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The Private Provision of Public Goods: Tests of a Provision Point Mechanism for Funding Green Power Programs (Revised)

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Abstract

This paper utilizes laboratory and field experiments to test the use of a provision point mechanism to finance renewable energy programs, commonly known as green pricing programs. The mechanism solicits discrete contributions towards a provision threshold using a money-back guarantee for insufficient contributions and extended benefits for contributions in excess of the threshold. In the laboratory, a single shot environment with a large group of potential participants produces contribution levels that are found to be partially demand revealing as well as motivated by altruism or warm-glow. Also, in contrast to most green pricing programs, relatively high participation is found in the field. Field participation is shown to be responsive to program goals and the provision point mechanism.

JEL Classifications: H41 Public Goods, C92 Design of Experiments, Laboratory, Group Behavior, C93 Design of Experiments, Field Experiments

Key Words: public goods, provision point, green pricing, renewable energy, experiments, free riding, altruism.

1. Introduction

Despite market research that has uniformly predicted substantial customer interest in paying higher electric power rates to support renewable energy generation and environmental programs, experience with green pricing indicates that participation levels have fallen well short of predictions (Byrnes, Jones, and Goodman, 1999; Byrnes *et al.*, 1995; Farhar and Houston, 1996).[3] Three explanations for this discrepancy seem possible. First, market research studies of hypothetical predicted program support may have been upwardly biased. Second, most utility customers may have been unaware of such programs, in spite of attempts by electric utilities to inform them using bill inserts, mailed brochures and advertising. Note that market research, by necessarily informing customers of a potential green pricing program, inherently creates perfect awareness concerning the program in the sample population. As a result, forecasts derived from market research depend critically on assumptions about customer awareness which in turn depend on the effectiveness of marketing. A third possibility is that actual customer participation in green programs may have been lowered by free-riding, because participation has commonly been structured as a charitable voluntary contribution. From the viewpoint of economics, the possibility of free riding in actual participation is of primary concern.

Provision point mechanisms have been shown to have desirable theoretical properties (Bagnoli and Lipman, 1989) and to substantially reduce free riding in experimental tests when compared to the voluntary contribution mechanism (VCM) (Isaac, Schmidtz, and Walker, 1989; Suleiman and Rapoport, 1992; Dawes *et. al.*, 1986). There have also been anecdotal reports of provision points being used to successfully resolve actual free riding problems (Bagnoli and McKee, 1991). In addition, innovations of the provision point mechanism, such as a money-back

guarantee and rebate rules, have been found to increase contributions and provision frequency in experiments (Isaac, Schmidtz, and Walker, 1989; Rapoport and Eshed-Levy, 1989; Cadsby and Maynes, 1999; Marks and Croson, 1998). Motivated in part by this literature, as well as by recent utility industry interest in voluntarily funded green power programs (see Holt and Associates' Green Pricing and Green Power newsletters), this paper reports the results of a paired laboratory and field application of a provision point mechanism using a green pricing program implemented by Niagara Mohawk Power Corporation. Both theoretical and experimental economists, not to mention financially constrained government agents, have long hoped for a practical mechanism for the private funding of public goods (see for example Groves and Ledyard, 1977; Smith, 1980). This research is designed to test whether this goal can be furthered by use of a provision point mechanism.

In Section 2 we provide the specifics of the Niagara Mohawk Power Corporation *GreenChoice*™ program and the provision point mechanism used. The third section replicates the Niagara Mohawk Power Corporation mechanism in an induced value laboratory experiment under the assumption that, if the mechanism fails to reduce free riding in the laboratory, then it will fail to reduce free riding in the field. The hypothesis that this provision point mechanism reduces free riding is tested by comparing individual and group contributions relative to induced values.[4] A random utility model is used to predict the probability of participation as a function of induced value. Free riding is not entirely eliminated. However, the probability of participation, at a fixed price, is positively correlated with induced value. This suggests that the mechanism is at least partially demand revealing. Also, what appears to be either altruism or warm-glow compensates for the negative provision consequences of free riding. In Section 4, we

describe the field experiment and estimate a random utility model of actual program participation, but now on the basis of individual characteristics. Complete awareness is assured in the sample population, by phoning customers, describing the *GreenChoice*™ program, and allowing them to sign-up or decline the offering on the phone. Thus, eliminating unawareness as a reason for non-participation. A problem which tends to plague participation rates in voluntary programs. The sign-up rates observed in the field experiment are much higher than those of previous green-pricing programs using voluntary contributions. In addition, the program objectives and funding mechanism features are found to be important determinants of participation. Finally, Section 5 presents our conclusions concerning the use of provision points for the private provision of public goods and discusses remaining issues.

2. The Niagara Mohawk Power Corporation GreenChoice™ Program

The Niagara Mohawk Power Corporation (NMPC), a public utility in New York State, sought to accelerate the development of renewable energy sources of electricity by offering its customers "green rates" as proposed by Moskovitz (1992, 1993). Moskovitz argued that customers would voluntarily sign up and agree to pay higher electricity rates if the additional money collected were earmarked to support renewable energy projects or other environmental activities. Economists were quick to point out that the selection of such a rate by a customer would be a charitable contribution since the mechanism proposed by Moskovitz would allow free riding (see Schulze, 1994).[5] NMPC in turn developed the *GreenChoice*™ program, using a modified contribution mechanism in an attempt to reduce free-riding incentives.

The mechanism adopted by NMPC employed three features that have been tested in the experimental literature. First, it contained a *provision point* of $864,000 to be raised through customer contributions. This minimum level of funding would provide for the construction of a renewable energy facility to serve 1,200 homes, and for the planting of 50,000 trees in the NMPC service area. The addition of a provision point adds multiple, efficient Nash equilibria at the threshold, and has been shown to increase individual pledges towards the provision of public goods. Unfortunately, if the threshold is not met, a provision point results in a complete loss of efficiency, unlike the VCM (Isaac, Schmidtz and Walker, 1989). A provision point is a practical tool for stating the minimum requirements for supply of a good, giving a degree of accountability for provision, increasing a user's stake in provision, and decreasing free riding expectations (Bagnoli and Lipman, 1989). Also, the provision point inherently provides greater product definition which market researchers advocate to achieve concreteness so that participants clearly understand what they will receive in return for their contributions.[6]

Second, NMPC's funding mechanism offered a *money-back guarantee* to customers which assured them that, if contributions failed to reach the threshold, all money collected would be refunded. The money-back guarantee provided insurance to potential contributors against the risk of losing their contributions should the provision point not be met. In experiments where subjects can contribute all or none of their endowment to a public good results have been mixed as to the usefulness of the money-back guarantee. Dawes et al. (1986) find that the money-back guarantee has no significant effect on the proportion of subjects contributing to the public good. However, Rapoport and Eshed-Levy (1989) find evidence to support the use of the money-back guarantee in greater frequency of provision and greater frequency of individual contribution.[7] In

an environment where subjects can contribute any amount, Isaac, Schmidtz, and Walker (1989) report that the guarantee significantly increases contributions; and, more recently, Cadsby and Maynes (1999) find greater contributions and provision frequency with both binary and continuous contributions.

Third, the mechanism offered the possibility of *extended benefits*. Money collected in excess of the provision point would be used to extend benefits, or increase the production of the public good. Here, excess contributions were to be used to increase the number of homes served with renewable energy or to plant more trees. Extending benefits beyond the provision point does not modify individual incentives in theory, but simply creates a VCM environment beyond the threshold (Marks and Croson, 1998). Marks and Croson refer to this use of excess contributions as a "utilization rebate" rule. In evaluating alternative rebate rules for provision point mechanisms experimentally, Marks and Croson found that offering extended benefits, via a utilization rebate rule, has the greatest positive effect upon average group contributions.

Also, the one-shot or single round nature of these experiments differs from the usual experimental analysis which utilizes multiple rounds. A few authors have examined one-shot mechanisms because they believe they are more accurate representations of actual public goods decisions (Alston and Nowell, 1996; Rondeau, Schulze, and Poe, 1999). However, in multiple round experiments, early round contributions have been significantly greater than in later rounds. Greater early round contributions has been attributed to strategizing behavior and confusion due to a lack of experience (Isaac, McCue, and Plott, 1985; Bagnoli and McKee, 1991; Palfrey and Prisbrey, 1997). Cadsby and Maynes (1999) claim that the observed deterioration over rounds is a special case where incentives for achieving the efficient equilibrium (i.e. threshold) are low.

