PAYING FOR A PUBLIC GOOD IN MONEY OR TIME: IS THERE A FUNDAMENTAL DIFFERENCE? AN INVESTIGATION OF CONSUMERS' PREFERENCES FOR COMMUNITY-WIDE RECYCLING

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PAYING FOR A PUBLIC GOOD IN MONEY OR TIME: IS THERE A FUNDAMENTAL DIFFERENCE? AN INVESTIGATION OF CONSUMERS' PREFERENCES FOR COMMUNITY-WIDE RECYCLING

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1. INTRODUCTION

Public goods cannot be produced optimally from voluntary provision mechanisms. This is a fundamental insight that comes out of the canonical model of public good provision in economics. The problem is the free-riding incentive. Nevertheless, both casual and formal observation of peoples' real-life behavior reveals that they are not always compelled to behave as prescribed by theory. Non-trivial contributions to public goods are observed in a variety of settings: charitable giving, volunteering for social causes, procurement of environmentally friendly products at price-premiums, and voting for political candidates.

Economists have formulated an assortment of theoretical models that could rationalize such behavior; see for example models of impure altruism (Andreoni, 1990), moral motivation (Brekke, Kverndokk, and Nyborg, 2003), identity preferences (Akerlof and Kranton, 2000), social norms (Holländer, 1990), and models of fairness and reciprocity (Rabin, 1993), to mention but a few.[i] None of this literature explores the potential role that the means of payment or, more narrowly, the contribution currency itself, may play in determining the level of voluntary provision. Typically, agents in the models which produce predictions of voluntary public goods provision are implicitly assumed to face only one constraint in making their choices, namely a money budget. Yet it is evident that time is an important (and for many, a more important) constraint on choice, and how people spend their time is also an important signal of their willingness to provide public goods.

This paper uses Becker's two-constraint model of consumer choice (Becker, 1965) to address the following fundamental question: Does the means of payment affect the magnitude of willingness to pay for public goods? When people are constrained by time as well as by money, their willingness to spend scarce time to obtain public goods is also a signal of their value. If the time spent is shadow-priced properly, are the two measures of willingness to pay equal, or does the way in which payment is made influence how much people are willing to contribute? An example may serve to illustrate this question. A person known to have a value of time of $15 per hour is asked to contribute 1 hour of that time towards a specific public good improvement. Would this person be more or less likely to contribute an hour of her time than to contribute $15 out of her wallet? Or would she be indifferent?

Several hypotheses can be put forth for why spending a specific amount of one's time would be perceived as different from spending its monetary equivalent. At the most basic level, spending time means a person engages directly in an activity (or activities) to produce the public goods. If this activity generates utility (or disutility) in and of itself, the person may prefer to be more (or less) directly involved.[ii] In related reasoning, Andreoni's model of impure altruism suggests that agents obtain utility from the act of giving itself ("warm-glow"), as well as from the resulting public good, which produces a voluntary contribution equilibrium with less than full free riding.[iii] The currency of payment for public goods might also matter if agents have some form of socially contingent preferences. Examples of this are preferences for attaining a specific identity as in Akerlof and Kranton, or live up to prescribed social norms, perhaps, as a way to gain social approval or avoid social disapproval, as in Holländer. In such contexts, the exertion of personal effort might be more visible to a person's peer group than spending money, hence, making time a more productive currency.[iv] The notion that personal effort constitutes a stronger signaling device clearly has important implications that carry over to models of reciprocity as well. Implicit cooperation would seem to be more achievable when the actions of others are readily observed.

The public good examined in this paper is community recycling. We investigate consumers' preferences for a non-marginal increase in their community's recycling rate. This recycling rate measures the fraction of all wastes, generated throughout the community economy, diverted away from landfills and other disposal methods for re-processing and secondary uses. To the extent that consumers perceive waste materials (ending up in landfills) as a public bad or conservation of resources as a public good, an increase in the level of recycling can be regarded as a public good. How do consumers value a specific increase in their community-wide recycling rate? Individual valuations will likely vary a great deal in the population and depend on the manner in which the recycling goal is proposed and implemented.

An important feature of our study is that an increase in the level of recycling can in actuality be achieved in several ways, varying in the amount public financing required and in how much consumer involvement is relied upon.[v] Throughout the United States, consumers already engage in wide-spread waste-sorting, frequently, in the absence of any economic incentives (Kinnaman, 2000). Moreover, the cost-effectiveness of many types of community recycling programs depends in large part on how willing consumers are to participate in them. As such, community recycling serves as an ideal setting for investigating the potential relationships between the means of payment and the magnitude of payment for public goods.

Our empirical analysis is based on data from a contingent valuation (CV) experiment conducted as part of a recent survey of Seattle residents. The current community-wide recycling rate in Seattle is 40%, but city officials have set 60% as the long term goal. The broad purpose of the survey was to collect data on households' recycling behavior and preferences for current and potential new recycling programs that could achieve the goal of 60% community-wide recycling.

