CHAPTER 2

REVIEW OF LITERATURE

2.1 Evaluation of Environmental Quality Improvement

The economic measure of an individual's net gain from consumption of goods and services is called consumer surplus. It is defined as the difference between the maximum a consumer would be willing to pay for his current consumption of the specified good and the amount he actually pays. But this approach has been shown to have a number of problems. These problems are the result of the income effect, which leads the consumer surplus definition to be a bias approximation of welfare change. Consumer surplus is a good approximation if the demand for a good doesn't change very much when income changes. Then the income effects will not matter very much, and the change in the consumer surplus will be a reasonable approximation of the change in consumer welfare.

Hicks suggested two other of measurements for change in consumer surplus the problem of the income effect by holding utility constant at different specified levels.

First is the compensating surplus (CS) and compensating variation (CV). The measures assume that the agent is entitled to his current level of utility as if there was no project that affected his utility. For a welfare gain, the amount is compensating surplus which is the amount he would be willing to pay (WTP) for the existence of a project. The measure for a welfare loss is compensating variation which is the amount he would be willing to accept (WTA) as compensation for the existence of a project.

Second is the equivalent surplus (ES) and equivalent variation (EV): the measures which assumes that the agent is entitled to some alternative level of utility as if there was a project that affected his utility. For a welfare gain, the measure is ES which is the compensation he would need (WTA) to forego the project. And the measure for a lfare loss is EV which is the amount he would be willing to pay (WTP) to avert the change in the utility.

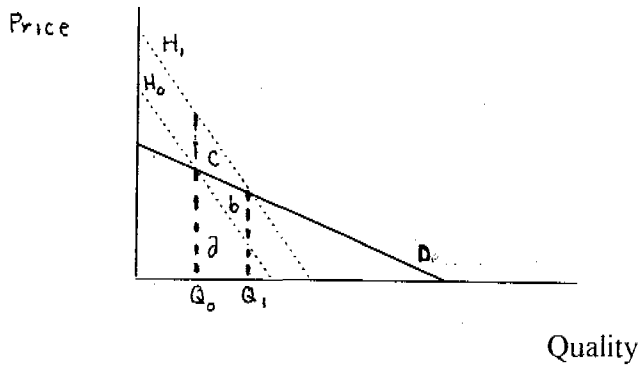

Figure 2.1 Measure of Surplus

Figure 2.1 is the diagram illustration of the surplus from environmental improvement. It is assumed that the price is zero. For the quality increase from Q0 to Q1, Marshallian consumer surplus is the quantity associated with the area under the demand curve labeled D and between Q0 and Q1 (that is a+b), compensating surplus is the area under the Hicksian compensated demand curve Ho (that is a); and equivalence surplus is the area under the Hichsian compensated demand curve H1 (that is a+b+c).

2.2 Contingent Valuation Methods (CVM)

Economists have for a long time routinely measured the value of goods bought and sold in the market place by thier prices. But ordinary markets do not exist for environmental goods.

The CVM is a well-known methods used to measure the value of environmental goods. CVM uses survey questions to find out the value of particular goods. It is based on the concept of Hicksian compensating surplus (CS). According to CS, the value of a change in water quality can be estimated from the amount of money which an individual would be willing to pay for the change, while holding his utility constant at the current level. By aggregating the willingness to pay of all individuals, we obtain the total value of a given water quality for society.

Mitchell and Carson (1989) suggested that there are three important parts in material used in Contingent Valuation survey:

(a) A detailed description of the good being valued and the hypothetical circumstance under which it is made available to the respondents.

(b) Questions which elicit the respondents willingness to pay for the good being valued.

(c) Questions about respondents' characteristics (for example age, income), their preferences relevant to the good being valued, and their use of the good.

2.1.1 Measure of Reliability

Reliability refers to the extent to which the variance of the WTP amount is due to random sources. The variance of the WTP is the result of two principle factors:

(a) The **true** variation in the WTP for the good in the population integer. Each person may differently value a specified good. For example, a person who loves birds tends to be willing to pay more money for bird conservation projects, while those who dislike birds may pay nothing.

