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Full Length Research Paper

Contingent valuation technique: A review of literature

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Managing environment and natural resources is one of the most important inputs for sustainable economic development. In statistics it said that "you cannot manage what you cannot count". This can be rephrased for environment and natural resources by saying you cannot manage the environment and natural resources unless you value them. Some of the natural resources can be valued in terms of their alternative uses, while others are difficult to be valued. Valuing environment is even more difficult than valuing the natural resources. The objective of this paper is to discuss the methods of valuing environment and natural resources with particular emphasis to the contingent valuation method. Relevant theoretical and empirical literature, methodological issues, and problems of the contingent valuation methods are discussed in detail. Conclusions and recommendations are also made.

Key words: Contingent valuation, willingness to pay, willingness to accept, valuation methods.

INTRODUCTION

Any country favorably endowed with natural resources always enjoys an advantage in the economic growth race over resource-poor countries (Raj et al., 2006). Raj et al. (2006) say also that there are resource-rich countries which have gone more slowly than countries with scare natural resources. One of the reasons of such an unexpected result may be the inability to manage their natural resources. Thus, for achieving a sustainable economic development a country has to achieve two things at the same time- managing resources properly and using the effectively(productively) in the sort run; and converting natural resources into sustainable economic growth and development in the long run.

However, Raj et al. (2006) also states that a country's environment- its air, water, diversity of biological species and natural surroundings are also useful (valuable) natural resources. Further, they add that the sad truth is that all economic activities use, at least to some extent the environment as a dump for waste products and environment damages can have serious adverse consequence on human health and welfare. Contaminated water and the resulting diarrhea disease kill a lot of children and cause millions of episodes of illness. Soil conservation, water and air pollution and deforestation can cause considerable losses by leading to contraction of a wide variety of economic activities. Furthermore, natural resources and wildlife have some intrinsic value in addition to their relationships to economic activity and human welfare (Raj et al., 2006).

Tietenberg (2003) say that in economics the environment is viewed as a composite asset that provides a variety of services. It is a very special asset, to be sure, since it provides the life support systems that sustain our very existence, but it is an asset nonetheless. Teitenberg (2003) also states that we wish to prevent undue depreciation of the value of this asset so that it may continue provide aesthetic and life- sustaining services.

In statistics it is said that you cannot manage what you cannot count. In environmental and natural resources economics also, to prevent the depreciation of some resource requires understanding its property and devising the ways of preserving it. People tend to preserve some resource when they understand its value. Even if they know the values of resources, they overuse it forgetting that it can be finished.

Some of the natural resources can be valued in terms of their alternative uses, while others are difficult to be valued. Valuing environment is even more difficult than valuing the natural resources. We get benefit from an environment, attaching monetary value to it, however, is difficult. We may get harm from environmental pollution or destruction, valuing the cost we incurred, again, is difficult to be measured.

Economists have made attempts to device some methods of valuing the environment and resources. Contingent valuation is one of the methods widely used for valuing the environment and natural resources. Any method devised to solve a given problem has its own advantage and limitations. Understanding the method with respect to its strengths and weaknesses helps a lot for its future uses. A method for which has more weaknesses than its strengths obviously make one produce wrong policy recommendations.

The main objective of this paper is therefore, to discuss the contingent valuation method by reviewing relevant past works.

METHODS OF VALUING ENVIRONMENT

Many environmental resources are not traded and so do not have an obvious price. Any good or service is constituted of different attributes some of which are concrete and easily measured, while others may be more difficult to quantify. Such an attribute is called total economic value (TEV). Awad and Holländer (2010) quoting Rogers et al. (2002), Raucher et al. (2005) and Turner et al. (2004) say that total economic value is broken-down into two main values: use values and nonuse values. The use values are subdivided into direct use value or indirect use value. Directive use value is consumptive, extractive, or structural use value, derives from goods which can be extracted, consumed, or directly enjoyed, for instance, direct use of water include drinking, waste disposal and industrial process such as the use value of water to a manufacturer is closely related to the degree to which water a necessary part of production of a given good, as well as other direct uses for water such as recreation or sport fishing. In contract indirect-use values are those in which water is indirectly used to produce a good. The indirect use values occur from the natural functioning of ecosystems, for example, an indirect use of water receives is characterized by its fewer benefits, which are not traded in any market and are sometimes referred to as un-priced benefits to water users (Awad and Holländer, 2010). Non-use value: this value of domestic water supply services includes intangible benefits that households derive without any direct or indirect use. The non-use value can, however, be subdivided into existence, bequest, and option value. Existence value means that keeping for natural resources simply thinking it must exist. Bequest value is the value that a habitant places on the ability to conserve a resource so that it can be used by future generations. In other words, respondents might be willing to pay to restore water quality for the time being and future, but from knowledge that their heirs and future generations will have good water quality. Option value also refers to the value resource for future times (Awad and Holländer, 2010).

