



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Dissonance-Minimisation in Contingent Valuation Surveys¹

R. Blamey, J. Bennett and M. Morrison².

Abstract

In a recent paper, Ready, Whitehead and Blomquist (1995) propose a "polychotomous" choice elicitation format as an alternative to the dichotomous choice or "take-it-or-leave-it" format now commonly used in contingent valuation (CV) surveys. The claimed advantage of polychotomous choice (PC) over dichotomous choice (DC) is that it allows respondents to express the ambivalence they face when making difficult trade-offs between environmental quality and income. This paper compares the PC and DC formats, both conceptually and empirically. A third type of elicitation format which we refer to as the dissonance minimising elicitation format (DMEF) is proposed which enables respondents to express their attitudes less ambiguously. Instead of using a unidimensional rating scale, the DMEF allows respondents to indicate which one of a series of theoretically derived attitudinal categories most closely represents their views. Their selection of category and responses made in follow-up questions permit each respondent to be subsequently classified as either a 'yes' or a 'no', thereby permitting analysis of results using standard binary logit procedures. An empirical comparison of the DC, PC and DMEF approaches is made in a study aimed at estimating the environmental costs associated with the draining of saline ground water into the Coorong in the Upper South-East of South Australia. Results indicate that the DMEF offers considerable promise, and is worthy of further investigation.

¹ The research reported in this paper represents part of a larger project undertaken by Environmental and Resource Economics (ERE) for the Australian Bureau of Agricultural and Resource Economics (ABARE). The views and opinions expressed in this paper are those of the authors. Comments regarding this paper should be directed to Dr Russell Blamey, Research School of Social Sciences, Australian National University, ACT, 0200. Telephone (06) 2493285. E-mail rblamey@coombs.anu.edu.au.

² Respectively, Postdoctoral Fellow, Urban Research Program, Research School of Social Sciences, Australian National University; Associate Professor, School of Economics and Management, The University of New South Wales (ADFA), and PhD student, School of Economics and Management, The University of New South Wales (ADFA).

1. Introduction

In a recent paper, Ready, Whitehead and Blomquist (1995) propose a "polychotomous" choice elicitation format as an alternative to the dichotomous choice or 'take-it-or-leave-it' format now commonly used in contingent valuation (CV) surveys. The claimed advantage of "polychotomous" choice (PC) over dichotomous choice (DC) is that it allows respondents to express any ambivalence they may experience when making trade-offs between specified environmental improvements and income. Ambivalence is held to occur "when an individual is forced to make difficult trade-offs between competing objectives"(p182).

The empirical study reported by Ready et al (1995) indicated mixed results for the PC format, with only marginally higher response rates when compared to the DC format, and lower sensitivity to the scope of the environmental good. In this paper, we discuss possible reasons for these results, and suggest an alternate elicitation format, which we label the dissonance-minimising elicitation format (DMEF). The DC, PC and DMEF formats are compared empirically, in the context of a case study involving willingness to pay to construct a pipe that would prevent environmental changes caused by the discharge of effluent from a system of ground water drains into the Coorong and nearby Tilley Swamp, in the Upper South-East of South Australia.

The paper is organised as follows. The conceptual discussion of DC and PC elicitation formats is introduced in Section 2, and the DMEF is introduced in Section 3. The application involving the Upper South East is described in Section 4, and the survey methods and focus groups are summarised in Section 5. Section 6 contains a detailed empirical comparison of the three elicitation formats and alternate ways of treating protest responses. Some conclusions are drawn in the final section.

2. Revisiting Ambivalence

Ready et al (1995) argue that individuals experiencing ambivalence may "derive disutility from being forced to give a confining response" (p186). Accordingly, they suggest a six-point PC elicitation format as an alternative to the widely used DC format. This six-point scale involves a gradation of preference strengths, ranging from "strongly support proposal" through to "strongly oppose proposal". Respondents who experience ambivalence when confronted with dichotomous support or oppose formats are hypothesised to experience less ambivalence when given the opportunity to express the degree to which they support or oppose the proposal.

In contrast to the DC format, the PC format is held to allow "the respondent to make less of a commitment, and may therefore be less distasteful to answer" (p186). The result may be higher survey response rates, lower item non-responses, and fewer protest responses. These hypotheses received only weak support in the empirical comparison of DC and PC formats reported by Ready et al (1995). The PC format produced significantly higher response rates in only one of the two case studies, and much higher rates of 'yes' responses in both studies, which some commentators might view as undesirable. Furthermore, the PC format produced less sensitivity to the scope

of the good being valued than the DC format, leading Ready et al (1995, p195) to conclude that the PC questions:

did not provide enough incentive for the respondents to think long and hard when answering the questions. It was too easy for respondents to say 'maybe yes' or 'slightly prefer'. It takes the discipline forced by a DC question to get the respondent to invest the time needed to fully consider the scenario being presented.

In considering these results, it is appropriate to consider the work of Opaluch and Segerson (1989) on the economics of ambivalence. Although Ready et al (1995) draw heavily on the general framework outlined by these authors, their approach differs in at least one important respect. The notion of ambivalence they adopt captures only part of the ambivalence construct, as originally conceptualised by Opaluch and Segerson (1989).

According to Opaluch and Segerson, ambivalence arises "when the individual faces strongly opposing feelings when making a decision. In cases where the decision is a difficult one to resolve, the decision-maker faces a dilemma where the outcome cannot be correctly described as indifference". Opaluch and Segerson observe that the violation of ethical principles, or social values, can also lead to ambivalence. They argue that the usual concept of indifference may not be appropriate for understanding how individuals resolve conflicts between their tastes, relating to the "usual concept of individual preferences over goods and services", and values, relating to feelings about ethical principles. Individuals may, for example, resolve ambivalence in these situations by either using lexicographic rules or modifying their beliefs³.

The concept of ambivalence considered by Opaluch and Segerson (1989) has much in common with the psychological phenomenon of cognitive dissonance studied in depth by Festinger (1957). Dissonance theory postulates that when people hold inconsistent beliefs they experience an unpleasant motivational state which tends to drive them to modify their cognitions so as to overcome this state. This is an example of a cognitive consistency theory, according to which people are held to strive for consistency among their beliefs, attitudes and feelings. Akerlof and Dickens (1982) considered the economic consequences of cognitive dissonance and present a decision model concerning the choices facing workers in hazardous industries⁴.

While ambivalence and dissonance have much in common, subtle differences emerge on close examination. Where ambivalence simply involves a state of discomfort,

³ Drawing on Opaluch and Segerson (1989), Ready et al (1995) argue that when respondents cannot reduce ambivalence through introspection regarding the location of their indifference curves, they resort to simple decision rules such as lexicographic and conservatism rules. The former gives dominance to one of the two goods under consideration, for all decisions within the 'ambivalence region', whereas the latter involves the avoidance of moves away from the status quo. Such decision rules may also be used when there is uncertainty about the nature of the goods in question rather than respondents' own preferences over these goods (see Hoehn and Randall, 1987). No amount of introspection is likely to resolve uncertainty arising from information omitted from the questionnaire.

