A REVIEW OF ENVIRONMENTAL VALUATION IN AUSTRALIA

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Australian attempts to value the environment began at least 35 years ago. Since then, environmental protection and natural resource management have become major national issues. But have the methods of valuation kept pace with the importance of the issues that they are meant to resolve? Can environmental and resource values actually be measured? Have any useful valuations actually been undertaken in Australia? And what criteria should be used to judge success? This review is an attempt to chronicle the successes and failures of 35 years and 100 Australian authors.

1 TRY THIS QUIZ

To try to assess our progress in the valuation of environmental goods and services, I recently posed this question to 25 colleagues throughout the country.

Q Name a useful valuation undertaken in Australia?

A Choose one of the following

(a) the last one you did,
(b) the last one I did,
(c) the last one they did, or
(d) I can't think of one.

The most common answer was (d), I can't think of one. If 25 practising resource economists cannot quickly identify useful an Australian valuation, there is a need to determine the status of environmental valuation in Australia, and to assess if we've made any progress at all. This review and assessment is, of course, just one person's opinion of the state of the art.

2 A RICH HISTORY

There is a wide variety of valuation methods, and all have been used in Australia. As Table 1 shows, the available methods are not restricted to contingent valuation, the travel-cost method, and hedonic pricing, as Rose (1990) and Delacy (1990) imply.

I have many acknowledgments of many kinds; to the forests of Great Britain for demonstrating that unpriced values were as important as priced ones; to the foresters of Australia for the opportunity to begin to value; to Oregon State University for the chance to develop a method of valuation; to Yale University for two opportunities to teach a course in valuation; to the University of Arizona for the chance to teach a course in the application of values; to Al Worrell for the scholarship that went into the book; to Jack Knetsch for the idea to test contingent valuation with actual money; to students of the University of New England for doing the tests and proving that contingent valuation works; to Dave King for continuing collaboration on hedonic pricing; to Dodo Thampapillai for too-frequent help in explaining economic principles; to the 20th Conference of Economists in Hobart in 1991 for the opportunity to obtain suggestions on a earlier version of this paper; and to the patience and help of 25 surveyed colleagues.

Table 1

Methods to value unpriced benefits and costs

	Method	What is valued?	What data are required?
Observed data from actual market exchanges			
1	Travel-cost	Net social benefit	Quantities consumed, and costs for persons in each of several travel zones
2	Cost-saving	Total benefit (values benefit as a saving in cost)	Actual money costs before and after a change
3	Replacement–cost	Total benefit (gives a range for the total benefit)	Actual and likely costs or replacement
4	Opportunity–cost	Total cost (values cost as a loss in income)	Money incomes before and after a change
Observed data from related markets			
5	Hedonic pricing	Value of a change in a characteristic of a good (as the change in purchase price of the good)	Prices and characteristics of a good from many exchanges of the good
6	Input valuation	Value of an input (as increase in value of output from using more input)	Value of the changes in output due to change in input
7	Interpret past decisions	Benefit or cost implicit in decisions	Considerable data on each of many comparable decisions
8	Value proxy goods	The benefit or cost of interest	Willingness to pay for a proxy good
Questionnaire data			
9	Contingent Valuation	Consumer surplus or total benefit	Responses to questionnaire surveys

2.1 Coral and jade

In the 1956 benefit-cost analysis of flood mitigation schemes in Launceston, Munro valued benefits as the costs of damage that were avoided by each scheme (in Munro 1974). This application of the cost-saving method is the first formal Australian valuation of an unpriced good or service that I can find. Occurring 35 years ago, it made 1991 the coral and jade anniversary for environmental valuation.

The same cost–saving method was applied by Neutze (1965) and Gillen (1974) to value the unpriced costs of city life. The disadvantages of traffic congestion were assessed as the extra traffic costs of Sydney relative to Wagga Wagga (Neutze). Gillen valued of the whole set of unpriced costs of noisy polluted, city life, relative to the tranquil, clean country life, at the extra wage of the marginal mover to the city. This valuation still ranks as a seminal exposition of natural resource accounting.

