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Household willingness to pay to avoid drought water restrictions :A case study of Perth, Western Australia

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Title

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Abstract

The reliability of future water supply in meeting demand is a major concern in most Australian cities, particularly because of climate change. Water utilities control demand by restricting how households use automatic reticulation (sprinklers) to water their gardens and lawns. This study estimated the cost of water restrictions to households using choice experiments (CE) to derive the willingness to pay (WTP) for a reliable water supply. The study found statistical evidence that if households were willing to move away from the status quo (a scenario in which they would have to endure severe water restrictions) they would be willing to pay 22 percent more on their water usage bill to be able to use their sprinklers up to 3 days a week. Additionally, on average, households would pay a higher water bill of approximately 50% more to finance a new source of supply instead of enduring severe water restrictions.

Keywords

water pricing, logit, desalination, aquifer, restriction, choice experiments

1 Introduction

One of the fundamental questions faced in the urban water sector is the optimal level of supply, given rising demand driven by population growth, increasing cost of supply augmentation, and variability in the yield of water sources due to the vagaries of the weather and more recently due to climate change uncertainties. Whilst there has been increased emphasis on the use of volumetric charging to signal long-run marginal costs in many countries, there is also reluctance on the part of many governments to rely entirely on price signals to ration supply due to political concern over the social implications of charging for water [*OECD*, 1999]. Restrictions on non-discretionary use, such as prohibiting the watering of gardens and lawns or the filling up of swimming pools is an alternative that has some political appeal because customers share the burden of water scarcity more equally [*ERA*, 2005]. However, it leads to criticisms that governments are ignoring consumer preferences in determining the level of water service provision (e.g. *Dwyer*, 2006; *Edwards*, 2006; *Byrne et al*. 2006; *Crase et al*., 2006) and that quantitative restrictions are inefficient.

In Perth, Western Australia, where outdoor water use makes up a substantial proportion of scheme demand, the banning or restriction of the use of sprinklers for garden irrigation has been technically a very effective way of restricting demand, and accepted in the short run. However, the third year in a row of complete sprinkler bans in other cities, such as Sydney and Brisbane, to deal with a prolonged drought has resulted in increased attention on the trade-off between sprinkler restrictions and supply augmentation.

The implementation of water restrictions is usually carried out according to transparent rules regarding the degree of water storage drawdown that invokes restrictions of different levels of severity. However, the point at which restrictions begin to be implemented and the severity do not appear to have been determined by economic considerations regarding consumer preference. In Perth, where climate change has led to a 40 percent reduction in the yield of surface water storages in the last 20 years, the policy emphasis has been on two day per week restrictions together with a ‘government guarantee’ that complete sprinkler bans will not happen. The ‘guarantee’ has been implemented as a 1 in 200 year risk of sprinkler bans (compared to a 1 in 25 year planning risk used in other Australian cities) and has led to accelerated development of supply augmentation.

A number of trade offs arise that are the focus of this analysis. The first is the relationship between severity and duration of water restrictions. By triggering limited restrictions earlier rather than later, water use may be reduced and more draconian measures may be avoided. This is seen to be particularly important in the case of Perth which has a Mediterranean climate, because the difference between two sprinkler-days per week and complete sprinkler bans is the survival of the garden over the summer. The second trade-off is between consumer preferences for water restrictions of any kind and the cost of providing a more reliable service. The third relates to non-market values that might be placed on particular source development options, which may be due to preferences towards water dependent ecosystems which may be damaged by development, or may be due to concern over the safety or taste of particular sources. This third issue may be likened to the market premium placed on credence characteristics in foods, for example.

There have been some economic studies undertaken in recent years to explore the trade offs between customer preferences, system reliability, and source development options. *Howe and Smith* [1993] applied contingent valuation to examine public's views regarding water supply reliability in the city of Aurora, Longmont and Boulder, Colorado. They found that for the city of Boulder, the water utility could reduce reliability of water supply since households were willing to accept (WTA) higher risks of annual shortage events. Several recent studies in Australia have used choice modelling (CM) to examine consumers' Willingness to Pay (WTP) to avoid sprinkler bans. *Hensher et al*. [2006] found that customers in Canberra, Australia, lack the WTP to avoid most types of drought-induced restrictions and were willing to tolerate high-level restrictions for limited periods each year, compared to paying higher water bills. *Gordon et al*. [8] investigated the WTP for future supply sources in Canberra. They found that households were willing to pay an increase of AU$47 on their bills to have recycled water for outdoor use. However, households were found to be WTP AU$55 to avoid drinking the recycled water. Apart from the two studies in Canberra, most published work has examined reliability in terms of WTP to avoid temporary (i.e. in terms of hours) disruption in supply that, from a policy perspective are more about the reliability of the distribution network, rather than about the underlying reliability of the water source (e.g. *Hensher, et al*., 2005; *Hatton McDonald et al*., 2005).