Valuation then means how individuals attach monetary values to these resources either when they want to use it or when they want compensation when the natural resource or environment of which they gain benefits is affected. There are also attempts to adjust the traditional GDP for the environment. Jinnan et al. (2004) state that subtracting the sum of maintenance cost of air, water and solid wastes pollution by industry and region from the traditional GDP we get the green GDP adjusted by environmental pollution (EDP) by industry and region. They defined EDP as total output minus the intermediate input minus maintenance cost. This paper will not discuss this one further, however.

Broadly there are two ways of estimating the economic value of non- marketed goods- revealed preference technique and the stated preference. In revealed preference technique, we use the current transactions associated with a public commodity to estimate the value of it. Travel cost and hedonic pricing methods are the two prevalent approaches in revealed preference technique. In travel cost method, the cost of enjoying the environmental amenity is used as a proxy to value it. The travel cost is an indirect approach based on real market. The characteristics of a site are evaluated as are the costs (time and money) involved in reaching that site. It is also useful for estimating time costs and their impact on the choice of transport mode. The problem with this method is that it does not take into account multi-purpose travel (that is, individuals will visit multiple sites on single trip). In hedonic pricing, researchers associate the price of a marketed commodity to its characteristics or the service it provides. The third and the most widely used technique is the contingent valuation (CV) method. CV is a direct approach using hypothetical market. Direct observation methods are those based on actual observable choices and from which actual resource values can be directly inferred.

Here the researchers ask hypothetical questions to elicit the amount the respondents are willing to pay for the improvement in the quality of service or commodity they are receiving. Respondents may also be asked the amount they are willing to accept to forego the existing service that they are enjoying currently. The first approach is called the Willingness-to-Pay (WTP) approach and the second is called Willingness-to-Accept (WTA). With this introduction, the contingent valuation will be discussed in detail in the subsequent sections.

The contingent valuation method

Contingent valuation method is a valuation based on questionnaire that offers the respondents an opportunity to make an economic decision on a good, which for no market exists. That is, the valuation is contingent upon the simulated market presented to the respondent. World Bank (2002) states that Contingent valuation is a method of estimating the value that a person places on a good, usually one that is not sold in markets, such as environmental quality or good health. CV is also claimed to recover existence or non-use values which other methods cannot. In natural resources, contingent valuation studies generally derive through the elicitation of respondents' willingness-to-pay to prevent injuries to natural resources or to restore injured natural resources (Abdul Rahim, 2005).

CV is also defined as a technique used for the valuation of non-market resources and in fact the commonly used technique for valuing the non-use values/passive values of the environment CV is a survey based method, where people are asked directly how much money they would be willing to pay (or willing to accept) to maintain the existence of (or be compensated for loss of) some environmental feature such as biodiversity. The technique is called contingent valuation method (CVM) because people are asked to state their willingness to pay, contingent on specific hypothetical scenario and description of the environmental service. The contingent valuation method is also referred to as a 'stated preference' method, because it asks people to directly state their values rather than inferring values from actual choices (Gundimeda, http://coe.mse.ac.in).

Literature show that the theoretical method of CV was first proposed by Ciriacy- Wantrup (1947) in 1947 as a method for eliciting market valuation of a non- market good. The method was practically applied in 1963 by Davis to estimate the value hunters and tourists placed on a particular wilderness area. The method gained popularity after the use of method in quantifying the damages following the Exxon Valdez oil spill in Prince William Sound in USA in 1989. Using this approach, a lower bound estimate of US $2.8 billion was reported to prevent another spill similar to the Valdeez with a mean of $7.2 billion (Gundimeda).

History also tells us there were controversies over the use of this technique for policy making. Hence in 1993 National Oceanic and

Atmospheric Administration commissioned a Blue Ribbon Panel consisting of Keneth Arrow and Robert Solow (Arrow et al., 1993) and other economists to answer the question 'Is CV a valid method for determining the lost economic value from natural resource damages?' Arrow et al. (1993) as quoted by Gundimeda (http://coe.mse.ac.in) and others concluded that the CV method can produce reliable estimates provided the surveys are carefully designed and controlled due to inherent difficulties in eliciting accurate economic values through the survey methods.

