Environmental Pricing; Review of the Methods and an Attempt to Answer the Question of their Robustness

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ABSTRACT

The main purpose of pricing environmental goods is to enable them to be recognized as integral component of any economic system. The environmental values are not associated with production or consumption, and they are not exchanged in the markets. Examples are the benefits that people simply get from knowing something, such as a national park. Many environmental goods and services are not priced because the costs of consumption are not born by the producer or consumer. Environmental pollution impacts are cases taking place as a result of, for example, releasing waste products into water. Good air depends on the waste processing service of ecosystems. If this is not provided, washing expenses, infection, etc. will increase, because more particulates reside on the clothes, cars, and so on, and thus more people are subjected to diseases. This paper reviews the methods of valuing environmental non-marketed goods and services that are most discussed in recent economic literature, including: replacement costs, travel cost method, hedonic Pricing method, and contingent valuation method.

Keywords: Environmental economics, pollution, Environmental goods and services

INTRODUCTION

Application of the methods for environmental valuation and pricing dates back as far as the 1930s (Thampapillai, 1993) (p.1).However, these methods have been widely used in the last decade. The environmental pricing can be carried out as a complement to the cost-benefit analysis and the cost-benefit analysis is a tool for valuing the outcomes of proposed projects and/or environmental good and services. Grounded in welfare economics, it bases its valuation on the prices at which goods and services are exchanged between producers and consumers. However, many environmental (and other) goods and services that will change in value over a project's life are not exchanged in markets, so cost-benefit analysis is confronted with the question: how can we value these non-market unpriced and services?

From the perspective of private financial analysis (the view point of companies) a clear indirect role cost-benefit analysis of a project that alter these unpriced, influential factors must include appropriate valuation. For example, the value of retention of urban bushland is not priced directly in the market as access to urban is not (generally) bought and sold .However; part of the value retaining bushland is exchanged for a higher value than a more remote property. The cost-benefit is exchanged for a higher value than a more remote property. To do a cost-benefit analysis of retaining or removing of urban bushland, this bushland-related element of property prices should be valued.

Fourthly, market prices are ignoring goods and services provided at no cost or a nominal cost by the governments. Recreational benefits of wilderness, parks, and wetlands are examples. Although no market exists because the good or service is not charged for by the supplier, if the recreational resource is to be destroyed or altered, the value of this change can be valued, because it is an alternation to the welfare of the receptionist.

This paper reviews the methods of valuing non-marketed goods and services that are most discussed in recent economic literature.

STRATEGIES FOR VALUING UNPRICED ENVIRONMENTAL GOODS

Providing monetary values for project effects, whichare not priced in markets, is obviously an order of magnitude more complex than valuing effects that are exchanged in markets. All methods must be in one way or another indirect, and all results are subject to a non-trivial level uncertainty.

Describing the range of potential methods, economists use a variety of frameworks. The diversity reflects the unsettled theory in this area of economist's .Sinden and Thampapillai (1991) group methods according to their data sources: actual market exchanges, related markets, or questionnaires. Dixon, et al. (1988) classify them according to their "applicability" chiefly a judgment on how often they would like to see the methods applied. Pearce (1971) contrast surrogate and simulated markets, Pearce and others (1989) quoted in Pearce and turner (1990) differentiated direct methods, which include reference to surrogates markets (i.e. related markets from which date can be drawn)and experimental techniques (which use hypothetical , simulated markets), and indirect techniques in which effects are priced on the basis of "dose-response" relationships (e.g. the effect of pollution on vegetation is determined and then priced "directly").Thampapillai (1993)uses the terms direct and indirect in a different sense: methods in which prices are inferred from date on related markets are indirect , and methods which ask consumers explicitly about prices are direct.

All of these contrasts are visible in the set of four methods of monetarily valuing unmarketed environmental goods reviewed here: the replacement method, travel cost method (TCM), hedonic pricing method (HPM), and contingent valuation method (CVM). The scope of each method will be discussed as follows (the set of valuation problems they can be applied to), and the problems will be underpinned.

REPLACEMENT COSTS

Scope

Degradation of ecosystems is often unpriced. Resource appropriation and waste disposal generally degrade environmental quality. These effects can be valued at the cost of replacing or rehabilitating the ecosystems. Replacement costs are a useful measure of value where replacement would normally occur (e.g. reconstruction after a storm; restoration of urban bushland). If replacement is not normally undertaken, then-assuming that a community is economically rational-the costs of replacement are greater that the benefits, so the replacement cost would overvalue the effect (Dixon et al., 1988). If replacement is normally undertaken, then the replacement cost is lower value for the benefit received from the resource in its undamaged state. Identifying a maximum replacement cost is more difficult as this is not evident from market exchanges. Estimates can be made by questioning decision-makers. If only partial restoration is required, then the costs of the work are only a lower estimate for part of the benefit provided by the environmental resource.

