# The Provision Point Mechanism and Scenario Rejection in Contingent Valuation[1]

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ABSTRACT: The provision point mechanism mitigates free riding behavior in economic experiments. In two contingent valuation method surveys, we implement the provision point design. We ask respondents about their perceptions about the success of the provision point mechanism. One of the determinants that identifies who is likely to feel the provision point will be met is the bid itself. We find that respondents who believe that the provision point would not be met are more likely to say no to a contingent valuation dichotomous choice question. The scenario rejection that arises may result in biased willingness to pay estimates.

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## Introduction

The contingent valuation method (CVM) elicits hypothetical statements of willingness to pay. Here lays its greatest weakness and its greatest strength. Critics of the CVM argue that its hypothetical nature leads to responses that do not measure the true valuation of a good in question either through biases from construction of the questions (i.e., starting point bias), strategic answering of questions (i.e., free riding or hypothetical bias), or inability of respondents to understand or accept the hypothetical scenario and questions (i.e., scenario rejection). Yet the hypothetical nature of CVM is also its greatest strength. There are no direct markets and no revealed preference data that can be used to measure nonuse values of environmental goods and assess the benefits of many policy proposals.

To help minimize the potential bias from the hypothetical nature of questions in CVM, Mitchell and Carson (1989) state: A hypothetical scenario "*must be informative; clearly understood; realistic by relying upon established patterns of behavior and legal institutions; have uniform application to all respondents; and, hopefully, leave the respondent with a feeling that the situation and his responses are not only credible but important.*" CVM researchers have taken their suggestions to heart and developed techniques to address hypothetical bias, the free rider effect, starting point bias and other concerns. In the process, the resulting highly structured hypothetical scenarios that have become standard best-practice may not be perceived as plausible to all respondents.

When respondents find contingent valuation questions implausible scenario rejection may arise. Scenario rejection may take the form of protest responses, where

respondents with positive willingness to pay will reveal only a zero willingness to pay value in an open-ended willingness to pay question or answer no to a dichotomous choice willingness to pay question even though their true willingness to pay is greater than the bid amount. Widespread scenario rejection will invalidate a CVM survey. If more limited scenario rejection is dealt with by excluding cases the reduction in sample size will decrease the efficiency of willingness to pay estimates. Ignoring scenario rejection will increase the variance of willingness to pay estimates and is likely to bias willingness to pay downwards.

Little attention has been paid to protest bids resulting from scenario rejection in past CVM research. Desvousges, Smith and Fisher (1985) first addressed the identification of protest bidders by using regression diagnostics to identify outliers based on income. Halstead, Luloff and Stevens (1992) use follow up debriefing questions in an attempt to identify protest bidders. They find that respondents may answer no to a dichotomous choice question due to protest of the payment vehicle. Clinch and Murphy (2001) pursue what has become the typical strategy in dealing with protest bids by asking respondents who are unwilling to pay for their primary reason. Protest bidders are identified as those who seem to be willing to pay for the good but indicate otherwise due to scenario rejection or other bias. Protest bidders are then discarded from the sample.

In this study we pursue a different strategy when dealing with protest bids. We use respondent perceptions about the feasibility of the hypothetical scenario to determine aspects of scenario design that lead to variation in willingness to pay. These perceptions can be used to explicitly test for the protest responses and assess the sensitivity of

willingness to pay to the protest. In particular, we focus on protest responses that arise due to the provision point mechanism which has been used to mitigate free riding with the voluntary contribution payment mechanism in laboratory (Rondeau, Schulze and Poe, 1999, Rose et al. 2002) and field experiments (Rose et al. 2002, Poe et al. 2002).

**Provision Point Mechanism**

In a provision point mechanism individuals are asked to donate money to pay for a public good but the donated funding will not be used for the public good unless some lower bound threshold is met. This threshold is defined as the provision point. If the threshold is not met then the donations will be refunded to the individuals. The provision point gives individuals an incentive to reveal their true willingness to pay because of the all or nothing construction. If enough donations are not received the public good is not provided. Also, the money back guarantee helps avoid the perception that donations might flow to unrelated projects if the primary project is not funded.

