Urban Water Restrictions: Attitudes and Avoidance

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In most urban cities across Australia, water restrictions remain the dominant policy mechanism to restrict urban water consumption. The extensive adoption of water restrictions over several years means that Australian urban water prices have consistently not reflected the opportunity cost of water (Edwards 2008). Given the generally strong political support for water restrictions and the likelihood that they will persist for some time, there is value in understanding householders' attitudes in this context. More specifically, identifying the welfare gains associated with avoiding urban water restrictions entirely would be a non-trivial contribution to our knowledge. This paper describes the results from a contingent valuation study that investigates consumers' willingness to pay to avoid urban water restrictions. Importantly, the research also investigates the influence of cognitive and exogenous dimensions on the utility gain associated with avoiding water restrictions. The results provides some salutary insights into the impact of this policy mechanism on economic welfare.

Key words: Urban water restrictions, water policy, contingent valuation

1. Introduction

In most urban cities across Australia, the level of rainfall is the key variable that determines the extent to which water can be harvested and used by the urban population. Faced with a sequence of dry years water restrictions remain the dominant policy mechanism to restrict urban water consumption. Economists are generally of the view that this type of allocation mechanism does not achieve economic efficiency (see, for example Edwards 2008). Using water efficiently in an urban context requires that it be allocated to those users who gain the highest marginal social value. This is often not given priority in an urban water economy, with social and political objectives generally dominating decision making.

Water restrictions usually constrain particular uses of water or their timing, but they do not require households to reduce the amount of water they use per se. Therefore, water restrictions do not directly address the fundamental issue of 'total use of water' and restrict householders' freedoms. Understandably, there is substantial conjecture about the positive and negative consequences of restrictions in the eyes of consumers.

Politicians favouring water restrictions commonly try to gain the support of the public by playing the 'moral suasion' card. Appeals are also often made on the basis of 'intergenerational equity', i.e. use less water to ensure water for your children (see, for instance, Goulburn Valley Water 2010; Water Corporation 2010). It has also become common place for proponents of restrictions to claim that the public generally supports water restrictions and the punitive measures that attend them (see, for instance, Gadd 2009).

This papers contribution is to challenge the context of these claims. For instance, is the purported support of the public premised on the assumption that the populous is attentive and knowledgeable about the national distribution of water and able to avail themselves of important information? Often, consumers are ignorant toward options and opportunities and this is apparent not only among the poor or the uneducated (Shafir 2007). Arguably, there is ample evidence in the press and elsewhere that consumer knowledge of water issues is far from complete (see, for instance, Crase 2009) and it may be useful to test the purported public support for water restrictions against this factor.

In the current context, understanding the value that consumers place on avoiding water restrictions would offer some insight into the welfare costs that are inflicted by water restrictions. Moreover, investigating the influence that psychometric and exogenous variables have on the value estimates of avoiding water restrictions would be a useful contribution in terms of differentiating the urban water customer market.

This paper considers the welfare estimates associated with avoiding water restrictions by presenting the results of a contingent valuation (CV) study drawing data from NSW and Victoria. The research also embodies data from water rich and water poor communities and draws from regional and metropolitan settings. Accordingly, the influence of these variables over the preferences of consumers can be considered.

The paper itself is divided into three additional parts. Section two explores several aspects of choice behaviour covering economic, sociological and psychological dimensions. In section three, we briefly consider the theoretical groundings of CV and present the design and results of this study. We also report the empirical estimates of respondents' willingness to pay (WTP) to avoid urban water restrictions. The final section addresses the core findings before offering some brief concluding remarks.

2. Behaviourist perspective

Behavioural economics builds on the foundations established by neo-classical economics by incorporating a focus on the underlying psychological cognitions and, in turn, improve predictions of field phenomena and policy. It is important to note that this approach does not dismiss conventional economics where equilibrium, efficiency, and utility maximisation are central. Rather, behavioural economics develops traditional economics in that it offers a greater psychological dimension and often simply relaxes basic assumptions that are not key to the economic field (Camerer *et al*. 2004). It also offers useful insights into choice and decision behaviour generally.

Stern (2000) has developed a classification of variables that influence behaviour comprising four main groups.[1] These include attitudinal factors, external or contextual forces, personal capabilities, and habit or routines. Attitudinal factors include values, norms, beliefs, and attitudes. These particular variables may affect the general behaviour

[1] Stern (2000) developed these groups after reviewing existing literature that studied causal variables on behaviour in an environmental context.

of individuals or their specific behaviours. There are a number of theories that underpin behavioural variance. Namely, the cognitive dissonance theory of Festinger (1957), the norm-activation theory of Schwartz (1977), the new environmental paradigm (NEP) scale of Dunlop and Van Liere (1978), and the theory of planned behaviour.[2]

Secondly, the external or contextual forces are variables that are exogenous to individuals and these may drive choices. For instance, financial constraints, legal structures, regulations, a constrained physical environment, and community expectations are all influencing factors that are exogenous to the individual. Notably, the way in which these factors impact on an individual's behaviour is dependent on their beliefs and attitudes (Stern 2000). In the present context, the way water restrictions impact on an individual's behaviour will be dependent at least in part on their beliefs and attitudes.

