Matching Grants and Public Goods: A Closed-Ended Contingent Valuation Experiment

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ABSTRACT

Matching grants are commonly used to influence the bundle of public goods provided by governments. We design a contingent valuation experiment to determine the value individuals place on improved recreational facilities under a matching grant proposal. The experiment provides an opportunity to examine preferences given the public good exists in an active and well-defined market, and the valuation experiment is perceived as meaningful to public policy. We estimate a mean willingness-to-pay for park improvements of $8.30, far less than the implied tax increase of $21 provided by local politicians opposed to the project, but nearly double the actual tax increase for the average property owner.

1. INTRODUCTION

Intergovernmental grants have for a long time been a means for federal and state governments to influence expenditures and the mix of services provided by local governments. Categorical matching grants are generally the most effective way to cause local governments to increase the output of a particular service, because the matching requirement effectively reduces the price of the target good relative to other publicly provided goods and relative to the prices of private goods [see Guttman (1978) and Cornes and Sandler (1986)]. The matching grant produces both an income effect and a substitution effect inducing the community to spend more on the target good. The offer of a categorical matching grant by a private benefactor should produce essentially the same result as a similar intergovernmental grant.

This paper examines citizen reaction to the offer, by a private benefactor, of a categorical matching grant to a small town in North Carolina. The proposed grant requires a 100 percent local government match for the improvement of a recreational park facility. Since the local government is already spending approximately 10 percent of its $10 million budget on recreation, the opportunity exists for funding the match by shifting recreational expenditures rather than increasing taxes. The situation is complicated somewhat by the fact that, as a condition of the grant, the donor will participate with the town government in the establishment of an independent authority to control the park development and operation. The grant proposal, including the question of who will control the expenditures, has generated considerable controversy in the community.

We develop a contingent valuation experiment to examine whether willingness-to-pay for the park improvements under this matching grant proposal can provide useful information to guide local officials in similar situations.[1] The literature on contingent valuation has argued that nonmarket valuation is substantially improved if two conditions are met: (1) the good exists in an active and well-defined market; and (2) the valuation experiment is perceived as being meaningful to policy

decisions [Cummings et al. (1986)]. In this paper we examine the value of improved recreation facilities given both conditions are fulfilled. First, there is a high degree of community awareness of the good and the question of improvements had been publicly debated over a six-month period. Second, the experiment is meaningful to respondents since it is public knowledge that all monies collected through higher taxes would be matched dollar-for-dollar by a closed-ended matching grant up to $75,000 per year. Respondents were asked to consider various alternatives including total rejection of the proposal, reducing other expenditures in order to pay for the project, raising taxes to cover the town's cost, and some combination of reducing other recreational expenditures and raising taxes.

Contingent valuation allows us to estimate the amount by which taxpayers would be willing to increase their tax bill to pay for the project. Using a closed-ended elicitation mechanism (i.e., dichotomous yes/no response to alternative willingness-to-pay amounts), the overall mean willingness-to-pay (WTP) has a point estimate of $8.30 and is statistically different from zero at a 1 percent significance level. The mean WTP of those in favor of the proposal (34.3 percent) is likewise statistically significant at just over $18. But, for those opposed to the proposal, the estimated mean WTP drops to under $2 and is not statistically different from zero, even at a 25 percent significance level.

The paper proceeds as follows. Section 2 develops the model of willingness-to-pay for improved parks. Section 3 describes the site background and design of the contingent valuation experiment. Section 4 presents summary statistics, estimation procedures, and parameter estimates. Finally, Section 5 contains our concluding comments.

2. THE CLOSED-ENDED CVM MODEL

Consider a representative household who selects a level of private consumption X to maximize utility U(X,Q), where Q is an exogenous level of a nonmarket commodity, subject to a budget constraint. Formally, the consumer is assumed to solve

$$(1) \qquad V(M,Q,P) = \underset{X}{\text{Max}} \ \{U(X,Q) \mid M \geq PX, \ Q \text{ preassigned}\}$$

where V(M,Q,P) denotes the household's indirect utility function, M is Beckerian full income and P is the unit price of X. Following the random utility model in Hanemann (1984) and Johansson *et al.* (1989), it is assumed that V(·) is unknown with

$$(2) \qquad V(M,Q,P) = Z(M,Q,P) + \varepsilon$$

where $E[\varepsilon] = 0$, and E is the expectations operator.

