THE ECONOMIC EVALUATION OF ENVIRONMENTAL 'GOODS' AND 'BADS': A COMPARISON OF ALTERNATIVE TECHNIQUES*

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INTRODUCTION

In many of the developed economies, major development projects which are deemed to have a potentially adverse impact on the environment are now required to have an environmental impact assessment undertaken to assess whether the costs of the project are likely to exceed the benefits when the full impact of the project on the environment is taken into account. How do we place values on these costs and/or benefits to the environment?

Several attempts to value the impact of changes on a sensitive environment have been the subject of public debate. For example, the valuation placed on the Kakadu Conservation Zone in Australia was considered by some mining companies to be unrealistically large and even more heated debate has surrounded the valuation of the environmental impact of the Exxon Valdez disaster in Alaska. Both of these controversial valuations involved the use of the contingent valuation method (CVM). However there are two other methods which have also been used to evaluate environmental and natural resources. This paper outlines these three main valuation methods and their limitations and criticisms and finishes by suggesting that, in the light of these criticisms, at least two of these methods should be used to provide some validation check to the estimates made within the different techniques.

THE VALUATION OF RESOURCES

The traditional method for assessing the net benefit of a project has been through the use of cost benefit analysis (CBA). However, in the past the benefits and costs assessed using this method have been largely related to the economic environment (although the impact on mortality rates has been included in many of these studies). The question of valuing goods and services

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in an economic environment is generally addressed by looking to the market mechanism and examining the appropriate market price. Some debate may take place as to whether this is the appropriate measure of value to use. For example, prices may not reflect the true social cost or there may be subsidies which affect the market price. However, at least there is some starting point provided by the market system for the valuation process.

The concern of this paper is the problem of placing a value on non-marketed resources in general to enable such resources to be incorporated within the framework of benefit cost analysis.

The valuation of environmental resources differs from that of most economic resources. In general, there is no market in environmental resources. However, there is an additional dimension to the value placed on environmental 'goods' compared with conventional economic (marketed) goods: the economic values to be attributed to environmental assets must include not only use values[1], such as the direct benefit/cost to production of the proposed change to the environment or the change in the value of output or utility of a consumer of the good, but also non-use or passive values. Non-use value includes the existence value (the intrinsic value of maintaining the Great Barrier Reef or Kakadu in its current relatively unspoiled state), option value (the potential value of the Amazonian rain forest in producing as yet unknown medicines) and bequest value (the value placed by current generations on being able to transfer the resource in its current state to future generations.[2]

In addition, these goods often have the characteristics of public goods with the possibility of free riders. Because these types of 'goods' are not marketed, people may be unfamiliar with the process of placing values on them. This has been put forward as one of the arguments against the CVM as is discussed below.

Three basic methods have been developed to produce estimates of the value of non-marketed resources: two indirect valuation methods which are limited by their ability to predict use values only, and a third direct approach which may be used to estimate both use and non-use values. The indirect or revealed preference methods are the travel cost method (TCM) and hedonic price method

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[1] Use values are the crux of market values with the price paid related to the utility derived from the consumption of the good.

[2] Imber *et al* (1991) also list quasi-option value and vicarious value in non-use value.

(HPM), while the direct method is the contingent valuation method (CVM).[3] Neither TCM or HPM can, even in principle, measure the non-use values of non-marketed resources. Indirect revealed preference methods measure the value placed on the resource implicitly through the use that is made of the resource by the individual in the consumption of a related marketed good. Non-use values are therefore outside the ambit of these methods. CVM, on the other hand, may be used to assess either use or non-use values (or both) by choosing a suitable survey methodology and framing the CV questions appropriately. Indeed, some researchers have concluded that only CVM are capable of estimating the total economic value of environmental 'goods' or 'bads' (for example, see Willis and Garrod, 1992). This is particularly so when the change to be assessed is hypothetical in nature. However, each of these three methods is subject to differing degrees of criticism, which can be at times so damaging as to suggest a particular method may not be valid in certain circumstances. These are discussed below.

