Contingent Valuation and Watershed Management: A Review of Past Uses and Possible Future Applications

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Abstract

Contingent valuation is an economic tool used for estimating the value that a person places on environmental goods and services. It is particularly useful for estimating the values of non-market and non-use goods and services. Contingent valuation has a number of possible uses for environmental decision-making such as measuring willingness-to-pay for environmental changes, for risk assessment, in environmental litigation, in policy formulation, and for evaluating investments. Contingent valuation also has possibilities for evaluating watershed management options. This paper examines the uses and limitations of contingent valuation and its possible future applications in watershed management.

Positive aspects of contingent valuation include its hypothetical nature and its ability to measure option, bequest, and existence values. However, among problems associated with contingent valuation are a failure to address global impacts, boundary issues, asymmetric valuation of gains and losses, contingent valuation's hypothetical nature, strategic bidding behavior of respondents, and irrational responses. Many of these drawbacks are important considerations when using contingent valuation for watershed management decisions. Some of these shortcomings may be addressed by use of integrated decision-making, multi-criteria analysis tools, and post-survey debriefing interviews to determine respondent frame of reference.

Contingent valuation has clear values to watershed management, but it also has clear limitations. If conducted correctly, in many situations it can be expected to provide fairly accurate results. For valuing the longer reaching effects of management activities on a watershed, however, contingent valuation results may be less than accurate. In these cases, alternative methods should be explored.

Keywords: contingent valuation method, watershed management, non-use value, stated preference method

Introduction

Contingent valuation is an economic tool used for estimating the value that a person places on environmental goods and services. Contingent valuation is particularly useful for estimating the value of non-market and non-use goods and services. It is referred to as a "stated preference" method of valuation because it involves the survey of personal opinions of value regarding hypothesized, but unrealized, environmental changes.

Researchers interview a sample of the population to be affected by a particular action, and through a series of questions and analyses, estimate the respondent's value of the resource or action in terms of willingness to pay (WTP) or willingness to accept (WTA). Willingness to pay represents the most a person would be willing to pay to keep her quality of life, while willingness to accept represents the minimum that a person would be willing to accept to keep her quality of life at its original level when she loses the good. The average WTP/WTA obtained from the sample is then extrapolated across the entire affected population (often taking into account factors such as income, education level, and other socioeconomic variables) and used as the dependent variable in a regression model.

Contingent valuation has a number of possible uses for environmental decision-making, such as measuring willingness to pay for environmental

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changes (Eisen-Hecht and Kramer 2002), for risk assessment (Fried et al. 1999, Novotny et al. 2000), in litigation (Arrow et al. 1993, World Bank Institute 2002), in policy formulation (He et al. 2002), and for evaluating investments (Ardila et al. 1998). It is also commonly used as a tool in evaluating different watershed management options (Cruz et al. 2000, Pattanayak 2001, Eisen-Hecht and Kramer 2002).

In 1993, a team of economists headed by two Nobel laureates convened to discuss the utility of contingent valuation (Arrow et al. 1993) (the "Arrow-Solow Report"). The result was a set of recommendations for the use of contingent valuation in natural resources. The authors suggest that the more closely their guidelines are followed, the more reliable the results obtained from a contingent valuation study. This report is commonly viewed as a list of best management practices for the assessment of damages caused by environmental disasters, but also has a more general applicability to natural resources as a whole (Carson et al. 1996). Many natural resource contingent valuation studies adhere to the methodology outlined in the 1993 Arrow-Solow Report and use this adherence as an indication of the validity of their study (Eisen-Hecht and Kramer 2002, He et al. 2002).