One theoretically undesirable feature of NMPC's mechanism was that, to legally qualify as a rate offering, the program could only be offered at a posted price. Thus, customers could only make the binary decision of choosing to contribute a fixed amount of $6.00 per month or not to participate at all. A posted price is undesirable because it does not allow households to self-select a monthly fee that better represents their preferences for the program.[8] Note that, despite the posted price, the mechanism does not reduce to a referendum, because only individuals who choose to participate pay.

Interestingly, the only other green pricing programs to use a provision point mechanism of which we are aware were fully subscribed. Traverse City Light and Power completed a windmill project using a funding mechanism similar to NMPC's, except that it did not offer extended benefits. Instead, participation was curtailed after the program's provision point was successfully reached with 200 customers at an estimated residential premium of $7.58 per month (23 percent of the average residential bill) (Holt and Associates, 1996a). The City of Fort Collins also used a series of provision points to solicit funds for up to three separate wind turbines. (Holt and Associates, 1996b). By early 1997, enough customers had agreed to pay an estimated average premium of $10 per month to exceed the minimum provision point established to fund two turbines (Clements-Grote, 1997; Holt and Associates, 1997).

In comparing these offerings with the *GreenChoice*™ program it is important to note that there are substantial differences in magnitude and scope. Both the Fort Collins and Traverse City programs were small, locally based programs able to focus on well-defined projects. Hence, broad awareness was easily achieved. In contrast, the *GreenChoice*™ program, although intended to be offered to only the Buffalo area, for legal reasons, had to be offered to NMPC's

entire service area. NMPC's service area covers well over half the area of New York State. Consequently, marketing became a major impediment to the program.

Unfortunately, though the *GreenChoice*™ program was formally approved by the New York Public Service Commission, it was ultimately suspended before completion because NMPC developed serious financial difficulties and was unable to promote customer awareness of the program. Most of the planned marketing campaign, including a substantial advertising budget and tree plantings at public schools throughout the service territory, was canceled. The program was only briefly mentioned in a bill insert and described in a brochure sent to about three percent of NMPC's customers. However, we were able to conduct a field experiment with NMPC customers before the program was terminated.

3. Laboratory Experiment

3.1. Experimental Design

The field experiment in the next section yields information about how the provision point mechanism adopted by NMPC might perform with respect to participation rate when full consumer awareness exists, and whether or not there might be consistency between individuals' stated preferences and program involvement. Nevertheless, without direct knowledge of individual valuations, we have no way of knowing how successful the mechanism is in eliminating free riding or if the mechanism is demand revealing. A laboratory experiment was thus designed to test this funding mechanism in an environment where program values could be induced. If this mechanism fails to reduce free riding in the laboratory, then we would expect it to fail to reduce free riding in the field. Often, in laboratory experiments with small groups,

subjects just miss the provision point by slight under-contribution, a behavior termed "cheap riding" (Bagnoli and Lipman, 1989; Cadsby and Maynes, 1999; Rondeau, Schulze and Poe, 1999). In contrast, as discussed below, there is some evidence that large groups reveal some portion of demand when faced with a single shot provision point mechanism.

Note, in addition to the free-riding Nash equilibrium of the voluntary contributions mechanism, the provision point creates theoretical Nash equilibria where costs are just covered by contributions. While, the money-back guarantee creates numerous Nash equilibria below the provision threshold where, given the decisions of others, an individual decision is inconsequential and does not lead to provision. In this money-back guarantee setting, the provision equilibria Pareto dominate the non-provision equilibria. Finally, extended benefits in the form of a utilization rebate can create efficient outcomes where contributions exceed the provision point level of contributions. These outcomes may or may not be Nash equilibria.[9]

This section describes a classroom laboratory experiment specifically designed to evaluate the demand revelation properties of the NMPC mechanism. In addition to designing a laboratory mechanism paralleling the NMPC program, this experiment deviated from the body of previous public goods research in three important ways. First, in contrast to most public goods experiments which have relied on "small groups" of less than 10 individuals, this experiment involved 100 participants. In part, this "large group" approach was adopted so as to more closely reflect the NMPC field conditions. The decision to use large groups was also based on experimental findings of Isaac, Walker and Williams (1994) that individuals in groups of 40 and 100 contributed significantly more to a VCM public good experiment than did subjects in small groups (n=4 and 10). Experimental results reported in Rondeau, Schulze, and Poe (1999) further

suggest that a provision point mechanism (using a proportional rebate) produces contribution levels consistent with aggregate demand revelation in a large group setting (n=45), while the same mechanism results in under-revelation for small groups (n=6). A result potentially confounded by altruism or warm glow. A second manner in which the analysis of this experiment contrasts with previous public goods research is that it models individual contribution decisions in a provision point setting with a random utility framework. Others have explored various aspects of individual behavior, but few within the random utility framework and with respect to provision point mechanims.[10] Lastly, while this research does not test the effect of a rebate, to our knowledge, this laboratory experiment is the first to use a rebate with a provision point mechanism and money-back guarantee in a discrete contributions setting (see Marks and Croson, 1998, for an explicit evaluation of rebate effects in a continuous contributions setting).

The experiment was performed in an undergraduate economics principles class without the involvement of the instructor. The students had experience in market experiments but not in public goods experiments. An experiment "in decision-making" was introduced at the beginning of a regularly scheduled class, and printed instructions were distributed after students were seated. Students were instructed to copy the subject number written on their instructions onto a blank envelope which they were also provided. Students read their instructions (see sample in Appendix A), after which a brief oral summary was given. Questions were answered privately by monitors. Students were then allowed approximately ten minutes to make a decision which shall be described shortly. They then sealed their instructions and decision responses in their envelopes. Follow-up questions were distributed immediately afterward, and subject numbers

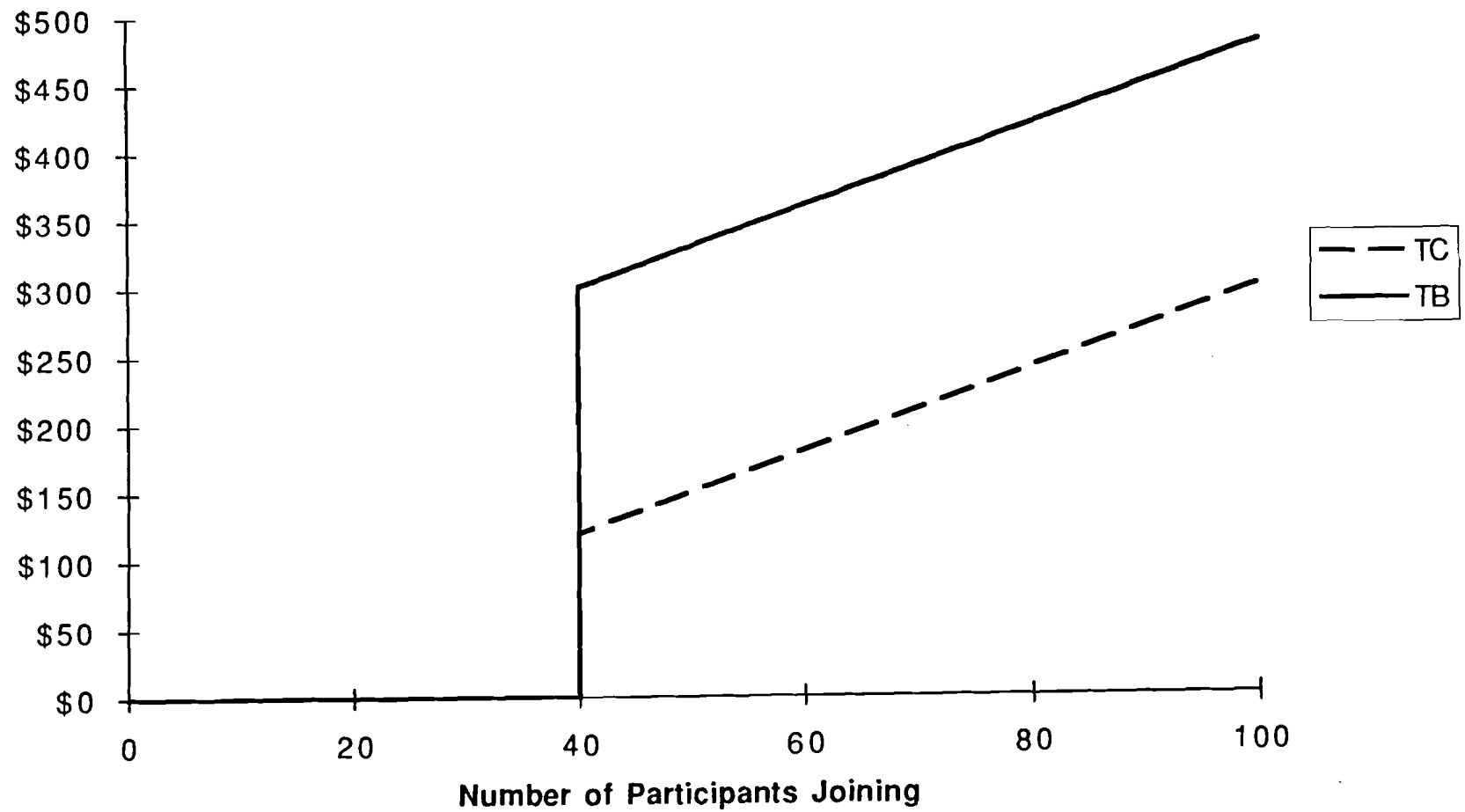
were copied from the envelopes to follow-up questionnaires. All materials were collected after the follow-up forms were completed. The sealed envelopes ensured that students could not alter their decisions after answering the follow-up questions. Students were not allowed to communicate during the experiment.

