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RESPONDENTS TO CONTINGENT VALUATION SURVEYS: CONSUMERS OR CITIZENS?

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The fundamental assumption of the contingent valuation method (CVM) is that responses to CV questionnaires may be interpreted as expressions of consumer preferences. The consumer preference interpretation has been challenged in recent papers arguing that willingness to pay for wildlife preservation is generated, at least in part, by ethical concerns, rather than by a view that wildlife preservation will yield any benefit to individual respondents. Some further evidence bearing upon these questions is derived from a study of forest management in Australia undertaken by the Resource Assessment Commission (RAC). The evidence supports the interpretation that respondents are acting primarily as citizens.

Introduction

Applications of the contingent valuation method (CVM) are becoming increasingly common. The results arising frequently generate controversy in public as well as academic forums. Much of the academic literature focuses on the discussion of rather technical aspects of the implementation of the method, or assessments of the results arising. We wish to step back somewhat from this kind of analysis, and to raise some questions about the foundations of the research strategy of the CVM.

The fundamental assumption is that responses to CV questionnaires may be interpreted as expressions of consumer preferences. Although critics such as Hausman (1993) have often suggested that responses may be biased or inaccurate measures of preferences, they have rarely questioned this underlying assumption. However, this assumption is called into question by the general move towards dichotomous choice (DC) elicitation procedures and by the frequent use of public policy instruments such as taxes as payment vehicles. These changes move the CVM away from the provision of a pseudo-market setting towards a political choice setting. Indeed, the term 'referendum method' is frequently applied to DC procedures, particularly where the payment vehicle involves an increase in taxes, though some authors restrict the use of this term to studies where the respondent is presented with a dummy referendum ballot. The change to a political choice setting raises the possibility that respondents in CV

surveys may be expressing social or political judgements rather than preferences over consumption bundles. In other words, they may be acting as citizens rather than consumers.

The consumer preference interpretation has been challenged in recent papers by Stevens *et al.* (1991, 1993) and Kohn (1993). Stevens *et al.* present evidence showing that willingness to pay for wildlife preservation is generated, at least in part, by ethical concerns summarised by the principle that 'All species of wildlife have a right to exist independently of any benefit or harm to people', rather than by a view that wildlife preservation will yield any benefit to individual respondents. Kohn presents a model in which citizen and consumer concerns are integrated to determine optimal levels of preservation.

Some further evidence bearing upon these questions is derived from a study of forest management in Australia undertaken by the Resource Assessment Commission (RAC). In addition to the usual variables thought to affect consumer demand, this study elicited broad statements of social/political attitudes relating to environmental issues. Hence it is possible to test the relative importance of consumer and citizen variables in determining responses to CV questions. This may be contrasted with results obtained using a pure consumer model, as reported by the RAC and by Bennett and Carter (1993).

The paper is organized as follows. In the next section, we briefly review the purposes of the CVM in order to provide context for the major issues addressed in the paper. The first issue, dealt with in the following section, primarily concerns the status of CV responses. The second issue, in the next section, concerns methodological issues relating to the status of competing hypotheses about the nature of CV responses. In subsequent sections, we present and discuss the results obtained from our analysis of CV data, and compare them with related work of Flores and Carson (1995) and of Loomis *et al.* (1993). In the final section, we offer some concluding comments.

Background

We begin with a brief overview of the context in which the CVM originally entered economic analysis: for a more extended overview, with particular reference to species preservation, see Randall (1986). Consider some development project for a wilderness area, and social decision making as to whether or not it should proceed. Let B be the present value of all of the beneficial project outputs, and C be the present value of all of the project inputs. Assume that for estimation of B and C market prices are satisfactory. Over and above the consequences captured in B and C, going ahead with the project would involve impacts on the wilderness area. Denote the present value of such impacts as EC, for environmental or external costs. Then, the decision rule is to go ahead with the project if

$$B - C > EC$$

Application of this benefit cost analysis (BCA) decision rule requires the identification and measurement of the impacts on the wilderness area, and then their valuation and aggregation to arrive at EC, the environmental costs of the project. Most economists would regard the purpose of the CVM as being the provision of information relating to environmental costs for use in BCA.

A similar analysis applies to publicly provided goods. In this case, independent information is available on the cost of provision, C, and the value of marketed outputs, B. The object of CV analysis is to elicit from each individual i their personal valuation of the publicly provided benefits EC_i. The standard framework assumes that individual i's welfare may be expressed as $U^i(x, \mathbf{q})$ where $\mathbf{q}$ represents the quantity of the good provided and x is a Hicksian composite of all other goods. In general the good may vary on a number of dimensions and $\mathbf{q}$ will be a vector. The willingness to pay (WTP) of individual i for increased provision of the good is given by the solution to

$$U^i(x^{i0}, \mathbf{q}^0) = U^i(x^{i0} - \text{WTP}, \mathbf{q}^1)$$

which is the compensating variation associated with the move from $\mathbf{q}^0$ to $\mathbf{q}^1$ at the initial income level x^{i0}.

Another purpose for the CVM has recently emerged as a result of developments in the legal system, particularly in the United States. These developments relate to natural resource damage assessment, which is frequently the subject of litigation under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), also known as the Superfund and under the Oil Pollution Act of 1990. In 1989 an appeals court ruled that CV estimates should be accorded rebuttable presumption. The court rejected arguments advanced by the state of Ohio in litigation between it and the United States Department of the Interior (DOI) concerning damages recoverable by government trustees for harmed natural resources. The court ruled that:

> Option and existence values may represent 'passive use' but they nonetheless reflect utility derived by humans from a resource, and thus, *prima facie*, ought to be included in a damage settlement . . . We find DOI's promulgation of CV methodology reasonable and consistent with congressional intent, and therefore worthy of deference (quoted in Peterson, 1992).

The CVM is seen, that is, as an admissible method for determining actual compensation payments to be made, on account of option and existence values, where actual damage has occurred. The most notable case of this kind was the Exxon Valdez oil spill in Alaska. The case resulted in an out-of-court settlement between Exxon and the trustees representing the public interest. However, Exxon commissioned a number of research projects (published as Hausman 1993), most of which produced reports highly critical of the CVM. As a result of this controversy, a 'Nobel laureate panel' was established to advise 'on the use of CV in

measuring oil spill damages'. Its report (Arrow *et al.* 1992) was cautiously favorable to the use of CV in damage assessment.

Criticisms of the CVM have taken two main lines. The criticism that has been discussed most in the literature is that CV responses are biased and inaccurate either because the CV framework does not provide respondents with incentives to provide accurate responses or because respondents do not conform to the rational choice assumption underlying the model. A wide range of criticisms based on the inadequacy of incentives were presented in Hausman (1993).

