



Public preferences in irrigation and conservation development projects: Does simultaneous consideration of substitutes in choice sets matter?

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ABSTRACT

This study relates to the Mackenzie Basin case study in New Zealand that exhibits many characteristics of public goods that requires government involvement and covers issues of efficient resource allocation decision-making between irrigation and conservation development in the basin. Many parties have different views on the proposed irrigation project and the policy debate was about whether to support the irrigation given that there are some environmental losses or to support further conservation programmes that forgo economic growth or leave the basin unchanged. The main objective of this paper was to evaluate environmental and social factors associated with irrigation and conservation development in the basin. The study applies choice experiment method by modelling realistic choice processes in ways that frame the issues of Mackenzie Basin within competing substitutes which have opposite environmental outcomes. This framing required an alternative specific experimental design for constructing the choice sets that allow respondents to consider the substitution effects directly giving them a more realistic decision-making context. This approach was compared with the traditional generic design to observe differences in terms of model parameters and willingness-to-pay (WTP) distributions. The results show that the alternative specific design has better predictive power in terms of statistical as well as behavioural interpretation.

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Introduction

The primary role of nonmarket valuation is to present information to decision makers on how society might balance trade-offs inherent in resource allocation decisions, and how costs and benefits might be distributed in any allocation of resources. This article relates to the case study on the Mackenzie Basin in New Zealand that exhibits characteristics of public goods that requires government involvement and issues of efficient resource allocation decision-making between irrigation and conservation developments. Considering the many different views on the proposed irrigation project, the policy debate was on whether to support the irrigation given that there are some environmental losses or to support further conservation programmes and forgo economic growth or leave the basin as it is. In other words, it calls for comparison of the benefits of further irrigation and conservation developments with environmental and economic growth losses. Thus, there is a trade-off in terms of decision-making between irrigation and

conservation or combination of both projects in the basin. This however requires the value of preferences that society has on valuing the situation of environmental impacts that are not currently being recognized by markets or policy makers. It is therefore critical that society assesses the welfare economic value of irrigation and conservation developments. The main focus of this paper involves the application of choice experiment (CE) techniques to estimate values for environmental and social factors associated with irrigation and conservation developments in the Mackenzie Basin (MB).

In a CE, respondents are asked to choose between different alternatives or options, each of which is described by a series of attributes at different levels. The choices can be presented as labelled (conservation, irrigation, status quo) or unlabelled (alternatives 1 and 2, status quo) options.¹ There is a concern in most CE applications especially in the field of environmental economics that both labelled and unlabelled survey designs asked respondents to consider the amenity of interest without considering the relevant substitutes and/or complements in the

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¹ Blamey et al. (2000) discuss advantages of these two approaches and compare them in an empirical study.

choice process.² Alternatively, respondents may be asked to choose between partial substitutes in utility such as between different recreational or fishing sites. Many studies have suggested that, in order to generate unbiased value estimates for a particular good, respondents must be asked to simultaneously value the good in question together with relevant substitute and/or complements (Hoehn and Randall, 1987; Hoehn, 1991; Hoehn and Loomis, 1993; Cummings et al., 1994; Neil, 1995). To our knowledge, only a few studies have explored the role of substitution in a CE context. Rolfe et al. (2002), Jacobsen and Thorsen (2010) and Jacobsen et al. (2011) analyzed substitution effects by including the substitutes in the alternatives of the choice sets with generic attributes (i.e., same attributes across the alternatives).

More importantly, there may be projects which are at risk of generating opposite outcomes in the respondents preferences such as the re-introduction of certain animal species such as wolves, supporting afforesting or deforesting of an area or, as in this application, land use change towards conservation or development options. These public actions clearly generate proponents and opponents, and it is important to take into account of both when valuing an increase in the quality of a public good. In this study, respondents face the alternative project outcomes simultaneously, a situation which is closer to reality. Thus, a key question: Can people visualize concurrently the irrigation and conservation impacts when presented to them, and state preferences with sufficient accuracy to disclose willingness-to-pay for improving the impacts? The challenge herein was, how to frame resource allocation issues in the context of survey design for estimating environmental values that minimize potential framing biases. In other words, finding a suitable survey design that reflects realistic choices, while at the same time eases respondent's ability to respond to choice tasks.

