

# Contingent Valuation: A User's Guide<sup>†</sup>

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Contingent valuation (CV) is a survey-based method frequently used for placing monetary values on environmental goods and services not bought and sold in the marketplace. CV is usually the only feasible method for including passive-use considerations in an economic analysis, a practice that has engendered considerable controversy. The issue of what a CV study tries to value is first addressed from the perspective of a policy-maker, and then the controversy over the inclusion of passive-use is taken up in more detail. The major issues and positions taken in the technical debate over the use of CV are summarized from a user's perspective. Key design and implementation issues involved in undertaking a CV survey are examined, and the reader is provided with a set of factors to examine in assessing the quality of a CV study.

## Introduction

The essence of an economic analysis is to compare *all* of the benefits of the proposed action to *all* of the costs (1), with a project said to pass a benefit–cost test if the sum of all the benefits is greater than the sum of all the costs. Such an analysis is seriously defective without monetary values for the environmental amenities and services (hereafter “goods”) affected by a proposed action. The central problem in the application of standard economic tools to the provision of environmental goods, whether indirectly through regulation or directly through public provision, is placing a monetary value on them. Because these goods are not routinely bought and sold in the market, actual cost/sales information is seldom available. Economists have developed a variety of techniques to value nonmarket amenities consistent with the valuation of marketed goods. These techniques are based upon either observed behavior (revealed preferences) toward some marketed good with a connection to the nonmarketed good of interest or stated preferences in surveys with respect to the nonmarket good (2). The stated preference approach is frequently referred to as contingent valuation (3, 4) especially when it is used in the context of environmental amenities. The use of contingent valuation (CV) has engendered a heated debate (5) between proponents (6) and critics (7).

A CV survey constructs scenarios that offer different possible future government actions. Survey respondents are then asked to *state* their preferences concerning those actions. The choices made by survey respondents are then analyzed in a similar manner as the choices made by consumers in actual markets. In both cases, economic value is derived from choices observed either in an actual market or in the hypothetical market created in the survey.

Under the simplest and most commonly used CV question format, the respondent is offered a binary choice between two alternatives, one being the status quo policy and the other alternative policy having a cost greater than maintaining the status quo. The respondent is told that the government will impose the stated cost (e.g., increased taxes, higher prices associated with regulation, or user fees) if the non-status-quo alternative is provided. The key elements here are that the respondent provides a “favor/not favor” answer with respect to the alternative policy (versus the status quo), where what the alternative policy will provide, how it will be provided, and how much it will cost have been clearly specified.

Random assignment of cost numbers to respondents allows the researcher to trace out the distribution willingness to pay (WTP) for the good. The percentage of the relevant public willing to pay different amounts is determined in much the same way as a dose–response experiment in biology or medicine (8, 9). When a parametric functional form is assumed for the WTP distribution, summary statistics such as mean and median WTP can be estimated.

WTP is one of the two standard measures of economic value. It is the appropriate measure in the situation where an agent wants to acquire a good. Minimum willingness to accept (WTA) compensation is the appropriate measure in a situation where an agent is being asked to voluntarily give up a good. Both of these measures are Hicksian consumer surplus measures and are often defined net of the price actually paid or received. Whether WTP or WTA is the correct measure depends on the property right to the good. If the consumer does not currently have the environmental good and does not have a legal entitlement to it, the correct property right is WTP. If the consumer has a legal entitlement to it and is being asked to give up that entitlement, the correct property right is WTA. For marketed goods, theoretically the difference between the two measures should generally be small and unimportant (10) as long as income effects and transaction costs are not large. For nonmarketed goods, this may not be the case (11) as the difference between WTP and WTA is also dependent upon the substitutability of the nonmarketed good for goods available on the market.

CV has been in use for over 35 years, and there are now over 2000 papers and studies dealing with the topic (12). Illustrative applications of CV to estimated benefits include the following: increasing air and water quality; reduced risk from drinking water and groundwater 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. While the most visible applications are those for natural resource damage assessments such as the *Exxon Valdez* oil spill (13), the vast majority of CV applications have been undertaken for the purpose of assisting in policy evaluations.

