.65 per month?

26. REDUCE3
If Logan City DOES NOT provide this curbside recycling service but still offers a wider range of garbage-cart sizes at different prices, which of the following would you prefer – 30 gallon cart at $4.00 per month, 40 gallon cart at $5.00 per month, 60 gallon cart at $6.55 per month, or 90 gallon cart at $11.65 per month?
1 30 gallon cart at $4.00 per month.
2 40 gallon cart at $5.00 per month?
3 60 gallon cart at $6.55 per month?
4 90 gallon cart at $11.65 per month?

27. COMMYRS
I need to end the survey with a few questions about your household. First, for how many years have you lived in your community? __________.

28. AGE
In what year were you born? __________.

29. ETHNICITY
How would you describe the ethnicity of your household? (Check all that apply).
___ White
___ Native American
___ Hispanic
___ African American
___ Asian
__ Other. Please specify ________________________________.

30. HHNUM
How many people currently live in your home, including yourself? ________.

31. CHILDREN
How many children under the age of 5 currently live in your home? ________.

32. EDUC
What is the highest level of education anyone in your household has completed?
1 0-8 YEARS, NO GED
2 8-12 YEARS, NO HIGH SCHOOL DIPLOMA OR GED
3 HIGH SCHOOL DIPLOMA OR GED
4 SOME COLLEGE, NO DEGREE
5 ASSOCIATE'S DEGREE
6 BACHELORS DEGREE
7 MASTERS DEGREE
8 DOCTORATE OR PROFESSIONAL DEGREE

NOTE: THE NEXT TWO QUESTIONS REFER TO THE ADULT WITH THE HIGHEST INCOME

33. EMPLOY
Is that adult currently working for pay, either full time or part time?
1 Yes → SKIP TO QUESTION 35
2 No
3 DK/NA/REF → SKIP TO QUESTION 35

34. NOTEMPLOY
Is that adult retired, looking for work, keeping house, taking classes, disabled, or something else?
1 SICK/ON VACATION FROM REGULAR JOB
2 RETIRED → SKIP TO QUESTION 36
3 LOOKING FOR WORK / UNEMPLOYED → SKIP TO QUESTION 36
4 KEEPING HOUSE → SKIP TO QUESTION 36
5 STUDENT TAKING CLASSES, GOING TO SCHOOL, ON BREAK FROM SCHOOL → SKIP TO QUESTION 36
6 DISABLED /UNABLE TO WORK → SKIP TO QUESTION 36
7 VOLUNTEER WORK ONLY → SKIP TO QUESTION 36
8 OTHER, DOING NOTHING, HANGING OUT AND NOT LOOKING FOR WORK → SKIP TO QUESTION 36

35. EMPRECY
Does that adult do any recycling on the job, or does his/her employer do any recycling of materials?
1 YES
2 NO
3 DK/REF/NA

36. GENLINK
When you or other adults in your household were children, did any of those households recycle?
1 YES
37. SOCNRM
Do most of your neighbors currently recycle (e.g., at a drop-off recycling center in town)?
1 YES
2 NO
3 DK/REF/NA

38. ENVORG
Does anyone in your household belong to an environmental club, group, or organization?
1 YES
2 NO
3 DK/NA/REF

38A. CLEANTEAM
Have you ever heard of the Cache Valley Clean Team?
1 YES
2 NO ➔ SKIP TO QUESTION 39
3 DK/NA/REF ➔ SKIP TO QUESTION 39

38B. CLEANLEARN
How did you learn about the Clean Team? (Circle all that apply)
1 HEARD ABOUT IT ON THE RADIO
2 READ ABOUT IT IN THE NEWSPAPER
3 HEARD ABOUT IT THROUGH A NEIGHBOR/FRIEND
4 OTHER Please Specify ____________________

39. LANDFILL1
Has anyone in your household ever visited your community’s landfill?
1 YES
2 NO
3 DK/NA/REF

40. LANDFILL2
Approximately how many miles from your home is your community’s landfill? _____

40A. COMPATIBILITY
Do you think Logan has (or will have) a landfill problem? How important do you think recycling is in solving the landfill problem? Why?

41. OP1
Please answer the next three questions with a simple “yes” or “no.” Do you feel an ethical duty to recycle to help the environment?
1 YES
2 NO
3 DK/NA/REF
42. OP2
Are you motivated to recycle in order to save money (e.g., you are able to use a smaller garbage container because you recycle or you get money for your aluminum cans)?
1 YES
2 NO
3 DK/NA/REF

NOTE: IF QUESTIONS 41 AND 42 WERE BOTH ANSWERED “YES”, CONTINUE WITH QUESTION 43. OTHERWISE, SKIP TO QUESTION 44.

43. OP3
Which one would MOST encourage your household to recycle – an ethical duty to help the environment, or saving money
1 ETHICAL DUTY TO HELP ENVIRONMENT
2 SAVING MONEY
3 DK/NA/REF

44. INCOME1
Is your total annual household income, from all sources, before taxes, over or under $35,000?
1 OVER $35,000 → SKIP TO QUESTION 47
2 UNDER $35,000
3 DK/NA/REF

45. INCOME2
Is it over or under $25,000?
1 OVER $25,000 → SKIP TO QUESTION 49
2 UNDER $25,000
3 DK/NA/REF

46. INCOME3
Is it over or under $15,000?
1 OVER $15,000 → SKIP TO QUESTION 49
2 UNDER $15,000 → SKIP TO QUESTION 49
3 DK/NA/REF → SKIP TO QUESTION 49

47. INCOME4
Is it over or under $50,000?
1 OVER $50,000
2 UNDER $50,000 → SKIP TO QUESTION 49
3 DK/NA/REF → SKIP TO QUESTION 49

48. INCOME5
Is it over or under $75,000
1 OVER $75,000
2 UNDER $75,000
3 DK/NA/REF

49. HOME
Do you currently rent or own the home you are living in?
1 RENT
50. ENDING
On behalf of Logan City and researchers at Utah State University, I would like to thank you for participating in this survey.