(b) The instruments include wording and method of presentation.

Fist is wording. Studies that have the same objective may report a different result, if they use different wording. The study that uses ambiguous wording will make respondents confused and lead to an incorrect valuation. Therefore, the wording used in the study should be clear and easy to understand.

Second is the method of presentation. Each interviewer uses a different style. Some interviewers may be friendly to respondents and make them feel comfortable enough to answer the questions. On the other hand, the interviewers who are strict with the respondents may make them feel uncomfortable and cause them to distort their answers. The style of presentation may have an influence on the variation of the WTP.

Assessing Reliability: there are several techniques used to assess the variance of the WTP.

(1) Test- retest method.

One of the CV test-retest examples is the study by Kealy, Montgomery and Davido (1990). They used this method to test the reliability of their study. The paper addresses the reliability-related issue of stability over time. They examined the relative stability of the response to a close-ended offer by reinterviewing a subsample of those interviewed two weeks earlier. They calculated the WTP from " Yes" or "no" responses to an offer to sell a commodity to the individual at a stated price. The stability of the response is measured by calculating the correlation between the responses given by the same respondents at two different times.

The result reports the relative strength of the relationships between the response to the offers in the first and second period. The coefficient for the public good is 0.66. This indicates a high level of reliability.

The test-retest method is not appropriate for a general population survey because it is costly and difficult to re-interview the same samples.

(2) Regression Analysis

In the absence of reinterviews, the burden on the researchers is to demonstrate that the individual willingness to pay certain amounts are not simply random responses. Mitchell and Carson (1989) suggest that the easiest method is to obtain a respectable R^2 when regressing the WTP on a set of independent variables, since the higher the R^2, the lower the random position of the WTP response variance. If the independent variables are those suggested by theory, regression analysis can also be used to demonstrate construct validity. However, using regression analysis does not convey any information about a study's validity or the absence of bias. Bias may exist, even though R^2 is high. High R^2 is not particularly meaningful if the equation is based on the kitchen-sink approach--in which explanation power is maximized by the indiscriminate use of as many variables as possible.

2.1.2. Measurement Bias

The following section focuses on the biases that may appear when using the CVM.

1. Strategic Bias

According to Mitchell and Carson (1989), strategic bias occurs "when a respondent gives a WTP amount that differs from his or her true WTP amount in an attempt to influence the provision of the good and/or the respondent's level of payment for the good".[1] Schulze, d' Arge, and Brookshire (1981) give an example of strategic bias, where if nearby residents were asked how much they were willing to pay to clean up the air near a power plant, and if the cost would be borne by consumers and owners elsewhere, local residents would have an incentive to overstate their own true value. If respondents believe that they would bear this expenditure themselves, they would understate their own willingness to pay.

Mitchell and Carson (1989) recommend a remedy for strategic bias, namely that contingent valuation instruments should create a plausible payment obligation. Questionnaires should not use such words as "pretend"[2], or "assume a hypothetical situation"[3], or use the implausible payment vehicle, since they encourage overbidding by respondents who want the good to be provided.

2. Information Bias

According to Schulze, d' Arge, and Brookshire (1981), information bias refers to the structural content of the contingent market being different than the valuation problem at hand. For example, if a household or individual was asked to respond to a hypothetical decrease in environmental quality at one location, he might respond with a low bid; the consumer basing his decisions on experience and gained knowledge which causes him to think that other nearby sites would make good substitutes. However, in

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[1] Robert Cameron Mitchell and Richard T. Carson, Using Survey to Value Public Goods: The Contingent Valuation Method (Washington D.C.: Resources for the Future, 1989), p. 237.

[2] Ibid., p.238.

[3] Ibid.

a real situation the individual might have found that other sites involved more travel costs and were less satisfactory than imagined. The information given to the respondent in a survey situation relating to substitute possibilities and alternative costs may well change the stated willingness to pay relative to other types of information.