INDIRECT METHODS OF VALUATION

TCM and HPM can be used in limited situations where the use value of a resource can be estimated by examining the consumption behaviour in related markets. Both methods therefore require that an appropriate related market exists.

Within the hedonic pricing model, the valuation of an environmental 'good', for example, scenic views, may be assessed by examining the price paid for housing in areas which are subject to differentials in quantity of the environmental 'good' encapsulated within the housing characteristic bundle (for example, different extents to which houses have such views). Information concerning the other quality characteristics possessed by the house would also be included in the estimated hedonic price equation. The method may also be used to estimate a value for environmental 'bads', for example, noise, by examining the differentials paid for housing subject to different levels of the environmental 'bad', such as the different noise levels resulting from proximity to an airport.

The two markets which are most commonly used in hedonic price studies are the labour and housing markets, where the wage paid may depend on the

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[3] There is an additional method which is a combination of the two indirect methods, referred to as the hedonic travel cost method. This is discussed below.

exposure to certain hazards or the house price may vary because of the presence or absence of the public good being valued. Examples of each of these uses of hedonic price studies may be found in two survey articles, Cropper and Oates, 1992, and Palmquist, 1991. The major problems with this methodology are, at the empirical level, the lack of availability of suitable data on the environmental good being valued, and, at a theoretical level, the assumptions required, such as those concerning utility functions and their aggregation, for the analysis to be valid. In addition, hedonic price estimation of the price paid for housing or labour assumes the existence of equilibrium in these markets. However, it may not be realistic to consider the housing or labour markets to be in equilibrium.

The basic estimated form of the hedonic model is:

$$p_i = f(x_{i1}, x_{i2}, \ldots, x_{im})$$

where p_i is the price of the ith heterogeneous product, such as housing, and

x_{ij} is the quantity of the jth characteristic provided by one unit of the ith product.

Variables other than quality attributes, such as the socio-economic characteristics of the household may also be incorporated into the estimating equation and indeed may be necessary to derive the appropriate implicit prices.

Once this hedonic price function is estimated, marginal implicit prices, and hence the marginal willingness-to-pay may be found for each of the quality characteristics, including the environmental good. However, a second estimation step is required to estimate the non-marginal willingness-to pay implicit in the demand functions which is generally of more interest to economists. This step involves the problem of identification of the demand curve, discussed in detail in Palmquist, 1991.

Problems exist at both stages of the estimation of hedonic prices. The estimates obtained may vary dramatically according to the functional form used for the hedonic price equation. (See, for example, Ziemer *et al.*, 1980; Milon *et al.*, 1984; and Graves *et al.*, 1988.) Omitted variables may also cause bias in the estimates obtained for the hedonic prices of environmental attributes, and thus in the associated consumer surplus estimate. Thus, the derivation of welfare measures, such as consumer surplus, is complex and may be subject to large errors (Palmquist, 1991).

In addition, the environmental goods which can be assessed by this method are limited, being restricted to those goods where a related market exists and for which data are available which are not subject to large measurement errors.

The travel cost method is perhaps the oldest of the non-market valuation methods assessed in this paper, dating back to the 1940s and Hotelling. Like the hedonic approach, the goods which can be evaluated using this approach are limited and the value found is the use value only. TCM is used primarily to evaluate natural resources which are closely associated with leisure and tourism, such as forestry reserves, lakes (for fishing, boating or swimming) or other reserves used for hunting, walking or climbing.

In brief, the method involves using the amount spent by visitors/users of the resource as the basis of the valuation. This 'travel cost' can be thought of as the price which people are willing to pay for the use of the resource. Travel costs vary depending on the distances travelled so a range of 'prices' can be observed with people travelling varying distances to visit the resource. It is possible to measure the quantity of visits made at these different 'prices' and so estimate a demand curve for the resource. From this, a measure of consumer surplus can be estimated.