Thirdly, personal capabilities refer to the knowledge and skills that are required for certain behaviours. A number of authors suggest that the explanatory power of socio-demographic variables is relatively limited in the context of environmental behaviours (see, for instance, Bateman *et al*. 2002; Dietz et al. 1998; McFarlane and Boxall 2003). However, Stern (2000) claims that variables such as income, gender, age and educational level may be proxies for personal capacities.

[2] Armitage and Conner (2001) regard the theory of planned behaviour (TPB) of Ajzen (1991) and the theory of reasoned action (TRA) of Fishbein and Ajzen (1975) as the most widely researched model of the relationship between attitudes and behaviour.

Finally, habits or routines also provide a set of variables that influence behaviour. Stern (2000) acknowledge that habits and routines may need to be altered in order for behaviour to change.

According to Stern (2000), these causal factors are not independent of each other, and behaviours are dependent on a wide range of causal factors, both general and behaviour-specific. In addition, the literature suggests that attitudinal factors appear to demonstrate the greatest predictive power when behaviours are not extensively limited by context or personal capacities (see, for instance, Stern 2000; Tyler *et al*. 1982; Ajzen 1991; Bamberg 2003).

2.1 A closer look at the psychology of choice behaviour: The theory of planned behaviour

The theory of planned behaviour is a model developed by Ajzen and Fishbein (1970) to predict an individual's behaviour. This model is embedded in a framework of learning theories and builds on the theory of propositional control (Dunlany 1967) and the theory of reasoned action (Ajzen and Fishbein 1970). The theory of planned behaviour has proved effective in predicting behavioural intention and actual behaviour in a wide range of situations, including donating blood, safer sex behaviours, alcohol use and voting (Ajzen and Fishbein 1977; Bryan, Ruiz and O'Neill 2003; Sheppard, Hartwick and Warshaw 1988). The theory suggests that the intention to engage in a particular behaviour is a function of three antecedents: the attitude toward the behaviour, social norms, and perceived behavioural control. The following discusses these in more detail and in the context of the research problem.

2.1.1 Attitudes

D'Astous *et al*. (2005, p.292) defines attitudes as "an evaluative predisposition toward the behaviour as a function of its determinant personal consequences". That is, the individual's attitude toward a particular behaviour is operationalised by the beliefs about the negative consequences and rewards associated with performing that behaviour (Ajzen and Fishbein 1970; Harrell 1991; Tolman, Edleson and Fendrich 1996). The anticipated gain and loss related with a certain behaviour is measured against one another to aid in choosing the behaviour that minimises loss and maximises gain.

The conclusions drawn from existing research into attitudes vary. For instance, Aitken *et al*. (1994) suggests that attitudes have limited explanatory power regarding water consumption behaviour, although this result must be reviewed in relation to methodological concerns (see, for instance, Watson *et al*. 1999). Moore *et al*. (1994) studied changes in community water conservation attitudes, knowledge, and behaviour intentions and found significant correlation between reported behaviour attitudes, and intentions.

2.1.2 Social norms

Subjective norms are defined as "the perceived social acceptability of behaviour" (Kernsmith 2005). Norms are usually limited to the social acceptability of the behaviour to people that are most significant to the individuals, however they may also include expectations by the society in general. Social norms related to the acceptability of domestic water usage have been addressed in primary prevention campaigns involving television and radio commercials, billboards, and education efforts in schools that attempt to convey the message that excessive water use is unacceptable (DSE 2004). In the context of water usage, social norms are evolving. Put simply, it is becoming increasingly socially unacceptable for consumers not to take responsibility for their own water consumption, especially in the urban domain.

2.1.3 Perceived behavioural control

Perceived behavioural control is an individual's perception of the extent to which they have the capacity (i.e. resources and opportunities) to achieve a behaviour in a successful way (d'Astous *et al*. 2005). These expectations vary in their magnitude, generality and strength. Basically, the theory proposes that an individual's confidence in their ability differs across situations, with magnitude referring to the degree of difficulty to perform the behaviour, generality to the scope of situations that the behaviour may be necessary and strength refers to the individual's degree of confidence (Kernsmith 2005). In the current context, the perception that individuals have of their behavioural control regarding compliance with water restrictions may potentially impact on their preferences toward avoiding them.

This discussion suggests that there is scope to address wider politico-economic considerations associated with urban water restrictions. More specifically, it is plausible to identify individuals' WTP to avoid restrictions and investigate how this interacts with psychological and exogenous variables and information about water management generally.

3. Contingent valuation

To further investigate householders' preferences surrounding water restrictions, data were collected to specifically uncover the preference for avoiding restrictions entirely. These data are considered in the context of the CV methodology.