⁴ Individuals were held to resolve dissonance created by psychic fear costs by modifying (often down playing) their perception of the probability of an accident. This is shown to have implications for equilibrium wage levels, the voluntary purchase of safety equipment, and other factors.

dissonance involves a further motivational component, in which individuals seek to reduce their dissonance by modifying key beliefs. A second difference is that where dissonance tends to involve behaviour that is inconsistent with one's belief system, ambivalence need not. Ambivalence can arise simply through having to choose between two highly valued goods, neither of which is in conflict with the individual's belief system. It is this type of ambivalence which Ready et al (1995) consider. It can be represented in money/amenity space and is associated with indifference and uncertainty with respect to the location of one's indifference curve⁵.

The PC format suggested by Ready et al (1995) may, however, play only a limited role in the minimisation of Opaluch and Segersons' (1989) concept of conflicting belief ambivalence. This is because the PC format still requires individuals to express their views in terms of a single normative dimension: the overall desirability of the environmental proposal⁶. This is little help to those respondents who find themselves wrestling with difficult procedural and/or distributive ethical concerns. In this paper, we are concerned primarily with Opaluch and Segersons' (1989) concept of ambivalence. To avoid confusion, we refer to this as dissonance. We do not focus on how individuals resolve indifference, but rather the development of elicitation formats that allow respondents to express dissonance and thus reduce reliance on heuristics involving lexicographic, conservatism or other rules which may compromise the validity of CV results.

A further possible limitation of the PC format is that it employs choice-based labels, suggesting that respondents must both choose **and** rate, rather than just choose as is the case with the DC format⁷. One might expect individuals presented with PC formats to use a two-stage decision strategy, first deciding which option they prefer, and hence which on side of indifference they lie, and second deciding where on that side to locate themselves. The conclusions reached by Ready et al (1995) suggest that the seriousness with which individuals consider the first choice stage is somehow compromised by the inclusion of the additional response options. Their disappointing results may have less to do with task differences, narrowly defined, and more to do with the way different elicitation formats prime individuals to define the context of choice. Individuals presented with a DC question may view the exercise in a referendum like manner, where the results of the survey are perceived to have an

⁵ When income is shown on the horizontal axis, trade-offs between income and amenity occur in the quadrant north-west of the baseline option (WTP formats). Some, but not all, of the points within this quadrant are likely to be associated with ambivalence. The respondent may readily agree to alternatives that offer substantial environmental improvement at little cost, and dismiss options that involve minimal environmental improvement at large cost. An ambivalence region can thus be defined as the region within the north-west quadrant where changes in the environmental good and income are sufficiently balanced for the respondent to experience difficulty in making a choice. Because ambivalence is a continuous construct, the precise partitioning of the ambivalence region in terms of difficulty, or discomfort, is arbitrary.

⁶ It is noted that the PC approach of Ready et al (1995) does not include a response option corresponding to exact indifference. Thus individuals who are unable to rank one option at least slightly ahead of the other will still experience ambivalence due to indifference.

⁷ Each point on the PC scale is given a label such as 'strongly prefer A', 'strongly prefer B', etc. In this sense, the PC format can be viewed as a 6-point ratings scale. This is in contrast to the DMEF presented in the next section, where each response option measures a substantively different construct.

important and immediate influence on the final decision. The PC format, on the other hand, may read more like an attitudinal question, where the influence of results on management decisions is less clear.

The likely tendency of the DC format to portray a more final set of policy options may also create adverse reactions in some individuals who strongly believe in public consultation from an early stage. This was evident in the focus groups conducted for this study (described below), where several individuals objected to what they perceived to be a lack of prior consultation, and an inability, and indeed pointlessness, of offering detailed comments on the different policy attributes when the government already appeared to have made most of the decisions. It appears that, in addition to their role in permitting respondents to express ambivalence created elsewhere in the questionnaire, some elicitation formats may themselves serve as a source of ambivalence. Elicitation formats which allow respondents to express differential support for different attributes of the policy initiative may be less objectionable than those which present a single multidimensional option, and ask 'yes' or 'no'. This is an important rationale underlying the DMEF presented in the next section.

3. An Alternate Way of Reducing Dissonance

We propose a third type of elicitation format which we refer to as the dissonance-minimising elicitation format (DMEF). The idea behind the DMEF is to enable respondents to express their attitudes less ambiguously than with either the DC or PC approaches. Instead of using a unidimensional ratings scale as with PC, the DMEF allows respondents to indicate which one of a series of theoretically informed response categories most closely represents their view. The importance of expressive motivations in CV studies has been emphasised by Blamey (1996a).

Our interest in developing an alternative CV format which allowed respondents to express their attitudes was stimulated by findings of the focus groups carried out for the Upper South East project. Discussion during the focus group sessions suggested how ambivalence may be reduced, and indicated the most appropriate way of defining the response categories, both in terms of content, and language. The following verbatim comments from one of the focus groups illustrates the general motivation for the DMEF:

shouldn't there be a third option...favour pipe but with other alternatives...For example, other payment methods.

It says that if you favour [the pipe] you will pay \$50. I think it should also...give you the option to say something about...who should pay and how it should be paid. Instead of just saying- if you are in favour-yes or no- but how do you think this should be funded- out of existing taxes, or out of additional taxes- and then you will get a true response.

You shouldn't ...have just two options-either you do or you don't. You should have a third option of whether you want it...If you were to go ahead and find that everybody wants it but nobody is prepared to pay for it- then you've got a dilemma then haven't you?

Comments such as these made in the earlier focus groups lead us to trial a "trichotomous" elicitation format in subsequent groups. Although this appeared to

create less conflict, some respondents felt more response options were needed. For example, one participant commented without prompting that "Maybe there should be five or six options".

The five statements finally chosen were established on the basis of theoretical considerations coupled with focus group findings. From a theoretical perspective, three attitude combinations that respondents may seek to express are immediately apparent. These are (i) support the pipe and can afford payment; (ii) support the pipe but cannot afford payment; and (iii) oppose the pipe making payment irrelevant. A fourth category, (iv) support pipe but it is not worth \$x to me, was added to ensure that the full range of motivations consistent with (ii) are adequately captured. Although the economic interpretation of (ii) and (iv) are essentially the same, the former is cast in terms of implications for the respondent's budget constraint whereas the latter focuses more on the respondent's objective function.

A fifth response category was added to permit respondents to express dissonance arising from a possible violation of their ethical views. Rather than including a broad category along the lines of "support the pipe but object to some aspect of the proposal", it was decided to draw on the focus group finding that the vast majority of objections related to the use of a levy. Specifically, individuals felt that the pipe should be funded out of existing taxation revenue rather than new and additional taxes. Of course, it is also possible for an objection to the levy to be expressed for reasons of self interest rather than as a reflection of a "violation of ethical views". Irrespective of the rationale behind respondents' protests against payment mode, the strategy of including a response option to capture such protests is consistent with Blamey's (1996b) view that the identification of plausible and non-objectionable payment vehicles presents a major challenge facing Australian CV researchers⁸. The fifth response category (option 4 below) thus took the form 'support the pipe but oppose a levy of any amount'. This captures those respondents protesting against the payment vehicle but who nonetheless may view the pipe as important. The question containing all five response options read as follows:

From what you have read above, and what you may already know, do you support the pipe, to be funded by a once-off levy of \$50 on income tax, or do you oppose it?

Please circle the one option which most closely resembles your view.