Laboratory experimental evidence and field survey research has found that the provision point mechanism has lessened the free rider effects found with the straight voluntary contribution mechanism. (Bagnoli and McKee 1991, Cadsby and Maynes 1999, Rose et al. 2002, and Rondeau, Poe and Schulze 2004). Bagonli and McKee find that in a laboratory setting that a provision point is met 86% of the time when a refund is used. Cadsby and Maynes (1999), also in a laboratory setting, find that a refund in a provision point design is effective when the provision point is a relatively high amount. Rondeau, Poe and Schulze (2004) note that in a field setting, however, nonprofit organizations are reluctant to use the provision point mechanism with the money back

guarantee because of the probability that the response will not meet the threshold and the project will not be funded. This reluctance suggests that respondents may not be familiar with the mechanism and may find the scenario that a nonprofit organization will refund donations implausible. Yet Poe et al. (2002) suggests that using the provision point mechanism in field contingent valuation method surveys provides incentives to respondents to truthfully reveal their WTP as in laboratory and field experiments.

Champ et al. (2002) implement the provision point with money back guarantee mechanism in a contingent valuation survey and compare it to a voluntary contribution mechanism and a referendum on a tax payment. One result is that the willingness to pay from the provision point mechanism is not significantly different than that from the voluntary contribution mechanism. There is weak evidence that willingness to pay is greater for the referendum treatment. They ask respondents "how likely do you think it is that enough/at least 30%/a majority will agree to donate/vote yes?" More respondents thought that it would be very unlikely that the voluntary contribution and provision point mechanism would lead to enough payments. This result suggests that the difference in willingness to pay between payment vehicles might be due to scenario rejection and not incentive incompatibility. They conclude that the provision point mechanism deserves more attention in contingent valuation research.

Relative to Champ et al. (2002) we use a different interpretation of respondent's perceived likelihood of funding success. We interpret the likelihood question as one of scenario acceptance and consider the extent to which the choice of the provision point mechanism payment vehicle leads to scenario rejection. We directly measure the effect of

scenario rejection on willingness to pay with data from two surveys. The first is from a survey of willingness to pay for a green energy program in North Carolina in which the perceived likelihood of success questions are asked prior to the willingness to pay question. The second is from a survey of willingness to pay for wetlands preservation in Michigan in which the perceived likelihood of success question is asked after the willingness to pay question.

## Data

### *Green Energy Survey*

The green energy survey was conducted by telephone in all 100 North Carolina counties in 2002 (Whitehead and Cherry, 2007). The response rate was 61%. The public good generated by the hypothetical green energy program is improved air quality in the western North Carolina Mountains. The survey uses the same payment vehicle used by Champ and Bishop (2001) and Poe et al. (2002) -- a voluntary surcharge to the monthly utility bill. The magnitude and rationale for the additional monthly fee, is described:

> *In a voluntary Green Energy program, households that choose to participate would pay an extra A dollar fee each month with their power bills. This fee would be fixed and not tax-deductible. The fee would cover the higher production costs of green energy.*

The fee was randomly assigned to respondents and took on one of four values: $A$ = 5, 15, 30, and 50. Respondents were then asked for their average monthly power bill in order to get them to assess the impact the monthly fee would have. The average monthly power

bill is over $100.

Payment mechanism and policy implementation rules are described and a dichotomous choice willingness to pay question is presented:

> *If 10% of all North Carolina utility customers sign up for the green energy program air pollution would be reduced. Recreation, visibility, forest and stream health and human health would improve. If you signed up and were not satisfied you could cancel the program at any time. But if less than 10% signed up, the green energy program would not have enough customers to make it cost effective. The program would stop and you would owe no money. Suppose you were given the opportunity to participate in the green energy program for an extra fee of **A** dollars each month. Would you sign up for the green energy program?*

We use two questions to test for scenario rejection. Each is placed prior to the willingness to pay question. The first asks about participation in a hypothetical green energy program. Respondents are told that the goal of the program is to get 10 percent of all North Carolina utility customers to sign up.

> *The goal of this program would be to get 10% of all North Carolina utility customers to sign up. In your opinion, how likely do you think it is that 10% of all North Carolina utility customers would sign up? Do you think it is very likely, somewhat likely, somewhat not likely, or not likely at all?*

Almost three quarters of the sample think that it is very likely or somewhat likely that 10

percent would sign up. This result indicates that most respondents find this component of the scenario credible. Yet about a quarter may not find the scenario plausible and might protest the willingness to pay question with a "no" response.