The claim that respondents do not conform to the rational choice assumption has been supported by reference to a number of features of CV responses that appear inconsistent with the valuation model discussed above. The best established is the existence of a large difference between willingness to accept (WTA) and willingness to pay (WTP) measures (Knetsch 1990), sometimes referred to as an 'endowment effect'. Hanemann (1991) shows that large differences between WTP and WTA may arise in consumption choices where substitution policies are limited, but it remains unclear whether observed discrepancies can be explained in this fashion. If the discrepancy between WTP and WTA reflects real economic preferences, WTA will be the appropriate measure for use in BCA studies involving preservation or development of existing undeveloped areas.

More recently, attention has focused on the issue of 'embedding'. According to Kahneman and Knetsch (1992), embedding arises 'when the same good is assigned a lower value if WTP for it is inferred from WTP for a more inclusive good rather than if the particular good is evaluated on its own'. Whether embedding is an inherent feature of responses to CV questions, or as contended by Harrison (1992) and Smith (1992), the result of poor survey design and statistical analysis, remains controversial.

A more fundamental issue has received less attention in the CV debate. This concerns the desirability of applying a market model, based on concepts of individual equivalent or compensating variation, to general classes of public goods. This question has arisen in a sharper form with the increasing popularity of CV analyses based on DC procedures, and particularly with the use of surrogate referendum methods. Although DC methods lend themselves naturally to a majority voting interpretation, the extraction of welfare measures such as equivalent and compensating variation from the results of DCCVM studies raises complex issues of inference (see Cameron and Quiggin 1994 for a discussion of some of these issues). By contrast, older approaches based on open-ended WTP questions, which have now largely fallen from favour, had a direct interpretation in terms of compensating or equivalent variation.

Mitchell and Carson (1989), widely regarded as the most authoritative source on CV principles and practice, pose (p. 295) the question: 'can CV surveys actually measure values that are sufficiently reliable and valid for use in benefit estimation?'. They note (p. 296) an 'emerging consensus

. . . that CV studies are able to measure meaningful values for 'familiar' goods such as local recreational amenities'.

Mitchell and Carson consider the market model to be an inappropriate standard by which to judge the CVM in the analysis of pure public goods. Thus, they state that:

> In our view, the appropriate model for CV surveys of pure public goods — goods that citizens are least likely to have direct experience in valuing — is the referendum, by which citizens make binding decisions about the provision of public goods. (Mitchell and Carson, p. 296).

The view that a CV analysis of a public good, particularly one based on dichotomous choice, is more akin to a referendum than to a market decision has been widely accepted (Arrow *et al.* 1992).

One interpretation of this view is that the CVM is to be understood as a means of generating information for input to the political process, rather than WTP/WTA information for input to BCA. If CV results are interpreted as surrogates for a political process, it is not obvious that they may be incorporated in BCA. Such a procedure is valid if political actions such as voting choices in referendums may be interpreted as expressions of consumer preferences, as implied by Mitchell and Carson. In other circumstances, it may be necessary to disentangle citizen and consumer choices.

That is, a critical question for interpretation of CV results is whether a referendum choice can be interpreted as a decision on whether $U^i(x^{i0}, \mathbf{q}^0) >= U^i(x^{io} - c^i, \mathbf{q}^1)$, where c^i is the individual cost price. Much public choice-theoretic analysis of referendum voting is based on this interpretation (see, for example, Bergstrom, Rubinfeld and Shapiro 1992). However, this interpretation has been criticized on a number of theoretical and ethical grounds. These criticisms are discussed in the following section.

Voters, Citizens and Consumers

Most of the criticisms of the CVM presented in Hausman (1993) or by writers such as Kahneman and Knetsch imply that responses to CV questions are biased or meaningless measures of consumer preferences. Other critics accept that responses to CV questions are meaningful, but deny that they can be interpreted in terms of private valuations. Rather, they take the referendum metaphor seriously and argue that CV responses should be interpreted as those of citizens or voters. Further, these critics deny the existence of the simple relationship between consumer preferences and voting behavior assumed in the public choice literature.

Philosophical critics such as Sagoff (1988) see the two types of activity as entirely separate. Sagoff argues that in regard to the making of 'hard' decisions, which include decisions about the environment, individuals act as citizens rather than as consumers. He sees citizen choices as separate from and ethically superior to consumer choices.

> As a citizen, I am concerned with the public interest, rather than my own interest; with the good of the community rather than simply the well-being of my family . . . . As a consumer . . . I concern myself with personal or self-regarding wants and interests; I pursue the goals I have as an individual. I put aside the community-regarding values that I take seriously as a citizen, and I look out for Number One instead (Sagoff, 1988, p. 8).

Sagoff, along with many writers in the tradition of political science and political philosophy, assumes that choices such as voting decisions are different in kind from market decisions and therefore involve public rather than private motivations. He denies that an objective function of the form U(x, **q**) exists or that elements of x and **q** are commensurable according to a money, or utility, metric. He states that the formulation of the objective function U(x, **q**) involves a 'category mistake'.

Sagoff and other writers such as Margolis (1982) have argued for the existence of separate objective functions reflecting private and public (or consumer and citizen) motivations. A closely related approach is developed, specifically in the context of the CVM by Kohn (1993), who posits a Bergson-Tintner-Samuelson ethical function in which consumption values (including consumption values associated with wildlife) and intrinsic values associated with wildlife preservation are separate arguments. Kohn proposes eliciting both a statement of the desirable level of public spending and a statement of individual willingness to pay for consumption benefits.

Writers in the economics tradition have generally preferred to assume a unitary model in which individuals have a single objective function. However, this does not necessarily imply that choice in the referendum setting can be regarded as equivalent to a choice between the bundle $(x, \mathbf{q}^0)$ and the bundle $(x-c, \mathbf{q}^1)$. The critical problem is that in the referendum (or surrogate referendum) situation the individual's vote is not, in general, decisive. A number of writers (Margolis 1982, Quiggin 1987) have argued that, because of this, the private consumption benefits of the alternative bundles, which would normally determine market choices, may be outweighed by other elements of the individual's objective function.

These include a desire to express particular values, or judgements as to the desirability of the good for society as a whole, considerations that typically play only a minor rle in market choices. Empirical evidence (Brennan, Quiggin and Shapiro 1991) supports the view that many people vote in referenda for goods that are of little value to themselves, on the basis that they are beneficial to society as a whole. A number of other commentators have put forward related criticisms, particularly challenging consumer sovereignty as a normative foundation for decision making where significant environmental effects are involved. Blamey and Common (1993) review some of the relevant literature from economics, philosophy and behavioral psychology.

Although the underlying analyses of individual behavior are different, both lines of argument support the view that referendum votes are more

likely to represent statements about the socially optimal level of provision of particular public goods than they are to yield estimates of individual benefit. This raises a number of issues regarding the interpretation of CV responses.