There are several assumptions one must make in order for contingent valuation to be valid. The first is that the resource to be valued can be described in a scenario that is meaningful to the respondent, and that the respondent understands the resource as the researcher intends it to be understood (World Bank Institute 2002). Maps, computer presentations, and pictures might be used to accomplish this. The second assumption is that there is a payment vehicle: for willingness to pay, the vehicle might be a new user fee. For willingness to accept, it might be a tax refund. The third assumption is that the questioner has a method for measuring the respondent's value of the proposed change. There are three common methods for this. The first is open-ended questioning, where the questioner asks the respondent how much he would be willing to pay, for example, for improved water quality. The second method is iterative bidding. The questioner asks the respondent if he would be willing to pay, for example, $10 more a year for improved water quality. If the respondent answers affirmatively, the questioner continues to increase the bid until the respondent answers no. The third, and most accepted method is dichotomous choice, or referendum, where the questioner offers the respondent a random price, to which she must answer either yes or no. Often a follow-up question or a combination of these methods is used to narrow the willingness to pay (or accept) price range (Carson et al. 1995).

Contingent Valuation Method: Strengths

Contingent valuation has a number of strengths. First, it can be used to value multiple destination recreation trips, as many other non-use valuation tools cannot (Loomis 2002). Second, contingent valuation is hypothetical in nature, so it can be used to measure the effects of an irreversible change without actually making the change (Loomis 2002). Second, it can be used to measure option values, or the value that one places on a resource for the option of having it to use in the future (Loomis 2002). Finally, it is the only method that can measure bequest value, which is the value one places on a resource in order to be able to pass it on to future generations, and existence value, which is the value one places on a resource just for knowing that it exists (Loomis 2002, World Bank Institute 2002).

Contingent Valuation Method: Issues

Despite these strengths, there are a number of problems with contingent valuation. First and foremost, any survey research is susceptible to a variety of different errors. Survey design, including question wording and question order, can all affect accuracy and can cause bias in survey results (Dillman 2000).

Although the Arrow-Solow Report is regarded as the industry standard, there are those who do not agree with the findings. Harrison (2001), for example, asserts that the report is "generally lacking in logic and empirical foundation," and encourages researchers to think important issues through on first principles. The Report does not seem to be infallible, either. Carson et al. (1995) tested the Report's assertion that timing of interviews could have a significant effect on the reliability of survey results. They found this to be untrue, and concluded that willingness to pay measures did not seem to be significantly sensitive to interview timing.

Projects implemented locally can have long reaching effects. Contingent valuation tends to focus its efforts on the communities in which the proposed change will take place and neglects to take into account the effects on a global scale (Westra 2000). But for issues affecting watersheds, these effects can have significant impacts, and contingent valuation

will fail to measure them. It is very difficult to place boundaries around environmental issues (O'Neill and Spash 2000), and the population sampled for a contingent valuation survey may not be a good sample of the underlying affected population. So for projects of more than local significance, use of the contingent valuation method is questionable. Asymmetry in valuation of gains and losses, depending on the respondent's point of view, creates interesting issues for contingent valuation (O'Neill and Spash 2000). We tend to put more value on things we already own (willingness to accept), and less value on things we have to purchase (willingness to pay), so depending on which criteria a survey is using, the measure can over- or underestimate the actual value to respondents.

Although the hypothetical nature of contingent valuation is a strength, it is also a weakness (Bateman and Langford 1997, Westra 2000, Morrison 2002, World Bank Institute 2002). The situations described by contingent valuation surveys are not real, and just because something is predicted to occur doesn't mean that it will. A potential Pareto improvement is an economic principle which states that if an action has "winners" (those whose quality of life is improved by the action) and "losers" (those whose quality of live is diminished by the action), it is possible that such a situation could exist where the winners could potentially compensate the losers and still have a gain remaining (Loomis 2002). In reality, just because it is possible for winners to compensate losers, it doesn't mean that they will. Westra (2000) also notes that although contingent valuation surveys are conducted with the caveat that respondents must have a full understanding of the issue at hand, that is seldom the case. Especially in cases that involve environmental risk, economically interested parties have a vested interest in protecting and promoting their products and operations. This can lead to half-truths and misinformation in the survey process.

