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Willingness to Pay and Willingness to Accept Compensation for Changes in Urban Water Customer Service Standards

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Abstract In this paper, we explore the use of choice modelling for obtaining implicit prices for attributes associated with changes in the reliability of household water services. While not often estimated in practice, the collection of information about willingness to accept compensation is relevant for utilities as customers often have implicit or explicit property rights for particular levels of customer service. Given ageing infrastructure in many cities, maintaining customer service standards requires large capital expenditures. It may be more economically efficient to allow standards to decline in some areas and compensate consumers. Therefore it is useful to understand the value of attributes of water service provision using willingness to accept and how this differs from willingness to pay. We therefore estimate both willingness to accept and willingness to pay measures, and find that respondents value a larger range of attributes using the willingness to accept approach.

Keywords Choice modelling · Price of water · Urban water · Willingness to accept compensation · Willingness to pay

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This paper is not in submission elsewhere in identical or similar form.

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1 Introduction

The upward trend in standards in the areas of customer service, public health and environmental quality has the potential to result in sharp increases in capital expenditure for the urban water industry. In the Australian context higher standards have become the principal driver for the industry's capital expenditure with capital costs accounting for sixty percent of the industry's total costs and with underground pipes amounting to around seventy percent of all capital costs (Speers et al. 2002). However, with ageing infrastructure and high costs associated with replacement, the question of whether to maintain or further improve quality of supply will receive greater scrutiny.

There are many options available for improving or maintaining quality of supply despite ageing infrastructure. For instance, to lower the probability of a pipe bursting in a street due to age of the pipe, pipes can be replaced according to a shorter schedule or more crews can be employed to reduce the repair time when a pipe bursts. However, these options are often costly. It may be more economically efficient to allow for a lower service level, allow a utility to move a replacement schedule further into the future and pay compensation for interruptions in service. From the perspective of economic theory, it is important that such decisions be undertaken within a framework that evaluates both the benefits (from the customers' perspective) and costs of the proposed higher standards. This paper focuses on the perceived values associated with changes in customer service standards from the perspective of consumers.

The question of willingness to pay for higher customer service standards for potable water has been addressed by Gordon et al. (2001), Raje et al. (2002), Hatton MacDonald et al. (2005), Hensher et al. 2005a, b) and, Genius et al. (2008). These studies implicitly assumed that the institutional arrangements or property rights to deliver a certain level of service quality are vested with the water authority, and that customers ought to pay for any improvements in service quality. In other words, the regulator or water authority can choose to establish a certain level of quality, and if consumers want higher levels of quality, it is consumer's responsibility to pay for this higher quality. An alternative perspective is that consumers have the property rights to a certain level of service quality, and they ought to be compensated for any degradation in quality. In Australia, there has been pressure by regulators for various bulk water utilities to guarantee specified levels of service quality to customers through what are known as General Service Level Agreements.[1] These agreements have been implemented in Victoria and New South Wales. These agreements serve two purposes. First, they provide a means of ensuring that water main breaks are attended to quickly by sub-contractors responsible for the delivery of water. If sub-contractors fail to deliver a required level of service, they are then responsible for providing the compensation to affected customers. Second, the process for addressing breaches of customer service standards is streamlined. Even

[1]While there has been a move towards the greater use of General Service Level Agreements, it is not the case that they are suited to all areas. It is more feasible to implement these Agreements in metropolitan areas which service relatively small geographic areas than in regional and rural areas where service areas are large and personnel often have to travel large distances to respond to outages and other service issues.

where property rights are less explicit but markets are competitive there remains a rationale for compensating customers for not achieving certain levels of quality in order to maintain good customer relationships. In either of these cases, consumers have rights to or expect a certain standard of quality, and if the water authority does not meet this standard, consumers ought to be compensated. Hence, the most appropriate measure of value for changes in quality if this latter property right is assumed is willingness to accept compensation, rather than willingness to pay (Mitchell and Carson 1989).