Implications for the CVM

Consider a project (taken broadly to include such measures as declaration of new national parks) which costs C to implement and yields aggregate benefits B in increased production of market goods. The project also has environmental impacts EC_i where the subscript i denotes individual i. Suppose that for each individual i, WTP for the project is elicited using the CVM.

The standard applications of the CVM to wilderness preservation and natural damage problems, are based not only the assumption that elicited values represent estimates of consumer surplus, but also that they are appraisals solely in relation to the environmental impacts of the project, ΣEC_i, to be compared with the net value of the project, B–C. What is required from the CVM is not consumers' appraisals of the overall net benefit of the project to them, or to society as a whole. CV questions are not supposed to elicit evaluations of the project. They are supposed to elicit estimates of the environmental impacts of the project on respondents personally. The CV scenario and questioning must isolate the personal environmental impacts from other aspects of the project, and elicit consumers' valuations of those impacts. Following Blamey (1991) a 2×2 matrix of possible CV responses can be written:

TABLE 1
Matrix of CV Responses

		Relating only to EC (preservation benefits)	Relating to EC and B–C
Role adopted by respondent	Consumer	1	2
	Citizen	3	4

The standard uses of CV responses in BCA, are based on the assumption of category 1 responses. However, the existence of category 2 responses does not pose a fundamental problem for CV analysis. Indeed, it leads naturally to the 'total valuation' framework (Randall and Stoll 1983), in which CV results are taken as an estimate of all costs and benefits accruing to the population sampled, other than those identified as part of the financing vehicle. If this is equal to the entire population of concern, the result is that BCA is reduced to CV analysis. There is no role left for estimates of B and C derived from the older techniques of traditional BCA, since they represent only a part of total valuation, and

the CV response yields no basis for partitioning the elements of the valuation.

Much greater difficulties arise with category 3 and category 4 responses. If respondents take into account benefits to others as well as themselves, as in category 3, aggregate benefit measures may involve undercounting or double counting. If respondents differ in their degree of concern for others, aggregate WTP measures may be meaningless or give rise to perverse policy prescriptions (Quiggin 1993). These difficulties will be reduced, but not eliminated, where altruism takes the form of vicarious enjoyment of consumption by others.

Category 4 responses are particularly likely to arise where the subject of the CV analysis has been a matter of public debate (as is the case for forest preservation in Australia). Individuals responding as citizens may incorporate into their replies citizen assessments of implications for jobs, or other economic costs of preservation. To the extent that this is the case and the scenario does not include specification of B and C, responses will be on the basis of individual assessments on these matters.

If CV studies are understood as referendum surrogates, citizen responses are not a problem. Precisely what is required is social agent appraisal of the total net benefits of the project. This has implications for CV design and implementation. If type 4 responses are sought, the scenario offered will have to include information on estimates of various components of B and C, as well as the usual information on the physical impacts involved in EC. CV applications developed without a clear purpose in this regard are likely to involve a design which does not properly elicit the intended responses.

This conclusion differs from that of Kohn. Kohn's framework may be regarded as eliciting both 1 and 4 responses. Kohn proposes that benefits should be estimated by summing the two categories of responses. This proposal appears to involve an assumption that when respondents are asked how much governments should spend on species preservation they do not take account of consumption benefits to themselves or to other citizens, but only of the intrinsic benefits of preservation. Once again, this points up the importance of clarifying the exact interpretation of survey questions. The recommendation of Smith (1985) and Stevens *et al.* (1993), that we should focus more an asking respondents to tell us what they think we are asking for, appears eminently sensible.

Mean and Median

A critical issue in distinguishing between the two interpretations is the choice between mean and median estimators. A referendum interpretation leads naturally to the use of the median estimator. We interpret the WTP derived from each respondent as an estimate of the social benefit of the project (in terms of Table 1, this may correspond either to category 3 or to category 4, depending on how the question is formulated). The median benefit estimate is equal to the maximum cost at which the majority of voters believe that the net social benefits of provision of the good are

non-negative. Under majority rule, the good should therefore be provided if its cost is below the median price.

In BCA, however, what matters are aggregate benefits and costs. The aggregate benefit is equal to the mean benefit multiplied by the number in the population, but it bears no necessary relationship to the median. Thus, the median benefit is of no interest in itself for BCA.

The median benefit may, however, be used as a robust estimator of the mean benefit. The requirement for robustness arises in its turn from concerns about strategic behavior. This issue does not arise on the referendum voting interpretation because the referendum procedure with majority rule (i.e. the median estimator) is incentive compatible (Zeckhauser 1973)[1]. By contrast, if a mean estimate is to be derived for use in BCA, a well-informed respondent can manipulate the procedure by claiming willingness to pay very large amounts for the good (or by denying any willingness to pay for a good that is, in fact, positively valued). Hence, it has been suggested that the median should be used as a robust estimator of the mean.

The use of the median as an estimator of the mean for the purposes of BCA seems to raise as many difficulties as it solves. Many, perhaps most, public projects yield direct benefits only to a minority of the population in the relevant jurisdiction. Thus, their median direct benefits are zero. Assuming that consumers only report positive WTP for projects which yield direct benefits to themselves personally, all such projects would be rejected. More generally, whenever project benefits are more concentrated than project costs a consistent use of median estimators will produce an inadequate supply of public goods. The compromise typically adopted in practice is to use a mixture of mean estimators from techniques other than the CVM and median estimators from CV analysis to derive a measure of net benefits. The statistical properties of such a measure are unclear, to say the least.

Embedding

Citizen responses also have important interpretations for the debate over 'embedding'. Under the standard interpretation, in the absence of satiation, increases in $\mathbf{q}$ will always be positively valued, although the marginal value will decline with increases in $\mathbf{q}$ (Loomis *et al.* 1993). Thus, we would expect to elicit higher WTP the greater is $\mathbf{q}$. However, for citizen responses this will not be the case. Respondents will have some estimate of the socially optimal level of provision $\mathbf{q}^*$. They will be less willing to support provision of levels in excess of $\mathbf{q}^*$. Hence there is no reason to expect that stated WTP should be increasing in $\mathbf{q}$.

[1] The absence of concern about strategic behavior in the referendum interpretation does not rely on a claim that individuals acting as voters or citizens will respond in a non-strategic manner because they are more 'moral' in this setting than in the market setting. Rather the claim is that there is no reason to misrepresent preferences in the referendum setting.

In terms of the classification presented in Table 1, we may observe that responses in categories 1 and 3 would be expected to exhibit WTP increasing in **q**. There is no general reason to suppose that categories 2 and 4 will display WTP increasing in **q**. However, for the particular problem considered in this paper, it is likely that economic losses from forest preservation would fall on a relatively small section of the population, so that for the majority of respondents, category 2 responses will display WTP increasing in **q**. The result observed is that WTP is decreasing in **q**, and is suggestive of category 4 responses.