3.1 Bid design

Amongst the stated preference techniques, the most extensively used approach is the contingent valuation (CV) method, which has been commonly employed to value preferences for goods across numerous countries (Carson *et al*. 1995; Carson 2001). In a CV method study, respondents are asked questions to elicit their maximum WTP or minimum willingness to accept compensation for a predetermined change. A number of contingent valuation studies have used the multiple-bounded discrete choice (MBDC) response format as an alternative to the dichotomous choice format (Loomis and Ekstrand 1997; Welsh and Poe 1998; Poe *et al*. 2001; Cameron *et al*. 2002; Roach *et al*. 2002; Alberini *et al*. 2003; Evans *et al*. 2003; Vossler *et al*. 2003). The MBDC approach increases the number of possible intervals to k+1 (where k is the number of bids shown to a respondent).[3] This approach improves the efficiency of the welfare estimate (Rowe *et al*. 1996).

[3] The MBDC approach presents respondents with a range of bid amounts, which are spaced by intervals.

This research employed a payment card (MBDC) with an exponential response scale design that contained 13 cells. The value given to respondents in the first cell was $0. The values in the second cell through to cell twelve were computed by equation (1),

$$B_n = B_1 (1 + k)^{n-1} \qquad (1)$$

In this case, B_n is the bid amount, where B_1 equals 1 and k is determined by the range selected for the payment card. The value of k[4] (0.86) is selected so that $(1+k)^{11}$ generates a maximum value for the payment card that approximates the desired value (i.e. $(1.86)^{11} = 921$). For ease of respondent review, the actual values listed on the payment card were rounded. Expressing a value of $900 instead of $921, or $40 instead of $41, is less distracting to respondents when they review the payment card, rarely has this had a significant effect on WTP summary statistics, and is not likely to be within the reporting precision of respondents (Rowe *et al*. 1996). Appendix A illustrates the bid design used for this study. In this study, the MBDC format required respondents to indicate their voting certainty on a proposed policy referendum at each of the possible dollar values specified on the payment card (bids) by choosing from "definitely no", "probably no", "not sure", "probably yes", and "definitely yes" response alternatives. The exact question asked was:

"Given your household's income and other expenses, we would like you to think about whether or not you would be willing to make an annual payment so your household would not be subject to water restrictions. This amount would be listed as a separate item

[4] The value k equals the percent increase between adjacent cells before smoothing of the values. Cell 13 includes the text 'More than the above,' which implies more than B_{12}.

on one of your water bills for the year. For each of the amounts below, please indicate your willingness to pay to avoid water restrictions" (refer to Appendix A).

3.2 Data collection

Six cities were selected to draw the sample for conducting the main survey, which was distributed on-line to a random sample of households.[5] These cities provided scope for analysis on several dimensions, including comparisons between water rich and water poor cities; Victorian and NSW cities; and regional and metropolitan cities. Complete and valid information was gathered from 512 respondents (Wodonga: 54; Albury: 94; Melbourne: 106; Sydney:102; Goulburn: 51; Bendigo:105). Notably, the surveys were framed such that half included information outlining the percentage of national water usage per sector and the remaining did not.[6] Table 1 presents some relevant characteristics of the pre-defined study locations.

[5] Refer to Fleming and Cook (2007) for a review of the advantages and disadvantages of on-line surveys.
[6] The significance of this is investigated later in the paper by including the variable FACTS into the models.

Table 1. Characteristics of study locations

City	State	Rural or Metropolitan Centre	Population	Average annual residential water supplied for the period 2006-2008 (kL/property)[à]
Melbourne	Victoria	Metropolitan	3.9 million[†]	161
Wodonga	Victoria	Rural	34 504[*]	235.5
Bendigo	Victoria	Rural	96 741[*]	158.5
Goulburn	NSW	Rural	27 277[*]	146.5
Albury	NSW	Rural	48 629[*]	234.5
Sydney	NSW	Metropolitan	4.4 million[†]	190.5

[†]Source: Australian Bureau of Statistics 2009
[*]Source: Australian Bureau of Statistics 2008
[à] This indicator is derived from dividing the total volume of residential water supplied with the number of connected residential water properties (Source: National Water Commission National Performance Report 2007-2008)

Sampling was completed during April 2008, with a response rate of 59%. The characteristics of the sample are presented in Table 2.

Table 2. Sociodemographics of the Survey Respondents

Metropolitan (Sydney, Melbourne)	40%
Rural or Regional Centres (Albury, Wodonga, Goulburn, Bendigo)	60%
New South Wales	48%
Victoria	52%
Average age	42 yrs
Average household income before tax	$978 per week
Own their home	30%
Male	40%
Completed a tertiary degree	34%
Have a lawn and/or garden that requires watering	85%
Have an outdoor pool or spa	15%

The questionnaire consisted of four parts. The first part contained questions regarding respondents' attitude toward water restrictions. A choice-experiment was also presented to respondents in the second section and questions regarding the respondents' socio-economic status were presented in part three.[7] The final section was used to probe respondents about their WTP to avoid water restrictions. The focus of the remainder of this paper will be on the results and findings of the respondents' WTP to avoid water restrictions. However, a feature of the data should be noted here: 18% of the sample reported that they would "definitely not" be prepared to pay any monetary amount to avoid restrictions i.e. this group gave the same response irrespective of the bid amount.

