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Estimating society's willingness to pay to maintain viable rural communities*

Jeff Bennett, Martin van Bueren and Stuart Whitten†

Declining populations in rural and regional areas have become a high political priority in Australia. Calls for measures to support rural communities have been prompted by substantial population declines in some country areas. In Europe and the USA, similar political pressures to halt population losses in rural and regional areas are also apparent; often as a component of the multifunctionality of agriculture. The question addressed in the present paper is whether or not the Australian tax-paying public would be willing to pay to avoid losses of people from rural and regional areas that may result from environmental protection measures. As an integral component of two recent non-market, environmental valuation exercises using Choice Modelling, the value of the benefits associated with the maintenance of rural populations has been estimated. The results demonstrate that a positive existence value is held primarily by urban dwellers for rural population levels.

1. Background

Australian rural society has undergone change as the agricultural sector has adjusted to changing economic conditions. Economic growth in non-farm sectors, declining terms of trade in the farm sector, technological improvement and the removal of commodity price support schemes have resulted in reduced rural populations and economic activity in rural communities. Services provided to rural areas (and rural populations) have become more concentrated in larger rural centres and the fortunes of many small towns have waned. Many rural inland regions have experienced

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† Jeff Bennett is Professor of Environmental Management in the Asia Pacific School of Economics and Government at Australian National University, Canberra, ACT, Australia. Martin van Bueren is Senior Economist at the Centre for International Economics, Canberra, ACT, Australia; and Stuart Whitten is an Economist with CSIRO Sustainable Ecosystems, Canberra, ACT, Australia.

net out-migration and this has generated falls in population (Australian Bureau of Statistics 2000a). In 1911, 48.5 per cent of Australia's population was located in small towns[1] and rural areas but by 1996, that figure had fallen to 18.2 per cent. The population living in towns of less than 1000 and in rural areas fell from 19.7 to 10.9 per cent between 1986 and 1996 (ABS 1998, 2000b).[2] That is not to say that there have not been pockets of rural population growth: mainly in some larger rural centres of greater than 20 000 people. In the Australian context, the rural communities facing the reality or the prospect of population decline are largely those that are dependent on primary production.

There is some evidence to suggest that the broader Australian society would like to avoid a continuation of this decline in the populations of rural areas, or at least, a halt to the withdrawal of key services to rural communities. Specific policies to support rural communities have been implemented. Governments have imposed 'community service obligations' on government business entities and now privatised utilities that include 'standard rates for letters, telephone calls, electricity and gas regardless of different costs of supply' (Freebairn 2003, p. 397). They have also convinced banks to install charters of social responsibility with promises of no further branch closures (Australian Bankers' Association 2002).

Whilst this evidence points to the existence of a public demand for maintaining the population of rural areas, it is not in a form that is useful to the design of specific policies. More detailed empirical evidence[3] of the extent of the demand expressed by urban people for maintaining rural populations would be useful in the policy process.[4] The aim of the present paper is

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[1] Small towns are defined by the (Australian Bureau of Statistics 2000a) as having populations below 3000 whilst large urban centres have greater than 20 000 people.

[2] Part of this apparent decline in population is a result of some centres growing beyond 1000 people as the number of centres with more than 1000 residents rose from 631 to 741 over this period. However, this growth is in part a result of the decline of smaller neighbouring centres.

[3] A call for estimates of nonenvironmental, non-market values was made by Portney (1994). What empirical evidence that did exist at that time was argued by Poe (1997) to be 'myopic and points to policies that address only one side of the agricultural environmental relationship' (p. 5). Subsequently, some attempts have been made to fill the void. For instance, Johnson and Desvouges (1997) estimated the value of employment effects of energy programmes, Morrison and Bennett (1999) performed a similar task in the context of wetland protection and Lockwood *et al*. (1994) estimated the willingness to pay to maintain logging activities in East Gippsland.

[4] Anderson (2000) makes the important point that 'the (policy) package would not include the very blunt instrument of general support to prices of farm products regardless of where in the country those goods are produced' (p. 491).

to make a contribution to that empirical evidence by detailing the results of two Australian studies that were aimed at estimating the non-marketed values associated with the outcomes of alternative natural resource management strategies. Both studies employed the Choice Modelling (CM) technique for estimating non-market values albeit in different settings. The first study estimated values associated with wetland management strategies for the Murrumbidgee River Floodplain, situated in southern inland New South Wales. In the present study, all wetland conservation strategies were assumed to involve reductions in the population of farmers over a period of 15 years relative to a status quo scenario. Therefore, the respondents to the CM questionnaire were confronted with trade-off decisions between enhanced environmental conservation outcomes versus lower farmer population levels. The second study investigated values associated with the implementation of alternative natural resource management strategies across the whole nation and, specifically, in two agricultural regions: the Great Southern in south-west Western Australia and the Fitzroy River Basin in Central Queensland. The present study was different to the first in that rural populations were assumed to either increase or decrease depending on the type of management strategy introduced. Therefore, some choice alternatives presented to the CM respondents in the present case study involved higher population levels and better environmental outcomes.

To summarise, the two studies offer empirical evidence on the extent of community willingness to pay for maintaining the populations of rural communities in the context of environmental management programmes.[5]

The present paper is structured as follows. In the next section, the issue of maintaining rural populations is placed in the context of the multifunctionality of agriculture. A brief outline of the CM technique is provided in Section 3. In Section 4, the results of the Murrumbidgee River Floodplain study are detailed. This is followed by Section 5, which contains the results of the national/regional study. Some conclusions are drawn in the final section.

