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Does Respondent Perception of the *Status Quo* Matter in Non-Market Valuation with Choice Experiments? An Application to New Zealand Freshwater Streams

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Abstract

In environmental valuation studies with stated preference methods, researchers often provide descriptions of *status quo* conditions which may differ from those perceived by respondents. Ignoring this difference in utility baselines may affect the magnitude of utility changes and hence bias the implied estimates of benefits from the proposed environmental policies. We investigate this issue using data from a choice experiment on a community's willingness to pay for water quality improvements in streams. More than 60 percent of respondents perceived the description of the quality of water in streams to be better than the one we provided in our scenario. Our results show that respondents who could provide details of their perception of the *status quo* displayed stronger preferences for water quality improvements - hence a higher marginal willingness to pay - than their counterparts. Respondents who opted for their own *status quo* description displayed a higher inclination to remain in the *status quo*, while their counterparts displayed the contrary. We argue this might be linked to the amount of knowledge each group displayed about the *status quo*: a kind of reluctance to leave what one knows well.

Keywords

choice experiments

fixed *status quo*

people's perceived *status quo*

status quo effect

willingness to pay

JEL Classification

C51; Q25; Q51

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1. Introduction

Since the pioneering work by Thurstone in the late 1920s and early 1930s, various forms of stated preference techniques have evolved and been applied in economics to infer the value of non-market goods. Discrete choice experiments represent one form of these techniques that have gained widespread recognition since their early application by Louviere and Hensher (1982) and Louviere and Woodworth (1983) and their earliest application to environmental valuation by Boxall *et al.* in this journal (1996). Choice analysis is an attribute-based technique in which respondents are presented with different alternatives defined in terms of environmental attributes and cost. They are then asked to select their preferred one. The tradeoffs that they reveal during this exercise between the cost of the proposed options and their environmental attributes are used to derive implicit estimate of monetary value, under a set of well qualified assumptions.

In order to study the preferences of respondents with respect to departures from the current environmental conditions, the so-called *status quo* (SQ), analysts often place this as an alternative in all choice sets. However, recent studies have shown that description of the *status quo*, or its mere presence in the choice context is not neutral to the choice outcome (Adamowicz *et al*., 1998a; Boxall *et al*., 2009a; Brazell *et al*., 2006; Breffle and Rowe, 2002; Dhar and Simonson, 2003; Scarpa *et al*., 2005).

Later in this paper we review the literature on current research results involving *status quo* in choice experiments, but we will focus on one area of relatively poor investigation, namely that of identifying the specific effect that respondent's perception of *status quo* conditions have on implied welfare estimates. In particular, respondents may or may not have a clear perception of how the *status quo* conditions they experience relate to the attributes and levels considered in the choice exercise. In short, respondents may not be able to map into the descriptors of environmental status used by the researcher. In this case, it is necessary for the purpose of the choice exercise to provide respondents with a description of the SQ conditions using the metric selected for the experimental design.

One can, therefore, distinguish two types of respondents. A first type, whose perceptions of the SQ can be mapped into the choice experiment and a second group, to whom a mapping needs to be supplied during the course of the interview on the basis of some previous, possibly technical, knowledge. Our contribution to the literature is that of investigating whether the effects of such an asymmetry of treatment systematically results in different welfare estimates from an endogenous split sample design.

We proceed by first reviewing the different formats for the SQ alternative in choice experiments[1]. Hess and Rose (2009) categorized the SQ alternatives into three formats:

> '…Firstly, [...] the presence of a *status quo* alternative which is represented as a null alternative with the attributes and attribute levels of the alternative not shown as part of the experiment. A second form of these experiments involves respondents being shown alternatives with attribute levels based on their own experiences but not the exact levels as described. A final form of these experiments involves the inclusion of one or more alternatives in the choice task being described with exact levels representing each respondent's recent experiences.' (p. 299).

An example of the use of the first format is provided in the study by Campbell *et al* (2008) on rural environmental landscape improvements in the Republic of Ireland, in which the SQ alternative was labelled 'No Action' without specifying the attribute levels. In this case it is quite obvious that the respondent is left to her own devices as to what conjecture to make about the SQ. Furthermore, the analyst does not collect any information on such conjecture. In this study we are particularly interested in the second and third formats above. The attributes described to respondents might either represent some average population measure of the good being valued and as such be described quantitatively to respondents (as in the second case above) or might be tailored to suit each individual's specific experiences (as in the third case above and Rose *et al*., 2008). The use of the second approach is the most prevalent in the existing literature on environmental valuation, to which our study contributes. Typically, this approach involves the use of the SQ alternative described in terms of the average population measures of the prevailing environmental quality (e.g., Kragt and Bennett, 2009; Morrison and Bennett, 2004).

Such average population measures are obtained through a consultative process involving the recording of expert assessments and public opinions, usually through focus groups. Additionally, other information obtained from a literature search may also be incorporated (Adamowicz *et al*., 1998b). In as much as the latter approach is the most commonly used in environmental valuation the following issues are worth addressing. First, what if the predicted average levels of environmental quality deviate from the attribute levels perceived by respondents? Second, in the face of an anomaly between the perceived attribute levels and predicted average attribute levels for the SQ alternative, how will respondents perceive the choice tasks presented to them? Third, what are the implications for the implied welfare measures of using SQ scenarios that directly account for individual specific perceived knowledge of environmental quality?

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[1] While here we focus on the SQ formats that are mostly applicable to environmental valuation, we recognize that these formats might not be relevant to fields such as marketing and others. We therefore refer the interested reader to Adamowicz, W., Louviere, J., Swait, J., 1998b. Introduction to attribute-based stated choice methods. A report submitted to National Oceanic and Atmospheric Administration (NOAA). and Blamey *et al.* Blamey, R., Louviere, J.J., Bennett, J., 2001. Choice set design, in Bennett, J., Blamey, R. (Eds.), The choice modelling approach to environmental valuation. Edward Elgar, Cheltenham, UK. for a more specific discussion of the various SQ (opt-out) formats.

