Auctions with Speculators: 
An Experiment

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The views expressed in this paper are those of the authors and do not necessarily reflect those of the Federal Reserve Bank of New York, the Federal Reserve System or the Bank of England.
For [the speculators’] interests are the opposite of other men’s: they make most profit when, on some bad news reaching the city, they sell their corn at a high price. And they are so delighted to see your disasters that they either get news of them in advance of anyone else, or fabricate the rumor themselves; now it is the loss of your ships in the Black Sea, now the capture of vessels on their outward voyage by the Lacedaemonians, now the blockade of your trading ports, or the impending rupture of the truce; and they have carried their enmity to such lengths that they choose the same critical moments as your foes to overreach you.

Λυσιας, Ο Κατα Σιτοπωλών (22)
Speculation = Curse?

- Speculators blamed for high oil prices

**Energy Markets Emergency Act of 2008**

To direct the Commodity Futures Trading Commission to utilize all its authority, including its emergency powers, to curb immediately the role of excessive speculation in any contract market...
Or Blessing?

- Hard to find normal people who consider speculation a blessing, so had to look among the usual suspects

1. Academic Economists
   *Speculative gains are [according to traditional economic thought] very much [like] entrepreneurial gains; they are earned, similarly to the profits of wholesalers or retailers, as a result of the transference of goods from less important to more important uses.*

   N. Kaldor, *RESTud*, 1939

2. Financial & business press
   *Ordinarily, we'd consider speculation in markets a good thing. Speculative traders are either introducing good information into markets or creating profit opportunities for those with good information.*

   *The Economist*, 8th July 2009

3. Hollywood villains
   *Greed is good*

   Gordon Gekko
Speculation in auctions

• Auctions are a nice environment to study/observe speculation
  – Baseline case (without speculation) well understood
  – Easy to create pure speculative motive (zero value bidder)
  – Anecdotal evidence speculative behavior in auctions
Speculation a la Garratt – Troeger (2006)

- One or more “regular” bidders with privately known value, e.g. in [0,100]
- One bidder commonly known to have a fixed value equal to minimum of PV interval (e.g. zero)

1. Bid in a first stage second-price auction
2. Winner gets to make a take-it-or-leave-it offer to loser (optimal auction)

- Symmetric bid-your-value equilibrium exists, no resale
- But a continuum of “speculative” equilibria also exist...
Speculative equilibria in Garratt-Troeger (2006)

- For any $\theta^*$ in $[0,100]$
  - Regular bidder bids $v_{RB}$ if $v_{RB} > \theta^*$, else 0
  - Speculator bids $b_s (=T$ if no discounting$)$
  - Off equilibrium belief for speculator: RB has value of 100 (stronger than necessary)
  - No deviation profitable, since value bidding RB would either
    - a. Win in first auction and get good for same price $T$, or
    - b. Lose and get an appalling offer in the second stage (100!)
Asymmetric equilibria in Garratt-Troeger (2006)

• Two interesting cases
  1. If $\theta^* = 100$, RB always bids 0 and speculator always wins!
  2. If $\theta^* = 0$, RB always bids value, speculator never wins
Other “solutions”: Signaling when games repeated or players altruistic

• The resale market is inefficient
• Often no trade, although there should have been some
• What if serious bidder can send signals of her value
  – Just use any strictly monotonic (i.e. invertible) bid function
  – Resale market perfectly efficient!
• Why would the speculator not abuse this info?
  a) Repeated games (fixed matching)
  b) Sharing the pie (altruism)
The experimental design (1-1)

- 1 serious bidder with $PV \sim U[0, 100]$
- 1 speculator with $PV=0$
- Neutral framing (types “A” and “B”)
- 42 periods (2 unpaid “practice” rounds)
- Fixed roles
- 2 treatments: fixed matching (6 sessions=72 subjects) $T_1$ and random matching (7 sessions=74 subjects) $T_2$
- 5 periods paid, randomly chosen
- About 2 hours
- Average payoffs of 17 GBP (about. 28 USD)
- zTree software, ESRC funds
The experimental design (2-1)

• 2 serious bidders with PV ~ U[0,100]
• 1 speculator with PV=0
• 9 sessions=132 subjects) fixed T3, 5 random=60 subjects) T4
RESULTS
## Results: 1-1 treatments

<table>
<thead>
<tr>
<th></th>
<th>Fixed</th>
<th>Random</th>
</tr>
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<tbody>
<tr>
<td>Speculator Bid = 0</td>
<td>5.5%</td>
<td>7.7%</td>
</tr>
<tr>
<td>RB value bid</td>
<td>19.1%</td>
<td>19.0%</td>
</tr>
<tr>
<td>RB overbid</td>
<td>30.2%</td>
<td>38.3%</td>
</tr>
<tr>
<td>RB underbid</td>
<td>50.7%</td>
<td>42.7%</td>
</tr>
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<td>Efficient stage 1</td>
<td>38.1%</td>
<td>44.1%</td>
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<tr>
<td>Efficient stage 2</td>
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<td>60.8%</td>
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## Results: 2-1 treatments

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<tr>
<td>Speculator Bid = 0</td>
<td>10.7%</td>
<td>11.9%</td>
</tr>
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<td>RB value bid</td>
<td>22.8%</td>
<td>19.0%</td>
</tr>
<tr>
<td>RB overbid</td>
<td>39.3%</td>
<td>46.9%</td>
</tr>
<tr>
<td>RB underbid</td>
<td>37.9%</td>
<td>35.1%</td>
</tr>
<tr>
<td>Efficient stage 1</td>
<td>52.4%</td>
<td>64.7%</td>
</tr>
<tr>
<td>Efficient stage 2</td>
<td>68.5%</td>
<td>72.1%</td>
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Results: 2-1 treatments

