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Shill bidding in common value auctions with discrete information

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There are several ways of cheating in auctions. Our cheating environment is called **shill bidding** and it consists on placing anonymous bids on the seller's behalf in order to artificially drive up the prices of the auctioned item

We build a simple model to understand the incentives a seller has to shill bid in an English common value auction where the bidders' private information is drawn from a discrete distribution

Our aim is **to show the existence of an equilibrium with no shill bidding**

The Model

- There are n risk neutral bidders in an English auction for a single object
- The seller has a value $v_0 = 0$
- Each bidder i receives a signal, $s^i \in \{s_1, s_2, s_3\}$, equally probable and equally distanced ($s_1 < s_2 < s_3$)
- The common value of the object is defined as the average of bidders' signals, $V = \frac{1}{l}\sum_{i=1}^{l} s^i$

  Where l is the number of participants in the auction
- Focus on **symmetric equilibrium**

Bidders' strategies

- **They drop out when they are just indifferent about finding themselves a winner or not** → to avoid the winner's curse
- They are **"myopic"** in the sense that they put probability zero that the seller is in the auction ($n = l$)

Seller's strategy

- He participates in the auction with probability μ ($l = n + 1$)
- If he participates, he must behaves as a real bidder (pretending to have s_1, s_2 or s_3) → avoids detection
- **He is an "advantage bidder"** meaning that he has the possibility to drop out at a certain stage once he observed how many bidders have already dropped out at that stage (upper bound to the seller's expected profits)

Timing

The auction starts here

Stage 0 Entry decision	Stage 1	Stage 2	Stage 3
The seller observes n and decides to enter and shill bids with probability μ	Bidders with the **lowest signal drop out** ↓ *If the seller is IN, he observes j_2 and decides to continue or not* ↓ *> 1 player -> stage 2 Game over, otherwise*	Bidders with the **medium signal drop out** ↓ *If the seller is IN, he observes j_3 and decides to continue or not* ↓ *> 1 player -> stage 3 Game over, otherwise*	Bidders with the **highest signal drop out** *If the seller is IN, he also drop out* *Game is over*

Main findings

Even when bidders are fully myopic, the seller **might be better off refraining from participating***

* If s_1 is sufficiently far from v_0 or s_3 is sufficiently far from s_1 (or both)

Price effect (+)

Probability effect (-) + Second highest bid effect + Perception effect = **Total effect**

- **Prob. of ties!** (Probability effect)
- **= to IPV** (Second highest bid effect)
- **≠ from IPV** (when $n \geq 3$) (Perception effect)
- **Gains of participation** (Total effect)

Stage 3 → there is no strategic decision for the seller

Stage 2 → It is never a best response for the seller to bid as a bidder with the highest signal when $v_0 \leq s_1$

Gain to Stop	$\geq$	Gain to Continue
• He gets is X_2 with prob. 1 (if $j_3 > 0$)		• He gets $X_2 + \varphi_{j_3}$ with prob. $\frac{j_3}{j_3+1}$

Where X_2 would be the price if he drops out at stage 2, φ_{j_3} is the increment the seller produces in the final price of the object after he decides he will be active at the last stage of the game competing with j_3 real bidders

- It means that there is an **upper bound** for the optimal shill bidding strategy

Stage 1 → The decision of dropping out at the first stage depends on n, j_2, and on the interval $\{s_1, s_2, s_3\}$