Exploratory and pioneering work on the differences between perceived and objective attribute measures was published as early as 1997 (Adamowicz *et al*., 1997). The first and second questions above were more recently addressed by Kataria *et al.* (2009) in their study of water quality improvements in the Odense River in Denmark. Respondents were asked whether they believed in the description provided for the *status quo* and whether they found the overall scenarios presented to them credible. They found that not accounting for respondent's beliefs in the proposed scenarios could lead to biased welfare estimates.

To date, we are not aware of any study in environmental valuation that has attempted to address the third question presented above. It is against this backdrop that this study endeavours to contribute to the environmental valuation literature by assessing the implications on welfare estimates of using a SQ alternative based upon each respondent's specific perceptions of water quality versus the use of a fixed SQ based upon average measures of water quality for the overall population.

We use choice experiment data on streams in the Karapiro Catchment to investigate whether respondents' perceptions agree with our chosen description of the SQ alternative (an average measure of stream quality in the catchment), which we provided to them. Instead of simply asking respondents whether they believed in the SQ or not—as was the case in a study by Kataria *et al*. (2009)—respondents in our study were asked to state their perceived water quality attribute levels. Only those respondents who were unable to give their own assessment were given 'the average assessment of the current condition of streams in the catchment', labelled henceforth as *SQ provided*. Respondents who were able to assess current water quality used their own SQ in the choice experiments, or *SQ perceived*. We investigate the nature of the SQ effect emanating from the use of these two alternative formats for the SQ alternative and the implications for the implied welfare estimates.

The remainder of the paper is organized as follows. The next section briefly reviews the nature of *status quo* effects. Section 3 covers methods and the empirical model used in this study. An outline of the survey and experimental design are presented in Section 4. Results and discussions are presented in Section 5, and finally, conclusions and implications of the study are presented in Section 6.

2. *Status Quo* Effects in Choice Experiments

Initially the use of SQ alternatives in choice experiments was supported mainly on the basis of making choice tasks more realistic. It was shown that individuals making decisions tend to refer to past experiences. Therefore, relating experimentally designed alternatives to a previously experienced reference point makes stated choice tasks more realistic to respondents and informative to analysts (Ortúzar and Willumsen, 2001; Starmer, 2000). This is consistent with psychological and behavioural theories, for example, prospect theory by Kahneman and Tversky (1979) and case-based decision theory by Gilboa *et al.* (2002).

Later on, the inclusion of the SQ alternatives in choice experiments was justified on other grounds, including avoidance of forced choices (Adamowicz and Boxall, 2001; Dhar and Simonson, 2003), improvement in model fit, ensuring unbiased estimates W. Adamowicz, Boxall *et al*. (1998a) and increase in design efficiency (Hensher *et al.*, 2007).

More recently studies have shown that the *status quo* description or its mere presence in the choice context is not neutral to the choice outcome. In particular, it has been found that respondents presented with both SQ and experimentally designed alternatives have a bias towards sticking with the SQ alternatives, generally referred to as the *status quo* bias effect, even though Scarpa *et al.* (2005) discuss how SQ effect can be due to either a predilection for the SQ or a reluctance to stick with it. This asymmetry in preferences between the SQ alternative and non-experienced alternative is consistent with reference-dependent utility theories (Bateman *et al*., 1997; Kahneman *et al*., 1991; Kahneman and Tversky, 1979; Samuelson and Zeckhauser, 1988). Various explanations for the SQ effect have been provided in choice experiment applications (see for example Breffle and Rowe, 2002; Dhar and Simonson, 2003; Brazell *et al*., 2006; Boxall *et al.*, 2009).

Similarly, methodologies for accounting for the SQ effect on utility have been developed. The common approach has been to include the alternative specific constant (ASC) to capture the SQ effect on the *systematic* component of utility. The conditional logit model is usually applied to measure such effects. On the other hand, the SQ effect on the *stochastic* component of utility which represents the correlation of the error structure between alternatives, is commonly modelled through the nested logit framework (see for example Lehtonen *et al.*, 2003; Li *et al.*, 2004).

Currently, studies have demonstrated that such specifications are limited in that they fail to simultaneously account for the SQ effect on the systematic component of utility and the variance differences in utilities between experienced SQ and conjectured utility from experimentally designed alternatives. To overcome such limitations Scarpa *et al.* (2007b; 2005) proposed the use of error components (MXL-EC) in which both the SQ effects on the systematic and stochastic component of utility can be identified. Since their application, numerous other studies have found the MXL-EC to be better suited in capturing the SQ effects than the conditional logit and nested logit frameworks (Campbell *et al*., 2008; Ferrini and Scarpa, 2007; Hess and Rose, 2009; Hu *et al*., 2009; Scarpa *et al*., 2007b; Scarpa *et al*., 2008; Scarpa *et al*., 2007a). Within the MXL-EC framework, the SQ effect on the systematic component of utility can be measured by the ASC, while the effect on the stochastic component of utility can be captured by introducing a common error component shared by the utilities associated with alternatives different from the SQ, which takes account of the correlation patterns and increased error variance due to the conjectural nature of the experimentally designed alternatives.

It has already been argued by Scarpa and colleagues that when the SQ alternative is included in the utility specification, the utility from experimentally designed alternatives tends to be more correlated amongst themselves than with the SQ alternative. This correlation pattern can be attributed to the fact that the utility associated with the SQ alternative is experienced by the respondents while that of experimentally designed alternatives is not and can only be conjectured. Additionally, the attribute levels pertaining to the SQ alternative are fixed while those of experimentally designed alternatives are variable across choice occasions. This implies that respondents face a higher cognitive burden in evaluating experimentally designed alternatives than the SQ alternative and therefore, extra errors in addition to the usual Gumbel Type I error are expected to be made. These extra errors would induce a common correlation structure across the experimentally designed alternatives and can be captured within the MXL-EC framework through the introduction of a dummy variable (Campbell *et al*., 2008; Ferrini and Scarpa, 2007; Scarpa *et al*., 2007b; Scarpa *et al*., 2005; Scarpa *et al*., 2007a). For this reason we adopt this modelling approach in our estimation.