CV experiments are commonly used by environmental economists to assess the economic value of non-marketed public goods such as environmental quality improvements. While traditional CV experiments have elicited consumers' preferences in terms of their willingness to pay money (WTPM), a recent innovation is to also elicit preferences in terms of willingness to pay time (WTPT); see Larson et al. (2004) for the first application. Surveys that elicit both WTPM and WTPT generate richer data on consumer preferences than has been typical from CV experiments. This approach has the double payoff in that one can learn about the value of consumers' time as well as their WTP for the public good in question.

In the empirical part of this paper, we first estimate separately consumers' WTPM and WTPT for an increase in the community recycling rate from 40% to 60% and investigate how these two WTP measures vary with personal characteristics, at wit, socioeconomics and general attitudes. Secondly, results from joint estimation of WTPM, WTPT, and the money value of time support our hypothesis that the payment currency matters. The remainder of this paper is organized as follows. Section 2 describes the data. Section 3 outlines the analytical framework while Section 4 presents the results. Finally, Section 5 offers some concluding remarks.

2. THE SURVEY DATA

Our empirical analysis is based on data from a mail-mode survey carried out between November 2004 and February 2005 in Seattle, Washington. The survey was designed, tested, and implemented in accordance with the principles of the Tailored Design Method (Dillman, 2000). Its broad purpose was to collect data on households' recycling behavior and preferences for current and new recycling program, to be used in program evaluation and policy design. Survey questionnaires were sent out to 2000 households. Half of these contained a CV experiment eliciting WTP money and WTP time for attaining an increase in the community-wide recycling rate.[vi] Of these 1000 surveys, about 550 were returned to us. Accounting for item-non response we end up with usable data on 506 individuals.

The Contingent Valuation Experiment

The CV experiment started out with an introductory statement about the recycling goal and the purpose of the accompanying questions:

> *Seattle is currently recycling 40% of all waste generate by households and businesses. The City's long term goal is to increase the overall recycling rate to 60%. We would like to learn how you would value two programs that could achieve the 60% recycling goal and how much money or time you might be willing to contribute towards this goal.*

The experiment proceeded to ask whether the participants' were willing to pay a specific amount of money per month for programs that would require general public financing, but would achieve the goal without affecting households' own efforts. Specifically, this policy scenario was presented in terms of new recycling programs external to the household sector, currently being investigated by City planners. The recycling rate increase is achieved in this scenario through expansion of recycling opportunities for businesses and local organizations and implementation of post-disposal waste sorting at a central sorting facility. The question used an increase in the household monthly utility bill as payment vehicle, with explicit statements that no change in household recycling time would be expected. The second CV question asked whether the participants' would be willing to spend a specific amount of time, presented in minutes per week, for programs that would require additional household effort to achieve the recycling goal, but would be provided free of charge. In this policy scenario, which is also based on current research by City planners, the increase in the community-wide recycling rate is achieved through expansion of existing curbside recycling programs, which would permit households to sort out additional recyclable materials. The question used an increase in recycling time, with no change in household money cost, as the payment vehicle. Both CV experiments used a closed-ended with follow-up question format, generating four observations on willingness to pay money and time per participant. As usual, the bid amounts were experimentally varied across the survey versions, after careful pre-testing, and assigned randomly throughout the sample.

Bid Amounts and Response Distributions

Initial bid amounts for the WTPM question were \$2, \$4, \$8, \$10, \$12, and \$15 per month. The high follow-up bids (presented to those that answered "yes" to the first bid) ranged from \$4 to \$30. The low follow-up bids (presented to those that answered "no" to the first bid) ranged from \$1 to \$6. The WTPT question started out at 5, 10, 15, 20 or 30 minutes per week. The high follow-ups ranged from 10 to 60 minutes while the low follow-ups ranged from 2 to 15 minutes. Table 1 summarizes the distribution of responses (please see Appendix 1 for tables and figures). For the WTP money question, 31% answered “no” to both bid amounts, 40% answer “no” to the initial bid, but accepted the second bid, 21% accepted the first bid but rejected the follow-up bid, while 8% answered “yes” to both bid amounts. For the WTP time question, the acceptance propensity was much higher. Only 10% answered “no” to both bid amounts, 18% said “no-yes”, 32% said “yes-no”, and, as many as 40% accepted both time bids. Responses to both questions satisfy a basic test of consistency with economic theory. The probability of a “yes” is declining in the bid amounts, with correlation coefficients of -0.28 in the money question and -0.24 in the time question.