The objective of this paper is to estimate household WTP for a reliable water supply in order to provide information for the rigorous assessment of the relative costs and benefits of water restrictions versus new source development.

1.1 Case study Perth metropolitan households

The water utility supplying the city of Perth has an approach to system planning that can be described as extremely conservative. Source development planning is based on (virtually) a zero tolerance to complete sprinkler bans. This is done by planning for a 1 in 200 year risk of sprinkler bans. A review of other Australian water utilities finds that currently there is consensus that the frequency of restrictions that involve a total sprinkler ban should be limited to 1 in 25 years [*ACTEW*, 2004]. The objective of maintaining a capacity buffer to limit the risk of a total sprinkler ban to a one in 200 year event warrants review [*ERA*, 2005] as this virtually 'no chance' of sprinkler bans accelerates the need for development of new supply sources.

Increased environmental awareness, and the national emphasis on allocating water for the environment has meant that the development of water sources for urban water supply can be very contentious. The concerns appear to relate specifically to the perceived environmental or other non-market attributes of the proposed water supply development. Amongst a number of potential new sources of supply, the study selected the following three that have received the most attention and investigation by the water utility:

1. Extracting groundwater from the south west Yaragadee aquifer, which is located in a nearby region, and which also involves investing in approximately 200 km of pipeline.

This option involves some risk associated with lowering of watertables which may impact upon water dependent ecosystems which are a habitat for rare species. It may also impact on river flows and reduce the quality of riverine environments used for recreation purposes. Another concern is the opportunity cost of water in terms of foregone economic growth in the local region, which have been shown to be substantial [*Brennan* [12]].

2. Constructing a second seawater desalination plant. The environmental impact can include greenhouse gas emission and uncertainty as to the impact of releasing hypersaline brine back into the ocean.

3. Reverse Osmosis Managed Aquifer Recharge (ROMAR) involves injecting treated recycled wastewater from wastewater treatment plants directly into the underground aquifers under controlled conditions. The water can be withdrawn at a later date for indirect potable reuse, or used as a barrier to prevent saltwater or other contaminants from entering the aquifer.

At the time of implementing the study all three options were potentially available, however, at the time of writing (May 2007) the Yarragadee scheme has been postponed indefinitely by the State Government.

1.2 The survey instrument

This study applies choice experiments (CE) as the survey instrument because it allows flexible alternatives and generates considerable cost savings through the ability to value a number of options simultaneously [*Gordon et al.*, 2001]. Choice experiments are a survey-based technique to model preferences for goods. The goods are normally described in terms of their attributes and the attributes have varying levels. In the survey, respondents are asked to choose their most preferred alternative from a set of alternatives having different attribute levels. By including the price as one of the attributes of the good, WTP for the attribute can be indirectly recovered from the people's choices [*Hanley et al*., 2001]. The identification of attributes and levels in this study was done through a series of focus groups and a pilot survey. The final list of attributes is presented in Table 1. It includes measures of 'regular' outdoor restrictions, probability and severity of a complete sprinker ban, sources of alternative water supplies and cost.

The statistical software package 'SAS' was used to generate the orthogonal experimental design that was needed to construct the CE survey. An orthogonal design is a combination of alternatives which would allow the attribute levels to vary independent of one another i.e. there is no correlation between the attributes [*Bennet,* 1999]. Given restrictions on the maximum sample size due to budget limitations, a one-ninth fraction of the $4 * 3^4$ full factorial design was used to reduce the number of choice sets down to $(4*3^4/9) = 36$ while maintaining orthogonality. The 36 choice sets were then segmented into four blocks of nine choice sets each. Each choice set listed three options, one of which was the status quo. The status quo remained the same across all choice sets while attribute levels in options II and III varied according to the experimental design.

An internet survey was chosen as the mode of obtaining responses due to its cost-effectiveness. Responses from each survey are automatically saved in a data-base file, which reduces non-sampling bias from inputting data incorrectly. It is known that internet access or coverage is the main hindrance of internet-based surveys. Hence, a panel of respondents was sought through an independent survey company and proportional stratified sampling was used to select respondents from each suburb of Perth to ensure coverage of the population.