While the indirect utility function is unobserved, the discrete (or closed-ended) contingent valuation method relies upon the consumer's willingness to accept or reject changes in the vector (M,Q,P) in order to identify the structure of preferences. Consider the household's response to a change in the preassigned level of Q from Q^0 to Q^1, with an accompanying reduction in personal income of A.[2] The consumer will accept this change if it leads to an increase in utility; that is,

$$(3) \qquad I(Q^0,Q^1;A) = \begin{cases} 1 & Z(M - A,Q^1,P) + \varepsilon_1 \geq Z(M,Q^0,P) + \varepsilon_0 \\ 0 & \text{otherwise} \end{cases}$$

where $I(Q^0,Q^1;A) = 1$ denotes acceptance of the offer and ε_0 and ε_1 are random variables. Discrete choice econometric estimation procedures can be used to estimate the parameters of Z using observations on $I(Q^0,Q^1;A)$.[3] An individual household's willingness-to-pay for the change in Q from Q^0 to Q^1 is defined as the equivalent surplus solving:[4]

$$(4) \quad V(M\text{-}WTP,Q^1,P) = V(M,Q^0,P) \ .$$

Substituting in equation (2) and rearranging, WTP is implicitly defined by:

$$(5) \quad [Z(M - WTP,Q^1,P) - Z(M,Q^0,P)] + \eta = 0$$

where $\eta \equiv \varepsilon_1 - \varepsilon_0$. Following Johansson and Kriström (1989), an explicit equation for WTP is then found using a linear approximation of Z around (Q^0,M,P), with

$$(6) \qquad Z(M - WTP,Q^1,P) - Z(M,Q^0,P) \approx \alpha - \beta WTP$$

where $\alpha \equiv \partial Z(M,Q^0,P)/\partial Q$ and $\beta \equiv \partial Z(M,Q^0,P)/\partial M$. Both α and β are anticipated to have a positive sign.[5] Substituting (6) into equation (5) and solving for WTP yields:

$$(7) \qquad WTP = \alpha/\beta + \eta/\beta$$

The mean WTP for the proposed change in the provision of the nonmarket good is then given by[6]

$$(8) \qquad E(WTP) = \alpha/\beta$$

3. THE MATCHING-GRANTS EXPERIMENT

The site selected for this experiment provides a real life situation with many aspects of a controlled experiment. The site, in the city of Lenoir, North Carolina, is a 34-acre park with a small pond encircled by a paved walking trail. The remainder of the park is undeveloped. A prominent family in the city proposed a 100 percent matching grant of $375,000 ($75,000 per year for five years) to provide further improvements in the park. Thus, for a tax expenditure of $375,000 the citizens of Lenoir could obtain park improvements of $750,000. The park would then be operated by a six-member independent authority, with three members appointed by the city and three members appointed by the family. Since North Carolina law does not allow local officials to make such expenditure commitments that obligate future boards, the City Council voted to request special authorization from the state legislature to allow the expenditure.

The proposed expenditure of tax funds and the issue of who would control the park generated considerable controversy, including the demand that the City Council conduct a special referendum to

obtain citizen input. In the absence of such a referendum, a survey was conducted to determine citizen preferences concerning whether the city should commit $375,000 to this project. A random sample of 481 households was selected from city of Lenoir property tax listings and then matched with household names and street address in the Lenoir telephone book. Comparability between tax listings and telephone numbers was assured. The survey was designed so that the margin of error would be ± 5 percent with a 95 percent confidence interval given 300 valid responses. Telephone interviews were successfully conducted with 301 households, or a 63 percent response rate. Nonresponse was generally a result of individuals not answering their phones.[7]