- I support the pipe with \$50 levy 1
- I support the pipe and the use of a levy but its not worth \$50 to me 2
- I support the pipe and the use of a levy but I cannot afford \$50 3
- I support the pipe but not if it requires a levy of any amount 4
- I oppose the pipe regardless of whether it costs me anything 5

⁸ In a national sample of 1680 eligible voters, Blamey (1995) reports that only 17.4% percent consider additional protection of the environment through additional taxes to be a 'reasonable position' compared to 62.3% who considered additional protection through redirecting taxes from other areas to be appropriate. In other results, 49.4% considered it appropriate to protect the environment as well as we can without additional expenditure, and only 3.0% considered a reduction in expenditure on environmental preservation to be appropriate. Respondents were requested to indicate which one or more of the four statements they considered to be reasonable.

In order to provide Hicksian surplus measures that are not biased downward due to the exclusion of category 4 respondents, specially designed follow-up questions were included immediately after the CV question. Specified rules were used to recode category 4 responses as either 'yes' or 'no' CV responses.

What we were seeking is a positive way of treating protest respondents that does not necessitate their rejection from the data set at the model estimation stage. This is especially important given the high number of such rejections reported in some studies. Loomis, Lockwood and DeLacy (1993), for example, report that approximately 20% of returned surveys were dropped as protests, many because they indicated in the debrief question that they thought the additional parks should be funded out of existing taxes, or that they pay enough taxes. Noting that the major source of protest concerned the use of additional rather existing taxes, we were able to draw on the focus group observation that individuals who protest to the use of additional levies often state that they would need to be more convinced that government couldn't, or wouldn't pay, before they would consider paying themselves. It follows that levy protesters who value the environmental good in excess of the bid value should agree that they would only support the levy if convinced that government wouldn't pay. Such respondents can then be recoded as 'yes' respondents, rather than being deleted from the data set. The following question was developed accordingly.

If you selected option "4" in Question 3, please answer Question 4. Otherwise, please go to Question 5.

Question 4

Do you agree or disagree with the following statements?

	Agree	Disagree
I would pay \$50 for the pipe if I could be convinced that the government is not prepared to pay for it out of existing revenue	<input type="checkbox"/>	<input type="checkbox"/>
I would pay \$50 for the pipe if I could be convinced that the government doesn't have enough money to pay for it.	<input type="checkbox"/>	<input type="checkbox"/>
I cannot afford to pay anything for the pipe	<input type="checkbox"/>	<input type="checkbox"/>
I would pay \$50 for the pipe if an alternative, acceptable way of collecting the money could be found.	<input type="checkbox"/>	<input type="checkbox"/>

Respondents agreeing with the first, second or fourth of these statements can be treated as 'yes' responses. This is perhaps a more desirable way of handling protests than rejection from the sample, since one would expect some degree of correlation between payment-vehicle objectionability and bid amounts. Because of this correlation, exclusion of all protests would be expected to affect mean willingness to pay.

4. Defining the Good

The viability of the DMEF was put to the test during a study involving the estimation of non-market environmental costs caused by dryland salinity. In recent years, the Upper South East (USE) of South Australia has been subject to increasing soil salinity resulting from the combined effects of high ground water levels and flooding. This has caused a decline in agricultural production within the region.

Various management options have been considered to remedy these problems and are detailed in an Environmental Impact Statement (EIS) (Upper South East Salinity and Flood Management Plan Steering Committee, 1993). Central to these options is the development of a regional network of ground water and surface drains. Whilst some options have the drainage water exiting the system at an ocean outlet, others have it being directed via Tilley Swamp into the Coorong, a large permanent lagoon about 100 km long and varying between 2 and 5 kms in width.

The Coorong is part of a national park and is listed as a wetland of international importance under the Ramsar Convention. The southern Coorong has an environment that is unique in Australia. It contains water that is hypersaline, meaning that it is much saltier than seawater. It produces large amounts of aquatic plants and fauna - such as insect larvae and salt flies - which provide food for a wide range of waterbirds. The southern Coorong is one of only a few major areas in southern Australia which are used by migratory and other waterbirds, particularly during drought. Tilley Swamp is one of a series of shallow freshwater wetlands located inland from the Coorong. It contains an existing conservation park and a further one is proposed. Tilley Swamp provides habitat and feeding areas for waterbirds and other fauna.

An ocean outlet would require the water to be piped across the Coorong and through the extensive coastal dune system lying between the lagoons and ocean. This would be more expensive than directing the water to the Coorong via Tilley Swamp, which raises the question of whether the (net) environmental costs associated with these wetlands are in excess of, or less than, the additional cost of the works required for discharge to the ocean, estimated in the EIS (p157) to be approximately \$3.8 million. It is this question that the contingent valuation study presented in this paper addresses.

The location of the Coorong, Tilley Swamp, the proposed drainage scheme and possible ocean outlet were communicated to recipients of the questionnaire using a map included with, but unattached to, the questionnaire⁹. A separate diagram was printed within the questionnaire, detailing how the pipe would take drainage water through sand dunes to an ocean outlet. The environmental impact of discharging the drainage water to the Coorong was communicated to respondents as follows:

Excess ground water that is rising to the surface is damaging large areas of farmland in the surrounding region. To help restore agricultural productivity, this excess water will be drained into The Coorong. The best available scientific evidence shows that the excess water will change the environment of The Coorong in the following ways:

⁹ Copies of the questionnaire are available on request.

- The extremely salty water of the southern Coorong will be diluted so that it will only be as salty as seawater. This will reduce the diversity of habitats in the region.
- The aquatic plants that require the extremely salty water will be replaced and the amount of food for waterbirds in the southern Coorong will be reduced.
- It is estimated that, on average, the number of waterbirds using the Coorong will fall from 130,000 to 70,000 each summer.

The possibility of discharging the water to the ocean was then described:

The Proposed Solution

A pipe has been proposed to avoid these environmental changes (see Diagram). The pipe would take the excess water out to sea so that it wouldn't enter the Coorong. Excavation through the sand hills would be needed so that the pipe could reach the sea. An Environmental Impact Statement has shown that the excavation and the discharge of the excess water into the ocean would have minimal impacts on the environment.

Results of the focus groups indicated that explicit acknowledgment of impacts of the pipe was required. Similarly, focus grouping of different draft questionnaires suggested that explicit attention should be paid to the question of why the government could not fund the pipe out of existing taxation revenue. Consistent with the current political climate of spending cuts, individuals were told that: "The proposed pipe would be expensive to build. The South Australian and Commonwealth Governments do not have enough money to pay for the pipe from existing taxation revenue." Although statements of this type run the risk of priming some respondents to have concerns that they would not otherwise have had, the focus groups indicated that this statement not only reduced protests, but enhanced payment vehicle plausibility. Nonetheless, the idea of paying additional taxes was still expected to stimulate negative reactions in a significant proportion of respondents. The payment vehicle was described as follows:

With this in mind, it has been calculated that building the pipe would require you to make an additional once-off payment of \$50, on your next year's income tax return.

The revenue that is raised would go into a special fund that would only be used to build the pipe.

The pipe will only be built if people are willing to pay this once off pipe levy.

Several other payment vehicles were trialed in the focus groups, including a levy on water rates, house rates and an abattoir levy. A levy on income tax appeared more plausible than these alternatives, particularly at a national level.