Covariates for Empirical Analysis

The survey collected detailed background information on the participants, including information on their demographic and socioeconomic status, general attitudes towards recycling, the environment, and public giving, in addition to information on their current recycling activities and related behavior. Here, we limit the analysis to the use of some basic socioeconomic and attitude information in explaining the CV responses. The socioeconomic profile for the sample of participants is as follows: 49% are males, the average age is 49, the average years of schooling is 16, 12% belong to households with annual household income of more than $150,000, the average household size is 2.4, and 89% owns their own home. Descriptive statistics for the responses to the attitude questions are reported in table 2. For these questions the participants were asked to indicate their degree of agreement with several statements, with “strongly disagree” coded as 1, “neutral” coded as 3, and “strongly agree” coded as 5. Statements A1-A5 were intended to capture attitudes towards environmental and natural resource issues, A6-A10 were intended to capture attitudes towards altruistic behavior, statements A11-A18 elicited reasons for why they engage in recycling, and statements A19-A25 probed reasons that might reduce people’s willingness to participate in recycling programs.

By design, several of the attitudinal measures are highly correlated (since they were intended to “uncover” latent motivations). To deal with this issue, and in order to reduce the dimensionality of the attitude data, we employed factor analysis. This yielded seven factor scores that we use in the ensuing empirical investigation of WTP money and WTP time. A description is provided in Appendix 2.

3. ANALYTICAL FRAMEWORK

Theoretical Model of Consumer Recycling Choices and Willingness to Pay

The underlying model of consumer choice is one of utility maximization subject to two binding constraints (time and money) and of contributions towards public goods (Becker; Andreoni). The idea of monetary contributions is standard in the literature on giving, but many types of public goods can also be provided by contributions of time by volunteers who organize, build, construct, or otherwise produce the public good. Recycling programs, the subject of our analysis, are one such type of public good. Increases in city-wide recycling rates, a public policy goal in many communities around the nation, can be achieved in several ways. On the one hand, consumers can fund financially programs undertaken by others to improve the collection, sorting, and recovery of recycling materials from the waste stream. On the other hand, increased personal recycling, which involves primarily increased use of household time, can achieve the same goals.

Our model of contribution reflects these multiple ways in which consumers can provide public goods. Arguments of the utility function are activities x_i that the consumer engages in, each of which has a time price t_i and a money price p_i.[vii] Utility $u(\mathbf{x},R,G^M,G^T,\mathbf{s})$ is a function of the activities $\mathbf{x} = [x_1,\ldots,x_I]$, which are private goods, and a publicly-provided good $R = R(\Sigma_n G_n^M, \Sigma_n G_n^T)$, whose level is based on contributions of both time ($\Sigma_n G_n^T$) and money ($\Sigma_n G_n^M$) by all consumers. Individual n's utility also may depend directly on their personal contributions or spending one's time, and reflects possible private benefits from giving such as warm glows, social approval and so forth. Other observable demographics of the consumer, $\mathbf{s} = [s_1,\ldots,s_m]$, also affect the utility from activity consumption. Finally, the constraints faced by the consumer in making her activity choices are the money budget $M = \mathbf{px}$ and the time budget $T = \mathbf{tx}$. Both constraints are assumed to be continuously binding, which is not a particularly strong condition on choice. The primal version of the problem leads to the indirect utility function V(**p**,**t**,**s**,R,M,T), defined as

(1) $$V(\mathbf{p},\mathbf{t},\mathbf{s},R,M,T) \equiv \max u(\mathbf{x},R,G^M,G^T,\mathbf{s}) + \lambda\,[M - \mathbf{px} - G^M] + \mu\,[T - \mathbf{tx} - G^T].$$

A key element of two-constraint models such as (1) above is the shadow value of time, $\rho = \mu/\lambda$, the ratio of the shadow values on the time and money constraints, respectively. While in Becker's work and much subsequent work, a joint labor supply decision implies that the shadow value of non-work time is the wage, this link needn't hold, for a variety of reasons.[viii] Our consumer choice problem intentionally does not include a labor supply decision, to emphasize that the value of non-work time in our model is not linked to the labor supply and wage. Instead, it is estimated jointly with other decisions in the model.

If the shadow value of time ρ(**p**,**t**,**s**,R,M,T) is a function of a person's characteristics and other exogenous factors, but not of the prices and budgets they face, i.e., ρ = ρ(**s**, R), then indirect utility is a function of full prices and full budgets, see Larson and Shaikh (2001). That is, indirect utility can be written as

$$V(\mathbf{p},\mathbf{t},s,R,M,T) = V(p_1+\rho t_1,\ldots,p_I+\rho t_I,\mathbf{s},R,M+\rho T)$$

as in the standard Becker model, even though the shadow value of time is a latent function rather than an observable economic variable such as the wage. It is helpful to exploit this structure of two-constraint choice models in formulating the joint model of money contributions, time contributions, and the shadow value of time.

