Review Article

Valuation of Environmental Assets

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THE MARKET FOR GOODS, COMMODITIES AND LANDED PROPERTY:

The most crucial factor in answering a valuation problem of any kind of good or commodity is the market for that particular good in question. A market offers comparable to all purchasers of goods as well as to the valuers. The prices set in a market serve as the ready reckoner of value. If perfect comparable were available services of no valuers were necessary. In the goods and commodities market usually plenty of comparables of the same type of goods and commodities are in existence. A variation between their different aspects is ordinarily absent. This is because goods and commodities are mostly produced industrially by the same sort of processing machines. But that is not so in the case of landed property addets. Property is said to be extremely heterogeneous in character. One property differs from another in so many internal and external aspects that a straightforward solution of a valuation problem guided by the available comparables is almost impossible. And that is where the value steps in to help.

THE MARKET FAILURE FOR ENVIRONMENTAL ASSETS:

There is always a demand for environmental goods and commodities. But there is no market price set for them. In the absence of a price the market fails to indicate scarcity of an environmental good. Since scarcity is not indicated by a market price there is no deterrent against its wasteful use. The wasteful use of environmental goods may lead to serious repercussions for human society some of which may surpass.

NATIONAL TERRITORIES:

The market failure in the case of environmental goods and commodities has the following elements:

1. Externalities

2. Unpriced good and missing market

3. Transactional costs,

4. Property rights

5. Ignorance and uncertainty

6. Myopic vision,

THE INDIRECT VALUATION METHODS:

The environmental impacts enshrining the above aspects are to be quantified by using appropriate valuation methods. As already indicated since there is no market signal of prices in the case of environmental goods and commodities one is to follow indirect methods mainly. There are three main kinds of methods available for tackling the variety of problems, which are as follows:

1) Market valuation of physical effects: Under this method the market prices for the physical effects of environmental change are evaluated.

2) Stated preference method: Under this method the preferences of people as expressed by them regarding environmental value are taken into consideration.

3) Revealed preference method: Under this method preferences of people regarding environmental are

studied from their actual behaviors and a conclusion is arrived on value.

We now intend to pick up method one by one.

(1) **Market valuation of physical effects:**

This is the most direct method of valuation of environmental changes. The approach comprises of observing the physical changes in the environment owing to some action and estimate the difference it causes in the environment owing to some action and estimate the difference it causes in the value of goods and services existing before and after the action. For example, air pollution may cause damage to human health that may result in hospital admission, restricted activity and working day losses. Similarly, intensive cultivation may result in loss of soil fertility and may require special treatment of the soil for replacement. In both the cases the victim is to be subjected to increased cost for restoration towards making good of the loss. In other words environmental damage involves someone in the expenditure of money.

MARKET VALUATION OF PHYSICAL EFFECTS IS CARRIED OUT IN THREE STEPS, WHICH ARE FOLLOWS:

a) First, an estimate is to be made of the physical effect of the damage due to environmental change on the receptor (the land, the person or the machine affected by the change). Say acid rain causing a 10% loss in soil fertility per annum in a field.

b) Secondly, an estimate is to be carried out as regards the difference it would make to the output, or costs, a loss in 10% of soil fertility may cause 8% reduction in output of the crops.

c) Lastly, to estimate the change in the value of the output or costs. Say, a loss of 8% in the output of crops results in the net loss of income of Rs. 200000 per annum to the farmer.

Case Study: **Effect of air pollution on health in Jakarta Jakarta: Capital of Indonesia, having a population of about 9 million in 1994, The year of study.**

ENVIRONMENTAL PROBLEM:

Acute air pollution due to particulate matters (PM). Two types were studied: the total Suspended Particulates (TSP) and the more damaging finer particulates PM10 (so named

being less than 10 microns in size). Pollution measured in micrograms of PM per cubic meter M^3 of atmosphere. A TSP level of 100 coverts to a PM10 of 55.

PURPOSE OF THE STUDY

To estimate the economic benefits of reducing the TSP level in Jakarta by reducing the existing level ranging between 100 to 350 mg/m^3 in various parts of the city. It was estimated that reducing pollution to the national Indonesian level would avoid 1200 premature deaths, would save 200 hospital admissions, 40000 emergency room visits and 6 million Restricted Activity Days (RAD).