[7] See Cooper and Crase (forthcoming) for a review of the choice-experiment analysis conducted with this data.

This implies a form of protest, or at least a perception that restrictions are not welfare reducing per see. As such their presence requires an extension to the normal statistical models used to analyze such data.

3.3 Ordered probit model

There are a number of techniques for retrieving WTP estimates from this form of data. Here we applied an ordered probit model (see, for instance, Cameron *et al*. 2002; Horna et al. 2007). The central concept of an ordered probit model is that there is a latent continuous metric underlying the ordinal responses observed by the analyst. Thresholds partition the real line into a series of regions corresponding to the various ordinal categories. The latent continuous variable, y^* is a linear combination of some predictors, **x**, the bid amount, **Bid**, plus a disturbance term that has a standard Normal distribution:

$$y^*_i = x_i \beta + \beta_0 \text{Bid} + e_i, \qquad e_i \sim N(0, 1), \forall\, i = 1, \ldots, N.$$

y_i, the observed ordinal variable for individual i, takes on integer values 0 through m according to the method below:

$$y_i = j \quad \Leftrightarrow \quad \mu_{j-1} < y^*_i \leq \mu_j,$$

where j =0,…,m, and $\mu_{-1} = -\infty$, and $\mu_m = +\infty$, and the μj are defined as the 'cut values'.

To determine how changes in the predictors translate into the probability of observing a particular ordinal outcome consider the following:

$P[y_i = 0] = P[\mu_{-1} < y*_i \leq \mu_0]$,

$= P[\infty 1 < y*_i \leq \mu_0]$,

$= P[y*_i \leq \mu_0]$,

substituting from (1),

$= P[x_i\,\beta + \beta_0\text{Bid} + e_i \leq \mu_0]$,

$= P[e_i \leq \mu_0 - x_i\,\beta - \beta_0\text{Bid}]$,

$= \Phi(\mu_0 - x_i\,\beta - \beta_0\text{Bid})$;

$P[y_i = 1] = P[\mu_0 < y*_i \leq \mu_1]$,

$= P[\mu_0 < x_i\,\beta + \beta_0\text{Bid} + e_i \leq \mu_1]$,

$= P[\mu_0 - x_i\,\beta - \beta_0\text{Bid} < e_i \leq \mu_1 - x_i\,\beta - \beta_0\text{Bid}]$,

$= \Phi\,(\mu_1 - x_i\,\beta - \beta_0\text{Bid}) - U(\mu_0 - x_i\,\beta - \beta_0\text{Bid}\,)$.

Therefore, generically:

$$P[y_i = j] = \Phi\,(\mu_j - x_i\,\beta - \beta_0\text{Bid}) - \Phi\,(\mu_{j-1} - x_i\,\beta - \beta_0\text{Bid}\,).$$

For j = m (the ‘highest’ category) the generic form reduces to:

$P[y_i = m] = \Phi\,(\mu_m - x_i\,\beta - \beta_0\text{Bid}\,) - \Phi\,(\mu_{m-1} - x_i\,\beta - \beta_0\text{Bid}\,)$,
$= 1 - \Phi\,(\mu_{m-1} - x_i\,\beta - \beta_0\text{Bid})$.

A maximum likelihood estimation (MLE) is used to estimate the model, thus initially a log-likelihood function is generated. This is achieved by defining an indicator variable Z_{ij} , which equals 1 if $y_i = j$ and 0 otherwise. The log-likelihood is simply:

$$\ln \mathcal{L} = \sum_{i=1}^{N} \sum_{j=0}^{m} Z_{ij} \ln[\Phi_{ij} - \Phi_{i,j-1}],$$

where $\Phi_{ij} = \Phi\,[\mu_j - x_i\,\beta - \beta_0\text{Bid}]$ and $\Phi_{i,j-1} = \Phi\,[\mu_{j-1} - x_i\,\beta - \beta_0\text{Bid}]$.

(Greene 1990)