Methodological Issues

Attempts to determine whether a citizen or consumer model is appropriate raise significant methodological issues. [2] In this paper, it is proposed to choose between the models on two broad bases. First, explanatory variables are divided into those that would most naturally be included in a consumer model (e.g. income, prices),those that would most naturally be included in a citizen model (e.g. general political attitudes) and those that would be included in either model (e.g. age). Second, the estimated coefficients are examined both for statistical significance and for consistency with theoretical expectations. In particular, we claim that, in the consumer model, prices and incomes would be expected to be important explanatory variables and that demand for environmental preservation should be both income-elastic and price-elastic. (A more precise statement of theoretical expectations by Flores and Carson is discussed below).

By contrast, for at least some users of the CVM the postulate that stated choices represent consumer preferences has the status of a maintained, rather than a testable, hypothesis. In the terminology of Lakatos, this postulate is part of the methodological 'hard core' of the CV research program. Thus, for example, it might be argued that what appears as a statement about Australian environmental policy may be reinterpreted as a proxy for particular consumer preferences, or may even be interpreted directly as a statement about individual consumer preferences. Similarly, it may be argued that the CV model makes no predictions with respect to income and price elasticities and, therefore, that no inference about the validity of the model can be drawn from the observation of low (or high) elasticities.

Conversely, many political theories would take as a maintained hypothesis the claim that stated choices on issues such as environmental preservation necessarily relate to a citizen rather than a consumer role. Evidence on, say, income effects would be reinterpreted in terms of class

[2] We use the term 'methodology' in its technical sense 'the study of scientific method and inference' rather than the widespread sense in which it is a more dignified synonym for 'technique'.

effects on political choices. Such a view, for example, underlies the outright rejection of public choice theory by many political scientists.

From either of these methodological perspectives, the task of attempting to distinguish empirically between citizen and consumer models is fundamentally misguided. Empirical analysis permits the application of the preferred model to a particular problem, but the model itself is immune from empirical testing.

The results presented below are stated in the form of a test of competing hypotheses. However, readers with a methodological precommitment to either a citizen or consumer perspective may easily reinterpret the results as evidence on the parameters applicable to the particular case of the forests of south-eastern Australia.

Re-analysis of the RAC South-East Forest CV Study

In this section we investigate the recently published results of the RAC's study of the forests of south-eastern Australia. We begin by first describing the CVM study.

The South-East Forest Study

Future management of the forests of south-eastern New South Wales, and East Gippsland in Victoria (referred to as the South-East forests) has been the focus of considerable debate over the last few years. In 1990 the Resource Assessment Commission was instructed to conduct an inquiry into forest management and timber. A major concern of the Forest and Timber Inquiry was to investigate management options for the South-East forests. One of several research projects undertaken by the Inquiry was a CV study directed at estimating preservation values for the South-East forests. Preservation values were estimated under three different scenarios; setting 100 per cent of the National Estate forests aside for preservation, setting 50 per cent aside, and setting 10 per cent aside. Three sets of results, corresponding to each of the three subsamples, are thus provided.

Within each of these subsamples, a further 11 subsamples were employed to provide the required variation in the stated costs ($X) of preservation, which ranged from $2 per year to $400 per year. A mail survey was employed which was administered by a consultancy firm. Reminder cards were sent out ten days after initial dispatch, and a further copy of the questionnaire was sent out ten days after this. The final valid response rate was slightly over 50 per cent. The dataset was also found to satisfy checks for representativeness, and also consistency with the results of one of the Inquiry's previous attitudinal surveys. The questionnaire was also pre-tested with focus groups.

The final questionnaire, which began with a map of the region in question, was also designed to provide data for a travel cost study of recreation values. In addition to the CV-relevant questions and general attitudinal and socioeconomic questions, information was collected on

recreation statistics such as expenses, activities undertaken, time spent at location, and so forth.

The CV question itself began by asking respondents to look at the map again. This was followed with:

> We are now going to ask you some questions about what you would like to see happen to the forests in the striped areas shown on the map.
>
> The Resource Assessment Commission is considering two options (A and B) for the future use of the forests in the striped areas of the map: we would like to know which of these options you prefer.

Respondents were then presented with concise summaries, in point form, of both options. Option A, referred to as 'Wood Production', meant setting aside half of the area in question to grow trees for wood; each year 2% of the wood producing area would be logged, and then allowed to regrow until the next logging. The wood producing areas were described as having younger trees on average; logging them would cause habitat disturbance to some rare and endangered species, but current job opportunities in the local region would be maintained. Option B, referred to as 'Conservation Reserves', would set the enitre striped area aside as a National Park and consequently would cause some job losses.

The remainder of the CV question was as follows:

> If you choose option B it could cost you $X each year.
>
> This is because:
>
> - with less wood being available the prices of timber products you buy, such as house frames and paper, could rise; and
>
> - government charges you pay could be increased to pay for the conservation of the areas.
>
> When you make your choice between Options A and B, keep in mind that there may also be other forests in Australia that you may wish to pay further money to have conserved. Which option do you prefer?

Discrete choice models were used in the regressions, with various forms for the index function being investigated. The results for the original RAC specification (reported by RAC 1992 and, in less detail, by Bennett and Carter 1993) are included in Table 2 below. Mean WTP was not reported for any of the options. The reported median yearly WTP figures were $43.50, $140.0, and $200 for the 100, 50 and 10 per cent preservation options respectively.

Although the signs of the coefficients were as expected, a number of results inconsistent with the standard theory underlying the CVM led the RAC to question the validity of their results. These were the non-significance of the price variable in the 10 per cent sample, the lower than expected responsiveness of option choice to price on the other preservation scenarios, and the fact that WTP decreases as the area set aside for

preservation decreases. Time and other constraints prevented any subsequent analysis of the data by the RAC.

TABLE 2
Results for RAC Consumer Model

	10 % Preservation		50% Preservation		100% Preservation	
Parameter	Estim.	t–stat	Estim.	t–stat	Estim.	t–stat
Constant	–1.52	–1.18	0.15	0.11	–1.19	–0.94
$X	–0.001	–0.74	–0.005	–3.46*	–0.002	–1.98*
INC	0.29	2.46*	0.13	1.10	0.25	2.12*
AGE	–0.02	–4.14*	–0.02	–3.40*	–0.02	–4.22*
Chi–Square	28.03		26.01		28.27	
LogL	–255.30		–251.78		–242.79	
% correct predict.	63		61		62	

* indicates statistical significance at 5 %, two-tailed test

Source: Resource Assessment Commission, (1992).