In this paper, we use choice modelling to derive estimates of willingness to accept compensation for declines in service level quality as well as estimates of willingness to pay for improvements in service level quality. For each approach we develop policy relevant scenarios which necessitated some differences in the levels of a few of the attributes, and in the periodicity of payment. This means that the magnitude of the values derived are not directly comparable. Nonetheless, we are able to identify which attributes are significant for each approach and demonstrate differences between what attributes are valued by customers from the perspective of willingness to accept and willingness to pay.

2 Survey of the Literature

The technique chosen for this study, choice modelling, has been used to estimate willingness to pay across a number of fields including transportation (Hensher 2000), environmental economics (Morrison et al. 2002) and health economics (Gerard et al. 2003). Recently it has been used in a number of quality of supply applications, including for water (Hatton MacDonald et al. 2005; Hensher et al. 2005a, b) and electricity (Goett et al. 2000; Morrison and Nalder 2009).

The disparity between willingness to pay and willingness to accept has been studied extensively in the environmental economics literature through stated preference studies (largely contingent valuation studies) or experimental approaches where it has been established that property rights do matter and that willingness to pay and accept do differ (Bishop and Heberlein 1979; Rowe et al. 1980; Randall and Stoll 1980; Shogren et al. 1994; Bateman et al. 1997; Mansfield 1999; Horowitz and McConnell 2002). The valuation literature suggests that willingness to accept will generally exceed willingness to pay measures since the latter is strictly limited by individual budget constraints while the former is not (Randall and Stoll 1980). Hanemann (1991) suggested that the disparity in measures is related to substitutability between goods and hence, in the context of valuing public goods, the disparity between willingness to pay and accept depends on the availability of private good substitutes. Specifically, equality between willingness to pay and accept should only be expected when close substitutes are available. Horowitz and McConnell (2002) suggested that the greater the difference to an ordinary private good, the larger the disparity between willingness to pay and willingness to accept. The experimental literature initially presented some alternative explanations with Kahneman et al. (1990) proposing that an endowment effect could lead to these differences. Tversky and Kahneman (1991) suggested that their theory of reference dependent preferences could be used to explain divergences between willingness to pay and accept. That is, people evaluate gains and losses differently. However Plott and Zeiler (2005, 2007) presented evidence that the endowment effect identified by Kahneman et al. (1990) is a figment of the design and execution of the experiments that seek to demonstrate this effect.

All previous testing of the equality of willingness to pay and willingness to accept that we have identified in the literature has involved the use of contingent valuation, and the majority of studies, especially more recent ones, have occurred in experimental laboratories. Given the nature of contingent valuation, this has involved comparison of total value or surplus estimates. In this paper we use a multi-attribute non-market valuation technique known as choice modelling. As it is a multi-attribute approach, it is a technique that lends itself to valuing changes in the various aspects of service quality for potable water. Use of this approach allows us to investigate whether the attributes associated with quality of service that respondents value when using willingness to pay are different to those that they value when willingness to accept compensation is used.

3 The Study Area, the Nature of Service Interruptions and the Sample

The study was conducted in Adelaide, which is the capital city of the state of South Australia located in south-eastern Australia. Adelaide is a city of approximately 1.1 million people. It has a mild, Mediterranean climate with moderate rainfall in the mild winter months and very little precipitation in the hot summer months. United Water (private company) provides water to Adelaide households and businesses, under contract with the state owned utility SA Water.

Adelaide experiences less than average water supply interruptions in comparison to other Australian cities. WSAA (2000) reported that SA Water experienced 24.6 breaks per 100 km of mains in 1999, which is slightly below the average for water utilities supplying major urban areas in Australia in the same year. Adelaide water is delivered through asbestos cement and cast iron pipes. Generally, pipe breakage that results in interruptions in service are related to the length and age of pipes and the stress created by reactive or corrosive soils (Constantine et al. 1996; Burn et al. 2002). There is some cyclic variability in pipe breaks around an ageing trend line which has been linked to changes in soil moisture. Water supply may also have to be interrupted because of random events such as a car hitting a fire hydrant or a road crew breaking a main during excavation. These are examples of interruptions in service as a result of third party incidents. A water utility will have no immediate control over these third party incidents but the utility will have to undertake repairs and contend with the interruption in service to its customers.