In the context of the current study, a number of further adjustments were made to account for the panel nature of the data (each respondent contributes 12 observations associated with the 12 bid amounts) and to allow for the possibility that the sample comprises a mixture, with different response behaviors. This can be dealt with by estimating a random effects ordered probit model, where the error term is modified such that:

$$y^*_{ki} = x_i\,\beta + \beta_0 Bid_k + \zeta_i + e_{ki}, \qquad e_{ki} \sim N(0, \sigma_s^2)\ ,\ \zeta_i \sim p_1 N(\mu_1, \sigma_{c1}^2) + (1-p_1)N(\mu_2, 1)$$

where ζ_i is an individual specific random effect, and k indicates the bid within the panel. The implication is that the responses are correlated for an individual, but are independent across individuals (Alberini *et al.* 2003). The individual specific effect ζ_i is specified as a mixture of two normals, with mixing probabilities of p_1 and $(1-p_1)$. The benefit of this specification is that it very parsimoniously allows for a latent class representation of complete rejection of the tradeoffs implied in the utility function. It is possible that some individuals are philosophically opposed to removing water restrictions, even if there were no cost to themselves. In fact, some 20% of the sample always select the "definitely no" response. If the mean of one of the distributions takes on a large –ve value, then, conditional upon membership of that class, the probability of rejecting any bid size can approach 1. Given that one cannot identify ex ante membership of the classes, the mixing probabilities identify the proportion of the sample. However, it is possible to parameterize membership based on observed characteristics, which we apply here: probability of class membership is modeled as a logit functional form. Identification requires that a number of restrictions be applied. It is not possible for the mean of both normal distributions to be freely estimated: here we impose the restriction that the expected value of the means is zero (i.e $p_1\mu_1 + (1-p_1)\mu_2 = 0$). Similarly, one variance term has to be constrained (to unity) while the other is freely estimated (σ_{c1}^2).

Finally, we allow for heterogeneity in the variance of the non-individual specific random component e_{ki}. An issue with the standard specification of the ordered logit model is that it imposes a common variance across individuals. The implication is that, for a common value of deterministic utility, all respondents are assumed to have the same distribution of probabilities across the 5 classes of responses. This does not allow for the possibility that some individuals may exhibit much greater consistency in their responses i.e. that the unobserved random component within each question may have a smaller variance for some than others. The scaled ordered probit relaxes this assumption and parameterizes the variance σ_s^2. These extensions to the representation of the error process gives considerable flexibility in the representation of different behaviors and motivations.

3.4 Findings

A scaled ordered probit model was estimated for all respondents. Table 3 summarizes the results of model 1, where significant socioeconomic and attitude items have been included to improve model fit.[8]

[8] Refer to Appendix B for a description of the additional variables.

Table 3. Ordered Probit Model

	Coefficient	Z statistic
BID	-0.435 ***	29.33
LAWN	0.237 ***	4.27
WATER	0.093**	2.03
FAIR	0.060 ***	2.66
SPACT	0.046**	2.55
TEDU	0.121 **	2.46
NUMRES	0.071 **	2.36
INCOME	0.374 ***	7.71
VALUES	0.137 ***	3.45
INTENTION	0.162 ***	3.34
ATITUDE	-0.281 ***	4.36
OFTCOM	-0.075 ***	2.54
	Cut points	
μ_1	-0.412 ***	2.55
μ_2	0.046	0.29
μ_3	0.528 ***	3.26
μ_4	1.174 ***	7.17
	Scale equation (log standard deviation)	
EXTINFO	0.038***	3.34
FACTS	0.116***	3.56
	Log odds parameters (class 1)	
EXTINFO	0.209**	2.41
PBC	0.531***	3.54
SOCIAL NORMS	-0.263*	1.89
FAIR	-0.209*	1.77
constant	-1.191***	7.83
	Random effects	
	Class 1	Class 2
location	-2.14	0.65
Prior probability	0.23	0.77
Log Likelihood	-5950.1452	

*** indicates significance at the 1 percent level. ** indicates significance at the 5 percent level. * at 10% level.

The model indicates that a number of household characteristics are significant determinants of WTP: having a lawn, being in a water poor city, having tertiary education, higher number of residents in the house and higher income all lead to greater WTP. Those who believe that the state has the right to impose restrictions, and that only allowing certain watering activities is reasonable, are also showing higher WTP. The model also indicates that a number of cognitive variables are significant determinants of WTP: those who expressed having a higher intention to comply with water restrictions and having higher environmental values were more WTP. Alternatively, respondents who showed a positive attitude toward water restrictions and who self report that they more often comply with regulations were less likely to pay to avoid them.

The parameterization of the variance shows two significant effects: being presented with additional information on national water consumption trends in the survey, and being informed about water restrictions both tended to increase the variance of the error process i.e. increased understanding reduces the predictability of the individual's response to any specific question. Put differently, for any given bid amount, there is a 'most probable' response, but this probability is smaller for those who were given additional information. This may imply more heterogeneity in beliefs after factual information has been given to respondents.

The introduction of the mixture model for the individual specific random effects gives two mass points, with means at -2.13 and 0.64, with prior probabilities of 0.23 and 0.73 respectively (with an expected mean across the two of zero). The first mass point is sufficiently negative for the probability of giving a "definitely no" response to even a zero bid amount is very high. The membership of this class is interpreted as essentially that group that does not show any response to the bids, consistent with a protest against the proposal to avoid water restrictions through a simple monetary payment. The logit model for membership reveals that those who believed themselves to be well informed about water restrictions, and those who held a higher perceived behavioural control over water were more likely to be members of this class who outright rejected the need to avoid water restrictions, as were those who believed that water authorities did not have a right to impose restrictions (possibly as a protest: if the restrictions are illegitimate, why should I have to pay to avoid them). Respondents that had a lesser concern for behaving 'appropriately' according to social norms were also more likely to be members of the class that rejected the need to avoid water restrictions.

