Selective Entry in Auctions: Estimation and Evidence

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Motivation

Research Question

How does selection into auction participation affect auction outcomes?

- This paper develops a model of auctions with selective entry, bidder asymmetry, and risk aversion
- It estimates bidders' utility functions, value distributions, and entry costs using data from the New Mexico State Land Office (NMSLO) oil and gas lease auctions
- The model and setting include both first-priced sealed-bid (S) and ascending English outcry auctions (O)

The model - 1

The agents

- Two subgroups $m \in \{1, 2\}$ with N_m members
- Joint distribution $F_m(v, s)$; conditional distribution $F_m(v|s)$
- U_m is the utility function for each subgroup

The stages

- Stage 1: Each potential bidder i observes a private signal s_i of her unknown private value v_i
- Stage 1: All potential bidders simultaneously choose whether to enter the auction, incurring a cost c_m
- Stage 2: All bidders who enter learn their valuations and submit bids

The model - 2

Key assumptions:

1. Independence across bidders: $(v_i, s_i) \perp (v_j, s_j)$ for all $i \neq j$
2. $F_m(v, s)$ have square support $[\underline{v}, \bar{v}] \times [0, 1]$
3. Stochastic ordering: $s' \geq s$ implies $F_m(v|s') \leq F_m(v|s)$
4. $F_m(v|s)$ is differentiable in s and continuously differentiable in v
5. The reserve price r is the lower bound of v, i.e., $\underline{v} = r$

In a PSBNE,

- Entry if and only if $s > \bar{s}_m$ (threshold rule implies selection)
- Monotonic bidding strategy $b_m(v_i)$
- Not necessarily unique

Key data

New Mexico's oil and gas lease auctions
2005-2014 auctions of 320-acre leases in the Permian Basin

First-price sealed-bid auction [1059 observations]

- Dollar amount for every bid
- Bidder identity for every bid

English outcry auction (ascending oral) [935 observations]

- Transaction price
- Winner's identity (not for the other bidders)

Strong overlap between winners' names in the two auctions (97-98% of the names). "*[...] assignment between the two formats is fairly random.*"

Identification strategy

Four-step approach to estimate $\bar{s}_m$, $F_m(v|s)$, U_m, and c_m.

1. Estimate entry thresholds $\bar{s}_m$ from the observed probability of not entering the auction.
2. Estimate conditional value distributions $F_m(v|s)$ from English auction data (MLE). Maximize the likelihood of observed prices and winners.
3. Estimate the nonparametric utility function U_m. It satisfies the first-order condition for bidding in the sealed-bid auction (based on $\hat{F}_m(v|s)$ and observed distributions of sealed bids).
4. Estimate the entry cost c_m for the "marginal bidder." The bidder with a marginal signal is indifferent between entering and not entering the auction.

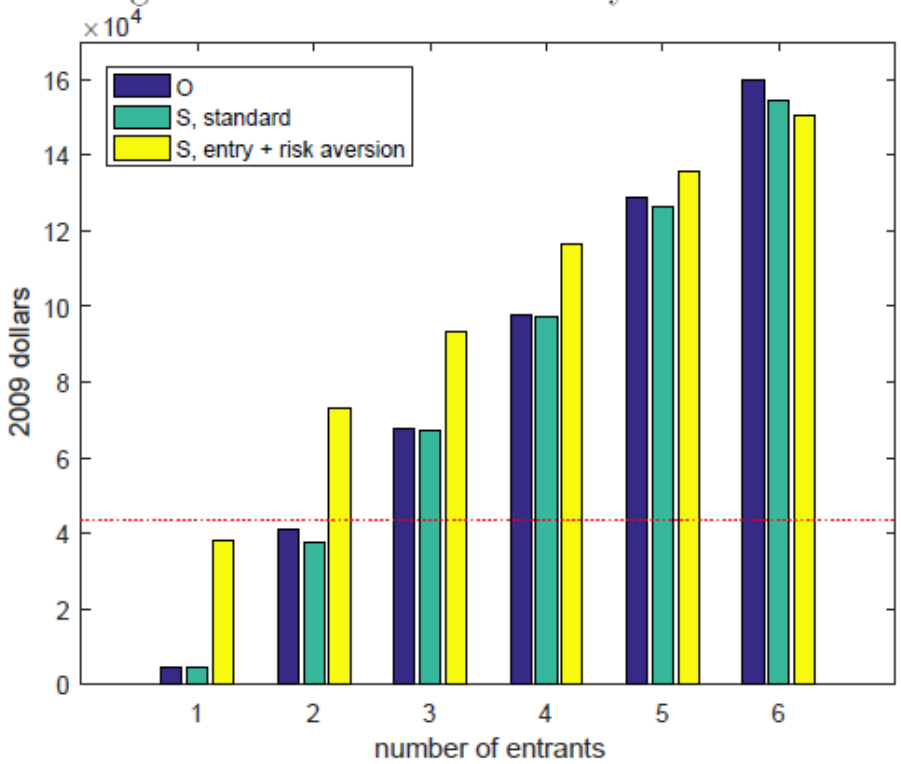
Counterfactuals

Three counterfactuals are considered:

1. How does uncertainty about the number of bidders work jointly with risk aversion to affect revenue in each auction format?
2. How would a policy that lowers the entry threshold affect revenue?
3. How would a policy that expands the potential bidder pool change competition among bidders?

Counterfactuals

Figure 7: Simulated revenue by realized n



Entry-induced uncertainty (a feature of S auctions) together with risk aversion provides protection against the effects of low competition

- equivalent to having an extra bidder in English auction format

Counterfactuals

Table 6: Simulated revenue response to drop in entry threshold, at modal $z'\beta$

	Selective Entry		Nonselective Entry	
$\bar{s}_1$	E[O price]	%Δ (logΔ)	E[O price]	%Δ (logΔ)
0.943	46,085	-	46,085	-
0.922	58,419	27% (0.24)	61,751	34% (0.29)

Under selective entry, lowering the threshold induces entrance of bidders with lower valuations, which leads to lower revenue increase (compared to non-selective entry).

Table 7: Counterfactual revenue with 50% increase in N_1, at modal $z'\beta$ and x

	E[S price]	E[O price]
Current	83,973	58,419
50% larger N_1, proportional increase in entrants	124,214	83,859
50% larger N_1, selective entry model	109,298	74,475

Expanding the pool of potential bidders increases competition but reduces porbability of entry (just the former effect in row 2, both effects in row 3).