Literature mention also that the application of CV has increased since then and several papers exist on CV. Contingent valuation method has been used to estimate the benefits from increasing air and water quality; reducing risk from drinking water and ground water contaminants; outdoor recreation; protecting wetlands, wilderness areas, endangered species, and cultural heritage sites; improvements in public education and public utility reliability; reduction of food and transportation risks and health care queues; and provision of basic environmental services such as drinking water and garbage pickup in developing countries(Carson, 2000).

CV has also been used by Tambor and Zethraeus (1998) to estimate the WTP for a health care program; by Krishnan et al. (1999) to elicit consumer's response to preferences for prices of information that helped them make up their decision to purchase seafood; and by Kramer and Mercer (1997) to value tropical rainforest. The World Bank has also used CV studies to estimate WTP for piped water connections in Karalla, India (Sing et al., 1993). Comparison of stated and actual willingness to pay for piped water connections in Kerala, found that CV studies correctly predicted 91% of the actual decisions to connect to pipe water (Griffin et al. 1995). Alemu (2000) used the CV method for the valuation of community forest in Ethiopia. Ayalneh (2010) used CVM to study willingness to pay and control right to the natural forest resources in Adaba district of Bale Zone of Oromiya Regional State. Lin et al. (2005) used CV method to consumers' willingness to pay for biotic foods in China. Leong et al. (2005) used CV method to estimate non- market benefits of highland forest accrued to local residents in Malaysia, list some examples. Herath and Kennedy (2004) used the travel cost and contingent valuation methods for estimating the economic value of Mount Buffalo National Park. It is also possible to list more literature in which CV have been used. For the sake of simplicity, I focus on its methodology in the subsequent sections.

Steps to be followed in contingent valuation technique

The first step in any research is identifying the research problem. Once the research problem is known it is important to know the data to be collected. The next step is to determine the source of the data and the method of collecting the data. The source of for contingent valuation method is the direct responses given by individuals.

Questionnaire is the main tool for data collection in contingent valuation and other studies. The questionnaire should be well designed, pre-tested and edited before applying for the survey. Randomly selected samples of individuals selected from the general population are given information about a particular problem with the following the most important steps:

1. Description of the scenario and the impact of the change in the provisions of and environmental good/service are explained (e.g. who will pay for the good, who will use the good, etc): In this part interviewer should explain the reason for payment and the form of payment. The payment can be made directly in cash, through tax, contribution to funding organizations or by paying higher prices of commodities related to the commodity or service being provided or improved.

2. The respondents are invited to consider the proposed context within which the choice concerning the environmental good/service will be made: In this step the interviewer tells the respondent how the provision of the services will be made. In telling how the provision is made the interviewer is expected not to exaggerate more than what he/she knows. As most of the studies are undertaken by students as partial fulfillment for their degrees I doubt how far students can tell about the provision of the service. The respondent can also doubt about the provision of the service under consideration. If the study is undertaken by government organization it is likely that respondents may expect that the services may be provided.

3. The respondents are invited to supply their statements concerning their willingness to pay (WTP) for a proposed welfare gain/Willingness to Accept (WTA) in the provision of the good/service in question is inferred. Various elicitations can be used to get their WTP/WTA. One should also ask them how they would like to or accept (e.g. higher taxes, entrance fee, donations to charitable trust, etc). Responses can be elicited either through on-site (face to face; users only), house to house (face to face, users and non-users) or by mail/telephone (remote users and non-users) survey.

The form of the question for willing to pay or willing to accept can take one of the following forms:

A. Open ended: in this format we ask the respondent to tell us how much he/she is willing to pay for the provision under consideration. This approach produces a continuous bid variable and may therefore be analyzed using standard statistical techniques. Here some literatures say that there is high degree of individual impreciseness, and sometimes systematic bias may be a problem.

B. Take-it-or leave-it (dichotomous choice): This method was developed by Bishop and Heberlein (1980). The respondent is asked "are you willing to pay $X?" This is a closed ended format, where Yes or No is expected for the questions. The amount X is systematically stepped across the sample to test individual's responses to different bid levels. This approach produces a discrete bid variable and requires sophisticated statistical techniques.

C. Double bounded dichotomous choice (with an iterative second round (double-bound) question): for example if the respondent answers yes to the $X bid then they are asked if they are WTP say $ 2X (or $ ½ X or 1/3 X if they answered No in the initial question). Alberini et al. (1997) in studying the willingness to pay to avoid pollution related illness used the structure of options for payment that is shown in Figure 1. This graph implies that the bid increases/decreases to get the final amount the household is willing to pay.