The posterior probability of membership of each class is very tightly defined: over 96% of individuals are assigned to one or other classes with a probability greater than 99%.

3.5 WTP to avoid water restrictions

The definition of the median WTP is complicated if the central category is "unsure". In such cases one can only say that the median WTP lies within a bound. These are defined in this case as:

$WTP_l = (x_i \beta - \mu_3)/\beta_0$

and

$WTP_u = (x_i \beta - \mu_2)/\beta_0$

where l and u indicate lower and upper bounds respectively. Given the inclusion of the respondent-specific exogenous variables x_j, the WTP values can be evaluated either at the means of the variables, or at specific values. One view of these bounds is that they represent alternative interpretations of the value needed to achieve a majority in a referendum: the lower assumes that the majority can include only those who say "definitely yes" and "probably yes", while the upper bound considers those who respond "definitely/probably yes" and "uncertain".

The median WTP for all respondents (assuming that the expected value of the individual specific random effect is zero), and for those in Class 2 are reported in Table 4 below. As one might expect, the range across all individuals is high, with the lower level not significantly different from zero. This is because this sample includes those who have an objection to accepting the policy, even at zero bid value. Those in Class 2 is that group who are responsive to payments, and these give significant upper and lower bounds on median WTP.

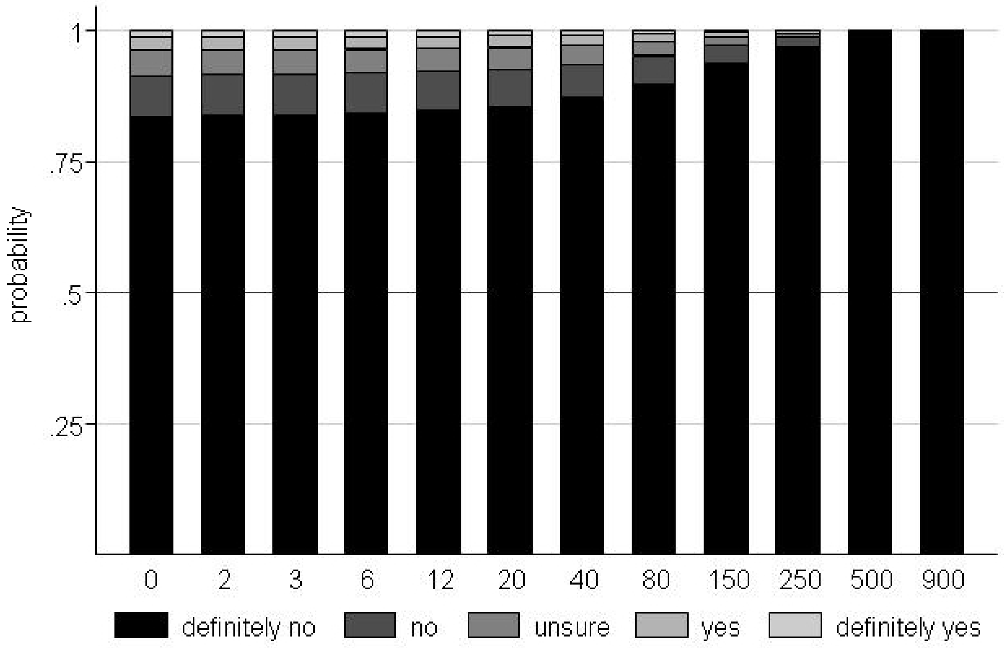
Table 4. Median WTP per annum

	All Respondents	Class 2
Lower bound (Conservative)	-$8	$141***
Upper bound (Liberal)	$103***	$252***

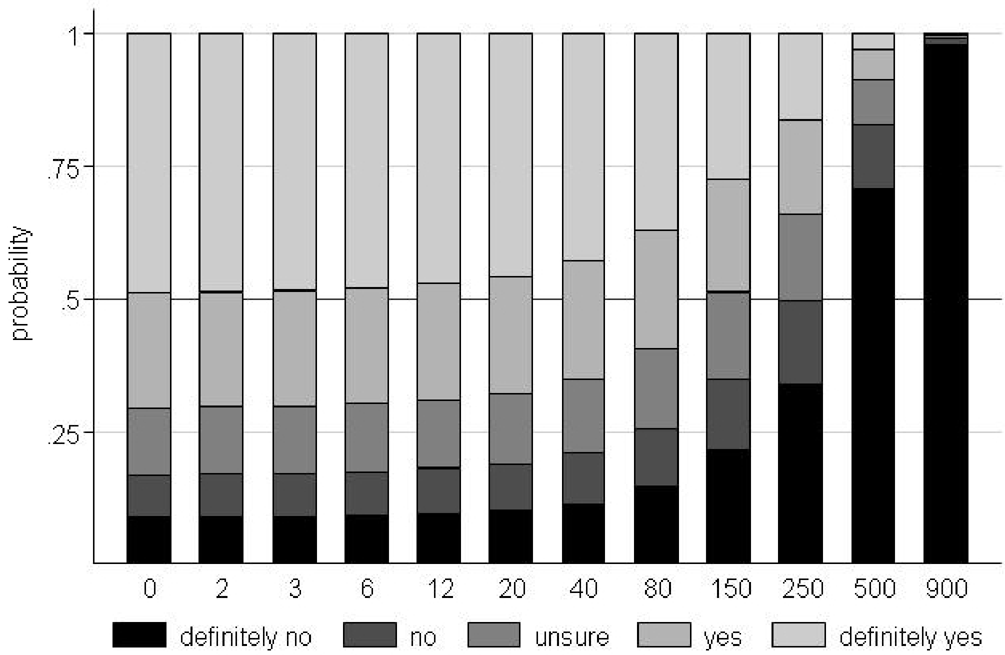
*** indicates significance at the 1 percent level.