Our analysis focuses on peoples' responses to the recycling options they face, some of which involve money payments to procure higher levels of a public good, others of which involve time contributions for the same purpose. In keeping with the linear-in-parameters form of indirect utility used to motivate discrete choice models, and the full prices/budgets considerations above, we specify conditional indirect utility as

(2) $$V = \beta_M(p_1+\rho t_1) + \alpha^M + \alpha^T + \beta_R R$$

recognizing that the other arguments of indirect utility (M, T, $p_2+\rho t_2,\ldots, p_n+\rho t_n$) will drop out of utility differences when comparisons between recycling alternatives are made. The parameter α^M represents the private benefit of money giving, e.g., warm glow or social approval, arising from one's money contributions (G^M); α^T analogously is the private benefit of giving time for the public good (G^T). Part of this private benefit of giving time (α^M/ρ) is the time-denominated warm glow from giving; the remainder (α^T - α^M/ρ) is the effect of *how* payment for the public good is made on utility. Put another way, the private benefit α^T of contributing time for an increase in R may differ from the time-equivalent of warm glow from giving money (α^M/ρ) because contributing time is a more, or less, preferred currency for paying for R.

When a person is asked to choose between paying \$p for ΔR and not having ΔR, the utility difference is

(3) $$\Delta V^p = \beta_M p_1 + \alpha^M + \beta \Delta R.$$

Instead, if asked whether she would be willing to spend t hours in order to help provide R, the utility difference would be

(4) $$\Delta V^t = \beta_M \rho t_1 + \alpha^T + \beta \Delta R.$$

Thus, in comparing the difference in utility from paying \$p instead of t hours in order to acquire R is

(5) $$\Delta V = \beta_M (p_1 - \rho t_1) + \alpha^M - \alpha^T.$$

Statistical Models for WTP Money and WTP Time

We analyze the response data generated by the CV experiment within a direct WTP estimation framework. Since it is the same public good improvement that is being valued in both scenarios, we represent the total benefits by two parameters $\alpha_{PG(M)}$ and $\alpha_{PG(T)}$

respectively, which in general can be made functions of covariates. The first parameter corresponds to $(\alpha^M + \beta\Delta R_R)/ \beta_M$ in equation (3) and the second parameter corresponds to $(\alpha^T + \beta\Delta R_R)/ \beta_M\rho$ in equation (4). The stochastic representations of WTPM and WTPT are as follows

(6) $$WTPM = \alpha_{PG(M)} + \sigma_M\varepsilon_M$$

(7) $$WTPT = \alpha_{PG(T)} + \sigma_T\varepsilon_T$$

where ε_M and ε_T are assumed to have standard normal distributions (potentially correlated). The probability of a "yes" response to a specific money bid (MBID) or time bid (TBID) is given by

(8) $$Pr[\text{Yes to MBID}] = Pr[(\alpha_{PG(M)} - MBID) / \sigma_M > - \varepsilon_M]$$

(9) $$Pr[\text{Yes to TBID}] = Pr[(\alpha_{PG(T)} - TBID) / \sigma_T > - \varepsilon_T].$$

If the benefits are the same across the two scenarios, such that WTPM = ρ·WTPT, where ρ is the latent money value of time, then the probabilities (8) and (9) can be estimated by imposing the restriction $\alpha_{PG(T)} = \rho^{-1}\cdot\alpha_{PG(T)}$ (see Larson et al.). However, the hypothesis in this paper is that this may not be true due to differences in private-good benefits arising from contributing to the public good improvement in money versus time. Formally, define ΔWTPM ≡ WTPM - ρ·WTPT (which can be non-zero) as the difference in the WTP money in the first scenario and the monetary equivalent of WTP time in the second scenario. Based on equations (6) and (7) the stochastic representation of this benefit difference is

(10) $$\Delta WTPM = (\alpha_{PG(M)} - \rho\cdot\alpha_{PG(T)}) + (\sigma_M\varepsilon_M - \rho\cdot\sigma_T\varepsilon_T).$$

By comparing response patterns across the two CV questions, we can express the probability that an individual prefer to obtain the public good improvement while paying MBID over obtaining the public good improvement while paying TBID as

(11) $\Pr[\Delta WTPM > 0] = \Pr[\text{Yes to MBID, No to TBID}] =$

$$\Pr[(\alpha_{PG(M)}-\rho\cdot\alpha_{PG(T)}-MBID+\rho\cdot TBID)/(\sigma^2_M+\rho^2\sigma^2_T-2Cov(\varepsilon_M,\varepsilon_T))^{1/2} > -\varepsilon^*_{PG}],$$

where, ε^*_{PG} is distributed standard normal.[ix]

4. ESTIMATION RESULTS

In this section we present some preliminary results. First, we show estimation results for WTP money based on equations (6) and (8). Second, we present WTP time results, based on equations (7) and (9). For these estimations, we utilize the fact that we have two responses per participant to each CV question and implement bivariate probit models, following the suggestion by Cameron and Quiggin (1994).[x] Finally, we illustrate joint estimation of WTPM, WTPT, and the money value of time, based on probability statements (8), (9) and (11). These results are inefficient, in the sense that we have ignored potential error correlations.