Data were collected on respondents' knowledge of and use of city recreational facilities, as well as familiarity with the matching grant proposal. Almost two-thirds of the respondents were familiar with the matching grant proposal.[8] Before being asked specifically about willingness-to-pay for park improvements, respondents were given an opportunity to consider whether they favored the matching grant proposal and whether they would favor the use of tax revenues to pay the city's portion. Each respondent was initially told that his or her information would help the city develop the plan to improve the park. Following Crocker and Shogren (1991), this was done for three reasons: (a) to provide the common frame and editing whose importance Tversky and Kahneman (1981) emphasize; (b) to inform the respondent about the value of careful, nonstrategic value formulation [Hoehn and Randall (1987)]; and (c) to increase the likelihood that the respondent would apply his or her experience of the park to planned improvements. Lenoir is a small town (estimated 1987 population 14,621), and the issue had received extensive coverage in the local press. Also, a large proportion of the population were knowledgeable about the park in its current state. Therefore, our analysis was aided by the respondents' familiarity with the commodity in question.[9] In addition, citizens were presented with an ex ante, but nonhypothetical choice; that is, would they be willing to pay additional taxes to provide the city's share of the cost of park improvements?

By their nature, categorical matching grants are distortionary to the extent that they cause a change in the mix of public sector expenditures. Although we have no information on general distortionary effects in this case, our survey results indicate a strong preference for funding the project by reallocating expenditures in the city's recreation budget. Thirty-one percent of the respondents favored a reallocation of expenditures to cover the entire obligation for the city's part of the project and an additional 29 percent favored some combination of a tax increase and reallocation of expenditures. Further verification of the power of categorical grants to affect the distribution of public expenditures is provided by the willingness-to-pay analysis.

The procedure used in this study to elicit willingness-to-pay is a variation on the traditional "closed-ended" survey approach. In the standard closed-ended question, the respondent is asked whether or not he or she would accept or pay a single specified amount (A). This dichotomous choice approach has been used successfully by Bishop et al. (1983), Loomis (1987), Cameron and James (1987) and Bowker and Stoll (1988), among others. The advantage of the closed-ended format is that it approximates the situation that most consumers face in usual market transactions, "take-it or leave-it" at the posted price. In addition, the closed-ended approach avoids asking the respondent to provide a "true" value of the good. However, the single closed-ended question limits the information revealed about an individual's willingness-to-pay, indicating only whether it is above or below a specified bid level (A). This in turn reduces the precision with which the analyst can measure and characterize the distribution of WTP in the target population.

The approach used in this analysis increases the information available from *each* respondent by posing an increasing series of closed-ended questions. In general, this "one-way n-chotomous" choice approach begins by offering the individual a compensation level A_1. If the individual responds "no", the questioning ends and the individual's maximum WTP is presumed to lie below A_1. If they answer "yes", a higher compensation level ($A_2 > A_1$) is offered. Again, if they answer "no", the questioning

ends (with $A_1 \leq WTP < A_2$), while a "yes" response leads to a new and even higher bid. The process continues until either the respondent has refused a bid or the highest bid (A_n) has been accepted (with $WTP \geq A_n$). This format retains the basic dichotomous choice structure, while allowing the analyst to further categorize each individual's WTP.[10,11]

In the current application, three bid levels were used, with A_1 = \$15, A_2 = \$30, and A_3= \$45.00.[12] This range of alternatives included the amount that the majority of homeowners would expect to pay if the funds were raised through a six cent increase in the tax rate. The exact question used in the survey is included as an appendix.

