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## Resources and Environment: Contingent Valuation

A major impediment to performing a benefit-cost analysis involving the provision of a new public good or a change in an existing public good is that public goods are not routinely bought and sold in markets. Hence 'prices,' the economic data routinely used by economists as indicators of the economic value of goods, are not available for public goods such as environmental amenities. To overcome this obstacle, economists have developed (Freeman 1993) an indirect valuation approach that infers economic value from observations on consumer behavior with respect to marketed goods having a relationship to the public good, and a direct approach that gives consumers the opportunity to make choices with respect to the public good. The indirect approach relies upon one of two factors: that the public good can be 'bundled' in as one of the attributes of a private good (e.g., close proximity to a public park) and that it is sometimes necessary to make expenditures of money or time to use the public good (e.g., driving to a hiking trail in a national forest). The direct approach can be implemented by subjecting consumers to a constructed choice situation involving the public good, such as a vote in a referendum to provide the public good. The now common survey variant of the direct approach has come to be known as contingent valuation (CV) because the estimates of economic value obtained are 'contingent' on the features of the scenario posed in the survey.

CV surveys differ from other surveys on public policy issues in several important ways. First, the entire survey is devoted to describing the public good (or a small number of public goods) of interest.

Second, they differ in that their major purpose is to obtain an estimate of the relevant Hicksian consumer surplus measure; maximum willingness-to-pay (WTP) to obtain a desired good not currently possessed, or minimum willingness-to-accept (WTA) compensation to voluntarily give up a good currently possessed. CV surveys are typically organized in the following manner which reflects current practice: (a) an introductory section identifying the sponsor and general topic, (b) a section asking questions about prior knowledge about the good and attitudes toward it, (c) the presentation of the CV scenario including what the project was designed to accomplish, how it would be implemented and paid for, and what will happen under the current status quo situation if the project were not implemented, (d) question(s) asking for information about the respondent's WTP/WTA for the good, (e) debriefing questions to help ascertain how well respondents understood the scenario, and (f) demographic questions. Mitchell and Carson (1989) provide a comprehensive overview of the issues involved in the design and analysis of CV surveys.

### 1. Development

Ciriacy-Wantrup (1947) put forth the first well-developed proposal on the need for CV surveys in a piece on the difficulties of measuring all the benefits of soil conservation programs. Empirical implementation of CV initiated by Davis (1963), in his Harvard dissertation, sparked considerable interest in the technique. He later compared a CV estimate with a corresponding estimate based on the travel cost method (an indirect approach then also being newly developed) and found that the two approaches produced similar estimates.

CV surveys were initially seen as having three distinct advantages. First, CV can obtain useful information where data on past consumer behavior had not been collected. Second, CV permits the creation and presentation of scenarios that provide new goods or changes in existing goods that were substantially outside the range of current consumer experience. Third, CV allows measurement of the desired Hicksian consumer surplus measure rather than its Marshallian approximation. For many economists, the major drawback to CV-based estimates was that they were based upon stated preferences rather than observed behavior.

A paper by Randall et al. (1974) greatly increased interest in CV. It valued changes in air quality necessary to maintain scenic vistas in the Southwest. The indirect valuation approach was not capable of being applied in this instance because all people in the area share the good equally (and hence, not bundled differentially into housing prices) and no expenditure of time or money is needed to enjoy it.

Randall et al. estimated what had been termed 'existence value' in an influential paper written by Krutilla (1967). The novel element in Krutilla's framework was that existence values were not generally revealed by market purchases. He argued that some people care about environmental resources, such as wilderness areas, irrespective of their desire to visit them. Krutilla did not measure existence values but rather recommended determining how large they would have to be to tilt the decision in the other direction. Failure to include existence values in policy-making, he contended, would likely entail too great a loss of existing environmental amenities and the provision of too few new environmental amenities. Other related concepts were soon enumerated (e.g., non-use value, stewardship value, bequest value, option value) and eventually encompassed into a single term, 'passive-use value,' first used in the 1989 court decision *Ohio v. Department of Interior* (880 F.2d 432, D.C. Cir.), which held that government trustees should include passive-use values in damage claims.

What Krutilla had called existence values had often been termed intangibles. They were not well integrated into welfare economic theory and thought to be unmeasurable. The key to measuring them lies in the recognition that due to scarcity effects, any form of economic value is a relative and not an absolute concept. Monetary measures of economic value are implicitly defined by choices made subject to an income constraint. CV permits the construction of the appropriate choice scenario. Also, economic value can be expressed in terms of any constraints/tradeoffs appearing in a choice scenario including time, other public goods, or private goods.

