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Price efficiency in environmental markets – Lessons from Experiments

Baker McKenzie - Transition of trading schemes – Presented by
From state to national level – 12th August 2005 Karel Nolles

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Presentation outline

- *Less focused on specific markets, more general in application*
- *Discusses current research that is not completed.*
- *Intended to be food for thought*
- *Discussion paper on the website.*

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Big policy stuff

- Using markets to drive least cost implementation of given goal. (Fix q , let p be determined).
- Seeking Allocative and Dynamic efficiency
 - Spot prices for managing efficient operation of today's plant
 - Forward prices for driving efficient investment
- Relationship between forward and spot prices depends on a number of things, including the market institution in each market.
- Stated policy goals are dependent on price being "correct" (meaning efficient).

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What is experimental economics??

- Using real people to participate in simplified markets under controlled laboratory conditions.
- Participants are remunerated in cash, according to their performance in the market.
- Since under controlled conditions, multiple runs can be conducted, while varying one or more parameters.
- Frequently implemented across a set of networked computers

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Generator G4

Today's Date and Days to next Acquistal
Friday 16 January 2009
There are 345 Days to Acquistal date

My Cash Balance: \$1,192.34

Send Offer or Bid
Offer Price Offer Qty
Enter Price Enter Quarter
Send Offer to Sell

Bid to Buy RECs
Bid Price Bid Qty
Enter Price Enter Quarter
Send Bid to Buy

REC Registry
RECs in MY account: 3,000

My Generator: G4
My Energy Generation and REC Creation
Cost of generation was \$28.00 per MWh

Last Market Traded Price: \$31.24

Received - Trades

Offers to Sell Currently in Market

11/Jan/09	G1	Offers 27 @ \$12.42 each = \$337.74
10/Jan/09	G2	Offers 208 @ \$14.37 each = \$2,987.76
12/Jan/09	G2	Offers 27 @ \$13.42 each = \$362.34
08/Jan/09	G2	Offers 287 @ \$19.37 each = \$5,550.49
13/Jan/09	G1	Offers 140 @ \$13.16 each = \$1,842.40
01/Jan/09	G1	Offers 215 @ \$9.35 each = \$2,010.25
09/Jan/09	G2	Offers 164 @ \$7.62 each = \$1,250.88
08/Jan/09	G1	Offers 206 @ \$5.59 each = \$1,151.54
06/Jan/09	G1	Offers 178 @ \$2.58 each = \$459.24
01/Jan/09	G1	Offers 115 @ \$1.54 each = \$177.10
11/Jan/09	G1	Offers 218 @ \$0.21 each = \$45.78
11/Jan/09	G1	Offers 217 @ \$0.10 each = \$21.70

Bids To Buy Currently in Market

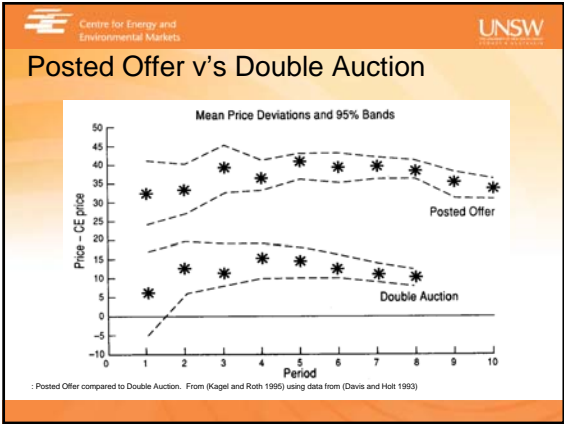
11/Jan/09	R7	Bids for 104 @ \$51.57 each = \$5,363.28
14/Jan/09	R8	Bids for 95 @ \$52.87 each = \$5,022.15
04/Jan/09	R6	Bids for 116 @ \$11.62 each = \$1,347.92
04/Jan/09	R6	Bids for 102 @ \$51.53 each = \$5,256.06
12/Jan/09	R6	Bids for 106 @ \$44.03 each = \$4,667.38
04/Jan/09	R5	Bids for 11 @ \$48.83 each = \$5,371.33
14/Jan/09	R8	Bids for 41 @ \$47.05 each = \$1,928.65
07/Jan/09	R9	Bids for 112 @ \$44.29 each = \$4,960.48
13/Jan/09	R6	Bids for 16 @ \$40.62 each = \$649.92
11/Jan/09	R7	Bids for 109 @ \$19.42 each = \$2,116.58
11/Jan/09	R5	Bids for 71 @ \$17.87 each = \$1,268.57

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Market Institutions

- Posted Prices
- One-Sided Sequential Auctions
- Double Auctions
- Decentralised negotiations

- All these institutions have been extensively studied experimentally. For given supply/demand, they have different outcomes.



