

*Empirical methods for determining a reserve
price in conservation auctions*

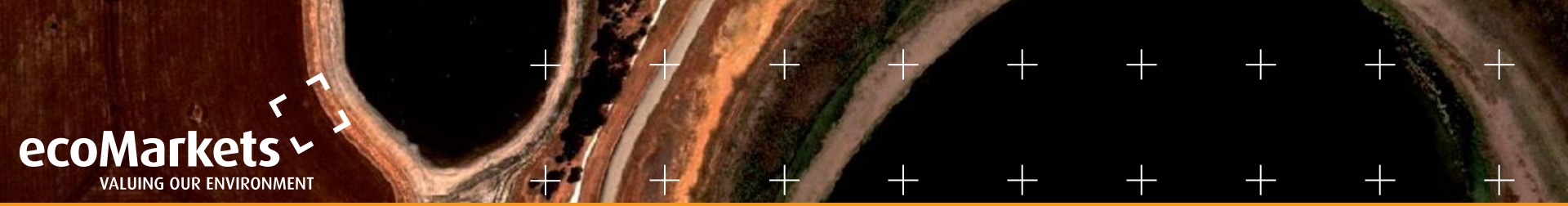
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Overview

- Increasing use of conservation auctions to procure environmental outcomes on private land
- Lack of demand-side information
 - > Reserve price?
 - > Demand schedule?
- Challenge
 - > Developing an empirical estimate of a reserve price “ex poste’ to select relatively *low* cost bids