The second question used to test for scenario rejection asks:

*If 10% of all North Carolina utility customers sign up air quality in the western North Carolina mountains would improve. Visibility would increase by about Q miles, the number of streams and acres of forest impacted by acid rain would decrease by about Q percent, and the number of people who get sick because of breathing problems would decrease by about Q percent. In your opinion, how likely do you think it is that these goals would be reached? Do you think it is very likely, somewhat likely, somewhat not likely, or not likely at all?*

The scope of the policy, Q = 2, 10 or 20, is randomly assigned to each respondent. Over three quarters think that it is very likely or somewhat likely that the goal will be reached. These frequencies do not vary significantly by the scope of the program. Yet, once again about a quarter do not feel the goals will be met suggesting a potential for scenario rejection.

*Wetland Preservation Scenario*

The second application used to explore scenario rejection is to a wetland preservation program in the Saginaw Bay area of Michigan (Whitehead et al. 2007). The survey was conducted by mail in the spring of 2005 to both a general population sample and a sample of hunting and fishing license holders who lived in the Saginaw Bay

counties of Michigan. The response rate was 21 percent. In contrast to the green energy survey, in this study a provision point mechanism is used in a willingness to pay question with a follow up question of likelihood of success of the provision point.

In the survey the wetlands as well as scope of preservation are described. Survey respondents are told that 9000 of 18,000 acres of Saginaw Bay coastal marshes are currently protected and that the remaining privately owned marshes could be purchased and protected. A hypothetical "Saginaw Bay Coastal Marsh Protection Program" was introduced.

> *Voluntary contributions to a "Saginaw Bay Coastal Marsh Trust Fund" would be used to purchase and manage Q acres of Saginaw Bay coastal marshes. The Trust Fund would be administered by a board of directors that would include representatives from the federal, state and local governments, conservation and environmental groups, and private landowners. Money would be refunded if the total amount is not enough to purchase and manage Q acres. If the amount of donated money is greater than the amount required to purchase and manage Q acres, the extra money would be used to provide public access and educational sites at Saginaw Bay coastal marshes.*

The acreage amount, *X*, was randomly assigned from three amounts 1125, 2500 and 4500.

The payment mechanism and policy implementation rules are described and the willingness to pay question is presented to the portion of the full sample that previously indicated that they would be willing to make a one-time donation:

> *If about 1% (1 in 100) of all households in Michigan made a one-time donation of $25 the Trust Fund would have enough money to purchase and manage Q acres of coastal marshes. Remember, if you made a one-time donation of $A into the Trust Fund, you would have $A less to spend on other things. Also remember that protected marsh would no longer be available for conversion to other uses. Under these conditions, would you make a one-time donation of $A to the Saginaw Bay Coastal Marsh Trust Fund within the next 12 months?*

The dollar amount, $*A*, was randomly assigned from the following amounts: $25, $50, $75, $100, $150 and $200.

To test for scenario rejection and determine if respondents thought that the provision point would be met, we ask a follow up question to the willingness to pay question: "how likely do you think it is that 1 percent of all households in Michigan would make a one-time donation of $*A* to the Trust Fund within the next 12 months?" Forty-eight percent thought that it would be somewhat likely or very likely.

**Results**

We report the means and standard deviations of the variables from both surveys (Table 1). In each we first code all don't know responses as no responses and then adjust for the possibility of hypothetical bias by recoding each yes respondent that was

uncertain that they would actually pay to a no respondent (Groothuis and Whitehead 2002; Champ and Bishop, 2001). After this recoding, 35% of the green energy respondents are willing to pay the bid amount. Seventy five percent thought that the provision point would be met, while 76% thought the goals of the program would be met. The average income of the sample is fifty-two thousand dollars. After recoding the uncertain yes respondents 32% of the wetlands preservation respondents are willing to pay the bid amount. Forty-eight percent thought that the provision point would be met. The average income of the sample is fifty-two thousand dollars.