2. Multifunctionality in agriculture

Anderson (2000) has noted that agricultural industries are sometimes seen to be sources of not only marketed goods and services but also non-marketed outputs including food security, environmental protection, viable rural communities, and heritage values. The provision of services beyond the primary role of food and fibre production is often referred to as

[5] As one referee correctly pointed out, population levels in rural communities are impacted by a much wider range of variables than environmental protection measures.

mulitfunctionality. The concept of multifunctionality has been accepted by the World Trade Organization in part through its establishment of the so-called Green Box measures for agriculture. Subsidies classified as Green Box are exempt from negotiated agreements that aim to reduce the level of farm support. Consequently, price support measures and subsidies on inputs have begun to give way to policies with a focus on supporting non-marketed aspects of agriculture.[6]

Anderson (2000) suggests that rural depopulation is of concern to some societies. In particular he advances the nostalgic attraction that rural villages and landscapes have for urban dwellers who hold an option value for future visits to the countryside and a sense of military insecurity arising from de-population. In addition to these option and security values, urban dwellers may also enjoy cultural/bequest values from the lifestyle and history associated with country communities. Latacz-Lohmann and Hodge (2003) argue that, in the European context, trade liberalisation may result in widespread abandonment and marginalisation of agriculture so that the positive environmental spillovers from agriculture in those areas would be diminished. This calls for policies that address the negative externalities of trade liberalisation, while not limiting the liberalisation process.

It is instructive to compare the different approaches to multifunctionality taken in Europe and the USA. In Europe, agriculture is seen primarily as producing positive non-market environmental spillovers such as biodiversity protection, aesthetic benefits, and public open space, so long as the style of production remains 'traditional'. The maintenance of traditional farming practices is perceived to be a necessary prerequisite for ensuring the supply of environmental and heritage values. The alternative to traditional farming systems might involve the reallocation of agricultural land to urban development or high-intensity forms of agriculture, both of which may threaten environmental and heritage values. Hence, European countries have implemented a number of policies that pay farmers to maintain traditional, low intensity farming practices. The stated emphasis is on preserving environmental values, the culture of country communities, and the non-use benefits of knowing that this way of life still exists. For example,

[6] However, the shift towards subsidies that are decoupled from production is relatively modest. The Organisation for Economic Cooperation and Development (OECD) estimates that 77 per cent of agricultural subsidies, by value, distort production (OECD 2002). Also, it is a moot point whether or not policies designed to maintain multifunctionality are in fact merely support measures for agricultural production. Anderson (2000) judges that 'some structured subsidies to address the issue of declining service provision in remote rural areas are WTO-consistent under the 'Green-Box' of the URAA (paragraph 2(g) of Annex 2) and the WTO's Agreement on Subsidies and Countervailing Measures (article 8.2(b))'.

under the Common Agricultural Policy (CAP), production support has been reallocated to measures designed to protect the environment (Latacz-Lohmann and Hodge 2003). In the UK, the Countryside Stewardship Scheme is used as a mechanism for enhancing countryside amenity values, whilst the Environmentally Sensitive Areas scheme is designed to protect existing natural areas.

In contrast, in the USA, greater policy focus is placed on managing the negative non-marketed environmental impacts arising from agriculture. Indeed, farmers and intensive agricultural practices are perceived to be part of the problem rather than the solution to reversing declines in environmental quality.[7] For example, farmers are supported financially to engage in water pollution control measures rather than to produce agricultural commodities (McCann 2001; Sumner 2003). Under the Conservation Reserve Program and other measures such as the Sod-buster and Swamp-Buster programmes, farmers have been paid to set aside land from production in order to secure environmental gain. There is also a demand in the USA for protection of open space, habitat and aesthetic values (often termed viewsheds), in both peri-urban and rural areas. This is the main driver for the establishment of conservation covenants in the USA. Therefore, it is apparent that in the USA, the goal of pursuing multifunctionality could involve tradeoffs between the environment, agricultural production, and rural population levels (Poe 1997).

In Australia, the policy focus has also shifted. Policies that sought to support farmers through price support and centralised marketing schemes have been phased out. Natural resource management (NRM) has become a key phrase in agricultural policy making. Programmes such as Landcare, the Natural Heritage Trust and the National Action Plan for Salinity and Water Quality involve payments being made to landholders adopting measures to reduce the negative non-marketed environmental impacts of agriculture (Agriculture Forestry and Fisheries 2002). The view of agriculture is, therefore, akin to that taken in the USA: some forms of agricultural practices are detrimental to the environment. For instance, the reduction or withdrawal of damaging agricultural practices encourages biodiversity protection. This is in contrast with the European situation where the continuation of traditional management practices is accepted as being complementary to the goal of maintaining species diversity.

[7] That is not to say that in Europe, farmers are seen as environmentally benign. Indeed, nutrient run-off and pesticide pollution from intensive livestock production are major environmental issues. However, the emphasis in Europe remains on the support of traditional practices that are viewed as being less environmentally damaging than modern intensive agriculture.

Under both the USA and Australian approaches there is the potential for rural populations to be reduced if environmental policies are pursued vigorously without due regard to the trade-offs. For example, taking land out of agricultural production and placing it in conservation reserves or revegetating the land with native species may cause reduced populations in some rural areas even where such changes in land use are required to ensure that agricultural production is sustainable in the long term.[8] The challenge for policy makers is to understand how the Australian public values the impacts of alternative outcomes. These values must be quantified using non-market valuation techniques because they are not evidenced in markets. The specific technique used in the present paper is CM.[9]

3. Choice modelling

CM was developed initially in the marketing and transport economics literature. In essence, the technique involves respondents to a questionnaire being asked to choose, in a sequence of such questions, their preferred alternatives from various sets of hypothetical options. The options are described using a common set of attributes that will include non-marketed, environmental characteristics as well as a monetary cost. The trade-offs that respondents make in these choice questions allow for the estimation of the non-market values of changing from one resource allocation scenario to another. The method is also capable of breaking down such values into their component parts as specified by Lancastrian demand theory (Lancaster 1966). That is, CM is able to yield estimates of the marginal values of the attributes that comprise the change. For instance, consider a change in resource management that will alter the number of endangered species present in a region, the aesthetic appearance of the countryside and the recreational activities that are possible. CM allows the aggregate value of the change to be disassembled into its component values (commonly referred to as attribute implicit prices). Hence, with the application of CM it is possible to estimate, for instance, the value to respondents of reintroducing

[8] This is not to argue that there is an inevitable trade-off between agricultural production and environmental protection. In some cases, environmental protection measures may be associated with increased agricultural production.