Twenty years ago, Nairn (1971) stood up at the Second Conference of Economist's and "sought ... sympathy" for a set of values for eight unpriced outcomes. The outcomes ranged from road deaths to noise and severance of road access. He received sympathy for his numbers, empathy for his efforts, and justified plaudits for using the replacement-cost, cost-saving, input-valuation, contingent valuation and proxy methods of valuation.

In 1971, O'Brien and Roy presented their system for multi–objective management of natural resources. This engineering approach rested soundly on the economic concepts of production possibility curves and indifference maps. Implementation to reduce conflicts required estimates of resource values and marginal rates of value change. But implementation was unnecessary to meet a second goal of the paper -- to promote the concepts and ways to value.

The first review that I'm aware of was published two decades ago (Sinden 1967), and reprinted one decade ago (Jones 1977). A comprehensive text on valuation was published one decade ago (Sinden and Worrell 1979), and more recently, thorough reviews of individual methods have appeared (Delacy, 1990, Streeting 1990, and Wilks 1990).

Informal valuations, as part of an overall decision, have of course been going on for years -- as demonstrated in the Australian Golden Book, Harry the Hairy-Nosed Wombat (Morris 1970). To preserve a wombat habitat on a prospective road line, the engineers made their decision to change the route.

'...There'll be a long curve and that will make the road a little longer...'

The engineers had informally assessed the benefit of preservation to exceed the extra costs of the longer road, as they had been doing in hundreds of similar cases.

2.2 Pioneers and adapters

As with all aspects of life in Australia, so it is with valuation of environmental goods and services. We have been both pioneers and adapters. The cost–saving method was applied by Greig and Devonshire (1981) to value the benefits of salinity control by retaining woodland. Although the senior author will deny the innovative nature of this effort, there are still no applications like it in Australia. Greig (1983) also pioneered an application of Lancaster's characteristics theory of consumer behaviour to derive a demand curve to value recreation benefits, and Sinden (1974) derived indifference curves from which to obtain demand curves for recreation. Equally pioneering were Findlater's (1978) improvement on Sinden, and Bennett and Smith's (1985) tests of additivity to assess this indifference–mapping procedure. Kennedy's (1980) criticisms of the procedure provided the context for these tests. Kennedy can be thanked for understanding the conceptual implications of the method and for stating them in words, so that Bennett and Smith could test them with numbers.

The travel–cost method originated in the United States of America with Hotelling in the 1930's, and with Clawson's major application in 1959. Then followed the Australian adaptations by Ferguson and Greig (1973) in the forests of the Grampians of Victoria, and Ulph and Reynolds (1978) in the Warrumbungles National Park of New South Wales. In the mid 1970s, the New South Wales government perceived the need to assess recreation benefits in Colo Shire and commissioned a travel–cost study (Sinden 1978). Subsequently Bennett and Thomas (1982) explored interesting ways to allow for the costs of time in the method.

Hedonic pricing is the procedure to value a characteristic of a good from the market price of the good. Early applications in the United States of America included estimation of the implicit values of characteristics of automobiles -- presumably to see whether the possible increase in purchase price exceeded the cost of adding an accessory. The same hedonic principles underlay Abelsons' (1979a) innovative application to value the costs of aircraft noise from prices of Sydney houses under the flight path. Soon after, that he (1979b) presented a rigorous analysis of data on 1400 properties in Sydney to relate market prices to valuations by the Valuer General's Department, and to characteristics of the land and house.

In a very practical attempt to compare the social costs of transport options in Melbourne, Andrews, Lacey and Moriarty (1981) cost noise pollution to houses bordering that city's 500 km of noisy roads at 6 per cent of the value of comparable houses in quiet areas. They quote and apply basic research by the Bureau of Transport Economics (1977) for Marrickville in Sydney.