D. Modified dichotomous choice method: Here the respondent was given a specified amount of money randomly asked if they would be willing to pay. They were also given an opportunity to bid an amount less or greater than the specified amount of money. Responses, therefore, could be viewed as originating from either an open-ended or a closed-ended dichotomous choice-bidding format. Unlike the discrete choice follow-up approach, this method can be used in mail surveys.

E. Payment card method: payment card technique was developed by Mitchell and Carson (1981) in order to avoid the starting point problem that can arise in traditional bidding applications. Payment cards display a range of dollar values starting from zero and increasing at fixed intervals. The respondent is asked to choose his WTP/WTA from these values. Sometimes the payment values are

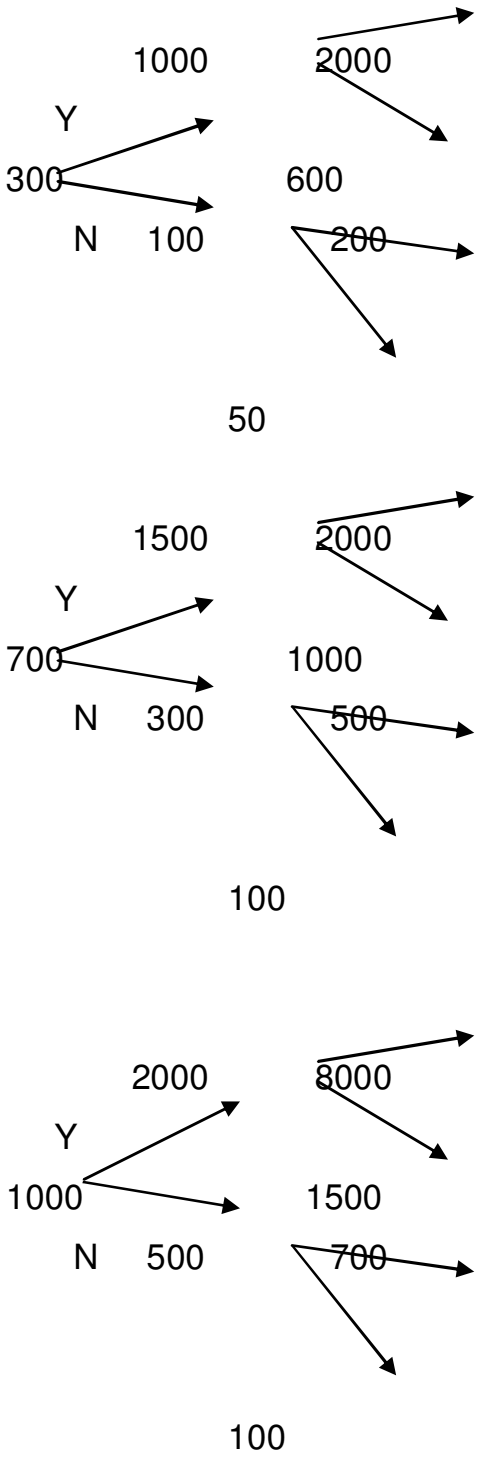

Figure 1. Schematic Representation of Double bounded dichotomous choice used by Alberini et al. (1997).

varied for different income groups and the respondent is asked to choose how much he would be WTP/WTA depending on his income schedule. This is called the anchored payment chard. One can use either open ended or closed ended questions. In the double-bound bid approach Alberini et al. (1997), for example, used three different starting values 300, 700 and 1000 as given in Figure 1.

F. Iterative bidding games: this process is similar to auctions. In the first step the respondent is asked how much he is willing to pay.

The stated amount is changed iteratively until the highest amount respondent is willing to pay/willing to accept is identified.

The willingness to pay or willingness to accept questions are usually followed by questions that individual's demographic and socioeconomic characteristics. Such questions help the researcher identify the determinants of the WTP/WTA. In Alberini et al. (1997), for example, the valuation questions were followed by standard demographic questions, questions about income, the respondent's attitude about health and pollution issues, his health history, and environmental quality in the home and at work place.