The travel costs, including a distance cost, time cost and entrance fee, if any, are included in a trip generating function which predicts the number of visits the individual is likely to make to the location, where other independent variables used might include income, age, and other socio-economic variables. A demand curve is estimated, relating the number of visits to the entrance fee, using simulation methods.

The basic model is the Clawson-Knetch model or zonal TCM:

$$V_{hj}/P_h = f(C_{hj}, S_h, A_{jk}, e_{hj})$$

where

V_{hj} is the number of trips from zone h to location j
P_h is the population of zone h
C_{hj} is the travel cost from zone h to location j
S_h is a vector of socio-economic characteristics of the population of zone j
A_{jk} is a vector of recreational attributes of location j measured relative to substitute locations, and
e_{hj} is an error term.

Individual TCM uses data which refer to individuals rather than the averages which are used in the zonal TCM. A general model could be:

$$V_{ij} = f(C_{ij}, D_i, N_i, P_{ij}, E_{ij}, L_{ij}, A_i, Y_i, e_{ij})$$

where

V_{ij} is the number of visits made by individual i to location j
C_{ij} is the travel cost faced by individual i in visiting location j
D_i is a set of 0-1 variables relating to the preferences of individual i
N_i is the number in the party with individual i
P_{ij} is a 0-1 variable relating to main purpose of trip (1 = main purpose of trip)
E_{ij} is an estimate of proportion of enjoyment attributable to visiting location j
L_{ij} is the number of hours spent by individual i in location j
A_i is the age of individual i
Y_i is the income of individual i, and
e_{ij} is an error term

Travel costs C_{ij} are estimated as a function of distance costs and time costs for individual i to visit j plus any fees to enter site j. Again, once this relationship is estimated, a demand curve for visits is simulated, relating visits to a fee.

In both cases, whether for the zonal or individual TCM, the area under this demand curve provides an estimate of consumers' surplus, usually reported as consumer surplus per visit.[4] This must then be aggregated over the appropriate population to provide a measure of total consumer surplus. The problem of what constitutes an appropriate population is less acute for the TCM that for the CVM (see below) as it is restricted to (potential) users of the resource. However, this does require clear definition if the total surplus measure so determined is to be accurate.

This methodology assumes separability in the utility function with respect to the recreation activity being measured: the demand for visits to snorkel on the Reef is independent of the demand for alternative leisure activities and non-leisure activities. A discussion of separability in respect of the TCM can be found in Fletcher *et al.* 1990. It is a restrictive assumption.

Sensitivity of the estimates to functional form has been found in many TCM studies. In particular, there are estimation problems related to the truncated nature of the data set: no data are available for those who do not use the resource, that is, do not visit the recreation site. Truncated maximum likelihood estimates which allow for this type of data set are required to avoid the upward bias resulting from the use of OLS. The problems intrinsic in TCM are discussed elsewhere (for example, Hanley and Spash, 1993; and Braden and Kolstad, 1991). Large differences exist in the valuations depending on the estimation

[4] If log of visits is used as the dependent variable in the trip generating function, the reciprocal of the travel cost coefficient provides an estimate of this consumer surplus per visit (Hanley and Spash, 1993, p.85)

process used.

In addition to these two simple model types, there is the hedonic travel cost method. This method, as does the hedonic method, attempts to find the marginal valuations for the characteristics of some resource, such as forest reserves. While the travel cost method finds the value placed on the resource by examining the consumption behaviour of users/consumers, the hedonic travel cost method ascribes this value into values associated with varying characteristics of the resource. This method shares some of the problems of the TCM and HPM.