Coelli, Lloyd–Smith, Morrison and Thomas (1991) have used hedonic pricing in an interesting policy–oriented valuation of the benefits of a water–supply pipeline to properties in the wheatbelt of Western Australia. The benefit was valued at the increase in property value, and was then used in a full benefit–cost analysis of the pipeline scheme. Maintenance of tree cover on grazing properties can provide amenity to the local community but constrain farm income. This trade–off was valued by Reynolds (1978) through the change in farm land value following a change in tree cover. The broader issues of the associated land–use choices were reviewed in the same way by Reynolds and Sinden (1979).

Mattinson and Morrison (1985) demonstrate the care that must be used to interpret values from the hedonic–pricing method. Algae in rivers can cause aesthetic and olfactory pollution that affects recreation, amenity, and the environment of neighbouring houses. The finding that house values were unaffected could be interpreted in several ways including a negligible nuisance, lack of knowledge of the problem, or a prospective quick solution.

The replacement-cost method assesses the minimum value of a benefit at the cost of replacing or restoring it. Barter (1986) relates costs of restoring damaged roads, bridges, and railways to the kinds of degradation that causes the damage. Laws governing open-cut mining, sometimes require that the soil and vegetation is restored at the end of the operation. On this basis, Park and Thampapillai (1989) and Thampapillai (1988) estimate costs of restoring woodland after open cut coal-mining in the Hunter Valley. The legislative requirement had placed a values on the woodland up to $233 000 per hectare. Davidson (1989) applied the same method in the same place to address the same problem. The costs of restoring pasture through land forming, seeding, and pasture establishment were some $800 per hectare. The benefits, valued as the sale value of restored land, were approximately $500 per hectare. The net social loss to the community from these legislative requirements is at least $300 per hectare. Legislators will not fund any more rational valuations of this kind, but analysts will do more of them to encourage more–rational legislation.

The principle, that the value of an input is the increase in value of the associated output, has been long and widely applied. Tisdell (1985) reviews the value of shelterbelts as the associated increase in agricultural production. Yapp (1989) summarises the results of many examples that demonstrate loss of agricultural production due to the degradation of the land input. He also summarises cases where local government authorities expend money to replace bridges and roads after degradation-related damage. Simila ly, the benefits of lower noise levels in factories have been valued at the higher output th ough less absenteeism (Bennett and Murray 1991).

At its simplest, the input–valuation method can be interpreted as increase in money revenue due to an environmentally–related activity. Both Lothian (1984) and Touche Ross Services (1984) demonstrate that a national park on Kangaroo Island will add value to the local tourism industry. While not necessarily an economic–surplus value, this kind of benefit is always useful information to assist the choice.

The potential role of the wide range of methods was ably recognised by Hundloe, McDonald, Ware and Wilks (1986) in their study of the use of cost-benefit analysis to improve techniques of environmental impact assessment. The authors clearly demonstrate that complete measurement of benefits requires hedonic pricing, travel-cost, opportunity cost, cost saving, input-valuation, replacement cost (or willingness to make defensive expenditures), and contingent-valuation methods. They show how to fill the conceptual vacuum of environmental impact assessment with the rich diversity of valuation principles.

2.3 The environmental dentists

Economists who even attempt to value these goods and services become the dentists of environmental management. They fill cavities that must be filled, they pull teeth that must be pulled, they inflict pain on themselves and their patients, but they are in positions to contribute greatly to the health of the community. Consider just two methods, the opportunity-cost and interpretation-of-decisions procedures.

The estimation of opportunity costs of environmental programmes is never easy, but the potential usefulness of the estimate surely justifies the attempt. Instead of estimating the benefits from preserving the sands at Cooloola in Queensland, Fitzgibbons and Hendriks (1970) estimated the opportunity cost of preservation as the foregone mining income. Their conclusion has now passed into folklore. Referring to the price-elasticity of demand for the beach sands output (p.72).