Research efforts have tended to focus on the impact various design characteristics have upon respondent's ability to respond to choice tasks. Specific issues examining the impact upon behavioural responses have included the number of alternatives within the task (Hensher, 2001), the number of attributes (Pullman et al., 2000), the number of attributes and alternatives (Arentze et al., 2003; DeShazo and Fermo, 2002), the impact of attribute level range upon response (Ohler et al., 2000; Verlegh et al., 2002; Mørkbak et al., 2010) and the number of choice profiles shown to respondents (Brazell and Louviere, 1998). Hensher (2004, 2006a,b) and Caussade et al. (2005) examined all of the above effects simultaneously (Rose et al., 2009). However, there exists no single study in CE that we are aware of that has systematically incorporated the idea of presenting competing substitute projects with opposite outcomes explicitly in the alternatives of the choice cards. A similar application has been done in a Contingent Valuation context by analyzing simultaneously positive and negative WTP for a project that involves increasing or decreasing the forested area in two national parks (Hanley et al., 2009). Nevertheless, in this study the WTP for the two alternative project outcomes were elicited separately.

This study adds two methodological contributions to the CE literature. First, we are suggesting a different way of framing resource allocation issues incorporating the impact on people's preferences and WTP when they simultaneously evaluate rival alternative projects. As described, this may be particularly useful to add reality to respondents' choice when opposite preferences for projected outcome are expected. This comes at a cost in terms of increased complexity of the experimental design and the information to be conveyed to respondents. The issue is to establish whether differences in behavioural choice response (and hence WTP for

specific attributes) associated with a choice setting can be attributed to differing design. Therefore, the second contribution of our study lies in the development of a flexible design called alternative-specific design, where labelled alternatives (conservation, irrigation, and status quo) consist of the presence or absence of different attributes which describe opposite outcomes. This new design will then be tested against standard generic design to observe any differences. The standard generic design typically used in the environmental application of CE assumes parameter estimates for each attribute are generic across the alternatives (labelled or unlabelled) within the experiment.³

The remainder of this paper is organized as follows. In the next section, the Mackenzie Basin as a case study is explained in detail followed by the study design and hypotheses. The materials and methods section discusses the survey design, attributes and their levels, experimental design, econometric model, welfare measures and data collection. The results and discussion section presents the research findings. Research and policy implications are also reported based on the results in this section. Finally, the paper concludes with the contributions of the study.

The case study and the policy debate

The Mackenzie Basin (MB) is an elliptical intermontane basin, located in the Mackenzie and Waitaki Districts, near the centre of the South Island of New Zealand. The basin extends approximately 100 km north to south, and 40 km east to west. The Southern Alps constitute its western edge. The majority of the MB is within Canterbury, while the area to the south of the Waitaki River is in Otago. Prominent rivers crossing the MB include the Waitaki, the Ahuriri, the Hakataramea and the Tekapo Rivers. Lakes Ohau, Pukaki, Alexandrina and Tekapo lie within the MB, as do the artificial hydroelectric lakes of Ruataniwha, Benmore and Aviemore. These rivers and lakes provide for the development of the water resources mainly for hydroelectric power generation during the 1960s and in 1970s made possible for irrigation purposes. The water resources are shared by both the power company, Meridian Energy and the Mackenzie farmers.

Recently, there are ongoing proposals to divert more of the water resources of the basin for agricultural and other uses. Thirty-four companies and individuals have already lodged applications to take more than 164 million cubic metres of water from high country rivers and lakes to irrigate more than 27,000 ha of public and private land in the MB (Forest & Bird, 2009). These irrigation proposals within the MB could have both positive and negative impacts on the environment. From a positive perspective, irrigation would reduce the erosion risk within the basin and also increase opportunities for environmental enhancement (MfE, 2005). One of the most significant impacts of further irrigation in this area will be a reduction in the amount of bare ground and corresponding reduction in wind erosion risk. Irrigation development will also contribute economic growth and employment opportunities in the basin. It is predicted that if 180/cumec of water is available for irrigation, there will be an increase of approximately 300–400 full-time equivalent employees directly employed in the agricultural sectors, and an associated population gain of about 800–900 people, thus addressing rural decline in non-irrigated areas (MfE, 2005). The MfE (2005) report also stated that agricultural value added activities will change by approximately NZ\$12–13 million per annum.

From a negative perspective, irrigation increases the risk of ground and surface water contamination and could adversely

² This is usually done when the substitute projects generate environmental changes which are close substitutes in utility, such as reducing soil erosion or diminishing water pollution.

³ The reader is referred to chapters 3 and 5 of Louviere et al. (2000) for details about the types of attribute (generic or alternative-specific) and the types of choice experiment design (labelled or unlabelled).

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