Investigation of citizen influences is made possible through responses to citizen-type questions that were included in the original survey. These questions were designed to elicit non-consumer preferences regarding what the individual believes is important for Australian society as a whole. These questions were presented after the CV question,[3] and were prefaced with the comment: 'Now we would like to find out your opinion on a number of issues concerning the environment in general.' The first citizen-type question was as follows:

> Do you think Australia needs to concentrate more on protecting the environment, or more on developing the economy, or would you say we currently have a reasonable balance?
>
> | | |
> |---|---|
> | More on environment | 1 |
> | More on the economy | 2 |
> | Reasonable balance | 3 |

This question is concerned with eliciting what the individual believes to be good for society, and implies consideration of both sides of the economy-environment equation. It is not concerned just with forests, but

[3] Since the questionnaire was mailed to respondents, it is possible that they may have read and considered the citizen-type questions before deciding on their answers to the CV questions presented earlier in the questionnaire.

rather all aspects of Australia's economy and natural environment. As a result, the question falls within the realm of the citizen rather than the consumer, eliciting type 4 responses in Table 2. The next question focussed on the financial trade-offs associated with environmental protection:

> Which of the following statements comes closest to your own view?
>
> | | |
> |---|---|
> | Governments should do more to protect the environment, even if this sometimes leads to higher taxes for everyone | 1 |
> | Governments shold keep taxes low, evenif this sometimes means that they do less for the environment | 2 |
> | Don't know, haven't thought much about it | 3 |

This question should also elicit type 4 responses, since it is the individual's perception of what would be best on balance for society that is sought.

Econometric Re-Analysis

The index functions employed by the RAC contained purely consumer variables, namely AGE, INC, and the stated cost of preservation $X. If respondents used only the desired type 1 considerations in formulating their CV responses, then one would expect that including citizen variables in the above logistic regressions in addition to the consumer variables would not significantly improve the fit of the estimated models, and the estimated coefficients on the citizen variables would not be statistically significant.

The first step in our analysis is thus to re-estimate the three logistic regressions from Table 2 with the addition of citizen dummy variables to the index function. Table 3 lists the variable definitions employed in this section, and Table 4 contains the results of the three re-estimations plus the same model estimated over the pooled sample. With this specification, the coefficient of PRICE (the log of $X) is the elasticity of the odds of a 'Yes' response with respect to the stated cost of preservation.[4]

[4] RAC 1992 used a specification linear in price rather than loglinear as here. We give in the Appendix the results arising when the consumer response model is estimated with this specification. Comparison of these results with Table 1 above indicates that the results reported by the RAC are not sensitive to this re-specification of the model.

TABLE 3
Definition of Variables Used in Econometric Analysis

P_i =	probability of the ith individual responding 'YES' to a particular preservation option.
y_i =	actual response to a particular preservation option (y_i=1 if 'YES', 0 otherwise).
X =	stated cost of particular preservation option (X=2,3,5,10,20,30,50,100,200,300 and 400 dollars).
PRICE = log(X)	
INC =	log of gross household income. Measured categorically with 8 ranges plus a don't know option.
AGE =	age in years.
GOV1 =	1 if respondent believes governments should do more to protect the environment. . . ; 0 otherwise.
GOV2 =	1 if respondent believes governments should keep taxes low . . .; 0 otherwise.

The control response to the GOV question was 'Don't know, haven't thought much about it'.

PRES50 =	1 if a 50% preservation questionnaire; 0 otherwise.
PRES100 =	1 if a 100% preservation questionnaire; 0 otherwise.

The control value for the PRES variable is 10%

BAL1 =	1 if respondent believes Australia needs to concentrate more on protecting the environment; 0 otherwise.
BAL2 =	1 if respondent believes Australia needs to concentrate more on developing the economy; 0 otherwise.

The control value for the BAL question is 'currently have a reasonable balance'.

Several observations can be made concerning the results in Table 4. Firstly, the three subsample regressions have considerably higher explanatory power than their consumer-only counterparts, shown in Table 2 (see also Appendix 1). The chi-squared and log-likelihood values are clearly much higher, and likelihood ratio tests reject (at 95%) the null hypotheses that the consumer-citizen (C-C) models offer no improvement over the corresponding consumer models. Indeed, in all models at least two of the citizen variables are statistically significant, whereas PRICE is only significant in the second model and INC in the first. In terms of predictive ability with respect to individual responses, the percentage of correct predictions increases from 63 per cent to 78 per cent in the case of 10 per cent preservation, from 61 per cent to 76 per cent in the case of

TABLE 4
Maximum Likelihood Estimates by Preservation Level

	10% Preservation		50% reservation		100% Preservation		Pooled Sample	
Parameter	Estimate	t–stat	Estimate	t–stat	Estimate	t–stat	Estimate	t–stat
Constant	–2.92	–1.67	0.60	0.35	0.02	0.01	–0.76	–0.79
PRICE	–0.07	–0.97	–0.18	–2.33*	–0.08	–1.06	–0.11	–2.47*
INC	0.34	2.20*	–0.00	–0.06	0.15	1.02	0.16	1.90
AGE	–0.02	–2.71*	–0.02	–3.04*	–0.03	–3.58*	–0.02	–5.53*
GOV1	0.96	2.22*	1.75	3.74*	0.39	0.94	0.98	3.99*
GOV2	–0.79	–1.53	–0.16	–0.29	–1.65	–3.10*	–0.92	–3.08*
BAL1	1.68	4.82*	1.28	4.10*	1.01	3.14*	1.28	6.96*
BAL2	–0.17	–0.49	–0.29	–0.77	–0.73	–2.00*	–0.37	–1.80
Chi–Squared	141.52		130.25		118.00		376.65	
Log L	–165.76		–165.82		–164.03		–503.67	
% Correct Predictions	78	N = 343	76	N= 335	74	N = 322	77	N =1000

* Indicates significantly different from 0, two-tailed test, at 5%.

50 per cent preservation, and from 62 per cent to 74 per cent in the 100 per cent preservation case.

The signs of the estimated coefficients in Table 4 are all as expected. Increases in INC, GOV1, and BAL1 can all be expected to be associated with a higher probability of a 'Yes' response. Increases in the stated cost of preservation, AGE, GOV2 and BAL2 can all be expected to be associated with a lower probability of a 'Yes' response. A likelihood ratio test indicates that the three datasets can be pooled (LR = 16.1, 16 df, critical value is 23.5 at the 90 per cent level). This greatly increases the sample sizes available for further analysis. Additive dummy terms for the proportion of forest preserved are however included in subsequent regressions, all of which are estimated using the pooled dataset. The fact that there is no statistically significant difference between the datasets with different levels of preservation suggests that the data are consistent with the embedding hypothesis.