Graphs 1 and 2 below illustrates the predicted probabilities for each outcome (definitely no; probably no; unsure; probably yes; definitely yes) for each of the bid amounts, conditional upon being in Class 1 and Class 2 respectively.

Graph 1: Predicted Probabilities: Class 1



Graph 2: Predicted Probabilities: Class 2



A number of unconditional median WTP values were estimated along situational dimensions in order to make meaningful comparisons within the sample data. Table 4 below presents the range for the unconditional Median WTP across three dimensions for Class 2 (those who are responsive to payment). As you would expect, the mediums remain negative for class 1 regardless of particular situational variables, thus these are not discussed further.

Firstly, the WTP range is presented for respondents who have a lawn compared to those respondents who did not have a lawn. In Class 2, respondents who have a lawn are generally more WTP to avoid water restrictions than those without a lawn. Even from the conservative perspective, respondents with a lawn were WTP $152 compared to those without who were WTP $98.

Secondly, Table 4 enables us to compare the WTP range for water rich cities with water poor cities; i.e. those cities that have a history of severe water restrictions compared to those that have been faced with less severe restrictions or restrictions more recently. Analysis shows that respondents from water rich cities have a generally lower WTP range. This may, in part, be explained by the temporal dimension associated with water restrictions. For instance, those in water rich cities may not have been faced with the burdens associated with water restrictions long enough to be prompted to buy their way out of them. Alternatively, those in water poor cities are more likely to be experiencing a diminishing enthusiasm for water restrictions due to the extensive length of time they have been inflicted upon them.

Finally, the WTP range is presented for those respondents with ‘lower’ household income compared to those with a ‘higher’ income (defined as mean minus/plus one standard deviation respectively). The data reveals that those with a higher income had a higher WTP to avoid water restrictions. Notably, participants with a higher income indicate a WTP value of $181 from the conservative perspective, with the upper bound estimating a WTP value of $291.

Table 4. Unconditional Median WTP Ranges: Class 2

	Lawn			
	Yes	t-ratio	No	t-ratio
Lower bound	$152.00	7.94***	$98.00	4.52***
Upper bound	$263.00	13.51***	$208.00	9.55***
	Water			
	Water Rich	t-ratio	Water Poor	t-ratio
Lower bound	$158.00	7.84***	$137.00	7.07***
Upper bound	$269.00	13.13***	$247.00	12.60***
	Income			
	Low	t-ratio	High	t-ratio
Lower bound	$106.00	5.38***	$181.00	9.24***
Upper bound	$216.00	10.90***	$291.00	14.60***

*** indicates significance at the 1 percent level.
Note: All other exogenous variables held constant at mean levels.

4. Discussion and concluding remarks

People's sensitivity to water restrictions across a number of dimensions appears to differ between groups within the population. Being able to identify the segments within the population who are most enthusiastic about paying to avoid water restrictions is an important element to developing effective policy.

Contrary to the implied value of 'saving water' that dominates popular thinking, these results reveal that particular segments within society actually value not being subject to water restrictions. More specifically, attitudinal variables (e.g. attitudes toward water restrictions) and particular value sets (e.g. environmental values) were proven to play some part in influencing an individual's WTP to avoid water restrictions. Similarly, respondents that differ across socio-demographic variables such as income and education also appear to receive significantly differing levels of utility from avoiding water restrictions. In addition, exogenous factors such as the severity and duration of water restrictions imposed within a respondent's city and whether the respondent had a lawn or not were shown to have an influence on the respondent's WTP to avoid water restrictions. Interestingly, the development of the two classes implies that there is a group of respondents who do not *prima facie* gain utility from avoiding water restrictions and another where the impact of water restrictions on human welfare is self evident.