CV is used by most Federal agencies with environmental responsibilities and by many state agencies. CV studies have been conducted in over 50 countries by government agencies and international organizations. One indication of the importance of CV can be seen by looking at Environmental Valuation Reference Inventory (EVRI), a large online database currently being assembled for policy-making purposes by Environment Canada, as a cooperative venture undertaken with the European Union, the U.S. EPA, the environmental protection agencies of Chile and Mexico, the World Bank,

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and the Economy and Environment Program for South East Asia (<http://www.evri.ec.gc.ca/evri/>). As of December 1999, that database contained 524 studies based upon stated preferences, 255 studies based upon revealed preferences, and 123 studies based upon actual costs.

The debate over the use of CV has two major thrusts. The first one is largely philosophical revolving around whether so-called passive-use or existence values should be included in an economic analysis (14). Economists have traditionally thought of marketed goods where it is necessary for a consumer to physically use a good to get utility from it. However, it is possible for consumers to get utility from a good, however, without physically using it. Such uses have become known as passive-uses, and without their inclusion, goods such as a remote wilderness area have little or no economic value. The use of CV is central to this debate, as it is the standard and often the only approach that can include passive-use values. The second debate, a largely technical one, revolves around what economic criteria the results of a CV study should meet. Much of this debate concerns the merits of particular tests and whether various phenomena are anomalies from the perspective of economic theory, and if so, whether they are peculiar to particular studies or CV practices (15) or symptomatic of more general problems with CV (7). Because CV studies range from very good to very bad, the key factors that an informed user should examine in making an initial assessment about the quality of a particular study are discussed below.

### Inclusion of Passive-Use Considerations

WTP and WTA are defined without regard to an agent's motives and as such are synonymous what has been termed "total" economic value. For market goods, it is generally considered necessary to directly use a good, often by consuming it or physically interacting with it for the good to have economic value to the agent. This is not the case for many environmental goods where it is possible to passively use the good.

Consideration of passive-use value in an economic analysis is due to Krutilla's (16) seminal observation that many people value natural wonders simply for their existence. Krutilla argued that these people obtain utility through vicarious enjoyment of these areas and, as a result, had a positive WTP for the government to exercise good stewardship of the land. These values have been called bequest value, look-existence value, intrinsic value, inherent value, passive-use value, stewardship value, and nonuse value. The term *passive-use* value was popularized in the important 1989 U.S. Appellate Court decision, *Ohio v. Department of Interior*, which mandated that such values be included in a natural resource damage assessment to the extent that they can be reliably measured.

Without the inclusion of passive-use considerations, *pure public goods*, including overall level of air quality, national defense, and remote wilderness areas, have little or no measured economic value. Pure public goods are those for which it is impossible to exclude people from enjoying the good and from which enjoyment by one person does not degrade another person's enjoyment of the good. Pure public goods are typically, but not always, provided by government. (Quasi-public goods are those provided for by the government, like a Forest Service campground, for which it is possible and often desirable to exclude people.) The value of pure public goods cannot be assessed by traditional economic techniques because they effectively work by looking at differences in quantities of a good consumed as a function of differences in prices. For a pure public good, all people experience the same level of the good.

A CV survey can create an idealized market for a pure public good whereby respondents face a choice between

two different quantities of the good. The usual example is the status quo level of the good versus an alternative level that will entail a specified cost increase. Any particular good can have both direct-use and passive-use values. The exact dividing line between direct-use and passive-use is to some degree dependent upon knowledge of physical and biological linkages and upon what activities of consumers are observed. For instance, while swimming in a lake obviously involves direct water contact, connecting the distant wetlands necessary to support a duck hunter may be difficult. Even in the quintessential example of lost passive-use, harm from the *Exxon Valdez* spill to households outside Alaska, household news-watching behavior was influenced by spill coverage (17).