The sample frame was designed to ensure that a fair number of respondents had experienced an interruption in service. A database provided by South Australian Water provided information on the streets where water supply interruptions have occurred. Streets with three or more interruptions in water service in a two year period were placed in a sampling frame for a stratified sample. Even so, any particular household may not have personally experienced a water service interruption. This would happen if they were not in the segment (shut-off block) within their street where the interruption occurred, or if they were asleep or not at home when the interruption occurred.

The surveys were administered by an independent market research firm (Market Equity) using a drop-off-pick-up format in order to ensure that respondents were given time to think about the choice experiments. The response rate (the number of surveys collected divided by the total number of households contacted) was 80.1%. A total of 835 randomly drawn households from the sampling frame were contacted to fill out the survey and 669 were completed in total. There were 75 refusals and 91 households failed to fill out the survey for pickup over the course of a few days. A total of 332 willingness to accept compensation surveys and 337 willingness to pay surveys were completed.

The sample appears reasonably similar to the census profile of Adelaide.[2] Our willingness to pay sample has the same mean household size, 2.7 persons per household, as the Adelaide metropolitan area. The household size in the willingness to accept compensation sample is slightly smaller at 2.5 persons per household. The mode age band is the same for the Australian Bureau of Statistics population data and our samples. The mode household weekly income level is slightly higher in the Adelaide metropolitan area $600 to $699 per week versus $400 to $599 in our samples. This characteristic is reported as lower income groups may more readily accept compensation. In terms of respondents' experience of supply problems, 61% had experienced a water supply interruption. The perceived inconvenience is wide-ranging with 7% reporting no real inconvenience; 38% reporting minor inconvenience; 38% some inconvenience; 13% significant inconvenience and 3% extreme inconvenience.

4 Description of the Questionnaire

Each questionnaire dropped off to households was accompanied by a covering letter asking the respondent to complete the enclosed survey. Respondents were told that the research would help the industry and regulators better understand community expectations concerning water services.

In each questionnaire respondents were asked about the number of interruptions their household has experienced, the perceived level of inconvenience if they had experienced an interruption in service, six choice sets, debriefing questions on how respondents made choices (did they use only one attribute) and finally a series of questions regarding socio-demographic characteristics. The six choice sets were either six questions focusing on willingness to pay for increasing standards or six questions focusing on willingness to accept compensation for decreasing service levels.

The choice sets were developed in consultation with industry representatives, through focus groups and two pretests. Table 1 provides an example of a choice set for the willingness to accept survey. Each choice set contains the current service standard column which is the same in every willingness to accept compensation choice set. In each choice set there are two alternatives to the current level of service, labelled Column B and C. Respondents were asked to choose among Columns A, Column B and C, or allowed the option of "don't know".

[2] http://www.abs.gov.au/Ausstats/abs%40census.nsf/

Table 1 Example of a willingness to accept compensation choice set

	Column A (current practice)	Column B	Column C
Without warning your house might be without water from...	5:30 A.M. to 8:30 A.M. (i.e. 3 h)	5:30 A.M. to 11:30 A.M. (i.e. 6 h)	5:30 A.M. to 2:30 P.M. (i.e. 9 h)
In the last year, your water supply has never been interrupted. The water supply company tells you that your water supply might fail...	No more times in the next 12 months	One more time in the next 12 months	Two more times in the next 12 months
You were advised about the interruption by...	A card put in your letterbox after the interruption	If you listened to a radio station that was notified	Only if you phoned to find out what is happening
The alternative water supply arrangements offered were...	A 2 l bottle of water to every household where someone is home	Water provided at a central location (water tanker in the street)	Nothing unless you requested it
As part of the package you choose, there will be...	No change to your next water bill	A \$25 once-off rebate on your next water bill	A \$50 once-off rebate on your next water bill
	☐ Column A ☐ Don't know	☐ Column B	☐ Column C