[9] Alternatively known in the published literature as Choice Experiments or Contingent Choice. See Bennett and Blamey (2001) for an exposition of the CM technique in the context of estimating non-market environmental values. Louviere *et al.* (2000) provide a comprehensive conceptual treatment of the technique and Adamowicz (2004) provides a review of applications.

an endangered species or improving water quality so that rivers become swimmable instead of only boatable.[10]

In brief, CM allows the estimation of values associated with NRM changes, including the estimation of the values of the attributes of change. The impacts of changes on those attributes do not have to be positive. Hence, while changing management strategies may improve species protection in a region, it may also lead to lower population levels in rural communities. The overall value of the change is, therefore, comprised of positive and negative impacts.

The studies reported in the next two sections involved presenting to respondents CM questionnaires depicting hypothetical alternative NRM strategies that yielded both positive environmental outcomes and, in some cases, negative impacts on the population of rural communities. Specifically, respondents were asked to make choices between alternative NRM strategies and the status quo. The willingness to make a monetary trade-off between the options was assessed through the inclusion of a payment associated with the alternative strategies. By making choices between the options presented, respondents demonstrated their willingness to pay for alternative NRM scenarios and for unit changes in the attributes used to describe the alternatives. Given that one of those attributes in both studies reflected the population levels of rural communities, the survey enabled the value that respondents place on this non-market good to be estimated.

4. Value of retaining farm populations in the Murrumbidgee River Floodplain

4.1 Research objective

The primary purpose of the Murrumbidgee River Floodplain (MRF) CM exercise was to estimate values associated with alternative wetland management strategies in the region.[11] The alternative strategies involved potential reallocations of resources from agricultural uses to conservation. The strategies included the reallocation of irrigation water to wetlands and the requirement that farmers preserve wetlands in their natural state rather than grazing them for agricultural production or modifying them to act as permanent water storages. Respondents were presented with three alternatives

[10] The validity of value estimates derived from CM applications has been successfully tested using tests of convergent validity and empirical consistency with a priori expectations (Bennett and Adamowicz 2001).

[11] Full details of the research are provided in Whitten and Bennett (2004).

Table 1 Attributes: MRF study

Attribute	Variable name	Unit of measurement	Levels used in questionnaire			
			Status quo	Level 1	Level 2	Level 3
Area of healthy wetlands	Wetlands	Hectares	2500	5000	7500	12 500
Population of water and woodland birds	Birds	Percentage of pre 1800 bird numbers	40	60	70	80
Population of native fish	Fish	Percentage of pre 1800 fish numbers	20	30	40	60
Social impact	Farmers leaving	Number	0	5	10	15
Levy on income tax	Cost	One-off dollar cost per household in 2000–01†	0	20	50	200

† Australian dollars. MRF, Murrumbidgee River Floodplain.

per choice question: a status quo management strategy, and two different wetland protection strategies that required respondents to pay a one-off environmental levy in return for environmental improvement that would be realised within a period of 15 years.

Respondents were told that the wetland protection strategies (the alternatives) would generate positive environmental impacts including increases to the area of healthy wetlands, the number of water and woodland birds and the number of native fish. These three impacts were used as attributes to describe the alternatives in the CM application (see table 1). The alternatives were differentiated from one another by the levels taken by each attribute. Three possible levels were specified for each attribute and an orthogonal experimental design was used to select combinations of the levels.[12] Respondents were informed that the protection policies may have a negative impact on farm viability meaning that some farmers could leave their farms and the region over the next 15 years. Respondents were also told that there were about 70 farmers who own wetlands on the floodplain and 2500 who irrigate from the river. The impact on the farmer population was assumed to be unidimensional; that is, no allowance was made for the possibility of increased farmer numbers under any of the conservation alternatives. Information set out in the CM questionnaire specified that,

[12] Orthogonality is required to ensure that there are no correlations between the attributes so that the separate importance of all the attributes in driving respondents' choices can be determined in the choice modelling process.

Table 2 Variable definitions: MRF study

Variable	Definition
Farmers leaving	Number of farmers who sell their farm and leave the region as a result of management changes
Cost	Size of one-off levy on income through income tax
Wetlands	Area of healthy wetlands (hectares)
Birds	Number of native birds as a percentage of pre 1800 numbers
Fish	Number of native fish as a percentage of pre 1800 numbers
ASC1	Alternative specific constant equals 1 for options 2 and 3, else zero
ASC2	Alternative specific constant equals 1 for option 2, else zero
Age	Age of respondent (continuous)
Adelaide	Dummy variable equals 1 for Adelaide, else zero
Griffith	Dummy variable equals 1 for Griffith, else zero
Intended visit	Dummy variable equals 1 for respondents intending to visit the region, else zero
Income	Log of respondent income (continuous)
Tert	Dummy variable equals 1 for tertiary education, else zero
NDT	Dummy variable equals 1 for respondents indicating they do not trust government to make levy one-off or protesting against the payment vehicle on other grounds, else zero
Levy	Dummy variable equals 1 where respondent indicated levy is not a good idea, else zero
IV	Inclusive value representing the expected utility from alternatives in the lower level of the nest

MRF, Murrumbidgee River Floodplain.

while compensation would be paid to farmers and irrigators for any costs associated with the changes to wetland management, some farmers could nevertheless decide to sell their properties and leave the region. Therefore, one of the attributes used in the questionnaire to describe the outcomes of the alternative management strategies was defined as the number of farmers leaving the region.[13] A fifth attribute, a levy to pay for the implementation of the alternative strategies, was included to provide the monetary numeraire. All variables are defined in table 2 and one of the choice sets developed for the present study is contained in Appendix 1.

[13] The use of absolute numbers as the metric for the farmers leaving attribute was the result of focus group testing that showed the alternative metric, the percentage change in the population of farmers, was too difficult for most respondents to comprehend. Hence, respondents seeking to understand the relative magnitude of the changes involved were required to make their own comparisons between total numbers of farmers and the numbers leaving from the choice alternatives and the current farmer numbers provided in the background information.