Following a further focussing paragraph and a reminder statement, respondents were then presented with the willingness to pay (WTP) question, which in the DC case read as follows:

From what you have read above, and what you may already know, do you support the proposal to build the pipe, to be funded by a once-off levy of \$50 on income tax, or do you oppose it? *Please circle the one option which most closely resembles your view.*

I support the proposal 1

I oppose the proposal..... 2

In the version of the questionnaire that used the PC format, the question itself was the same, but the response options included: strongly support proposal, support proposal, slightly support proposal, slightly oppose proposal, oppose proposal, and strongly oppose proposal. This corresponds to the second variant of the PC format reported by Ready et al (1995). The DMEF contained the same wording of the question as the other two splits, but the response options differed as described in the previous section.

In the DC and PC questionnaires, the next question began with the statement: *We are interested in how you responded to question 3. Please circle the one option which most closely resembles your view.* The five statements contained within the DMEF were then listed. Including the DMEF statements as debrief questions in the DC and PC questionnaires serves two principal functions. First, it permits an understanding of how the DMEF response categories map onto the DC and PC response options. Second, it provides a valid comparison of the three elicitation formats since it is now accepted CV practice to include debrief questions immediately after the main WTP question. This permits respondents who object to the levy to be omitted from the data set at the estimation stage, for comparison purposes. A further benefit of the above debrief question is that the second stage of the DMEF can then be included as a second debrief question in the DC and PC questionnaires. This is desirable for reasons outlined above.

The second half of the questionnaire contained several attitudinal questions, some being specific to the case study and others relating more to respondents' general attitudes. The usual socio-demographic questions such as age, sex, income and education were also included. The last page of the questionnaire involved a minor departure from standard protocol: it was labelled *SECTION E: CAN YOU HELP US?* and began with the following introduction:

We want to thank you for your valuable input on the issues mentioned in the survey. In order to determine how questions of this type might be improved, we would like to ask you a few very brief questions about how you interpreted one of the questions.

Respondents were then requested to think about the CV question (question 3) and indicate whether they agree or disagree with the statements: "Question 3 was difficult to answer", "I felt uncomfortable answering Question 3", and "I did not like Question 3". The purpose of this question was to provide an additional basis for comparison of the three elicitation formats. The intention was to compare the formats not just in terms of the results they produce, but also the degree to which they stimulate the key psychological constructs associated with dissonance (and ambivalence), which we take to be cognitive difficulty, feelings of discomfort, and negative affect, or dislike.

5. Survey Methods and Focus Grouping

The sample frame was developed from the Australian Electoral Commission roll for South Australia and New South Wales. Individuals were randomly assigned to one of 24 treatments, corresponding to two states (NSW and SA), 4 bid values (\$5, \$20, \$50 and \$100), and 3 elicitation formats (DC, PC and DCE). The Dillman (1978) total design method was used as a base in designing the mail questionnaire and the follow-up strategy for non-respondents. Reminder cards were sent out two weeks after initial dispatch, and a complete re-mail of the questionnaire was sent out a further two weeks later. The questionnaire contained 11 pages of questions and was presented in the form of a B5 booklet, with an orange cover and black and yellow map.

In order to understand the level and nature of public understanding of the concepts to be communicated in the questionnaire and to trial drafts of the questionnaire, an initial telephone survey, a series of nine focus group sessions and a pre-test were held. Three groups were held in the USE town of Naracoorte, three in the nearest major city, Adelaide, and three interstate in Sydney, New South Wales¹⁰. Particular attention was paid to participants' level of understanding of salinity problems, including concepts such as rising ground water and excessive soil salinity. Also discussed at length was the question of payment, and the distinction between how individuals thought the pipe should be funded (appropriateness) and how it would most likely be funded (plausibility). Several possible payment vehicles were tested, as noted previously. More general discussion was prompted using questions such as the following: *Did you find anything unclear or ambiguous?; Is there anything that you disagreed with or didn't like?; Was there any information that you thought was missing?; What further information do you think you need?; Did you think any of the information, or the questionnaire as a whole, was biased?* The focus groups lead to numerous changes to the draft questionnaire. Blamey (1996e) describes the focus group procedures and results in the context of a theoretical model of respondent behaviour, and Bennett, Blamey and Morrison (1997) present the results in the broad context of the USE study.

6. Results

6.1 Survey Response Rates and Item Non-Responses

A total of 2472 questionnaires were mailed of which 1144 were returned with the majority of the questionnaire completed. This constitutes a valid response rate of 46.3%. When broken down by elicitation format, the response rates are 46.7% (DC),

¹⁰ Recruitment was undertaken by professional recruitment agencies, the only specification being to ensure that approximately eight individuals aged 18 or over turn up at any one meeting, and that overall the group profile should be as demographically representative of the general population for that town or city, as practically possible. Groups were held at 10.30 am, 6 pm and 8 pm, and lasted an average of approximately 1 hour and 40 minutes. Slightly more women than men were recruited, particularly for the 10.30 am meeting. Participants covered a wide range of age and socioeconomic groups. The minimum attendance at any group was seven, and the maximum 10. Overall, 52 respondents attended the nine focus groups. With the exception of Naracoorte, where the focus groups were held in an unlined motel dining room, the groups were held at specially designed facilities, with viewing rooms and video and audio facilities. The first author moderated six of the nine groups, and the first author moderated three.

45.6% (DMEF) and 46.5% (PC). We can thus reject the hypothesis that the DMEF and PC formats, by reducing respondent dissonance, lead to higher response rates than DC formats. This result can be contrasted with the marginally higher response rates for the PC format than the DC format reported by Ready et al (1995). Overall, we conclude that alternate elicitation formats such as the PC and DMEF approaches are unlikely to lead to higher response rates in CV studies.

But is it possible that these alternate approaches may lead to *lower* response rates than the conventional DC approach? Ready et al's (1995) conclusion that respondents have less incentive to think hard in PC studies is consistent with such a hypothesis. To test this possibility, logit analysis was used to analyse factors influencing the probability of a valid response. This analysis indicated that neither of the two elicitation format dummies were statistically significant at the 95% significance level. The only significant treatment variable was the state of residence. People living in SA were far less likely to respond than those living in WA, the respective response rates being 38.8% and 53.7%.

6.2 CV Results

For the purpose of comparing the results for the DC, PC and DMEF approaches, a number of alternative dependent variables were created, differing in the way levy protesters are treated and consistency checks applied to the data. These alternate dependent variables are defined in Table 1 below. DC2 and DC6 and DMEF2 correspond to conventional practice of deleting all levy protesters from the data set, and DC3 and DMEF3 involve the alternative recoding approach outlined above. DC8 and DMEF4 also employ positive or 'yes' recoding, but instead of treating non-recoded protesters as 'no' respondents, they are omitted from the data set. The remaining definitions correspond to the raw data, where no action is taken with respect to protesters, or the raw data subject to consistency checks involving the debrief question.

Table 1: Summary of Alternate Dependent Variables

Dependent Variable	Description
DC1	Raw data on DC format.
DC2	DC1 with those who objected to the levy being omitted from the data set.
DC3	DC1 with the majority of levy protesters being recoded as 'yes' responses (using the second follow-up question, based on Question 4 of the DMFF).
DC5	DC1 with removal of theoretically inconsistent responses to the CV question and the CV debrief question (eg. respondents indicating that they support the pipe and levy proposal in the CV question but indicating that they cannot afford payment in the debrief).
DC6	DC5 with those who objected to the levy being omitted from the data set.