The nature of the decision was as follows. Each participant was given a starting balance of $5 and the opportunity to join a group investment program for a one-time fixed fee of $3. Before a participant decided whether or not to join, the group investment program and payoff calculations were described. The group investment program would yield a return only if 40% or more of the participants joined. Each participant was informed that they would receive their pre-specified "return" if this provision point was met or exceeded regardless of whether or not they had joined. Each subject was randomly assigned a return without replacement from a set of 100 values, consisting of twenty of each of the values in the set {$0.50, $1.75, $3.00, $4.25, $5.50}. Hence, twenty subjects were assigned to each "return". Subjects were told their own return but were not made aware of the returns of other subjects, i.e. the distribution of other subjects was not known. These returns were the induced values, designed to reflect the heterogeneous values NMPC customers hold for the *GreenChoice*™ program. If more than 40% joined, each participant also received a fixed "bonus payment" of 3¢ for each participant that joined in excess of the provision point. If fewer than 40% joined, the group investment program was canceled and all contributions were refunded. The bonus payment was public information. Only the induced value was private information. Marks and Croson (1999) show that this environment of incomplete information, about the distribution and sum of values for the public good, does not undermine the provision point mechanism, providing equivalent levels of success with respect to

provision, Nash equilibria played, and levels of contributions produced under complete information.

The fixed participation fee was selected in conjunction with the induced values to insure that 1) the average payoff would equal or slightly exceed the participation fee and that 2) the total group benefits would equal or exceed twice the total group cost if the provision point were met or exceeded. Total costs (TC) and benefits (TB) are illustrated in Figure 1 for a group of 100 participants. This sample size was chosen to correspond with a large group setting, and to enable statistical analysis. The investment return values were chosen to be symmetric around the fixed fee and, based on pre-test results, to vary sufficiently to identify any relationship between induced value and participation for this sample size. The bonus mechanism was incorporated to reflect NMPC's offer of extended benefits financed by funds in excess of the provision point. The bonus amount of 3¢ was chosen so as to equate the aggregate group marginal benefits and marginal costs, as shown in Figure 1. Hence, excess contributions were symmetrically re-distributed to the entire group—contributors and non-contributors—such that there were no efficiency gains and no Nash equilibria above the provision threshold.[11] The instructions were worded so as to avoid intrinsic value associated with program context; we sought to isolate the effectiveness of the mechanism alone in reducing free-riding behavior. Though this removed an important aspect of realism associated with NMPC's *GreenChoice*™ program, it allows for an unbiased evaluation of the program's financing mechanism. Lastly, follow-up questions were posed to collect additional information on the participation decision (see Appendix B). The questions attempted to measure expectations, as well as self interest and altruistic or warm-glow factors that might exogenously enter into participation decisions.

Figure 1: Total Costs and Benefits



In summary, this experiment was designed to test the "naive" hypothesis that the provision point mechanism used by NMPC induces demand-revealing behavior under laboratory conditions. That is, we test if subjects with induced values above a posted price contribute and those with induced values below the posted price do not. If the mechanism is perfectly demand revealing, 50% of the 100 subjects should choose to participate in the program at a cost of $3, given the distribution of induced values: the 40% with induced values less than $3 should not sign up, the 40% with induced values exceeding $3 should sign up, and the 20% with the $3 induced value should be indifferent between joining and not joining. If, like the voluntary contribution mechanism, the provision point features fail to induce participation to levels approximating demand revelation, then we would expect that the results of the field experiment underestimate the "true" demand for the program. However, like others, altruism or warm-glow may confound the interpretation of the results.

4.2 Experimental Laboratory Results and Analysis

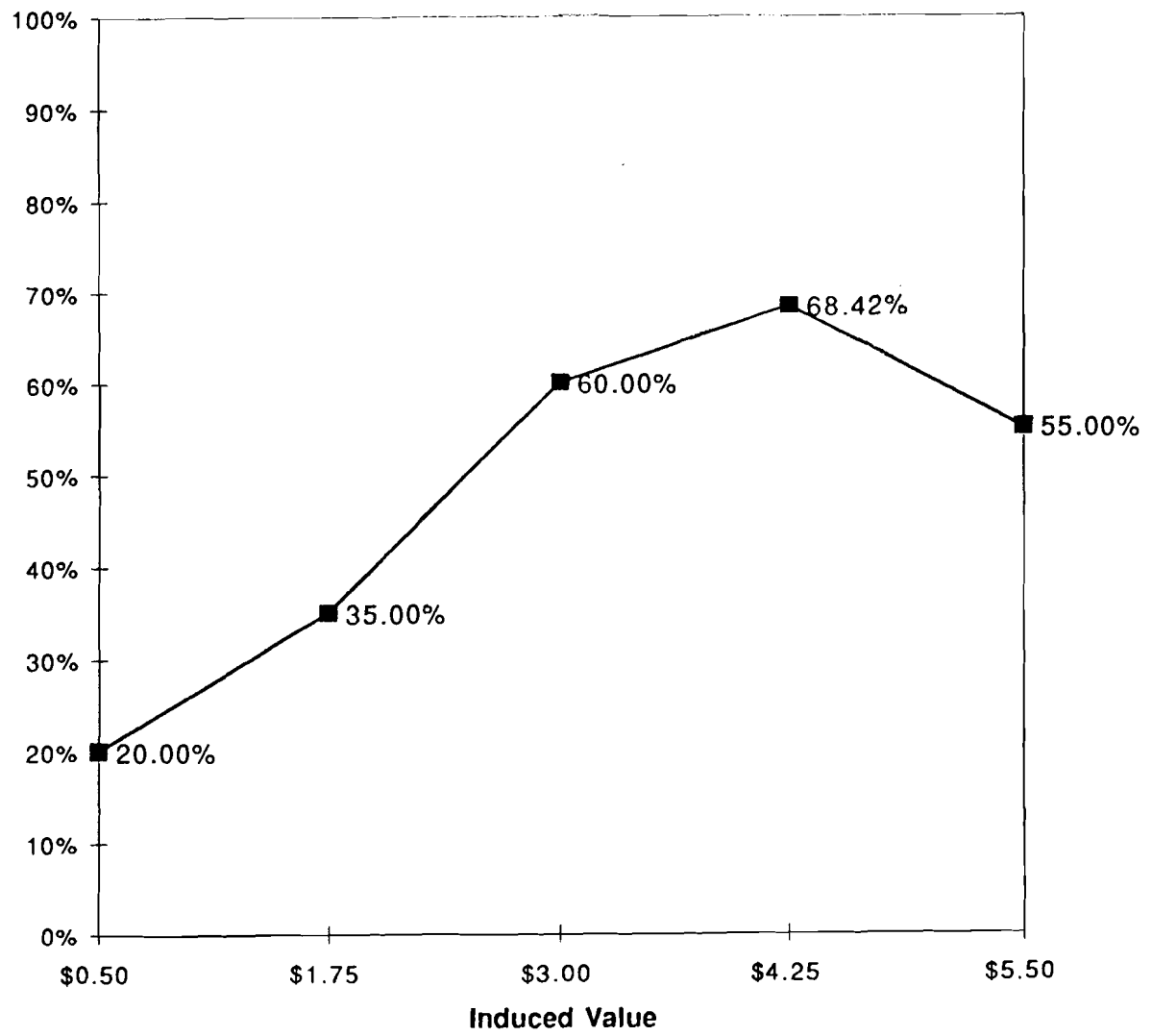
At the aggregate level, 47 subjects chose to join the program and pay the $3 fee. As a result, the public good was funded and the efficient equilibrium was realized. Clearly, this participation level closely approximates the 50 percent participation rate expected under our naive hypothesis. Thus, given this sample design, the mechanism produces aggregate participation consistent with demand revelation, subject to our caveats concerning altruism and warm-glow. In reaching this conclusion, it is interesting to note that in the week following the experiment described here, the same students participated in a standard computerized VCM public goods experiment.[12] Contributions in the first round of this multiple round experiment

were 41 percent of the maximum possible *payoff* (where the payoff corresponds to the induced value in the provision point experiment).[13] This proportion is consistent with the 40 to 60 percent contribution levels observed by the VCM literature (Davis and Holt, 1993). Thus, the subjects participating in this experiment appear typical, in that they exhibit substantial free-riding when in a single or initial period VCM environment.