3. Methods

We employ a mixed logit specification that combines both the random parameter and error component interpretation. Train (2003) has shown how the mixed logit model can give rise to two different interpretations, the random coefficient and the error component interpretations. The random coefficient interpretation accounts for taste variations over the sampled individuals and has been widely applied in many studies (e.g. Banzhaf *et al*., 2001; Revelt and Train, 1998; Train, 1998). On the other hand, the error component interpretation refers to the decomposition of the error term and accounts for different correlations patterns among utilities for different alternatives (Ben-Akiva *et al*., 2001; Brownstone and Train, 1999; Herriges and Phaneuf, 2002; Train, 2003).

In the case of this study, the choice tasks consisted of two experimentally designed alternatives and the SQ alternative. We therefore, define the following utility structure:

$$U(a_1) = \tilde{\beta} x_{a1} + \varepsilon + \mu_{a1} \tag{1}$$

$$U(a_2) = \tilde{\beta} x_{a2} + \varepsilon + \mu_{a2} \tag{2}$$

$$U(sq) = \beta x_{SQ} + \mu_{SQ} \tag{3}$$

where $\tilde{\beta}$ denotes the random preference parameters for different water quality attributes used in this study; β_{SQ} is a fixed SQ specific constant which in our case takes a value of 1 for the SQ and 0 for the other alternatives; x is a vector of attributes describing the alternatives as well as selected respondents' characteristics; μ_{a1}, μ_{a2} and μ_{sq} depict the unobserved component of utility and are assumed to be i.i.d. Gumbel-distributed. Instead, the error component ε is distributed $N(0,\sigma^2)$. The σ^2 adds to the Gumbel variance of μ_{a1} and μ_{a2}.

Assuming a balanced panel of discrete choices, with T choices made by each individual n, the joint probability of a sequence of choices $(y_1, y_2, \ldots, y_T)$ made by an individual is given by:

$$P(y_1, y_2, \ldots, y_T) = \int_\beta \int_\varepsilon \prod_{t=1}^{T} \frac{\exp(\beta x_{ti} + \varepsilon_i)}{\sum_{j=a1,a2,sq} \exp(\beta x_{tj} + \varepsilon_j)} \varphi(\varepsilon|\sigma^2) f(\beta|\theta) d\varepsilon d\varepsilon \quad (4)$$

where ε_j is equal to zero when $j = sq$.

Since the integral in equation (4) has no closed-form, it is approximated in the log-likelihood function by numerical simulation, in our case by using quasi-random Halton draws (Hensher *et al*., 2005; Train, 1998).

We first illustrate the methods for the estimation of the random utility model and then the specific tests used to evaluate the difference between simulated distributions from models with different SQ data

3.1 Model Estimation

The model in equation (4) above for the *SQ provided* and *SQ perceived* treatments was estimated in NLOGIT 4.0 by maximum simulated likelihood using 350 Halton draws. The random parameters were assumed to be independent and normally distributed, except for the cost attribute which was assumed to follow a triangular distribution constrained to have the scale parameter equal to the median. Such distribution was used for the cost parameter so as to ensure non-negative willingness to pay values (Hensher *et al*., 2005). Attributes with parameters which were repeatedly found to show insignificant standard deviation estimates were eventually specified as non-random. The final estimates are presented in Table 2.

3.2 Testing Differences in the Implied WTP Distributions

We focus on the marginal WTP for the stream water quality attributes. Rather than estimating the individual-specific WTP conditioned on the observed individual choices, we derived estimates of the population mean WTP for each of the non-monetary attributes for the *SQ provided* and the *SQ perceived* samples. Population moments were simulated in R-Console using 50,000 random draws to obtain WTP distributions for each non-monetary attribute in the two sub-samples. Non-parametric procedures using the Kolmogorov-Smirnov test were used to test for equality in the WTP distributions between the two treatments[2]. The WTP distributions were found to be highly skewed, therefore, instead of testing for the differences in the mean WTP between the two treatments, we opted for the median WTP. The differences in the median WTP were described using box plots as outlined by Chambers *et al.* (1983).

4. Survey and Experimental Design

The study area for this research (the 'Karapiro catchment') stretches over 155,303 hectares and covers the lower part the Upper Waikato catchment from Lake Arapuni to the Karapiro

[2] The Kolmogorov-Smirnov test statistic does not make any assumptions about the underlying distribution of the data and therefore it is appropriate for the simulated WTP distributions for which no closed form exists.

dam including contributing tributaries. Land use is predominantly for dairy (34percent), pastoral (13percent) and forestry (48percent) production. It has already been identified as requiring high priority for nutrient management (Broadnax, 2006). However, much of the area now used for commercial pine forestry could potentially be converted to dairy. The Waikato Regional Council – Environment Waikato (EW) is seriously concerned that recent and planned land use changes in the catchment between Karapiro Dam and Taupo gates will lead to increasing levels of nitrogen and phosphorus in the Waikato River and its tributaries.

The amount of nitrogen and phosphorus reaching waterways in the catchment has generally been increasing and is expected to continue to rise because of intensification and conversion of land from forestry to dairy. Even with good farm management practices it is expected that the streams and rivers in the catchment will support more algae, clarity will fall and ecological health may decline. Levels of Ecoli may also increase.

Four focus groups were held to derive an understanding of people's views on water quality in the catchment and to identify attributes for inclusion in the choice experiment. These sessions were also used to test early versions of the questionnaire and to discuss the appropriate range of values for the payment variable. Procedures for running the focus groups were developed drawing on Krueger (1994) and on more specific New Zealand experience from Bell (2004) and Kerr and Swaffield (2007).

Focus group discussions highlighted the increasing number of fences on farms restricting livestock access to streams and creeks, and hence livestock pollution. This was recognized as an improvement and many participants thought that stream water quality was improving, especially when streams were protected by fenced areas of bush, which create a natural filter. Focus group participants from different areas had different perceptions of the quality of their local streams. For example, while some streams experienced by participants at the Karapiro focus group were perceived as with poor water quality, participants at the Waotu group reported high quality streams with trout the water from which was used as a supply of domestic drinking water. Further details on focus group procedures can be found in Marsh and Baskaran (2009).