Table 3 Sample sizes and respondent characteristics: MRF study

Sample	Sample size	Undelivered[†]	Response[‡] (%)
Griffith	800	113	22.0
Wagga Wagga	800	96	33.0
Canberra	800	121	33.7
Adelaide	400	48	34.1
Total	2800	378	30.2

Sample characteristics	Canberra	Adelaide	Wagga Wagga	Griffith	Overall
Median age	48	52	49	52	50
Sex (% male)	61.8	60.2	55.8	66.2	60.9
Median annual househhold income ($A)	52 000–77 999	36 400–51 999	36 400–51 999	36 400–51 999	36 400–51 999
Proportion with tertiary education (%)	52.3	42.5	28.4	26.0	37.9

Population characteristics[§]	Canberra	Adelaide	Wagga Wagga	Griffith	Overall
Median age	39	43	39	41	42
Sex (% male)	48.7	47.8	48.5	50.3	48.9
Median annual h/hold income ($A)	48 699	30 971	32 850	33 163	34 322
Proportion with tertiary education (%)	23.9	10.4	8.9	6.1	11.0

[†] Undelivered surveys were those returned to sender. [‡] Response rate expressed as a percentage of delivered questionnaires. [§] For all samples, the sample is significantly different from the population age at the 95% level of confidence. Population means sourced from Australian Bureau of Statistics 1996 census. MRF, Murrumbidgee River Floodplain.

4.2 Survey mechanics and sample characteristics

In order to examine potential differences in values held by different populations, the respondent sample was drawn from four different geographical locations: Wagga Wagga; Griffith (major rural centres in the region); Canberra (a city upstream of the region); and Adelaide (a city downstream of the region).[14]

Table 3 contains a summary of sample statistics and shows how the samples compare to population means. An average response rate of 30.2 per cent was achieved across all samples. The median age of respondents was older than the population for the sample areas. Income and educational

[14] A modified form of the Dillman Total Design Method (Dillman 1978) was used in a mail-out/mail-back survey format.

qualifications were also generally higher than the wider population. Seventy-eight percent of respondents had visited the region. Only 10.3 per cent did not intend to visit in the future.[15]

4.3 Model specification

A multinomial logit model was used initially to describe the data relationships. The model of respondents' choices was estimated using pooled survey data from the four subsamples. The computer package LIMDEP was used to estimate the model parameters. The model was specified as follows:

Alternative 1 (status quo):

$$V_1 = \beta_1 * cost + \beta_2 * 1/wetlands + \beta_3 * 1/birds + \beta_4 * 1/fish + \beta_5 * farmers\ leaving \quad (1)$$

Alternative 2:

$$V_2 = \mathrm{ASC} + \beta_1 * cost + \beta_2 * 1/wetlands + \beta_3 * 1/birds + \beta_4 * 1/fish + \beta_5 * farmers\ leaving + \sum B_i * \mathrm{ASC} * (socioeconomic\ and\ attitudinal\ variables) \quad (2)$$

Alternative 3:

$$V_3 = \mathrm{ASC} + \beta_1 * cost + \beta_2 * 1/wetlands + \beta_3 * 1/birds + \beta_4 * 1/fish + \beta_5 * farmers\ leaving + \sum \beta_i * \mathrm{ASC} * (socioeconomic\ and\ attitudinal\ variables) \quad (3)$$

where V_j is the utility associated with alternative j and ASC is an alternative specific constant.[16] Note that the model structure uses a $1/x$ form for the wetlands, birds and fish attribute parameter coefficients. The $1/x$ form allows for diminishing marginal values for increases in attribute levels. The farmers leaving and cost attributes are assumed to be linear because of the inclusion of zero as the status quo level of those attributes.[17] The form of

[15] The response rate coupled with the sampling bias evident in the present study restrict the capacity to extrapolate the results of the survey to the entire population. However, they do not preclude the use of the survey results to draw conclusions about the preferences of a significant proportion of the population.

[16] Definitions of the variables used are provided in table 3.

[17] Note also that both the farmers leaving and the cost attributes take on levels that are relatively small in comparison to the total numbers involved and, therefore, could be expected not to show diminishing marginal utility. In contrast, the other attributes have levels that increase between 100 and 500 per cent across choice alternatives.

the model was established on the basis of theory and empirical testing for best fit.

Tests of this initial model indicated that the critical 'assumption of independence of irrelevant alternatives' (IIA) was violated.[18] Hence, a nested logit model was constructed. It was assumed that respondent behaviour is characterised by a sequence of choices. In the first instance (called the upper level in a decision tree analysis) respondents make a decision as to whether or not to support an environmental levy to fund wetland protection. Conditional on supporting a levy, the respondent moves to a second stage of the choice (called the lower level decision). This choice involves the selection of a particular protection strategy to support. The upper level decision was assumed to be influenced by a range of socioeconomic variables, attitudinal variables, and an inclusive value (IV) that represents the sum of expected utility from the choice alternatives nested below the support or non-support options. The lower level utility associated with each alternative was specified to be a function of the attributes. In this form, the nested multinomial logit model estimated is:

Upper-level choice:

$$V_{support} = ASC1 + \sum \beta_I * (\textit{socioeconomic and attitudinal variables}) + \alpha_1 * IV_{support} \tag{4}$$

$$V_{no\ support} = \alpha_2 * IV_{no\ support} \tag{5}$$

Lower-level choice:

$$V_j = ASC2 + \beta_1 * cost + \beta_2 * 1/wetlands + \beta_3 * 1/birds + \beta_4 * 1/fish + \beta_5 * farmers\ leaving \tag{6}$$

where $V_{support}$ is the utility associated with the levy options and $V_{no\ support}$ is the utility obtained from selecting the status quo option. An alternative specific constant (ASC1) was specified for the levy option, and the socioeconomic and attitudinal characteristics were incorporated into the model as interactions with this ASC. The coefficient on the inclusive value for the no support option (α_2) was fixed to one because only one alternative exists in the lower level nest for this option. V_j is the utility function for management strategy j, where the set of J strategies includes the status quo.

[18] IIA is a requirement for the statistical validity of multinomial logit models. In this application, testing of the best performing multinomial logit model showed IIA violations at the 1 and 5 per cent level.