Results for WTP Money

Table 3 shows results for four different models. Model 1 is an intercept-only model, which gives mean WTPM directly. Model 2 includes socioeconomic covariates, Model 3 includes attitude covariates, and model 4 has both socioeconomic and attitude covariates. All models are statistically significant overall. Model 1 is statistically different from a “coin-flip” model at a 0.01 level of significance. Model 2 and 3 are improvements over model 1, with likelihood ratio tests rejecting the model 1 restriction at a 99% level of confidence. Likewise, model 4 is superior to models 2 and 3 by appropriate likelihood ratio tests.

The mean willingness to pay is similar across estimations. The results suggest that households are willing to pay on average about $4 per household per month to achieve an increase in the community-wide from 40% to 60%. Among the socioeconomic covariates, WTPM appears to be decreasing in the participant’s age and increasing in the level of education. Members of households that earn more that $150,000 have a higher WTPM all else equal.

Several of the attitude factors are statistically significant (please see Appendix 2 for factor interpretations). The "green consumer" factor (F1), "general altruism" factor (F2), and the "concern for earth and living things" factor (F3) enter positively into the estimated WTPM function. The "technological optimist" factor (F4) enters negatively. These results are consistent with the idea that community recycling is seen as a public good and that contributing towards and increase in the recycling rate through money financing of additional recycling programs has a private-good benefit dimension. Interestingly, the "external motivations" factor (F6) has a negative sign. This suggests that those who see recycling as a way to save money, or express they engage in recycling to appear responsible to others have smaller WTPM in this policy scenario. However, it should be noted that this covariate is only significant in model 3, not in model 4.

Results for WTP Time

Table 4 provides estimation results for WTPT. Again, four different specifications are reported. Each model is statistically significant overall and the preferred model in terms of best statistical fit is model 4. Mean WTPT is similar across the models at about 2.2 hours per household per month. The estimated WTPT function is decreasing in age and increasing in level of education, though the age covariate is not significant in model 2.

As for WTPM above, the "green consumer" factor (F1) is statistically significant determinant of WTPT and the "technological optimist" (F4) enters negatively. In contrast to above, the "general altruism" factor (F2) is only significant in model 3 (not in model 4) and the "concern for earth and living things" is insignificant. The "private technological constraints" factor (F5), which was insignificant in the WTPM models, enters negatively into the estimated WTPT function. Overall, these estimation results are consistent with the notion that there are both public- and private-good dimensions associated with this policy scenario as well.

Joint Estimation of WTPM, WTPT, and the Money Value of Time

Taken at face value, the above results suggest an average money value of time of about $1.80 per hour ($4/2.2). This assumes that contributing money and time have the same associated total benefits such that when time is valued appropriately, WTPM is equal to the monetary value of WTPT. In table 5 we present results for joint estimation of WTPM, WTPT, and the money value of time (MVT). As can be seen, the WTPM and WTPT estimates (AlphaM and AlphaT) are similar to before: Mean WTPM is about $4 per household per month and mean WTPT is about 2.3 per household per month. However, the joint estimate of MVT is about $5.6.[xi] This implies that the money-equivalent of WTPT is about $13 ($5.6·2.3) per household per month, in the time payment scenario. Hence, it appears that consumers value the ability to pay or contribute towards achieving the 60% recycling goals much more highly when they are permitted to be directly involved through their time effort.

5. CONCLUDING REMARKS

This paper has explored the private-public good dimensions of paying for public good improvements. Specifically, it analyzed consumers' willingness to pay money (WTPM) and willingness to pay time (WTPT) for an increase in their community's recycling rate from 40% to 60%. We explored the hypothesis that two contribution scenarios, one requiring money payment and one requiring time payment, may have different private-good implications, hence resulting in divergence between the two WTP measures, even when time is appropriately shadow-valued (and the public good improvement is held constant). Across several empirical model specifications, estimated mean WTPM was about $4 and estimated WTPT was about 2.2 hours (both on per household per month basis). Joint estimation of WTPM, WTPT, and the money value of time suggested stronger preferences, and hence higher WTP in money-equivalence, for reaching the recycling goal through direct consumer involvement. This result may have important implications for how public agencies design and promote public recycling programs. Moreover, this aspect of public good provisions may have similar implications for how other public goods are best produced.