However, inspection of participation levels across induced values does not support the naïve hypothesis. As shown in Figure 2, participation is generally responsive to increases in induced return, but the response proportions do not exhibit a sharp step at $3. Subjects with negative net values are contributing, in violation of their dominant Nash strategy not to do so, and subjects with positive net values are free riding. Therefore, we find a combination of over- and under-revelation of demand respectively. Subjects with induced values less than the posted price may well be contributing because they have an additional willingness to pay from altruism or warm-glow. Conversely, under-revelation is labeled free-riding behavior. An analysis of individual behavior can shed some light on what forces are motivating participation.

Using the random utility framework first developed by McFadden (1976), it is possible to test the internal consistency of participation rates observed and the hypothesis that participation rates increase with induced value. In this framework, it is assumed that individuals know their own preferences with certainty, but that they may make errors in decision-making because of imperfect information or errors in optimization. In addition, some aspects of the individuals' preferences are not observable by the analyst, and treated as random. These limitations introduce a stochastic error component into the modeling of decisions (Maddala, 1983). Using such a model, we shall first specify the random utility equivalent of the naïve null hypothesis, in which a

Figure 2: Actual Joining Distribution (By Induced Value) .



customer will sign-up for the program at posted price $C if the utility associated with having the program and paying $C is greater than the utility associated with not having the program. If we assume that indirect utility is additively separable, the probability of a "yes" response to a particular posted price is then:

$$(2) \qquad \Pr\{\text{"Yes" response}\} = \Pr\{V - C + \varepsilon > 0\}$$

where V is an individual's value or willingness to pay for the green program and ε is an error term. Assuming that the error is logistically distributed, Equation (2) can be expressed as:

$$(3) \qquad \Pr\{\text{"Yes" response}\} = \frac{1}{1 + e^{-(\alpha + \beta(V - C))}}$$

where α and β are respectively location and slope parameters to be estimated. The null hypothesis H_o^1: $\alpha = 0$ corresponds to the hypothesis that, at V = C, there is a 50 percent participation level. A positive value for α would shift the entire distribution to the left in a manner consistent with over-revelation relative to induced values, while under-revelation would correspond to $\alpha < 0$. The null hypothesis for the slope parameter H_o^2: $\beta = 0$ has only a one-sided alternative $\beta > 0$. That is, we are testing the hypothesis that participation does not increase with induced value.

Note, from Equation (3) that for $\beta > 0$, the relationship between induced value and participation becomes an "S" shaped function with the introduction of logistically distributed random errors. Additionally, if $\alpha = 0$, when induced value equals cost (V = C), participation is 50%; as V-C becomes large, participation approaches 100%; and for small V relative to C, participation ultimately approaches 0%. The shape, or rather steepness, of the response function

does vary with the magnitude of β. If $\beta = 0$, the probability of participation is a constant, but for large β, a step function is predicted. Figure 3 shows this relationship for a range of β values.

Estimates of α and β using maximum likelihood techniques are found in the "base" column of Table 1.[14] Consistent with our hypotheses, α is not significantly different from zero, indicating that the hypothesis of 50% participation at V-C = 0 cannot be rejected statistically. In addition, the estimated coefficient on V-C, β, is positive and significant. This latter result supports the hypothesis that participation is positively correlated with induced value.[15] In all, these results are consistent with the naïve hypothesis that this mechanism is demand revealing.

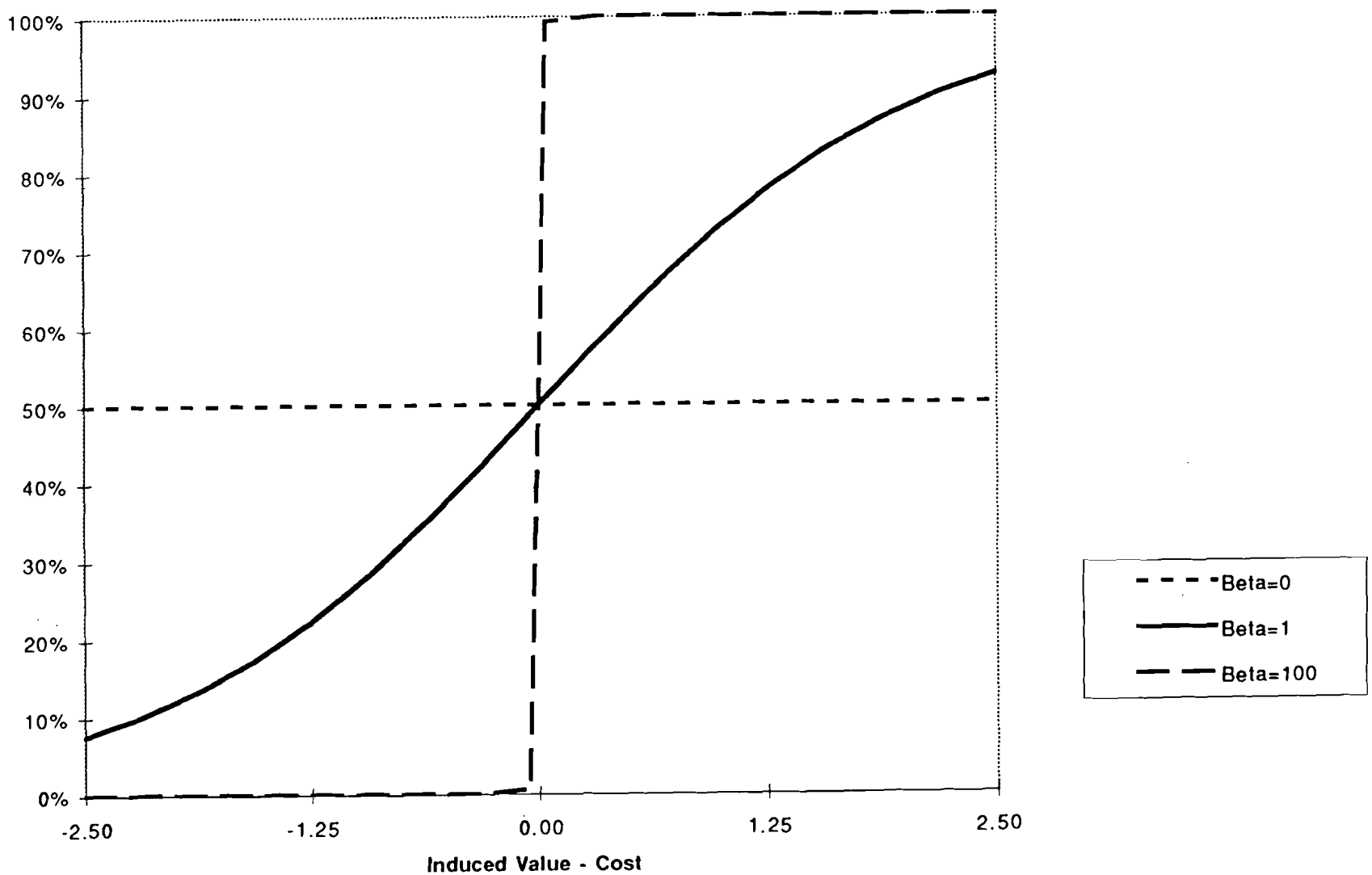
Table 1: Estimated Logit Models Using Induced Values