> '...If the elasticity is less than 1.83, then from a national viewpoint our interests would not be served by mining Cooloola if it were in the middle of a rubbish tip rather than around rainforest...'

Eucalypt dieback in New England has demonstrably increased farm incomes by orders of magnitude (Sinden and Jones 1985). Preservation of all existing woodland will therefore impose substantial opportunity costs on the farm community. Presentation of these results to environmental groups was like having a tooth extracted. Presentation to a group of professional foresters in a triennial conference of the Institute of Foresters of Australia drew the

rapporteur's comment that something must be wrong with the analysis. (The analysis was fine, the trees were in the wrong places.). Nevertheless, the level of the debate has now lifted. Nadolny (1991) has begun to define the benefits to be gained from woodland preservation and set these explicitly against the monetary opportunity costs. The welfare of the community may not have increased but the issues are now in much better focus.

The potential increase in community health and welfare lies largely in the clarity with which the fundamental questions can be framed. If sand mining were resumed on Fraser Island, recreation and preservation benefits would be reduced. Bennett (1991, p.13) crafts the opportunity-cost question as follows.

"Are the $200 million benefits of sand mining worth the reduction in recreation and preservation benefits that would result?"

The question is more important than the answer.

Saddler, Bennett, Reynolds and Smith (1980) presented a thorough and timely determination of threshold opportunity costs to assist the decision on damming the Franklin River. Yapp and Sinden (1987) gave a start in the attempt to assess the opportunity costs of land degradation on a statewide basis--although no-one in my survey could remember the junior author of this study.

Past decisions can be interpreted to determine the values implicit in them. This method has been much discussed in Australia but, as far as I can tell, only applied twice anywhere in the world. In 1964, Cannegieter valued the contribution of the Ord River Scheme to defence at £45m. The basis of this valuation was the £45m of protection paid to the Queensland sugar industry when it was protected mainly for strategic reasons. Musgrave and Lewis (1965) pointed out all the difficulties in drawing such a conclusion from a single decision. Bowen (1964 and 1965) and Laing (1964) also helped to clarify the relevance of this estimate. But in a well-balanced caveat, Bowen (1964, p.394) heralded the next 25 years of work on valuation.

"The discussion here is a beginning and not an end. In attempting to assess the benefits of the Ord, we have tried to discuss the fundamental assumptions as well as methods of computation."

Helliwell (1967) in England and Gupta and Foster in Massachusetts (1975), were both able to analyse many actual decisions and so circumvent these difficulties and estimate the values implicit in the characteristics of the purchased. The contribution of these two studies

was to generalise the particular and then show how to apply universal values to specific cases -- while all the rest of us have been trying to grapple with the particular. For example, Loane and Gould (1986) discuss the same kind of valuation for a few purchases for national parks in Victoria, and Sinden and Mackay (1979) observe in a single case and suggest that wombats are worth $30,000. The paucity of applications of this method is surprising, in view of the implied values in every choice, and the firm foundations of the method (Kort 1968, and Weisbrod 1968). This is surely an analytical cavity waiting to be filled.

Fowler (1980) combined the opportunity–cost and interpretation - of - decisions methods, and contributed to both. The Australian Heritage Commission Act 1975 restricts the activities of owners of listed properties and so imposes costs on them. The owners of the 20 listed properties in Armidale incurred, on average, an extra $10,200 in building and renovation costs because of the Act. If the Commission explicitly considered the heritage benefits in their listing, then these benefits are worth at least $10,200 per property.

3 THE STATE OF AN ART

The caution which greets valuation is somewhat surprising, since Australia has 35 years experience to draw on. Does all this experience warrant all this caution? To resolve environmental problems, there are many different unpriced values to assess, many contexts and applications to assess them in, and many methods of assessment to choose between. Any attempt to evaluate progress must therefore be restricted, superficial or both. Nevertheless, some assessment is necessary.