Data analysis in contingent valuation technique

Once data are collected using appropriate tool and appropriate sampling procedure, the next step is extracting information from the data, i.e. analyzing using appropriate statistical/econometric methods. Literature on CV focus on three main analyses to be done in CV studies- estimating the average WTP/WTA, estimating the bid curves and aggregating the data. Estimating the average WTP/WTA involves determining the mean, median and/or the modal value of the WTP/WTA. The computation of the mean commonly involves the omission of protest votes, and/or the use of trimmed means when there are extreme cases. In case of dichotomous choice method mean is obtained by calculating the expected value of the dependent variable (WTP or WTA). Estimating the bid curve means modeling the WTP/WTA as a function of different demographic and socioeconomic characteristics of the respondent and some characteristics of the characteristics of the environment/service under consideration. Aggregating the data means simply that estimating population parameters based on sample statistics. All these estimations usually depend on the type of sampling procedure used. When simple random sampling is used the aggregation is straight forward, we multiply the sample statistics by the population size for which we infer. For stratified random sampling, we may find different estimates for each stratum or aggregate the mean over strata.

Antony and Rao (2010) state that the theoretical model for explaining an individual's WTP comes from income compensating function. When we consider WTP as the desired benefit measure, the income- compensating function can be referred as the WTP function. We could hypothesize that the arguments are elements of a vector of respondent's taste or personal characteristics, as well as being variables representing both respondent's environmental concerns and economic situation. i.e. WTP (q_1) =f (P, q_1, q_0, Q, Y, T), where P is the vector of prices of marketed goods, q_1 is the environmental amenity being changed, q_0 is the baseline level of the environmental goods of interest, Q is a vector of the other public goods, Y is the income and T is a vector of respondent's tastes or characteristics. This equation forms the basis for estimating a valuation function that depicts the monetary value of a change in economic welfare that occurs for any change in q_1.

The function can be estimated using a suitable econometric technique. There is theoretically no correct form to estimate this function. However, if a log-log function is specified, the coefficients would be elasticities, directly. The elasticities tell us by how much the mean WTP/WTA would change for a given change in environmental variable under consideration. If a dichotomous payment format has been used then a logit approach is required, relating the probability of a yes answer to each suggested sum to the explanatory variables listed earlier. For a continuous question format OLS estimation techniques are employed.

Hammitt and Zhou (2006), for example, used regression analysis with the maximum likelihood approach for estimation to study the economic value of air-pollution related health risks in China. Before applying their models they made goodness-of- fit test for normal, Weibull, and lognormal distributions. Based on the chi-square goodness-of-fit tests and the log-likelihoods of the fitted models, both the lognormal and Weibull, distributions fit the data much better than the normal distribution, while the lognormal provides slightly better fit than the Weibull distribution. Therefore, they used the lognormal distribution for their study. For the risk-risk tradeoff question between chronic bronchitis and mortality they assumed a beta distribution as it provides a wide range of possible shapes on a support which is bounded between zero and one.

Hammitt and Zhou (2006) have also used what they called bid vector. This simply means giving the frequency distribution for each level of bid and see if the willingness to pay changes as the bid value increases. They displayed both descriptive statistics and regression results for rural, Anqing and Beijing, China. Hammitt and Zhou (2006) used the beta distribution to estimate the maximum mortality risk that the respondent would accept in a treatment to cure their chronic bronchitis. For respondent j, the expected value of in difference mortality risk is calculated as:

$$s_j^* = \frac{a_j}{a_j + b} = \frac{\exp(\beta Z_j)}{\exp(\beta Z_j) + b}$$

Where, β and b are estimated parameters. a_j is assumed to depend on individual characteristics (Z_j) and that b is constant across individuals. They have also made comparisons between locations. Hammitt and Zhou (2006) have also made sensitivity analysis of their models and found their results disappointing. The estimated coefficients of risk reduction are never significantly different from zero in standard models. In the mixture and two-parts models, the coefficients of risk reduction is significant only once, in the part of the mixture model describing the probability that WTP is positive for mortality-risk reduction in Anqing, China. They found most of the independent variable insignificant.

Alberini et al. (1997) on their study for valuing health effects of air pollution in developing countries, the case of Taiwan explain that a person's willingness to pay to avoid air-pollution-related illness may be developed in the context of the following household production model. Ideally, one would embed such a model in a dynamic programming framework in which utility in period t depends not only on acute illness in that period, but also on the stock of acute illness experienced to date. In such a framework, the actions a person would take to mitigate illness in period t would also depend on illness experienced in the past and on the realization that mitigating illness today would reduce future disutility of illness.

Alberini et al. (1997) regressed the log of WTP over different variables that were assumed to affect the willingness to pay to reduce air pollution. They found that willingness to pay to avoid illness increased with duration of illness, with the number of symptoms experienced, and with education and income.