4. RESULTS

4.1 Summary Statistics

The series of discrete choice questions in the survey enables us to classify respondents into one of four mutually exclusive willingness-to-pay categories:

- Category 1: $I(Q^0,Q^1,15) = 0$, $I(Q^0,Q^1,30) = 0$, and $I(Q^0,Q^1,45) = 0$ (i.e., $WTP < 15$);
- Category 2: $I(Q^0,Q^1,15) = 1$, $I(Q^0,Q^1,30) = 0$, and $I(Q^0,Q^1,45) = 0$ (i.e., $15 \leq WTP < 30$);
- Category 3: $I(Q^0,Q^1,15) = 1$, $I(Q^0,Q^1,30) = 1$, and $I(Q^0,Q^1,45) = 0$ (i.e., $30 \leq WTP < 45$); and
- Category 4: $I(Q^0,Q^1,15) = 1$, $I(Q^0,Q^1,30) = 1$, and $I(Q^0,Q^1,45) = 1$ (i.e., $WTP \geq 45$) .

Letting $D_{ji} = 1$ if the respondent i belongs to WTP category j (= 0 otherwise), Table 1 indicates that majority (66 percent) of the survey respondents belong to the first category, unwilling to pay even \$15 for the proposed park improvement. Approximately 27 percent were willing to pay \$15 for the change, but not \$30, thus falling into category 2. Of the remaining respondents, 5 percent fell into category 3 and 2 percent into category 4.

Table 1 also presents the definitions and summary statistics for the additional explanatory variables obtained from the questionnaire. Over 60 percent of the respondents used some part of the city's recreational facilities including the park. About 63 percent of the respondents were familiar

with the matching grants proposal, with nearly 34 percent in favor of the proposal.[13] The average age of the respondents was nearly 54 years, with an average of 2.6 household members.

The property tax listing of the city provides additional indirect information on the wealth of the survey respondents, including their declared personal property (primarily the valuation of automobiles owned by the respondent) and real property valuations. Willingness-to-pay for the park improvement may vary by consumer wealth. The average tax valuation on real property in the sample equaled $29,300, while personal property averaged $6,250.

4.2 Estimation Procedures and Parameter Estimates

Knowledge of survey respondent i's location in the four WTP categories allows us to identify the range of values that η_i can take. Specifically, using the definitions of D_{ji} and equation (3) we have:

$$
(9)\quad
\begin{cases}
\eta_i < Z(M_i,Q^0,P) - Z(M_i\text{-}15,Q^1,P) & \text{for } D_{1i} = 1 \\
Z(M_i,Q^0,P) - Z(M_i\text{-}15,Q^1,P) \le \eta_i < Z(M_i,Q^0,P) - Z(M_i\text{-}30,Q^1,P) & \text{for } D_{2i} = 1 \\
Z(M_i,Q^0,P) - Z(M_i\text{-}30,Q^1,P) \le \eta_i < Z(M_i,Q^0,P) - Z(M_i\text{-}45,Q^1,P) & \text{for } D_{3i} = 1 \\
Z(M_i,Q^0,P) - Z(M_i\text{-}45,Q^1,P) \le \eta_i & \text{for } D_{4i} = 1
\end{cases}
$$

Substituting equation (6) into (9) yields:

$$
(10)\quad
\begin{cases}
\eta_i < -\alpha + \beta(15) & \text{for } D_{1i} = 1 \\
-\alpha + \beta(15) \le \eta_i < -\alpha + \beta(30) & \text{for } D_{2i} = 1 \\
-\alpha + \beta(30) \le \eta_i < -\alpha + \beta(45) & \text{for } D_{3i} = 1 \\
-\alpha + \beta(45) \le \eta_i & \text{for } D_{4i} = 1
\end{cases}
$$

Assuming that η is normally distributed, the corresponding log-likelihood function is a generalization of the traditional probit specification, with

$$(11) \quad \mathcal{L} = \sum_i \{ D_{1i}\Phi[-\alpha + \beta(15)] + D_{2i}\{\Phi[-\alpha + \beta(30)] - \Phi[-\alpha + \beta(15)]\} + D_{3i}\{\Phi[-\alpha + \beta(45)] - \Phi[-\alpha + \beta(30)]\} + D_{4i}\{1 - \Phi[-\alpha + \beta(15)]\}\}$$

where $\Phi(x)$ is the cumulative distribution function of a standard normal variate.