Criticisms from economists and non-economists are not addressed here. Criticisms from economists, and the responses to them, are well known and so do not require discussion. The growth in numbers and kinds of valuations has been so great that all the non-economist has achieved is the discovery that he can achieve nothing. This growth is well illustrated by the trend for different government agencies to develop their own guidelines for benefit–cost analysis and valuation. For example, the Road and Traffic Authority of New South Wales (1990) routinely assesses the benefits of noise reductions at a proportion of the value of affected houses.

Values can help decisions in many ways, as Greig (1977) discusses for travel-cost values. The obvious role is the instrumental one, where values are directly used to determine choices. The other, equally-important, role is the conceptual one, where values are used to promote an understanding of problems and situations. These two roles provide the criteria against which to assess progress.

3.1 To assist choice

There are cases where government choices (appear to) have been based on valuations, and on what the valuations indicated. Four, or perhaps three-and-a-half, examples can be identified.

The Commonwealth and Queensland Governments banned drilling on the Great Barrier Reef shortly after Cochrane Fitzgibbons and Hendriks (1971) showed that drilling contributed between - $13m and + $170m to economic welfare, surely a small present–value contribution. The research by Saddler, Bennett, Reynolds and Smith (1980) did not make an explicit valuation of the wilderness benefit of preserving the Franklin River. But it did provide a threshold value. If the benefits of preservation were deemed higher than this, preservation is preferable to hydro-electric development. Kellow (1989) reports that these results directly influenced the government to preserve the river.

The Western Australian Government has just abandoned a proposal for a water supply pipeline to farms in the wheatbelt. A recent benefit-cost analysis, with its hedonic valuation of pipeline benefits, confirmed the result of an earlier benefit-cost analysis that the line would lead to a net loss in welfare (Coelli, Lloyd–Smith, Morrison and Thomas, 1991).

The Hawke Government has ruled against mining at Coronation Hill in the conservation zone of Kakadu National Park. The evinced reasons for preservation concerned preservation of sacred areas of the Jawoyn people, although a struggle for political leadership was occurring at the time of the decision. Nevertheless, the contingent valuation (Imber, Stevenson and Wilks 1991) indicated that the benefit of preservation exceeded the costs of preservation.

3.2 To assist understanding

In the longer term, individual valuations and benefit-cost analyses, are more useful in assisting general understanding than in assisting a given choice. In this context, values and analyses help to define issues, focus debates, formulate problems, provide orientation, provide a framework for thought, expose fallacious arguments, and raise the general level of debate over particular issues. Values are part of benefit–cost analysis, a technique which emphasises the broad social context, the long view, and the full set of biological–social–economic relationships. In this context, Dumsday's estimation of the opportunity costs of degradation neatly emphasises the full framework of biological relationships in land uses and the biophysical causes of degradation. The opportunity costs of changing land uses to reduce

salinity successfully demonstrated to farmers, engineers and biologists both the true economic costs of their proposals and the ways in which the components of the system interacted (Dumsday and Oram 1990).

Numbers focus discussion, and Australian discussions on environmental issues always need a better focus. Irrespective of the problems in estimating the preservation value of the Kakadu Conservation Zone, the Resource Assessment Commission's value of $647 million per year has generated an essential debate on what are the real benefits of preservation and whether they exceed the costs The benefits of river recreation were estimated by Sinden (1990a), and the importance of the natural environment to the value of river recreation was demonstrated by Walpole (1991). These demonstrations of the possibility of valuation, and the quantitive importance of the environment, have proved as important as the values themselves. The studies have encouraged the recognition by river managers of recreation as a legitimate use, and have encouraged a shift in management priorities toward recreation and toward improvements in the naturalness of recreation environments.