We first estimate probit models where the dependent variable is the perception that the provision point would be met for both the green energy and the wetlands sample (Table 2). We find that in the green energy model both income of the respondent and the perceived likelihood that the goals of the program will be met influence the perceived likelihood that the provision point would be met. Respondents with higher income are less likely to expect the provision point will be met. Respondents who expect the goals of the program are likely to be met are also more likely to expect the provision point will be met. The log of the bid does not influence the likelihood that the provision point would be met in the green energy program. We expect this result because the question about the provision point precedes the willingness to pay question.

In the wetlands model using the follow up question respondents who had a higher bid amount thought that it would be less likely that one-percent of the population would donate the required amount. Here we find that individuals who were given higher bid amounts expect that fewer individuals will pay the bid thus lowering the perceived

likelihood that the provision point would be met. The results of both models suggest that scenario rejection may influence willingness to pay.

In Table 3 we estimate probit models of willingness to pay for each set of data. We use the natural log of the bid ($*A*) amount to improve the statistical fit. Considering first the green energy model, we find that the yes responses fall with increases in the log bid amount. Increases in income increase the likelihood of saying yes. Those who received the cheap talk hypothetical bias mitigation treatment are less likely to say yes in the green energy program. Increases in the scope of the green energy program increase the likelihood of a yes response.

Individuals who believe the provision point will not be met and individuals who thought the goals of the program would be met are more willing to donate the bid amount. These results suggest that scenario rejection has an impact on willingness to pay. Individuals who do not believe that the provision point or overall program goals will be met are more likely to say no to the bid amount. If these no responses reflect scenario rejection then willingness to pay is biased downwards as respondents do not reveal their true willingness to pay.

The results from the wetlands preservation model are similar. We find that the yes responses increase with decreases in the log of the bid amount and if the respondent is a conservation or environmental organization member (Table 3). Similarly to the green energy model, individuals who believe the provision point will be met are more willing to donate the bid amount.

To understand how the perceived likelihood of meeting the provision point influences willingness to pay, we present three estimates where median willingness to pay is evaluated with all other independent variables at their mean (Cameron and James, 1987, Cameron 1991). In the first column of Table 4 we report the willingness to pay of individuals with a zero value inserted for the provision point dummy variable. This is the willingness to pay estimate associated with a scenario that is rejected by all respondents. The willingness to pay estimate in the second column is evaluated at the mean of the provision point dummy variable. This is the willingness to pay estimate that would correspond to a model where scenario rejection is not explicitly modeled. In the last column, we report the willingness to pay with a value of one inserted for the provision point dummy variable. This estimate simulates the outcome of a scenario where all respondents believe the provision point will be met.

The baseline median willingness to pay estimate from the green energy and wetlands preservation models is $4 and $25, respectively. Scenario rejection by all respondents lowers willingness to pay to an amount that is not statistically significant in the green energy program. In the wetlands preservation scenario, complete scenario rejection reduces willingness to pay by 56%. If the model is adjusted to simulate all respondents accepting the scenario, willingness to pay more than doubles for both the green energy and wetlands protection programs. Each of these differences is statistically significant.

**Conclusion**

Although the provision point mechanism in voluntary contribution mechanisms to

mitigate the free rider problem has shown promise in the laboratory it is not a familiar fundraising method. The lack of confidence in government agencies and nongovernmental organizations to successfully implement the provision point mechanism may lead to scenario rejection by some respondents.

We find that rejection of the provision point mechanism scenario leads to reductions in the number of respondents who are willing to pay the bid amount and willingness to pay. To the extent that the likelihood variable reflects scenario rejection and responses that do not reflect true willingness to pay, these results suggests that the provision point mechanism leads to scenario rejection that biases willingness to pay downward. Our results run counter to the finding from experimental economics that the provision point mechanism eliminates free riding behavior by giving incentives to truthfully reveal. In contrast, we find that respondents, who feel that the provision point will not be met, may answer with a protest no response. In particular, we find that when the bid amount is high there is more scenario rejection and a lower likelihood of participation. This runs counter to the Cadsby and Maynes (1999) result that found high provision points let to more participation.