To control this type of bias, the information presented to respondents must correspond to the good being valued and respondents should be remind of some details that they might overlook.

3. Instrument Bias

According to Schulze, d' Arge, and Brookshire (1981), this type of bias is due to the vehicle for payment and the starting point for initiation of the bidding process. The vehicle of payment may influence its magnitude. For example, if the respondent was asked to pay for an environmental improvement, the obtained amount may differ between using a higher park entrance fee and another type of tax.

According to Mitchell and Carson (1989), the starting point bias occurs when the respondent's WTP amount is influenced by a value introduced by the scenario. Schulze, d'Arge, and Brookshire (1981), state that potential bias arises in suggesting a starting point in two ways. First, respondents may believe that the starting bid is an appropriate bid. Second, if the respondent values time highly, he may become bored with going through a lengthy bidding process. Consequently, if the suggested starting bid is substantially different from his actual willingness to pay, the bidding process may yield inaccurate results.

4. Amenity Misspecification Bias

There is a potential for respondents to ignore some or all of the details in a CV scenario. The effect of this ignorance may invalidate a CV study. A amenity misspecification is labeled as part-whole bias, or the embedding effect.

Kahneman and Knetsch (1992), conducted an experiment to investigate the embedding effect which they considered the most serious shortcoming of CVM. They focused their experimental design on the valuation of a public good that was of personal relevance to respondents: the increased availability of equipment and trained personnel for rescue operations in the event of a disaster.

The study described more or less inclusive policies. Respondents were separated into three groups. Each group was asked to assess the WTP for the stated improvement. The difference between each group represented the degree of inclusiveness of the initial question.

The finding reports the existence of the embedding effect which can be seen from the difference of the WTP amount for the specific service among three sample groups. The good is assigned a lower value if it's WTP is inferred from a more inclusive good than if it is evaluated on its own.

Another study that examined the part-whole effect was done by Carson and Mitchell (1993). This study estimated the value of national water quality benefits. They tested the embedding effect by comparing the result of their study with those made by Desvousges, Smith and Fisher (1987), for the same quality changes in a subnational resource: the Monongahela River.

They statistically tested the difference between their estimate and adjusted Desvouges, Smith and Fisher's estimate. They set the hypothesis that two related goods are valued identically by respondents against the null hypothesis that the good which encompasses the other is valued more highly. The approximate t-test based on unequal variance is 4.88 and has a p-value of less than 0.001. Thus they reject the existence of the part-whole bias.

To control this type of bias the researcher should emphasize the process of instrument development. The researcher should state the cost of the operation, which will help the respondent to clearly understand what is being valued (Kahneman and Knetsch, 1992).

2.2.3 Elicitation Methods

The CV study aims to obtain the respondents' consumer surplus in the form of the maximum willingness to pay. It may be difficult for the respondents to assess the correct value. There are several elicitation methods used in a CV study.

1. The Bidding Game.

This method is widely used in contingent valuation surveys. The researcher provides the starting point, which may be a high or low amount, for respondents. After the researcher describes the detail of the study to a respondent, the respondent is asked whether he is willing to pay the specified amount. If his answer is 'yes', the researcher continues to use the higher value which he is willing to pay. If the answer is 'no', the respondent is asked to state the maximum amount that he is willing to pay.

The following study applied the bidding game process as the elicitation method.

1. Nantana Limprayun (1994)

This study set two starting points, low and high amonts. The study also conducted a test for the starting point bias. There are five questionnaire formats, such as Open-ended, Closed-ended Single Low Value, Closed-ended Single High Value, Closed-ended Iterative Low Value and Closed-ended Iterative High Value. The results indicate that there is no significant differences between the WTP of each question format.

2. The study of TDRI (a) (1995)

This study set two starting bids, a low and high bid. The result confirms that different starting points do affect users' WTP bids.

3. The study of TDRI (b) (1995)

There are two starting bids, a low and high bid. The findings showed that the starting point did not significantly affect the WTP for a waste-water treatment model, while it did significantly affect the WTP for an improved piped water service model.