Questionnaire development and improvement took place over an extended period. Testing started using focus group participants and was followed by a pilot survey using two groups of six participants and a pre-test of 21 questionnaires. The water attributes identified by focus groups participants were supplemented by literature review and discussions with experts in the field. The attributes eventually selected for the final study were:

- Suitability for swimming (percentage of readings that are satisfactory for swimming)
- Ecology (percentage of excellent readings)
- Native, fish and eels (presence of)
- Trout (presence of)
- Water Clarity (Can you usually see the bottom?)

Suitability for swimming and ecological quality were defined by reference to criteria already defined by EW whereby water is assessed as being suitable for swimming (or not) and ecological health is assessed as being excellent, satisfactory or not satisfactory. The suitability for swimming attribute aligns with the proposed national policy statement for freshwater management that aimed to ensure that appropriate Freshwater Resources reach or exceed a swimmable standard. This attribute is also intended as a 'catch all' that enables respondents to state their preference for water that is safe for all forms of contact recreation (swimming, paddling, fishing, eeling etc).

The ecology attribute aligns with data collected by Environment Waikato (EW) on the ecological health of waterways in the catchment. Based on 100 monitoring sites across the region, EW reports that ecological health readings for undeveloped catchments range from 23percent to 100percent excellent, but for developed catchments the percentage of excellent readings is between 0 and 25percent. The Karapiro catchment falls under the lower Waikato catchment zone where 68percent of ecological health readings are reported to be unsatisfactory with only 2percent excellent. The ecological health and 'native fish and eels' attributes are assumed to vary together, for example poor water quality results in 'only small eels being found in most catchment streams' while high water quality leads to 'large eels, bullies and smelt being found'.

The ecology of rivers and streams in the catchment has been adversely affected by clearance of forests and riverside vegetation, habitat loss and creation of barriers to fish passage (including dams). Aquatic plants and animals have also been affected by reduced water quality, changes to flow regimes, habitat loss (due to drainage and changes in land use) and introduced species that compete with or eat native fish (Environment Waikato, 2010).

Native fish populations in the Waikato Region are documented in Joy (2005). These species are highly affected by the Waikato dams which prevent fish migration. The population of eels depends on recruitment (which has been falling steadily in recent years) and the number of elvers transported over the hydro dams. Shortfin eels (Anguilla australis) are very tolerant of poor water quality and may even increase with rising levels of N and P. In poor conditions these eels would mainly be 30 to 40 cms in length. If water quality increases (and sufficient numbers are moved over the hydro dams), then the population of longfin eels (Anguilla dieffenbachia) should increase. This species is far less tolerant of poor water quality and can grow to 2 metres in length. Native bullies and smelt should be migratory but landlocked populations exist in Lake Taupo. Numbers of these species may be expected to increase with better water quality. Respondents were asked for their assessment of the condition of streams in the catchment based on the attributes and levels used for the choice cards. Respondents who indicated that they had 'no idea' of the quality of the streams in the catchment were presented with the *status quo* defined as 'our assessment of the current overall condition of streams in the catchment' (see Table 1).

During the survey, respondents who felt able to make their own assessment of stream quality used their perceived quality assessment as the *status quo*. In this case attribute levels were entered onto a transparent overlay and placed on top of each page of choice cards to make it easy for respondents to compare their perceived *status quo* with the alternative levels offered in each choice card. Attributes, attribute levels and labels used in the survey are defined in Table 1. Choice cards were based on an orthogonal design of 72 choice sets, with each respondent completing six choice tasks.

The initial sample for this study was drawn by intersecting the Land Information New Zealand (LINZ) property title database with the catchment boundary layer in ArcGIS. In this way a list of all 7627 properties in the catchment was produced including physical location, territorial authority and other variables. The population was broken down into three geographical strata to reflect the markedly different socioeconomic characteristics of these areas; namely Tokoroa, Putaruru/Tirau and the remaining rural areas. Address lists were drawn up for each stratum and a pseudo-random number generator was used to draw up lists of addresses to be visited by each enumerator. Field work proved to be very time consuming with each enumerator only able to complete three to six surveys each day. Field work was carried out both during the day and at weekends to try to avoid bias towards people staying at home. In the later stages of the survey a quota system was used to try and reduce bias towards people over 60.

Comparison of socioeconomic and attitudinal characteristics for our sample, with data for the Waikato Region as a whole enables some conclusions to be drawn. Men are over represented at 62percent, perhaps because men were more likely to participate. Differences between the sub-samples are also observed particularly in levels of education and income; for example 49percent of the respondents in the *perceived* category achieved at least a diploma or a certificate compared to only 23percent in the *provided* group. Similarly, 65percent of respondents in the *perceived* category earn at least $50,000 compared to 39percent in the *provided* category. Given random sampling, the differences in representation may also be attributed to differences in propensity to take part in the survey. The highest refusal rate was experienced in Tokoroa where only 30percent of eligible people contacted, agreed to participate, as opposed to other areas where the participation rate averaged 60percent.

5. Results and Discussion

Respondents in the *SQ perceived* subsample generally registered higher incomes and better education levels than their counterparts in the *SQ provided* subsample. So, we proceeded by comparing the two sub-samples before and after controlling for outliers in income and qualification. In Table 2 we report the models for these comparisons. Model 1 and 3 include all respondents and pertain to the subsamples *SQ provided* and *SQ perceived*, respectively. Model 2 and 4 are based on subsamples in which respondents with income levels of over NZ$50,000 and those with any tertiary qualification in education were excluded. We excluded these to try and ensure that differences in the estimated results can be attributed to differences in the SQ treatment alone, rather than to the effect of outliers in socio-economic covariates in one of the two sub-samples.

