Buyback Auctions for Fisheries Management

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Background

• Many, if not most, national and international fisheries are either being overfished or are subject to overfishing.
  – Especially those fisheries still operating under a regime of Open Access

• A key cause of overfishing is excess capacity - “too many boats chasing too few fish”
Excess capacity results from

• Declining fish stocks from lack of harvest controls
• Technological progress that increases catch per unit effort
• Increasing returns to vessel size
• National industrial policy to subsidize fishing and the construction of fishing vessels
Buyback programs

• Buybacks are used to remove excess capacity in fisheries and to facilitate the establishment of a RBM regime.

• Buybacks have often come at a very high cost.
  – Mostly in the form of government subsidies to buy out excess capacity.
  – These subsidies may even have exceeded the full gain in social surplus realized from eliminating the excess capacity.
The Problem

• Goals
  – Efficiency:
    • Remove the highest cost or least efficient vessel capacity from the industry.
  – Self-financed:
    • No outside financing
  – Voluntary:
    • All boats, winners and losers, should be better off after the buyback than they were before.

• Environment: capability and cost of fishing
  – Private value: individual talents, etc.
  – Common value: size of stock after contraction
General Theory

• There do not exist dominant strategy incentive compatible mechanisms which are efficient, self-financing and voluntary.
  – Groves, Hurwicz/Walker, Green/Laffont

• With independent values, there do exist Bayesian incentive compatible mechanisms which are efficient and self-financing.
  – D’Aspremont/Gerard-Varet, Arrow

• With interdependent values, there exist BIC mechanisms which are efficient, voluntary and extract full surplus.
  – Cremer/McLean
Buyback Auction Proposal

• **Second price auction with rebate.**
  – Individual boat capacities are common knowledge.
  – A desired capacity level, $K^*$, is chosen.
  – Boats each submit a per-unit capacity bid.
  – Bids are accepted from high to low and until $K^*$ is reached. (Partial acceptance = full acceptance)
  – The per capacity price, $P^*$, is the highest rejected bid.
  – Winners pay $P^*$ times their capacity.
  – The total of all payments is redistributed to ALL bidders.
    • In proportion to capacity

• Could also be run as a clock (ascending bid) auction.
Auction Theory for 2\textsuperscript{nd} price auction with rebate

• Not DSIC
  – If i is highest loser then i can increase their own rebate.

• If independent values and symmetric equilibrium, then Bayes equilibrium is efficient and self-financing.
  – Bids are increasing in private value.

• A sufficient condition for voluntary participation is that the rebate to a boat is larger than its pre-auction profits.
  – Roughly, this will be true if the total profits of the fishery after the contraction are larger than the fishery total profits before the auction.

• But, if interdependent values then self-financing but not necessarily efficient.
  – Optimism about stocks can overwhelm private capabilities.
    • Goeree and Offerman provide experimental evidence for 1\textsuperscript{st} price auctions.
Behavioral Theory

• Probability of being 1\textsuperscript{st} rejected is small.

• Therefore, bidding your estimated value is “good enough”

• Empirical question: will participants bid “honestly”? 
Experiment: Auction Designs

• Sealed bid:
  – Each of N bidders submits a bid without knowing the others’ bids.
  – The highest K bids win and pay a price equal to the 1st rejected bid.
    • Ties broken by first in.
  – The proceeds are distributed proportionately to everyone.

• Clock auction:
  – Price increases by 5 each x seconds.
  – Bidders must choose to stay in any round. If no choice then drop out (with no re-entry).
  – Auction stops when remaining number is less than or equal to K.
    • If too many drop in last round, then winners chosen randomly from that group.
  – The proceeds are distributed proportionately to everyone.
Experiment: Parameters

• 20 subjects, 4 win
• 5 sealed bid, 10 clock, 5 sealed bid 4 win
• Values randomly drawn
  – **Private values:**
    • \( v \) in \([50,550]\) then \( V \) in \([v-50,v+50]\).
    • Signal = \( V \), Value = \( V \)
  – **Private and common values, tight information:**
    • \( v \) in \([50, 550]\), \( V \) in \([v-50,v+50]\),
    • \( c \) in \([750,2550]\), \( C \) in \([v-50,v+50]\).
    • Signal = \((V,C)\), Value = \( V+c \)
  – **Private and common, loose information:**
    • \( v \) in \([50, 550]\), \( V \) in \([v-50,v+50]\),
    • \( c \) in \([750,2550]\), \( C \) in \([v-150,v+150]\).
    • Signal = \((V,C)\), Value = \( V+c \)

• This is all common knowledge.
Experiment: Results

Bidding Behaviors

- Sealed-Bid 1
- Clock 1
- Clock 2
- Sealed-Bid 2

Legend:
- Green: Overbid
- Yellow: Truthful
- Red: Underbid
Experiments: Results

Efficiency = (subject payoffs – random)/(max possible – random)
Lessons learned

• With independent values, it is definitely possible to design self-financing, highly efficient buyback auctions with voluntary participation.

• With a common value, uncertainty about the common value lowers efficiency.
  – Making public all information about the stocks expected after contraction, will increase the efficiency of a buy-back auction for fishery management.

• Both designs, sealed bid and clock, perform about the same.
Questions?
Experiments: Results

Efficiency = (subject payoffs – random)/(max possible – random)

• Sealed bid and clock both perform well.
• Some learning occurs with the clock.
• Efficiencies are higher after learning.

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<th>session</th>
<th>First</th>
<th>Second</th>
<th>2nd w/o worst case</th>
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<tr>
<td>Sealed bid</td>
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