2. The Payment Card

The researcher provides respondents with a visual aid which contains a large number of potential WTPs to match the respondents'income levels, ranging from $0 to some large amount. Then the respondents are asked what amount on the card they would be willing to pay for the level of good being proposed (Mitchell and Carson 1989, p.100). Examples are the study of Carson and Mitchell (1993), which study about the value of clean water, and the study of Kwak and Russell, which is a study of the willingness to pay for protecting drinking water quality.

The disadvantage of this method is the difficulty in selecting the income which is suitable for each payment card. To construct an appropriate payment card requires the cooperation of many agencies. In Carson and Mitchell's study (1993), which was a national project, they use the information from three phases of pilot studies to develop the payment card. For Kwak and Russel's study, they received the assistance of the Korean Institute for Industrial Economics and Trade, which identified payment amounts for sanitary services, public health, traffic control, public housing and education, and defense for constructing their payment card.

3. The Take-It-or-Leave-It Approach.

The respondents will be asked whether they would be willing to pay the specified amount for the proposed level of good. The answer is either ' yes' or 'no', without identifying the individual WTP (Mitchell and Carson, (1989, p.101).

The disadvantage of this method is that it does not provide the exact amount of the willingness to pay.

2.2.4 Protest and Outlying Bid

Estimates from contingent valuation surveys may be affected by the procedures used to determine the final sample in the analysis of responses. Contingent valuation data set has been screened by analysts to eliminate protest bids and to delete influence observations in order to detect individuals who fall into one or more of the three following categories:

(a) Respondents who reject the framing of the contingent commodity.

(b) Respondents who fail to take the valuation exercise seriously, thereby putting less effort into examining their preferences.

(c) Respondents who misunderstand or are incapable of processing the information required to participate efficiently in the contingent market.

The observations that would most likely lead to biased estimates of a model's parameters include protest bidders and those classified as outliers.

1. Protest Bidders

Respondents who elicit zero amount of WTP can be classified into two groups.[4] First, protest bidders refers to respondents who give a reason that reflects a protest response. Second, valid zero bidders: respondents who indicate that the specified good is not worth anything to them, or what they bid is all they can afford.

2. Outliers

Outliers[5] refers to respondents who place very high or very low bids relative to the mean WTP. Outliers can significantly distort a benefit estimate.

The following are ways to handle outliers.

(1) Delete outliers on an ad hoc basis. This procedure suffers from the obvious drawback that it opens the researcher to criticism that he has engaged in selective deletion to achieve the desired results.

(2) Analysis of WTP based on Median. The study of Kahneman and Knetsch (1992), reported that the data included extremely high responses, in some cases up to 25 % of reported household incomes. Since there is no agreed way to draw a line beyond which responses will be rejected, the analysis of WTP results are based on median instead of mean and uses all responses.

(3) Mitchell and Carson (1989), suggest a way to deal with outliers. They recommended the alpha trimmed mean as a substitute for the sample means a summary WTP statistic.

The α-trimmed mean is estimated by ordering the sample observation which we will denote by Xi from the smallest, Xi, to the largest, Xn. The α-trimmed mean, $\bar{X}\alpha$, is defined as:

[4] William H. Desvousges, V. Kerry Smith, and Ann Fisher, " Option Price Estimates for Water Quality Improvement: A Contingent Valuation Study for the Monongahela River," Journal of Environmental Economics and Management 14 (September 1987): p.253.

[5] Ibid.

$$\bar{X}\alpha = \frac{X_{(n\alpha)+1} + \ldots\ldots + X_{(n-n\alpha)}}{n - 2(n\alpha)}$$

where n refers to number of observations

for $0 \leq \alpha \leq 0.5$

An operational estimator of the variance of the α- trimmed mean, $\sigma^2{}_\alpha$, is given by:

$$\sigma^2{}_\alpha = \frac{\sum_{i=[n\alpha]+1}^{n-[n\alpha]} (Xi - X_\alpha)^2 + (n\alpha) * [(X_{(n\alpha)+1} - X_\alpha)^2 + (X_{n-(n\alpha)} - X_\alpha)^2]}{(1 - 2\alpha)^2 n}$$

where $X_{(n\alpha)+1}$ and $X_{n-n\alpha}$ are the empirical order statistics.