Table 4 Model results: MRF study†

Model statistics	
N (choice sets)	3148
Log Likelihood	–2400.30
Adjusted rho-square (%)	33.58
Lower level choice equations	
ASC2	1.20E – 01**
Cost	–0.12E – 01**
1/wetlands	–7.83E + 03**
1/birds	–5.10E – 01**
1/fish	–3.28E – 01**
Farmers leaving	–0.70E – 01**
Upper level choice equations	
ASC1	5.81E + 00**
Income	–3.45E – 01**
Intended visit	–4.44E – 01**
Age	1.01E – 01**
Tertiary	–2.16E – 01*
NDT	1.55E + 00**
Levy	2.11E + 00**
Griffith	5.39E – 01**
Adelaide	–2.28E01
Inclusive value parameters	
IV no support	1.00
IV support	4.65E – 01**

* Denotes significance of parameter at the 10% level; ** denotes significance at the 5% level. † Model estimates are based on pooled data from the four respondent samples. ASC, alternative specific constant; IV, inclusive value; MRF, Murrumbidgee River Floodplain; NDT, dummy variable equals 1 for respondents indicating they do not trust government to make levy one-off or protesting against the payment vehicle on other grounds, else zero.

4.4 Results

The model was estimated using data pooled across all four respondent samples. The parameter estimates are contained in table 4. Most of the variables are significant at the five per cent level and the choice model has a reasonable goodness of fit: as indicated by an adjusted rho squared statistic of 34 per cent.

The implicit prices derived from the attribute coefficients estimated in the model are shown in table 5. These estimates are measures of the amount of money respondent households are willing to pay to trade-off for a unit improvement in an environmental attribute or the amount they are willing to pay to prevent a farmer leaving the MRF region. The equation for calculating implicit prices (IP) for the environmental attributes is:

$$IP = -(-\beta_{\text{non-monetary attribute}}/\text{attribute level}^2)/\beta_{\text{monetary attribute}} \qquad (7)$$

Table 5 Mean implicit price estimates for MRF attributes (95% confidence interval in parentheses)

Wetland area ($A per 1000 ha)	Number of native birds ($A per 1% change)	Number of native fish ($A per 1% change)	Farmers leaving ($A per farmer)
11.39 (9.05–13.71)	0.55 (0.35–0.79)	0.34 (0.24–0.45)	−5.73 (−7.35 to −4.21)

Implicit price estimates are average one-off household values for the specified unit change in attribute level that will be realised within the next 15 years. Values are in Australian dollars at year 2000 levels and are evaluated at the midpoint of the levels used in the survey.

and for farmers leaving the IP formula is:

$$IP = \beta_{\text{farmers leaving}}/\beta_{\text{monetary attribute}} \tag{8}$$

Note that the IP for farmers leaving is a constant, while that for wetland area, birds and fish varies according to the level of the attribute (because of the functional form). Survey respondents were willing to pay, on average, a one-off amount of $A5.73 per household to prevent a farmer leaving. The 95 per cent confidence interval for this estimate is $A4.21 to $A7.35.[19] There is no significant difference in willingness to pay to prevent farmers leaving across the four subsamples, indicating that values are invariant to the respondent's place of residence.

The implicit price estimates indicate the importance that the sampled respondents placed on maintaining rural populations. Marginal rates of substitution between the non-monetary attributes can also be calculated. For example, at the survey attribute level midpoint respondents are willing to trade-off: one more farmer leaving = 503 hectares of extra healthy wetlands = 10.4 per cent extra native bird numbers = 17.0 per cent extra native fish numbers.

5. Value of maintaining rural populations: a national and regional perspective

5.1 Research objective

The focus of the national/regional study was to produce value estimates for a set of generic attributes that characterise the environmental and social impacts of land and water degradation at national and regional levels.[20]

[19] Confidence intervals estimated using a random draw procedure of 200 draws, as specified by Krinsky and Robb (1986).

[20] Full details of the research are provided in van Bueren and Bennett (2004).

Table 6 Attributes: national and regional study

Variable name	Species	Aesthetics	Water	Social	Cost
Attribute	Species protection	Landscape aesthetics	Waterway health	Social impact	Environmental levy
Description	The number of species protected from extinction by 2020	The area of farmland repaired and bush protected by 2020	The length of waterways restored for fishing or swimming by 2020	The net loss of people from country towns each year over the next 20 years	The amount of money households would be required to pay each year
Unit of measurement	Number	Hectares	Kilometres	Number	$A
Attribute levels					
National questionnaire					
Status quo	50	4 m	1 000	15 000	0
Level 1	70	6 m	5 000	5 000	20
Level 2	140	8 m	8 000	10 000	50
Level 3	200	10 m	10 000	20 000	200
Great Southern questionnaire					
Status quo	25	250 000	100	1 500	0
Level 1	35	500 000	250	500	20
Level 2	70	750 000	500	1 200	50
Level 3	100	1 m	800	2 000	200
Fitzroy Basin questionnaire					
Status quo	5	250 000	100	1 200	0
Level 1	10	500 000	500	450	20
Level 2	15	750 000	800	1 000	50
Level 3	20	1 m	1 000	1 500	200

The present study addressed the need to develop a better understanding of community willingness to pay for various environmental and social improvements associated with natural resource policies.

The CM questionnaire was similar to the MRF study in that respondents were presented with three alternatives per choice question: a status quo alternative, and two levy options which funded environmental improvements relative to the status quo. Three attributes were used to specify the environmental changes: species, aesthetics and water (see table 6 for definitions). Social impacts of resource use changes were defined in terms of the net loss of people from country towns each year over the next 20 years. Both positive and negative outcomes were formulated. This takes account of the possibility that some types of environmental programmes could accelerate population loss while other strategies could stem out-migration flows. As with the MRF study, the changes in attribute levels were expressed in absolute terms rather than relative or percentage terms. This approach was selected because focus group participants who tested early versions of the questionnaire had difficulty comprehending percentage changes. Therefore, respondents were presented with concise information about existing population levels and environmental quality so that the absolute changes were placed in context.

For instance, respondents were informed that under the status quo alternative, 15 000 people would leave country towns each year over the next 20 years. However, under other alternatives, this number varied between 5000, 10 000 and 20 000.