The estimate inferred from the contingent market described in the survey will generally be an estimate of total economic value (WTP or WTA). Any estimate of total economic value includes both direct-use and passive-use considerations. Efforts to disaggregate these two components, however, have been shown to be problematic (14).

There are three well-articulated viewpoints with respect to the inclusion of passive-use: (a) that passive-use values are irrelevant to decision making (18), (b) that passive-use values cannot be monetized but should be taken account of as a political matter or by having experts decide (19), and (c) that passive-use values can be reliably measured and should explicitly be taken into account (20). The first position is hard to defend from an economic perspective. Failure to consider passive-use value is clearly inconsistent with economic theory if the objective is to maximize public welfare in any well-defined sense as pure public goods would clearly be under-supplied. The difference between the second and third position depends largely upon whether one wants the monetary value the policy-maker placed on the good to be kept implicit (21) rather than explicitly disclosed, whether one wants the preferences of experts or the public, and one's view on whether CV techniques can be reliably implemented.

### Technical Issues Surrounding the Use of CV

The measure of economic value produced by a CV study should conform to several different economic criteria; various tests of these have been proposed. Much of the technical debate is over whether failure to satisfy one or more of these tests in a particular CV study is indicative of a problem with that particular CV study or of problems with CV generally. This debate exists because there is considerable variation in CV practices and results. Critics sometimes fail to see that economic theory often predicts that these practices should influence the results (15). Furthermore, some suggested tests (especially large split-sample comparisons) are very expensive to implement; hence, all available tests are not performed in any particular study.

Concerns raised by CV critics over the reliability of the CV approach led the National Oceanic and Atmospheric Administration (NOAA) to convene a panel of eminent experts co-chaired by Nobel Prize winners Kenneth Arrow and Robert Solow to examine the issue. In January 1993, the Panel, after a lengthy public hearing and reviewing many written submissions issued a report which concluded that "CV studies can produce estimates reliable enough to be the starting point for a judicial or administrative determination of natural resource damages—including lost passive-use value (22)." The Panel suggested guidelines for use in natural resource damage assessment legal cases to help ensure the reliability of CV surveys on passive-use values including the use of in-person interviews, a binary discrete choice question, a careful description of the good and its substitutes, and several different tests that should be included in the report on the survey results. The Panel suggested several topics needing

further research. Since the Panel issued its report, many empirical tests have been conducted, and several key theoretical issues have been clarified.

The simplest test corresponds to a well-known economic maxim: the higher the cost, the lower the demand. In the binary discrete choice format, this can be easily tested by observing whether the percentage favoring the project falls as the randomly assigned cost of the project increases. This price sensitivity test has rarely failed in empirical applications.

The test that has attracted the most attention in recent years is whether the WTP estimates from CV studies increase in a plausible manner with the quantity or scope of the good being provided (23, 24). CV critics often argue that the lack of sensitivity to scope, or embedding as it is sometimes called, results from what they term "warm-glow" by which they mean getting moral satisfaction from the act of paying for the good independent of the characteristics of the actual environmental good (23). Several well-known examples in the literature show insensitivity to the scope of the good being valued (25); other examples show substantial sensitivity to the good's scope (26). There have now been a considerable number of tests of the scope insensitivity hypothesis, and a recent review of the empirical evidence suggests that the hypothesis is rejected in a large majority of the tests performed (27).

There are two difficulties with the warm-glow explanation for embedding. The first, while warm-glow is a well-defined concept in the economic literature with clear implications for giving to private charities, its relevance to public provision of environmental goods via taxation requires that agents get utility from the act of paying higher taxes (28). The second is that the term embedding has multiple meanings as used in the nonmarket valuation literature (24). Specifically, it has been used to refer to an insensitivity of estimates to the scope of the good being valued as well as a sensitivity of the estimates to the order in which they are valued. Under the latter phenomena, the value of a particular good tends to fall, often substantially, as it is valued further out in a sequence of goods. Having the value of the good differ depending upon the order in which it is valued is disturbing to many policy-makers. However, such an effect is predicted by economic theory due to the substitution possibilities between the goods and the reduction in disposable income that occurs with the purchase of each new good (29). This dependence on the order in which a good is valued is simply one manifestation of why political control of the agenda (e.g., the order in which issues are considered) is so important.