1.3 The questionnaire

In the choice sets, respondents were presented with a range of supply augmentation options to choose. Figure 1 shows a typical choice set presented in web format. Option I was identical in each choice experiment, and represented the consequences of doing nothing about future supplies, and hence was described as the 'status quo' scenario. They were asked to consider the scenario over a 10 year time horizon (from now until 2016). In the 'do nothing' scenario, they would be faced with a level five (one watering day per week) sprinkler restriction which will never be lifted during the 10 year time period. Additionally, they would also face a one-in-three year chance of a total sprinkler ban which, once invoked, would persist until there is sufficient rainfall to refill dams and replenish aquifers. In this 'do nothing' case, their water usage bills will remain unchanged. Three future supply sources along with a brief description were presented to respondents for selection; they include extracting groundwater from the South West Yarragadee aquifer, construction of the second desalination plant and injecting treated wastewater into the underground aquifer for future use. The survey asked respondents to assume that all three sources produce the same amount of water. These alternative sources of supply were then included as potential changes in the second and third options.

[Insert Figure 1 here]

Respondents were reminded before every choice set to keep in mind their budget constraints and were asked to provide an estimate of their annual water usage bill. A hyperlink was provided in the choice sets for respondents to click and read the details of each attribute if they feel the need for clarification. The final section of the questionnaire consisted of a series of socio-economic questions including whether the respondents own a home, have an automatic reticulation (sprinkler) system and the number of people in the household. There were also questions on level of education, age and whether they were pensioners, as pensioners receive a rebate on their water bills.

1.4 The model

For a three option choice set, implicitly the respondent is assumed to be comparing the utility obtained from each of the three options. The utility for choosing each option is determined by the levels of the five attributes in the choice sets and the individual preferences as modified by the socio-economic variables. . Hence the model provides an estimate of the effect of a change in any of these attributes on the probability of one of these options being chosen [*Morrison et al.*, 1998]. The functional form of the utility functions (Vj) are shown in equations (1a) and (1b).

The status quo utility is specified as

$$V_1 = SQ + \sum \beta_k (A_{1k}) + \sum \beta_s (SQ * S_s) + \beta \ (BILL_1) + \sum \beta_{js} (A_{1j} * S_s) \quad (1a)$$

and options II and III utilities are specified as

$$V_2 = \sum \beta_k (A_{2k}) + \beta \ (BILL_2) + \sum \beta_{js} (A_{2j} * S_s)$$

$$V_3 = \sum \beta_k (A_{3k}) + \beta \; (BILL_3) + \sum \beta_{js} (A_{3j} * S_s) \qquad (1b)$$

where

- SQ status quo dummy variable (SQ=1 for the status quo option and SQ=0 for options II and III.
- A_{nk} level of attribute k in option n
- S_s socio-economic variable s
- $BILL_n$ water usage bill amount (% change/year) in option n

It was decided that the options will not be labelled because labels can prompt respondents to select their preferred alternative on the basis of the label alone and the impact of varying levels of attributes can become trivialised [*Bennett and Adamowicz*, 2001].

When the data consist of choice-specific attributes instead of individual-specific characteristics, the appropriate model is the conditional logit model which is specified as

$$\mathrm{Prob}(Y_i) = \exp^{\lambda V_i} \Big/ \sum_{j=1}^{J} \exp^{\lambda V_j} \qquad (2)$$

where V_i is the indirect utility function which represents the utility of the different options specified in (1) and λ is a scale parameter.

Estimation of the conditional logit model is simplest by Newton's method or the method of scoring. The log-likelihood is

(3)

where $d_{ij} = 1$ if $Y_i = j$ and 0 otherwise. The conditional logit assumes independence from irrelevant alternatives (IIA) in that the disturbances are independent and homoskedastic. If a subset of the choice set is truly irrelevant, omitting it from the model altogether will not change parameter estimates [*Hausman and McFadden*, 1984].

A number of socio-economic variables were introduced into the model as interactions with the SQ. Incorporating socio-economic interaction terms enriches the model by bringing in the heterogeneity, or difference between individual respondents. It also helps answer questions of varying preferences amongst varying socio-economic groups.

2 Results

A total of 414 usable questionnaires were obtained. Response rate is difficult to estimate for these types of survey, because it is not simply the proportion who respond from any initial invitation. Sample filters (such as excluding households without private gardens and/or lawns) and the fact that the survey may be closed when target numbers are achieved, irrespective of the willingness of potential respondents to complete the survey make the concept of response rate problematic. Summary statistics for socio-economic variables that were hypothesized to possibly have an impact on choices are reported in Tables 2 and 3. Not all of the socio-economic variables reported were significant in the final model. The conditional logit results presented in this paper were analysed using STATA, a specialised statistical software package. Table 4 presents the parameter estimates for the significant variables from the model. The β coefficients estimated under the conditional logit model can be used to estimate the part-worth, or the rate at which respondents are willing to trade-off one attribute for another. The part-worth indicates the maximum (minimum) increase (decrease) in costs that the respondent would be WTP (WTA) to achieve a change in an attribute that increases (decreases) their utility. For each attribute it can be estimated by dividing the derivative of the utility function with respect to the attribute by (the -ve of) the coefficient of the price attribute.