Antony and Rao (2010) put the logistic regression for CV to estimate the average amount of willingness to pay. In the double bound approach, the log-likelihood function is given by:

$$\log L^{DB}(\alpha, \beta, I_i^{yy}, I_i^{yn}, I_i^{ny}, I_i^{nn}) = \sum I_i^{yy} \log P_i^{yy} + \sum I_i^{yn} \log P_i^{yn} + \sum I_i^{ny} \log P_i^{ny} + \sum I_i^{nn} \log P_i^{nn}$$

Where,

$$P_i^{yy} = \frac{1}{1+e^{-(\alpha+\beta HB)}}$$

$$P_i^{nn} = \frac{1}{1+e^{-(\alpha+\beta LB)}}$$

$$P_i^{yn} = \frac{1}{1+e^{-(\alpha+\beta HB)}} - \frac{1}{1+e^{-(\alpha+\beta FB)}}$$

$$P_i^{ny} = \frac{1}{1+e^{-(\alpha+\beta FB)}} - \frac{1}{1+e-(\alpha+\beta LB)}$$

I_i^{yy}, I_i^{yn}, I_i^{ny} and I_i^{nn} are the dummy variables (1, 0) denoting the group to which the i^{th} respondent belongs. I_i^{yy} denotes those who answered YES to the first and second bids, I_i^{yn} those who answered YES to the first question and No to the second question, etc,. FB denotes the first bid amount, LB the low bid and HB the higher bid.

The various choices of the bid amounts in the double bound approach indicate that the second bid value to be offered should be carefully chosen by investigator. A proper choice of the second bid amounts is likely to improve the performance of the double bound estimators compared to single bound estimators (Antony and Rao, 2010).

PROBLEMS IN CONTINGENT VALUATION TECHNIQUES

Any method of valuing environment has its own strengths and weaknesses. Different literature tried to list the advantages and disadvantages of the contingent valuation method. Some of the problems are related to the bidding system used in the particular CV study. The initial bid given to the respondent may have a problem by itself and/ or lead to the willingness by the respondent in the next bid. This is called the starting point bias. A way to overcome this is the payment card technique but this induces a different kind of bias called anchoring bias because of the range of values presented on the payment card. Dichotomous choice questions are free from anchoring bias. But they also suffer from the bias that the bid presented to the respondent may be reflecting the respondent's true WTP. Valuation may also depend on the information about the good/service and its provision and financing is provided, who makes the interview, what other information the respondents have about a particular good or incident. Such information may be information about the characteristics of the good/ service, information about the substitute and complements, information on relative expenditure, information on the behavior of others, and the provision rule. This information may result in a bias WTP/WTA. Such a bias is called information bias.

The WTP/WTA may also affected by the mode of payment. For example, if the respondent is asked how much they would be willing to pay in the form of a price increase vis-à-vis other modes of payment like tax, user fee etc., and the response may be different. This difference in WTP depends on the method of payment is called vehicle bias (Gundimeda). It is also given that WTP<WTA due to income effect. People systematically value losses more highly than equivalent gains, and reduction in losses more highly than foregone gains. What literature did not consider in this respect is that respondents may have sufficient evidence to value WTA than WTP as requesting compensation involves the true value plus some margins of error that they impose as punishment for the damage. Property rights and ownership matter also a lot in this regard.

If the respondents believe that the bids will be collected, they may underestimate their WTP. This bias also occurs if an individual feels that the good would be provided anyway if others contribute, and thereby providing an incentive to free-ride. If the respondent is keen that the good would be provided, there may be an incentive to over-state his WTP, thereby ensuring the provision of the good. This is termed as strategic bias or free riding bias. Sometimes, individuals' WTP responses fail to distinguish between specific good (the part) and the wider group (the whole) into which the specific good falls. Because of this when respondents are asked to value some environmental good they may in fact make that valuation on the basis of a much wider range of environmental goods. As a result the respondents may pledge more than their entire income. Such a bias is called the mental account bias or part-whole bias. This may be one of the reason that outliers which are about 18% of invalid responses in Alemu (2000) were determined as those whose WTP was over 5% of their income and was over Ethiopian Birr 20 (which is over 330% of the maximum starting price used) for his first open- ended question.

Because the market and the payment in CV method are hypothetical, the individuals declared intentions may not be meaningful at all. Such a problem is called hypothetical market bias. It can be minimized by making the hypothetical market as actual as possible, motivating the respondents well and changing the elicitation methods.