Table 1: Attribute Levels and Labels

Attribute	Current Situation	Improvement Levels		
Suitability for Swimming *(percent of readings rated as satisfactory for swimming)*				
	30percent	50percent	70percent	90percent
Variables		SWIM50	SWIM70	SWIM90
Ecology *(percent of readings rated as excellent)*				
	<40percent	40-70percent	>70percent	
	Only small eels	Small eels, bullies and smelt	Large eels, bullies and smelt	
Variables		ECOM	ECOH	
Trout	*No* Trout	Trout *are* found (TROUT)		
Water Clarity	Usually you *cannot* see the bottom	Usually you *can* see the bottom (CLARITY)		
Cost to Household	*$ per year for the next 10 years* (COST)			
	$0	$50, $100, $200		

Labels	
ASC	fixed SQ specific constant which is equal to 1 for the SQ and 0 for the other alternatives
σ_ε	error component capturing the extra variance associated with the experimentally designed alternatives.
Per	denotes attributes pertaining to the *SQ – perceived models*
Pro	denotes attributes pertaining to the *SQ – provided models*

Table 2: Estimation Results

	Model 1 SQ-Provided All Respondents		*Model 2* SQ-Provided High Income and Qualification excluded		*Model 3* SQ-Perceived All Respondents		*Model 4* SQ-Perceived High Income and Qualification excluded	
Variable	*Coefficient*	*|t-value|*	*Coefficient*	*|t-value|*	*Coefficient*	*|t-value|*	*Coefficient*	*|t-value|*
Fixed Parameters								
ASC	-2.293	5.04	-2.143	3.79	0.792	2.19	0.55	1.45
SWIM50			0.504	1.74	0.601	3.18	0.792	3.04
SWIM70	1.130	4.45	1.02	3.28	0.954	4.65	1.103	3.99
ECOM	0.301	1.47	0.131	0.53	0.829	4.83	0.954	3.98
TROUT	0.711	3.84	0.636	2.91				
CLARITY	0.507	2.65	0.532	2.35			0.835	4.06
Random Parameters								
SWIM50	0.344	1.34						
SWIM90	1.641	5.07	1.51	4.25	1.281	5.17	1.765	4.7
ECOH	0.602	2.27	0.687	2.21	1.187	5.59	1.438	4.77
TROUT					1.014	5.12	0.834	3.18
CLARITY					0.82	5.14		
COST	-0.035	5.04	-0.041	6.75	-0.017	8.59	-0.023	-6.04
Error Component σ_ε								
	2.692	6.91	2.487	5.93	3.341	7.22	2.181	5.86
Summary Statistics								
Log L	513.5999		-342.7		-742.1944		-387.27	
AIC	1.202		1.206		1.223		1.213	
BIC	1.273		1.296		1.282		1.301	
R^2 (McFadden)	0.466		0.469		0.453		0.466	
N (Observations)	876		588		1236		660	

5.1 SQ Provided Models

Models 1 and 2 refer to respondents who were told that the SQ involved poor suitability for swimming and poor ecological health. These models show estimates of utility weights with the expected signs for all attributes. The alternative specific constant (ASC) is negative and highly significant at the 1percent level in both models implying, preference for a change from the *status quo*. In a study by Scarpa *et al*. (2005) on customer preference for water service provision, a negative ASC was attributed to dissatisfaction with the current provision of the good being valued. While this might be one of the possible explanations for the negative ASC in the SQ provided models, this inclination towards change might be further attributed to lack of familiarity with the SQ by this group of respondents. Since they were less familiar with the SQ, the perceived loss of leaving it might have been lower than if they were more familiar with it. This explanation is also consistent with the loss aversion hypothesis by Kahneman and Tversky (1979) and it also minimizes regret (Loomes and Sugden, 1982).

In terms of the preferences for water quality attributes, the results reveal that respondents have very strong preferences for water quality that is (a) highly suitable for swimming (SWIM70, SWIM90) and (b) where TROUT is found. Both models indicate lower preferences for the ecology attributes with ECOH being significant at 5percent level while ECOM is not statistically significant. The COST attribute is negative and highly significant in both models, in accordance with expectations.

The error variance in both models is highly significant indicating that the inclusion of the SQ alternative had a significant effect on the stochastic component of the utility structure of the experimentally designed alternatives. The total variance associated with the unobserved component of utility pertaining to experimentally designed alternatives for model 1 is given by $2.692^2 + \pi^2/6 \approx 8.89$; where $\pi^2/6 \approx 1.645$ is the Gumbel error variance. For model 2, the total variance is equal to $2.487^2 + \pi^2/6 \approx 7.83$, which is slightly lower than that of model 1. The total variance of indirect utilities associated with experimentally designed alternatives is much larger than what Gumbel error accommodates for both models. This is in line with the findings of the proponents of this approach (Scarpa *et al*. 2005, 2007).

5.2 SQ Perceived Models

Models 3 and 4 refer to respondents who felt able to make their own assessment of the *status quo*. On average these respondents considered the condition of streams to be better than the assessment we provided to those who ‘had no idea’ of these conditions. Comparison of model 3 and model 4 shows that all water quality attributes are highly significant at the 1percent level demonstrating that respondents had very strong preferences for all the water quality attributes. The only difference is observed for CLARITY which is heterogeneous across respondents in model 3 but fixed in model 4.

The ASC is positive and significant at the 5percent level in model 3, but positive and insignificant in model 4. The positive ASC reveals that respondents in this category are inclined to remain with the *status quo*. Since the SQ alternative in this model was dependent upon each individual specific experiences the bias towards the *status quo* might be taken as a confirmation of the loss aversion hypothesis by Kahneman and Tversky (1979). However, other explanations cannot be ruled out, such as avoidance of cognitive burden associated with the evaluation of the experimentally designed alternatives as championed by Samuelson and Zeckhauser (1988) and others.

The total variance associated with the unobserved component of utility pertaining to experimentally designed alternatives in model 3 is approximately equal to $3.341^2+\pi^2/6 \approx$ original 12.81, which is almost twice as high as the variance in the model 4 given by $2.181+\pi^2/6 \approx 6.40$. These results demonstrate that the inclusion of the SQ alternative had a significant effect on the stochastic component of the utility structure of the experimentally designed alternatives, consistent with findings from the *SQ provided models*. In addition, these results demonstrate that respondents with higher income and qualification levels in the *SQ perceived* treatment seem to have had relatively high valuation errors as indicated by the higher variance in model 3 compared to that in model 4, where such respondents were removed.

Further comparison is made between the respondent's willingness to pay (WTP) for water quality improvements in the two treatments. The simulated population mean and median WTP values for the different attributes are presented in Table 3, as derived from the estimated random parameter models.

