Lecture on environmental economics, May 7, 2004

Direct methods for valuation of environmental goods

Among direct methods, it is usual to distinguish between two main groups, as follows.

1.The contingent valuation method (CVM). By this we mean that the value of an environmental good is elicited directly, as answer to a question about willingness to pay (WTP) to have more of the good, or willingness to accept (WTA) to have less of it.

The execution and design of this method will be explained more carefully below. CVM is the most applied valuation method in recent years, and it has been developed mainly in the context of environmental valuation, over the last 30 years. It is therefore of great interest to study it more carefully.

2.Choice-experiment (CE) methods. This is rather a group of methods, where individuals are asked to choose between different alternatives, which involve the environment, but where there are no direct questions about valuation. In an individual CE question, individuals are faced with a choice between two "projects" which differ in the environmental dimension, and in addition in some other dimension or dimensions.

The lack of a direct valuation question in CE is both a strength and a weakness, relative to CVM.

One strength of CE relative to CVM, is that people often have trouble attaching direct monetary values to environmental goods which they are not used to valuing. Then it may be easier to choose between attribute combinations.

Another point is that the choice situations constructed in CE studies often correspond more closely to real-life choices and thus perhaps be relatively familiar. In contrast, the scenarios described in CVM studies are often unfamiliar, and sometimes unrealistic.

Indeed, familiarity of the choice situation is one strength of CE that one tries to exploit in designing such studies.

A weakness of CE relative to CVM is just that it is less direct. When people have a good sense of the value of a particular environmental good, it is best to ask them directly about this value, instead of asking in a circumscribed way.

Example of a CE study of transportation choice involving environmental amenities

Assume that individuals surveyed are required to choose between different bus rides, that at the outset are relatively familiar to them.

The choice situation is assumed to involve the variables included in the following tables. The individual questioned is required to choose between choice alternatives 1 and 2, as follows:

Choice number	Bus ticket price	Envir. quality along route	Other attribute
1	10	"Bad"	No seat
2	20	"Good"	Seat

Assume that the individual questioned chooses alternative 2. This person is then faced with the following choice, between the new alternatives 1 and 2:

Choice number	Bus ticket price	Envir. quality along route	Other attribute
1	10	"Bad"	No seat
2	30	"Good"	Seat

We see that the only difference between the two tables is in the bus ticket price, which is higher in alternative 2 in the last table. If the individual now chooses alternative 1, we know that the maximum willingness to pay (in the form of bus fares) to avoid "bad" environment and "no seat" is between 10 and 20. If the person still chooses alternative 2, this number is greater than 20.

Note that we have here not identified the value of the individual effects "environment" and "seating". More questions are necessary to decide this.

THE BASICS OF THE CONTINGENT VALUATION METHOD (CVM)

We may distinguish between 5 steps in establishing the method, as follows.

Step 1: Construction of a hypothetical market

The main idea here is to construct a scenario which corresponds as closely as possible to a real-world situation. It is still usually hypothetical for the persons being interviewed. In most cases there will namely not be a direct link between the answers of the persons being interviewed in the CVM survey, and a possible decision to implement or not implement the environmental change to be valued.

a) Sets the <u>reason for payment.</u> With standard market goods: We must pay to get more of a good. The improvement specified is <u>contingent on</u> payment actually being made. This scenario must be understood by respondent.

b) Must construct a so-called <u>bid vehicle</u> or method of payment. This vehicle must fulfil conditions with respect to incentive compatibility, realism, and subjective justice among respondents. Relevant vehicles are:

- Direct sum of money to be paid
- Payment to a fund/contribution
- Support of a particular tax
- Payment in the form of higher price of commodity related to the improvement (such as: higher electricity prices when the objective is to stop a river or nuclear power plant from being developed).

c) Construct a <u>provision rule.</u> This is a mechanism by which the good is to be provided, as a function of the stated value.

Step 2: Obtaining the data

We select a limited sample of the underlying population, and let this sample go through an interview (or possibly a sequence of interview sessions). Interviews can be obtained in the following possible ways:

a. Personal interview, person to person
b. Personal interview session using an interactive medium (computer)
c. Mail questionnaire (with follow-ups)
d. Telephone interview

Most research and recommendations about research departs from person-to-person interviews. These have advantages of face-to-face contact, increasing engagement and awareness by interviewee, reduces misunderstading, makes spontaneous questions possible (may be important).

b can sometimes have advantages, in cases where a computer program may be better at choosing a (complex) path of questions when there are several alternatives.

Valuation measure sought:

a. Maximum willingness to pay (WTP) for an improvement in environmental quality, corresponds to CS
b. Minimum willingness to accept (WTA) to abstain from an improvement in environmental quality, corresponds to ES
c. WTP to avoid a worsening in environmental quality, corresponds to ES
d. WTA to accept a worsening in environmental quality, corresponds to CS.

Most studies have adopted WTP as the sought valuation measure, due to severe perceived problems with WTA (protest bids and infinitely-high bids).

The "theoretically correct" measure is however instead determined by the property rights involved (such as whether the individual questioned have a legal right to the environmental good or not).

WTA questions are however often problematic, as there is a lot of emotion involved in the answers to these. Also, it is shown that a good may be valued quite differently, according to whether the individual initially does not have it (and must pay for it to get it), or the individual already has it initially (and must give it up, in fact be "bribed" into giving it up). In the latter case, we often find very high valuation statements.