Tourism and pastoralism interact in the Flinders Range of South Australia. In places, tourism brings business, employment and income for pastoralists. In others, tourists create costs through littering, leaving gates open, and frightening stock. Delforce, Sinden and Young (1986a), compared the net revenue from pastoralism with the net benefit (or extra willingness to pay) for tourism. The real role for this comparative valuation came from Young's more detailed report (Delforce, Sinden and Young 1986b) from the same study. The greater detail on tourist preferences, pastoralist opionions, options for management, willingness to pay by sites, individual categories of cost, and quantitites of use, provided more information than comparative values alone. These complementary and supplementary data widened the audience and relevance of the values themselves, and greatly assisted the understanding of the interaction between tourists and pastoralists, and the possible solutions.

3.3 Foghorns create fogs

The kind of valuation that is useful for policy choices often differs from methodological doctrine or the latest development in econometrics. All a choice really needs is advice that alternative A makes a substantially greater contribution to welfare than alternative B. Precise estimates of welfare changes are often unnecessary, usually unobtainable, and probably counter-productive. The analytical precision and perfection required to develop methods and contribute to the discipline are rarely necessary to contribute to choices -- a paradox at least as important as that facing the child who could only see fogs when hearing foghorns.

The importance of this paradox implies an extra line in all our duty statements -- the right to ask questions is accompanied by the duty to ask the correct questions. Did ABARE ask the right questions in the debate over preservation of Coronation Hill? According to ABARE (1990), the net present value of mining at Coronation Hill is $82 million at 8 per cent over 12 years (assuming 8 per cent is not 3 per cent too high, assuming money wage costs represent true social costs, and assuming the included provision of depreciation represents the true economic cost of replacement).

The basic estimate of the benefit of preserving the area, derived by contingent valuation (Imber, Stevenson and Wilks 1991), is $647 million per year or a present value of $5 876 million (at 8 per cent for 12 years). Any reasonable minimum estimate of the benefit of preservation, derived from this base, must surely exceed $82 million by an order of magnitude. The order of magnitude by which the preservation benefit exceeds $82m is surely the issue, not the well-known statistical and other difficulties with contingent valuation that ABARE (1991) emphasise. In the same way, the Tasman Institute (Moran 1991) and Institute of Public Affairs (Brunton 1991) provided good discussions, offerred useful commentaries, but created the same kind of fog. I can accept criticisms of the struggles and failures, even when the critics adopt inappropriate criteria. But I find it hard to accept criticisms of the successes, when the same critics adopt the same inappropriate criteria.

4 CONTINGENT OPTIMISM?

Of the three popular methods, the travel-cost technique uses observed data so should provide reliable values. One application of hedonic pricing has been the basis of a decision, (Coelli, Lloyd-Smith, Morrison and Thomas 1991) and the results of two others appear to have been widely accepted and their results widely recognised (Abelson 1979a and King and Sinden 1988). The third method, contingent valuation, has been used in Australia for at least two decades, by many kinds of agencies and organisations, to value many kinds of outcome, and the accuracy of the results has been tested at least 17 times. Nevertheless, the method is still the subject of debate and so a specific assessment of it seems appropriate.

4.1 Less than desired, more than expected?

The continued application, to many kinds of good and service, by many kinds of agency and organisation, indicate a widespread acceptance of contingent valuation amongst the research community. Consider the breadth of the following applications. The Australian Environmental Council (1982) authorised a survey of willingness to pay for pollution control and cleaner air. The phrasing of the willingness - to - pay question is of course crucial because

apparently - substitutable goods (like cans of fly-repellent and a research programme eradicate flies) may not be true substitutes and Johnston (1982) fully explored solutions to this problem. Throsby (1982) estimated the willingness to pay of residents of Mildura for an arts centre in the town. Bennett (1984) assessed willingness to pay for the benefits of bushfire prevention in National Parks, while Majid Randall, Sinden and Sinden (1984) investigated the value of adding increments to national parks. Ekanayake (1985a) estimated the changes in recreation benefit with increasing distance from the recreation site. Carter (1987) valued the consumers' surplus from visits to coral sections of the Great Barrier Reef, with a question carefully phrased to assure respondents that the amount paid would be used in management of the reef. Hundloe (1990) measured the value of risks to the reef as a whole. Young and Carter (1990) apply the method to value the benefits of research, while Stone (1991) estimated the value of preserving Barmah wetlands. Dumsday, Jakobsson and Ransome (1991) show confidence in contingent valuation by smoothing a range of individual values to give a single set of overall valuations, and applying the set to a statewide valuation of rivers in Victoria.