A DIRECT METHOD OF VALUATION, CVM

The contingent valuation method has recently been under the spotlight of the attention of some of the most prestigious American economists in the context of the aftermath of the Exxon Valdez disaster, with Arrow and Solow heading a team to investigate the question: "Is the contingent valuation method capable of providing estimates of lost non-use or existence values that are reliable enough to be used in natural resource damage assessments?" (Portney, 1994). It appears to be the most controversial of the methods of valuation, despite the problems besetting the other methods which have been indicated above. In this section, the CVM and its problems are outlined.

In contrast to the other two methods, with CVM, both use and non-use values may be estimated, although the questions within the CV questionnaire may be designed to extract information on use values only (for example, Hanley and Munro, 1994). In fact, in many instances, it is use value which is estimated with the respondents to the CV questionnaire being restricted to users. There appears to be less controversy in this area of estimating use value using CVM although most of the criticisms which have been levied against the method apply equally to use and non-use valuation. However, it is the potential for the valuation of non-use which makes the CVM so attractive.

A CVM questionnaire typically consists of three sections. In the first section, there is a detailed description of the good/resource being valued and of the hypothetical market which is available to respondents. The second part consists of questions which elicit the respondents' willingness to pay (or, in some circumstances, their willingness to accept compensation) and their preferences generally for environmental goods. Finally, details on the respondents' socio-economic characteristics and preferences concerning the goods in question and

substitutes are collected.

As indicated above, the attention of Nobel prize winning academics has been turned to the CVM through the National Oceanic and Atmospheric Administration (NOAA) panel. In their report they established guidelines for the conduct of future CV studies. Portney summarises the seven key guidelines in his recent article (1994) and these are indicated below.

Problems concerning the first part of the questionnaire, the choice and description of the hypothetical market, have been widely discussed elsewhere and are very case specific. The NOAA panel recommended in regard to this issue that the description of the scenario portrayed must be accurate and understandable and that the hypothetical market is believable.

The framing of the CV question is all important to the valuations which respondents place on the non-marketed goods in question with changes in the frame affecting the valuations imparted by the CVM study. The salient features of the framework concern the realism of the hypothetical market and the payment mechanism proposed as well as the quantity of information supplied to respondents. Differing quantities and types of information have been shown to affect the valuations placed by individuals with the CVM framework (Bergstrom *et al.*, 1989; Hanley and Munro, 1994). Information may be provided by the researchers or may be already in the possession of the respondents. This information may refer to the good itself, the availability of substitute and complementary goods, relative expenditures and the future availability of good and potential supply uncertainty. Again the NOAA had specific recommendations about the information to be supplied: the survey should contain reminders that by paying the amount indicated in the survey, the amount available for spending on other goods and services would be reduced; and the survey must remind the respondent about the availability of substitutes for the environmental good being valued.

The problem of information is related to the familiarity (or lack of) of the respondents to the idea of valuing an environmental good. A recent Australian study (Windle and Cramb, 1993) found that the lack of familiarity with the concept of valuing environmental goods led to the bids tendered being influenced by factors other than the value of the good in question.

The types of method used to 'collect' the willingness to pay (WTP) bids vary, but are of four main formats. The open ended format consists of a direct

question concerning the respondent's WTP. Critics claim that "how much am I willing to pay for, say, clean air?" is too hard a question and people are not always willing to devote time to think about it and may be unable to resolve the question anyway. A bidding game is one alternative but this has been shown to suffer from starting point bias. A payment card avoids the problem of starting point bias but the method recommended by the NOAA is the discrete response or referendum type question: "Would you vote for this policy to be provided at this pre-specified cost (in taxes or raised product prices)?" The problem with this method is that this price is not the participant's maximum willingness to pay and further logit analysis must be undertaken to determine the demand curve and WTP with the corresponding opportunity for error. This format also requires that the respondent believes that all respondents will have to abide by the decision and that the price is set exogenously so that their response will not affect the future.