DC7	DC5 with the majority of levy protesters being recoded as 'yes' responses (using the second follow-up question, based on Question 4 of the DMEF).
DC8	as for DC7 but remaining levy protests omitted from the data set.
PC1	PC responses 'strongly support proposal', 'support proposal' and 'slightly support proposal' being coded as 'yes', and 'strongly oppose proposal', 'oppose proposal' and 'slightly oppose proposal' coded as 'no'.
PC2	PC1 with removal of inconsistent responses to CV and CV debrief questions.
DMEF1	Raw data for DMEF, with response 1 coded 'yes', 0 otherwise.
DMEF2	DMEF1, with levy protesters (response 4) being omitted from the data set.
DMEF3	DMEF1 with majority of category 4 responses recoded as category 1 ('yes')
DMEF4	as for DMEF3 but remaining levy protesters omitted from the data set.

The way in which the values taken by each of these dependent variables change across bid values is shown in Table 2.

Table 2: Percentage 'Yes' Responses by Bid Value and Response Variable

	Bid				Range	N
	\$5	\$20	\$50	\$100		
DC1 (raw)	80.4	67.1	66.3	57.8	22.6	375
DC2 (protest)	88.2	82.1	76.6	78.7	9.5	312
DC3 (positive recode)	84.0	78.9	72.1	68.4	15.6	357
DC5 (consistency)	75.6	57.8	48.2	39.7	35.9	266
DC6 (consistency & protest)	84.3	75.5	61.4	62.8	21.5	206
DC7 (consistency & positive recode)	79.2	72.4	56.6	53.2	26.0	250
DC8(consist, positive recode, protest)	84.7	77.8	63.8	67.3	17.4	222
PC1 (raw)	75.0	81.3	78.9	68.6	6.4	379
PC2 (consistency)	64.6	69.2	60.4	40.0	24.6	215
DMEF1 (raw)	57.9	44.8	23.2	16.7	41.2	373
DMEF2 (protest)	68.8	59.1	31.4	21.9	46.9	289
DMEF3 (positive recode)	69.9	55.4	36.4	26.1	43.8	356
DMEF4 (positive recode & protest)	72.2	63.0	40.0	29.6	42.6	324

A first observation is that the raw DC data suggests a median WTP in excess of \$100, and beyond the range of bid values included within the questionnaire. When considered in relation to the gun levy, which has attracted a great deal of media attention, and is perceived by the majority of Australians to be an extremely important cause, this may be considered high.

Consistent with high estimates of WTP is low price sensitivity. It is noted that with DC1, the proportion of respondents supporting the proposal drops by 23% when the bid value increases from \$5 to \$100. This figures can again be compared with that of

other Australian CV studies. Interestingly, this range is greater than that of the Resource Assessment Commission's CV study into mining in Kakadu National Park. Whilst 65.9% of respondents presented with a bid value of \$100 at the first stage of the double-bounded study gave 'yes' responses, the proportion was only 78.3% at the lowest initial bid value of \$5 (major impact scenario, national sample). The equivalent range for the minor impact scenario was 53.6%-64.9%, a difference of slightly over 10% (Imber, Stevenson, and Wilks, 1991).

A second observation from Table 2 is that treating levy protesters as outliers reduces the range of 'yes' probabilities and considerably increases mean WTP, which in DC2 (and DC6) is well in excess of \$100.

As expected, the use of positive recodes in DC3 produces 'yes' probabilities in excess of that of DC1, but less than that of DC2. This occurs because DC2 involves the removal of all levy related protest 'no' responses, whereas DC3 involves recoding some of these as 'yes' responses. Note that 'yes' probabilities are monotone decreasing with price in the case of DC3, but not DC2, where \$50 and \$100 appear to bite equally. This may in part be a reflection of the smaller sample size in DC2 compared with DC1 and DC3. Use of positive recoding rather than treating all protests as outliers improves the sample size by 14%.

Now consider the effect of removing all cases involving theoretically inconsistent responses to the DC question and the follow-up debrief question. Perhaps the most striking finding with DC5 is the fall of 29% in sample size compared to DC1. Results not shown indicate that the majority of these deletions involve individuals who responded 'yes' to the CV question, but then circled either the second, third or fourth response option in the debrief (ie. they said 'yes' and then went on to give explanations that correspond to 'no' responses). Several possible explanations for this phenomenon are apparent.

First, the debrief may be picking up erroneous DC responses, possibly associated with strategic or hypothetical biases, or heuristics employed to reduce dissonance. As noted earlier, the use of heuristics as a response to ambivalence has been emphasised by Ready et al (1995) and Opaluch and Segersen (1989). It is interesting to observe that the DMEF-based DC debrief used in our study is answered by all respondents to the CV question, in contrast with the more common approach of providing separate debrief questions for 'yes' and 'no' responses. An advantage of our approach is that it permits important inconsistencies between CV responses and self-reported respondent motivations to be identified.

It is also possible that some respondents interpreted the CV question as seeking their view on the pipe only, independent of the costs described to them. Although, we cannot establish the degree to which this has occurred, we note that the wording of the CV question itself specifically referred to payment. Indeed, we consider the wording of our CV question to be consistent with standard convention of referring to payment within the CV question but not the actual response options¹¹.

¹¹ The style of CV application that we have taken as standard convention is that used by Natural Resource Damage Assessment Inc in the United States for the estimation of environmental damages.

A second possible explanation is that some individuals who indicate that they oppose the levy, cannot afford it, or do not think the Coorong is worth \$x to them, are in fact willing to pay the levy, if they are confined to give a 'take-it-or-leave-it' choice. The DMEF may offer an escape from the hard realities of the trade-offs described.

Future research might address this intriguing result, which may have implications for how CV questions and associated debriefs are worded in the future. Two types of errors or biases need to be considered and, ultimately, traded off. The first stems from respondents who give 'yes' responses in the DC question but are not prepared to pay the bid amount. Heuristics associated with dissonance could cause this result in DC studies. The second stems from respondents who indicate what amounts to 'no' responses when presented with dissonance-minimising elicitation formats, but who would honestly answer 'yes' if confined to a simple 'yes/no' response. One reason for trying to minimise the former at the possible expense of the latter is that it is more conservative with respect to WTP estimates. In this respect, dissonance-minimised WTP estimates may serve as a lower bound, and potentially more accurate estimate of, actual WTP.

What is clear, however, is that the application of the consistency check referred to above dramatically increases price sensitivity. Whilst 'yes' probabilities are only 5% lower at \$5, they are 18% lower at the maximum bid value. The range of 'yes' probabilities increases from 22.6% with DC1 to 35.9% with DC5. For many commentators, this would constitute an improvement.

For DC6, it is again noted that treating protest 'no' responses as outliers dramatically increases the conditional 'yes' probabilities, and hence the likely location of the non-parametrically estimated median. Indeed, median WTP appears to lie in the interval [\$20-\$50] with DC5, but well in excess of \$100 with DC6. This demonstrates the high sensitivity of estimates of median (and mean) WTP to the way in which protest 'no' responses are treated. Lindsey (1994) and Blamey (1996b) have questioned the appropriateness of treating protest 'no' responses as outliers in CV studies employing a political goods market model. Note that whilst treating all protest 'no' responses as outliers increases by 23 percent the number of respondents supporting the proposal at the maximum bid value, the positive recode approach reduces this to 13.5%.