Variable (coefficient)	**Mean (s.d.) [Range]**	**Base**	**Long**
Constant (α_0)	1	-0.093 (0.211)	-2.26*** (0.537)
Group/Self (α_1)	0.61 (0.44) [0.14, 2.50]		3.688*** (0.856)
Induced Return (β)	0.01 (1.77) [-2.50, 2.50]	0.337*** (0.123)	0.301*** (0.143)
N		98	98
Likelihood Ratio χ^2		8.02***	38.19***
Percent Correctly Predicted		61	73

*** indicates significance level of 1 percent.

However, in spite of the highly significant estimation results reported in Table 1, closer examination of the data reveals that the model is not completely characterizing individual

Figure 3: Random Utility Model for Various Betas
(By Induced Value minus Cost)

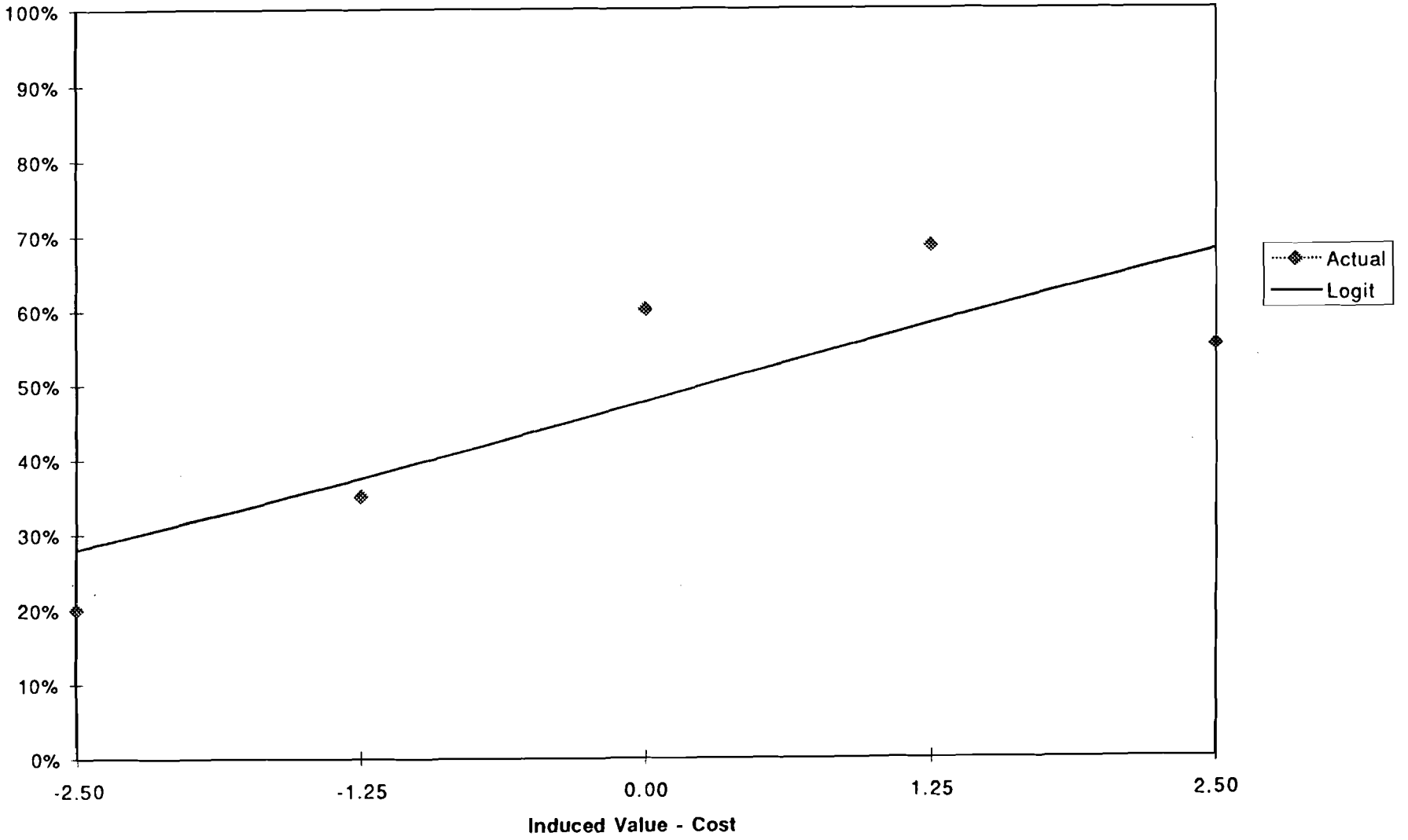


decisions. Recall Figure 2, actual participation at lower values (e.g. V = 0.50) exceeds the zero percent participation predicted by theory. There is also an obvious dip at the induced value of $5.50. Figure 4 (an alternative depiction of Figure 2 with, instead, induced value minus cost on the horizontal-axis), shows the fit achieved by the base regression model. Over- and under-provision are clearly not captured. The remainder of this section summarizes an exploratory investigation of why these deviations occur by focusing on altruistic or warm-glow and free-riding motivations. This extended analysis is intended, in part, to further demonstrate the opportunities arising from a random utility modeling framework in future experimental economics research. The objective is to also provide an empirical base and motivation for future theoretical research.

It is worth noting that none of the subjects viewed themselves as "critical" to provision. None of the subjects entered 39 in response to the follow-up question about how many people they believe joined, excluding themselves. However, one subject entered 40, believed the program was funded and joined. It is reasonable to believe that they may have thought they were "critical." This apparently lack of the perception of being critical supports the findings of Dawes et al. (1986) yet contradicts the findings of Rapoport (1988).

An advantage of random utility modeling is that it allows other explanatory variables to be incorporated into the error based decision framework. In an effort to account for heterogeneous, exogenous motives, subjects were asked to indicate the importance they attached to maximizing their own earnings and to maximizing group earnings in making their decision, both on seven-point scales (1 = Not Important, 7 = Extremely Important). Each of these questions are provided in Appendix B.

Figure 4: Actual vs. Logit Estimated Distribution
(By Induced Value minus Cost)



The self-reported interest in maximizing "group" and "self" earnings were combined in a "group/self" ratio so as to normalize relative responses at the individual level. In other words, a response pattern group=5, self=5 would be assigned a group/self ratio of 1, as would the response pattern group=2, self=2. In terms of Equation (3), this ratio (group/self) is included by expanding α from a constant to a vector and treating the ratio group/self as a separate element of the vector. As such, argument α in Equation (3) becomes $\alpha_{Grand} = \alpha_0 + \alpha_1$*(group/self). The expectation is that participation is positively related to group orientation, and thus α_1 should be positive with a corresponding null hypothesis H_0^3: $\alpha_1 = 0$. To account for this ratio, the null hypothesis H_o^1: $\alpha = 0$, must be restated as H_0^4: $\alpha_{Grand} = (\alpha_0 + \alpha_1$*(group/self)) = 0. As before, a positive value for α_{Grand} would shift the entire distribution to the left, indicating "over-revelation" associated with altruism or warm-glow. A negative α_{Grand} would shift the distribution to the right, providing evidence of free-riding.

The results from including this ratio in the estimation are provided in the "long" column of Table 1. The estimated coefficient α_1 is positive and significant, i.e. the average respondent exhibits behavior suggesting the presence of altruistic or warm-glow value. Notably, the inclusion of this variable does not have a significant effect on the slope coefficient, but does greatly increase the explanatory power of the estimated model, as demonstrated by the jump in the percentage of responses correctly predicted and the likelihood ratio chi square values. Thus we argue that the addition of this variable makes a significant contribution to the explanatory power of the decision making model.

