Secrecy in Auctions

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You are interested in buying an object and have the opportunity to inspect it prior to the auction. 

*Should you conduct your inspection publicly or secretly?*

In “The Value of Information in a Sealed-Bid Auction” (1982, JME), Paul and Bob Weber provide a fascinating, nuanced answer:

- “The informed bidder’s profits rise when he gathers extra information, and the increase is greater when the information is collected overtly than when it is collected covertly”
- “A bidder may prefer less information to more if the information must be gathered overtly”
- “[The uninformed bidder has] a preference for covert information over overt information.”
“Covert” vs “Overt” Information: Milgrom and Weber (1982, JME)

Despite the rich and interesting subtleties hinted at by Paul and Bob’s findings, this is an area where surprisingly few researchers have followed up. As Dan Quint wrote as late as 2010:

\[
\text{Aside from Milgrom and Weber (1982a) [and Quint (2010)], nearly all papers on information acquisition in auctions assume either covert or observable information-gathering, rather than comparing the two.}
\]

Indeed, this area of research is still wide open, with much left to learn about strategic information acquisition in auctions.
In this talk, I will briefly discuss two lines of recent research, inspired in part by Paul and Bob’s seminal contributions:

1. How does costly bidding impact strategic information acquisition?
   - **Answer:** Ignorance can deter entry, so you may want to overtly *not* acquire info.

2. What if bidders can mask their participation in the auction?
   - **Answer:** (i) “Secret participation” occurs in equilibrium, but secret bidders are non-representative and (ii) The seller prefers to force bidders to participate overtly.
“Strategic Ignorance in the Second-Price Auction” (EL 2011)

- Suppose costly bidding and independent private values that can be learned at zero cost, but that the decision whether to learn is public.
- In equilibrium, some bidders “flaunt their ignorance” by publicly NOT acquiring information.

“Secrecy in Auctions” (working paper)

- Suppose bidders learn their values, then decide whether to participate publicly or secretly.
- When bidders are symmetric, seller revenue is higher than when secret participation is not permitted.
- Moreover, English > 2nd-price > 1st-price given symmetric independent signals.
Strategic Ignorance in the Second-Price Auction

Two bidders have iid $U[0, 1]$ private values.

Timing of the game:

- **Costless Public Learning**: Both decide whether to learn their values. Learning is costless and public.
- **Costly Bidding**: Both decide whether / what to bid, in a second-price auction with zero reserve. Bidding costs $c \approx 0$.

Payoffs, depending on who learns:

- **Both learn**: Bidders each get expected surplus $\approx \frac{1}{6}$, as in standard auction with zero costs.
- **None learn**: Bidders each get zero expected surplus (bid $\frac{1}{2}$).
- **One learns**: Informed bidder is deterred from bidding when $v_i < \frac{1}{2}$, but uninformed bidder always bids $\frac{1}{2}$ $\Rightarrow$ Informed bidder gets $50\% \times \frac{1}{4} = \frac{1}{8}$ while uninformed gets $50\% \times \frac{1}{2} = \frac{1}{4}$. 
Equilibria:

▶ Asymmetric equilibria in which (say) bidder 1 flaunts ignorance \( \left( \frac{1}{4} > \frac{1}{6} \right) \) and bidder 2 always learns \( \left( \frac{1}{6} > 0 \right) \).
▶ Symmetric equilibrium in which each bidder remains ignorant \( \frac{2}{5} \) of the time.

Comments:

▶ Public ignorance has an entry-deterrent value but, obviously, learning has an information value.
▶ The seller can deter strategic ignorance by increasing the value of information, e.g., by raising the reserve price.
“Friday March 19th [1965]. Rembrandt. Lot 105. Portrait of Titus. When Mr. Simon is sitting down he is bidding. If he bids openly when sitting down he is also bidding. When he stands up he has stopped bidding. If he then sits down again he is not bidding until he raises his finger. Having raised his finger he is continuing to bid until he stands up again. P. Lindsay.”
Outline of the talk – if I had 60 more minutes

Secrecy in the First-Price Auction

- Model & preview of results
- When will bidders choose to be secret?
- Revenue and welfare superiority of the second-price auction

Secrecy in the Second-Price Auction

- Model & preview of results
- When will bidders choose to be secret?
- Revenue and welfare superiority of the English auction
Outline of the talk

▶ “Costs” of secret and/or public participation
▶ Secrecy in the first-price auction
▶ Secrecy in the second-price auction
▶ Transparency in the English
“Costs” of secret and/or public participation

Bidding in an auction can be costly:

▶ “competing firms must bear significant bid-preparation and documentation costs” (Samuelson 1985)

So can being a *known* participant ...

▶ *exposes your need:* banks in Canada’s LVTS auctions of one-day cash; dealers in diamond auctions
▶ *reveals your plans:* Apple in Infineon deal (perhaps)

... or remaining an *unknown* participant:

▶ *requires special arrangements with the auctioneer*
▶ *forces you to defer other plans:* Apple in Infineon deal (perhaps)
Infineon is a wireless-chip supplier, sold to Intel in 2010. Rumors swirled that Apple was also interested in the company, but Apple’s involvement in the deal remains unknown.

Both secret and public participation could plausibly have been costly for Apple.