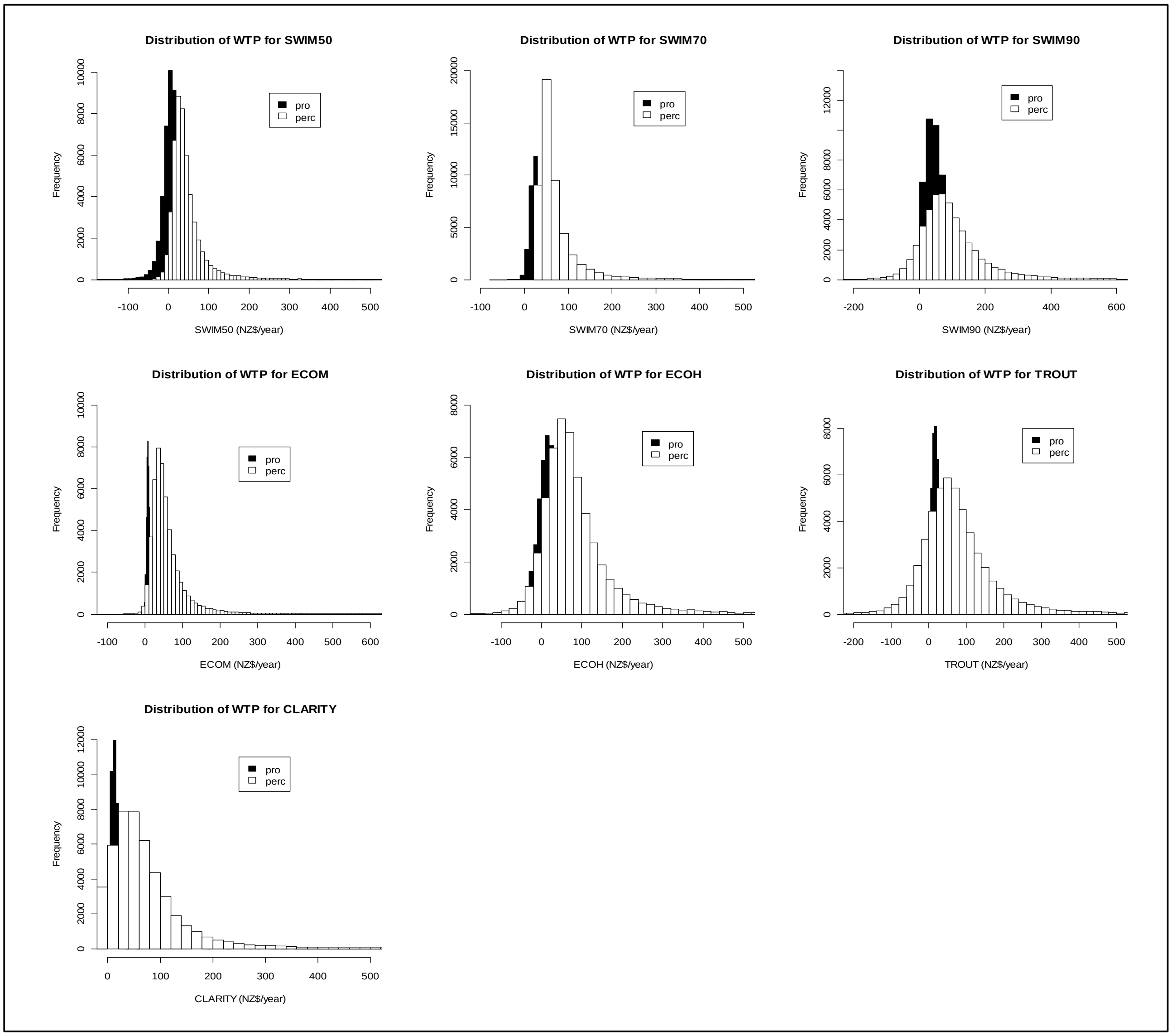
Table 3: Mean and Median Marginal WTP Estimates in NZ$/Year

	Model 1 SQ-Provided All Respondents		*Model 3* SQ-Perceived All Respondents		*d-stat'*	*Model 2* SQ-Provided High Income and Qualification Excluded		*Model 4* SQ-Perceived High Income and Qualification Excluded		*d-stat'*
Attribute	*Mean*	*Median*	*Mean*	*Median*		*Mean*	*Median*	*Mean*	*Median*	
SWIM50	13.4	9.56	48.4	34.82	0.455	17.63	12.64	48.28	34.7	0.524
SWIM70	42.59	30.72	77.65	55.86	0.505	32.01	22.99	67.21	48.34	0.447
SWIM90	67.19	48.05	109.05	78.67	0.249	51.97	37.24	92.89	66.765	0.281
ECOM	11.74	8.47	64.41	46.33	0.780	4.92	3.52	63.98	46.15	0.941
ECOH	30.29	21.71	91.01	65.61	0.408	23.83	17.07	83.85	60.28	0.529
TROUT	27.69	19.95	85.46	61.79	0.475	19.91	14.26	51.39	36.93	0.398
CLARITY	19.75	14.15	69.3	49.99	0.526	16.52	11.84	45.99	33.16	0.745