One problem with CVM is that the respondents are forced to think in terms of trade-offs between money and environmental 'goods and bads'. The difficulty which some have with this has been shown in the literature to be the cause of zero (protest) bids. Some feel that it is morally wrong to think in terms of such trade-offs and others find the concept too difficult to handle. With hedonic pricing, the comparisons may be between two houses, one with a view and one without and the individuals can assess how much more they would be willing to pay to possess such a view. This is a much less abstract concept than being asked "How much would you be willing to pay to preserve the Barrier Reef?" A more manageable question would be "How much would you be willing to pay to enter the Barrier Reef National Park as a visitor?". That is, the use value (and to a lesser extent option value) is a more tangible concept for participants in a CVM study. However, in many applications, non-use can be the more important and more relevant valuation.

The problem of whether the CV study should be framed in terms of willingness to pay (WTP) or willingness to accept compensation (WTA) is addressed throughout the literature. WTP relates to the concept of the compensating variation of standard microeconomics while WTA relates to the equivalent variation. In a situation where the change in income is not great and there is a low income elasticity of demand, the valuations derived using WTP and WTA should be similar, and thus the two estimates derived will be approximately equal. However, this result has not been found in the literature. The difference may be explained by peoples' loss aversion:

> losses from a reference position are systematically valued far more

than commensurate gains (Knetsch, 1989, p.1277)

The NOAA panel recommended the use of WTP as the appropriate measure to be used, recognising that this may tend to underestimate the 'true' value of the resource especially if there has been a loss in environmental quality.

The NOAA recommended also that the survey be conducted by personal interview rather than by telephone and the survey must contain follow-up questions to ensure the respondent understood the issue.

The Theoretical Validity of CVM - The Problem of Embedding

One way of testing the validity of a methodology is to test how it performs with respect to accepted theory. The problem of embedding found in CV studies has been shown to be at odds with accepted preference theory. The problem arises when the valuation of a particular good, such as a particular forest or river, determined through a focussed CVM question, is compared with a valuation inferred from a wider CV study determining the value of a more inclusive good of which it is part, such as a number of forests or rivers. The individual valuations have tended in many cases to be higher than those inferred from the valuation of the inclusive good. Kahnemann and Knetsch (1992) showed that the WTP for a particular good can vary from nine times more depending on the level of embedding. Some have blamed these results, not on CVM *per se*, but on careless questionnaire design (see Garrod, Willis and Saunders, 1994) with 'top-down disaggregation' suggested as a more appropriate framework for a CV study. Such a questionnaire would begin with questions concerning the WTP for some general public goods with the questions becoming more focussed towards the specific environmental good which is of prime interest. For example, if a CV study were to be carried out to place a value on a particular forest, respondents would first be asked to give an estimate of their total budget for environmental-type goods and services, then for a particular group of such services (for example, all forests), and only then is the question placed concerning the WTP for the particular forest. (For an example of such an approach, see Garrod, Willis and Saunders, 1994.)

This problem of embedding (and the related issue of question order) is seen as perhaps the major argument against CVM put forward by Diamond and Hausman (1994). They argue that the problem of embedding shows that preferences are not being properly or accurately revealed by CVM. They argue that the valuations found using CVM include a large component of 'warm glow' effect with people placing a high value on the mere act of preserving some

natural resource. This effect would naturally yield the result shown and ascribed to embedding - that it is more valuable to preserve the first item than any subsequent items included in the CV questionnaire - the warm glow is associated with the first valuation.

HOW MUCH DO THESE VALUATIONS DIFFER?