- Announcing interest in Infineon would reveal Apple’s desire to develop its own wireless chips (much as Apple developed its own low-power microchip for the 2010 iPad, after acquiring P.A. Semi in 2008).
  - Such an announcement could make it more costly to acquire necessary expertise ⇒ cost of publicity.
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Both secret and public participation could plausibly have been costly for Apple.

- Announcing interest in Infineon would reveal Apple’s desire to develop its own wireless chips ⇒ cost of publicity.
- If Apple is uninterested in acquiring Infineon, they have a strong incentive to invest to strengthen relationships with other suppliers.
  - Maintaining secrecy requires making relational investments, even if Apple would prefer not to ⇒ cost of secrecy.
Outline of the talk

- Possible "costs" of secret and/or public participation
- Secrecy in the first-price auction
- Secrecy in the second-price auction
- Transparency in the English
$N$ symmetric risk-neutral bidders with independent private values and zero reserve price.

**Timing of the game:**

1. Arrive and observe private values
2. Decide whether to participate publicly (cost $c_P \geq 0$), secretly (cost $c_S \geq 0$), or not at all. Assume $\max\{c_P, c_S\} > 0$.
3. Set of public participants commonly observed
4. Participants submit sealed bids
Example: Secrecy in the First-Price Auction

- Two potential bidders each arrives with probability $p = \frac{1}{2}$
- iid private values $v_i \sim U[0, 1]$
- Public and secret participation cost $c_P = 0$ and $c_S = \frac{1}{9}$

\[
\begin{array}{c|c|c}
\text{ABSENT} & P & P \\
v^P = 0 & S & q^S = \frac{3}{5} \\
v^S = \frac{2}{3} & 1 &
\end{array}
\]
Outline of the talk

- Possible “costs” of secret and/or public participation
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Model: Secrecy in Second-Price & English Auctions

\[ N \text{ symmetric risk-neutral bidders w/ common value } V = \sum_i S_i / n \]
and i.i.d. signals \( S_i \).

Timing of the game:

1. Observe private signal \( S_i \in [0, 1] \)
2. Decide whether to participate publicly (cost \( c_P > 0 \)), secretly (cost \( c_S > c_P > 0 \)), or not at all
3. Set of public participants commonly observed, then auction
4. In English auction, bidders observe public drop-outs as well as when the auction ends.
Review: bidding in second-price auction

Under **public-only participation**, suppose $P$ is set of participants.

Bidder $i$’s bid equals value in the strategically-relevant hypothetical scenario in which:

1. **tie**: $s_i = \max_{j \neq i \in P} s_j$
2. **pessimistic non-bidders**: $s_j < s$ iff $j \notin P$

That is, bidder $i$ bids

$$E \left[ V \middle| s_i, s_j \in [s, s_i] \forall j \in P, s_j < s \forall s_j \notin P, s_i = \max_{j \neq i \in P} s_j \right].$$
Suppose now secret-only participation.

Bidder $i$’s bid equals value in the strategically-relevant hypothetical scenario in which:

1. tie: $s_i = \max_{j \neq i} s_j$

That is, bidder $i$ bids

$$E \left[ V \mid s_i, s_i = \max_{j \neq i} s_j \right].$$
Second-price auction when \( c_S > c_P > 0 \)

**Theorem:** In unique symmetric PBE, bidders’ participate secretly iff \( s_i > s_S \) where \( s_S > s_P > 0 \).

Equilibrium bids by public and secret bidders take the form:

\[
b_P(s_i; P) = E \left[ V \mid s_i, P, \max_{j \neq i \in P} s_j = s_i, \max_{j \neq i \notin P} s_j < s_P \right] \\
b_S(s_i; P) = E \left[ V \mid s_i, P, \max_{j \neq i \notin P} s_j = s_i \right]
\]

Public bidders base bids on the (strategically-relevant) presumption that there are no secret bidders \( \Rightarrow \) public bidders bid less!
Outline of the talk

- Possible “costs” of secret and/or public participation
- Secrecy in the first-price auction
- Secrecy in the second-price auction
- Transparency in the English
Consider an English auction with public-only participation.

Each bidder $i$ drops out once the price overtakes the good’s value, conditional on the strategically-relevant event in which all remaining bidders have received the same signal as him ("tie").
**Theorem:** In a symmetric PBE, no bidder is ever secret.

Steps of proof idea:

- As long as two or more public bidders remain, drop-outs proceed as in standard English auction, i.e. as if:
  - all remaining public bidders received the same signal
  - all secret bidders dropped out already
- Once one public bidder remains, that bidder drops out as if:
  - at least one secret bidder remains
  - ... with signal(s) at least as high as his own
- \( \Rightarrow \) Conditional on being secret and winning, your last opponent drops out at same price as if you were public
- \( \Rightarrow \) Secrecy no longer creates winner’s curse concerns
First-price auction with independent private values:

- Option to conceal participation lowers ex post efficiency and ex ante revenue.
- **Second-price auction is superior to first-price auction.**

Second-price auction with common values and independent signals:

- Option to conceal participation lowers ex post efficiency and ex post revenue.
- **English auction is superior to second-price auction.**
Broader agenda

Real-world bidders take observable actions that influence their values / information, or others’ beliefs about their values / information.

- inspection / learning
- real investment / acquiring complementary assets
- commitments / pre-auction signals

Milgrom and Weber (1982a) was a seminal contribution in this area, but much more remains to be done.
THANK YOU!