Methods

Minimum replacement costs are identified by investigating expenditure on similar restoration and rehabilitation projects. For case to case comparisons to be reliable, the magnitude of the damage must be measurable. To estimate the maximum replacement costs, experts in restoration etc. would need to be consulted and decision-makers questioned on their willingness to pay (WTP) for the restoration.

Weaknesses

By definition, replacement costs cannot be used to value irreversible effects-

Replacement cannot occur so cannot be costed. But with alterations to ecosystems there is often some measure of irreversibility. For example restoration after mining does not return wilderness to its original ecological diversity. So where ecosystem degradation is concerned," replacement costs" generally do not capture the full value of the ecosystem costs.

Where restoration is a condition of a license (e.g. after a mining project), the community requiring the restoration to occur, "pays" the opportunity cost of the restoration, not the financial cost (for example paid by the mining company). If these diverge (e.g. the company is foreign-owned so the community's opportunity cost is only the tax foregone

because the company's profit has been reduced by the costs of restoration), then one could argue the replacement cost overstates the benefit.

Because maximum replacement estimates depend on question about willingness to pay, valuing them has much in common with contingent valuation. Actual replacement costs reflect willingness to pay (WTP) in actual markets .Cost-benefit analysis attempts to measure welfare defined as WTP in perfect markets. In practice, ignorance regarding the extent of the costs of disruption of environmental services is usual, so replacement costs paid in actual markets may substantially understate true benefits. This qualification applies to all efforts to welfare changes from market-like information.

TRAVEL COST METHOD

Scope

The travel cost method (TCM) uses the cost of travel for a facility (e.g. recreational use of a national park) to construct a demand curve. It is based on the premise that even though most public recreation sites have zero (or nominal) entry fees, reservationists nonetheless pay an implicit price for a sites s services when visited. This implicit price includes vehicle-related and time costs of the trip (Smith et al., 1986).The method was developed for valuing the benefits of recreation, "but it can be applied to value to acquire it (Sinden and Thampapillai, 1991).

Method

Users of facilities (parks, rivers, wetlands, etc.) are surveyed to determine their costs travel (direct travel costs and costs of time spent). Users are grouped according to their distance from the facility. For each group the number of visits per head of population and their average travel cost are calculated "increasing travel costs are [treated as] a surrogate for variable admission prices" (Dixon and others, 1988 .p . 55).We thus have a set of price-quantity points from which to plot the demand curve implicit in the pattern of park usage.

This procedure rests on a number of assumptions however: notably "that individuals can be grouped into residential zones where the inhabitants have similar preferences" (Dixon, and others, 1988, p.55).Three factors that may confound a simple cost/consumption relationship – "tastes, incomes and intervening opportunities" (Farber and Costanza, 1987) need to be controlled for.

Weaknesses

The major weakness of the TCM is it s limited applicability .It can only be used where users travel varying distances to enjoy a facility , and where the travel costs are the major determiner of the amount of consumption . Often although travel is a component, it is not the major factor shaping consumption (e. g. traveling from the suburbs to the city to see a newly released movie).

A second limitation is that it can only be measured for facilities that are already in use. Valuing a proposed facility by the TCM requires finding and existing facility whose funding and local market closely match those of the facility proposed, this is often difficult.

A third limitation is that it only measures the value to users. Non-use values – existence value, option value, and bequest value – are not measured (see Streeting, 1990, p.11).

In this respect, at least, it therefore understates the actual value of the facility. With these qualifications, the travel cost method is a relatively reliable method of valuing benefits as it is closely tied to actual costs incurred.

HEDONIC PRICING METHOD

Scope

The hedonic pricing method of valuing non-marketed goods exploits the fact that when a person purchases a marketed, priced good, one factor influencing their choice may be their valuation of an unpriced benefit bundled into the market good. For example, in choosing to buy a house in one locality rather than another, a purchaser may be expressing a value for noise or air pollution. Statistical analysis of the characteristics and prices paid for goods and services can differentiate (approximately) the proportion of the price attributable to such marketed environmental goods and services (Streeting; 1990, p.iii).

Method

Some assumptions must be satisfied before HPM can be attempted (Sinden and Thampapillai, 1991, Pp.6-19):

a) "The participants in the market must perceive a characteristic as important in determining the price of the good".
b) Buyers and sellers "must have the opportunity to observe and react to the actual level of the characteristic"; and
c) There must be methods measuring a characteristic which are valid and reliable and which "are meaningful to buyers and sellers".