The quantity of CV research steadily increased throughout the 1970s and early 1980s. The importance of CV in the USA was raised considerably by presidential executive orders that required an assessment of the benefits and costs of all major new government regulations and reauthorization of existing ones. Outside the USA, CV was incorporated into OECD reports on measuring the economic value of pollution impacts and into World Bank reports on providing basic infrastructure. The rapid growth in the use of CV since the mid-1980s, in the USA and elsewhere, was a response to the growing demand for more comprehensive benefit-cost assessments for policies with substantial environmental or health impacts.

By far the greatest stimulus to the current CV debate, however, was the enactment of US laws that allowed for the recovery of monetary damages for injuries to natural resources. The focal point was the Exxon Valdez oil spill where the government's case was largely based upon a monetary claim for loss of passive use (Carson et al. 1992). Potential liability for lost passive use values should increase a firm's precautionary activities and environmental restoration efforts. Not surprisingly, industry facing such liability questioned whether passive use values should be

counted and whether CV estimates are reliable. A set of papers highly critical of CV from an Exxon-sponsored conference appear in Hausman (1993). In response to the industry critique, the US National Oceanic and Atmospheric Administration (NOAA) convened a Blue Ribbon Panel co-chaired by two Nobel Prize winners (Arrow et al. 1993) which concluded that passive use values should be included in damage assessments and 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.' That report has also been influential for the guidelines that it suggested for conducting reliable CV studies for natural resource damage cases and the issues that it identified as requiring further research.

CV has been applied in more than 50 countries and there are now several thousand CV papers. Most US federal agencies with environmental, health, or natural resource responsibilities have relied upon CV studies in making policy decisions, as have many state agencies. The use of CV has dramatically increased over time in other OECD countries and international agencies regularly commission CV studies. The range of CV applications is broad. It has been used to estimate the benefits of: improving national and regional air/water quality; reducing risk from drinking and groundwater contaminants; improving outdoor recreational opportunities; protecting wetlands, wilderness, rainforests, and endangered species; providing public education; improving food and transportation safety; reducing queues for public health care services; increasing the reliability of electric and water utilities; providing cultural amenities; and improving sanitation services in developing countries.

## 2. Initial Research Focus

Two concerns first voiced during the early phase of CV development have been particularly influential: the possibility that respondents would not take seriously a 'hypothetical' survey question with no money directly changing hands and Paul Samuelson's warning that people would not truthfully reveal their preferences for public goods. Random response to a CV survey which was feared due to its 'hypothetical' nature could be ruled out by noting whether WTP responses systematically varied with particular covariates in the expected way. The tests economists paid the most attention to, however, were those comparing CV estimates with those from indirect techniques (e.g., hedonic pricing and travel cost analysis) for quasi-public goods, where both approaches are applicable. Early work suggested reasonably close comparison between the two, thus ruling out the extreme random behavior or strategic behaviour initially feared. Carson et al.'s (1996) meta-analysis of these comparative studies (616 comparisons from 83 separate

studies) found that CV estimates on average were slightly lower than their corresponding indirect technique estimates and the CV and indirect estimates were highly correlated.

For pure public goods, the indirect approach is not possible so one can only compare estimates based upon different types of constructed markets. With coercive payment (e.g., taxes), incentive theory suggests that CV responses should be similar to those obtained from observing voting in an equivalent referendum, the observed empirical result. With voluntary payment, theory suggests that survey estimates will be larger than true (and unobservable) WTP that in turn should be larger than actual contributions due to free riding. The observed empirical result is that survey WTP is substantially larger than actual contributions.

Other issues that concerned early CV researchers were whether the payment vehicle used should influence WTP estimates, how much information should be provided to respondents about the good, what fraction of WTP/WTA was due to passive use considerations, what the 'best' elicitation format was, why the difference between CV, WTP, and WTA estimates was larger than expected, and the relative merits of different modes of survey administration. Some of these issues have been resolved whereas others continue to be debated. The latter are discussed in the next section.

WTP estimates for the same good were shown to differ, often considerably, with different payment vehicles. Respondents were not indifferent to how public goods were financed. This was distressing to many who believed, or at least hoped, that the value of a good should be independent of the exact manner in which it was supplied and paid for. The CV estimates suggested that this was not the case.

As one would expect, WTP estimates were sensitive to the nature and amount of information provided. However, this sensitivity entailed the thorny issue of what information should be provided. CV researchers began undertaking extensive survey development work including focus groups to determine what information people wanted in making their decision. Many early CV surveys asked respondents to apportion their WTP estimate into different parts corresponding to various types of use and passive use values. Such decompositions were shown not to be unique and the various components had no distinct policy implications, so this practice has largely been abandoned.