All *d*-statistics have significance at p-value < 0.001

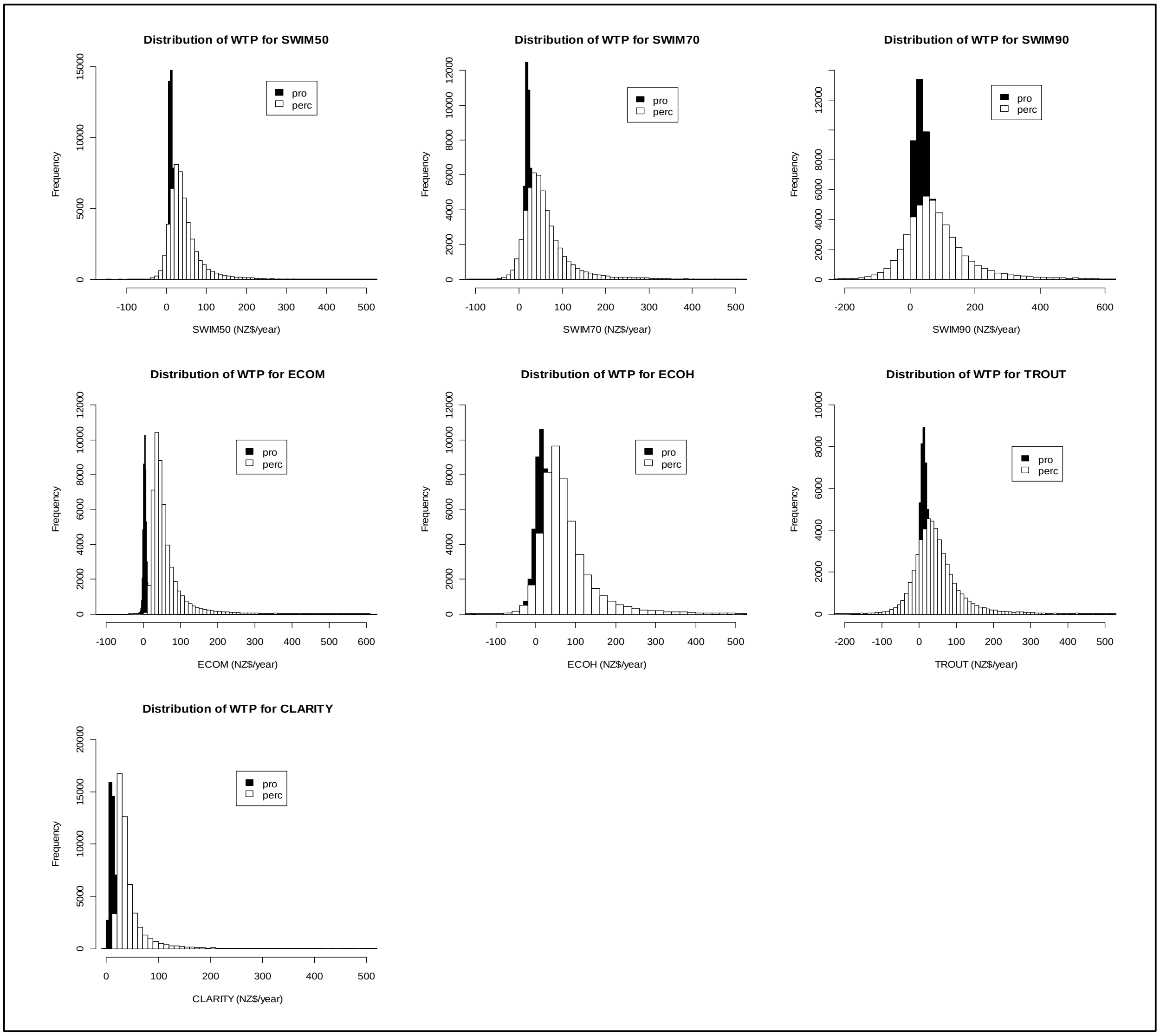
Comparing the mean and median WTP in model 1 and model 3 there is a clear indication that respondents in the SQ perceived model are more willing to pay for water quality improvements than those in the SQ provided model for all attributes. A similar trend is observed in models 2 and 4 in which respondents with high income and qualification levels were excluded from the analysis. The median WTP values are less than the mean WTP values in both treatments for all attributes indicating that the distributions are highly skewed upwards. In general the differences in WTP values between the two treatments appear to be quite substantial. A graphical comparison of the distributions of WTP values across the two SQ treatments based on models estimated on all respondents (Model 1 and 3) are presented in Figure 1.

Figure 1: Histograms Showing Distribution of Marginal WTP for Models 1 and 3



The distributions are highly skewed with long and fat tails towards the upper end of the scale. Further, analysis of the histograms highlights that although the distributions of the WTP for all attributes overlap, the WTP for most respondents in the *SQ provided model* is relatively lower than their counterpart. The Kolmogorov-Smirnov test (*d-statistic*) in Table 3 reveals that there are significant differences in WTP distributions for all attributes in the two treatments. Likewise, the simulated distributions of WTP for Model 2 and 4 are compared and presented in Figure 2 below.

Figure 2: Histograms Showing Distribution of Marginal WTP for Models 2 and 4



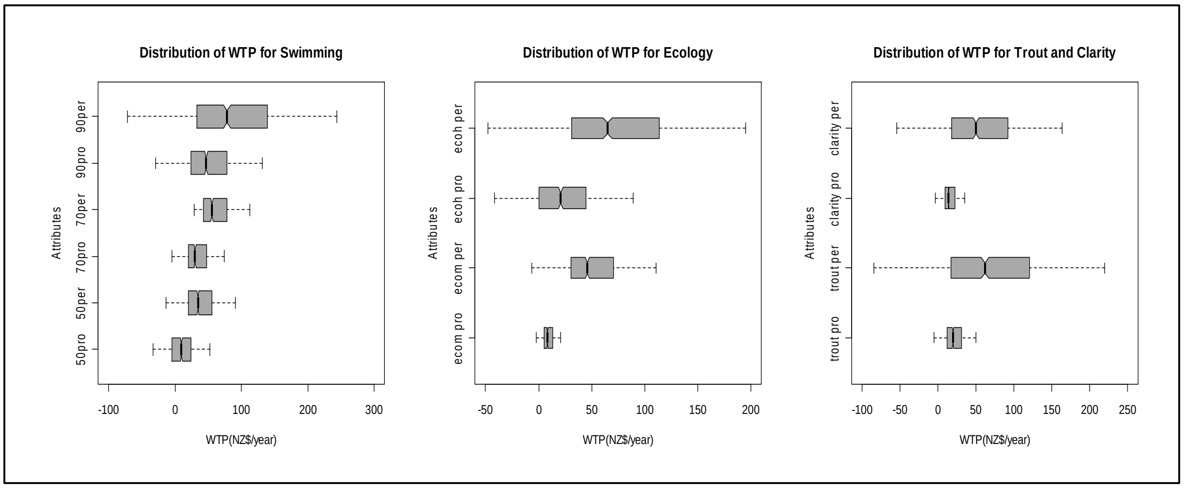
Once more, the distributions are highly skewed with relatively fat tails towards the upper end of the scale, with the simulated population distribution of WTP from the *SQ provided model* being relatively lower than that from the *SQ perceived model*. The Kolmogorov-Smirnov test (*d-statistic*) again reveals that there are significant differences in the distributions of WTP values from the two subsamples (Table 3).

