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 <u>Open Access</u>

- 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^{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.
- <u>But</u>, 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^{st} price auctions.

Behavioral Theory

- Probability of being 1^{st} rejected is small.
- Therefore, bidding your estimated value is "good enough"
- Empirical question: will participants bid "honestly"?

Experiment: Auction Designs

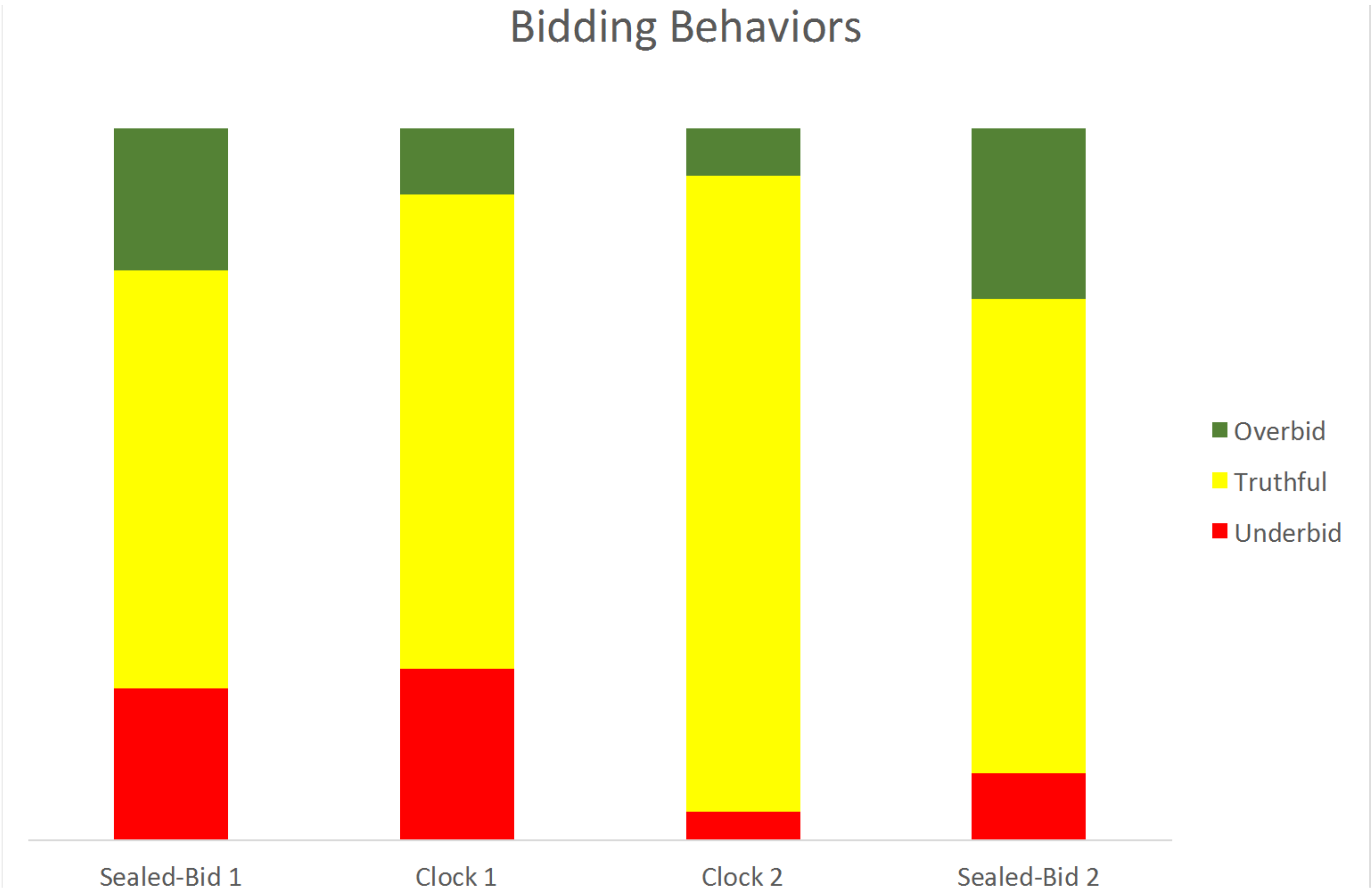
- Sealed bid:
  - Each of N bidders submits a bid without knowing the others' bids.
  - The highest K bids win and pay a price equal to the 1st rejected bid.
    - Ties broken by first in.
  - The proceeds are distributed proportionately to everyone.