Strategic bidding is also an issue, and can introduce bias into contingent valuation studies (Kuriyama 1999, Morrison 2002). An underbid may be indicative of the fact that someone isn't willing to state his actual value for a resource because he believes it should be available at no cost. An overbid might represent a respondent's strategy to give a higher than reality price to something in hopes that the inflated response will influence the final results of the survey. Irrational responses, or responses that make no sense, can also confound contingent valuation surveys. Respondents might state a positive willingness to pay for something they think will have no effect (He et al. 2002). They may also not be willing to put a price on something that clearly has a value to them. For instance, if they feel something to be a basic human right, respondents may see it as an act of betrayal to put a verbal price on it, despite the fact that it has value to them (O'Neill and Spash 2000).

Yea saying, or a tendency of the respondent to agree with the interviewer regardless of his true views, can also be an issue (He et al. 2002). Social pressures may motivate some of these responses. Studies have shown that people are less willing to voice their undesirable positions when they are aware that they are being tested (i.e., in a survey situation)(Singleton and Straits 1999). This so-called social desirability effect has the potential to bias the validity of any contingent valuation study.

A further problem with contingent valuation is that it can give respondents unrealistic expectations of what is going to happen. Especially with willingness to accept contingent valuation surveys, respondents can be led to expect that they will receive a payment at some point in the near future, based on their responses to the survey. In practice, it is rarely the case that any payment is actually granted (Westra 2000). Particularly when working with populations in developing and impoverished areas, this "promise" of money that never comes can lead to a decline in trust of researchers and can have negative impacts on the future of conservation efforts in the region. This is an especially important factor to consider for watershed conservation efforts in developing countries.

Contingent Valuation Method: Improvements and Alternatives

There are many ideas for improvement of the valuation of natural resources, but no all-encompassing answers. Integrated decision-making seems to be critical (O'Neill and Spash 2000). An integrated approach that involves all stakeholders, relevant policy makers, and hard scientific evidence in a decision process is critical to gaining an understanding of the true value of a resource (Westra 2000).

Although economically interested parties are stakeholders and should be included in the decision process, in order to make sure respondents receive as accurate and nonpartisan information as possible, disinterested third parties should conduct impact

assessments and design and conduct contingent valuation surveys (Westra 2000).

Multi-criteria analysis (MCA) tools take into account the fact that some things aren't measurable by money, and the resource requirements and effects of different watershed management alternatives may be comparable in several different dimensions, but without a single unit of measure (O'Neill and Spash 2000). Analytic Hierarchy Process is an example of MCA. In this process, stakeholders choose preferred management options based on pairwise comparisons of several alternatives. Preferences of respondents for one option over another are the measuring rod instead of dollars. Methods such as this can help to eliminate bias caused by the pressure of having to choose a dollar value.

People's decisions can be based on concerns about legitimate procedures and the fairness of the distribution of burdens and benefits (O'Neill and Spash 2000). This can be independent of concerns about maximizing total welfare. Questions should be worded such that respondents don't compromise their ethical beliefs by giving a truthful answer. Multi-criteria analysis combined with deliberative methods (such as stakeholder focus groups) may help elicit a more accurate value of the resource (O'Neill and Spash 2000).

Although the contingent valuation methodology certainly has drawbacks, there are ways to help counteract these issues. If values placed on a resource depend on the frame of reference of the respondent (i.e., WTP vs. WTA), it becomes very important to elicit not only the respondent's value of the resource, but also his frame of reference. This will help explain why he puts this value on the good in question. It also becomes critical to have demographic data to help estimate the frame of reference of the population as a whole.

Boundary issues can be minimized by using a distance decay function when extrapolating WTP/WTA to an entire population. Rubin et al. (1991) used this method to perform a benefit-cost analysis of the Northern Spotted Owl. According to their paper, WTP decreases with distance from the affected area. Rubin et al. estimated that WTP decreased approximately 10% for every 1,000 miles distance, and used this estimate to extrapolate the value of the spotted owl to their entire affected population (in this case, the United States).