Sometimes there may be scenario misspecification. The researcher may be incorrect in economic theory or about the amenity or policy itself; the respondent may misinterpret the meaning intended by the interviewer; and the respondent may perceive the probability of the amenity being provided is different from the interviewer's intention. Such problems can be avoided through proper survey design and implementation (Carson, 1989 as cited in Rahmatian (2005)).

Gundimeda (http://coe.mse.ac.in) and other quote Arrow et al. (1993) state that The Blue ribbon Panel gave the following suggestions on how to carry a good CVM study.

1. For a single dichotomous question (yes-no type)

format, a total sample size of at least respondents are required. Clustering and stratification issues should be accounted fro and random sub sampling will be required to obtain a bid curve and to test for interviewer and wording biases.
2. High non- response rates would render the survey unreliable.
3. Face-to-face interviewing is likely to yield the most reliable results.
4. Full reporting of data and questionnaires is required for good practice.
5. Pilot surveying and pre- testing are essential elements in any CVM study.
6. Underestimation of WTP/WTA is to be preferred to overestimation of WTP/WTA.
7. WTP format is preferred to WTA format.
8. The valuation question should be posed as a vote on referendum, that is, a dichotomous choice question related to the payment of a particular level of taxation.
9. Accurate information of the valuation situation must be presented to the respondents, particular care is required over the use of photographs
10. respondents must be reminded of the status of any undamaged possible substitute commodities;
11. Time-dependent measurement noise should be reduced by averaging across independently drawn samples taken at different points in time
12. A no- answer should be explicitly allowed in addition to the 'yes' and 'no' vote options on the main valuation question;
13. Respondents must be reminded of alternative expenditure possibilities, especially when 'warm-glow' effects can be prevalent(that is, purchase of moral satisfaction through the act of charitable giving).

These guidelines are important and plausible as they were prepared by panel of experts based on research findings. Among these thirteen points, points stated under (1) and (7) are of great doubt. It is good to have large sample size. Equivalently it is also good to know that as the sample size increases too much non-sampling errors become higher. A sample size of at least 1000 respondents also implies that CVM is valid only when we undertake large scale surveys. If this is the case, CVM studies undertaken by students are unreliable. Arrow et al. (1993) might have preferred the WTP format to the WTA format as WTP<WTA in most/all of the studies they considered. In my opinion, however, WTA format is preferred to WTP as the respondent estimates the WTA based on the past evidences on value of the good/service and or costs involved in protecting the good/service. The reason that WTA exceeds WTP, is presume that the respondent adds some values as a form of punishment. It is also natural that you value something higher when you sell than when you buy.

Gundimeda (http://coe.mse.ac.in) says also that the CVM should pass the following tests in addition to the earlier listed thirteen criteria:

1. Price sensitivity test: the higher the cost, lower the demand. In case of binary discrete choice format, this can be tested by observing whether the percentage favoring the project falls as the cost of the project increase. Many good CVM studies pass this test.
2. Scope test: Does the WTP/WTA increase when the amount of good increase? Researchers, however, often found it difficult to establish this.
3. Debriefing: why did the respondent answer the way he did? For example, if he is not willing to pay, the interviewer should include reasons behind.
4. Interviewer effect and protest should be examined.
5. Sample size must be hundreds at least
6. Probability of Yes equation should have several significant explanatory variables.

When we consider these tests again, expecting the WTP/WTA to increase when the amount of good increase depend on the type of good. For some goods increasing the amount may be impossible. Sample size being hundreds is also vague at whether he said one hundred or nine hundred is not clear. To be a good criterion it must be fixed like to be at least 1000 in Arrow et al. (1993). Large sample sizes may also result in invalid results. Ayalneh (2010) dropped 11 questionnaires among 306 filled ones because of invalid responses. Alemu (2000) who used a random sample of 480 households dropped 55 (11.46%) of the questionnaires because of invalid response. Norwood et al. (2005) used only 288 questionnaires out of 513 that they dispatched for the study. The response rate of their survey was only 57% even if they called this percent is 'high response rate'. Goldberg (2005), on the other hand reported no dropping of questionnaire among the 240 sample households he used for the study; and Solomon (2004) also reported no dropping of questionnaires because of invalid responses from among 250 questionnaires (sample size) he used. Leong et al. (2005) report also that there were only 47.53% of the 226 samples respondents found usable for the WTP estimation. Bowker and Didychuk(1994) in their study to estimate the non-market benefits of agricultural land retention in Eastern Canada sampled 140 households of which 38 refused the interview, 1 response was incomplete and 9 protest bids used only 92 effective sample size. These and other evidences show that a sample of at least 1000 is rarely practically possible and even large samples results in many questionnaires to be discarded.