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- ### Experimental Analysis of Institutions
- The experimental evidence is fairly clear that in cases where direct comparisons can be made, the efficiency of the market institutions descends as follows :
 - Double Auction (DA)
 - Discriminatory Call Markets and Sequential Markets
 - Clearing house (Uniform price to single seller)
 - Posted Offer (PO)
 - Negotiated Prices
 - Posted Offer with subsequent negotiation

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- ### Performance of market institutions
- Posted Offer slower to track changes in equilibrium.
 - Market Power much more easily implemented in PO and negotiated institutions than under DA.
 - DA requires some minimum volume of transactions to provide efficient price discovery.

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Exercising Market Power

- Factors that have been shown experimentally to facilitate collusion and the exercise of market power
 - Multi-period repetition with the same group of participants.
 - Communication between parties
 - The ability of parties to punish "deviation" from the collusive course.
 - The existence of vertically related markets
 - Significant market concentration.
 - Significant search or transaction costs.
 - Where a posted price or "by negotiation" institution is used. Particularly if the market is small.

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Other factors that may impact price in environmental markets

- Reputational Risk
 - Companies on the demand side view market as a regulatory exercise. Any small profits that might be realisable from trading are outweighed by the risk of being non-compliant
 - No experimental evidence at this point
- Low Perceived "Cost of Carry"
 - Where the traded instrument is perpetual, they appear to be viewed as having a low or zero "cost of carry".
 - Tendency for "buy and hold"
 - Some experimental evidence.

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Virginia NOx market

- Virginia NOx market had 100% grandfathering
- Very little trade occurring
- To allow for new entrants, 5% of each participants allocation clawed back and auctioned.
- Auctioned prices much higher than anticipated
 - Explosive growth in trading following the auctions.
 - Companies with large holdings suddenly realised the things had a value, and should be used or sold.

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Experimental Evidence of impact of Grandfathering

- Current CEEM experiments
- Two treatments:
 - Participants on supply side substantially grandfathered
 - Participants on supply side had to create/earn all "credits" to sell
- Prices in first institution consistently much higher.
 - No cost risk from not selling.
 - More willing to withhold.
- Grandfathering can cause prices to go up....
- Preliminary experimental results. (but consistent with Virginia ??)

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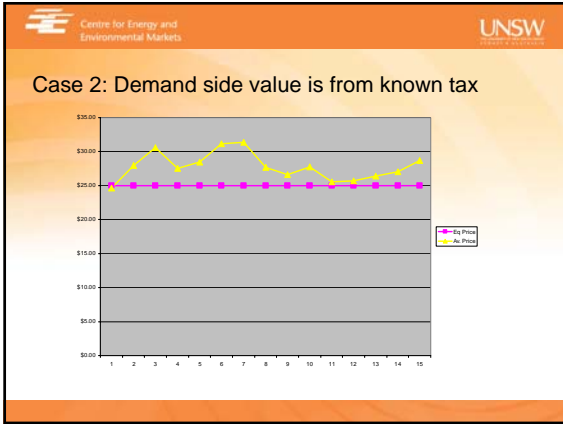
Example: Impact of form of demand side value induction (Asymmetric Information)

- Experiment has 10 participants, 5 retailers, 5 suppliers, all participants on each side of market of equal sizes.
- No banking/Borrowing
- "Hyper-competitive" environment. (1.5 suppliers at/above equilibrium price).

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Case 1: Demand side induced value is private

Trial	Bid Price	Ask Price
1	\$50.00	\$45.00
2	\$50.00	\$48.00
3	\$50.00	\$48.00
4	\$50.00	\$48.00
5	\$50.00	\$48.00
6	\$50.00	\$35.00
7	\$50.00	\$35.00
8	\$50.00	\$35.00
9	\$50.00	\$35.00
10	\$50.00	\$35.00
11	\$50.00	\$50.00
12	\$50.00	\$50.00
13	\$50.00	\$50.00
14	\$50.00	\$50.00
15	\$50.00	\$50.00