A whole sequence of studies sought to determine the level of community support for soil conservation in New South Wales (Sinden 1987, Dragovich 1990 and 1991, and Yapp, Young and Sinden 1991). Economically, the central feature of all these studies was the question--what is the maximum extra amount you are willing to pay per loaf of bread if all the extra goes to control soil erosion? Instrumentally, the particular values may not have assisted any particular decision. But conceptually, the orders of magnitude, and the similarity of results across many situations, helped to frame broad budget decisions and to expose fallacious arguments against funding conservation programmes.

In addition to these direct monetary applications, there have been direct applications with non–money measures of value. Sinden and Smith (1975) compared benefits of eucalypt and pine habitat for recreation through willingness to spend hours in travel. Sinden, Koczanowski and Sniekers (1982) assessed landholder preference for eucalypt and pine for several purposes through similar willingness to travel versions of the standard contingent question.

This wide range of applications, with many very–intensive studies, has provided the opportunity for many writers to assess the potential of contingent valuation. The role of the method is well summarised by Blamey 1991a (p 7-10), in a careful assessement of the statistical models which underly estimates of willingness to pay, and the way the estimates depend on particular utility functions. "The development and use of the CV method has been particularly useful in bringing arguments for preservation of wilderness areas onto the same footing as the arguments for exploitation of these areas that the developers have been

employing for years- the appeal to monetary return". This sort of role is well illustrated by Hundloe, McDonald, Blamey, Wilson and Carter (1990). The purpose for which the method was originally designed has finally been realised in applications where its use has been the most demanding.

Rose (1990) concludes that contingent valuation procedures can generally be designed to limit the degree of bias. Bennett (1982) concludes that contingent valuation is not perfect, but provides relatively-objective values which are much more useful than political judgements on them and greatly more useful than ignore them.

Two thorough assessments of the method are provided by Imber (1991) and Blamey (1991b), and both derive from the authors' intensive applications of the method. The former rather modestly argued (p.20) that the study of preserving the Kakadu conservation zone "helped raise the level of environmental debate. Environmental opportunity costs are now widely recognised" -- adequate justification for any study. The latter aptly concludes (p27) "non-market values are now generally recognised as valid components of welfare, with the consequence that most controversy now concerns the accuracy of the estimates rather than whether such values are worthy of consideration at all" -- sufficient reason for any valuation.

No doubt, the authors of the large number and wide range of contingent valuations would like to identify instrumental use of their monetary values. That these authors contributed to such significant advances in understanding is a greater long term achievement--and much greater than they could rationally have expected.

4.2 Warts are healthy -- aren't they?

Unlike body warts, professional warts are often a sign of good health. However, many potential users of values and valuation methods regard the manifestation of our professional success as a wart–ridden expression of our failure. For example, the journals are replete with tests of contingent valuation under conditions of different information, discrete choice versus open–ended questions, different starting points, and different aggregation procedures. This lively debate is a manifestation of our success. But potential users who are diligent enough to study the arguments, regard them as an expression of our disagreement and failure. We should no longer have to bear this external cost of our success.

Consider also the choice also between willingness to pay and willingness to accept as measures of welfare. The choice between them turns on issues of actual endowments, perceptions of endowments, reference points, perceptions of reference points, changes in

consumption, perceptions of changes, and prospects. The potential user, who actually reads this literature, can be forgiven for concluding that economists are split on the choice between these measures of welfare. Wrong, we're not split. Some of us have read Hicks (1943), some haven't, and the confused potential user can explore this seminal article afresh. But another, greater, problem is involved. An economist like Hicks, who can offer such important insights, should never have to share them and so risk the indifference of those who need them.