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APPENDIX 1: TABLES AND FIGURES

Table 1: Distribution of CV Responses for Money and Time WTP Bids

Initial $ Bids	Observations	NN	NY	YN	YY
2	62	26%	26%	26%	23%
4	92	23%	29%	43%	4%
8	99	30%	40%	20%	9%
10	110	33%	46%	13%	8%
12	109	35%	50%	11%	4%
15	34	44%	38%	12%	6%
	506	**31%**	**40%**	**21%**	**8%**
Initial Time Bids	**Observation**	**NN**	**NY**	**YN**	**YY**
5	94	9%	5%	27%	60%
10	87	6%	15%	32%	47%
15	104	8%	10%	38%	45%
20	114	15%	22%	33%	30%
30	107	14%	34%	29%	23%
	506	**10%**	**18%**	**32%**	**40%**

Table 2: Attitude Questions

ID	Attitude Statements (Strongly Disagree = 1, Neutral = 3, Strongly Agree = 5)	Mean	St. Dev.	Min	Max
A1	The *ecological crisis* facing humankind has been greatly exaggerated.	1.96	1.20	1	5
A2	Plants and animals have as much right as humans to exist.	3.89	1.18	1	5
A3	Human resourcefulness will insure that we do not make the earth unlivable.	3.32	1.30	1	5
A4	The earth has very limited room and resources.	4.07	1.11	1	5
A5	The balance of nature is strong enough to cope with the impacts of industrial nations.	1.83	1.02	1	5
A6	Contributions to community organizations rarely improve the lives of others.	2.02	1.08	1	5
A7	The individual alone is responsible for his or her well-being in life.	2.77	1.29	1	5
A8	It is my ethical duty to help other people when they are unable to help themselves.	3.90	0.91	1	5
A9	My responsibility is to provide only for my family and myself.	2.14	1.11	1	5
A10	My personal actions can greatly improve the well-being of people I don't know.	4.03	0.94	1	5
I recycle because..					
A11	..It saves me money since I am able to use a smaller garbage container.	3.11	1.35	1	5
A12	..I want to be a socially responsible person.	4.43	0.78	1	5
A13	..I want other people to think of me as a responsible person.	3.15	1.18	1	5
A14	..Regardless of what other people might think, I feel it is my ethical duty.	4.34	0.86	1	5
A15	..I find it to be a pleasant activity in itself, compared to other 'everyday' chores.	3.01	1.06	1	5
A16	..It is a good way to contribute to preserving environmental quality.	4.50	0.70	1	5
A17	..It is a good way to contribute to conserving scarce natural resources.	4.49	0.74	1	5
A18	..I feel it is expected of me.	3.59	1.08	1	5
I hesitate to recycle because..					
A19	..I don't think recycling benefits me personally.	1.73	0.93	1	5
A20	..I don't think recycling provides benefits to the community/society.	1.46	0.81	1	5
A21	..It is often difficult to know what items can or cannot be recycled.	2.79	1.21	1	5
A22	..It takes too much time.	1.83	0.97	1	5
A23	..I don't have enough recyclables.	1.62	0.90	1	5
A24	..It is difficult to find room/space for temporarily storing recyclable items.	2.23	1.25	1	5
A25	..Other people are not doing enough.	2.97	1.23	1	5

Table 3: Estimation Results for Willingness to Pay Money (WTPM)

BIVARIATE PROBIT MODELS OF WILLINGNESS TO PAY MONEY												
	MODEL 1			MODEL 2			MODEL 3			MODEL 4		
Variable	Coef.	St. Er.	P-Value	Coef.	St. Er.	P-Value	Coef.	St. Er.	P-Value	Coef.	St. Er.	P-Value
ALPHA_M:												
Constant	3.7819	0.7643	0.0000	-1.4619	4.2314	0.3649	3.6257	0.7724	0.0000	1.8330	4.3297	0.3360
Gend	.	.	.	0.9482	0.9598	0.1616	.	.	.	1.9779	1.0226	0.0265
Age/10	.	.	.	-1.3066	0.3651	0.0002	.	.	.	-1.1639	0.3738	0.0009
Edu/10	.	.	.	6.1870	1.8646	0.0005	.	.	.	3.4911	1.9591	0.0374
DHInc	.	.	.	2.6114	1.4595	0.0368	.	.	.	3.2344	1.5032	0.0157
HHSIZE	.	.	.	-0.2619	0.4068	0.2599	.	.	.	-0.1154	0.4060	0.3881
OWN	.	.	.	1.7975	1.5881	0.1289	.	.	.	0.9356	1.6019	0.2796
F1	.	.	.	.	.	.	0.7767	0.4988	0.0597	0.9393	0.4804	0.0253
F2	.	.	.	.	.	.	2.2103	0.5969	0.0001	1.9322	0.5757	0.0004
F3	.	.	.	.	.	.	1.9325	0.5950	0.0006	1.7244	0.5515	0.0009
F4	.	.	.	.	.	.	-1.4390	0.5218	0.0029	-0.9970	0.5033	0.0238
F5	.	.	.	.	.	.	-0.2888	0.4955	0.2800	-0.3629	0.4703	0.2201
F6	.	.	.	.	.	.	-0.9833	0.5048	0.0257	-0.4057	0.4749	0.1965
F7	.	.	.	.	.	.	-0.4287	0.4993	0.1952	-0.1626	0.4841	0.3685
sigma	12.0272	1.9489	0.0000	10.8094	1.6082	0.0000	11.7990	1.9426	0.0000	11.0359	1.6709	0.0000
rhostar*	0.2179	0.2617	0.2025	0.2195	0.2669	0.2054	0.0634	0.2645	0.4053	0.0390	0.2515	0.4384
LL @ Covergence	-1.2491			-1.2080			-1.2013			-1.1732		
Equally Likely LL	-1.3863			-1.3863			-1.3863			-1.3863		
NOBS	506			506			506			506		
WTPM (Mean)**	$3.78			$4.04			$3.71			$3.87		
WTPM (St. Dev.)				$3.08			$3.56			$4.30		