The probability of Yes equation to have several significant explanatory variables is also in contrary of the parsimony of a model in econometrics. A model should have few explanatory variables with sufficient information. Inclusion of the questions which as the reason of 'no' answers should also be designed in the questionnaire. The interviewer is usually expected to follow the questionnaire and the survey guidelines. Concerning the interviewer effect, one survey on willingness and ability to pay for health services in Ethiopia in 2000 was experienced.

As a team leader and supervisor of the survey in eastern Ethiopia, the questionnaires filled by the interviewers every night are being checked. All the questions in the questionnaires filled by one of the interviewers were found answered yes to all bids. My personal observation about the households was completely different from what he filled. When the case was deeply studied, it was found that the interviewer had been with military uniform and thus the respondents responded yes to all bids thinking he would report to the government that they are not willing to pay for the services that the government provides them. The responses in the questionnaires filled by other respondents were fair and differ from household to household. Thus training and supervision of interviewers should be given due attention to get reliable data from CV methods.

The other problem related to CVM is that the WTP sometimes is positively related with income while it is negatively related in other studies. Solomon (2004) found positive and insignificant relation between WTP for protection of eucalyptus and indigenous trees, while Ayalneh (2010) got negative relationship between WTP for forest protection and the income of the household. Ayalneh gave the possible reason saying that households with low income may want the forest products as a source of income and thus they want to pay more. Bowker and Didychuk (1994) also found income to be insignificant to determine the WTP for environmental goods and services. Such differing result may result from the differences in the types of the commodities, but it creates difficulty in using economic theories to test the validity of the model. The other important problem in CVM that was never mentioned by literature if the fact that respondents are asked give decision for the problem they are not experienced with before. Like any decision making process, valuing an environment needs time and information. The CVM surveys are, however, carried out in the same way as the common surveys that ask respondents about what they know or experienced before.

Among the literatures that have been read so far, no one talked about the ways of varying the bid. For example, if the first bid is Birr 20, what is our basis to make the next bid 30? or 10? In mathematics the Zenos paradox says “between two num-bers there are infinitely many numbers”. In economics too, when we interpret a slope we say “for a unit change in the particular independent variable, the dependent variable changes by the amount of the slope, cetirus paribus”. But the bids in CVM are made to change by 10s or 1000s. A one cent increase or decrease in the amount to be paid/accept, however, matters for the respondent.

CONCLUSIONS AND RECOMMENDATIONS

Contingent valuation method is the most widely used method of valuing national resources and environment. Despite its wide use it also suffers from a lot of biases. Such biases can be reduced be proper design and implementation of the survey. There have been suggestions by different scholars to improve the usability of the contingent valuation method. Arrow et al. (1993), for example, suggested the sample size to be at least 1000. In practice, however, such a large sample size is difficult to be used. There are a lot of research works who dropped a lot of questionnaires due to invalid responses. Further research to determine the optimum sample size for using CVM is recommend. In fact, the implementation stage of the survey should also be given due attention to get useful results.

The other important point the CVM lacks is that the CV questions ask the respondents to make decision on the matter they might not known before. Thus, their valuation may become or arbitrary. If the objective of the survey is to value an environmental good/service, it is wise to give time for the respondent to collect sufficient information may be by discussion with his/her family and give well thought value for the commodity or the service. It is equally important to review the information that is offered to the respondents to come up with valid results.

Among the common biases in CV studies is also the starting point bias. A lot is said about it but none of the literatures give the guideline for fixing it. Using similar studies to fix the stating point bid and/or making further studies to determine the way optimum staring point is suggested. To the best of my observations, there is no culture of sharing information between various CV studies. One of the basic objectives of undertaking surveys is to generate information for future studies. Sample size for current study, for example, is fixed using the information from past similar studies. When the bids vary based on the respondent’s response as yes or no also researchers vary the bids as they want. Some increase or decrease the bids in 10s while others increase/decrease in 100s and even some in 1000s. For this also there must be a system for by how much the bid should be change to obtain reliable WTP/WTA. Repeated experiments on surveys can help in this respect.

As mentioned in the previous sections CVM does not give sufficient time for giving well thought WTP/WTA values. It is suggested, therefore, that CVM surveys could yield better results if time is given for the respondent to give well thought value for the commodity/service.

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