Insert tables 2, 3 and 4 here

2.1 Preference for water restriction

Not all variables relating to water restrictions were significant. Of perhaps most interest is the lack of significance of any variable that relates to the probability or severity of a complete sprinkler ban (i.e. DURA1, DURA5, BAN110 and BAN1200). There are two possible interpretations of this result. One possible explanation is that that the welfare of consumers is genuinely not impacted by the prospect of a complete sprinkler ban. The other explanation is that households view the development of new sources overrides the these outcomes. It is difficult to evaluate which of these is a more appropriate explanation, but it is likely to be the latter. This is because households do show a preference for increasing sprinkler days from 1 day a week (the status quo) to 3 days a week (DAY3). This is evidence that they do show some sensitivity to access to sprinkler use and therefore must have some concern over sprinkler bans.. A potentially perverse result, however, is the equivalence of the status quo and the option to use sprinklers for 5 days per week (DAY5). As 5 days use includes the possibility of using for 3 days, one might expect that DAY5 should be as least as valued as DAY3. A possible interpretation is that respondents are concerned not only for their own use but also potential use by others. They may be concerned that ‘other’ irresponsible users will overexploit the resource if allowed to use for 5 days (even if they would not) and are prepared to trade away the increased value of their own (responsible) use of water to prevent this happening. Another possible explanation is that there may be other disutilities associated with DAY 5 such as the lawn growing too fast and mowing would have to become more frequent. However, without further evidence this is conjecture. For the option of moving from 1 day to 3 days sprinkler use they are willing to pay 22% extra on their annual water usage bills (or around AU$57 based on average water usage bill of respondents surveyed = AU$260) to increase sprinkler days from one to three per week.

2.2 Preference for a new source of supply

The three alternative sources of supply are treated as separate variables. There is evidence of some variation in values due to the heterogeneity in the socio-economic factors, as measured by interaction terms between source and factors. Specifically, higher education levels tend to reduce the value of desalination and Yarragadee options; being male tends to increase the preference for ROMAR, and having automatic reticulation tends to reduce the value for all sources, with a higher impact on ROMAR (Table 4).

The preference for ROMAR amongst men is consistent with *Leviston et al.*, [2006] where they found in their study on predicting community behaviour on indirect potable reuse of wastewater through managed aquifer recharge that male were more likely to support recycled water scheme than women. However, *Leviston et al.* [2006] did not find any other significant differences based on education income, age and family unit.

Interpreting partworths for source is now complicated by the impact of the socio-economic effects. To better understand the population heterogeneity effect on WTP for different supply sources, eight possible representative respondents, given the 3 socio-economic attributes used were analysed separately. Reported in Table 5 are the part-worth or WTP estimates (defined as % changes in bill) for different supply sources based on varying combinations of socio-economic characteristics which were significant in the model. Blank spaces in the table represents WTPs which were not significantly different from zero, therefore, are not reported.

Men with lower than university education level and have no automatic reticulation were willing to pay nearly double (99% increase) their current bill to have ROMAR as the new supply source. On the contrary, women of the similar education level with automatic reticulations preferred the second desalination plan and were willing to pay 89% more on their usage bills. The group with the highest WTP for the South West Yarragadee were WTP up to 73% and were the same group of men that preferred ROMAR.

[Insert Table 5 here]

Note the results in Table 5 imply that there is no strong indication of people with automatic reticulation preferring a particular supply source. This is most like because households with automatic reticulation are more concerned about having water to use in the future than where the water actually comes from.

2.3 Preference to move away from the status quo

It was stated in the choice experiment questionnaire that respondents will be faced with severe water restrictions if they decide to do nothing (do not augment supply) in the next 10 years. Generally in choice experiments, respondents have a tendency to be reluctant to move away from the status quo (status quo inertia). It is also the case that this preference for the status quo (irrespective of the attributes of the alternatives) can be influenced by the socio-economic characteristics of the respondent. These impacts can be evaluated by including a status quo dummy into the model, equal to one if the option is the status quo, and interacting the dummy with respondent attributes. The results from Table 4 indicate a large number of significant respondent attributes: increased income, age, education, auto reticulation and presence of kids are all associated with a lower preference for the status quo, while higher number of people per household tends to increase the preference for the status quo. Several summary estimates of the status quo effect can be calculated. If one takes a representative individual with the average socio-economic characteristics of the sample the status quo effect is not significantly different from zero. However, if one evaluates the effect for each individual in the sample one can see considerable heterogeneity, and in particular a large proportion have a significant negative effect. The interpretation of this effect is that these respondents positively prefer change from the status quo, *irrespective of the attributes of the alternatives on offer*. This is contrary to the normal stasis argument. Interpretation of this in a strict form is problematic: the implications are that respondents would be preferred to move away from the status quo, even if the alternative options have higher costs and no significant improvement in service levels or source. It is possible that the current high profile of the water crisis in Perth has led to an overstatement of the willingness to change, and a possible implicit assumption that any change from the status quo will be an improvement, even if this was not the case in all of the actual choices presented to them in the experiment.