* Estimated as follows: rho = (1-exp(-rhostar))/(1+exp(-rhostar))
** Calculated for each individual at parameter point estimates and averaged.

Table 4: Estimation Results for Willingness to Pay Time (WTPT)

BIVARIATE PROBIT MODELS OF WILLINGNESS TO PAY TIME												
	MODEL 1			MODEL 2			MODEL 3			MODEL 4		
Variable	Coef.	St. Er.	P-Value	Coef.	St. Er.	P-Value	Coef.	St. Er.	P-Value	Coef.	St. Er.	P-Value
ALPHA_T:												
Constant	2.2417	0.1132	0.0000	0.9563	0.7650	0.1056	2.2102	0.1012	0.0000	1.5518	0.7467	0.0188
Gend	.	.	.	-0.2052	0.1773	0.1236	.	.	.	-0.1551	0.1707	0.1818
Age/10	.	.	.	-0.0789	0.0625	0.1034	.	.	.	-0.1000	0.0608	0.0499
Edu/10	.	.	.	0.8427	0.3299	0.0053	.	.	.	0.5358	0.3343	0.0545
DHInc	.	.	.	-0.2670	0.2688	0.1603	.	.	.	-0.1769	0.2529	0.2421
HHSIZE	.	.	.	0.0880	0.0752	0.1209	.	.	.	0.0936	0.0709	0.0934
OWN	.	.	.	0.2115	0.2885	0.2318	.	.	.	0.1470	0.2736	0.2955
F1	.	.	.	.	.	.	0.2010	0.0809	0.0065	0.1926	0.0803	0.0082
F2	.	.	.	.	.	.	0.1632	0.0867	0.0299	0.0972	0.0895	0.1386
F3	.	.	.	.	.	.	0.0606	0.0847	0.2373	0.0560	0.0838	0.2520
F4	.	.	.	.	.	.	-0.1672	0.0814	0.0200	-0.1124	0.0835	0.0892
F5	.	.	.	.	.	.	-0.4387	0.0850	0.0000	-0.4391	0.0834	0.0000
F6	.	.	.	.	.	.	-0.0334	0.0794	0.3368	0.0131	0.0821	0.4367
F7	.	.	.	.	.	.	0.0111	0.0846	0.4479	0.0561	0.0834	0.2509
sigma	1.9015	0.1899	0.0000	1.8259	0.1742	0.0000	1.7308	0.1594	0.0000	1.6911	0.1517	0.0000
rhostar	1.2342	0.2933	0.0000	1.2569	0.2954	0.0000	1.2483	0.3003	0.0000	1.2484	0.2995	0.0000
LL @ Covergence	-1.2115			-1.1982			-1.1699			-1.1602		
Equally Likely LL	-1.3863			-1.3863			-1.3863			-1.3863		
NOBS	506			506			506			506		
WTPT (Mean)**	$2.24			$2.22			$2.21			$2.20		
WTPT (St. Dev.)				$0.32			$0.54			$0.59		

* Estimated as follows: rho = (1-exp(-rhostar))/(1+exp(-rhostar))
** Calculated for each individual at parameter point estimates and averaged.