The validity of the estimates obtained through the use of any of the above methodologies can be examined with respect to their construct validity, theoretical validity and convergent validity (Hanley and Spash,1993). In the above, reference has been made to the first two of these aspects of validity testing. In this section, the concern is with how closely estimates from the different methods correspond. If two estimates do appear to be similar, this is no real test as to whether the results are converging on the correct valuation but it is perhaps reasonable to believes that such convergence be taken as a positive rather than negative signal

Convergent validity examines the extent to which different methods produce similar results. The use of convergent validity tests to check on the results of a CVM study has been suggested in the literature (eg. Hanley and Spash, 1993). However, others have expressed some cynicism as to the usefulness of this approach: "it is questionable whether hedonic methods should be used to bolster CVM results...since virtually any hedonic result desired can be plausibly obtained" (Graves, 1991, p.217). This criticism was made with reference to the sensitivity of hedonic estimates to choice of functional form. It is clear from the literature that similar criticisms could be addressed to the TCM with regard to functional form sensitivity, suggesting that validation testing may be an expensive yet unconvincing exercise.

Despite this criticism, there is frequent mention made in the literature of the difference between CVM valuations and those obtained using HPM and TCM. As stated above, the latter can only measure a subset of the total value of the resource, the use value, while CVM, if appropriately designed, may result in an estimate which captures both use and non-use values. Brookside et al (1982) argue, using standard neoclassical utility theory, that *a priori* CVM valuations must be less than those using HPM and indeed find this result in their analysis of the value of clear air in Los Angeles. However in a later paper (1985), the same authors find a result which conflicts with their previous analysis with the valuation from HPM exceeding that from CVM. This later result is perhaps more in keeping with intuition. Since HPM only incorporates use values, whereas

CVM covers (potentially) both use and non-use, intuitively CVM will result in a higher valuation. In addition, CVM measures what people are willing to pay for a resource, where there may be no active budget constraint (that is, they do not have to actually pay it), and, as Blamey and Common (1993) discuss, this WTP may incorporate the views of the respondent acting as a social agent (what society should be willing to pay to preserve the resource). The HPM and TCM provide estimates of what the individual actually pays (albeit implicitly) for the resource. So intuition would argue for a CVM valuation to exceed that of either TCM or HPM approach.

In the Brookside study a key factor which may limit the extent to which the results may be applicable to other situations was the familiarity of the Los Angeles residents with air pollution. This familiarity means that the respondents are not entirely unused to the idea of trading in the resource. This is a condition which is believed to be important for the validity of a CVM study (Cummings *et al.* 1986).

There may be another reason for the reversal in magnitude of the values found in Brookside's CV studies compared with his HP studies in the two papers (Brookside *et al.*, 1982 and 1985). In both examples, the CV studies were concerned with estimating use-values, in the first case, the amount they would be WTP to improve their air quality and, in the second case, the amount they would be willing to pay to move into a non-earthquake prone region. There is probably little difference between the two studies with regard to the knowledge of the environmental product being valued, air quality and earthquakes. The difference may lie in the levels of uncertainty associated with the two 'goods': air quality was directly observable and experienced by the CV respondents whereas their exposure to earthquakes was more limited. In assessing the WTP to avoid earthquakes, the respondents had to implicitly estimate the expected cost of experiencing an earthquake (plus the disutility of uncertainty). The value placed on this depends on the probabilities placed on the possible outcomes, say, modest earthquake, average earthquake and severe earthquake. Implicitly this is also the exercise undertaken when valuing alternative housing, as in an hedonic study. However, will the (subjective) probabilities differ according to whether money has to be paid over (hedonic) or there is only a hypothetical situation and no money is actually handed over (the case of CVM)? More time can be taken in assessing alternative house choices and their associated exposure to risk of earthquakes than in assessing a hypothetical WTP value for a CVM study. Thus more time can be spent on estimating and, if necessary, revising the probabilities, particularly on the extreme situation of major

earthquake. The expected value and thus the WTP is likely to be lower for the actual payment scenario than the hypothetical one. This aspect of how risk may affect valuations does not appear to have been examined in the literature.

Randall (1991) points out the theoretical difference between CVM estimates and those obtained through the revealed preference methods of TCM and HPM. TCM and HPM estimates are by necessity *ex post* estimates, with valuation taking place after there has been some change to the resource. CVM estimates are *ex ante*. In this chapter, he also examines the difference between the holistic approach to total value possible within the CVM framework and independent valuation and summation (IVS) methods where existence values and use values may be aggregated following their independent valuation. He shows that these two approaches will not lead to the same total valuation.