AVAILABILITY OF DATA ON COSTS

No data were available on the cost associated with hazards described above for Indonesia. However such surveys were carried our in USA and study team was of view that the data available in USA be adjusted for difference in wage and economic level between USA and Indonesia. It may be pointed out that the World Bank Report Indicates that Close to the material time of this survey the per Capita GNP of USA and Indonesia was $ 26980 and $ 980 respectively i.e. in the ratio of 1:0.0363.

ADJUSTMENTS OF COST AVAILABLE IN USA

Per Capita Cost	USA	Factor	Indonesia
Hospitalization Cost (10 days)	$ 28000	0.0363	$ 1016
			$ 200
Emergency room visits	$73.9		$ 2.7
Restricted activity days (wage)	$ 3 million		$ 0.1089m
Premature death			

Valuation of Savings to be reaped if pollution could be controlled:

Hospitalization : 2000 x $1016
= $ 20.32million

Emergency Room Visits : 4000 x $ 200
= $ 8 million

RAD : 6 million x $ 2.7
= $ 16.2 million

Premature deaths : 1200 x $ 0.1089 million = $ 130.68 million

Total Saving (benefit = $ 175.2 million

Case study: a public sewerage project for a sea beach of great tourist attraction.

Study focus: a sea beach of consistent tourist attraction throughout the year is responsible for the foundation of the economy of a major town in eastern India. The beach is flanked by a densely populated area comprising of a large number of hotels, holiday homes, guest house as well as residential bungalows. Besides, a noted pilgrimage drawing devotees from the region and beyond and a large commercial center situated within two kilometers form the beach also add to the number of visitors using the sea beach over the year.

PROBLEM TO ENVIRONMENT:

The main factor contributing to the environmental hazard is the absence of any sewerage system in the area. The house and hotels maintain their own septic chambers/ cesspools form where the excreta finally take refuge to the sea through limestone formation. Further untreated surface drainage water and foul discharges also find way direct to the sea. The continuous contamination of the water with the effluents pose serious threat to the health of the swimmers and other enjoying a bath in the sea. Other damages that are likely to occur on the environment are:

1)   decay of the coral reefs on the continental shelf that put up a resistance against the erosion of the sea shore and soil, and

2)   depletion of the vegetation growth on the reef that supply the food chain for the fishes flocking the shore and thus posing extinction of the fish industry in the coastal area.

PROBLEM:

To estimate in money terms the tangible and intangible benefits to be reaped as against the cost to be incurred in installation of a sewerage system.

Method of valuation followed to estimate the benefits of a sewerage system:

CONTINGENT VALUATION METHOD.

Survey coverage: Nearly 300 hotels, 150 holiday homes, and other residential premises are situated adjacent to the beach. About 550 house are situated outside the beach are resident from which also use the beach regularly. The former batch of hotels and other premises are to be linked with the sewerage system to be installed.

Total number of people in the 1st category of the area mentioned above using the beach is 20000 and in the second category is 6000 only.

Survey details: in order to quantify the willingness to pay of both the category of people questionnaire were served of the hoteliers and house – owners / occupiers of both the categories. For the hoteliers and the hose – owners/ occupiers living adjacent to the beach the benefits to be enjoyed were both due to the sewer connection as well as the cleaning up of the beach. The other category of house 550 in number was to be benefited form the overall environmental improvement and also out of the beach cleaning.

Sufficient publicity was given to convince the two categories of owners / hoteliers as well as the occupiers of the two alternatives.

1) either to allow deterioration of the beach by leaving things in their present condition keeping it open to environmental degradation and soil erosion

2) or to reap the benefits of the sewerage system to be installed and thus allow a total improvement of the environmental condition and promote tourism strengthening the economy further. The households that were outside the beach are and were not to be directly connected with

The sewerage system were to be levied for environmental improvement only.