Irrational responses may not be the result of failure to understand the survey, but instead may represent very real indications of willingness to pay, and why respondents are (or are not) willing to pay. Reconsider the example of someone stating a positive willingness to pay for something that she thought would have no effect. There are conceivable situations in which citizens could be willing to contribute to something that they didn't think would necessarily have immediate, on-the-ground effects, but that they thought might influence the future of conservation. According to accepted contingent valuation theory, these irrational responses are discarded with the assumption that the respondent didn't properly understand the survey. It becomes very important to understand exactly why respondents answered as they did. Post-survey debriefing sessions are a necessity if one is to clearly comprehend respondents' understanding of the proposed scenario and the meaning behind irrational responses (Hanemann 1994). In addition, careful survey design and administration can help to alleviate some of the bias-causing mistakes common in survey research.

Contingent Valuation as a Tool for Watershed Management: An Example

There are many examples of the utility of contingent valuation for evaluating different options in watershed management. Generally, a set of alternatives is developed and presented to the public in the form of a contingent valuation survey. Based on public response to the survey, researchers can then perform a cost-benefit analysis to determine which alternative is the most preferred.

The literature is full of a variety of different examples of using contingent valuation for watershed resources. In order to demonstrate this use, we consider a study conducted by Eisen-Hecht and Kramer (2002) in the Catawba Basin, located in North and South Carolina. This study was an analysis of the cost-effectiveness of maintaining the current level of water quality in the Catawba River Basin. Researchers estimated economic benefits using the contingent valuation method by surveying a total of 1,085 area residents. They calculated a mean willingness to pay of $139/household, and compared it with the estimated cost of the proposed management plan over a 10-year period. Using net present value and a variety of discount rates, researchers found that the potential benefits would outweigh the costs by more than $95 million. Researchers used dichotomous choice (referendum) for eliciting a value from respondents. They then

used logistic regression to find which social and demographic factors affected respondents' willingness to pay. They asked a wide range of questions, and found that the cost of the management plan had the most direct affect (people were more willing to pay for lower cost management plans), but a number of other variables also had both significant positive and negative effects, such as belief that management plan was likely to succeed, membership to an environmental or conservation organization, whether or not respondents trusted universities, and respondent's household income.

Potential Problems with the Study

Overall, the study conducted by Eisen-Hecht and Kramer reads much like a checklist of how to conduct a contingent valuation study. One potential problem, which in this particular case doesn't seem to have had a negative impact, is that researchers didn't appear to address any larger scale management implications. In a situation like this, which aims to make environmental improvements to an ecosystem, the project may have longer reaching positive effects, and so benefits may have been underestimated. Since this example appears to be a winner, in any case, this omission may not be important. For a project where the decision isn't as clear-cut, however, or where there could be long-reaching negative effects, consideration of all stakeholders, costs, and benefits is vital.

Conclusions

Contingent valuation has clear values to watershed management, but it also has clear limitations. It is a tool that can be used for valuation of natural resources, and if conducted correctly, can be expected to provide fairly accurate results. For valuing the longer reaching effects of management activities on a watershed, however, it can be difficult to include all relevant stakeholders, and contingent valuation results may be less than accurate. In these cases, alternative methods should be explored.

There are a number of means suggested to help counter the shortcomings of contingent valuation methodology. Acknowledgement of all stakeholders, careful survey design and administration, and post-survey debriefings (particularly for examining the reasoning behind irrational responses) are all methods that help improve the process of valuation of watersheds, and the use of contingent valuation as a means for doing so. Most importantly, researchers need to be aware of the limitations of contingent valuation and the knowledge that the situation in which contingent valuation is to be used can have important ramifications for the accuracy of the test. In these situations, integrated decision-making and multi-criteria analysis tools may help make more accurate management decisions.

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