We may now consider the relative impacts on the log(odds) of certain consumer and citizen variables. In particular, consider the increase in the stated cost of preservation that is required to have the same effect on the log(odds) as a reduction in BAL1 from 1 (more on environment) to 0 (reasonable balance). The impacts on the log(odds) of a one unit increase in PRICE and BAL1 are –0.11 and 1.28 respectively. Thus PRICE must increase by a factor of 11.5 to have the same impact on the log(odds) as a reduction in BAL1 from 1 to 0 (with no change in BAL2). The latter change would arise if a respondent who answered 'Need to do more to protect the environment' were replaced by an otherwise identical individual who answered 'Currently have a reasonable balance'. Since PRICE is the log of stated preservation costs, an increase in BAL1 from 0 to 1 would only be offset by an increase in preservation costs by a factor of approximately 100,000! This is a striking result that illustrates the relative lack of responsiveness of the log(odds) to consumer variables compared with citizen variables. A similar, though less extreme effect is obtained for a change in the GOV variable.

Another way of illustrating the very small impact of price on choices is to observe that, in a neighbourhood of $p = 0.5$, we can use the approximation (Maddala 1983, p. 23)

$$\partial p/\partial X = \beta/4,$$

where β is the estimated coefficient in a logit regression, to obtain the estimate that a unit increase in the log of price (i.e. an approximately threefold increase in prices) will raise the probability of a 'Yes' response by about 0.03.

We are now ready to consider the relative impacts of the consumer and citizen explanatory variables in more detail. In order to investigate the extent to which the log(odds), and hence willingness-to-pay, are sensitive to citizen preferences, we have partitioned the pooled dataset into three separate datasets corresponding to different responses to the BAL question. The C-C logit specification has been re-run for each of these sub-

samples, plus the original (pooled) dataset, and the results are presented in Table 5.

First, consider whether or not the three logistic regressions for the subsamples are significantly different. The likelihood ratio statistic for testing the null hypothesis that such differences do not exist is 83.0 (16 df), which is greater than the critical values of 26.3 and 32.0 at the 95% and 99% significance levels respectively. This indicates that the behavioral relationship between the log(odds) and the independent variables listed in Table 4 changes significantly as we move from individuals with one common citizen preference to those with another. This is consistent with the above results for the pooled C-C model.

The most striking result relates to the proportion of correct predictions. If we had no information other than that provided by the BAL question, it would be reasonable to guess that all those who answered 'More on environment' would answer 'Yes' to the CV question, and that all those who answered 'More on economy' would answer 'No'. Those who answered 'Reasonable balance' could be presumed to be equally likely to answer 'Yes' or 'No' to the CV question.

This very simple procedure would actually perform nearly as well as the maximum likelihood model reported here, and considerably better than the standard procedure incorporating only consumer variables. Overall the simple procedure would correctly predict 69 per cent of cases compared to 77 per cent for the maximum likelihood procedure using full information and only 62 per cent for the model based on consumer variables alone.

For the group who answered 'More on environment' the simple procedure would be correct in 81 per cent of cases, compared to 80 per cent for the maximum likelihood (ML) model. For the group who answered 'More on economy' the proportions would be 76 per cent and 79 per cent. Thus, the response to a single citizen question provides much the same predictive power as the full ML model.

Only for the group giving the equivocal 'Reasonable balance' answer does the ML model provide a clear increase in predictive power. However, even this increased power reflects the fact that the ML model incorporates responses to a second citizen question. If the 'Reasonable balance' group is subdivided on the basis of their response to the Government question, it turns out that 214 answered in favor of environmental protection, 88 in favor of lower taxes and 53 answered 'Don't know'. Adopting the same procedure as above (i.e. predicting 'Yes' for the first subgroup, 'No' for the second and assuming equal probabilities for the third) yields correct predictions in 63 per cent of cases. For the sample as a whole, the use of the extra citizen information on the 'Reasonable balance' group would raise predictive accuracy to 74 per cent, virtually the same as for the ML model.

The standard consumer variables (price and income) in these regressions have the expected signs but are not significant in most cases. The strongest effects are found for the group answering 'More on environ-

TABLE 5
Maximum Likelihood Estimates by BAL

	More on Environment (BAL1=1, BAL2=0)		More on Economics (BAL1=0, BAL2=1)		Reasonable Balance (BAL1=0, BAL2=0)		Pooled Sample	
Parameter	Estim	t–statistic	Estim	t–statistic	Estim	t–statistic	Estim	t–statistic
Constant	–0.55	–0.33	–1.48	–0.77	0.65	0.43	0.07	0.08
PRICE	–0.19	–2.39*	–0.05	–0.65	–0.07	–1.05	–0.11	–2.63*
INC	0.26	1.77	0.30	1.66	0.02	0.19	0.11	1.37
AGE	–0.01	–1.78	–0.04	–3.64*	–0.03	–4.11*	–0.02	–5.65*
GOV1	1.21	2.59*	0.38	0.69	1.09	3.16*	1.33	5.64*
GOV2	–0.74	–0.72	–1.23	–2.24*	–1.05	–2.40*	–1.34	–4.76*
PRES50	–0.38	–1.06	0.00	0.00	0.02	0.10	–0.01	–0.08
PRES100	–0.70	–1.98*	–0.61	–1.58	0.05	0.17	–0.28	–1.54
Chi–Square	28.66 (N = 378)		53.10 (N = 269)		73.94 (N = 353)		309.79 (N = 1000)	
Log L	–169.72		–121.04		–204.83		–537.10	
% Correct Predictions	80		79		70		73	
Actual % No.	81		24		44		52	

* Indicates significance at 95%, two-tailed test.

strongest effects are found for the group answering 'More on environment'. This could be explained as follows. Members of this group are generally predisposed to answer 'Yes', but amounts as large as $400 per year could violate budget constraints, particularly for those on low incomes. Hence this group is likely to show some price/income sensitivity. By contrast, those who answer 'More on economy' are unlikely to express any positive willingness to pay. The small proportion of 'Yes' answers are likely to arise from attitudinal differences more subtle than those captured by the Balance question rather than from a price/income trade-off.

Age is statistically significant in the second and third regressions, and has the expected sign in all three, even after citizen attitudes regarding the environment are accounted for. The fact that older people tend to be more likely to say 'No' to the CV question may be interpreted either in terms of consumer or citizen preferences. The high significance of the AGE variable does not preclude an interpretation of the results presented here in terms of citizen attitudes. As would be expected from the results reported for Table 4, the level of preservation is insignificant in the pooled regression and in all but one of the individual regressions, again suggesting that the responses display an embedding effect.

The final step in the analysis is to estimate a single regression containing both consumer and citizen variables for the entire sample. The results are given in Table 6. Of the pure consumer variables, only PRICE is significant at the 5 per cent level, and the absolute magnitude of the price effect is small. The INC variable is right-signed but small and not significant. The variables on level of preservation are wrong-signed on a consumer interpretation. As argued above, negative coefficients could be explained from a citizen perspective. However, given that the coefficients are statistically insignificant, the issue is moot. The AGE variable, which may be interpreted from either a consumer or a citizen perspective, is right-signed[5] and significant.