Table 5: Joint Estimation of WTPM, WTPT, and the Money Value of Time (MVT)

Variable	Coef.	St. Er.	P-Value
AlphaM	4.0353	0.3373	0.0000
AlphaT	2.3078	0.0699	0.0000
MVT	5.6267	0.4972	0.0000
SigmaM	8.0653	0.4328	0.0000
SigmaT	1.6017	0.0834	0.0000
Equally Likely LL			-0.69315
LL @ Convergence:			-0.46848

APPENDIX 2: FACTOR ANALYSIS FOR ATTITUDE DATA

The attitude data presented in table 2 were analyzed via factor analysis is SPSS Student Version 12.0. The 25 attitudinal measures reduced to seven factors, using the principal component extraction method with VARIMAX rotation. Based on relative loading (loading coefficient > |0.5|), we give these seven factors the following labels:

F1: “Green Consumer”
F2: “General Altruism”
F3: “New Environmental Paradigm: Concern for Earth and Living Things”
F4: “New Environmental Paradigm: Technological Optimist”
F5: “Private Technological Constraints”
F6: “Externally Motivated”
F7: “Free Rider Awareness (Negative Reciprocity)”

Paraphrasing the original attitude statements, one interpretation is as follows. 1) Someone who scored high on F1 sees recycling as a way to contribute to resource conservation and improving environmental quality, to be socially responsible, and to satisfy an intrinsic ethical duty. 2) Someone who scored high on F2 sees contributing to public causes as effective and part of one’s personal responsibility. 3) Someone who scored high on F3 thinks the earth has limited resources and that plants and animals have rights, alongside humans. 4) Someone who scored high on F4 thinks the ecological crisis is exaggerated, that nature is resilient, and that human creativity can resolve whatever environmental problems might arise. 5) Someone who scored high one F5 sees recycling as too time consuming, requiring too much storage, difficult due to lack of information, and not privately beneficial due to insufficient recyclable materials. 6) Someone who scored high on F6 sees recycling as a way to save money and appear responsible in the eyes of others, something that others expects one to do. 7) Someone who scored high on F7 perceives a lack of effort by other people.

ENDNOTES

[i] See Nyborg and Rege (2003) for an overview of various public good contribution models.

[ii] This idea is related to whether individuals' values of time bear a relation to the wage. Consider a two-constraint (money and time) model of consumer choice, in which an individual is paid per hour worked and is free to choose how many hours to spend in employment. Such a model implies that the value of time is equal to the wage rate only when work is utility-neutral. If work yield utility (or disutility), the value of time is less (greater) than the wage.

[iii] The basic model does not account for a time budget. Nevertheless, to the extent that agents are motivated in their behavior by the suggested motivation, it would seem likely that paying for the public good in money versus time is distinctly different: contributing one's effort directly may be regarded as more genuine (less selfish) hence generating greater warm-glow benefits. In the model of Brekke et al. agents choose effort towards production of a public good, and are better off, ceteris paribus, the closer their actual effort is to a "morally ideal effort". The model does not have built into it a substitution possibility between contributing money versus time towards the public good, which may makes sense in cases of morally motivated behavior: it seems reasonable that contributing directly is a more productive way of satisfying such preferences. Indeed, paying money might even be entirely unproductive since it may not be possible to pay oneself free from a perceived ethical responsibility.

[iv] For the same reason, socially contingent preferences could result in agents disfavoring new projects that rely on time payments. For example, consider a policy intended to increase the level of a specific public good. If one's time contribution is more visible to others than money contributions, then new programs that rely on time contributions can lead to tightened social expectations and stronger social enforcement. All else equal, this reduces individual welfare. In the empirical part of this paper, we explore both the possibility that money as a payment currency is preferred over time as payment currency, as well as the converse.

[v] At one extreme, all household waste could be collected as single-stream, taken to a central waste sorting facility, where recycle materials are sorted out by paid workers. At the other extreme, consumers could sort all recyclable materials in their home, and subsequently take them to recycling centers.

[vi] The survey had one section asking revealed preference-stated behavior questions, two stated preference sections – one asking CV questions and one containing a choice experiment, in addition to two sections soliciting socioeconomic characteristics and attitudes respectively. There were a total of 30 different questionnaire versions used, half asking CV questions about current recycling programs and half containing the CV experiment for new programs. Aside from the choice of survey mode, the CV experiment was designed and implemented in accordance with the recommendation of Arrow et al. (1993). Further details can be found in Bagby et al., (2005) and Bagby et al. (2004).

[vii] Activities needn't have both time and money prices (as, for example, with walks in the park or automatic bill payments), but they must have at least one.

[viii] Among these is the fact that work time may itself be a source of utility or disutility, or that the consumer is unable to smoothly adjust her amounts of work and non-work time consumed, see Bockstael et al. (1987).

[ix] Specifically, if a person said "yes" to money bid k and "no" to time bid j we can say that obtaining the public good improvement while paying $MBID_K$ is "revealed preferred to obtaining the public good improvement at $TBID_j$.

[x] Here, we focus on restricted specifications where both mean willingness to pay and the scale of willingness to pay is the same across the pair of responses.

[xi] In extension of this research, we will specify the latent value of time as a function of observable characteristics, hence, permitting the value of time to vary across individuals.