This result is consistent with Andreoni's (1995) arguments concerning the role of altruism in public goods experiments as well as the speculations of van de Kragt, Orbell, and Dawes

(1983), Rapoport (1988), Rapoport and Eshed-Levy (1989), and Palfrey and Rosenthal (1991) regarding the presence of altruism. However, Palfrey and Prisbrey (1997) formally test for and find significant evidence of warm-glow in VCM contributions but no trace of altruism. Based on their convincing analysis, we speculate that warm-glow underlies the observed over-contributing captured by a positive α_1. In addition, as discussed earlier, the nature of one-shot environments suggests that some portion of single round contributions may be due to confusion (Palfrey and Prisbrey also find evidence of confusion in the contribution behavior they observe).[16]

Overall, however, setting the group/own ratio at its mean (0.61), α_{Grand} is not significantly different from zero at any standard level of significance: $\hat{\alpha}_{Grand} = -0.01$ (s.e. = 0.25). As such, the naïve null hypothesis H_o^4: $\alpha_{Grand} = 0$ still cannot be rejected for the average respondent in spite of the fact that the individual coefficients used in calculating α_{Grand} are each significantly different from zero. In other words, the warm-glow behavior of subjects with induced values of \$0.50, \$1.75, and \$3.00, as captured by the positive and significant α_1 estimate, is being canceled out by the traditional free-riding behavior of subjects with the higher induced values (recall Figure 2). A similar phenomenon is observed by Rondeau, Schulze, and Poe (1999). It is interesting to note however that α_{Grand} is significantly different from zero in the expected directions when the ratio group/self falls below 0.47 or exceeds 0.77. These results are consistent with previous research using split-sample designs to examine subject group effects in public good provision experiments, and provide additional evidence that participants bring different motives into experimental settings (Ledyard, 1995). From the perspective of this paper, these results, in the "controlled environment" of the laboratory, further heighten the importance

of identifying respondent characteristics and preferences that may affect actual participation levels in field experiments.

4. Field Experiment

The findings in the previous section imply that participation elicited using a provision point mechanism is sensitive to private value for the public good, as well as other motives which might include altruism, warm-glow, and confusion. In general, the one-shot NMPC provision point mechanism appears to create an environment capable of increasing contributions and improving the probability of provision for whatever public good is offered. Fortunately, we were able to directly solicit actual contributions before NMPC cancelled *GreenChoice*™. The results of this effort allowed us to evaluate the individual incentives of actual participation when private values are unknown. Below we investigate these incentives with analysis of the participation effects of the *GreenChoice*™ program's green objectives and provision point financing features, as well as the characteristics of individual participants.

4.1. Experimental Design

The field experiment was conducted as part of a larger National Science Foundation/Environmental Protection Agency research effort to investigate environmental values for public programs (Poe, Clark, and Schulze, 1997). A telephone survey was utilized to attempt to contact a random sample of 206 households in the Buffalo area.[17] The telephone survey began by screening customers to identify the person in the household who usually pays the NMPC electric bill. Once that person was on the phone, the interviewer described the purpose of the

survey and the sponsors of the study. The individual was then asked to rate NMPC's service. This allowed the small number of dissatisfied customers to vent frustration before answering the remaining questions. Customer awareness of the *GreenChoice*™ program was obtained next, and then the goals of the program were described in turn. As the goals were described, the respondent was asked:

> *How interested are you in the goal of replacing fossil energy with renewable energy sources? On a scale from 1 to 10, where 1 is not at all interested and 10 is very interested, how interested are you?*

and later:

> *How interested are you in the goal of planting trees on public lands in upstate New York? As before, on a scale from 1 to 10, where 1 is not at all interested and 10 is very interested, how interested are you?*

The funding plan was then described as follows:

> *The GreenChoice program would be funded voluntarily. Customers who decide to join the program would pay an additional fixed fee of $6 per month on their NMPC bill. This fee would not be tax deductible. Customers would sign up or cancel at any time. While customers sign up, NMPC would ask for bids on renewable energy projects. Enough customers would have to become GreenChoice partners to pay for the program. For example if 12,000 customers joined the first year, they would invest $864,000, which would allow Niagara Mohawk to plant 50,000 trees and fund a landfill gas project. The gas project could replace all fossil fuel electricity in 1,200 homes. However, if after one year, participation were insufficient to fund GreenChoice activities, Niagara Mohawk would cancel the program and refund all the money that was collected.*

The program description was taken more or less directly from the program brochure prepared by NMPC. Note that NMPC was deliberately vague about the exact level of the provision because the renewable energy project was to be sent out for competitive bid. This feature should be irrelevant, since changing the threshold level and even knowledge of the threshold level has been shown to be inconsequential in the presence of a money-back guarantee (Cadsby and Maynes, 1999; Rondeau, Poe, and Schulze, 1999).

The survey then asked respondents whether the mechanism features of the funding program made them more or less interested in the program (see section 3.2 for details). This was followed by the participation question. It was phrased as follows:

> *You may need a moment to consider the next couple of questions. Given your household's income and expenses, I'd like you to think about whether or not you would be interested in the GreenChoice program. If you decide to sign up, we will send your name to Niagara Mohawk, and get you enrolled in the program. All your other answers to this survey will remain confidential. Does your household want to sign up for the program at a cost of $6.00 per month?*

Note that participation was not hypothetical. Participants were informed that their names were to be sent to NMPC for enrollment.[18] Although actual monies were never collected because the program was suspended, this sign up now/pay later approach corresponds with the following stepwise process typically used in green pricing programs: 1) potential projects are described; 2) subscriptions from customers are elicited through direct marketing, bill inserts and advertising; and 3) money is collected through regular billing. Experience from the Traverse City project suggests that the payment to intention ratio is very high--in that case, Traverse City Light and Power found that approximately 5% of those who originally signed-up reneged.

The survey ends with socioeconomic questions useful for modeling demand.

3.2. Results and Analysis

Of the sample of 206 households, contact was made with 179.[19] Of these, 34 refused to participate and three could not complete the questionnaire. Thus, 142 respondents completed the survey, yielding a response rate of 69% of the base sample. Of the 142, 29 signed up for the program, resulting in a participation rate of 20.4 percent. If we assume that the 37 households

who refused or could not complete the survey would also have refused the program, the participation rate would fall to 16.2 percent. Both these estimates stand in marked contrast to the actual sign-up rate of less than 3.3 percent observed by NMPC throughout the period *GreenChoice*™ was offered via bill inserts and brochures.[20] As discussed previously, this low participation was likely caused by the minimal marketing and low customer awareness of the program. Indeed, none of the 142 randomly sampled respondents in our survey recalled having heard about the program. Participation rates of 16.2 and 20.4 percent are consistent with a preliminary market evaluation of the NMPC service area conducted by the Research Triangle Institute (RTI) (Wood *et al.* 1994), which estimated that with full awareness 17 percent would adopt a tree planting program at a $6 monthly premium.[21] The RTI data were taken from a sample that over-sampled "green" customers, since such customers were regarded as the target group for an actual program. Based on prior information, approximately 30 percent of urban NMPC customers were classified as "green", while the in-person interview sample was 67 percent "green".

It is important to note that a participation rate of 16%-20% is substantially higher than the 1% potentially needed to fund *GreenChoice*™ (12,000 of a total of 1.2 million NMPC customers) as well as the participation rates observed by the majority of actual green pricing programs reported in the literature (Byrnes, Jones, and Goodman 1999; Baugh *et al.* 1995; Byrnes *et al.* 1995; Holt and Associates, 1996; Farhar and Houston 1996). As suggested earlier, however, there are notable differences between our experiment and the majority of previous studies. First, reported participation rate estimates have generally not been adjusted to account for program awareness, which was controlled in our study at 100 percent. Instead, participation

rates have typically been defined over total customer base or over the base of customers targeted with direct mailings. Previous participation experiments have also (with the two exceptions noted previously) relied on voluntary contributions rather than the provision point mechanism used here. The findings of Byrnes, Jones, and Goodman (1999) support these conclusions. They provide complete program awareness while obtaining voluntary contributions. The resulting 5.6 to 10 percent participation rates are higher than most observed in implemented green-pricing programs but below those observed here.

To investigate individual specific factors associated with participation decisions, we again turn to the random utility model (McFadden, 1976). The linear logistic distribution is assumed to characterize individual decisions,

$$(1) \qquad \Pr\{\text{"Yes" response}\} = \frac{1}{1 + e^{-\alpha \underline{X}}}$$

where $\underline{X}$ depicts a vector of covariates characterizing individuals and their perceptions of the program (including a constant term), and $\underline{\alpha}$ is the corresponding set of coefficients to be estimated. A separate independent variable and corresponding coefficient for value can not be included in the model since individual values are unobserved and cost is constant across all respondents.

Assuming this logistic distribution, participation decisions are modeled as a function of three categories of covariates elicited in the questionnaire. The first concerns respondents' perceptions of the program's worth. Respondents registered their interest in the twin goals of the *GreenChoice*™ program -- replacing fossil fuels and planting trees in upstate New York -- using

a scale of one (*"not at all interested"*) to 10 (*"very interested"*) for each goal.[22] It is expected that the sign on these variables will be positively correlated with the probability of joining the program.