A major focus of the technical debate concerning CV has been on the choice of the particular format used to elicit information about the respondent's preferences. Different question formats are used. For instance, a binary discrete choice question versus an open-ended question that asks the respondent directly for their WTP for the good may result in different estimates, with estimates from binary discrete choice questions being higher than those from open-ended questions. The argument made by some is that if agents had well-defined preferences for the good, both formats should result in similar estimates (30). The counter argument, which comes from the economic theory on mechanism design, is that incentives for truthful preference revelation are different for these two formats, and as consequence, one should expect the estimates should be different with the binary discrete choice question predicted to yield truthful responses (31) if other conditions typically associated with a referendum are met.

Another major focus of the technical debate has been comparing estimates from CV surveys to estimates from other methods (32). Most available comparisons are for quasi-public goods such as outdoor recreation. CV estimates tend to be slightly lower and highly correlated with corresponding

estimates based upon revealed preference methods such as travel cost analysis where differentials in the cost of getting to a recreation site implicitly define a demand curve for the site or hedonic pricing where the environmental good is bundled into a marketed good like a house (33). For private goods, surveys tend to predict higher purchase levels than actually observed (34), which is the same as the result from comparing survey indications of willingness to make voluntary contributions and actual contributions to provide a public good (33). In the public arena, however, surveys taken close to an election tend to provide quite good predictions of the actual vote (35), and when large changes are seen in the percent favoring a ballot measure over time, it is usually due to grossly disproportionate expenditures by the measure's opponents (36).

There are several other issues surrounding the use of CV. These include the related issues of yea-saying, protest zeros, nay-saying, and calibration. Yea-saying is manifested when a respondent says yes to an amount in order to please the interviewer even though the respondent's WTP is less than the amount asked about (4). Protest zeros occur when a respondent who has a positive WTP for a good gives a response of \$0 to a question that requests an actual WTP response even though the respondent has a positive WTP for the good (4). A variety of explanations for protest zero ranging from rejection of the legitimacy of the scenario presented to strategic behavior have been put forth. When asking discrete choice questions, the corresponding phenomenon is sometimes labeled nay-saying (4). This occurs when the respondent provides a no response to an amount asked even though WTP is greater than the amount asked about. The presence of "untruthful" responses, for whatever reason, leads to arguments that contingent valuation responses should be "calibrated" to potentially correct for either an upward or downward bias (37). Interesting adjuncts to this issue is the issue of how to combine data from both the stated and the revealed preference approaches (38, 39) and how to perform benefit transfers (40). Some economists and psychologists have raised the larger issue of whether respondents have well-defined economic preferences for many goods. The interested reader is directed to refs 41–43 for lively discussions and exchanges on whether such problems generally exist, and if so, how they should be handled.

### Assessing the Quality of a CV Study

The first consideration in evaluating the quality of a CV study is the survey instrument. A good CV survey should have what is known as "face validity". The good and the scenario under which it would be provided should be described clearly and accurately, and the tradeoff that the respondent is asked to make should be a plausible one. The respondent should be provided with enough information to make an informed decision but not be overwhelmed with it.

Most good CV surveys contain the following: (a) an introductory section that helps set the general context for the decision to be made; (b) a detailed description of the good to be offered to the respondent; (c) the institutional setting in which the good will be provided; (d) the manner in which the good will be paid for; (e) a method by which the survey elicits the respondent's preferences with respect to the good; (f) debriefing questions about why respondents answered certain questions the way that they did; and (g) a set of questions regarding respondent characteristics including attitudes and demographic information. Estimates from studies with vaguely described goods and vaguely defined or implausible payment obligations should be carefully scrutinized for their relevance (44).