The presence of a status quo effect (of either sign) leads to further issues in evaluating the amount that individuals will pay for alternative programs. Conventional partworths (as reported in Table 5) reflect the value placed in a marginal change in an attribute. However, by definition, change in an attribute implies movement away from the status quo. Evaluating a change in the state of the world requires both the status quo and attribute specific effect to be included (*Bennet and Adamowicz*, 2001). Figure 3a-3c report estimates of the partworths associated with all three sources, having taken into account the socio-economic attributes affecting both status quo and the alternative sources.

3 Discussion

This study found that there was little ability to identify preferences to pay for reduced risk of water restrictions in either short or long term. The only water use attribute that was found to be significant was the increase from one sprinkler day per week (the proposed status quo) and three sprinkler days a week. Given the current level of two days a week, this may reflect a strong desire not to suffer further restrictions, as compared with the current position. Nonetheless, it is possible that respondents may find the attributes presented in a choice set format too difficult to understand, or used the availability of new sources as a causally prior attribute.

This finding supports the argument by *Howe and Smith* [1993] regarding the importance of incorporating the public's views regarding reliability in water systems planning.

In terms of preference for new source of supply, this study however, contrasts with findings from *Gordon et al*. [2001] which argues that households have a negative WTP for drinking recycled water. We found evidence that households were willing to pay to have ROMAR as a new source of supply if they had to choose between ROMAR and severe water restrictions. We also found consistent results with *Leviston et al.* [2006] in that men are more likely to support ROMAR. The difference in the findings can be due to time frame as this study had been conducted in a time of heightened awareness of water scarcity and better public understanding of ROMAR. The difference could also be because ROMAR does not require households to drink recycled water directly. However, there are wide distributions of WTP, reflecting the heterogeneity of the individuals in the sample, although the vast majority were positive towards each source (no more than 5% have negative values).

Information provided to respondents regarding different supply sources were all published information found on the water utilities' website and academic studies. Information on the uncertainties of health impact and environmental impact of different supply sources were kept at a minimal as to not bias the respondents' decision. Therefore the authors could not conclude that decisions regarding different supply sources were based on the respondents' perfect knowledge of the advantages, short-comings, environmental impacts and investment costs of each source.

4 Conclusions

This study attempts to estimate households' WTP for reliable water supplies to allow a rigorous assessment of the relative costs and benefits of demand management through restrictions versus new source development. The study found that households consider water bill, supply source and the ability to water three days a week as important factors that affect household WTP. Water utilities and those involved in setting water planning strategies should take household preferences into account when making decisions regarding water restrictions and supply augmentation due to the significance of the attributes found in this study.

There is consensus that the frequency of restrictions that involve a total sprinkler ban should be limited to one in 25 years [*ACTEW*, 2004]. This study could not conclusively justify the currently high supply buffer set by the water utility in Perth as results from the survey did not show any statistically significance results of WTP for different levels of sprinkler ban probabilities. However, there is a possibility that the BAN variables were not significant because respondents assumed that accessing new sources would alleviate the need for restrictions, even though the choice options did not reflect this.

There is significant difference in WTP for different water sources when one accounts for different socio-economic groups. The distributions of WTP suggest mean values of around 50% increases in water bills although there are some individuals with much higher estimated values, in excess of a 100% increase.

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Figure Captions

Figure 1 **Example of a choice set as seen by respondents on the internet**

Figure 2 **Distribution of status quo preferences across sample the**

Figure 3a **Distribution of individual partworths for source: Desalination plant**

