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**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 experiment¹

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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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Groundwater	No

- Unlike other DCEs where risk can be considered separately from options (extrinsic risk like probability of success of a policy), risky attribute is intrinsic 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:

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

- \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:

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

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

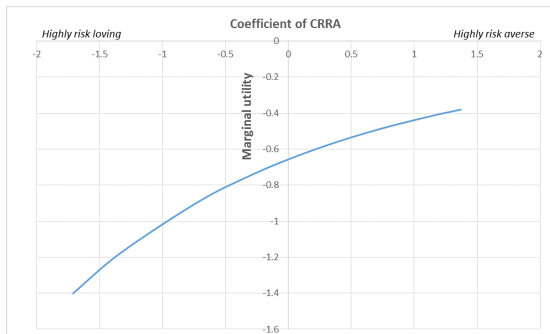
Results - mixed logits

	(1)	(2)
<i>Fixed Coefficients</i>		
Non-potable outdoor	0.0265 (0.0470)	0.0259 (0.0470)
Non-potable indoor	-0.1452*** (0.0514)	-0.1471*** (0.0514)
β_r (weather dependent risk)		0.7115*** (0.2236)
<i>Random Coefficients</i>		
Desalination	-0.7724*** (0.0879)	-0.0546 (0.2417)
Recycled	-1.6845*** (0.1109)	-0.9622*** (0.2506)
Groundwater	-2.5589*** (0.1207)	-1.8375*** (0.2533)
Stormwater	-0.9977*** (0.0788)	-0.9998*** (0.0789)
Pipeline	-2.2565*** (0.0980)	-2.2534*** (0.0978)
Cost	-0.1118*** (0.0425)	-0.1086** (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

$$\hat{V}_D - \hat{V}_{ND} = \hat{\beta}_D + \hat{\beta}_r \left(\frac{1^{1-\gamma_i} - 1}{1 - \gamma_i} \right) - \hat{\beta}_r \left(\frac{2^{1-\gamma_i} - 1}{1 - \gamma_i} \right) \quad (3a)$$

$$= \hat{\beta}_D - \hat{\beta}_r \left(\frac{2^{1-\gamma_i} - 1}{1 - \gamma_i} \right) : \quad (3b)$$



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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- 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