Producing a good CV survey instrument requires substantial development work (4, 44, 45). This work typically including focus groups and in-depth interviews to help

determine the plausibility and understandability of the good and the scenario being presented. The task of translating technical material into a form understood by the general public is often a difficult one. Developing a useful CV survey instrument requires the research team to clearly define what the proposed project will produce in terms of outputs that people care about in language they understand. Pretests and pilot studies are conducted to assess how well the survey works as a whole, with some elements of the survey usually needing redesign to improve respondent understanding.

Second, the particular population sampled should be the relevant one for evaluating the benefits and/or costs of the proposed project. The size of the population over which benefits and costs accrue can be one of the major factors in determining a good's economic value. For a pure public good, the economic value of a good is simply the sum of the WTP of all agents in the relevant population, since enjoyment of the good by one agent does not diminish any other agent's enjoyment of it (1).

Third, survey data are typically highly variable when trying to measure a continuous variable (e.g., income or hours worked), and CV survey data are no exception. A sample size on the order of several hundred to a couple thousand observations is generally required to achieve reasonable reliability from a sampling (confidence interval) perspective. All members of the relevant population should have a positive and known probability of being included in the sample. If inclusion probabilities are not equal, an appropriate set of weights is needed.

Fourth, consider the mode of survey administration and the survey's response rate. The NOAA Panel (22) recommends in-person interviews in part because visual materials such as maps and pictures that facilitate respondent understanding can be used. Mail and telephone surveys are dramatically cheaper and should not be dismissed out of hand. Mail surveys tend to suffer from sample selection bias, because those returning the surveys are typically more interested in the issue than those who do not. Such respondents are more likely to provide extreme WTP responses than a randomly chosen individual. Furthermore, households who moved into an area tend not to be included in the original sample. Telephone surveys have severe drawbacks if the good is complicated or visual aids are needed, and response rates from random-digit-dialed telephone surveys are becoming harder to calculate due to the increasing number of computer and fax lines. A high response rate to a survey (currently in the 60–80% range for the surveys of the general population) helps minimize potential problems with extrapolating to the population of interest. A variety of weighting and imputation procedures are available to help correct for the inevitable deviations from the desired sample, and there are statistical methods to help correct for sample selection bias (46).

Fifth, there are other more mundane aspects of the survey instrument and its administration that a reader should examine. For all administration modes, look at how non-respondents were treated and the effort expended to convert initial refusals. For in-person interviews, professional interviewers should be used. For mail surveys, the adequacy of the original mailing list should be examined. With respect to the unit of observation, the household is generally more appropriate if a payment vehicle like higher taxes or utility bills is used; while the converse is true of payments that take the form of entrance fees. Was the payment described as a lump sum or a continuing payment? With respect to payment frequency, a one-time payment generally produces more conservative estimates since it does not offer the opportunity to spread payments over time. A one-time payment is appropriate in cases where providing the good represents a one-time event, but not in cases, like local air pollution, for which ongoing easily visible actions must be taken. Was the

respondent asked for information about WTP or WTA? WTA questions are usually much harder to successfully implement due to the need to convince respondents of the legitimacy of giving up an environmental good, but they often represent the correct property rights perspective.

We have focused substantial attention on the survey aspects of a CV study because care in handling them usually reflects care in dealing with other aspects of the study. Studies that do not follow good survey practices often produce results that are difficult to use and to interpret (44).

Most studies construct an equation that predicts WTP for the good as a function of several other variables in surveys, such as income, past recreational use, and various attitude and knowledge questions concerning the good. An equation with reasonable explanatory power and coefficients with the expected signs provides evidence in support of the proposition that the survey has measured the intended construct. If this is not the case, either the research team has failed to collect the relevant covariates in the survey, suggesting inadequate development work, or the WTP responses are random and completely useless.

CV results can be quite sensitive to the treatment of potential outliers. Open-ended survey questions typically elicit a large number of so-called protest zeros and a small number of extremely high responses. Inference about the right tail of the WTP distribution is often problematic as only a very small fraction of the population having extreme high values for a good can dramatically influence mean WTP. In discrete choice CV questions, econometric modeling assumptions can often have a substantial influence on the results obtained (9). It is particularly critical to allow for the possibility of a spike in the WTP distribution at zero (47) and to account for income constraint on WTP (48). Any careful analysis will involve a series of judgmental decisions about how to handle specific issues involving the data. These decisions should be clearly noted.

