Environmental Valuation

Valuation is the heart of environmental economics and is emerging as a very active and rapidly expanding field. The basic strategy for environmental valuation is the co-modification of the services that the natural environment provides. It serves to assess individual and group priorities and tradeoffs in the case of unpriced scarce commodities. In its simplest form economic valuation is the process of identifying the relevant changes in consumer demand and producer supply arising from a (project-induced) change in environmental quality, or the change in the provision of an environmental resource. In brief Environmental Valuation is concerned with the analysis of methods for obtaining empirical estimates of environmental values, such as the benefits of improved river water quality, or the cost of losing an area of wilderness to development. The most commonly used approach is based on the concept of Total Economic Value (TEV).

In this approach an impact on an environmental resource, for example, a pollutant on a river, is broken down into a number of categories of value. The idea behind this approach is that a good or service comprises of various attributes, some of which are tangible and readily measured, while others are less tangible and thus more difficult to quantify. The total value of the good or service however, is given by the sum of all categories of value, and not simply those that are easy to measure. The Total Economic Value is generally decomposed into three categories of value: (1) direct use value; (2) indirect use value; and (3) non-use value. The former two categories are sometimes collectively referred to as “use value.

The Direct use value is derived from goods, which can be extracted, consumed or directly enjoyed. It is also therefore known as extractive or consumptive use value.

Indirect use value is referred to as non-extractive use value, derived from the services that an environmental resource provides. A wetland, for example, acts as a water filter, often improving water quality for downstream users. This service is valued by downstream users, but does not require any good to be extracted/consumed.

Non-use values are defined as those benefits or welfare gains/losses to individuals that arise from environmental changes independently of any direct or indirect use of the environment. This category can be further subdivided into (1) option value and (2) existence value.

Option value is the value derived from maintaining the option to use a good or service at some point in the future, it is sometimes treated as a special case of use value (hence the dashed line in (figure)

Existence value can be defined in various ways. Most definitions however contain two main components: (1) pure existence values and (2) bequest values.

Pure existence value is the worth you associate with an environmental good or service, which is completely unrelated to current or future use of that commodity, by yourself, your descendants, or others. These values are intrinsic in nature, i.e. they represent a value that resides in something. Some possible motivations or rationales for the presence of such values include the preservation of, concern for, sympathy with, respect for the rights of, any other altruistic motives with respect to non-human beings. A number of pure existence values are related to ecological attributes. Support for the protection of endangered species and the protection of critical habitats for those species represents an intrinsic valuation process.

Bequest value derive from our desire to preserve the environment for relatives and friends, and also for all other people living today and future generations, so that they may benefit from conservation of the environment

Total Economic Value = Direct and Indirect Use Values + Option Values + Existence Values

Environmental valuation techniques

Hedonic Price Method:

It is based on consumer theory, which postulates that every good provides a bundle of characteristics or attributes. Market goods are often regarded as intermediate inputs into production of more basic attributes that the individuals really demand. For e.g., the demand for housing can be considered a derived demand. A house yields shelter but through its location it also yields access to different quantities and qualities (example: schools, activities etc.) and different quantities and qualities of environmental goods (open space, access to clean air, woodland etc.). Thus HPM relies on the proposition that an individual's utility for a good or service is based on the attributes, which it possesses. If the hedonic analysis is conducted on housing data, it is referred to as the property value approach. When applied to wage data – to measure the value of changes in morbidity/mortality risks – it is often referred to as the wage differential or wage-risk approach.

The hedonic property value approach measures the welfare effects of changes in environmental goods or services by estimating the influence of environmental attributes on the value (or price) of properties. In order to obtain a measure of how a specific environmental attribute of interest affects the welfare of individuals, the technique attempts to: (1) identify how much of a property price differential is due to a particular environmental difference between properties and (2) infer how much people are willing-to-pay for an improvement in the environmental quality and to estimate the social value of improvements.

In attempting to isolate the effects of specific environmental attributes on the price of houses we have to "explain" the price of a house as a function of its key characteristics. If we take house price to be a function of all the physical features of the house (e.g. number of rooms, central heating, garage space etc.), neighborhood characteristics, and environmental attributes, then the following relationship can be identified.

Implicit prices can be estimated for different properties. Every estimated implicit price is only one observation of the true individual demand curve and corresponds to the individual WTP for a marginal unit of environmental good only for that specific level of environmental good purchased. Therefore, the implicit price (curve) cannot be viewed as an inverse demand curve. Hence, it does not represent the maximum marginal WTP of the individual for one more unit of the environmental attribute, unless we assume that all the individuals have the same structure of preferences and the same income. If this assumption does not hold, the various individuals will have different inverse demand curves. However the implicit price can be regressed on the observed quantities of the environmental attribute and some socio-economic characteristics of individuals. The second stage here is the identification of the inverse individual demand function. The area under the inverse demand curve between two levels of the environmental attribute represents the change in the consumer surplus caused by the change in the attribute. By aggregating all individuals' consumer surpluses we obtain the overall value of the environmental change.