While the same format was used for the willingness to pay choice sets, the choice levels in the choice sets are not strictly comparable. In focus groups, participants indicated that the changes in service standards in the choice sets had to be logically consistent and plausible. Focus group participants were not entirely sure of the customer service standards prior to participating in the focus group. Therefore in the choice set, there was some ability to change the current standard so that the willingness to pay and willingness to accept treatments were effectively valuing similar changes in quality, as has been done in previous studies of this type. However, maintaining uniformity across all attributes was not possible if plausibility was to be maintained. For example, focus group participants indicated that they believed that increasing customer service standards would involve an annual increase in water rates. However, they suggested that decreases in customer service standards would be more likely to involve a one-off rebate associated with an event. Thus the periodicity of the payment vehicle is different for the two treatments and the empirical results to follow are not strictly comparable. Nonetheless it is possible to compare which attributes that households value across the two treatments, even if the willingness to pay values are not strictly comparable.

Of the choice set attributes, three of these, (frequency, duration and the rebate level/increase in water bill) are quantitative variables and two are qualitative variables (communication and alternative water supply). The attribute levels are summarised in Table 2.

The attribute levels in column B and C change from choice set to choice set according to an experimental design. The experimental design contained 192 choice

Table 2 Attributes and levels in the willingness to accept compensation and willingness to pay treatments

Attributes	Levels		
	Current practice	Other levels	
Willingness to accept compensation			
Duration of interruption	3 h	6 h	9 h
Expected number of interruptions in twelve months	No more times	One more time	Two more times
Communication	Card in your letter box	Radio station announcement	Information only if you phoned in
Alternative water supply offered	2 l bottle of water	Water tanker in a central location	Nothing unless you requested it
Rebates	$0	$25 off next water bill	$50 off next water bill
Willingness to pay			
Duration of interruption	6 h	4 h	2 h
Expected number of interruptions in 12 months	Two more times	One more time	No more times
Communication	Card in your letter box	Phone call	Knock on your door
Alternative water supply offered	Nothing unless you requested it	Water tanker in a central location	A 2 l bottle of water is delivered
Cost of annual bill	$0	Increase by $40	Increase by $80

sets which were separated into 32 blocks of six choice sets. The design was developed to ensure that there were contrasts between each of the levels of each of the attributes. While not strictly orthogonal, the average correlation between attributes in the design was small and averaged about 0.06. The design has a D-efficiency of 69%. Not having a design that is 100% efficient was considered desirable as because demonstrated by Severin (2001) there is a trade-off between design efficiency and respondent efficiency (see also Louviere 2004). That is, as designs become very efficient they also become more difficult for respondents to answer. This is because very efficient designs require respondents to trade-off on every attribute which leads them to making more errors which increases variance. Consequently, a design that leads to the most efficient results is unlikely to be a 100% efficient design.

5 Random Utility Models

The choice experiment mimics the choice problem that consumers face everyday when they face products with a wide range of attributes. The consumer is assumed to choose one product over another if the satisfaction derived from that product and its corresponding attributes is greater than the alternatives. This is the random utility model that has served as the basis for modelling choices in a number of applications (Ben-Akiva and Lerman 1985). The consumer, t, receives utility from choosing a particular combination of customer service standards. Utility is assumed to take two parts, an observable systematic component (V_{tk}) and a random unobservable component (ε_{tk}).

$$U_{tk} = V_{tk} + \varepsilon_{tk}$$

where V_{tk} equals the product of B_t, a vector of coefficients and X_{tk} the observable variables that relate to the alternative k and the individual t. The probability (π_{tk}) that any particular set of standards k of the choice set C is chosen by individual t can be written as

$$\pi_{tk} = \Pr\left[V_{tl} + \varepsilon_{tl} \geq V_{tk} + \varepsilon_{tk}; \forall k \neq l \in C\right]$$

If the unobservable components are identically, independently distributed (IID assumption) as Type I extreme values, according to Maddala (1983) the probability that any particular set of standards will be chosen can be written as:

$$\pi_{tl} = \frac{\exp\left(V_{tl}\right)}{\sum \exp\left(V_{tk}\right)}$$

This formulation allows for a closed form solution and the estimation of a conditional (multinomial) logit model of choice. However, the formulation implies a number of restrictions, in particular, the property of independence of irrelevant alternatives. This property results from the IID error assumption.