Data on prices paid and on variables that affect market prices is gathered and analysed to see if the environmental good or service influence the price (using multiple regression analysis the influence of variables other than the environmental good is eliminated).If the environmental good or service is significant, a function is derived that describes the price of the good as a function of the significant variables(See King and Sinden, 1988).For small changes in the quantity or quality of the environmental good, the marginal implicit price function derived by differentiating the implicit price function on the selected environmental good is used to measure welfare changes. To measure the benefit changes associated with large changes in the environmental good, the underlying demand and supply functions for the environmental good must be estimated (Streeting, 1990, P.5).

Weaknesses

For regression analysis to yield unbiased assessments of the role of environmental goods in property prices (or similar), all the significant factors affecting property prices must be included in the data analysed. If a factor is missing, the results for the environmental good may be biased up or down (Pearce and others, 1989, P. 65).In practice, however, many variables are highly correlated, e.g.:
"Accessibility to the town center is often closely related to some measures of air pollution such as total suspended particulate matter, which is very closely related with other measures such as sulphor "dioxide" (Pearce and, 1989, p. 66)
To improve the sensitivity of the statistical tests, highly correlated variablesare employed. Consequently, the results more often describe only the influence of a general class of variables, e.g., Pollution or land quality, on price and thence welfare.

A second weakness of hedonic pricing is that non-use values, e.g. existence value, option value, and bequest value, value, are not included in hedonic prices as these are prices paid by users of goods and services (Streeting, 1990). Carefully structured hedonic pricing is believed to value environmental attributes to within one order of magnitude (Dixon et al., 1988) and the influences of other socio-economic variables (Thampapillai, 1993).

CONTINGENT VALUATION METHOD

Scope

Contingent valuation consists of a sense of asking people what they place on environmental cost or benefit - what they are willing to pay to get it or what compensation they would be willing to accept for losing it. Its great advantage over other methods of pricing unmarketed goods is that all kinds of laboratory experiments are used (Pearce and Turner, 1990).

Method

CVM presents people with a hypothetical market. Method used include (after Dixon et al., 1988):
bidding games, in which people are asked to evaluate hypothetical situation(s) and to state what they are willing to pay for or accept for a giving change in an environmental good ;
take –it-or-leave-it experiments , in which experimental subjects are divided into groups and members of each group are asked whether they will pay some money for a giving quantity of an environmental good or service;
trade-off games, in which participants are asked how much money they would be prepared to trade for an increase in an environmental good;
costless choice, in which people are asked whether they would prefer , say, a given sum of money or a given increase in environmental quality;
The Delphi technique, in which domain experts are asked to value goods or services, their justifications of these values are circulated amongst their fellow experts, and each expert is asked to review their valuations in the light of the other experts' comments. This process is repeated a

number of times in the hope that the experts' valuation will converge on a mean. In questionnaires or experiments of these types the presentation of the hypothetical market may bias peoples' responses substantially. Types of bias include (after Imber et al., 1991):

a) Strategic bias, in which the respondent over or under – bids to influence authorities to provide the amenity being valued;
b) Compliance bias, in that the respondent attempts to give the willingness to pay that they think will please the interviewer;
c) starting point bias, in which "initial money amount influence the WTP amount given by the respondent" (Imber et al., 1991);
d) theoretical and amenity mis-specification biases, in that the scenario described by the interviewer – in terms of economics, policy proposals or environmental and cultural values – is incorrect in some significant respect;
e) context mis-specification bias, in which the context for the market that the respondent assumes is different form that intended by the researcher;
f) population bias , in that the population whose benefit is being valued, and
g) Sampling bias, in which the sample chosen is not representative of the target population. Strategies to address these of bias in CVM are required.

Weaknesses

A basic problem with valuation techniques that rely on questioning people is that peoples; intentions do not always predict their behavior. The key question for CVM is does it reflect people's valuation of amenities in ways that are directly comparable with actual market behavior?
One significant anomaly is that people generally request in the order of three times more compensation for the loss of an amenity than they say they are prepared to pay to gain the same amenity. Conventional economic theory says that willingness to accept should equal WTP. At this point it is not clear whether this result reflects an error in economic theory, errors in the CVM studies, or a difference between people, valuation of the kind of amenities that CVM is applied to and amenities bought and sold in actual markets (Pearce and Turner, 1990; Pearce et al., 1989). Options as to the reliability of CVM vary. Common (1988) suggests, "where it has been possible to compare CVM results with valuations expressed in actual markets, it is usually found that the former are unreliable".
Loomis and Walsh (1986) remarks, "Comparison of the hypothetical market approach used in CVM with property value markets for air quality ... and simulated markets with real cash for goose hunting permits ... shows that CVM values tend to be conservative".
Sinden and Thampapillai (1991) report a survey of 17 comparison between values derived form CVM and from actual markets and found "no statistical difference before hypothetical and actual payments in any of the 17". Pearce and Turner (1990) report comparisons of CVM and other valuations of unmarketed goods and found that CVM was accurate to within +/- 60% of the other methods.
From this evidence, it seems reasonable to conclude the carefully designed CVM draft will give a valuation of environmental goods and services that is about the right of magnitude.