Many such comparisons between the estimates derived from revealed preference and direct approaches appear in the literature. Garrod and Willis (1991) compare the estimates of consumer surplus obtained by two different forms of the TCM, Zonal Travel-Cost Method (ZTCM) and Individual Travel-Cost method (ITCM) and by a CVM study. There are large differences between the three estimates, with the benefit estimates from the ZTCM exceeding those from the other two methods, at times by a factor greater than 10.

In Hanley and Ruffell (1992) and Garrod *et al* (1991) estimates were obtained using both CVM and TCM. In the first study, WTP derived form the CVM was less than half the estimate obtained using the TCM.[5] In the latter case, the WTP to enter botanic gardens in the U.K. were similar to the TCM estimates (although the TCM estimates were shown to be subject to great variation due to functional form specification).

Graves (1991) makes summary comparisons of a number of environmental studies which have used two or more of the above techniques to estimate the value of a number of non-marketed goods. In all cases, the claim was made that the estimates obtained were 'close', 'fairly close' or 'ballpark similar' (pp. 224-225). However, at least in the comparisons between CVM and the indirect methods, these similarities may be unexpected, with many of the goods valued referring to aesthetic qualities which could be expected to have a high non-use value which could not be captured by the indirect valuation methods.

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[5] This difference would have been even greater had the distance costs included the full cost of car transport rather than just the running cost.

Hanemann (1994) claims that such convergent validity tests have generally shown the valuations from indirect methods to be "often fairly close" to those using CVM "overall, the contingent valuation estimates are slightly *lower* than the revealed preference estimates" (p.29-30).

AGGREGATION PROBLEMS

The problem of choosing the appropriate population over which to aggregate estimates of WTP or consumer surplus exists for all the methodologies examined above. However, the problem is perhaps less severe when the analysis is restricted to estimating the use value of environmental goods: the appropriate population is that which uses the resource. This provides a theoretically satisfactory definition of the relevant population without actually providing a necessarily empirically feasible definition. For example, it may not be possible to ascertain the users of a particular good. However, when non-use values, including option values are examined, the question of relevant population poses more severe problems. For example, in assessing the relevant population for Kakadu National Park, should the population have been restricted to that of Australia when a high proportion of the visitors are from overseas. It is likely that there is a non-Australian population which has non-zero option and existence values for such natural resources. Should their preferences be included? Some guidance may be found in the treatment of overseas income in CBA studies. Among the benefits listed in projects is often the benefit to tourism income from overseas travellers - benefits are not restricted to those accruing from domestic tourists.

CVM also may have problems which emerge particularly when aggregation over individuals occurs to obtain a value of the non-marketed resource to society as a whole. As Blamey and Common (1993) point out, the consumer may be responding using a 'citizen' stance rather than an individual stance. If respondents value the resource in this broader context, the aggregation of the per person valuations will result in an over-estimate of the resource to society. This problem of altruistic externalities and the 'warm-glow' effect and its associated over-estimation of society's willingness to pay is also put forward coherently by Diamond and Hausman (1994).

This is a potentially major problem of CVM - how do we assess whether the respondent is answering in his own right as an individual or taking a more public spirited attitude and is assessing what he believes should be the value placed on the resource by society? This is related to the 'warm glow' effect mentioned

above. The answer probably lies in the careful construction of CV questionnaires to ensure the respondent is answering as an individual. The use of personal interviews and follow-up questions as suggested by the NOAA panel may alleviate this problem.