Figure 3b **Distribution of individual partworths for source: ROMAR**

Figure 3c **Distribution of individual partworths for source: Yarragadee**

Tables

Table 1: Attributes levels in the choice sets and coding

Attribute	Levels	Variables and coding
Sprinkler days allowed per week	1 day per week	DAY3=0, DAY5=0
	3 days per week	DAY3=1, DAY5=0
	5 days per week	DAY3=0, DAY5=1
Duration of sprinkler restrictions (over period 2006-2016)	1 year in the next 10 years	DURA1=1, DURA5=0
	5 consecutive years in the next 10 years	DURA1=0,DURA5=1
	All 10 years for the next 10 years	DURA1=0,DURA5=0
Chance of a sprinkler ban	A 1 in 3 year chance	BAN110=0, BAN1200=0
	A 1 in 10 year	BAN110=1, BAN1200=0
	Never have a sprinkler ban	BAN110=0, BAN1200=1
Source of new supply	Second Desalination	DESAL=1, ROMAR=0, YARRA=0
	South West Yarragadee	DESAL=0, ROMAR=0, YARRA=1
	ROMAR	DESAL=0, ROMAR=1, YARRA=0
	No new source supply	DESAL=0, ROMAR=0, YARRA=0
Bill	No change	Bill = 1, 2, 3
	100% increase (double)	
	200% increase (triple)	

Table 2: Socio economic variables (dummy variables) and the percentage of responses

Variable	Description	(%) total responses
OWN	OWN=1 if respondent owns a home (paid off mortgage)	27
BORE	BORE=1 if household has a bore	17
PENSION	PENSION=1 if respondent is a pensioner	19
EDU	EDU=1 if respondent has university education or more	38
AUTO	AUTO=1 if household has automatic reticulation	57
GEND	GEND=1 if male	37
KID14	KID14=1 if household has children under the age of 15	22

Table 3: Descriptive statistics of socio-economic variables (continuous variables)

Variable	Description	Average	Std. Dev.
INC	Gross annual household income	72,446	43,287
PPL	Number of people in the household	2.8	1.3
AGE	Age of respondent	45.	12.5
WBILL	Annual water usage bill for the household (AU$)	260	217.4

Table 4: Parameter estimates of the conditional logit model

Variables	Coef.	Std. Err.	P>|z|	[95% Conf. Interval]	
DAY3	0.2478††	0.0921	0.0070	0.0673	0.4282
DAY5	0.0996	0.0940	0.2890	-0.0846	0.2839
DURA1	-0.1032	0.0971	0.2880	-0.2935	0.0871
DURA5	-0.0950	0.0957	0.3210	-0.2825	0.0926
BAN110	-0.0156	0.0649	0.8100	-0.1427	0.1115
BAN13	0.0072	0.0958	0.9400	-0.1806	0.1950
BILL	-1.1331††	0.0547	0.0000	-1.2404	-1.0258
DESAL	1.0094††	0.2365	0.0000	0.5458	1.4729
ROMAR	0.8578††	0.2339	0.0000	0.3993	1.3163
YARRA	0.9265††	0.2298	0.0000	0.4762	1.3768
SQ	1.0522††	0.3784	0.0050	0.3106	1.7938
SQ*INC	-2.1E-06†	9.2E-07	0.0220	-3.9E-06	-3.1E-07
SQ*AGE	-0.0160††	0.0032	0.0000	-0.0223	-0.0096
SQ*PPL	0.2154††	0.0341	0.0000	0.1485	0.2822
SQ*EDU	-0.5207††	0.1885	0.0060	-0.8901	-0.1512
SQ*AUTO	-1.0177††	0.2044	0.0000	-1.4184	-0.6170
SQ*KID14	-0.5722††	0.1061	0.0000	-0.7802	-0.3642
DESAL*EDU	-0.6423††	0.2145	0.0030	-1.0627	-0.2219
ROMAR*EDU	-0.0760	0.2092	0.7160	-0.4861	0.3341
YARRA*EDU	-0.5291†	0.2124	0.0130	-0.9454	-0.1127
DESAL*GEND	-0.1304	0.1220	0.2850	-0.3696	0.1088
ROMAR*GEND	0.2674†	0.1194	0.0250	0.0333	0.5015
YARRA*GEND	-0.0983	0.1226	0.4230	-0.3385	0.1420
DESAL*AUTO	-0.4670†	0.2289	0.0410	-0.9156	-0.0184
ROMAR*AUTO	-0.6673††	0.2247	0.0030	-1.1078	-0.2268
YARRA*AUTO	-0.4690†	0.2267	0.0390	-0.9134	-0.0247
Log likelihood	-2965.4224				
LR $chi^2(26)$	1405.69				
Prob > chi^2	0.0000				
Pseudo R^2	0.1916				
No of obs	10017				

†† indicates statistical significance at the 99% confidence level

† indicates statistical significance at the 95% confidence level

Table 5: Part-worth of different supply sources based on varying socio-economic groups