Of the pure citizen variables, all are right-signed and all except BAL2 are strongly significant and large in absolute magnitude. The insignificance of BAL2 may reflect a relatively small difference in attitudes between those responding 'More on economy' and those giving the base category response 'Reasonable balance' to this question.[6] The size of the coefficients on the citizen variables mean that the influence of these variables on the probability of a positive response outweighs that of even

[5] The consumer model predicts a lower WTP for older people on the assumption that environmental benefits of preservation are more likely to occur in the future and market benefits of exploitation in the present. A negative coefficient on age would be predicted in the citizen model on the basis of the contingent fact that environmental concern has been increasing steadily over recent generations and is therefore expected to be more pronounced among the young.

[6] Reference to the need for a reasonable balance between economic and environmental objectives is a staple of industry group rhetoric in Australia. The similarity in attitudes between those answering 'More on economy' and those answering 'Reasonable balance' is also apparent in Table 4.

extreme values of the consumer variables. Comparing the proportion of correct predictions to that obtained using only naive prediction based on the citizen information, it is apparent that the incorporation of the citizen information adds little to the predictive power of the model. By contrast, the full model strongly outperforms the pure consumer model of Table 2.

TABLE 6
Pooled Estimation with Consumer and Citizen Variables

Parameter	Estim.	t–stat
Constant	–0.58	0.605
PRICE	–0.11	2.528*
INC	0.17	1.887
AGE	–0.03	5.548*
PRES50	–0.10	0.522
PRES100	–0.33	1.728
GOV1	0.99	–3.981*
GOV2	–0.93	3.088*
BAL1	1.29	6.995*
BAL2	–0.37	1.764
Chi–Square	379.80	
LogL	–502.0946	
% correct pred.	76.4	

* Indicates significance at 95%, two-tailed test.

Comparison with Previous Work

The results on the price and income coefficients may be assessed in the light of recent work by Flores and Carson (1995), who argue that, even where environmental preservation (or any other rationed commodity) is a superior good, the elasticity of WTP with respect to income may be arbitrarily small. For the case of a single public good, Flores and Carson derive the relationship

$$\eta^v = \eta^d S_y / \sigma^d$$

where

η^v is the income elasticity of WTP;

η^d is the income elasticity of demand;

S_y is the share of the public good in total income; and

σ^d is the (compensated) own-price elasticity of demand.

Two issues arise here. First, the elasticity of WTP will be proportionately lower than the income elasticity of demand depending on the ratio of disposable income to total income (including market and nonmarket goods). Taking government consumption expenditure as a proxy for expenditure on nonmarket goods, this means that *ceteris paribus*, the income elasticity of WTP will be around 70 per cent of the income elasticity of demand. Second, the income elasticity of WTP is inversely proportional to the own-price elasticity of demand. This second result may be interpreted straightforwardly in terms of demand for either rationed or non-rationed goods. If demand is highly elastic, a small increase in price will reduce demand sufficiently to offset a large increase in income. Hence the price at which a given quantity is demanded will not change much in response to an increase in income.

In the case of the South-East forests the estimated income and price elasticities of WTP implied by the model in Table 2 are both well below 1. In terms of the consumer model, this outcome, in combination with the results of Flores and Carson, implies either that the true income elasticity of demand is very low (contrary to general perception) or that the share of nonmarket goods in total income is substantially higher than 30 per cent. The latter interpretation would appear to yield the policy implication that current levels of spending on public goods are well below the social optimum. However, a detailed analysis of this issue is beyond the scope of the present paper.

The results derived here may also be compared with those of Loomis *et al.* (1993), who also asked respondents about preservation of the South-East forests, using both open-ended questions and a DC format, with the payment vehicle being a tax payment allocated to a trust fund managed by the Australian Heritage Council (an official body). This payment vehicle is more precise than that suggested by the RAC and also places the issue more clearly in the context of political choice.

Loomis *et al.* were primarily concerned with testing for embedding. As in the study reported here, there was no significant difference in mean WTP (as elicited by open-ended questions) between an option involving preservation of the entire South-East forest area and an option involving preservation of East Gippsland only. (Indeed, as with the present study, estimated WTP is higher for the East Gippsland per cent option than for the 100 per cent option, though not significantly so). However, a third option, in which about 5 per cent of the total area was protected, elicited significantly lower mean willingness to pay.[7]

[7] The area in question, the Errinundra plateau, was the subject of considerable conflict, including physical occupation by environmentalists attempting to prevent logging. It is possible that this may have had some impact on results, though it is not clear, *a priori*, in which direction. Responses to the other two questions may have been influenced by the fact that respondents were Victorians, but the 'extra' forest was located in NSW.

Loomis *et al.* also estimate multivariate equations to explain observed WTP. The variables included are the response to a question concerning the importance of more national parks, a dummy variable on whether the subject is likely to visit national parks or forest areas in south-eastern Australia in the next two years, education and, in the case of the logit equation for the DC model, the bid amount. The 'park importance' variable would normally be regarded as a citizen variable, and the 'expect to visit' and price variables as consumer variables. Income and age, although elicited, were not included in the WTP equations.[8]

The results were fairly similar to those obtained here, although somewhat more favourable to the consumer model. As in this study, the coefficient on price was statistically significant, but very small. The coefficients on the price variables, which were included in linear form, were similar to those obtained by the RAC using the same functional form (Table 1). For example, in the regression for all South-East forests, the coefficient on the bid amount was -0.0026. Using the standard approximation for logit that $\partial p/\partial X = \beta/4$ (Maddala 1983), if the initial probability of a 'Yes' response were 0.5, the effect of an increase of $100 in the bid amount would be to reduce that probability to around 0.44. Smaller effects are obtained as the probability approaches 0 or 1.

No variables were consistently significant, although both the 'park importance' variable and the 'expect to visit' variable were significant in the majority of equations. No goodness of fit measures were reported. Although the precise wording of the 'park importance' question was not given, the absence of an explicit trade-off between forest preservation and (measured) economic output means that questions of this kind are less likely to capture differences in citizen attitudes than are the questions used here. On the other hand, a weakness of the data set used in the present study is the absence of a consumer tastes variable such as the 'expect to visit' variable included in the Loomis *et al.* study.

Concluding Comments

The evidence from this study suggests that responses to CV questions concerning environmental preservation are dominated by citizen judgements concerning desirable social goals rather than by consumer preferences. At least in the case of pure public goods, it may be inappropriate to use the CVM as an input to BCA studies, unless means can be found to extract information on consumer preferences from data predominantly generated by citizen judgements. A difficulty that arises here is that the more complete and realistic the problem setting presented to respondents, the more likely it is that citizen responses will be elicited in place of, or in addition to, consumer responses.

[8] A referee advises that income was omitted because the income variable disappears from the utility-theoretic specification used to calculate compensating variation.