3) reveled preference methods

People have always a demand for environmental quality. But no such market exists that gives an indication of price at which such environmental goods is brought and sold. In such 'missing market' it is extremely difficult to value the environmental good. Examples of peoples' demand for such environmental good. Examples of peoples' demand for such environmental quality may be noticed in public desire for enjoyment of recreational pleasure by visiting places of natural attraction or beauty, national forests and parks water courses forests, dams and reservoirs with associated recreational attraction etc.

In order to value environmental (say, enjoyment of recreational pleasure) in such missing market indirect costs incurred by people is taken as the proxy for price payable for such enjoyment.

THE PRINCIPLE WAYS TO ESTIMATE SUCH VALUES ARE:

A) Travels cost method:

An estimate of the cost of traveling to the sit, associated costs for visiting the site and a valuation of the time devoted in the visit are carried out which to gather serve as the proxy for the price.

B) Aversive behaviour (ab) or defensive expenditure (de)

When there is an actual or potential decline of environmental quality people indicate their preference for environmental good by incurring cost in preventing them. Such behavior is counted as an indicator of peoples' preference for environmental quality and the cost incurred is taken as the proxy prices.

C) Hedonic pricing method (hpm)

The principle behind this method is that property price reflects the quality of environment where it is situated. If there is an environmental improvement there is a resultant increase in the property prices. Based on this principle the vale of the environmental improvement is measured form a corresponding increase in the property prices.

All the approaches described above are based on revealed preferences that are inferred from expressed behavior of people in terms of cost incurred by them for enjoyment of environmental quality.

We now proceed to give a brief account of the actual steps followed in the three methods.

A) Travel cost method

In theory the principle followed in travel cost method is that people incur their own cost in terms of traveling expenses and money equivalent of time spent (in terms of wage loss or leisure time sacrificed0 along with other associated cost of traveling to a place of recreational attraction etc., according to economic principles of demand and supply the higher the travel cost measured in this way lesser is the number of visits. This is analogous to the economic principle that at higher prices lesser of a thing is demanded. Figure 1 (p. 496) indicate that at any particular price the environmental goods is valued by taking into account the price multiplied by the quantity plus the amount of consumers surplus. That denotes the total willingness to pay for an environmental asset at a given price. The total willingness to pay of all the visitors is indicated by the area under the demand curve in figure2. The task under the travel cost method is to find out how the number of visits falls as the travel cost increase, the study is then pictorially presented with travel cost as the ordinate

and the no of visitors as the abscissa. The total willingness to pay by all the visitors is then expressed by measuring the area under the demand curve.

THE FOLLOWING STEPS ARE FOLLOWED IN COMPUTATION OF THE DEMAND CURVE UNDER THE TRAVEL COST METHOD:

1) Zoning:

The potential area surrounding the site form where the visitors make their journey is first divided into separate zones. The zoning is made in such a fashion that the time required for traveling form any point in the same zone in roughly the same. The zone may be in the form of concentric circles in an ideal case. However they may be irregular shaped area as well. In some actual cases the zones corresponded to the districts of a town.

2) Representative sampling:

Visitors (their representative sample) are subjected to a survey as regards their characteristics covering a host of aspects. Data include on the motive of the visit cost of traveling (direct and indirect costs), respondent's own assessment as regards valuation of his time, duration of his journey. Frequency of the visits place of origin, total population in each zone, any secondary purpose of the visit etc.

3) Frequency of visits:

From the survey materials the total number of yearly visits per head of population from each zone is found out which is also called the visitation rate.

4) Estimation of travel cost:

Estimation of travel cost mainly involves a) direct expenses incurred by the visitors in fares, fuels and incidental cost in visiting the site and back ; b) the value of time in journey including that spent at site; and c) the entry fees and any other expenses at the incidental to the visit.

The valuation of time poses particular problem in that leisure time is in most studies empirically valued at one quarter to one half of the prevailing. Wage rate. However if there is no specific guidance readily available one third of the average wage rate is taken.

5) The regression analysis:

A statistical multiple regression analysis is made that attempts to establish a relation between visitation rates and travel cost, income of the respondent education, travel cost

to substitute sites. The form of the regression model is as education, travel cost to substitute sites. The form of the regression model is as education. Travel cost to substitute sites. The form of the regression model is as Follows:

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