Gender	Education	Have automatic reticulation	WTP		
			DESAL	ROMAR	YARRA
Men	≥University	Yes			
Men	≥University	No		93%	
Men	< University	Yes	36%	40%	
Men	< University	No	78%	99%	73%
Women	≥University	Yes			
Women	≥University	No		69%	
Women	< University	Yes	48%		40%
Women	< University	No	89%	76%	82%

Table 6: Part-worth of alternative sources

Source	Part-worth (reported as % increase water usage bill)	
	Mean	Median
Desalination	54%	56%
ROMAR	62%	61%
Yarragadee	51%	53%

Figures

Figure 1

	Option I (Status Quo)	Option II	Option III
Water restriction days	Can use sprinklers 1 day per week	Can use sprinklers 3 days per week	Can use sprinklers 5 days per week
Water restriction duration	All 10 years for the next 10 years	All 10 years for the next 10 years	5 consecutive years in the next 10 years
Sprinkler ban	A 1 in 3 year chance of a total sprinkler ban	A 1 in 10 year chance of a total sprinkler ban	Never have a total sprinkler ban
Source supply	No new source supply	South West Yarragadee aquifer	Second desalination plant
Water bill	No change	100% increase	200% increase
Please select the button for the option you most prefer			
	Select here for Option I (Status Quo)	Select here for Option II	Select here for Option III
Select only one			