Finally, the distribution of economic value on a per-capita basis should appear reasonable. For estimates based on the general population rather than a specific population (like hunters), many respondents are likely to be unwilling to pay anything for the good. For most environmental goods, WTP distributions will be quite asymmetric with mean WTP larger than median WTP, in part because the income distribution is asymmetric and in part because there is often a sizable part of the population that is fairly indifferent to the environmental good and a smaller group that care a great deal about its provision. Mean WTP is the traditional measure used in benefit–cost analysis, while median WTP, which corresponds to the flat amount that would receive majority approval, is a standard public choice criterion. There is no single “correct” measure independent of the purpose for which it is being used. Typically, the entire WTP distribution will be of interest to policy-makers. The degree of precision necessary for the CV results to provide a useful input to the decision-making process can vary substantially. In some instances only a rough order of magnitude comparison between benefits and costs may be required, while in other instances relatively small changes in an estimate may influence the preferred outcome. This consideration should be reflected in the sample size chosen and the effort put into survey design.

## Concluding Remarks

The recent debate surrounding the use of CV is, to some degree, simply a reflection of the large sums at stake in major environmental decisions involving passive-use and the general distrust that some economists have for information collected from surveys. Outside of academic journals, criticism of CV has taken a largely anecdotal form, ridiculing the results of particular CV studies, many of which use techniques

known to be problematic. The implication drawn is that all CV surveys produce nonsense results upon which no reasonable person would rely. In an academic context, however, the debate over the use of CV has been more productive. The spotlight placed upon CV has matured it; its theoretical foundations and limits to its uses are now better understood. A carefully done CV study can provide much useful information to policymakers.

Much CV research, however, still needs to be conducted. Perhaps the most pressing need is on how to reduce the cost of CV surveys while still maintaining a high degree of reliability. Current state-of-the-art practices are very expensive and, hence, impractical to implement in many situations where information on the benefits and cost of environmental aspects of policies are badly needed. The cost of state-of-the-art CV surveys stems from their use of (a) extensive development work to determine how the public views the good, (b) in-person interviews, (c) full probability sampling designs, (d) large samples, (e) extensive visual presentations of the good and its method of provision, and (f) a single binary discrete choice question. Items a–e are largely survey design and administration issues. It is possible to cut development costs and time for any specific CV survey by implementation of research programs designed at solving some of the more generic representation issues such as low-level risk (49) or large-scale ecosystems (50). Combination telephone–mail–telephone surveys (where a random sample of respondents is first recruited by phone, mailed the visual aids for the CV survey, and then asked the CV survey question by phone) hold promise in terms of substantially reducing survey administration costs while retaining many of the advantages of a high quality in-person survey. Item f is currently the focus of substantial research. One can generalize the binary discrete choice question in two general directions: getting more information about the interval where the respondent's value for the good lies or asking the respondent about different but related goods. The first approach has long been used in CV surveys in the form of asking one or more repeated binary discrete choice questions or for the respondent's actual WTP amount. It can substantially decrease the number of observations needed for a given level of statistical precision. The second of these approaches is becoming increasingly popular in the environmental valuation literature (51) and is often referred to as choice-based conjoint analysis, a term from the marketing literature (52). Under this approach, respondents are asked to pick their most favored out of a set of three or more alternatives and are typically given multiple sets of choice questions. This practice can provide substantially more information about a range of possible alternative policies as well as reduce the sample size needed. Survey design issues with the choice-based conjoint approach are often much more complex due to the number of goods that must be described and the statistical models that must be employed. A drawback of both of these approaches is that they provide increased incentives for strategic behavior on the part of survey respondents. Assessments of the tradeoffs involved in the use of these and other stated preference approaches to placing a monetary value on nonmarketed goods are currently underway.

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