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Asset Bubbles

- “Or, to change the metaphor slightly, professional investment may be likened to those newspaper competitions in which the competitors have to pick out the six prettiest faces from a hundred photographs, the prize being awarded to the competitor whose choice most nearly corresponds to the average preferences of the competitors as a whole; so that each competitor has to pick, not those faces which he himself finds the prettiest, but those which he thinks likeliest to catch the fancy of the other competitors, all of whom are looking at the problem from the same point of view. It is not the case of choosing those which, to the best of one's judgement, are really the prettiest, nor even those which the average opinion genuinely thinks the prettiest. We have reached the third degree where we devote our intelligences to anticipating what average opinion expects the average opinion to be. And there are some, I believe, who practice the fourth, fifth and higher degrees”
- Keynes - 1936

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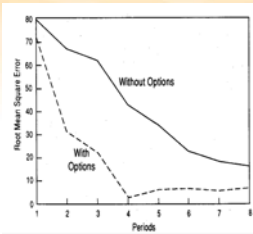
Experimental work on asset bubbles

- Large number of experiments conducted on asset bubbles.
- Interestingly, the existence of a well functioning forward market goes a long way towards stabilising them.

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Impact of Forward Markets

- Both theory and experiments show that a well functioning forward market can make a dysfunctional spot market come to equilibrium
- Forward markets can REDUCE asset bubbles.
- Forward markets drive investments
 - Need to be seriously considered as part of the overall development of an environmental market.

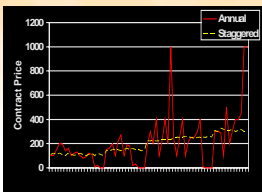


Periods	Without Options (RMS Error)	With Options (RMS Error)
1	80	80
2	75	65
3	65	55
4	55	45
5	45	35
6	35	25
7	25	15
8	20	10

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Impact of the Instrument Design

- Annual Acquital dates
 - Tends to drive the action to the periods around those dates.
- Ishikida/Porter 2000 – experiments examining the RECLAIM market.



Periods	Annual (Contract Price)	Staggered (Contract Price)
1	100	100
2	100	100
3	100	100
4	100	100
5	100	100
6	100	100
7	100	100
8	100	100

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Price distortions from other factors

- Shared desire for non-market outcome
 - Eg: If participants know that current market will be used to set future baselines or policies
- Vertical market impacts
 - Use input market to manipulate competitive position in output market
- Participants may be able to tacitly collude to bring about inefficient pricing.
 - EU ETS ?

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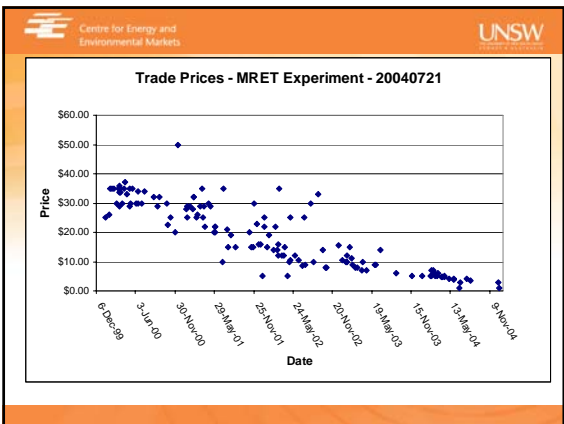
Relating all this to NGAS and MRET

- Small markets
- Highly concentrated
 - Single participant created 46% of 2003 NGACs.
 - Top 3 created 70%
- Repeated annual periods with stable cohorts
- Same participants also dealing in a vertically related market
- Anecdotal evidence of “buy and hold”
- Considerable grandfathering / non-additionality
 - over 95% of 2003 NGACs were generated by plant that was commissioned before the start of the scheme
- Institution is essentially posted-offer with bilateral negotiation
 - Institution most susceptible to poor price formation

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Some thoughts....

- MRET and NGAS markets, as well as other environmental markets, have characteristics that under experimental conditions result in prices consistently away from the “correct” ones.
- Particular market institutions, matched to the market characteristics may be required.
 - Possibly a NYSE style market with “specialists” could be appropriate?
- There is very little, if any, ongoing market monitoring and assessment as to market efficiency and performance.



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MRET Non-woodwaste RECs 2002 – 05 (AFMA Data)


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NGACs – spot & cal+3. AFMA Data


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- CEEM Conference
 - November 18
 - Vernon Smith & Dave Porter
- CEEM Energy Markets Forum
 - Probably November 17
- ASX – CSIRO
 - “Bureaucrat” workshops – early November
- It’s all on the website....





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Thankyou... and *questions*

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