Within the literature, a number of less restrictive specifications of this model of choice has been developed, including the random parameters logit model and the multinomial logit model. The random parameters model is commonly used where the goal is to understand the heterogeneity of respondent preferences. However, this model has several limitations, including (1) that the analyst has to specify which variables to distribute and how (which is typically somewhat arbitrary), (2) that it is typically not possible to distribute more than a few variables (Swait 2006) and (3) there are concerns in the literature about whether this model suffers from a confound between the model parameters and scale (Swait 2006). For these reasons the multinomial probit model was used in this study.

Until recently the multinomial probit model has not been practical to estimate because of computational limitations (Hausman and Wise 1978; Daganzo 1979). However, with new simulation techniques and improvements in computational speed, the models are becoming more commonplace (e.g. Chen and Cosslett 1998; Cooper 2003). With the multinomial probit model a normal distribution is assumed for the error terms. Thus the utility of alternative j in a multinomial probit model can be expressed as follows:

$$U_j = V_j + \varepsilon_j \sim N\left[0, \sum\right]$$

where ε_j is a random term that is distributed normally with a mean of zero and a variance-covariance matrix of Σ. The probability of choosing alternative j is calculated by multidimensional integration associated with ε:

$$P_j = \int_{\varepsilon=-\infty}^{\varepsilon_c+V_c-V_l} \cdots \int_{\varepsilon_c=-\infty}^{\infty} \cdots \int_{\varepsilon_c=-\infty}^{\varepsilon_c+V_c-V_C} f\left(\varepsilon\right) d\varepsilon_C ... d\varepsilon_1$$

Simulated maximum likelihood estimation is used to estimate the multinomial probit model. A Monte Carlo simulator (e.g. GHK) is used to evaluate the multidimensional integral specified above (see Train 2003).

The covariance matrix for the multinomial probit model is:

$$\sum = \begin{pmatrix} \sigma_1^2 & \sigma_{12} & \cdots & \sigma_{1C} \\ \sigma_{12} & \sigma_2^2 & & \vdots \\ \vdots & & \ddots & \\ \sigma_{1C} & \cdots & & \sigma_C^2 \end{pmatrix}$$

In this model it is possible to allow for the standard deviations of the errors of the alternatives to be different (i.e. not identically distributed), and for the errors to be correlated across alternatives (i.e. not independently distributed). Thus it is technically possible to relax the IIA property. However, in practice not all of the $J(J+1)/2$ elements of the covariance matrix are identifiable (Bunch 1991).

6 Empirical Results

In both treatments, each respondent was asked to complete six choice tasks where they were presented with three choices labelled Column A (Current Practice), Column B or Column C and asked to make a choice. Respondents were also allowed to answer "Don't Know". The distribution of choices is shown in Table 3. For both treatments over half the respondents chose the Current Practice where the customer service standards and the water bill stayed the same.

Effects codes were used for modelling the qualitative variables, (Louviere et al. 2000; Hensher et al. 2005a, b). As each of the attributes have three qualitative levels, two effects coded variables were created for each attribute.

6.1 Estimated Models

Multinomial probit models were estimated for both the willingness to pay and willingness to accept compensation treatments. Variables were included in the models for each of the attributes in the choice sets and an alternative specific constant for the non-current practice options. A two-way interaction between frequency and duration was also included as a likelihood ratio test indicated it was significant, both in the willingness to accept ($\chi^2 = 6.719$, $p = 0.010$) and in the willingness to pay ($\chi^2 = 2.674$, $p = 0.102$) models. An additional covariate was included that represented the number of years that the respondent had lived in their current

Table 3 The range of choices

Choices	Proportion of responses—WTAC (%)	Proportion of responses—WTP (%)
Column A—current practice	54.7	51.2
Column B	16.7	19.0
Column C	13.4	17.6
Don't know	15.2	12.2

residence. Attempts were made to include other socio-demographic variables in the models, however none were found to be significant.