Possible bidding mechanisms:

a. "Bidding game": ask a sequence of questions until maximum is found. May suffer from lack of incentive compatibility and starting point bias, and fatigue effects.

b. Payment card: Card indicates range of possible values, one of which is pointed out by interviewee. May have problems of starting point bias.

c. Open-ended question: no anchor. Here high degree of individual impreciseness, and sometimes systematic bias, may be a problem.

d. Closed-ended single-bounded referendum.

e. Double-bounded referendum (same as d, but with an additional follow-up question of maximum WTP).

Out of these, d is usually considered incentive compatible and free of starting point bias, but provides little information (only one bound). The others provide more information, but this may be distorted.

Step 3: Estimating average WTP/WTA

Straightforward with open-ended and bidding-game formats.

More difficult with single-bounded referendum. Must estimated probability functions, requiring more data.

Step 4: Estimating bid curves

Define bid curve for individual i as

WTP(i) = f(Y(i), E(i), A(i), X(i), Q, U(i), e(i)),

where Y = income, E = education, A = age, Q = environmental quality, X = vector of other background variables we want to include, U = individual use of the environmental asset/object, e = random disturbance.

Objective is to find a "best" fitting function of this sort, from the material collected. Since material is "experimental", simple estimation methods are usually sufficient (OLS or GLS with direct bid data, logit or probit with referendum-type data).

Step 5: Aggregating the data

Convert mean bids to population aggregates
Utilize derived bids and bid functions for benefit transfer

Possible biases due to strategic behavior

Type of payment mechanism	Provision of environmental good indpenendent of bid	Provision of environmental good depends positively on bid
Actual payment by interviewee independent of expressed bid	Indifferent. Perhaps overstatement if interviewee attaches some probability that the interview will be used	Overstatement
Actual payment depends positively on expressed bid	Understatement	Depends: Possibly incentive compatible

The possibility of strategic bias was a main initial objection among most economists, against using the CVM.

Referendum format may reduce strategic bias, if referendum is considered realistic by interviewee.

Generally, however CVM has appeared to be less prone to strategic bias than first suspected.

Other possible biases

While strategic bias is the type of bias most emphasized by economists, it is found, in many applications of the CVM, that other biases are practically more important. We will here briefly go through some of these.

1. **Starting point bias, "anchoring"**. The idea here is that an initial valuation figure, indicated to the respondent, may indicate a "normal" level of value or payment, and that later valuation figures may be drawn in the direction of this amount. This problem is greater, the less familiar the respondent is with the object to be valued, and the valuation procedure.

2. **Vehicle bias** (individuals may have preferences/dislikes for particular vehicles).

3. **Mental account or scope bias**: Individuals have a particular "account" allocated to e.g. environmental goods.

4. **Embedding:** More comprehensive good valued about equally as less comprehensive. May have a theoretical basis in strong substitutability, but may else be related to the mental account issue.

5. **Major differences WTP-WTA:** May be due to property rights notions, or to factors related to fairness about who is to pay to correct a particular damage.

6. **Informational biases:** Valuation may depend on how the information about the good and its provision and financing is provided, who makes the interview, what other information the respondents have about a particular good or incident.

Different formats for checking and control for biases:

- Top-down format: Start at comprehensive good, work down to more specific

- Bottom-up format: Start with the specific, work up to the more inclusive.

Particular problems raised by the inclusion of passive-use values

Particular problems in interpreting answers from CVM studies, are raised by altruism (paternalistic versus nonpaternalistic), and by other passive-use motives (such as the values of future generations, of other intrinsic sources of valuation than humans, "warm glow").

It can be shown that when altruism is nonpaternalistic (or pure), values motivated in this way should not "count". The reason is that such altruistic motivations increase the value of all goods equally much, and relative values remain unchanged.

Under paternalistic altruism, things are different. Then relative values change, and such altruism regarding other persons' use of particular environmental goods, adds to the social value of these environmental goods.

Some economists do not fully recognize "warm glow" as an economic value. This remains a contested area today. Personally, I think all values ought to be included regardless of motivation.

The NOAA panel

Set up in the early 1990s in the U.S., to review the CVM. A concrete background for the panel was the controversy surronding the socalled Exxon Valdez incident, with a large oil spill off the Alaska coast, in 1989. In that case, WTP data obtained from CVM studies were brought to court. These studies were contested, and the entire CVM seriously questioned.

The NOAA panel tried to remedy this problem, by providing guidelines for use of the CVM, in particular as court evidence. It issued a report in 1993, which as been widely cited and followed.

General guidelines given by the NOAA panel:

- Probability sampling from the entire affected population
- Minimize nonresponses
- Personal interview
- Careful pretesting for interviewer effects
- Clear reporting, of defined population, sampling method, non-response rate and composition, wording of questionnaire and communications
- Careful pretesting of CV questionnaire
- Conservative design. By this them mean that one should generally prefer options that tend to underestimate, rather than overestimate, WTP
- WTP format instead of WTA
- Referendum format
- Accurate description of program of policy
- Pretesting of photographs to be used

- Reminder of undamaged substitute commodities
- Adequate time lapse from possible concrete incident to be valued
- Temporal averaging
- "No-answer" option available
- Yes-no follow ups to referendum question
- Cross-tabulations of other questions such as attitudes toward site, environment etc.
- Checks for understanding
- Alternative expenditure possibilities provided
- Present-value calculations made as clear as possible