Our results have shown that the distributions of WTP values between the two treatments are significantly different from each other. Poe *et al*. (1994, p. 911) states that:

‘Differences in estimated WTP distributions do not necessarily imply that the means derived from these distributions are different. For instance, it is possible that two significantly different distributions can cross and have identical means.’

To explore graphically the differences in the simulated measures of central tendency between the two treatments, the quartiles of the distributions of WTP are compared using box plots see Tukey (1977) and reported in Figures 5 and 6. The box plots display the upper and the lower limits of the cumulative distributions, and the inter-quartile range showing the first quartile, the median and the third quartile. Given that, the distributions of WTP are highly skewed, the median is used as a basis of comparison as opposed to the mean, since the latter can be influenced by extreme values. Figure 3 shows the box plots for models 1 and 3 with all respondents included in the analysis.

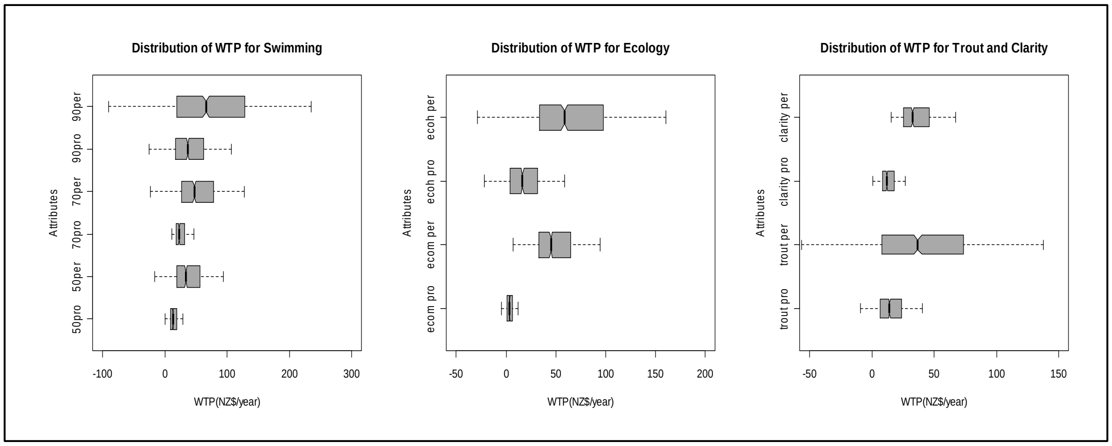
Figure 3: Box Plots for Distributions of Marginal WTP for Models 1 and 3



The quartile distributions are consistent with the previous results, with respondents in the *SQ perceived model* generally showing higher WTP for all attributes than those in the *SQ provided model*. Specifically, the notches in the box plots signify the 95percent confidence interval for the median. According to Chambers *et al.* (1983), if the notches do not overlap, the null hypothesis of equal medians is rejected.

A similar comparison between the median WTP values for models 2 and 4 in which respondents with high income and qualification levels were excluded from the analysis is presented in Figure 4.

Figure 4: Box Plots for Distributions of Marginal WTP for Models 2 and 4



Inspection of the box plots demonstrate that the notches do not overlap for all stream water quality attributes and therefore, the hypothesis of equal medians is rejected. This test is a further confirmation that respondents in the *SQ perceived models* display stronger preferences as implied by higher WTP values than those in the *SQ provided models.* The results further highlight that there is more variance in the WTP values in the *SQ perceived models* especially for SWIM90 (90 percent of readings satisfactory for swimming), ECOH (excellent ecological health) and presence of trout, than in the *SQ provided models*.

6. Conclusions and Implications of the Study

The broader purpose of this research was to assess a community's preferences for stream water quality improvements. A specific focus in this paper was placed on the effect of perceived versus described *status quo* levels. The study revealed that about 58percent of respondents had their own perceived baseline condition of water quality and that they could map it into the framework of attributes and levels proposed in the survey. On the other hand 41percent of respondents were provided a SQ description by researchers because these respondents either had little or no prior knowledge of the prevailing conditions of water quality in streams or they had this knowledge but could not map it into the proposed framework. We believe that such a dichotomy is common in many nonmarket valuation studies, and hence its consequences for policy prescription via value estimation are worth exploring.

The results of our investigation show marked differences in the marginal value that these two groups of respondents place on water quality improvements and this has implications for their willingness to pay values. The respondents who were provided with *status quo* descriptions expressed strong preference for water that is suitable for swimming, clear and where trout can be found. Yet, this group displayed a reluctance to stay with the SQ scenario. We argued that this might be the case because of their comparative ignorance of baseline water quality conditions. The second group of respondents, who adopted their own perceived SQ scenario, expressed significantly *stronger* preference for improvements across all the attributes subject of this study, but this tendency was attenuated by a general reluctance to embrace policy options implying changes from the SQ, about which they had quite good knowledge. For this group estimates of marginal willingness to pay values are higher across the entire distribution than for respondents to whom the *SQ* information was *provided*.

Economic theory suggests that marginal WTP should be proportional to the expected improvement. This in turn depends on individual perceptions in one group and the provided description in the other. In our individual perception data we observe that on average perceived quality of the SQ conditions was higher than the one that was provided. This might be the cause for the observed reluctance to abandon the SQ, as manifested by a positive and significant alternative specific constant for the SQ alternative. In principle then for this group the expected improvement would be perceived as smaller, and so would the associated marginal WTP when compared to that held by the SQ provided group. This holds only for quality changes within evaluations by the same respondent. Unfortunately this cannot be tested here because of the lack of a counterfactual. We offer an alternative explanation, based on the speculation that respondents in the SQ perceived group may be a self-selected group with higher awareness of environmental conditions and that this enhanced awareness may be associated with higher marginal WTP for water quality improvements. This would be more in line with previous findings which indicate - for example - that respondents who are members of environmental-related organizations tend to display higher marginal WTP.

This study demonstrates the effects of using a coding specification of the *status quo* directly built on respondents' perceptions. Our results are supportive of the findings by Kataria *et al*. (2009) which showed that failure to take account of respondents' beliefs leads to biased welfare estimates.

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