The results for both of the models are presented in Table 4. Several evaluative statistics have been presented for each model. The chi-square statistic indicates that both models are significant overall. In addition, percentage correct predictions have been reported for both models. The willingness to accept compensation model predicts 63.3% of responses correctly, while willingness to pay model predicts 70.4% of responses correctly. Given that there are three alternatives in each choice set and hence the chance of a correct prediction is 33%, these results suggest that both models are reasonably robust (Louviere et al. 2000).

The coefficients and the t statistics for each of the variables in the two models are also presented in Table 4. Notice that the signs of each of the coefficients for the choice set attributes differ across the willingness to accept compensation and willingness to pay models. This is to be expected. For example, the coefficient for a rebate on water rates should be positive in the willingness to accept compensation model. Conversely, in the willingness to pay model the coefficient for an increase in water rates should have a negative sign as one would expect that respondents would want not rates to be increased. In the willingness to pay model, only three coefficients are significant namely water rates, duration and frequency of interruptions. This indicates that respondents are only willing to pay additional water rates to reduce the duration and frequency of interruptions and not extra to pay for improved communication about interruptions or alternative methods of supply. A larger number of coefficients are significant in the willingness to accept compensation model. In addition to the coefficients significant in the willingness to pay model, both of the communication variables (radio station announcement and information only if you

Table 4 Results of the multinomial probit models

Variable name	Willingness to accept compensation		Willingness to pay	
	β	*t*-statistic	β	*t*-statistic
ASC	−0.867[a]	−3.426	−0.165	−0.870
Duration	−0.059[b]	−1.978	0.093[a]	2.560
Frequency	−0.578[a]	−3.833	0.507[a]	2.910
Communication—Level 1	−0.130[b]	−2.049	0.059	0.900
Communication—Level 2	−0.131[c]	−1.843	0.033	0.450
Alternative Supply—Level 1	0.101	1.539	−0.010	−0.150
Alternative Supply—Level 2	−0.005	−0.082	−0.062	−0.920
Rebate/increase in water rates	0.014[a]	4.754	−0.064[a]	−11.390
Years of residence	−0.867[a]	2.508	−0.041	−1.620
σ_2	0.615[c]	1.735	0.152	1.103
σ_{12}	1.095[a]	6.327	0.744[a]	7.919
Summary statistics				
Log-likelihood (asc only)	−1188.721		−1086.042	
Log-likelihood (final)	−1140.481		−733.239	
% Correct predictions	63.44		70.39	
χ^2	52.07[a]		160.63[a]	
N	1,321		1,111	

[a] Significant at the 1% level
[b] Significant at the 5% level
[c] Significant at the 10% level

phoned in) are significant. This suggests that while respondents are not willing to pay for improved communication, if they are asked to choose whether to accept a rebate their choice will depend on the nature of the communication about future supply interruptions. As noted above, the two-way interaction between frequency and duration was significant in both models. This means that the willingness to pay/accept for frequency depends on the level for duration and vice versa. This means that respondents are willing to pay for one of the variables, but their willingness to pay is lower if both are improving in quality (the converse is the case for willingness to accept). The covariate "Years of Residence" is also significant indicating that respondents are more likely to choose the current practice the longer they have been residing in their current location. Lastly, the variables σ_{12} and σ_2 represent the covariance between the error term for alternatives one and two and the standard deviation of alternative two respectively