Table 2 presents the results of estimating the model in equation (11). Column 1 lists the parameter estimates for the model using all 290 respondents in the sample.[14] As expected, the marginal utility of income is positive (i.e., $\beta > 0$) and statistically different from zero at a 1 percent level. The implied mean willingness-to-pay for the overall sample (i.e., α/β) is likewise positive at $8.30 and statistically significant.[15]

In addition to these overall results, the basic model was also estimated for several alternative sub-samples of the survey population: (a) columns 2 and 3 group the sample according to their familiarity with the proposal; (b) columns 4 and 5 establish sub-samples classified by the household's use of city recreational facilities; and (c) columns 6 and 7 divide the sample into subgroups according to their opinion (favor or oppose) on the proposal to improve the park. In each case, the marginal utility of income term (β) remains positive and statistically significant, with considerable similarity across the various population subgroups. However, substantial differences arise when comparing the mean WTP estimates. For example, those who favor the proposal were found to have a substantially higher mean WTP (at $18.07) than those opposed to the proposal. The opposed group's mean WTP of $1.75 is not statistically different from zero at a 10 percent significance level. A likelihood ratio test of the equality of the parameters in the two samples, reported in the last row of Table 2 is rejected at a 1 percent significance level.

A similar difference arises when comparing those who use recreational facilities to those who do not, with those using the facilities having a significantly higher mean WTP. Finally, comparing those familiar with the proposal to those unfamiliar with the proposal, the differences are not as stark. Both groups have statistically significant mean WTPs at the 5 percent level. While those unfamiliar

with the proposal do have a larger mean WTP, the test of equality between the two sub-samples is rejected only at a 10 percent level, but not at the 5 percent significance level.

The tests reported in Table 2 indicate the importance of respondent characteristics on their mean WTP for the park improvement. To test the impact of these characteristics jointly, the basic model is expanded, allowing the intercept term to be a function of respondent characteristics. Specifically, α in equation (7) is replaced by $[\alpha + \sum_{k=1}^{N} \gamma_k(Z_{ki} - \bar{Z}_k)]$, where Z_{ki} denotes individual i's value for the k^{th} characteristic (k = USEANY, FAMILIAR, FAVOR, AGE, MEMBERS, REAL, and PERS) and $\bar{Z}_k$ denotes the mean value of Z_{ki} in the sample.[16] Table 3 presents the resulting parameter estimates, for the overall sample and the individual subsamples.[17]

The addition of the conditioning variables to the model has little impact on the basic results. As in Table 2, the marginal utility of income is consistently positive and statistically different from zero at a 1 percent level. The mean WTP in the overall sample has changed little, from $8.30 in the basic model to $8.25 in the expanded model. The relative size and significance level for the mean WTP estimates in population subsamples are also consistent with those in the basic model.

Turning to the γ_i parameter estimates, the coefficients generally have the expected signs.[18] In particular, respondents who use recreational facilities in the town have a higher probability of a "yes" response to the willingness-to-pay offer (i.e., $\gamma_{USEANY} > 0$) than those who do not use recreational facilities. This corresponding parameter (γ_{USEANY}) is statistically significant for all subsets of respondents except for those familiar with the proposal and those opposed to the proposal. Similarly, those in favor of the proposal have a consistently higher probability of responding "yes" to a willingness-to-pay offer. Familiarity with the proposal appears to have little additional impact on the individual's decision making process, with $\gamma_{FAMILIAR}$ being consistently insignificant in the various sub-samples.

Of the remaining respondent characteristics included in the model, age (AGE) and personal property wealth (PERS) emerge as important factors. Older respondents are found to be less inclined

to accept the proposed park improvements, with γ_{AGE} being consistently negative and statistically significant for the overall population and many of the subsamples. Wealthier households, as indirectly measured by their personal property holdings, were more likely to accept a given willingness-to-pay proposal. The remaining customer characteristics, household size (MEMBERS) and real property wealth (REAL), are generally insignificant in their impact on WTP and response to the proposed park improvement.