The second category of covariates includes variables specific to the respondent, such as gender (Male=1), age (Years), education (College Graduate or higher =1), and recent financial support of environmental groups (Yes=1). Such characteristics are widely used as explanatory covariates in the environmental valuation literature. Based on this literature, it is expected that age will be negatively correlated with WTP, while recent financial support for environmental groups will be positively correlated with joining the program. The other variables have provided mixed results in the literature. In addition, as noted earlier, individual perception of NMPC service was elicited using a one (*"unfavorable"*) to 10 (*"very favorable"*) scale and included as a covariate in the analysis.

The final category of covariates concerns respondents' perceptions of the provision point mechanism itself. After hearing about the funding provision point and money-back guarantee, respondents were asked the following two questions:

> *Does the fact that there is a minimum level of customer participation required for GreenChoice to operate make the program of less interest to you, more interest, or does it not affect your interest?*
>
> *Does the fact that Niagara Mohawk would refund all the money it collects -- if support is insufficient -- make GreenChoice of less interest to you, more interest, or does it not affect your interest in the program?*

These variables are admittedly *ad hoc*, in the sense they do not proxy for the value of the program. However, they do provide information about perceptions regarding these specific components of the provision point mechanism. We found that over 55 percent responded that

their interest was not affected by including a provision point and about 16 and 27 percent indicated that it respectively increased and decreased their interest in the program. In contrast, the money-back guarantee was widely favored: only 9 percent of respondents indicated that this attribute reduced their interest in the program, while 46 percent indicated that it increased their interest. For the purpose of modeling the participation decision, these response categories were re-coded as binary variables assigned '1' if the *"more interest"* option was selected, and zero otherwise. We expect their estimated coefficients to be positive.

The logit model of program participation is reported in Table 2, together with the sample means, standard deviations, and the expected signs of the estimated coefficients for all the explanatory variables described above. Given the single $6 threshold, the estimation results are fairly strong: 80 percent of the responses are correctly predicted and the overall likelihood greatly exceeds the critical value (LR=31.03 > 14.68 = $\chi^2_{0.10}(9)$).

Considered jointly, the estimated coefficients for the two program goals are significant using a likelihood ratio test (LR = 7.23 > 4.61 = $\chi^2_{0.10}(2)$), leading to the conclusion that there is a positive response to the tree-planting and renewable energy objectives of the NMPC program. Comparison of the individual coefficient estimates suggests that, in spite of the observation that more people favored the tree planting objective, interest in fossil fuel replacement is a more significant predictor of participation decisions. The implication is that tree programs will have broad general support, but that interest in the fossil fuel replacement component will be the significant explanatory factor in participation decisions. This finding is consistent with the NMPC market research (Wood *et al.*, 1994).

Table 2. Estimated Logit Models of NMPC Phone Participants

Variable [Scale]	Mean	Expected Sign	Estimated Coefficients
Constant	1	n.a.	-4.386 (2.184)**
Replace Fossil Fuel [1-10]	6.27 (2.82)	+	0.233 (0.118)**
Plant Trees [1-10]	8.35 (2.18)	+	0.216 (0.186)
Gender [Male = 1]	0.46 (0.50)	?	0.954 (0.517)*
Age [Numeric]	55.09 (15.70)	-	-0.0396 (0.0192)**
Give to Environment [Yes = 1]	0.19 (0.39)	+	0.666 (0.624)
College Graduate [Grad = 1]	0.45 (0.50)	+?	0.002 (0.546)
Rating of NMPC Service [10=very good]	8.49 (1.67)	+?	0.082 (0.644)
Min. Participation [More Interested = 1]	0.17 (0.38)	+	1.416 (0.588)**
Money-back Guarantee [More Interested = 1]	0.47 (0.50)	+	-0.098 (0.550)
N	128		128
Likelihood Ratio χ^2			31.03***
Percent Correctly Predicted			80

Numbers in () are standard errors.
*,**, and *** indicate significance levels of 10, 5, and 1 percent, respectively.

A joint test of the null hypothesis that restricts all demographic coefficients to zero was rejected at the 10 percent level (LR = 10.28 > 9.24 = $\chi^2_{0.10}(5)$). The estimated coefficients on respondent attributes vary in significance, consistent with other studies in the environmental

valuation literature. Age was negatively correlated with participation (also a result in Byrnes, Jones, and Goodman 1999), a factor that may be attributed to the life cycle hypothesis of value in which potential use values decline with age (Cropper and Sussman, 1990). This negative relation may also be associated with the fact that age is also inversely correlated with income in this data set.[23] The finding that male respondents had a higher likelihood of participation contrasts with evidence suggesting that this variable is not substantially related to environmental concerns (Van Liere and Dunlap, 1980). The coefficients on the other socio-demographic covariates were not significantly different from zero.

From our perspective, the coefficients on the funding mechanism variables are of considerable interest, despite their *ad hoc* nature. Considered jointly, these variables are significant ((LR = 5.84 > 4.61 = $\chi^2_{0.10}(2)$). In particular, interest in the provision point mechanism is a significant and positive explanatory variable in participation decisions. The minority of respondents with interest in that feature clearly had a higher participation rate, suggesting that the addition of this feature increases the likelihood of funding. In contrast, interest in the money-back guarantee is not a significant explanatory variable in the estimated model in spite of the fact that there appears to be a widespread interest in the money-back guarantee.

In summary, modeling of participation decisions indicates that the content and structural attributes of the NMPC mechanism are influential in participation decisions. The program goals of replacing fossil fuel energy and planting tree are important to participation decisions, particularly the former. In addition, the provision point feature increases participation.

5. Discussion and Conclusions

Green pricing programs have come under substantial criticism in the electric utility industry because of their cost and poor customer participation. Our field experiment shows that customers who are made fully aware of a green pricing program, and who face a binary decision within a provision point mechanism with money-back guarantee and extended benefits, participate at a relatively high rate (between 16 and 20 percent). Recall, the two completed programs in which provision points were utilized succeeded in funding local projects with relatively high levels of participation. Further, our laboratory examination of the NMPC mechanism found results consistent with demand revelation at the aggregate level and partial demand revelation at the individual level, i.e. the probability of participation was positively correlated with induced value. Additional investigation revealed that warm-glow like behavior and free-riding incentives were significant counter-balancing factors in overall participation. While the persistence of free riding in the lab suggests that the field experiment results likely underestimate true demand, the field results suggest that subjects respond to the features of this provision point mechanism, increasing contributions and the likelihood of provision. This suggests that the disappointing sign-up rates of most green pricing programs to date could well be due to increased free riding associated with mechanism design, as well as to the problem of limited customer awareness. Employing a provision point mechanism is a relatively costless way to increase participation.

Unfortunately, it is difficult, time consuming, and expensive to raise customer awareness for new programs such as *GreenChoice*™. Economists should recognize the large impediment that consumer awareness plays for the private provision of public goods. The NMPC program

may well have failed, even if implementation had been carried through, simply because the company was unable to expend sufficient resources to effectively market a statewide program. The successful provision point programs in Traverse City and Fort Collins funded local rather than statewide projects; so, given the high profile nature of wind energy projects, awareness was easily achieved. This research found that, where large groups are involved in a single solicitation, provision point mechanisms may fulfill the objective of privately funding public goods.

APPENDIX A: Sample Subject Instructions for the Laboratory Experiment

Subject Number ___
PRINT your Name and Social Security Number so that we can pay you
Name _____
Social Security Number _____

INSTRUCTIONS

First, please write your subject number on the front of the envelope you have been given. You have been given the envelope to insure confidentiality.

This is an experiment in the economics of decision making. If you follow the instructions closely and make decisions carefully, you can earn money. Please do not communicate with any other students during the experiment. If you have any questions please do not hesitate to raise your hand so that someone can come over and answer your questions individually.

In this experiment all participants are given a starting balance of $5, which is yours to keep or use any way you like. At the end of these instructions, all of you will be asked if you want to join a group investment program for a one-time fee of $3. **The exact amount of money that you will earn in the experiment depends on your answer to this investment question, as well as on the answers of ALL the other participants in your group.** At the end of the experiment, your earnings will be calculated and you will be paid in cash.

Once you understand the group investment program and how your earnings will be calculated, your task is to decide whether or not you want to join the group investment program for a fixed fee of $3.