DC7 and DC8 both utilise the protest recoding approach, but differ in the way non-recoded protesters are handled. Whilst DC7 treats protesters who do not qualify for 'yes' recoding as 'no' responses, DC8 omits them from the data set, in the same way as in DC2 and DC6. Both of these approaches appear to produce considerably higher 'yes' percentages at the upper bid values, than DC5.

Now consider how the DC results compare with the PC results. In the absence of the above mentioned consistency checks, the PC results demonstrate very little price sensitivity, with the percentage of 'yes' responses increasing from \$5 to \$20, and \$5 to \$50, and only falling for the highest bid value of \$100. We find it hard to attach much credence to these results, preferring the results for DC1 to those of PC1. However,

under the Superfund legislation. For an example, see Carson, Hanemann, Kopp, Krosnick, Mitchell, Presser, Ruud and Smith (1994).

when the consistency checks are applied (PC2) a stronger sensitivity to price is recorded. Compared to DC5, PC2 provides lower estimates of the percentage of 'yes' responses at \$5 and higher estimates at \$50 and \$100. The range of 'yes' percentages remains considerably higher for PC2 than DC5.

The DMEF produces the highest price sensitivity and lowest estimates of WTP of the three elicitation formats under trial, with all 4 variants producing a range of acceptance probabilities in excess of 40%. Only 16.7% of DMEF1 respondents supported the pipe at \$100, far lower than the equivalent figures for any of the DC and PC formats. The location of the median is again sensitive to assumptions involving the treatment of protest respondents, with the median lying in the interval [\$5-\$20] in the case of DMEF1, and [\$20-\$50] in the other three cases.

We note that these results are consistent with the view that allowing respondents to express the source of their ambivalence leads to cleaner, less noisy data. The DMEF not only produces greater price sensitivity, and lower estimates of median WTP, but higher effective sample sizes. The reason for the latter is twofold. First, there is no need to subject responses to the consistency checks used in DC studies that can be costly in terms of sample size, and second, the follow-up question for levy protesters permits the majority of these individuals to be treated as valid 'yes' respondents rather than outliers. The DMEF with positive recoding (DMEF3) produces an effective sample size that is 73% higher than the common DC approach of omitting levy protesters from the data set (DC2).

Whilst the above observations are highly illustrative, they need to be backed up with formal statistical tests before firm conclusions can be drawn. Only in this way can it confidently be concluded that many of the differences reported above are truly significant.

6.3 Sociodemographic Models

Statistically significant coefficients on socio-demographic variables such as education and income were only attainable in a few, simple, models. A full socio-demographic model for the raw DC data, for example, produced the following results, where AGE is age in years, SEX = 1 for males and 0 for females, INCOME is gross income in dollars, and TERTIARY = 1 if respondent has a tertiary degree, 0 otherwise (standard errors reported in brackets):

$$\begin{aligned} \log[\text{pr}(\text{yes})/(1-\text{pr}(\text{yes}))] = & 1.8129^* - 0.0092 \text{ BID}^* - 0.0128 \text{ AGE} + 0.1854 \text{ SEX} \\ & (0.4800) \quad (0.0032) \quad (0.0076) \quad (0.2476) \\ & -0.0000034 \text{ INCOME} + 0.2194 \text{ TERTIARY} \\ & (0.0000038) \quad (0.3233) \end{aligned}$$

*=significant at 95% significance level.

(% correct pred=69.9; LogL (init)=400.569; LogL (final)=387.179; N=322).

Dropping AGE and SEX together, or AGE, SEX and TERTIARY together also fails to produce a significant coefficient for INCOME. Although a basic BID and

INCOME specification failed to give statistically significant coefficients for income in all seven DC definitions shown in Table 1, the same specification did provide significant coefficients in some DC and all DMEF results. For example, the following result is obtained for the raw DMEF data:

$$\log[\text{pr}(\text{yes})/(1-\text{pr}(\text{yes}))] = -0.0867 - 0.0218 \text{ BID}^* - 0.000012 \text{ INCOME}^*$$

(0.2291) (0.0038) (0.0000042)

*=significant at 99% significance level.

(% correct pred=69.9; LogL. (init)=444.57; LogL. (final)=394.94; N=336).

These results indicate highly significant bid and income coefficients. When levy protesters are recoded as 'yes' responses according to the definition of DMEF3, the results are instead as follows:

$$\log[\text{pr}(\text{yes})/(1-\text{pr}(\text{yes}))] = 0.2492 - 0.0198 \text{ BID}^* - 0.000017 \text{ INCOME}^*$$

(0.2352) (0.0035) (0.0000047)

*=significant at 99% significance level.

(% correct pred=69.0; LogL. (init)=447.75; LogL. (final)=394.48; N=323).

The finding that INCOME is significant in all BID-INCOME DMEF runs but none of the DC runs is encouraging for the DMEF. INCOME was also significant in the case of PC2. AGE and SEX were not significant in any models.

6.4 Attitudinal Models

In this section we consider in detail the results of attitudinal valuation functions. Preliminary analyses indicated that INCOME tended to lose its statistical significance when attitudinal independent variables were included, suggesting income may be correlated with measures of respondent attitudes. Hence, for the attitudinal models reported below, income is omitted.

Table 3 shows the independent variables used in the logistic valuation functions. The attitudes were selected on the basis of *a priori* focus group findings regarding important determinants of CV responses, and the results of multicollinearity checks. The highest bivariate attitude correlation was 0.25, and parameter estimates appeared stable when one or more of the attitudes was removed. Tables 4 and 5 show the parameter estimates with standard errors (in brackets) and probabilities, initial and final likelihood statistics, percentage correct predictions and the estimated median. Estimates of the median should be treated with caution, since, as noted above, in a number of cases it is estimated to lie outside the range of bid values contained in the survey.

Table 3: Variables Used in Logit Regressions

BID	bid amount in dollars (5, 20, 50, 100)
OPTION	=1 if expect to visit area in future; 0 otherwise
ENVSCORE	5-point scale indicating importance of continued government funding for environmental projects, relative to other areas of government expenditure (5=most important, 1=least important).
CAUSE	5-point Likert scale measuring agreement with the statement "Payment should be restricted to those who caused the problem" (1=Strongly Agree).
DTRUST	5-point Likert scale measuring agreement with the statement "I do not trust government to make the levy once-off" (1=Strongly Agree)