Finally, for each division of the sample, Table 3 reports a likelihood ratio test of the equality of the parameters in the two subsamples. As in the basic model, this restriction is rejected at a 10 percent significance level for all three sample divisions, and at higher significance levels for the "use/not-use" and "oppose/favor" divisions.

5. CONCLUSIONS

Local governments are typically faced with a difficult task in trying to measure how citizens value particular projects. Listening to vocal advocates and vocal opponents of a project can often be confusing and may not provide much information about the extent to which the average voter values the project. Likewise, a voter referendum on the project, in addition to being expensive, will probably reflect the views of only those voters who are strongly opposed or strongly in favor of the project, leaving the decision makers relatively ignorant of the value that the average voter attaches to the project. As an alternative, we have designed a contingent valuation experiment to verify whether surveys can be expected to generate valid information to guide policy decisions by local governments. Our results suggest that well-designed experiments in an active market may provide useful information to help guide expenditure and tax decisions by local policy makers considering specific public sector projects.

Finally, note that the efficacy of contingent valuation depends on information, both internally provided by the experimenters and externally promoted by parties interested in the provision of the

public good. While researchers can control internal information through policy design institutions and payment mechanisms, control of external information is another matter altogether. One question raised by this experiment is the extent to which local leaders may influence the outcome of a referendum by releasing information to the public. The mayor was quoted three times in the *Lenoir News-Topic*, October 19, 20, and 24, 1988, as stating that completing the park project (i.e., raising $75,000 per year for five years) would require a six-cent per $100 of valuation increase in the city property tax rate. Applying the rate increase to the estimated average property valuation for all respondents in our sample households results in an expected increase of $21.29 in the average household tax bill, far in excess of the estimated average mean willingness-to-pay.

But the actual increase required to fully fund a $75,000 per year increase in the city's budget is generally less than the estimated mean willingness-to-pay. With total property valuation of over $614 million, the city would need an increase of 1.22 cents per $100 of valuation to fund its obligation for the park project. This increase would amount to $4.33 for the average household in our sample. If a referendum had been held, the implied six-cent tax rate increase may have resulted in its defeat, even though most households indicated a WTP in excess of the actual increase necessary to fund the city's obligation. Given most respondents were aware of the publicly projected cost which is five times greater than the actual cost, it suggests an intriguing avenue for future research on the political economy of external information and contingent valuation.

Table 1. Descriptive Statistics of the Sample

Variable	Description	Mean	Std. Dev.
D_{1i}	= 1 if respondent i falls into WTP category 1 (i.e., WTP < 15) = 0 otherwise	.655	.476
D_{2i}	= 1 if respondent i falls into WTP category 2 (i.e., 15 ≤ WTP < 30) = 0 otherwise	.268	.444
D_{3i}	= 1 if respondent i falls into WTP category 3 (i.e., 30 ≤ WTP < 45) = 0 otherwise	.055	.229
D_{4i}	= 1 if respondent i falls into WTP category 4 (i.e., WTP ≥ 45) = 0 otherwise	.021	.143
$USEANY_i$	= 1 if respondent i uses city's recreational facilities = 0 if respondent i does not use city's recreational facilities	0.614	.478
$FAMILIAR_i$	= 1 if respondent i is familiar with proposal = 0 if respondent i is not familiar with proposal	0.631	.483
$FAVOR_i$	= 1 if respondent i is in favor of proposal = 0 if respondent i is in favor of proposal	0.351	.488
AGE_i	Age of respondent i	53.9	15.3
$MEMBERS_i$	Number of members in household i	2.57	1.27
$REAL_i$	Tax valuation on real property ($1,000's) for respondent i	29.3	35.2
$PERS_i$	Tax valuation on personal property ($1,000's) for respondent i	6.25	6.41

Table 2. Estimated Parameters - Basic Model
(Standard Errors in Parentheses)