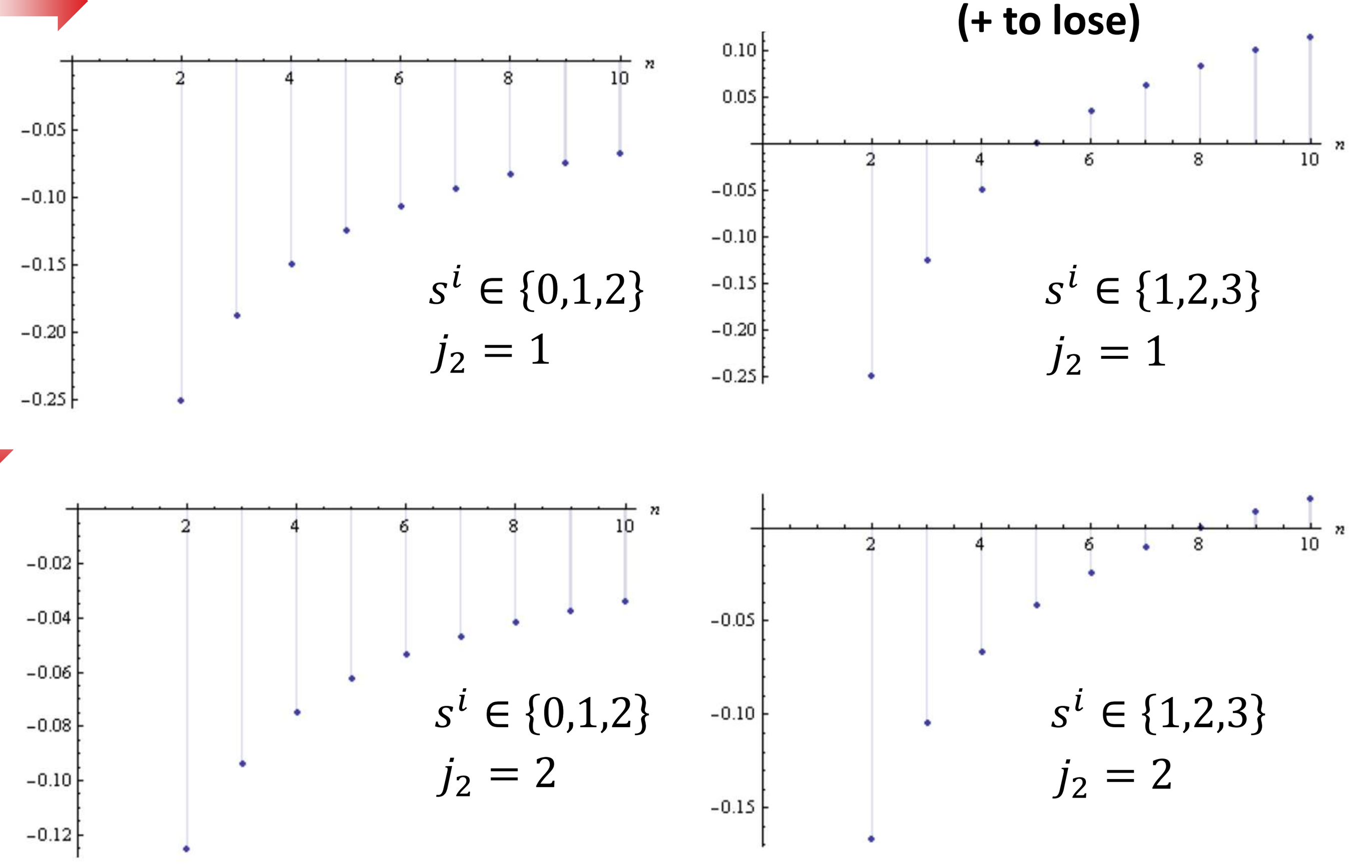
- Examples -

Higher (and wider) interval →

More remaining bidders (j_2) ↓

↓ incentives to continue (+ to lose)

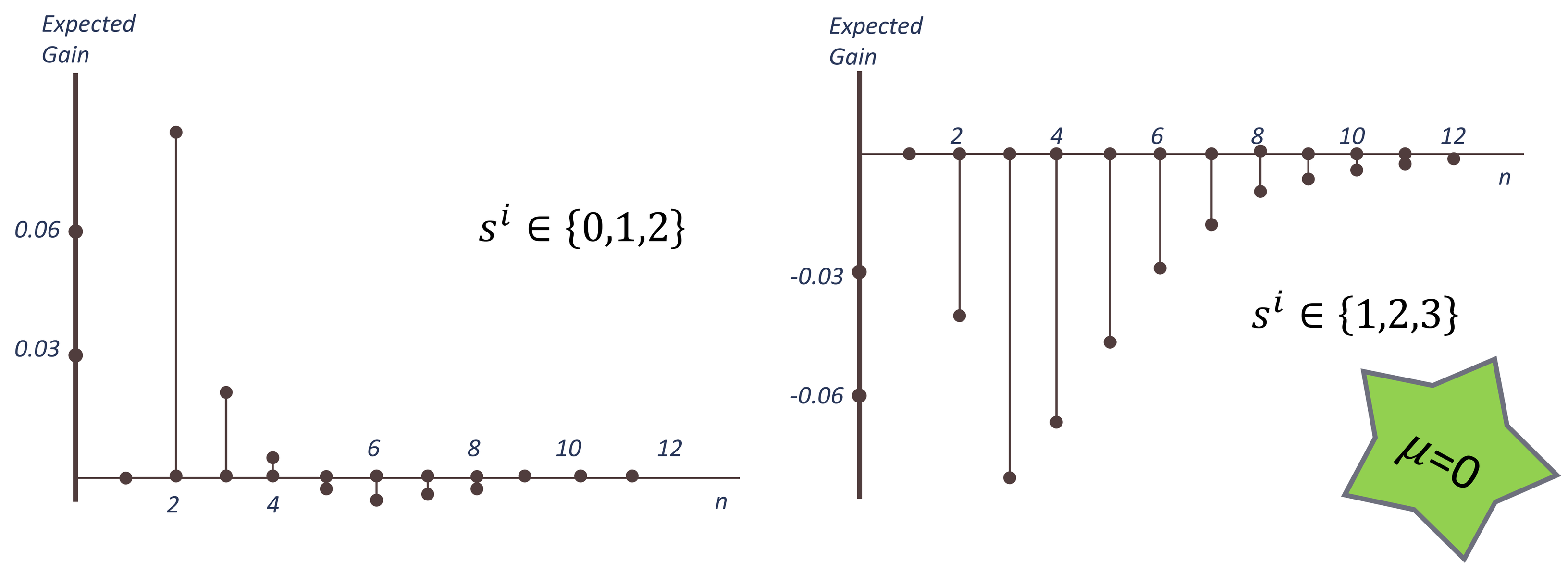
↑ incentives to continue (- probability effect)



Stage 0 → Entry decision

- We simply compared the expected gain with optimal shill bidding against the price of the object without the seller's participation (the expected second highest valuation)

If the number of legitimate bidder is sufficiently high, the **seller is always better off refraining from participating**



When $n \geq 5$ the seller is better off refraining from participating

For any n the seller is better off refraining from participating

References

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