Risk Aversion and Preferences for an Environmental Good: A discrete choice experiment

Zack Dorner, Daniel A. Brent, and Anke Leroux

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Risk Aversion and Preferences for an Environmental Good:

A discrete choice experiment[1]

Zack Dorner[2], Daniel A. Brent[3] & Anke Leroux[2]

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[1] Funded by CRC for Water Sensitive Cities
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Water supply in Australia

Mix of mains supply (2009/10) (Productivity Commission 2011, pg 18):

Source	**Proportion of supply (%)**
Dams	81.1
Groundwater	9.0
Desalination	2.8
Recycled	3.8
Pipeline	3.3
Total	100.0

Data - survey

- Professional door to door survey of 981 home owners in Manningham and Moonee Valley (VIC) and Fairfield and Warringah (NSW)
- March to October, 2013
- Random sample of home owners
- 167 people randomly selected to do incentivised risk task first (based on Holt and Laury, 2002, to estimate coefficient of CRRA)
- Risk data imputed for most of the rest of the sample

Discrete choice experiment

	Desalination	Recycled	New Dam	Groundwater	Stormwater	Pipeline
Allowed Use						
Price/Kl	$2.80	$1.60	$2.20	$2.80	$3.20	$1.60

Intrinsic source of risk - supply risk

Source	**Weather dependent?**
New dam	Yes
Stormwater	Yes
Pipeline	Yes
Desalination	No
Recycled	No
Groundwater	No

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- Unlike other DCEs where risk can be considered separately from options (extrinsic risk like probability of success of a policy), risky attribute is instrinsic to the options
- Eg. Wielgus et al. (2009), Botzen & van den Bergh (2012), Glenk & Colombo (2013), Rolfe & Windle (2015)

Theoretical framework - including intrinsic risk

Utility V from choosing a water source is given by:

$$V = \boldsymbol{\beta}_j \mathbf{X}_j + \boldsymbol{\beta}_q \mathbf{X}_q + \beta_c C \quad (1)$$

- $\mathbf{X}_j$ is dummies for source (relative to new dam)
- $\mathbf{X}_q$ is dummies for for allowed use (relative to potable)
- C is cost

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Adding risk:

$$V = \boldsymbol{\beta}_j \mathbf{X}_j + \boldsymbol{\beta}_q \mathbf{X}_q + \beta_c C + \beta_r \left(\frac{X_r^{1-\gamma_i} - 1}{1 - \gamma_i} \right) \quad (2)$$

- $X_r = 1$ when not risky
- $X_r = 2$ when risky
- γ_i is CRRA coefficient estimated by risk task

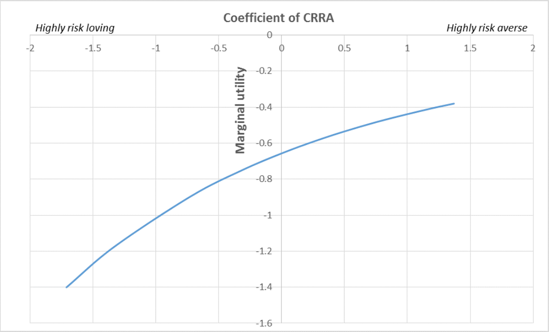
Results - mixed logits

	(1)	(2)
Fixed Coefficients		
Non-potable outdoor	0.0265	0.0259
	(0.0470)	(0.0470)
Non-potable indoor	-0.1452^{***}	-0.1471^{***}
	(0.0514)	(0.0514)
β_r (weather dependent risk)		0.7115^{***}
		(0.2236)
Random Coefficients		
Desalination	-0.7724^{***}	-0.0546
	(0.0879)	(0.2417)
Recycled	-1.6845^{***}	-0.9622^{***}
	(0.1109)	(0.2506)
Groundwater	-2.5589^{***}	-1.8375^{***}
	(0.1207)	(0.2533)
Stormwater	-0.9977^{***}	-0.9998^{***}
	(0.0788)	(0.0789)
Pipeline	-2.2565^{***}	-2.2534^{***}
	(0.0980)	(0.0978)
Cost	-0.1118^{***}	-0.1086^{**}
	(0.0425)	(0.0431)
AIC	23795.0	23787.7
BIC	23893.8	23893.6
Observations	8600	8600
Individuals	860	860

Coef; (Std Err); *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
Std Errs are clustered at the respondent level.
Allowed use relative to potable; source relative to new dam.
$^{+}$Triangular distribution. All others are normal.

Marginal utility of choosing desalination over new dam, by γ

$$
\begin{aligned}
\hat{\hat{V}}_D - \hat{\hat{V}}_{ND} &= \hat{\hat{\beta}}_D + \hat{\beta}_r \left(\frac{1^{1-\gamma_i} - 1}{1-\gamma_i} \right) - \hat{\beta}_r \left(\frac{2^{1-\gamma_i} - 1}{1-\gamma_i} \right) \quad \text{(3a)} \\
&= \hat{\hat{\beta}}_D - \hat{\beta}_r \left(\frac{2^{1-\gamma_i} - 1}{1-\gamma_i} \right) : \quad \text{(3b)}
\end{aligned}
$$



Results summary and conclusion

- Supply risk (weather dependence) is an intrinsic attribute of new water sources that matters to individuals, depending on their level of risk aversion
- We also test new technology risk and do not find statistical significance
- Non-potable indoor is disliked relative to the other allowed uses
- Significant heterogeneity in preferences for water sources

Results summary and conclusion

- Supply risk (weather dependence) is an intrinsic attribute of new water sources that matters to individuals, depending on their level of risk aversion
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- Non-potable indoor is disliked relative to the other allowed uses
- Significant heterogeneity in preferences for water sources

- We build a more complete picture of preferences for new sources of water by incorporating an important and intrinsic risky attribute - supply risk - in a theoretically informed model
- We utilise level of risk aversion, measured by an incentivised risk task