5.2 Survey mechanics and sample characteristics

Three separate CM questionnaires were developed in order to examine how value estimates vary across different policy contexts. One questionnaire was designed to estimate respondents' values for resource use impacts at a national level, while the other two questionnaire versions each referred to one of two case study regions: the Great Southern region of Western Australia and the Fitzroy Basin region of Central Queensland. The same set of attributes was used in each questionnaire, although the levels of these attributes were different, reflecting the different characteristics of each region and the differences in scale between the regional context and the national context (see table 6). A sample choice set from the questionnaire is displayed in Appendix 2.[21]

The national version of the questionnaire was issued to a sample of households drawn at random from a telephone directory database of the Australian population. The region-specific versions of the questionnaire were issued to households from Albany and Rockhampton, which are major rural centres in the Great Southern and Fitzroy regions, respectively. Separate samples from each of these centres were also surveyed using the national questionnaire. The sample sizes, questionnaire response rates, and socioeconomic characteristics of the samples are summarised in table 7. Relatively low response rates (14–17 per cent) coupled with sample self-selection bias is evident and this necessitates some caveats on the extrapolation of results.[22]

[21] The complete Dillman Total Design Method was used in a mail-out/mail-back format.

[22] Because of the relatively low response rate, a follow-up telephone survey of non-respondents was undertaken. Predominantly, it was found that non-respondents had been too preoccupied with other matters to answer the original questionnaire. Put simply, the issue was not of sufficient importance to warrant their use of time to respond.

Table 7 Sample sizes and respondent characteristics: national and regional study

Questionnaire version	Sample	Sample size	Undelivered	Response rate†
National	National	3200	363	17%
National	Albany	1200	79	17%
National	Rockhampton	1200	101	14%
Great Southern	Albany	1200	171	16%
Fitzroy Basin	Rockhampton	1200	75	16%

Sample characteristics	National	Albany	Rockhampton
Median age group	45–54	45–54	45–54
Sex (% male)	62	57	57
Median annual household income ($A)	36 400–51 999	36 400–51 999	26 000–51 999
Proportion with tertiary degree (%)	35	23	26
Proportion supporting green groups‡(%)	24	27	13

Population characteristics§	National	Albany	Rockhampton
Median age	34	35	32
Sex (% male)	49	46	48
Median annual h/hold income (A$)	33 020	23 556	29 588
Proportion with tertiary degree (%)	14	6.2	6.7

† Response rate expressed as a percentage of delivered questionnaires. ‡ Respondents were asked whether they donated money to a conservation organisation or whether they were a member of such an organisation. § Population means sourced from Australian Bureau of Statistics 1996 census.

5.3 Model specification

A similar nested model structure was used to model respondents' choices of alternative options as that used for the MRF study.[23] As for that study, respondents were asked to choose between three alternatives. Two alternatives involved the payment of an environmental levy and the other alternative was a status quo option. The main differences in model structure (apart from differing socio-economic and attitudinal variables) are that all attributes enter the model linearly (as opposed to the $1/x$ functional form used for the MRF study) and there is no ASC specified for the lower level choice options.[24] Hence, the lower-level utility function for option j is:

[23] Modelling was undertaken using the computer package Limdep. Initially, a multinomial logit model was used to describe the data relationships. However, this specification was shown to result in breaches of the IIA assumption.

[24] Differences in functional form between different CM applications are not uncommon or unexpected. For instance, the different scales at which these two studies were conducted could contribute to the differences in estimated relationships. In the national/regional study, the absence of an ASC in the lower level choice indicates that unobserved factors determining choice behaviour were not significant.

Table 8 Variable definitions: national and regional study

Variable	Definition
Social	Viability of country communities, measured by the net annual loss of population from country towns
Species	Endangered species, measured by the number of species protected from extinction
Aesthetics	Landscape aesthetics, measured by the area of farmland repaired and bush protected (hectares)
Water	Waterway health, measured by the total length of waterways restored for fishing or swimming (kilometres)
Cost	The environmental levy, measured as an annual levy on household income
ASC	Alternative specific constant for the levy option, assigned a value of 1 for options B and C, else zero
Sex	Respondent's gender, assigned a value of 0 for females and 1 for males
Age	Respondent's age category, ranging from 1 to 6 (youngest to oldest)
Income	Respondent's before-tax household income category, ranging from 1 to 8 (lowest to highest)
Green	Dummy variable assigned a value of 1 for respondents who are members of, or donate to, an environmental organisation, else zero
Confuse	Dummy variable assigned a value of 1 for respondents who reported that they found the background information confusing else zero
IV	Inclusive value representing the expected utility from alternatives in the lower level of the nest

$$V_j = \beta_6 * \text{species} + \beta_7 * \text{aesthetics} + \beta_8 * \text{water} + \beta_9 * \text{social} + \beta_{10} * \text{cost} \quad (9)$$

where j is either the no support option or one of two alternative levy options. As in the MRF study, the upper-level utility associated with the support or non-support of a levy was assumed to be a function of socio-economic characteristics, attitudinal variables, and an inclusive value. Definitions for the variables are set out in table 8.

5.4 Results

The sampling strategy enabled five different models to be estimated, three of which used data from the national questionnaire, and two of which were derived from the results of the case study regional questionnaires. The parameter estimates for the models are summarised in table 9.

The model results were used to calculate implicit prices for each of the attributes, as reported in table 10. The results indicate that respondents perceive declining rural populations as a cost. In the national context, respondent households are willing to pay approximately 9c per annum over a 20-year time period for every 10 persons that are retained in country communities. Conversely, respondent households would be 9c worse off

Table 9 Model results: national and regional study

Model	1	2	3	4	5
Questionnaire	National	National	National	Great Southern	Fitzroy Basin
Sample	National	Albany	Rockhampton	Albany	Rockhampton
Model statistics					
N (choice sets)	2329	860	720	765	818
Log likelihood	–2196.05	–803.75	–645.29	–683.77	–802.10
Adjusted rho squared (%)	23	21	24	26	17
Lower level choice equation					
Species	5.49E – 03**	2.39E – 03*	2.89E – 03*	1.28E – 02**	4.07E – 03
Aesthetics	6.01E – 08**	1.84E – 07**	2.04E – 07**	1.52E – 06**	8.07E – 07**
Water	6.33E – 05**	4.55E – 05	7.54E – 05**	1.29E – 03**	1.04E – 03**
Social	–6.94E – 05**	–9.46E – 05**	–6.74E – 05**	–4.52E – 04**	–1.15E – 03**
Cost	–8.13E – 03**	–8.78E – 03**	–1.04E – 02**	–8.28E – 03**	–5.14E – 03**
Upper level choice equations					
ASC	–5.85E – 01**	–1.00E + 00**	2.40E + 00**	–2.02E + 00**	9.30E – 01**
Sex	–3.24E – 01**	5.01E – 01**	–5.96E – 01**	5.70E – 01**	–6.94E – 01**
Age	7.96E – 02**	–1.22E – 01**	–3.50E – 01**	9.03E – 02	–7.39E – 02
Income	2.62E – 01**	2.13E – 01**	1.72E – 01**	3.48E – 01**	1.15E – 01**
Green	2.47E – 01**	4.50E – 01**	6.49E – 01*	1.31E + 00**	2.02E – 01
Confuse	–7.07E – 01**	–6.77E – 01**	–1.05E + 00**	–7.74E – 01**	–6.37E – 01**
Inclusive value parameters					
IV no support	1	1	1	1	1
IV support	3.4E – 01**	3.9E – 01**	1.9E – 01	2.5E – 01*	2.3E – 01