6.2 Estimates of Willingness to Accept and Willingness to Pay

One of the purposes of this paper is to estimate willingness to accept compensation and willingness to pay for variations in customer service standards. In this case we are interested in the point estimates or the implicit price for the various attributes of service that enter the multinomial probit models. The implicit price is typically calculated by dividing the estimated coefficient on the attribute of interest by the negative of the coefficient of the water rates attribute. However in the presence of two way interactions this formula needs to be modified, as follows:

$$\text{WTA Duration of Interruptions} = \frac{\beta_{Duration} + \left(\beta_{Duration \times Frequency} \times Frequency\right)}{-\beta_{Rebates}}$$

To operationalise this formula, a value for frequency needs to be inserted, and in this case the level relating to current practice has been selected. The implicit prices for willingness to accept compensation and willingness to pay treatments are shown in Table 5. The results indicate that respondents have implicit willingness to accept of \$4.19 to increase the duration of an outage by one hour, and \$29.10 for an additional outage. For the willingness to pay treatments, respondents were prepared to pay \$0.15 to reduce the duration of an interruption by one hour and \$4.05 to reduce the number of annual outages by one. For these attributes the willingness to accept measure exceeds willingness to pay, which is consistent with the literature. However, it needs to be borne in mind that these willingness to pay and willingness to accept

Table 5 Implicit prices for quality of service attributes

	Willingness to pay	Willingness to accept compensation
Duration (hours)	\$1.45	\$4.19
Frequency (number of occurrences)	\$7.95	\$41.18
Radio station announcement	–	\$9.24
Alternative supply arrangements	–	\$9.37

estimates are not directly comparable because of differences in the periodicity of payment and attribute levels

Nonetheless while respondents were not prepared to pay for improved communications, either for phone calls from their utility, or having someone knock on their door to tell them about a supply interruption, respondents willingness to accept values were influenced by a decline in communication standards. In the willingness to accept treatment the implicit price for a "radio station announcement" in place of a "card in your letter box" was \$9.24, while the implicit price for "information only if you phoned in" was \$9.37.

7 Conclusions and Future Research

In most stated preference surveys respondents are asked about their willingness to pay for some policy or quality change. However, in cases where the community has property rights for existing levels of service quality, the use of willingness to pay measures are arguably inappropriate (Mitchell and Carson 1989). An example might be where the community has a legislated right to a certain level of quality of water service or continuity of electricity supply. The main reason that stated preference practitioners have resorted to using willingness to pay measures is because of a perceived difficulty of operationalizing willingness to accept measures (Cummings et al. 1986).

However, rebates are often used by manufacturers, quasi-private utilities and sometimes crown or public corporations, including electricity and water supply authorities or telephone companies. While the community has less experience with the use of rebates in the context of non-use environmental values, this is not the case with some use values such as water supply. The *prima facie* case for rejecting the use of willingness to accept compensation is less strong in this context.

The results presented in this paper demonstrate that it is possible to estimate willingness to accept changes in water supply attributes. The willingness to accept compensation model presented here had reasonable explanatory power, and had a larger number of significant coefficients than the willingness to pay model.

The results also provide a cautionary note about the inaccuracies of using a willingness to pay measure in place of willingness to accept. It was found that the attributes values that are statistically significant differ under each property rights regime. In the context of rebates, the provision of additional communication and provision of alternative water supply was shown to influence whether the community would support a reduction in quality of service, but this was not a significant value for a price increase. Therefore simply assuming that a willingness to pay model can be used to represent the community's attitudes about the use of rebates may well be subject to error.

While this study has estimated the community's willingness to accept compensation for declines in service levels, it has not examined the community's willingness to pay for Guaranteed Service Levels. Achieving certain levels of service is not cost-less, and the paying out of subsidies when service levels are not met also creates a cost, both of which are ultimately paid for through increases in utility bills. Given the tension between those generally metropolitan utilities that find the use of Guaranteed Service Levels convenient for managing contractors, and those utilities in rural and regional areas which find them infeasible to implement because of the large geographic areas that they manage, further research in this area could be undertaken to identify the willingness to pay of metropolitan versus rural and regional communities for Guaranteed Service Levels and the availability of rebates for service failures. This could be compared to the costs of implementing these guarantees to determine whether and where they are economically efficient.

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