The group investment program works as follows. You are a member of a group of 100 people in this class. The program will only be funded and implemented if at least 40 of the 100 participants in your group join the investment program. If enough participants join the investment program so that the program is implemented, the return on the investment will be **SHARED BY ALL** participants in the experiment, **investors and non-investors alike**. Specifically, **regardless of whether or not you have joined the group investment program,** if enough people join, you will receive a return of $5.50. You will also receive a bonus payment of 3¢ for each participant that joins in excess of the minimum number of 40 necessary for the group program to be implemented. Furthermore, you keep your initial credit of $5 from which $3 will be deducted if you decide to join the investment program. Note that other participants may have a different return but do **not** have a different bonus.

If **not** enough participants join the investment program, the program will **not** be funded and will be canceled. In this case all the $3 fees collected will be refunded to those who joined. Thus, regardless of your decision to join the program or not, you would keep your $5 starting balance.

To Summarize:

- You must decide whether or not to join a group investment program for a cost of $3.
- If fewer than 40 participants out of 100 join, the program will be canceled and all $3 fees will be refunded.
- If 40 or more participants join, the program will be implemented and you will receive a return of $5.50 plus a bonus of 3¢ for each household that joins above 40.
- Recall, that you do not need to join to receive your payment from the investment program if 40 or more other participants join.
- But if you do join, you must pay the $3 fee.

This is the end of the instructions. If you have any questions please raise your hand.

THE QUESTION

Do you want to join the group investment program for a fixed fee of $3?
(Circle one only)

YES I wish to join

NO I do not wish to join

Please place this sheet in the envelope provided and seal it. When everyone has sealed their envelope, you will each be handed another sheet of questions. You must complete these additional questions in order to get paid.

APPENDIX B: Follow Up Questions for Laboratory Experiment

TO BE PAID, YOU MUST COMPLETE THESE QUESTIONS

Please enter your Subject Number from your envelope ___
PRINT your Name and Social Security Number as you did before
Name _____
Social Security Number _____

(1) Do you think that enough people joined to fund the group investment program? (Circle one answer)

YES NO

(1a) More precisely, how many people do you think joined--excluding yourself?

_____

(2) On a scale from 1 to 7, where 1 is not important and 7 is extremely important, how important were the following in your decision?

2a. I wanted to make as much money as I could for myself. (Circle one number)

1 2 3 4 5 6 7

Not Important Extremely important

2b. I wanted the group to make as much money as possible. (Circle one number)

1 2 3 4 5 6 7

Not Important Extremely important

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[2] The authors are respectively affiliated with: the Department of Agricultural, Resource, and Managerial Economics (ARME), Cornell University; the Department of Economics, University of Canterbury; ARME, Cornell University; the Department of Economics, University of Victoria; and ARME, Cornell University.

[3] See Baugh et al. (1995) for a detailed discussion of Green Pricing programs. This discrepancy between hypothetical and actual willingness-to-pay is frequently observed in the contingent valuation literature (Brown et al. 1996; Cummings, Harrison, and Rutström 1995; Cummings et al. 1997; Loomis et al. 1996; Neill et al. 1994; Seip and Strand 1992).

[4] In a series of papers, Palfrey and Rosenthal (1984, 1988, and 1991) develop theoretical models of contributions to public goods when individuals face the binary choice of contributing either a posted price or nothing. Unfortunately, the complex environment under consideration in our experiment (a large group, heterogeneous valuations, and incomplete information about others' preferences) precludes a direct test of this theory. Note that Palfrey and Rosenthal analyze environments with homogeneous values, so demand revelation is not considered.

[5] In designing this program, NMPC asked William Schulze to suggest mechanisms to reduce free riding in green pricing programs (Schulze, 1994).

[6] Macmillan, Hanley, and Buckland (1996) find a preference for environmental projects with greater certainty. A general affinity for more certain benefits is an essential element of Kahneman and Tversky's (1979) "prospect theory."

[7] Rapoport and Eshed-Levy find some support for the Dawes *et al.* (1986) finding in a single round experiment. However, Dawes *et al.* do not analyze frequency of provision, which can be computed from their reported data. With a money-back guarantee, the public good was provided 100 and 57 percent of the time when provision required three and five contributors from seven subjects respectively. Without the money-back guarantee, the public good was provided 70 and 40 percent of the time respectively. Testing for the difference between sample proportions (Goldstein, 1964, pp. 100-101), the increased provision proportion with the money-back guarantee is significant with a provision point of three contributors ($x = 1.60 > 1.55 = x^*$ for a one-tail test at 6% from the standard normal distribution) but is not with a provision point of five contributors ($x = 0.69$).

[8] Cadsby and Maynes (1999), in a comparison of threshold experiments with continuous contributions and binary discrete contributions, find increased contributions and provision in the case of continuous contributions.

[9] For a pareto superior outcome when contributions exceed the provision point in the presence of extended benefits, an individual contribution must lead to group extended benefits in excess of the individual contribution amount. If the individual's share of the extended benefits from their contribution exceeds the individual contribution amount then the outcome is also a Nash equilibrium (Marks and Croson, 1998).

[10] RUM applications in public goods experiments are relatively new. Palfrey and Prisbrey (1997) and Spencer, Swallow, and Miller (1998) analyze individual behavior using the RUM in VCM experiments and contingent choice experiments respectively.

[11] Unlike a proportional rebate which re-distributes to contributors only. Both the NMPC utilization rebate and the proportional rebate are Pareto neutral.

[12] The experiment was developed by the Economic Science Laboratory at the University of Arizona. The experiment was conducted (using monetary incentives) as part of the students' regular weekly sections held in the Laboratory for Experimental Economics and Decision Research at Cornell.

[13] This contribution figure is based on 84 valid VCM observations from the same 100 students. The 16 invalid observations were due to computer malfunction, student absence, or untraceable student information data.

[14] Only 98 observations are reported in Table 2, due to the fact that two respondents had missing values for various parts of the questionnaire.

[15] This finding is consistent with those of Isaac, McCue, and Plott (1985) and Palfrey and Prisbrey (1997). Each found, in VCM environments, that average contributions and participation increase with greater relative induced value for the public good.

[16] Altruism is the value received from increasing returns to the group. Warm-glow is the value received from the act of giving. Altruistic value increases as group benefits increase. Warm-glow value is constant, unaffected by group or private returns from the public good. Our experimental design does not allow us to disentangle altruism from warm-glow. Separating the two could be accomplished by varying the group return as in Palfrey and Prisbrey (1997).

[17] The survey instrument followed the Dillman Total Design Method for telephone surveys (Dillman, 1978) which is designed to achieve a high overall response rate by keeping text blocks short and clear and by engaging the respondent with frequent questions throughout the survey. The response rate was just under 70%. The survey was pretested by administering successive draft

versions by phone until respondents clearly understood the instrument. Hagler Bailly Consulting, Inc. was contracted to administer the survey. Prior to telephone contact, potential respondents were sent a hand-signed cover letter on Cornell University stationery. The letter informed them that they had been selected as one of a small sample of customers to participate in the study of a new type of environmental program. It identified the study's sponsors as the National Science Foundation and the Environmental Protection Agency, together with NMPC, and enclosed a two dollar bill as a token of appreciation for participation. The two dollar bill has been found to be cost effective in increasing response rates.

[18] In an analysis of Wisconsin and Colorado green-pricing programs, Byrnes, Jones, and Goodman (1999) find that market simulations of this sort are better predictors of actual participation.

[19] Households were classified as "unable to contact" based on a minimum of eight attempts.

[20] NMPC had 0.1 percent of their 1.2 million customers sign-up. Recall, that they sent bill inserts and brochures to three percent of their 1.2 million customers, i.e. 36,000 customers. Hence, 3.3 percent of the 36,000 signed-up.

[21] However, RTI also estimated that 57 percent of customers not classified as "green" would adopt a renewable energy investment program at a $6 monthly premium, while 79 percent of "green" customers would adopt the same program.

[22] Respondents were also asked how they viewed the program in comparison with other causes they might support "*like the United Way, public television, or environmental groups,*" using a scale of one ("*much less favorably*") to 10 ("*much more favorably*") as a means of consolidating their preferences immediately prior to answering the participation question. Response to this question is not included here since it was found to be a statistically significant function of the type of project as well as the mechanism attributes.

[23] In the linear random utility model used in this analysis, income cancels out of the equation (Hanemann, 1984) and is therefore not included here.

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