* Denotes significance of parameter at the 10% level; ** denotes significance at the 5% level. ASC, alternative specific constant; IV, inclusive value.

Table 10 Mean implicit price estimates – national and regional attributes (95% confidence interval in parentheses)

	Species protection $A per species protected	Landscape aesthetics $A per 10 000 ha restored	Waterway health $A per 10 km restored	Social impact $A per 10 persons leaving
National questionnaire				
National sample	0.67	0.07	0.08	−0.09
	(0.47–0.88)	(0.02–0.14)	(0.04–0.16)	(−0.11 to –0.07)
Albany sample	0.27	0.21	0.00	−0.11
	(–0.03–0.51)	(0.14–0.29)	Not significant	(−0.14 to –0.08)
Rockhampton sample	0.28	0.20	0.07	−0.06
	(0.03–0.58)	(0.2–0.3)	(0.07–0.14)	(−0.06 to –0.08)
Great Southern questionnaire				
Albany sample	1.56	1.84	1.58	−0.56
	(0.77–2.33)	(1.06–2.79)	(0.92–2.40)	(−0.88 to –0.30)
Fitzroy questionnaire				
Rockhampton sample	0.00	1.57	2.02	−2.24
	Not significant	(0.41–3.25)	(0.94–3.55)	(−3.32 to –1.55)

each year for every 10 persons leaving rural areas. Therefore, a scenario where 10 000 people leave Australian rural areas over the next 20 years is estimated to reduce welfare by $A90 per respondent household each year. Alternatively, respondent households would be willing to pay this much to prevent the population decline.

The case study regional questionnaires yielded significantly higher implicit price estimates for rural population decline, with value estimates ranging between A$0.56 per annum for a 10 person decline in the Great Southern area to A$2.24 per annum for the Fitzroy region. Framing or scope effects could be responsible for these higher values. A framing effect is said to occur when respondents are willing to pay more for an attribute when it is assessed in a narrow context compared to when it is valued as part of a more inclusive package (Rolfe and Bennett 2001). It is possible that the case study questionnaire focused respondents' attention on a narrow set of impacts in a region they were familiar with, whilst the national questionnaire encouraged respondents to think more broadly. Alternatively, a scoping effect could be the dominant reason for the higher values. This refers to the situation where diminishing marginal values are observed for large changes in attribute levels, as is the case in the national questionnaire.

Another observation to be made from the case study results is that Rockhampton respondent households value changes in rural population more highly than Albany respondent households. This could reflect the different attitudes and socio-economic characteristics of these populations. For instance, it is apparent that a smaller proportion of Rockhampton respondent households donated money to environmental organisations than Albany households (table 7). This observation supports the finding that, relative to Albany respondents, Rockhampton respondents place more weight on social impacts than environmental impacts. In addition to attitudinal differences, the resource issues pertaining to the Great Southern and Fitzroy Basin regions are substantially different, and this is likely to contribute to the observed differences in value estimates. The value estimate differences do not arise in the national context where all three samples (Rockhampton, Albany and national) are willing to pay similar amounts to maintain rural populations.

6. Concluding remarks

The results of the two studies presented in the present paper demonstrate that both rural and urban Australians value the maintenance of rural population levels. This finding is robust in that it has been replicated for three diverse and geographically separated regions across a variety of rural, regional and urban populations, as well as in the national context.

It remains difficult to draw direct quantitative comparisons across the results of the two studies given their differing contexts. Most significantly, comparison is hindered by the different approaches used to define the impact of natural resource management policies on rural populations. In the MRF study, the social impact attribute was defined as the number of farmers leaving the region. In the second study, the number of people leaving country towns was the focus. These two attributes are not the same. The net migration of people from country towns is a 'catch all' measure for population change while 'farmers leaving' is open to interpretation. That is, the exit of farmers may also lead to the closure of businesses that support other members of the community.

Other factors that complicate the comparison include:

1. The two studies employed different frames and scopes. Framing and scope effects on value estimates were tested for in the second study.[25]
2. The MRF study used a one-off tax as a payment vehicle whilst the second study used an on-going, annual environmental levy collected over a 20-year period. Hence, the implicit prices derived from each study need to be adjusted to take account of the different payment frequency.
3. The response rates achieved in both surveys mean that the data collected may be subject to extrapolation problems associated with sample bias.

[25] The full results of these tests are given in van Bueren and Bennett (2004).

Despite these complications, it can be concluded that both studies reveal a consistency in value estimates between rural and urban respondent households. In the MRF study, there is no significant difference between the values estimated for rural population decline across the four subsamples, indicating that city dwellers hold similar values to rural households. A similar finding is evident for the national/regional study, at least for rural population changes framed in the national context. This is a result not expected a priori given that the types of values, related to use and non-use benefits, enjoyed by the two groups of people could be expected to be different.[26]

There are numerous policy implications that follow from these results. Not the least of these is some justification for the redirection of wealth from city to rural areas to ensure the maintenance of rural populations. Even given the caveats associated with sampling in both studies, the evidence shows that a significant proportion of Australian households are willing to pay to see rural population levels maintained. It is worth reinforcing the point that this should not be achieved through price intervention in commodity markets but rather through payments specifically designed to achieve the goal of maintaining rural communities.