Table 4: Logit Coefficients For Dichotomous-Choice Models

	Model (defined by dependent variable)						
	DC1	DC2	DC3	DC4	DC5	DC7	DC8
CONSTAN	2.1854	1.8053	2.0469	2.3733	2.1477	2.1584	1.8642
T	(0.6114)	(0.7637)	(0.6650)	(0.7099)	(0.8452)	(0.7429)	(0.8282)
	0.0004	0.0181	0.0021	0.0008	0.0111	0.0037	0.0244
BID	-0.0120	-0.0108	-0.0132	-0.0178	-0.0168	-0.0182	-0.0155
	(0.0034)	(0.0043)	(0.0037)	(0.0042)	(0.0050)	(0.0042)	(0.0048)
	0.0004	0.0124	0.0004	0.0000	0.0007	0.0000	0.0012
OPTION	0.5130	0.0686	0.3626	0.8337	0.4199	0.6140	0.2738
	(0.2601)	(0.3345)	(0.2830)	(0.3081)	(0.3750)	(0.3212)	(0.3649)
	0.0485	0.8375	0.2001	0.0068	0.2628	0.0559	0.4530
ENVSCORE	0.1113	0.2232	0.1597	0.2387	0.3670	0.2811	0.3397
	(0.0973)	(0.1282)	(0.1073)	(0.1179)	(0.1500)	(0.1256)	(0.1438)
	0.2528	0.0815	0.1366	0.0430	0.0144	0.0252	0.0182
CAUSE	-0.3898	-0.2007	-0.3089	-0.4879	-0.3525	-0.3780	-0.2436
	(0.1093)	(0.1411)	(0.1187)	(0.1319)	(0.1662)	(0.1373)	(0.1584)
	0.0004	0.1549	0.0093	0.0002	0.0339	0.0059	0.1242
DISTRUST	-0.0555	0.0512	0.0133	-0.2674	-0.1766	-0.1772	-0.1217
	(0.1151)	(0.1463)	(0.1247)	(0.1324)	(0.1608)	(0.1382)	(0.1582)
	0.6297	0.7264	0.9154	0.0434	0.2721	0.1996	0.4420
-2LogL (initial)	412.057	256.056	325.112	327.878	211.822	286.431	219.328
-2LogL (final)	374.990	246.359	324.995	268.038	187.598	246.711	199.533
% corr. pred	70.52	82.05	74.84	74.17	72.97	72.00	74.24
N	329	273	314	240	185	225	198
Estimated Median \$	113.9	189.7	136.1	62.0	111.5	87.2	121.7

Table 5: Logit Coefficients For Polychotomous and DMEF Models

	Model (defined by dependent variable)					
CONSTANT	2.8651 (0.7028) 0.0000	-3.2937 (0.9017) 0.0003	1.2766 (0.6481) 0.0489	1.7632 (0.7179) 0.0140	2.3987 (0.6543) 0.0002	2.4430 (0.6761) 0.0003
BID	-0.0036 (0.0038) 0.3401	-0.0102 (0.0051) 0.0458	-0.0183 (0.0041) 0.0000	-0.0196 (0.0045) 0.0000	-0.0171 (0.0038) 0.0000	-0.0165 (0.0039) 0.0000
OPTION	-0.0678 0.2943 0.8178	0.3591 (0.3769) 0.3408	0.6731 (0.2748) 0.0143	0.7291 (0.3078) 0.0179	0.7408 (0.2686) 0.0058	0.5977 (0.2791) 0.0322
ENVSCORE	0.2225 (0.1152) 0.0534	0.3718 (0.1416) 0.0086	0.3894 (0.1002) 0.0001	0.3573 (0.1138) 0.0017	0.2137 (0.0968) 0.0272	0.2109 (0.1005) 0.0358
CAUSE	-0.2953 (0.1201) 0.0139	-0.7431 (0.1691) 0.0000	-0.6835 (0.1310) 0.0000	-0.7254 (0.1425) 0.0000	-0.6185 0.1207 0.0000	-0.6186 0.1246 0.0000
DISTRUST	-0.2952 (0.1416) 0.0371	-0.4309 (0.1846) 0.0196	-0.1423 (0.1311) 0.2777	-0.0845 (0.1545) 0.5846	-0.2209 0.1305 0.0905	-0.1695 (0.1364) 0.2140
-2LogL (initial)	328.073	229.842	432.098	350.539	435.245	392.898
-2LogL (final)	308.846	178.416	328.846	260.321	342.968	314.433
% corr. pred.	75.99	74.27	75.15	76.28	70.70	70.18
N	304	171	326	253	314	285
Est. Median \$	399.5	83.9	2.7	34.9	39.4	53.8

The variable BID is statistically significant at the 95% level in all regressions, with the exception of that corresponding to PC1. This is consistent with the above observations relating to Table 2, and the concerns expressed by Ready et al (1995) regarding the degree to which PC respondents think hard about the information presented to them. As noted above, the PC format may read more like an attitude than a vote or other measure of behavioural intention. It is also possible that some respondents may indicate that they slightly support the proposal in order to convey that they support some of it, such as the idea of a pipe, but not all of it. Note that BID is only marginally significant when inconsistent responses to the PC and PC debrief questions are removed. OPTION is insignificant in both of the PC regressions, and ENVSCORE is only significant in the second. The median is estimated to be \$400 in the case of PC1, and \$84 in the case of PC2.

By contrast, BID is statistically significant in all DC and DMEF regressions, with the bid value varying between 0.0108 (DC2) and 0.0196 (DMEF2). Estimates of median WTP range from as little as \$3 in the DMEF1 case, to as much as \$400 with PC1. Although the higher values involve extrapolation, it is clear that estimates of WTP can

vary by a substantial amount, depending on the elicitation format used, and the way in which protest responses are handled. Treating all protesters as outliers tends to produce the highest estimates of WTP, these being 25-30% higher than those estimated using positive recoding only. Treating protest 'no' responses as valid, as suggested by Lindsay (1994), produces estimates of median WTP that are more than 40% lower than the common outlier approach.

OPTION is statistically significant in all DMEF regressions, but only three of the DC regressions. ENVSCORE is also significant in all DMEF results, and significant in those DC regressions where consistency checks have been applied. CAUSE is significant in five of the DC regressions and all DMEF results, while DISTRUST is significant in only the first version of the DC, and both the PC formats. The latter result is consistent with the view that the PC reflect unconstrained attitudes to a greater degree than the other two formats.

Now consider the relative influence of the variables in two of the models, DC5 and DMEF1. The increase in price required to have the same effect on the log(odds) as a one unit increase in OPTION is \$46 in DC5 and \$37 in DMEF1. This indicates that at the margin, an individual who expects to visit the Coorong and/or Tilley Swamp sometime in the future is willing to pay approximately \$40 more to protect the area as specified, than someone who does not. Similarly, the price-equivalent of a two unit increase in ENVSCORE, corresponding to a shift from mid to top rank for priority for continued government funding, is \$27 in DC5 and \$21 in DMEF1.

One would expect CAUSE and DISTRUST to have a bearing on dissonance and ambivalence experienced when answering the CV question. The significant, negative co-efficients estimated in all models for CAUSE demonstrates the important role that attribution of responsibility plays in the formulation of CV responses. Respondents who do not believe they should be responsible for dealing with the problems in the Upper South East are substantially less inclined to support the proposal. With respect to DISTRUST, the results are less clear-cut. For most of the models estimated the DTRUST co-efficients are not significant.

6.5 Comparison of Ambivalence Self-Reports

Whilst the above results are supportive of the two-stage DMEF approach, it has not yet been demonstrated that the DMEF creates less dissonance than the other two formats. Recall that each version of the questionnaire asked respondents to indicate whether they (i) found the CV question difficult to answer, (ii) felt uncomfortable answering it, and (iii) disliked it.

These dichotomous variables can each be regressed on treatment variables such as price, state and elicitation format to test the hypothesis that the DMEF results in the least ambivalence of the three formats. The model is thus estimated over the pooled data set, with dummies included to capture differences arising from the different formats. The following two dummy variables were created accordingly:

dmeff=1 if dmeff; 0 otherwise;
pc=1 if pc format; 0 otherwise; and

state=1 if respondent lives in South Australia; 0 if New South Wales.