Champ et al. (2002) compare willingness to pay in referendum tax, voluntary contribution and voluntary contribution with a provision point mechanism payment vehicles in the context of the incentive compatibility of the willingness to pay questions. Our results provide another interpretation of their results. The additional number of respondents that reject the provision point scenario may bias willingness to pay downwards. If scenario rejection is controlled with a perceived likelihood variable and

willingness to pay estimates adjusted to simulate scenario credibility, referendum tax and voluntary contribution with provision point mechanism payment vehicles may yield similar results. In other words, the differences found by Champ et al. (2002) may be due to scenario rejection and not incentive incompatibility.

Given that scenario rejection arises with the provision point mechanism in voluntary contribution willingness to pay surveys, the question becomes: What is the correct willingness to pay estimate? We offer one possible correction by calculating willingness to pay when all respondents believe that the provision point will be met. Another question that arises is: Does the benefits of using the provision point mechanism to mitigate the free rider problem outweigh the cost of scenario rejection? Future research could address these issues.

We also find evidence that other forms of scenario rejection exist that contingent valuation researchers have mostly ignored. In our case, one of our scenarios elicited the perceived likelihood of program success. Willingness to pay is positively related with perceived program success which suggests that respondents who reject the scenario on credibility grounds are unlikely to take the willingness to pay question seriously. Future contingent valuation method applications should consider the use of follow-up and debriefing questions to (a) identify scenario features that cause respondent concern and (b) exploit these empirical relationships and adjust willingness to pay estimates accordingly. This is especially important in applications of the contingent valuation method that do not have the budgetary resources to pursue focus groups and pretests.

Table 1: Data Summary

| | Green Energy | Wetlands Preservation |
|---|---|---|
| Yes, willing to pay $A (= 1) | 0.35<br>(0.47)* | 0.32<br>(0.47) |
| Natural Log of Bid Amount, $A | 2.82<br>(0.86) | 4.37<br>(0.69) |
| Income | $52,738<br>(29,395) | $52,201<br>(28,148) |
| Provision point is likely to be met (=1) | 0.75<br>(0.43) | 0.48<br>(0.50) |
| Scope | 9.96<br>(7.36) | 2588<br>(1432) |
| Goals of the policy are likely to be met (=1) | 0.76<br>(0.42) | |
| Cheap talk treatment (=1) | 0.33<br>(0.47) | |
| Organization membership | | 0.41<br>(0.49) |
| Sample size | 315 | 293 |

*Standard deviation in parentheses.

Table 2. Probit Models for Likelihood that Provision Point Will be Met

| | Green Energy | | Wetlands Preservation | |
|---|---|---|---|---|
| | Coeff. | t-ratio | Coeff. | t-ratio |
| Intercept | -.13 | .34 | 1.11 | 2.18 |
| Natural log of $A | .09 | .36 | -.27 | 2.48 |
| Scope | -.01 | .52 | .00002 | 0.38 |
| Cheap Talk | -.06 | .36 | | |
| Income | -.005 | 1.96 | .0004 | 0.18 |
| Goals Likely Met | 1.35 | 7.45 | | |
| Organization membership | | | -.14 | 0.92 |
| $\chi 2$ | 61.56 | | 7.07 | |
| Cases | 315 | | 293 | |

Table 3. Probit Models of Willingness to Pay

| | Green Energy | | Wetlands Preservation | |
|---|---|---|---|---|
| | Coeff. | t-ratio | Coeff. | t-ratio |
| Intercept | -.94 | 2.58 | .49 | 0.85 |
| Natural log of $A | -.35 | 3.82 | -.48 | 3.93 |
| Provision Point Likely | .40 | 1.92 | .78 | 4.65 |
| Goals Met Likely | .66 | 2.97 | | |
| Cheap talk | -.39 | 2.33 | | |
| Scope | .024 | 2.24 | .00002 | 0.27 |
| Income | .010 | 3.96 | .009 | 3.06 |
| Organization membership | | | .399 | 2.33 |
| $\chi 2$ | 58.60 | | 63.94 | |
| Cases | 315 | | 293 | |

Table 4: Willingness to Pay Estimates

| | Likelihood provision point is met | | |
|---|---|---|---|
| | 0 | Mean | 1 |
| Green Energy | $0.43<br>(0.46) | $4.42<br>(1.76) | $9.19<br>(2.75) |
| Wetlands Preservation | $11.47<br>(6.28) | $25.07<br>(8.17) | $58.23<br>(13.75) |

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