A caveat to this conclusion is that the results do not necessarily justify the provision of support to rural areas in the absence of any environmental stewardship obligations. The context of the present study was one in which environmental damage control and rural populations were directly linked. Where no such link exists, the conclusion that declining rural populations warrant wealth redistribution cannot necessarily be drawn. In line with this contextual caveat, the converse of the support argument is that policies impacting rural and regional Australia need to be assessed carefully for any detrimental impact they may have on the populations of country communities. These impacts should be factored into the policy assessment process.

Another caveat on using the results for policy formulation is the potential for double counting of values in benefit cost assessments of possible policy interventions. This would occur if the values held by local people for their own communities are included. In responding to the questionnaire, local people may have traded off the value of rents created in the income generation process when answering the CM questionnaire. Hence, to include the locals' values for maintaining rural population in addition to producers' surplus estimates would be double counting. Separating income rents from other non-market values that may be bound up in the population

[26] There is insufficient evidence from the case study data to allow a more detailed assessment of what motivates people to form their preferences for maintaining rural populations. Whether people are looking for use benefits or non-use benefits from rural populations would need to be the subject of further study.

maintenance value estimates, such as option values and the non-marketed use values associated with life in a vibrant community, cannot be achieved from the results reported here. From a conservative perspective it is, therefore, prudent to leave aside the locals' value estimates in any examination of policy options that involve impacts on rural communities.

Not so for the values estimated for people living outside the local community. There is a much-reduced chance of double counting in that case, given the distant relationship between financial well-being in the cities and rural population levels. However, it is important to note that the values estimated in the present study are not merely payments for country people to keep doing what they are currently doing. Rather, the values relate to the populations of communities: which may be maintained through a range of economic activities other than traditional agriculture. It is in the assessment of such alternatives that the values reported here will be of particular use.

The value estimates reported must also be considered in a relative context. Not only are they contextual; that is, they relate to changes in rural populations resulting from environmental protection policies, but they must also be considered relative to the other environmental values associated with those policies. Direct comparisons between the attribute implicit prices are not straightforward because of the different units of measurement involved across attributes. However, potentially, rural population maintenance may be a lesser priority than environmental protection. The conditions pertaining in each policy circumstance will be important in determining the relative importance of the components of value. For example, the relative scarcity of some environmental features in a region (say an endangered species) may weigh more heavily than the loss of a relatively small number of farmers from the region.

Furthermore, the results reported relate to case studies in Australia involving Australian respondents. They indicate that the movement toward cross-compliance payments for multifunctionality outputs in agriculture observed in the USA and EU has support in the Australian context. Specifically, the results suggest that the Australian public is willing to pay to avoid reductions in rural populations that may result from environmental restoration and protection policies.

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Appendix

Figure A1 Murrumbidgee River Floodplain study choice set

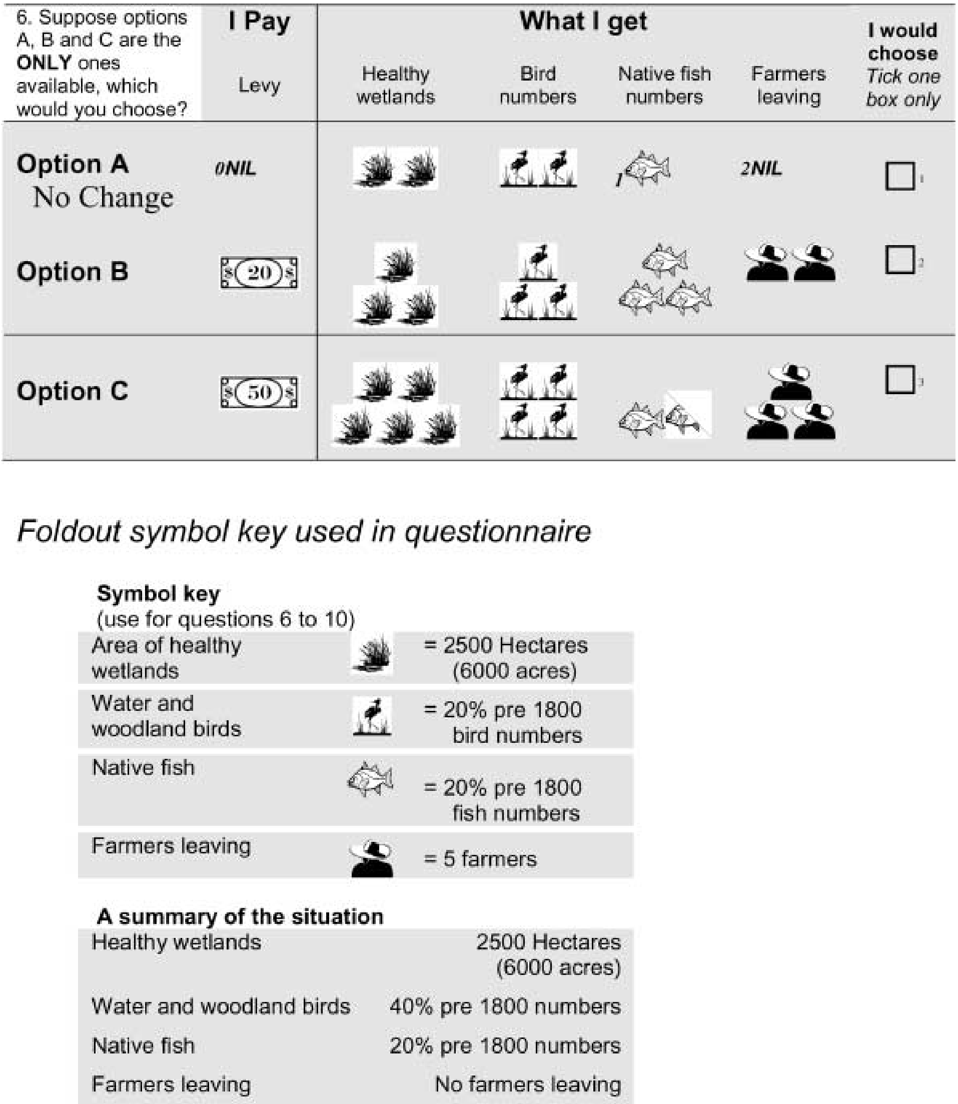

Figure A2 National and regional impacts of land and water degradation