THE APPARENT INCOME INELASTICITY OF DEMAND FOR THE ENVIRONMENT

Many CV studies have found that WTP is not particularly responsive to income. This has been used by some to suggest that CVM is thus an inappropriate method (Diamond and Hausman, 1994, and McFadden, 1994). Low income elasticities have been found in most CV studies. This may be the result of an inactive budget constraint, with low income respondents acting in the knowledge that payment is hypothetical. In contrast, in hedonic and travel cost methods, the budget constraint is active and preference ratings and thus valuations are within the context of a well-defined income/budget constraint[6]. In many CVM studies there has been an attempt to introduce budget constraints. This is no doubt the rationale for the NOAA panel's recommendation for the inclusion of a section reminding respondents that the stated WTP would reduce the amount available for spending on other goods and services.

There is much evidence that the income elasticity of demand for environmental goods may be low (see Kristrom and Riera, 1994). In a recent paper by Flores and Carson (1995) they argue that a low income elasticity of WTP (which is what is actually measured) may not necessary imply that the income elasticity of demand is less than one. If this is the case, then the low elasticities estimated in CV studies may not be of such major concern.

CONCLUSIONS

There is a clear need for a method of valuing non-marketed environmental resources. In the accountancy discipline, a new area is emerging called 'Green Accounting' where attempts are made to consider costs to the environment among the other more directly measurable costs. In the legal profession, there is a need to be able to value such resources to settle damages litigation. Economists are in a position to be able to provide a valuable input yet there is

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[6] However, few such studies have investigated the income elasticity of their WTP estimates.

great controversy about the potentially most useful method of valuation, CVM.

The concern rests primarily in the area of using CVM to quantify non-use or passive use values for environmental resources. For use values, it is possible to obtain alternative values using either or both of the indirect, revealed preference methods, hedonic pricing or travel cost method. As discussed above, there have been numerous studies in which this has been carried out. However, even here there has not been general acceptance of these results, as indicated in the two recent papers by Hanemann (1994) and Diamond and Hausman (1994).

If the valuations are close for use-values using the alternative methods, indicating at least consistency if not accuracy, why should CVM result in extreme valuations for non-use values? The non-familiarity with the valuation process is perhaps a little less familiar for non-users of the resource. CVM studies have to deal with the relative unfamiliarity of respondents placing a monetary value on some environmental good. Bias of many types has been shown to exist which is exacerbated by lack of information and familiarity with the good being valued. The hypothetical nature of the market may also tend to lead to problems in valuation. In contrast, the TCM and HPM have the advantage that people do implicitly value environmental goods which enter into the characteristic set of qualities possessed by their house or work. However, there also must be some aspect of familiarity in that setting otherwise the (implicit) valuation placed upon the environmental characteristic may not be well-defined. With regard to the use of CVM, the NOAA panel's guidelines to ensure the believability of the hypothetical scenario and to provide adequate information will alleviate many of the problems which have beset past CV studies and have led to the criticisms of the methodology.

Differences in the valuations found between the methodologies may have some basis other than one or both of the methodologies being inherently faulty. There are valid reasons, as indicated above, for the valuations to differ and more work is required using parallel testing to investigate the nature of these differences further. By selecting a number of appropriate scenarios, a series of studies could be carried out to estimate the valuations placed upon environmental 'goods' or 'bads' using two or more of the methods discussed above in order to establish the extent of divergences in use values between the methodologies. With the current advanced state of the methodologies, for example, conducting CV studies in accordance to the guidelines of the NOAA, a series of rigorous tests could be carried out to examine whether there is consistent over-valuation by any one method (the CVM, if critics are correct). Such an approach cannot allay

all the fears of the CV opponents but may establish some bounds within which CV estimates of use value can be expected to lie. These bounds could be applied for broader CV studies involving non-use values.

CVM is currently the only method whereby respondents can be given the opportunity to express their non-use value for environmental goods. Unless some other method is developed which can be used to evaluate these non-use values, CVM will remain the only option. Efforts should be made to ensure that CVM evolves sufficiently to address the areas of criticism highlighted above. This will require the input not only of economists but also other behavioural scientists.

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