Parameter	Sample						
	All Respondents	Familiar with Proposal	Not Familiar with Proposal	Do Not Use Recreational Facilities	Use Recreational Facilities	Oppose Proposal	Favor Proposal
α	.509** (.122)	.275 (.50)	.900** (.217)	.130 (.317)	.809** (.149)	.109 (.171)	1.31** (.202)
β	.061** (.005)	.054** (.006)	.073** (.009)	.070** (.017)	.063** (.005)	.062** (.007)	.073** (.007)
N	290	183	107	112	178	188	102
Mean WTP	8.30** (1.51)	5.07* (2.37)	12.24** (1.81)	1.86 (4.13)	12.68** (1.59)	1.75 (2.58)	18.07** (1.62)
χ^2 (2 d.f.)	---	5.70†		25.00**		82.94**	

†Statistically significant at the 10 percent level.
*Statistically significant at the 5 percent level.
** Statistically significant at the 1 percent level.

Table 3. Estimated Parameters - Expanded Model

Parameter	Sample						
	All Respondents	Familiar with Proposal	Not Familiar with Proposal	Do Not Use Facilities	Use Facilities	Oppose Proposal	Favor Proposal
α	.646** (.143)	.398** (.174)	1.17** (0.28)	.248 (.472)	-.963** (.170)	.146 (.197)	1.53** (0.22)
β	.078** (.006)	.069** (.008)	.101** (.013)	.092** (.029)	.077** (.006)	.073** (.099)	.086** (.009)
γ_{USEANY}	.565** (.200)	.316 (.270)	1.29** (0.36)			.457 (.284)	.887** (.322)
$\gamma_{FAMILIAR}$	-.091 (.170)			.308 (.351)	.230 (.204)	-.303 (.264)	.239 (.271)
γ_{FAVOR}	.992** (.166)	1.08** (0.22)	.562† (.305)	.926* (.368)	.981** (.206)		
γ_{AGE}	-.017* (.007)	-.022* (.009)	-.011 (.010)	-.016 (.013)	-.017† (.008)	-.011 (.009)	-.018† (.010)
$\gamma_{MEMBERS}$	.048 (.059)	.010 (.073)	.024 (.136)	-.066 (.198)	.069 (.063)	.159† (.092)	-.086 (.083)
γ_{PERS}	.044** (.014)	.033† (.017)	.071** (.019)	.086** (.031)	.034* (.016)	.051* (.019)	.037† (.021)
γ_{REAL}	.004 (.003)	-.002 (.003)	.010† (.005)	-.002 (.009)	-.003 (.003)	-.004 (.005)	.004 (.004)
Mean WTP	8.25** (1.38)	5.75** (2.05)	11.49** (1.75)	2.69 (4.33)	12.52** (1.51)	2.00 (2.50)	17.93** (1.52)
χ^2 (8 d.f.)	---	14.64†		17.29*		45.01**	

† Statistically significant at a 10 percent level * Statistically significant at a 5 percent level** Statistically significant at a 1 percent level

ENDNOTES

1. See Cummings *et al.* (1986), or Mitchell and Carson (1989) for a detailed discussion on the use of contingent valuation for valuing nonmarket goods.

2. In the current application, the change in the public good (i.e., the park improvement) is conditional on the matching grant. The role of the matching grant in the CVM offer is to enhance the perceived probability that Q will in fact be increased from Q^0 to Q^1, thus reducing the potential hypothetical bias in the questionnaire responses.

3. See, for example, Maddala (1983) for a description of these techniques.

4. See Hanemann (1984) for a detailed discussion of the derivation of WTP in this context.

5. Note that, since $\beta = \partial Z/\partial M = \partial V/\partial M$, this parameter can be interpreted as a measure of the marginal utility of income. See Kriström (1990, p. 67).

6. Johansson and Kriström (1988) note that in the simple linear model the mean and median willingness-to-pay estimation coincide; in non-linear models, however, they do not. However, Johansson *et al.* (1989) conclude that the mean measure is the preferred measure to employ in cost-benefit analysis because the mean is consistent with Pareto efficiency, although the mean is not robust toward tail behavior [see Kriström (1990), Chapter 4 for details].