### *3. Research Issues*

The issue of the best elicitation format continues to be debated but is increasingly being cast in terms of a bias-variance tradeoff. The binary discrete choice format with random assignment of respondents to

different amounts (Bishop and Heberlein, 1979) has gained prominence owing to its desirable incentive properties for truthful preference revelation, in many (but not all) situations. This format has two major drawbacks. First, it collects relatively little information about a respondent's value for the good (i.e., only whether this value is above or below the amount asked), thus requiring large samples for precise estimates. Second, its estimates are sensitive to the particular parametric functional form chosen. Response formats directly asking for WTP provide the maximum amount of information (the amount making the respondent indifferent between the status quo and the alternative). This format, however, invites non-truthful strategic behavior and typically results in a sizeable fraction of the sample providing either a zero WTP amount or no response. CV researchers have proposed a number of different response formats falling between these two extremes.

Early CV WTA estimates were considerably larger than corresponding WTP estimates. This was originally thought to be a defect of CV surveys but similar divergences now appear to be typical of experimental and actual markets. A number of reasons for large divergences have been suggested (Bateman and Willis, 1999), some consistent with neoclassical economic theory and some more psychological in nature. As a consequence, interest has been renewed in measuring WTA, since the substitution of a WTP measure in its place can substantially underestimate the value of a good.

The merit of different modes of survey administration also continues to be debated. Many CV studies need visual representations of the good (e.g., pictures or maps) precluding the use of telephone surveys. The in-person vs. mail survey debate has several elements, including the much greater cost of personnel interviews, the importance of controlling the order in which material is presented, the importance of being able to read material to respondents, potential sample selection bias due to interest in the topic, and the potential influence of the interviewers.

CV researchers also came to realize that they faced the standard array of survey design issues. Adequate presentation of the material in the typical CV survey is now seen as a much more difficult task than the standard public opinion survey and is one for which most economists have had little training or experience. Further, several cognitive psychologists (e.g., Kahneman and Knetsch 1992) argued that the estimates of economic value obtained in CV surveys were likely to be subject to several undesirable effects. Chief among these was that the estimates obtained in a CV survey would be insensitive to the scope of the good being valued. They argued that stated intentions and actual behavior will diverge because respondents get a 'warm glow' from 'giving' in a survey context. While there are a few study results consistent with this prediction, a fairly large number of split-sample tests

using more fully developed CV scenarios have tested this hypothesis and reject it. Nonetheless, the Kahneman and Knetsch paper stimulated considerable interest in testing the properties of CV estimates against predictions from economic theory.

#### 4. State of the Debate

Although there is widespread general agreement among CV practitioners on many issues, they often disagree regarding the extent and applicability of various best-practice standards, such as those proposed by the NOAA Panel, when cost and complexity factors are introduced. The recent Bateman and Willis (1999) volume considers these issues.

Participants in the early years of the CV debate were mostly environmental economists. One now finds that corporate executives, ecologists, lawyers, microeconomic theorists, philosophers, psychologists, public administrators, statisticians, and survey researchers have joined in. The increasingly interdisciplinary nature of this debate attests to the complexity of the issues and importance of CV for policy decisions (Portney 1994). Opponents of CV often conclude that CV is fundamentally flawed (Diamond and Hausman 1994). Their typical recommendation is to let the 'experts' decide. Proponents of contingent valuation acknowledge that poorly designed and implemented studies have produced problematic results that should not be used. However, they believe that these problems are not inherent to the method and are not found in the better studies (Hanemann 1994). They argue that without CV it is not possible to conduct a comprehensive economic analysis of many environmental issues and that the public's preferences concerning the provision and payment for public goods cannot be adequately represented to policymakers.

*See also:* Consumer Economics; Consumption, Sociology of; Ecological Economics; Environmental Adaptation and Adjustments; Environmental Economics; Public Goods: International

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## Respiratory Disorders: Psychosocial Aspects

Man can do without food for weeks, without water for a few days. A few minutes without air, however, means death. Experiencing shortness of breath is associated with strong feelings of anxiety and panic. In this article, the three most prevalent respiratory disorders will be discussed, from a behavioral and social science perspective.

### 1. Asthma, Chronic Bronchitis, Pulmonary Emphysema

In order to understand the relevance of the contribution of behavioral and social sciences to the study of patients with respiratory disorders, in this paragraph definitions of asthma, chronic bronchitis, and emphysema, and risk factors, epidemiology, and medical management will be discussed briefly first.

Asthma is derived from Greek, meaning 'panting or distressed breathing.' A universally accepted definition of asthma is not available, reflecting changing views over time in the area of pulmonology and gaps in the

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