CONCLUSION

Environmental goods and services that are not exchanged in markets are unpriced .However, because they have economic value, they must be included in cost-benefit analysis of the environment and the projects that will alter their quality or quantity. Methods of valuing them are therefore, needed.
Estimations of prices for unmarketed goods are necessarily somewhat tentative, but valuation techniques are at a point where they provide some assistance to decision-makers. The replacement cost method, the TCM, and HPM can set fairly clear lower bounds on the value of some unpriced goods and services. Contingent valuation surveys can be used to value all kinds of environmental goods and services, and, when carefully drafted, appear to be accurate within about one order of magnitude.
Apart from the weaknesses cited in this article, review of the various methods of valuation reveals that almost all methods are subject to controversy, having different degrees of deficiencies. Therefore, the robustness of these methods is still under question. Thampapillai (1993) argues that

whilst the CVM can theoretically deal with all attributes of the environment, the wide variations in expressed values and the inconsistencies between hypothetical transactions and economic commitments renders the method to be inefficient. Knetsch (1993) questions the people, sattitudes and environmental goods and services are commonly provided free or at regulated nominal costs. However, cost-benefit analysis cannot adopt financial pricing. If a goods or service is Provided free, when in fact it has positive economic value, then it is in accordance with the laws of supply and demand more of it will be consumed than maximization of welfare warrants , Various environmental goods and services clearly have positive economic values because feedbacks from them affect economic welfare. Thinning of the ozone layer increases skin cancers and thence health costs .Reductions in wilderness reduces the recreational opportunities of a community. Clearly if it is to value projects from the public perspective, cost-benefit analysis must find values for these unpriced environmental goods and services.

What kinds of environmental goods and services are unpriced? There are a variety of reasons why goods and services with positive economic value are not exchanged in markets. Values that are not associated with production or consumption are not exchanged in markets. Examples are the benefits that people get simply from knowing something, e.g. a national park, the benefits received from knowing that one can visit a place at a later stage, and the present benefits of being able to bequeath an environmental amenity to one's children and grandchildren. Existence, option, and bequest values are called non-use values to distinguish them from values associated with the use of goods or services. Although they are unmarketed, they must be included in cost-benefit analysis of projects that affect cultural or environmental heritage.

Many environmental services are not priced because the costs of consumption are not born by the producer and consumer. Pollution impacts are the classic example. Release of waste products into water and air relies on the waste processing services of ecosystems. If, as is now often the case, the ecosystems dispersal, decomposition, filtering, and recycling capacities cannot process the flows of waste sufficiently quickly to keep the air and water clean, the human welfare is impacted in various ways, consider exhaust fumes from cars as an example. At the point of release, the high concentration of particulates affect people's breathing and carbon monoxide contributes minor positioning. Further, downwind exhaust fumes react with atmospheric gases to from ozone, with other health implications. In the particulates deposition zone, washing expenses increase more particulates are settling out in clothes, cars, etc. Gardens are reduced in diversity because of the poisons in the air, and we can go on. These costs are not borne by neither producers nor consumers, so they are not priced in any of their market exchanges. However, these costs are borne by the community, so a full cost-benefit analysis of a project that increases vehicle usage, would need to examine which impact to determine its economic value.

Some environmental goods and services are not directly priced in markets, but do play preferences in using the environmental pricing and valuation methods. There exists a wide range of research criticizing the travel cost method (see for example, Ribaudo and Epp, 1984). This is the case with other pricing methods. The environmental valuation methods however, have become widespread, being established onwards. The more recent application of these methods have been reflected in the studies of Alberini (1995) and Burgestram (1995) , Shure (1995) on pollution , natural resources , WTP for clean water services (Khorshiddoust , 1997).

With all these problems in hand , hopefully further economic research will improve the present unstable situation of the use of methods correct valuation of environmental goods and services. It is central to efforts to implement ecologically sustainable development policies in public sector planning and management.

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