If we assume that the Xi are from a symmetric unimodal distribution, then asymptotically the random variable is:

$$T = \frac{\sqrt{n}(\bar{X}_\alpha - \mu),}{\hat{\sigma}^2{}_\alpha},$$

where μ is the population mean, has approximately a standard normal distribution (Z). Confidence intervals can be formed in the following manner:

$$\bar{X}_\alpha \pm \frac{Z(1-1/2\alpha)\hat{\sigma}^2{}_\alpha}{\sqrt{n}}$$

Thus, a one-and two-tailed test can be formed so that comparisons with costs can be made for a benefit-cost analysis.

"Stigler has examined a large number of experiments designed to measure physical constants (physical constants are mostly subject to normal measurement

error), and has shown that a 10 percent trimmed mean would have resulted in a much more efficient and less biased estimate"[6], (Mitchell and Carson, 1993, p. 227).

2.1.5 Functional Form of WTP

The functional form usually used to explain the relation between the WTP and explanatory variables is linear function. The following studies applied linear function:

The study of Nanthana (1994) explains the evaluation of Samet Island conservation.

The study of Kwak and Russell (1994) explains the WTP for the protection of drinking water quality in Seoul.

The study of TDRI (a) (1995) explains the evaluation of Khao Yai Natural Park.

The study of TDRI (b) (1995) explains the willingness to pay for improved water service in Phuket.

The study of Parichat (1990) explains the willingness to pay for a waste-water treatment plant in Pattaya.

The study of Desvousges, Smith, and Fisher (1987) explains the willingness to pay for improvement in the water quality of the Monongahela River.

2.3 The Explanatory Variables of the Willingness to Pay

Each study about the willingness to pay has different explanatory factors depending on the objective of the study.

[6] Sigler, 1977, quoted in Mitchell and Carson, 1993, p. 227.

Table 2.1

Explanatory Variables of the Willingness to Pay

Study	Objective	Explanatory Variables
1. Nanthana (1994)	Valuation of Samet Island	income, age, sex, length of stay on Samet, the frequency of visits.
2. TDRI (a)(1995)	Valuation of Khao Yai	park user: income, age, sex, marital status, education, nearby province, starting bid, length of stay, presence of listener, quality of interview, satisfaction score, bird watching, trekking, visiting water fall, viewing scenery.
3. TDRI (b) (1995)	The willingness to pay for improved water service	household income, existing water storage, primary water source, ownership of house, education, age, age of house, marital status, bid starting point, quality of interview, listener present,
4. Parichat (1990)	The willingness to pay for a waste-water treatment plant.	age, education, occupation, income, the distance between the residence and the beach, use of the sea, general knowledge, attitude toward tourism.
5.Kwak and Russell (1994)	The willingness to pay for protection of drinking water quality in Seoul	attitude toward current tap water quality, expenditure for a tap water filtration system, expenditure for bottled water, education, age, income,...

From Table 2.1, the explanatory variables can be classified into two groups. First, socioeconomic factors, such as age, sex, income, and education, exist in all studies. The second group of explanatory variables depends on the goods and services under valuation of that study.

2.4 Tobit Analysis

Kwak and Russel (1994), discuss the case where the dependent variable is censored at zero; that is, values which should be less than zero were transformed to a single value, zero, by the application of interviewed protocol. In this case, OLS parameter estimates will be inconsistent. And it results in the biased predicted value. Greene (1991), recommends the Tobit model, estimated via maximum likelihood (MLE).

The study of Kwak and Russel (1994), reports that the number of statistically significant (at least five percent level) coefficients increase from 7 out of 12 in the OLS version, to 8 out of 12 in MLE based Tobit.