Thus, the results of the present studies are discouraging for the use of the CVM as an input to BCA studies. On the other hand these results increase the appeal of an alternative interpretation of CV studies as surrogate referendums. It may be possible to use the CVM to assess the price-sensitivity of political support for various public goods and to assess the relative appeal of competing proposals for public expenditure.

It may be that the results obtained here, and similar results obtained in the RAC study of the Kakadu Conservation Zone (Imber *et al.* 1990), reflect the political polarization surrounding environmental issues in Australia. However, opinions about environmental preservation display some degree of political polarization in many countries. Hence, it is unlikely that the interpretation of CV responses as citizen judgements is unique to Australia.

Further research into the motivations underlying responses to CV studies is essential. We are unlikely to obtain meaningful responses of any kind unless we are clear about the possible range of behavioral motivations involved in response making, and about the purpose of seeking those responses.

References

Arrow, K., Solow, R., Leamer, E., Portney, P., Radner, R., Schuman, H., (1992), *Report of the NOAA Panel on Contingent Valuation*, Washington DC.

Bennett, J. and Carter, M. (1993), 'Prospects for contingent valuation: Lessons from the South-East forests', *Australian Journal of Agricultural Economics* 37(2), 79-94.

Bergstrom, T., Rubinfeld, D. and Shapiro, P. (1982), ÔMicro-based estimates of demand functions for local school expenditures', *Econometrica* 50 (5), 1183D1205.

Blamey, R. K. (1991), 'Contingent valuation and Fraser Island', paper presented at 20th Conference of Economists, Economic Society of Australia, Hobart.

Blamey, R. and Common, M. (1993), 'Sustainability and the limits to pseudo market valuation', in van den Bergh, J. and van der Straaten, J. (ed.), *Concepts, Methods and policy for sustainable development: Critique and New Approaches*, Island Press, Washington D.C.

Brennan, G., Quiggin, J. and Shapiro, P. (1991), *The supply of votes for publicly provided goods*, Working Paper, Centre for Economic Policy Research, ANU.

Cameron, T. A. and Quiggin, J. (1994), 'Estimation using contingent valuation data from a "Dichotomous choice with follow-up" questionnaire', *Journal of Environmental Economics and Management* 27(3), 218-34.

Flores, N., and Carson, R., (1995), *The relationship between the income elasticities of demand and willingness to pay*, UCSD Working Paper.

Hanemann, W. M. (1991), 'Willingness to pay and willingness to accept: how much can they differ?', *American Economic Review* 81(3), 635-47.

Harrison, G. (1992), 'Valuing public goods with the contingent valuation method: A critique of Kahneman and Knetsch', *Journal of Environmental Economics and Management* 23(3), 248-57.

Hausman, J. (ed.) (1993), *Contingent Valuation: A Critical Assessment*, North-Holland, Amsterdam.

Imber, D., Stevenson, G. and Wilks, L. (1990), *A contingent valuation survey of the Kakadu Conservation Zone* (Draft), RAC Research Paper No. 3, Resource Assessment Commission, Canberra.

Kahneman, D. and Knetsch, J. (1992), 'Contingent valuation and the value of public goods: Reply', *Journal of Environmental Economics and Management* 22(1), 90-94.

Kahneman, D. and Knetsch, J. (1992), 'Valuing public goods: The purchase of moral satisfaction', *Journal of Environmental Economics and Management* 22(1), 57-70.

Knetsch, J. L. (1990), 'Environmental policy implications of disparities between willingness to pay and compensation demanded measures of values', *Journal of Environmental Economics and Management* 18(3), 227-37.

Kohn, R. (1993), 'Measuring the existence value of wildlife: Comment', *Land Economics* 69(3), 304-8.

Loomis, J., Lockwood, M. and DeLacy, T. (1993), 'Some empirical evidence on embedding effects in contingent valuation of forest protection', *Journal of Environmental Economics and Management* 24(1), 44-55.

Maddala, G. S. (1983), *Limited-dependent and Qualitative Variables in Econometrics*, Cambridge University Press, Cambridge.

Margolis, H. (1982), *Selfishness, Altruism and Rationality*, Cambridge University Press, Cambridge.

McFadden, D. (1974), 'The measurement of urban travel demand', *Journal of Public Economics* 3 (4), 303-28.

Mitchell, R. and Carson, R. (1989), *Using Surveys to Value Public Goods: The Contingent Valuation Method*, Resources for the Future, Washington D.C.

Peterson, G. L. (1992), 'New horizons in economic valuation: Integrating economics and psychology', in Lockwood, M. and DeLacey, T. (ed.), *Valuing Natural Areas: Applications and Problems of the Contingent Valuation Method*, Johnstone Centre of Parks Recreation and Heritage, Charles Sturt University.

Quiggin, J. (1987), 'Egoistic rationality and public choice: Theory and evidence', *Economic Record* 63(180), 10D21.

Quiggin, J. (1992), *Altruism, total valuation and benefit cost analysis*, Working Paper, Centre for Economic Policy Research, ANU.

Randall, A. (1986), 'Human preferences, economics and the preservation of species', in Norton, B. G. (ed.), *The Preservation of Species*, Princeton University Press, Princeton.

Randall, A. and Stoll, J. (1983), 'Existence value in a total valuation framework', in Rowe, R. and Chestnut, L. (ed.), *Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas*, Westview Press, Boulder.

Resource Assessment Commission, (1992), *Forest and Timber Inquiry: Final Report*, AGPS, Canberra.

Sagoff, M. (1988), *The Economy of the Earth*, Cambridge University Press, Cambridge.

Smith, V. K. (1992), 'Arbitrary values, good causes and premature verdicts', *Journal of Environmental Economics and Management* 22(1), 71-89.

Stevens, T., Echeverria, J., Glass, R., Hager, T. and More, T. (1991), 'Measuring the existence value of wildlife; What do CVM estimates really show?', *Land Economics* 67(4), 390-400.

Stevens, T., Echeverria, J., Glass, R., Hager, T. and More, T. (1993), 'Measuring the existence value of wildlife: Reply', *Land Economics* 69(3), 309-12.

Zeckhauser, R. (1973), 'Voting systems, honest preferences and Pareto optimality', *American Political Science Review* 67(3), 934D46.

APPENDIX 1
Results for RAC Consumer Model with LogX Specification

	10 % Preservation		50% Preservation		100% Preservation	
Parameter	Estim.	t–stat	Estim.	t–stat	Estim.	t–stat
Constant	–1.38	–1.05	0.57	0.42	–1.09	–0.85
LogX	–0.05	–0.89	–0.20	–3.33*	–0.08	–1.38
Log(Income)	0.29	2.46*	0.13	1.11	0.25	2.13*
Age (yrs)	–0.02	–4.17*	–0.02	–3.45*	–0.02	–4.19*
Chi–Square	28.28		24.95		26.18	
LogL	–255.18		–252.30		– 243.84	
% correct predictions	64		60		61	

* Indicates significance at 95%, two-tailed test.