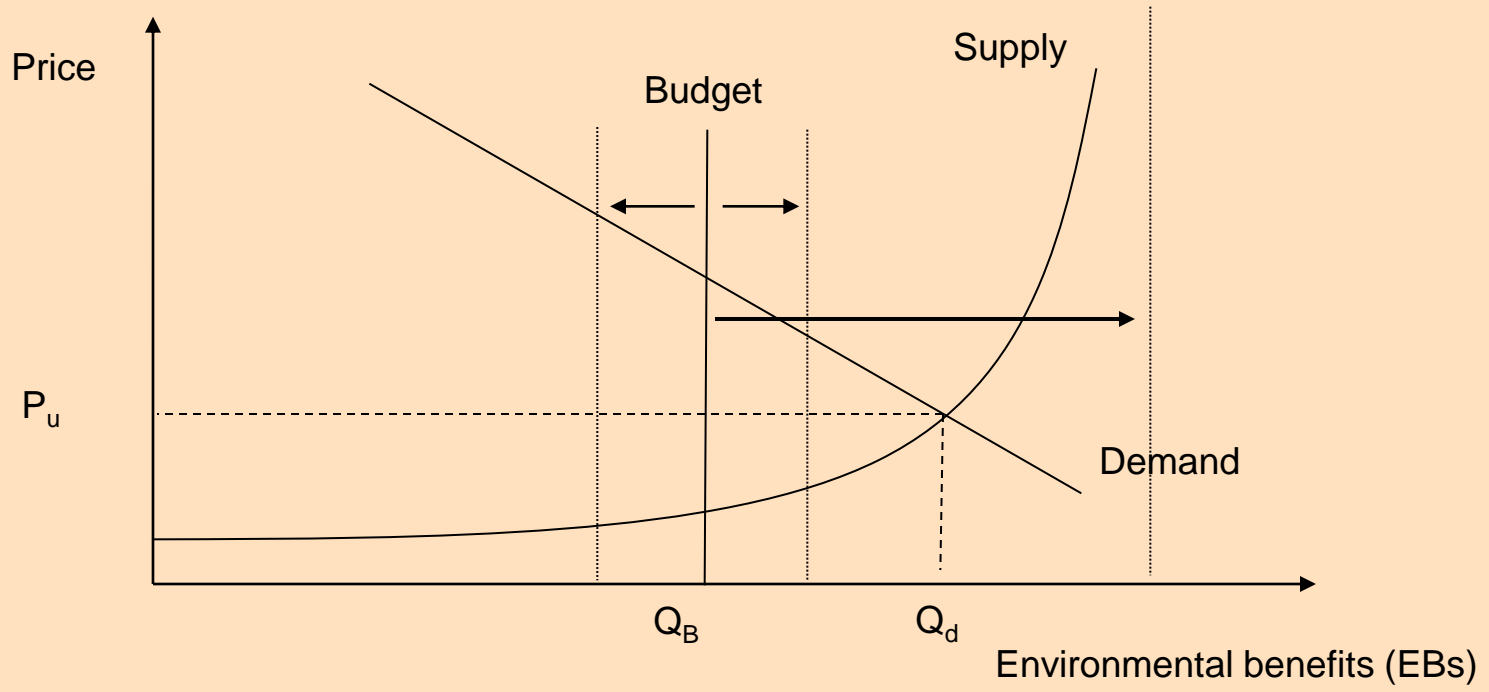


Conservation auctions

- Benefits include:
 - > Cost revelation incentives provided by competitive bidding
 - > The use of a scientifically based scoring system to identify high value project – *bang for buck*
 - > When bids are ordered they provide a traditional view of supply curve
- Issues
 - > Majority of auctions are implemented in Australia without a reserve price
 - > US Conservation Reserve Program, Victorian Stormwater Tender



Supply and demand for environmental services





Ex post reserve price strategy

- Motivation
 - > Victorian government committed \$4.5m to three EcoTenders without a budget breakdown
 - Focus on possibility of a tender that may be undersubscribed
- The strategy required the following properties:
 - > Relies solely on data obtained within the tender;
 - > Is replicable and transparent; and
 - > Selects a cut-off that has merit from a theoretical point of view.



Information Gain

- Unit bid prices are interpreted as signals by landholders to provide EBs
 - > Landholders 'willingness-to-accept'
 - > bids come from low-cost and high-cost sources
 - > Basic model – prices are normally distributed – the mean could be used to split low and high

- Source of the signal
 - > Typical landholders
 - > *'Information gain' requires an alternative model for the source*



Information-theoretic principles

- > Consider two types of landholders
 - Low-cost and high cost
 - Use information gain to separate landholders into two mutually exclusive groups
- > More complex model assumes two sources
- > The threshold (between groups) that leads to the greatest amount of information gain forms the reserve price

$$\mathcal{I}(X; Y) = H(X) - H(X|Y) \quad (3)$$



Solution Process: Algorithm 1

$$I(S; \theta) = h(S) - h(S|\theta) \tag{20}$$

$$= h(S) - (h(S_{\text{low}}|\theta) + h(S_{\text{high}}|\theta)) \tag{21}$$

- where $\theta = \{y_1, y_2, \dots, y_n\}$ denote the labels of the bid prices in S
- > Candidate thresholds are the mid points between the bids
- > For each threshold the bids are labelled (low, high) and Equation 21 is evaluated
- > This is done for all thresholds and the threshold that maximises Equation 21 generates the greatest *information gain* and forms the reserve price





Application

- The algorithm has been applied to many tenders across Victoria
 - River , Wetland, Victorian Volcanic Plains, Weeds, Coastal and Woodland
- Three EcoTenders (\$4.5m)
 - Two were under subscribed and one over subscribed
 - In all three (including those above) there was an absence of data to inform a reserve price

EcoTender Results

	(1)	(2)	(3)	(5)	(6)	(7)	(11)
Area	Budget Allocation	Algorithm Allocation	Total cost all bids	Algorithm Alloc. as percentage of budget	Marginal cost (Budget)	Marginal cost (Algorithm threshold)	Percentage change in avg. unit cost (Algorithm over Budget)
CC	\$1.5M	\$1.1M	\$1.4M	71%	N/A (\$2025)	\$242	27%*
PPWP	\$1.5M	\$0.87M	\$1.3M	58%	N/A (\$57,851)	\$6,572	40%*
WG	\$2.5M	\$2.7M	\$5.2M	108%	\$0.55	\$0.78	-7%



Conclusion

- > The algorithm is useful when there is no information about opportunity costs (other programs)
- > There are cost savings if a tender under-subscribed
- > Budget has little relevance to the cut off point on the supply curve
 - Advertising, communications, geographic, timing (season)
- > Probity
 - It can be replicated (bid panels – objectivity)
- > Extensions to the current application
 - Prior information - past reserve prices, any other information about prices