PC and DMEF are included in both an additive form and in an interactive form with price. The interactive terms are included to provide a test of whether the ambivalence and/or dissonance created by price is higher with the DC and PC formats than the DMEF. The results for the "difficulty" and "discomfort" regressions are as follows:

$$\begin{aligned} \log\{\text{pr}(\text{difficult})/(1-\text{pr}(\text{difficult}))\} = & -0.4088^* + 0.0014 \text{ BID} - 0.0872 \text{ STATE} - 0.2651 \text{ PC} \\ & (0.1876) \quad (0.0029) \quad (0.1294) \quad (0.2472) \\ & -0.3920 \text{ DMEF} + 0.0056 \text{ BID*PC} + 0.0105 \text{ BID*DMEF}^* \\ & (0.2482) \quad (0.0042) \quad (0.0042) \end{aligned}$$

*=statistically significant at 95% significance level.

(% correct pred=60.3; LogL (init)=1403.254; LogL (final)=1381.351; N=1038).

$$\begin{aligned} \log\{\text{pr}(\text{discomfort})/(1-\text{pr}(\text{discomfort}))\} = & -0.7710 + 0.0040 \text{ BID} + 0.0648 \text{ STATE} - 0.1592 \text{ PC} \\ & (0.2011) \quad (0.0031) \quad (0.1420) \quad (0.2638) \\ & -0.7726 \text{ DMEF}^* + 0.0006 \text{ BID*PC} + 0.0104 \text{ BID*DMEF}^* \\ & (0.2805) \quad (0.0044) \quad (0.0046) \end{aligned}$$

*=statistically significant at 95% significance level.

(% correct pred=66.5; LogL (init)=1215.036; LogL (final)=1190.358; N=953).

The elicitation format has a significant direct additive effect only in the case of the discomfort experienced by DMEF respondents. The negative co-efficient implies that DMEF respondents experience significantly less discomfort. However, the multiplicative impact of elicitation format and bid value appears to be significant in both the difficulty and discomfort models. The positive co-efficients on these co-efficient estimates implies that both the DMEF format creates more problems for respondents as the bid value rises. A similar regression run for the 'dislike' response variable produced no significant coefficients. It appears that this so far preliminary analysis gives mixed support for the hypothesis that the use of the DMEF format causes less respondent dissonance.

7. Conclusions

Criticisms of Australian applications of the CV method have focussed on the perceived over-estimation of environmental values and the lack of price-responsiveness (Blamey, Common and Quiggin, 1995, Brunton, 1991, Moran, 1991). The DMEF has been shown in the case study reported here to provide lower estimates and a more responsive logit function when compared to the DC format that is now standard CV practice. The analysis presented provides prima facie evidence that the DMEF offers a practical way around the problems created by the dissonance faced by respondents to

the DC format. The PC format suggested by Ready et al (1995) appears inferior to both the DC and DMEF questioning styles.

A feature of the DMEF is that it can be tailored to address specifically the main causes of respondent dissonance in a particular application. These causes need to be identified in preliminary focus groups. The two-stage DMEF described in this paper may be particularly helpful when preliminary focus grouping indicates that frequent ethical objections cannot be avoided simply through the use of alternative payment vehicles. The second stage of the DMEF can also be modified to produce a debrief question for use in DC studies. Responses to the debrief question can be used to identify inconsistent CV responses and motivations, as illustrated in this paper. This is particularly important as the appropriate treatment of protest votes has been shown here to have a major impact on the magnitude of the value estimates derived from CV studies.

The DMEF appears to be worthy of further investigation. Of particular importance would be tests of sensitivity to scope, with a view to checking that the DMEF does not suffer from the scoping insensitivities reported by Ready et al (1995) in relation to the PC format.

References

- Akerlof, G.A. and Dickens, W.T. (1982). "The economic consequences of cognitive dissonance". *American Economic Review* 72:305-19.
- Bennett, J.W., Blamey, R.K. and Morrison, M. (1997). *Non-Market Valuation Case Study*. Report of a consultancy for the Australian Bureau of Agricultural and Resource Economics. Environmental and Resource Economics, Gundaroo.
- Bennett, J.W. and Carter, M. (1993). "Prospects for Contingent Valuation: Lessons from the South-East Forests", *Australian Journal of Agricultural Economics*, 37(2): pp79-93.
- Blamey, R.K. (1996a). "Citizens, Consumers and Contingent Valuation: Clarification and the Expression of Citizen Values and Issue Opinions" in Adamowicz, V., Boxall, P., Luckert, M., Phillips, W. and White, W. (eds) *Forestry, Economics and the Environment*, CAB International, Wallingford, pp103-133.
- Blamey, R.K. (1996b). Contingent Valuation: A Question of Validity, paper presented to 40th Annual Conference of the Australian Agricultural and Resource Economics Society, University of Melbourne, 11-16 February.
- Blamey, R.K. (1996c). "The Activation of Environmental Norms", Urban Research Program Working Paper No. 53, Research School of Social Sciences, Australian National University.
- Blamey, R.K., Quiggin, J. and Common, M.S. (1995) "Respondents to Contingent Valuation Surveys: Consumers or Citizens?" *Australian Journal of Agricultural Economics*, 39(3): 263-288.

- Brunton, R. (1991). "Will play money drive out the real money? Contingent Valuation Surveys and Coronation Hill". *Environmental Background*, No. 2, Environmental Policy Unit, Institute of Public Affairs Ltd, Canberra.
- Carson, R., Hanemann, W.M., Kopp, R., Krosnick, J., Mitchell, R., Presser, S., Ruud, P. and Smith, V.K. (1994). *Prospective Interim Lost Use Value due to DDT and PCB Contamination in the Southern Californian Bight*. Natural Resource Damage Assessment Inc, La Jolla.
- Dillman, D.A. (1978). *Mail and Telephone Surveys: The Total Design Method*. Wiley-Interscience Publication, John Wiley and Sons, New York.
- Festinger, L. (1957). *A Theory of Cognitive Dissonance*, Stanford University Press, Stanford.
- Imber, D., Stevenson, G. and Wilks, L. (1991). *A Contingent Valuation Survey of the Kakadu Conservation Zone*, Resource Assessment Commission, Research Paper No.3, Canberra.
- Lindsey, G. (1994). "Market models, protest bids, and outliers in contingent valuation". *Journal of Water Resources Planning and Management* 120:121-29.
- 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* 24:45-55.
- Moran, A. (1991). *Valuing the Kakadu Conservation Zone: A Critique of the Resource Assessment Commission's Contingent Valuation Study*. Tasman Institute Occasional Paper No B8.
- Opaluch, J.J. and Segerson, K. (1989). "Rational roots of "irrational" behaviour: New theories of economic decision-making". *Northern Journal of Agricultural and Resource*: 9, -15.
- Ready, R.C., Whitehead, J. and Blomquist, G. (1995). "Contingent valuation when respondents are ambivalent". Invited paper for presentation to the Allied Social Science Association Annual Meeting, January 4 1995, New Orleans, Los Angeles.
- Upper South East Dryland Salinity and Flood Management Plan Steering Committee (1993). *Upper South East Dryland Salinity and Flood Management Plan: Draft Environmental Impact Statement-for Public Comment*. Natural Resources Council of South Australia, Adelaide.