Figure 2

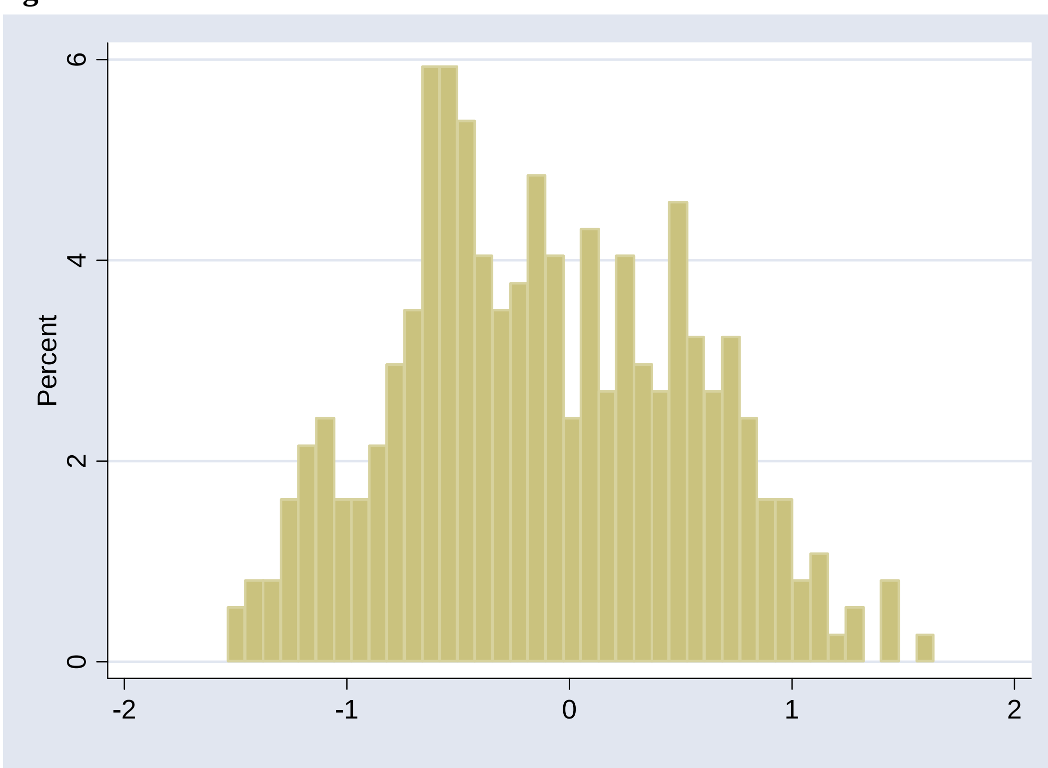

Figure 3a

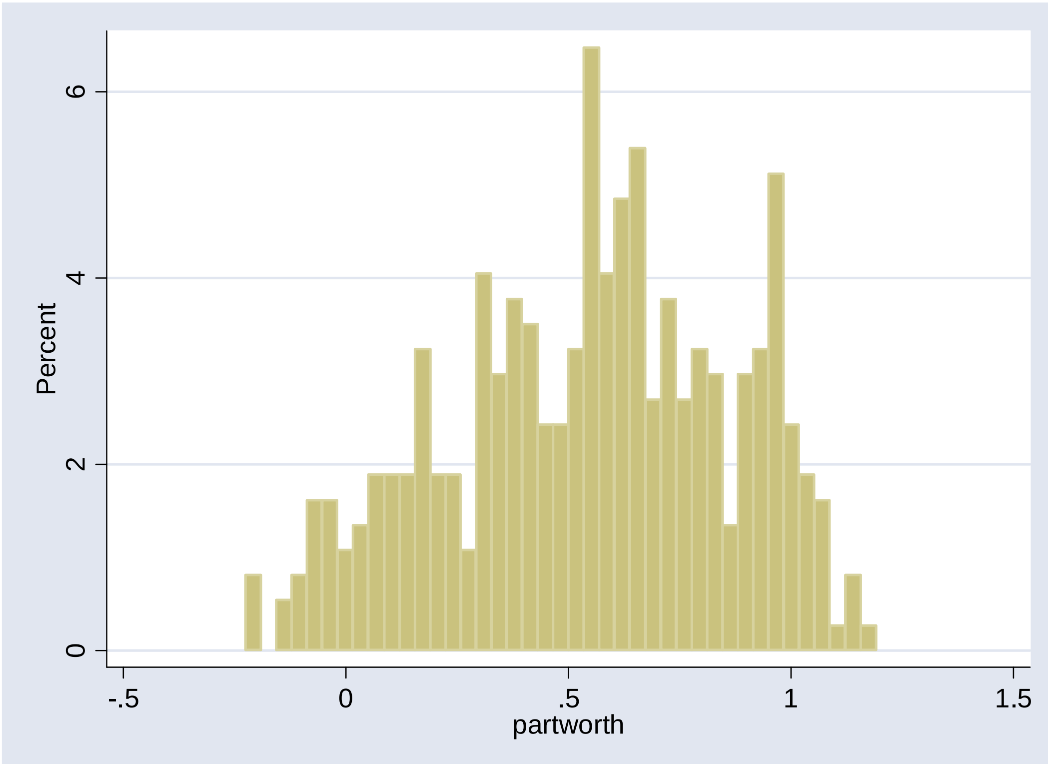

Figure 3b

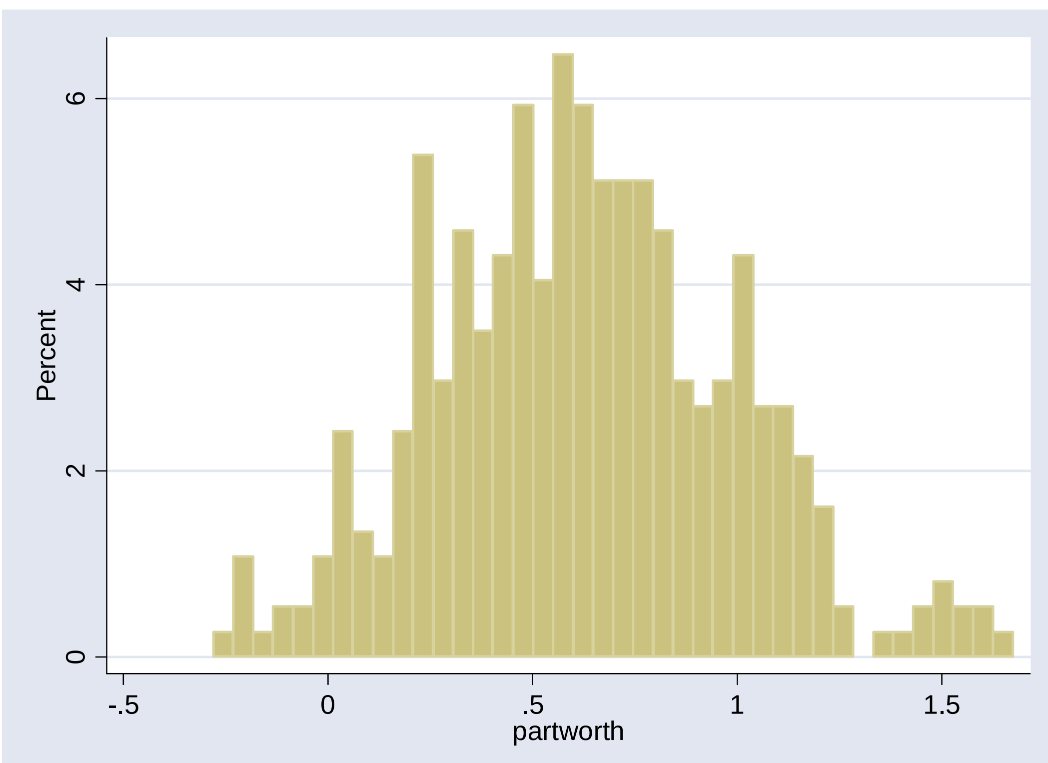

Figure 3c