7. The rule for the survey was that each telephone number was tried three times: twice on the same evening and once the next evening.

8. Respondents who were unfamiliar with the proposal were read a statement outlining the terms of the proposal.

9. The experiment designed followed Cummings et al.'s (1986) recommended reference operating conditions (ROC) to help facilitate accurate value formation by respondents. The ROCs are: 1) respondents must understand and be familiar with the commodity to be valued; 2) respondents must have had or be allowed to obtain prior choice experience at valuing the consumption levels of the commodity; 3) there must be little uncertainty to avoid distortions from respondents using heuristic decision devices; and 4) willingness-to-pay bids should be elicited, not willingness to accept.

10. The choice of n must reflect the tradeoff between refining the WTP categories and losing the survey respondent's interest and/or attention. Investigating this tradeoff is beyond the scope of the current paper.

11. This procedure represents a limited form of the traditional bidding method and is similar in spirit to the "double-bounded" dichotomous choice method developed in Hanemann (1985) and Hanemann *et al.* (1991). The double-bounded approach differs in that it uses only three bid levels and the bidding process begins with the middle bid (our A_2). Depending upon their response to this bid, the household is offered either the lower bid (A_1) or the higher bid (A_3). Both methods attempt to further categorize each survey respondent's willingness-to-pay. For n=3, the only difference lies in the order in which this information is extracted. In the notation of Hanemann *et al.* (1991), A_1 corresponds to B_i^d, A_2 corresponds to B_i, and A_3 corresponds to B_i^u. The authors are indebted to two anonymous referees for

pointing out this similar methodology.

12. Our contingent valuation design is similar to the model of a policy referendum with individual costs for voters [See Hoehn and Randall (1987, p. 237) or Mitchell and Carson (1989, p. 149)]. But in contrast to a pure one vote referendum, we provided each respondent the opportunity to "vote" on three increasing cost levels. Our objective was to obtain a more detailed estimate of the respondent's likelihood function than would be provided with the one-vote referendum. Therefore, we did not explicitly state that the project would be implemented if a plurality of the respondents approved it.

13. Respondents who were opposed to this park improvement totalled 34.3 percent of the sample, with 31.3 percent of the respondents being neither in favor of nor opposed to the improvement.

14. Data from 11 of the survey respondents could not be used due to incomplete responses.

15. As indicated in equation (8), the mean WTP is a nonlinear function of the estimated parameters. The standard errors reported in Tables 2 and 3 for the mean WTP are based upon first order Taylor series approximations. Simulations procedures, described in Krinsky and Robb (1986,1990) and Kling (1991), were also used to compute these standard errors. For each model, 25,000 iterations were used. In all but one case, the simulated standard errors were within 5 percent of Taylor series approximations. The one exception occurs for the "do not use" subsample model, where the simulated standard errors for WTP were significantly larger (7.43 for Table 2 and 259 for Table 3). However, the differences between the two methods do not alter the basic conclusions of the analysis.

16. Deleting the means from each characteristic allows us to interpret α as the intercept associated with the average customer in the sample.

17. The sample sizes for each regression are the same as in the basic model.

18. The likelihood ratio test was conducted for each sample subgroup, testing the hypothesis that $\gamma_i = 0$ for all i. This hypothesis was rejected at a 1 percent significance level for each subsample and for the overall population.

APPENDIX: ONE-WAY TRICHOTOMOUS WILLINGNESS-TO-PAY QUESTION

"9. Suppose taxes were raised to support this improvement, how much would you be willing to pay per year in increased property taxes?

$15	<IF YES, GO TO $30 AMOUNT>	9(A)	YES_____ (1)
	<IF NO, GO TO QUESTION 10>		NO_____ (2)
$30	<IF YES, GO TO $45 AMOUNT>	9(B)	YES_____ (1)
	<IF NO, GO TO QUESTION 10>		NO_____ (2)
$45	<GO TO QUESTION 10>	9(C)	YES_____ (1)
			NO_____ (2)"

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