- 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

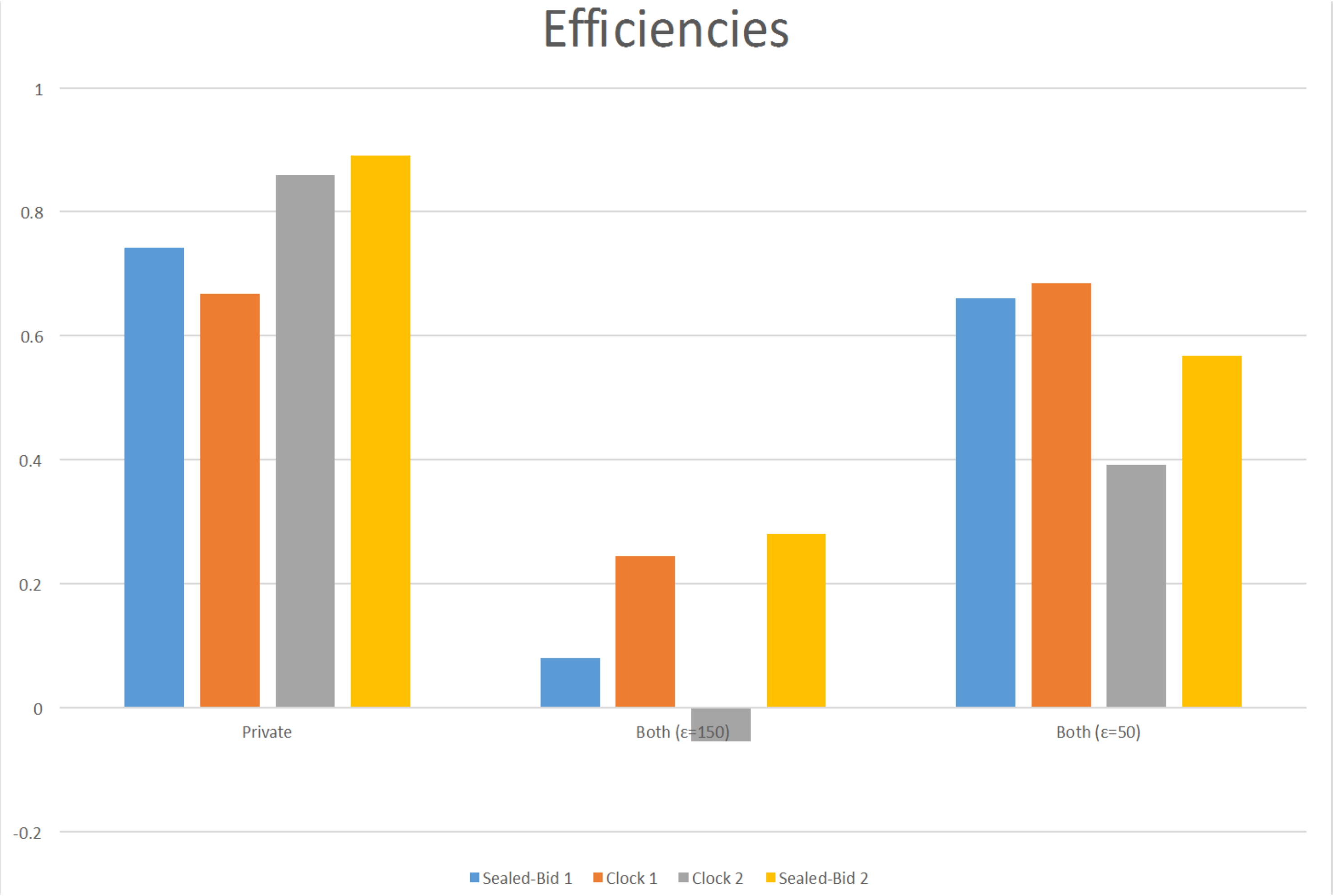
- 20 subjects, 4 win
- 5 sealed bid, 10 clock, 5 sealed bid 4 win
- Values randomly drawn
  - Private values:
    - v in [50,550] then V in [v-50,v+50].
    - Signal = V, Value = V
  - Private and common values, tight information:
    - v in [50, 550], V in [v-50,v+50],
    - c in [750,2550], C in [v-50,v+50].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



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)

session	First	Second	2^{nd} w/o worst case
Sealed bid	86	75	90
Clock	94	76	94
Sealed bid	95	89	94

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