• Prices higher than predicted by the symmetric equilibrium

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<th>2-1 Fixed</th>
<th>2-1 Random</th>
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<tr>
<td>Mean Price</td>
<td>33.3</td>
<td>47.23</td>
<td>44.83</td>
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<tr>
<td>s.e.</td>
<td>n/a</td>
<td>(.2017)</td>
<td>(.1917)</td>
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- Instability declines, Variance decreases relative to 2 bidder auction without speculator (reason=prices are less informative)
Comparing (1-1) treatments: specular bids

Speculators more aggressive with fixed matching
Comparing (1-1) treatments: regular bidders
Dynamics (1-1)

Faster learning with fixed matching

Not obvious whether prices are falling because of convergence to symmetric or asymmetric eq (both would lower prices!)
1-1 Fixed Matching

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<th>Regular Bidder Bid</th>
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<tr>
<td></td>
<td>b &gt; 10</td>
<td>b &gt; 50</td>
</tr>
<tr>
<td>0-10</td>
<td>94.1</td>
<td>59.1</td>
</tr>
<tr>
<td>11-20</td>
<td>94.1</td>
<td>58.8</td>
</tr>
<tr>
<td>21-30</td>
<td>90.0</td>
<td>54.7</td>
</tr>
<tr>
<td>31-40</td>
<td>86.2</td>
<td>58.8</td>
</tr>
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# 1-1 Fixed Matching

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<tr>
<td>b &gt; 10</td>
<td>b &lt; 5</td>
</tr>
<tr>
<td>b &gt; 50</td>
<td>b &lt; .5V</td>
</tr>
<tr>
<td>b &gt; 95</td>
<td></td>
</tr>
</tbody>
</table>

| 0-10 | 94.1 | 59.1 | 18.5 | 12.3 | 25.4 |
| 11-20 | 94.1 | 58.8 | 20.6 | 21.5 | 39.7 |
| 21-30 | 90.0 | 54.7 | 21.8 | 26.2 | 38.5 |
| 31-40 | 86.2 | 58.8 | 24.7 | 29.1 | 40.6 |

- Some speculators gave up over time, but not many
- Speculators that stuck with it became more aggressive
- More regular bidders “caved” over time
- Similar results with random matching
  - Speculators tried just as hard but regular bidders did not cave as much
Individual groups (1-1 Fixed)
Individual groups (1-1 Fixed)
Individual groups (2-1 Fixed)
Asymmetric Bidder Equilibrium
Classifying groups (1-1)

The PV bidder is

\[
\begin{align*}
\text{zero bidding} & \quad \text{if } b_{PV} \in [0, v - 5] \\
\text{value bidding} & \quad \text{if } b_{PV} \in (v - 5, v + 15] \\
\text{overbidding} & \quad \text{if } b_{PV} \in (v + 15, 140]
\end{align*}
\]
Classifying groups (1-1)

Speculator is
\[
\begin{align*}
\text{inactive} & \quad \text{if } b_s \in [0, 10] \\
\text{active} & \quad \text{if } b_s \in (10, 50] \\
\text{overactive} & \quad \text{if } b_s \in (50, 140]\n\end{align*}
\]
Most frequent states (under fixed matching)

(a) Zero bidding PV bidder, active speculator
(b) Value bidding PV bidder, active speculator
(c) Zero bidding PV bidder, overactive speculator
(d) Value bidding PV bidder, overactive speculator.
Markov transition matrix

<table>
<thead>
<tr>
<th>From ↓ To →</th>
<th>State a</th>
<th>b</th>
<th>c</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>State a</td>
<td>68.7%</td>
<td>6.4%</td>
<td>8.6%</td>
<td>2.7%</td>
</tr>
<tr>
<td>b</td>
<td>4.6%</td>
<td>78.2%</td>
<td>1.3%</td>
<td>5.4%</td>
</tr>
<tr>
<td>c</td>
<td>3.4%</td>
<td>1%</td>
<td>88.4%</td>
<td>4.2%</td>
</tr>
<tr>
<td>d</td>
<td>1.6%</td>
<td>6.6%</td>
<td>9.9%</td>
<td>72.7%</td>
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(a) Zero bidding PV bidder, active speculator
(b) Value bidding PV bidder, active speculator
(c) Zero bidding PV bidder, overactive speculator
(d) Value bidding PV bidder, overactive speculator.
One reason why speculation is difficult

• If regular bidder is overbidding, then speculator can lose a lot of money
  – Suppose bidder with value 50 bids 55
  – Speculator bids 100 and wins, paying 55
  – Speculator infers a PV of close to 55, so asks for 55
  – RB rejects, speculator loses 55!

• Understanding the strategy of the regular bidder very important to set correct reserve prices
  – Harder with random matching
Reserve prices

Reserve prices almost always above the auction price

Mean at zero is 39.37

Learning: Reserve prices going down (slightly but significantly) with time, from 52.5 in first 3 periods to about 41.2 in last 3 periods
Signaling?

- Recall, fixed matching allows for signaling in equilibrium
- Could also happen with random matching, if speculator altruistic
- Most efficient bid function for signaling
  - $\lambda v$ with $\lambda$ very small
- Result: among under-bidders estimated $\lambda$ is still about 0.6!
- What if we allowed pre-play communication?
Conclusions

• Speculators matter
  – Disrupt value bidding equilibrium
    • Higher prices
    • Lower efficiency
  – Achieve “true” speculative equilibrium in some cases
    • Somewhat remarkable
    • In other cases qualitative features of spec. eq. apparent
  – More pronounced with fixed matching
  – Much more to do
    • Non-spec treatments with resale
    • Individual/group classifications and analysis