The results also show that when respondents received additional information on their survey regarding national water allocation by sector it significantly reduced the predictability of their responses. Thus, further investigation into the influence of educating householders about national water consumption trends on decision making appears to be warranted. Put differently, the data support the view that objective, factual data on water consumption significantly changes the probabilistic distribution of the choices (for any bid level) in this context, at least relative to those who are exposed to the present information on water saving that typifies most jurisdictions.

The policy implications of these findings are useful in terms of effectively differentiating the market according to variables that influence WTP for water. For instance, differentiating the price of discretionary water use for householders that have a lawn and a higher income compared to householders that do not have a lawn and a lower income appears to have merit. Moreover, presently, state jurisdictions impose a range of constraints to limit household water use with little account for individual preferences or use. Clearly, this approach is not unanimously supported by the population, although many would appear to be in favour of more rigorous application across the populous simply for the sake of it (see Cooper and Crase forthcoming). By way of contrast, the CV data show that particular household segments have a greater inclination to pay to avoid restrictions. All of these topics are worthy of greater scrutiny in a policy context and provide a useful basis for future research.

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Appendix A: Bid Design

Given your household's income and other expenses, we would like you to think about whether or not you would be willing to make an annual payment so your household would not be subject to water restrictions. This amount would be listed as a separate item on one of your water bills for the year.

For each of the amounts below, please indicate your willingness to pay to avoid water restrictions.

	Willingness to Pay?				
Amount (each year)	**Definitely No**	**Probably No**	**Not Sure**	**Probably Yes**	**Definitely Yes**
0	A	B	C	D	E
$2	A	B	C	D	E
$3	A	B	C	D	E
$6	A	B	C	D	E
$12	A	B	C	D	E
$20	A	B	C	D	E
$40	A	B	C	D	E
$80	A	B	C	D	E
$150	A	B	C	D	E
$250	A	B	C	D	E
$500	A	B	C	D	E
$900	A	B	C	D	E
More than the above	A	B	C	D	E

Appendix B: Interactions Variables

ATTRIBUTES/ VARIABLES	DESCRIPTOR	LEVELS/CODING
WATER	Do respondents live in a water poor or water rich city	Water poor=1 Water rich=0
FACTS	Did respondents receive facts outlining national water usage on their survey	Yes=1 No=0
INCOME	Total household income per week	<$200=200 $200-$299=249.5 $300-$399=349.5 $400-$499=449.5 $500-$599=549.5 $600-$699=649.5 $700-$799=749.5 $800-$999=899.5 $1,000-$1,499=1249.5 $1,500+ =1500
EDUCATION	Highest level of education completed	Year 10 at secondary college=1 Year 12 at secondary college=2 Diploma or certificate=3 Tertiary degree=4
NUMBER OF RESIDENTS	The number of residents in their household	1 or 2=1 3 or 4=2 5+ =3
LAWN	Do respondents have a lawn/garden that requires watering	Yes=1 No= 0
FAIR	Do respondents believe that the way authorities enforce water restrictions is fair	Yes=1 No=0
REASONABLE	Do respondents believe that only allowing certain watering activities is a reasonable restriction	1 (Not reasonable)=1 2=2 3=3 4=4 5 (Very reasonable) =5
COMPLY	How often respondents believe their household complies with water restrictions	< 20% of the time=1 20-40% of the time=2 41-70% of the time=3 71%-89% of the time=4 90% plus=5
INFORMED	How informed respondents feel about water restrictions	1 (Very uninformed)=1 2=2 3=3 4=4 5 (Very informed) =5

ATTITUDE VARIABLE	**DESCRIPTOR**	**EXAMPLE QUESTION**	**CODING**
INTENTION	Intention to comply with water restrictions: where increased intention implies greater intention to comply with water restrictions.	"I intend to follow water restrictions in the future"	Factor Score: 4 questions (5 stage Likert scale) were reduced to a single INTENTION variable.
ATTITUDE	Attitude toward water restrictions: where an increase in this variable implies a more favourable attitude toward complying with water restrictions.	"I think it is a good idea to comply with water restrictions"	Factor score: 11 questions (5 stage Likert scale) were reduced to 2 variables- ATTITUDE and SOCIAL NORMS.
SOCIAL NORMS	Respondents attitude toward social norms: where increased social norms implies a greater concern for behaving 'appropriately' according to society's norms.	"Most members of my family think I should comply with water restrictions" x "Generally speaking, I want to do what most members of my family think I should do"	
E-VALUES	Environmental values: where increased environmental values implies stronger values for the environment.	"It makes me sad to see natural environments destroyed"	Factor score: 8 questions (5 stage Likert scale) were reduced to 2 variables- E-VALUES and MORAL PREDISPOSITION.
MORAL PREDISPOSITION	Moral predisposition in general: where increased moral predisposition implies stronger values for complying with the law in general.	"Generally, I feel that I have a duty to comply with the law"	
PBC	Perceived behavioural control over the national water situation: where higher PBC implies higher perceived control.	"It won't make any difference if my household does not comply with water restrictions"	Factor Score: 7 questions (5 stage Likert scale) were reduced to a single PBC variable.