4.3 Unearned rewards and unrewarded duties

An overall assessment of a particular method must rest on two criteria -- the degree to which it improves the information for choices, and the reliability of the values it provides. In this context, contingent valuation has received undeserved praise for its natural versatility, but has gone unrewarded for providing both substantial improvements in information and true values. The extra information provided by valuations is accidental but not superfluous. The information demonstrates who benefits, exposes fallacious arguments about zero and infinite values, and indicates the relative size of some benefits -- to cite just a few examples.

The versatility of the method could well be further exploited. We seem to limit our use of contingent valuation to the relatively straight forward question, how much are you willing to pay? The flexibility of the method could well be applied to develop trade-off games, budget allocation games (as explored in Sinden 1990, and Ekanayake 1985b), or versions such as the priority evaluator (O'Hanlon and Sinden 1978).

The ultimate test for values is their predictive ability. There appear to be some 20 tests worldwide, of which 17 are reported in Sinden (1988). Authors are probably the worst judges of their best papers, but this largely–ignored paper must surely be one of the most important in the contingent–valuation literature. In each test, students completed a survey with a standard, hypothetical willingness-to-pay-question. They were then asked to donate actual money for the same, local, environmental purpose as in the question. In 16 tests there was no statistical difference between the mean donation and the mean hypothetical willingness to pay. In the 17th, the actual payment exceeded the mean hypothetical one. In this set of tests, the small absolute sums involved ($1 to $20) were relatively large to their donors. The students were in my classes in only 12 of the tests. Students are ideal subjects because they know all about playing strategic games with questionnaires. Most had already taken several economics courses, and so knew all about free riding.

In a review of predictive tests which omitted Sinden (1988), Smith (1991) argues that some forms of contingent valuation do provide consistent and plausible values for some types

of environmental resources. Smith had entitled this paper, 'is non–market valuation of environmental resources sustainable?' The title of his earlier paper was better, 'can we measure the value of environmental amenities?' His earlier conclusion was certainly better -- contingent values are systematically related to the types of resource and assumptions of the study.

Valuation in general, and contingent valuation in particular, is now being used instrumentally, for major land-use decisions. As such it is at a critical stage of public scrutiny, leading Bennett and Carter (1991) to conclude that the next step with it must be validation testing. In the context of instrumental use, they are right and echo an earlier plea. Under a heading "Validation of values", Sinden and Worrell (1979 p.126) wrote "... In addition to selecting and applying appropriate methods, an analyst must also justify his results." But in the context of conceptual use, we can be much more confident. In assisting understanding, contingent valuation (and all the other methods) have proved their worth.

5 BACK TO THE QUIZ

After some thought, my 25 survey colleagues did nominate several useful surveys, all of which have been cited above. But collectively, they emphased the aggregate role of all this work. More important than any individual study is the total body of knowledge and experience which now allows valuation to be routinely attempted -- as for example Roads and Traffic Authority (1990).

The initial challenge with valuation, it seems to me, is to elevate the confused nature of a choice to the pristine realm of an economic abstraction, and then to dismember this conceptual idea into discrete researchable packages. The valuer must then apply the delicate craftsmanship of an artist to estimate gross orders of magnitude. The further challenges for valuation arise in interpretation, not estimation. First, the current preoccupation with one method (contingent valuation) fails to recognise the variety of useful methods, and succeeds in ignoring the innovativeness of the many Australian studies which have applied them all. Second, the myopic insistence on instrumental use as the criterion of success is matched by the short–sighted indifference to conceptual use as the real long–term criterion of success.

Thirty–five years ago, an engineer showed us how to value an environmental service. Since then, one hundred authors, including several more engineers, have shown how to apply the wide range of methods. These applications demonstrate what is required for valuation -- a touch of artistry, a grasp of magnitudes, an insight into economic principles, and a bit of luck.

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