In practice, especially in developing countries, only the first stage of the process is usually carried out, and the results used to obtain only rough values for the impact of the attribute in question

The hedonic wage-risk method is very similar, and is only briefly discussed here. Basically, to estimate the relationship between wages and risks we must control for other variables that influence earnings - as in the hedonic property value approach above - except this time we estimate a hedonic wage function.

The hedonic technique has several advantages. Firstly, hedonic analysis uses market, i.e.

observed, data on property sales or wage rates. The method is versatile and can be adapted to consider several possible interactions between market goods and environmental quality. Moreover, estimated values obtained from one study can be used in other policy areas if the environments have similar demand and supply characteristics. On the negative side, the results of hedonic studies are sensitive to the econometric assumptions adopted. Furthermore, the assumptions necessary to interpret the results as measures of WTP are restrictive and, in many real world settings, unrealistic. From a practical perspective, full hedonic pricing studies require a considerable amount of data, which may be difficult and expensive to collect, such studies tend not to be done quickly.

Travel Cost (TC) Method

The Travel Cost (TC) method is a technique, which attempts to deduce values from observed (i.e. revealed) behavior. The TC model, and its many variants is the most commonly used indirect approach to valuing site-specific levels of environmental resource provision. Basically, information on visitors' total expenditure to visit a site is used to derive their demand curve for the services provided by the site. Among other things, the TC model assumes that changes in total travel expenditures are equivalent to changes in an admission fee. The model used tries to predict changes in demand in response to changes in 'admission fees', thereby tracing out a demand curve for the site. This demand curve may then be used to measure the total benefits visitors accrue from the site.

There are two main variants of the TC model: (1) the Zonal TC model (ZTCM) and (2) the Individual TC model (ITCM). The ZTCM divides the entire area from which visitors originate into a set of visitor zones and then defines the dependent variable as the visitor or visitation rate (i.e. the number of visits made from a particular zone in a period divided by the population of that zone). The ITCM defines the dependent variable as the number of site visits made by each visitor over a specified period.

Contingent Valuation Method (CVM)

This method uses interview techniques to ask individuals to place values on environmental goods and services. The most common approach in the CVM is to ask individuals the maximum amount of money they are willing to pay (WTP) to use or preserve a good or service. Alternatively the respondents could be asked the maximum amount of money they are willing to accept in compensation (WTA) to forgo the given environmental good or service. The basic notion underpinning CV is that a realistic, yet hypothetical market for buying or selling use and/or preservation of an environmental good/service can be described in detail to an individual. Individuals are then asked to participate in this hypothetical market, by responding to a series of questions.

The features of the hypothetical market include:

- A detailed description of the good/service being valued. The situation before and after any proposed change in environmental quality and subsequent provision of the good/service should be clearly stated. In addition, it is vital that the respondents perceive the correct good/service.
- A detailed description of the "payment vehicle", i.e. the means by which the respondent would pay for the change in provision of the good/service. The payment vehicle should be appropriate to the good/service and the hypothetical market. Moreover, it should be realistic and emotionally neutral.
- The procedure to elicit the respondent's valuation. The actual valuation can be obtained in a number of ways, for example, asking the respondent to name an amount, having them choose from a number of options. The respondent could also be asked whether they would pay a specific amount. In the case of the latter, follow-up questions with

higher and lower amounts are often used. Statistical analysis of the responses is then undertaken to estimate the average WTP in this hypothetical market.

In principle, it can be used to value any change in environmental quality. Furthermore, CV can be used to accurately elicit values about very specific changes in the provision of goods/services, since it does not rely on observed data. But it requires that the hypothetical market and elicitation questions be appropriately worded. Another advantage, with CV is that, in contrast to the other valuation techniques described above, which only provide a partial estimate of the value of a good/service, CV can provide a measure of the TEV of a change in environmental quality.

However CV methods has been the subject of much criticism, mainly relating to their reliance on hypothetical markets. In short, some economists argue that asking individuals hypothetical questions only provides you with hypothetical answers, which cannot be meaningfully used to value environmental quality changes.

In addition to the above conceptual concerns over the validity of CV based benefits estimates, survey-based research is expensive and time-consuming, valid benefit estimates require properly designed sampling and enumeration procedures.

The following table is available in ENVIS- Subject Information under the Environmental Valuation title.

STEP 1 of the Objectives	STEP 2 Questionnaire Design	STEP 3 Survey of Sampled Population	STEP 4 Database Creation and Data Analysis	STEP 5 WTP Estimation
1a Identification of the object to be valued	2a Introduction	3a Decide the sampling technique	4a Collection and verification of data	5a WTP models choice
1b Establishment of value to be estimated and unit of measurement	2b Socio-economic information	3b Decide how, when, and where to run interviews	4b Data base creation	5b Estimation of annual individual average max WTP
1c Identification of time span of the valuation	2c Scenario formulation	3c Training of enumerators	4c Elimination of invalid questionnaires	5c Annual net benefits
1d Identification of who should be interviewed (definition of the population)	2d WTP/WTA elicitation format	3d Running the interviews	4d Derived variables building	5d Total value of environmental services
	2e Payment vehicle		4e Data analysis	